THE IMPLEMENTATION OF GEOSS: A REVIEW OF THE ALL-HAZARDS WARNING SYSTEM AND ITS BENEFITS TO PUBLIC HEALTH, ENERGY, AND THE ENVIRONMENT

HEARING

BEFORE THE

SUBCOMMITTEE ON
OVERSIGHT AND INVESTIGATIONS

OF THE

COMMITTEE ON ENERGY AND
COMMERCE
HOUSE OF REPRESENTATIVES

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

MARCH 9, 2005

Serial No. 109–2

Printed for the use of the Committee on Energy and Commerce

Available via the World Wide Web: http://www.access.gpo.gov/congress/house

U.S. GOVERNMENT PRINTING OFFICE

99–903PDF WASHINGTON : 2005

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

COMMITTEE ON ENERGY AND COMMERCE

JOE BARTON, Texas, *Chairman*

RALPH M. HALL, Texas
MICHAEL BILIRAKIS, Florida
Vice Chairman
FRED UPTON, Michigan
CLIFF STEARNS, Florida
PAUL E. GILLMOR, Ohio
NATHAN DEAL, Georgia
ED WHITFIELD, Kentucky
CHARLIE NORWOOD, Georgia
BARBARA CUBIN, Wyoming
JOHN SHIMKUS, Illinois
HEATHER WILSON, New Mexico
JOHN B. SHADEGG, Arizona
CHARLES W. "CHIP" PICKERING, Mississippi, *Vice Chairman*
VITO FOSSELLA, New York
ROY BLUNT, Missouri
STEVE BUYER, Indiana
GEORGE RADANOVICH, California
CHARLES F. BASS, New Hampshire
JOSEPH R. PITTS, Pennsylvania
MARY BONO, California
GREG WALDEN, Oregon
LEE TERRY, Nebraska
MIKE FERGUSON, New Jersey
MIKE ROGERS, Michigan
C.L. "BUTCH" OTTER, Idaho
SUE MYRICK, North Carolina
JOHN SULLIVAN, Oklahoma
TIM MURPHY, Pennsylvania
MICHAEL C. BURGESS, Texas
MARSHA BLACKBURN, Tennessee

JOHN D. DINGELL, Michigan
Ranking Member
HENRY A. WAXMAN, California
EDWARD J. MARKEY, Massachusetts
RICK BOUCHER, Virginia
EDOLPHUS TOWNS, New York
FRANK PALLONE, Jr., New Jersey
SHERROD BROWN, Ohio
BART GORDON, Tennessee
BOBBY L. RUSH, Illinois
ANNA G. ESHOO, California
BART STUPAK, Michigan
ELIOT L. ENGEL, New York
ALBERT R. WYNN, Maryland
GENE GREEN, Texas
TED STRICKLAND, Ohio
DIANA DEGETTE, Colorado
LOIS CAPPS, California
MIKE DOYLE, Pennsylvania
TOM ALLEN, Maine
JIM DAVIS, Florida
JAN SCHAKOWSKY, Illinois
HILDA L. SOLIS, California
CHARLES A. GONZALEZ, Texas
JAY INSLEE, Washington
TAMMY BALDWIN, Wisconsin
MIKE ROSS, Arkansas

BUD ALBRIGHT, *Staff Director*
JAMES D. BARNETTE, *Deputy Staff Director and General Counsel*
REID P.F. STUNTZ, *Minority Staff Director and Chief Counsel*

SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

ED WHITFIELD, Kentucky, *Chairman*

CLIFF STEARNS, Florida
CHARLES W. "CHIP" PICKERING, Mississippi
CHARLES F. BASS, New Hampshire
GREG WALDEN, Oregon
MIKE FERGUSON, New Jersey
MICHAEL C. BURGESS, Texas
MARSHA BLACKBURN, Tennessee
JOE BARTON, Texas, (Ex Officio)

BART STUPAK, Michigan
Ranking Member
DIANA DEGETTE, Colorado
JAN SCHAKOWSKY, Illinois
JAY INSLEE, Washington
TAMMY BALDWIN, Wisconsin
HENRY A. WAXMAN, California
JOHN D. DINGELL, Michigan, (Ex Officio)

(II)

CONTENTS

	Page
Testimony of:	
Colleton, Nancy, Co-Founder, Alliance for Earth Observations	35
Dearry, Allen, Associate Director, Division of Research Coordination, Planning, and Translation, National Institute of Environmental Health Sciences, National Institutes of Health	61
Foley, Gary, Director, National Exposure Research Laboratory, U.S. Environmental Protection Agency	65
Glass, Gregory E., Professor, Molecular Microbiology and Immunology, Bloomberg School of Public Health, Johns Hopkins University	41
Hood, Carroll A., Geoss Chief Architect, Raytheon	44
Hooke, William H., Director, Policy Program, American Meteorological Society	50
Lautenbacher, Vice Adm. Conrad C., Jr., Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator, U.S. Department of Commerce	10
Patrinos, Aristides, Associate Director for Biological and Environmental Research, U.S. Department of Energy	68
Additional material submitted for the record:	
Colleton, Nancy, Co-Founder, Alliance for Earth Observations, response for the record	85
Hood, Carroll A., Geoss Chief Architect, Raytheon, response for the record	94
Hooke, William H., Director, Policy Program, American Meteorological Society, letter dated April 13, 2005, enclosing response for the record	98
Lautenbacher, Vice Adm. Conrad C., Jr., Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator, U.S. Department of Commerce, response for the record	76

THE IMPLEMENTATION OF GEOSS: A REVIEW OF THE ALL-HAZARDS WARNING SYSTEM AND ITS BENEFITS TO PUBLIC HEALTH, ENERGY, AND THE ENVIRONMENT

WEDNESDAY, MARCH 9, 2005

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ENERGY AND COMMERCE,
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:54 p.m., in room 2123 of the Rayburn House Office Building, Hon. Ed Whitfield (chairman) presiding.

Members present: Representatives Whitfield, Bass, Burgess, Blackburn, Barton (ex officio), DeGette, Schakowsky, and Inslee.

Staff present: Mark Paoletta, chief counsel; Casey Hemard, majority counsel; Peter Spencer, professional staff; Michael J. Abraham, legislative clerk; Edith Holleman, minority counsel; Voncille Hines, research analyst; and Turney Hall, clerk.

Mr. WHITFIELD. At this time, I will call the hearing to order, and I would apologize to those of you who have been waiting, but we had a vote on the floor, so it looks like we are about 15 or 20 minutes late, but I can assure you that we will hopefully not be delayed much longer. And I certainly want to thank the witnesses this morning.

And at this time, I will take 5 minutes for my opening statement to get the hearing started.

First of all, good afternoon.

On December 26, 2004, the world witnessed a disaster in South Asia that, in minutes—in a matter of minutes, destroyed villages and close—and left close to 300,000 people dead or missing. The Indian Ocean tsunami was staggering in its devastation.

While there is no way to stop a tsunami, warning areas in the path of a tsunami are possible and provide the best opportunity to save lives. Tsunami warning systems assemble and integrate data from satellites, buoys, and gauges to determine where a tsunami could hit.

The United States, in fact, uses such a system. It is part of the Pacific Tsunami Warning System that provides warnings on tsunamis to most countries in the Pacific Ocean. South Asia, sadly, did not have the benefit of such a warning system.

Given the technological capabilities of the 21st century, we should be able to harness our data-gathering abilities and do more to warn people the world over about impending dangers, both for tsunamis and other destructive events.

I have called this hearing today, because the United States has just entered into an agreement with 59 countries and other international organizations to develop over the next decade just such a system. The system, or rather system of systems, will allow for an unprecedented amount of data sharing that could bring real benefits to our lives.

The Global Earth Observation System of Systems, or GEOSS as it is commonly called, is an effort by participating countries, including countries from South Asia, to create an all-hazards warning system. Just as we have tools to determine where tsunamis could hit, we have tools to forecast weather and monitor air pollution, wind currents, air temperature, and ocean currents. These tools include satellites, seismographs, gauges, and buoys. GEOSS would link our U.S. technology to that of the other participating nations, creating an integrated system that would give us access to data from around the earth.

Out of this effort, proponents tell us we not only will enhance and expand our ability to predict and warn of tsunamis, but also be able to make informed decisions in anticipation of a variety of other threats to life, health, property, and the economy around the world and here at home.

Today, we will hear from witnesses about GEOSS and what it does, what is involved and necessary to make it work, the U.S. role, and the range of benefits that we may see when it is operational. Witnesses will also speak to three specific areas that may benefit from the system: public health, energy, and the environment.

First this afternoon, we will hear from Admiral Conrad Lautenbacher. Admiral Lautenbacher currently serves as 1 of 4 co-chairs of the Group on Earth Observations, and plays a critical role in seeing that the 10-year plan for GEOSS is implemented. He has been involved with organizing this integrated system from the outset.

Since the United States must integrate its own assets and make them interoperable to successfully link up with the other regions of the world, I will look forward to hearing from Admiral Lautenbacher about the standards we need to develop to make our information sharing more effective and more efficient. Of course, as the Administrator of the National Oceanic and Atmospheric Administration, he can also explain how the United States is prepared to address the risk of tsunamis along all of our coasts.

We will hear, also, from Dr. Allen Dearry from the National Institute of Environmental Health. He will discuss how GEOSS will advance the cause of public health. Scientists, for example, hope 1 day to use satellite data to trace an illness-causing bacteria, fabrio cholera, in plankton before it hits coastlines so that regions can get medicine and rehydration materials to affected populations. The World Health Organization receives reports of approximately 185,000 cases of cholera in 2001, so this would aid a great deal of people.

We will also hear from Dr. Greg Glass who can offer insight on the potential of forecasting diseases like malaria and West Nile Virus. Malaria causes more than 300 million episodes of acute illness and 1 million deaths annually, according to the World Health Organization.

Dr. Ari Patrinos from the Department of Energy will explain how GEOSS will enable us to better manage and monitor our energy resources. One study has shown that if we could more accurately predict the temperature by 1 degree Fahrenheit, we would save more than $1 billion annually. Armed with better information, utility companies could anticipate their needs and purchase electricity in more financially advantageous ways. These savings could, in turn, be handed down to the customer.

Dr. Gary Foley of the Environmental Protection Agency will talk about the potential benefits to our air and water quality. EPA is already engaging a data-sharing partnership within the United States. They are adding to the quality of life. Dr. Foley will describe how partnering with other agencies has enabled EPA to get better air quality data to the State of New York so that the State can inform its citizens when the air quality may be harmful to their health.

We will also hear from several witnesses who will provide outside perspectives on this system. Nancy Colleton heads the Alliance for Earth Observation, a group bringing industry and academia together to provide their input to the process. Carroll Hood is formerly of NASA and now works on Raytheon Corporation's efforts in the development of GEOSS. Mr. Hood will testimony about some of the architectural aspects of this system. The American Meteorological Society recently issued a report that outlined challenges facing implementation of the U.S. portion. Dr. William Hooke of the Society will be able to discuss what needs to be done for this important endeavor to reach its full potential.

GEOSS is far reaching in its scope and has the promise to improve our lives. EPA's website outlines some of the potential benefits to each State. Using my Home State of Kentucky as an example, earth observations can help Kentucky track plant diseases and invasive species, such as blue mold, by satellite and predict where it will go based on our knowledge of the climate, soil, and the mold itself. This will certainly be helpful to farmers and those involved in agricultural.

From benefiting loss of life to improving our quality of life on a daily basis, the information derived from this new system can benefit us all.

I look forward to hearing from our witnesses about these opportunities and all that they will yield.

Let me welcome our witnesses.

And I now recognize the ranking member for the purpose of making an opening statement.

[The prepared statement of Hon. Ed Whitfield follows:]

PREPARED STATEMENT OF HON. ED WHITFIELD, CHAIRMAN, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

Good afternoon. On December 26, 2004, the world witnessed a disaster in South Asia that left close to 300,000 people dead or missing. Parents lost children, other children were made orphans, and villages were destroyed in a matter of minutes. The Indian Ocean tsunami was staggering in its devastation.

While there is no way to stop a tsunami, warning areas in the path of a tsunami is possible, and provides the best opportunity to save lives. Tsunami warning systems assemble and integrate data from satellites, buoys and gauges to determine where a tsunami could hit. The United States, in fact, uses such a system. It is part of the Pacific Tsunami Warning System that provides warnings on tsunamis to most countries in the Pacific Ocean. South Asia, sadly, did not have the benefit of such a warning system.

Given the technological capabilities of the 21st Century, we should be able to harness our data-gathering abilities and do more to warn people the world over about impending dangers, both for tsunamis and other destructive events. I have called this hearing today because the United States has just entered into an agreement with 59 countries and other international organizations to develop over the next decade just such a system. The system—or, rather, system of systems—will allow for an unprecedented amount of data sharing that can bring real benefits to our lives.

The Global Earth Observation System of Systems, or GEOSS as it is commonly called, is an effort by participating countries—including countries from South Asia—to create an all-hazards warning system. Just as we have tools to determine where tsunamis could hit, we have tools to forecast weather and monitor air pollution, wind currents, air temperature, and ocean currents. These tools include satellites, seismographs, gauges, and buoys. GEOSS would link our U.S. technology to that of the other participating nations, creating an integrated system that would give us access to data from around the earth.

Out of this effort, proponents tells us, we not only will enhance and expand our ability to predict and warn of tsunamis, but also be able to make informed decisions in anticipation of a variety of other threats to life, health, property, and the economy around the world and here at home.

Today we will hear from witnesses about GEOSS, what it does, what is involved and necessary to make it work, the U.S. role, and the range of benefits that we may see when it is operational. Witnesses will also speak to three specific areas that may benefit from the system: public health, energy and the environment.

First, this afternoon, we will hear from Admiral Conrad Lautenbacher. Admiral Lautenbacher currently serves as one of four co-chairs of the Group on Earth Observations and plays a critical role in seeing that the 10-year plan for GEOSS is implemented. He has been involved with organizing this integrated system from the outset. Given that the United States must integrate its own assets and make them interoperable to successfully link up with other regions of the world, I look forward to hearing from Admiral Lautenbacher about the standards we need to develop to make our information sharing more effective and more efficient. Of course, as the Administrator of the National Oceanic and Atmospheric Administration, he can also explain how the United States is prepared to address the risk of tsunamis along all our coasts.

We will hear from Dr. Allen Dearry, from the National Institute of Environmental Health. He will discuss how GEOSS will advance the cause of public health. Scientists, for example, hope one day to use satellite data to trace an illness-causing bacteria vibrio cholerae in plankton before it hits coastlines, so that regions can get medicine and rehydration materials to affected populations. The World Health Organization received reports of approximately 185,000 cases of cholera in 2001, so this could aid a lot of people. We will also hear from Dr. Greg Glass who can offer insight on the potential of forecasting diseases like malaria and West Nile Virus. Malaria causes more than 300 million episodes of acute illness and one million deaths annually, according to the WHO.

Dr. Ari Petrinos from the Department of Energy will explain how GEOSS will enable us to better manage and monitor our energy resources. One study has shown that if we could more accurately predict the temperature by one degree Fahrenheit, we could save more than $1 billion annually. Armed with better information, utility companies could anticipate their needs and purchase electricity in a more financially advantageous way. These savings could in turn be handed down to the customer.

Dr. Gary Foley of the Environmental Protection Agency will talk about the potential benefits to our air and water quality. EPA is already engaging in data-sharing partnerships within the United States that are adding to quality of life. Dr. Foley can describe how partnering with other agencies has enabled EPA to get better air quality data to the State of New York so that the state can inform its citizens when air quality may be harmful to their health.

We will also hear from several witnesses who will provide outside perspectives on GEOSS. Nancy Colleton heads the Alliance for Earth Observation, a group bringing industry and academia together to provide their input to the GEOSS process. Carroll Hood is formerly of NASA and now works on Raytheon Corporation's efforts in the development of GEOSS. Mr. Hood will testify about some of the architectural aspects of this system.

The American Meteorological Society recently issued a report that outlined challenges facing implementation of the U.S. portion of GEOSS. Dr. William Hooke of the Society will be able to discuss what needs to be done for this important endeavor to reach its full potential.

GEOSS is far-reaching in its scope and has the promise to improve our lives. EPA's Website outlines some of the potential benefits of GEOSS to each state. Using my home state of Kentucky as an example, earth observations can help Kentucky track plant disease and invasive species, such as tobacco blue mold by satellite and predict where it will go, based on our knowledge of the climate, soil, and the mold itself. This information would be of great benefit to farmers. From preventing loss of life to improving our quality of life on a daily basis, the information derived from GEOSS can benefit us all. I look forward to hearing from our witnesses about these opportunities and all that they will yield.

Let me welcome our witnesses. And I now recognize the Ranking Member for the purposes of making an opening statement.

Ms. DEGETTE. Thank you so much, Mr. Chairman.

And on my behalf and on behalf of Mr. Stupak, let me welcome you as chairman. We look forward to working with you on this subcommittee in the 109th Congress.

The concept of an integrated global system of the earth observations collected by a large number of countries that would be free and available for use by government, scientists, universities, industry, environmentalists, and individuals to better predict and understand the workings of our world is truly an exciting one.

In the area of climate change, being able to follow changes in air emissions, deforestation, temperature and water level changes on a global basis would be invaluable as we confront global warming.

More complete and long-term weather observations would help electric utilities more economically purchase power, allow farmers to more effectively plan the use of irrigation and fertilizer for better crop yields, and assist countries in planning for droughts and floods. Being able to track the moisture and temperature factors the affect the life cycle of mosquitoes would be invaluable in preventing a number of diseases, including malaria and the West Nile virus.

But, as our witnesses will tell us today, this integrated system is not something that will be realized immediately. It will take commitment and money, particularly from developed countries, like the United States, to create a coordinating structure and a technical architecture that can integrate the many pieces of data that now exist. We will need to identify the gaps in data and set priorities. As one of our witnesses will testify later today, "The level and nature of investments made in this area in the coming few years will either sustain or limit our ability to meet national and international needs for effective earth observations." More immediate for this country, however, is the need to integrate our own earth observation system. An undertaking like GEOSS absolutely requires the commitment, both financial and political of the United States.

The American Meteorological Society reports that GEOSS will fail unless the U.S. effectively integrates its own earth observation systems. This has not yet been done, and the first step toward implementation, which is to set up a permanent interagency subcommittee, has not yet been accomplished.

I look forward to hearing from the various agency officials on their progress toward this end.

Additionally, I am sorry to say, there does not yet appear to be the political commitment necessary to fund these efforts. In fact, in the 2005 omnibus spending bill, $10.6 million out of NOAA's $24 million budget for climate observations and services was eliminated. The cuts included funding for a new network of 110 observation stations intended to provide a definitive long-term climate record for the United States. Atmospheric monitoring of carbon dioxide, which first alerted the world to a steady rise in CO2 levels, was also cut.

Both networks were described in a recent issue of Science Magazine as key pillars in a much touted international system of systems for earth observation that the Bush Administration has called essential for resolving uncertainties in the connection between greenhouse gas emissions and climate change. If we can not protect this relatively small expenditure to benefit our own country from the budget cutters, how are we going to integrate our own earth observation system much less the world's?

Admiral Lautenbacher is to be commended for his commitment to making these systems a reality, and we hope that he is successful. GEOSS has enormous potential. My Home State of Colorado is the national and international center for earth observing data collection. NIST and NOAA operate national laboratories there. Our research universities work hand-in-hand with NASA and other Federal agencies, and a vibrant private sector is expanding knowledge and creating jobs every day.

By integrating our own Nation's data gathering, providing information to countries that need it most, and benefiting from the help of the international community's efforts, we can ensure a safer world and a more complete understanding of it. But there are many questions surrounding the implementation of GEOSS.

I look forward from—to hearing from all of the panelists who represent a wide array of stakeholders from the public and private sector.

And Mr. Chairman, once again, I would like to applaud you for holding the first of what I hope will be many hearings in Congress so that we robustly exercise our constitutional oversight role.

And I yield back. Thank you.

Mr. WHITFIELD. Thank you, Ms. DeGette.

And now it is my pleasure to introduce the chairman of the Energy and Commerce Committee for his opening statement.

Chairman BARTON. Thank you, Mr. Chairman.

And I want to commend you, as Congresswoman DeGette did, on your virgin hearing as chairman of the Oversight and Investigations Subcommittee. This is the first of many, and I am sure you will do an excellent job. You are a long-time member of Oversight and Investigations Subcommittee. And my first subcommittee chairmanship was this—where you are right now. It is, in many ways, I think the premier subcommittee chairmanship of this committee, and this committee has a proud tradition of doing bipartisan oversight and investigations going back for the last 30 to 40 years. So I will support you in every way possible to carry on that tradition.

I want to welcome our witnesses today. This is a very important issue to have our first oversight hearing on. The tsunami in late

December that claimed the lives of approximately 300,000 was obviously a huge tragedy in the world. The United States has met with other countries in the last month or so to try to come up with a protocol on how to integrate all of these systems. And our hearing today is to see how we can do it here in the United States and then expand that to the GEOSS system around the world.

I thank the Admiral for being here and the other panelists. I won't be able to stay for the entire hearing, but I will try to pop in and out.

And with that, Mr. Chairman, again, congratulations on your chairmanship and good luck, and thank you for hosting this important hearing to start the process.

[The prepared statement of Hon. Joe Barton follows:]

PREPARED STATEMENT OF HON. JOE BARTON, CHAIRMAN, COMMITTEE ON ENERGY AND COMMERCE

Thank you, Chairman Whitfield for holding what promises to be a very interesting and important hearing and is your kickoff hearing as Chairman of this Subcommittee.

Late last year America watched as images came back from South Asia of the deadliest tsunami the modern world has known. The toll, as awful as it was in the beginning, grew each day until we realized that nearly 300,000 people were lost. The worst part is that thousands of lives could have been saved if South Asia had the weather detection equipment already in place in other parts of the world.

We can't stop a tidal wave, but it is a miracle of science that we can see one in the making and warn people in time to flee and live. Today, the Subcommittee will examine the Global Earth Observation System of Systems, or GEOSS, a network that promises to transform disaster warning systems and other types of surveillance that can further save and improve our lives.

We now have technology that can gather and link information from around the world in an unprecedented way. Thousands of instruments—from satellites, to buoys, to tidal gauges—providing important data offer tremendous resources of opportunity, yet many of them operate in isolation. GEOSS offers the means to bring all this vital information together. The information is out there, and GEOSS promises to give us the capability to have useful access to it.

This observational data could produce breakthroughs that would significantly enhance mankind's quality of life. From improving agriculture to thwarting outbreaks of malaria and other diseases to saving lives from natural disasters, the applications are countless.

If we could forecast drought more effectively based on the information we receive from data sharing, we could arm farmers in the affected regions with this information so they could make better decisions to maximize efficiency and minimize losses.

If we could utilize this information to determine where and when disease epidemics are likely to hit, we could get medical supplies to the appropriate regions to combat outbreaks.

At the outset of my remarks I referenced the 2004 tsunami, but this system could also save lives from a whole host of other disasters including avalanches, wildfires, floods and droughts.

For all the promise, there is much work to be done. Today's hearing will examine what remains to be implemented, what steps we are making in the right direction, and what steps we should question. We should know clearly the challenges before us.

Nevertheless, GEOSS offers genuine and beneficial opportunities. And these opportunities would never have reached this point without the commitment of the Administration, which we should applaud.

This Administration had the foresight to bring high-level ministry officials from countries all over the world together to collaborate on this.

On that note, I'd like to welcome Admiral Conrad Lautenbacher, who has been a driving force in this effort. He joins us this afternoon to discuss the benefits of GEOSS and challenges we face as the 10-year implementation plan endorsed in Brussels last month gets underway.

In the United States, there is an interagency working group on earth observations that is implementing our own 10-year all-hazards plan. I look forward to hearing today from agencies in this Committee's jurisdiction that sit on the interagency group. I want to learn what this Committee can do to ensure that information gathering and sharing is as robust, valuable, and timely as can be to their missions.

Within the United States, the integration of our own system will involve partnerships among our federal agencies, academia, industry, and other non-governmental organizations. To gain a better handle on this aspect of the project, we will hear from representatives of these groups today. I look forward to their perspectives on this "System of Systems."

Mr. Chairman, only through clear-eyed assessment will we be able to make thoughtful decisions to ensure the promises of this system can be achieved.

Let me again thank all the witnesses. I look forward to your testimony. And I yield back the remainder of my time.

Mr. WHITFIELD. Thank you, Mr. Chairman.

And at this time, I will recognize Ms. Schakowsky for an opening statement.

Ms. SCHAKOWSKY. I thank you, Chairman Whitfield, for holding today's hearing on GEOSS, the Global Earth Observation System of Systems.

GEOSS would help connect the dots between thousands of environmental sensors currently monitoring the earth. This is an intriguing concept, which, if implemented, could provide the United States and the international community with a valuable resource to better understand our planet. And I want to join in congratulating Admiral Lautenbacher for his forward-looking thinking on this topic.

There are a number of questions, I am sure he would agree, that need to be explored and answered if this is to become a reality, and I hope that our witnesses today will address some of these concerns and provide Congress with a better understanding of this proposal.

The potential of this program is enormous. GEOSS would provide timely data for local, regional, national, and international policymakers. On the global level, we will be able to more effectively sustain agricultural development, determine weather patterns, monitor our fragile environment, reduce damage from natural resources, improve public health, and much more. I hope that the United States' major contribution to GEOSS, the integrated earth observation system will begin the process of protecting U.S. coastlines from the devastation of tsunamis such as the one we recently witnessed in the Indian Ocean amongst the nearly 300,000 dead. In that tragedy was a constituent and family friend of mine, Ben Ables.

Enhanced environmental tracking in my Home State of Illinois where agriculture is of vast importance, would provide several benefits. GEOSS would create a better understanding of soil moisture available to crops and understanding of weather-related crop damage. GEOSS may help to protect our watersheds with water quality monitoring and mapping of land cover changes, which will help protect sources of water for both agriculture and human use.

I am concerned that it will be difficult to guarantee the consistent level of international diplomatic and financial cooperation needed to ensure the success of this program. I would like to know how we can guarantee full international cooperation to make GEOSS effective. I also have not seen how a technology platform could be developed that can be successfully utilized by all the nations committed to this program. Additionally, I am interested in learning more about the potential role of the private sector in this program.

I would like to believe that the vision of GEOSS is realizable, given its potential. We need to seriously consider what steps must be taken to further progress toward its realization. I am glad that all of our panelists were able to join us today to help us determine the best role for the Federal Government to make GEOSS a success. And I look forward to your testimony in particular, Admiral, and I thank you, Chairman Whitfield.

Mr. WHITFIELD. At this time, I will recognize Mr. Burgess for an opening statement.

Mr. BURGESS. Thank you, Mr. Chairman.

I will submit a statement for the record and—so we can go on to the witnesses.

Mr. WHITFIELD. Forgive me. I should say Dr. Burgess.

Mr. BURGESS. Right.

Mr. WHITFIELD. I recognize the gentleman from New Hampshire, Mr. Bass.

Mr. BASS. Thank you very much, Mr. Chairman, and I would like to join my colleague from Texas, Mr. Barton, the chairman of the committee, in congratulating you and commemorating this, the first hearing that you are holding as the chairman of this committee. I wouldn't characterize your attendance here as "virgin", however. I would call it "veteran". Not only are you a veteran of this committee, but you are definitely becoming a veteran on the use of the time clock. I noted that it stopped at 32 seconds, and you were able to deliver a good 10-minute opening statement, and I commend you for that creativity in your first day.

I also want to thank you for holding this hearing. This is certainly an issue that is critical for the safety of our citizens in—during a natural disaster, but has, as others have mentioned, many far-reaching implications: public health, agriculture, energy, and environmental sectors. It is also my hope that witnesses—perhaps our first witness, will address the possible national security applications of an all-hazards system and the implications that it could have in dealing with movement of poisonous gases, chemical spills, dirty bombs, and other issues and threats to the homeland.

I do have a more detailed statement, which I would like, with your permission, to submit for the record. And I look forward to hearing from our witnesses.

I yield back.

Mr. WHITFIELD. Without objection.

Mr. Bass, thank you very much for those kind remarks.

And is there anyone else? Okay.

Well, at this time, I would like to formally welcome Vice Admiral Conrad Lautenbacher who is the Undersecretary of Commerce for Oceans and Atmosphere and the NOAA Administrator and tell you how pleased we are that you are here this afternoon.

Now, Admiral, you are aware that the committee is holding an investigative hearing and when doing so, has had the practice of taking all testimony under oath. Do you have any objection to testifying under oath?

Vice Admiral LAUTENBACHER. I do not.

Mr. WHITFIELD. Then if you would please rise at this time. And the Chair will advise you that under the rules of the House and the rules of the committee, you are entitled to be advised by counsel. Do you desire to be advised by counsel during your testimony today?

Vice Adm. LAUTENBACHER. No, sir.

Mr. WHITFIELD. Then in that case, I would like to, at this time, swear you in. Thank you. You know, when you are in your first hearing, it is always good to have people helping you out, and I want to thank Ms. DeGette.

[Witness sworn.]

Mr. WHITFIELD. Thank you. You are now under oath, and you may proceed with your 5-minute summary of your written statement, Admiral.

TESTIMONY OF VICE ADM. CONRAD C. LAUTENBACHER, JR., UNDERSECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE AND NOAA ADMINISTRATOR, U.S. DEPARTMENT OF COMMERCE

Vice Adm. LAUTENBACHER. Thank you very much, Chairman Whitfield, Ms. DeGette, distinguished members of the subcommittee, and staff. Thank you very much for this opportunity to address you this afternoon on GEOSS, the Global Earth Observation System of Systems. I ask that my written testimony be submitted for the record, and I will make a brief statement.

I was most delighted with the opening statements, because you took away everything that I would have to say about the system, and I am extremely pleased that there is this much interest and understanding of what we are about, so I am grateful for that.

If I could just make a couple of comments that I think set in context that you have also mentioned, this is an effort that exists on a technical level, and it exists on a political international level. And so we are working on both parts of that, and it is very challenging. The technical part probably is the most—is the easiest part of this, this state-of-the-art that we have today for satellites, for information technology, for computers, for data transmission, for building standards. All of that is well known. You all use the Internet. You can see today that we have an information system that works around the world.

Our issue is to get the right kinds of earth observing information available in such a context and such a format that it can become even more useful to the entire world. So technically I think we can do this.

The hard part is the international organization issue. Earth problems know no political boundaries. We deal with air that comes from China. It comes over California and Colorado and comes to the East Coast. The water that goes from the Gulf Stream ends up in Iceland, and vice versa. You know, you can see that the systems are connected around the world, and it requires an international collaboration.

Today, we have these elements of many—in many developed nations that are doing a great job for each country, but we believe if they are connected together, you can build an even more powerful system. So this is a—today, a coalition of volunteers, and it has grown from basically about 30 countries who agreed to come at the United States' invitation to the first Earth Observing Summit a year and a half ago, roughly, and 26 or 24 international organizations because it is a win-win situation. It is an issue where you give and you get. And so the building—the buildup of this organization has been phenomenal. It has almost doubled the size in the year and a half with what I would call very little advertising. We have gone from a summit in the United States to a summit in Japan to now a summit in Europe hosted by the European Union and have agreement to build a 10-year plan, as you mentioned. And that is about—that is what we—that is the task upon which we are embarking. It has great support from all of the developing nations that—or developed nations today that have systems in play. They are all in this consortium, because they see huge benefits, and we are now getting developing nations to come into it. So the newer members that have joined this willingly are developing nations who see the value of it. And that capacity building is a very important part of this effort.

You will hear more about the benefits, but there are two key pieces to making this successful. This is the first time we have had political interest in such an issue. It has been a Holy Grail of scientists for many years to look at these kinds of things and be able to wire the world and figure out what is going on with our systems. But today, it is such an important issue that elected leaders and policymakers from around the world see the benefit of it. So the earth observing summits were the first time that we had cabinet and ministerial level people from all of the nations come together and agree, and that is a very important milestone in this development.

The other issue is that we have turned it around from about it as a science project to a benefit area. It is to the benefit areas. It benefits energy. It benefits water, all of the things that you talked about in your opening statements, agriculture. So those are two developments that have caused this to give it a platform to be successful. I do believe that it offers enormous benefit for the areas that we have cited and you will hear today in testimony. I think this is a turning point for our ability to start to work together on global economic development and environmental—sustainable development areas for our—efforts for our environment.

Again, I want to acknowledge this—the work of this committee and allowing me to speak. I also want to mention my boss, Commerce Secretary Gutierrez, who went to Brussels and gave the United States' speech and endorsement of this system and took the President's blessing with him at that point.

And so with that, I want to finish my statement. Again, thank you for allowing me this opportunity. I look forward to answering your questions, sir.

[The prepared statement of Vice Adm. Conrad C. Lautenbacher, Jr. follows:]

PREPARED STATEMENT OF VICE ADMIRAL CONRAD LAUTENBACHER, JR., (U.S. NAVY, RET.), UNDERSECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE AND NOAA ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Chairman Whitfield, Mr. Stupak, 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 last summer 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.

Mr. WHITFIELD. Well, Admiral Lautenbacher, thank you very much for those comments. And for this round of questions, I think, one person on this panel, we will allow everyone 10 minutes on their questions. And I would make this comment, that obviously this system has been in the planning stages for some time, and there has been a lot of discussion about it. But with the tsunami that recently hit Southeast Asia, there has been a lot of focus on the tsunamis. And before I formally ask some questions, I would like to show a TV clip from—many of you may have seen the program on the Discovery Channel, and we have about a 2-minute clip here that I would like to show.

[Video.]

Well, that gives us a little feeling of what it could be like. We wanted to get you all in the right mood before we started talking about this. But as you could see, this mega-tsunami in the Atlantic could be triggered by a volcanic eruption in the Canary Islands resulting in massive destruction on the East Coast of the United States under that theory. So Admiral, what steps are being taken today to protect the Atlantic region?

Vice Adm. LAUTENBACHER. We have worked—immediately after this tragedy occurred, we have put together a plan, which is now being funded in the supplemental as well as the fiscal year 2006 budget of about $37 million, $24 million of which go to NOAA and the other $13 million to the USGS to put together a comprehensive warning—tsunami warning system for not only the Pacific, where we have the system, as you have mentioned, but the Atlantic as well. If we gain success in our budget deliberations, we would be able to get that system in place within the next 2 years.

In the meantime, we are taking steps to hook up to our current system, the tide gauges and seismometers that already exist in the area that protects the southern part of the United States and the Caribbean, so we are not waiting to put into place the full system. We are bringing online assets that are there today in terms of tide gauges and seismometers to give us a preliminary warning capability for the East Coast.

Mr. WHITFIELD. And would you explain in a little bit more detail how information from GEOSS would warn us of such an event? What—how would that actually occur?

Vice Adm. LAUTENBACHER. Let me—this is an interesting comment, the fact that this enormous tragedy occurred, and I am—my heart is going out to all of the people that were involved in this, so I am not trying to make any hay out of this, so to speak. But it has brought home the value of a GEOSS or a global earth observing system, because what we are talking about here is one piece of one of the nine benefit areas that a GEOSS can provide for us. So we are talking about, actually, a very little piece of it, and this is something that could save 90,000 lives just like that with a relatively small investment. So the way it would work is to have—it is—it has to be an end-to-end system, so you have to, first of all, go and look and see where hazard areas are, which is what we do in the United States. And we do mapping of hazards. We run models. We try to find out where the vulnerable parts of the country are. Obviously the Pacific is where we have concentrated, because that is the Ring of Fire, as they say. Then you have to have the proper kinds of technology for warning. We have put—the newest technology is called DART or dart buoys. They are open-ocean monitoring buoys that monitor the formation of the tsunami hopefully right after the fact has occurred, right after the potential earthquake has occurred. We have tide gauges along the coasts. Seismometers give us the original warning, so we could even tell whether there has been something in the ocean area. So you look at the seismic traces. You look at the reactions of the buoys and tide gauges along the ocean at a central warning center, and then put out broadcast information to all the nations and to us, to our States and our weather forecast offices. Now that information has to be—get—has to go to the emergency managers in the cities and coastal areas that are affected, and they then have to take the actions to mitigate and to prevent further disaster.

We have a program called a tsunami ready program that we support, and it allows certification of coastal areas. We also have a storm ready program for inland tornadoes, but in other words, it is a program that teaches the emergency managers in this—the towns and regional areas how to deal with the situation. We just had our first—we had 15 that were—15 communities in the United States declare tsunami ready. We need to have a lot more, but we just got a new one this week, Lincoln City, Oregon, Mr. Gehman requested we certified and did all of the work. So it is an end-to-end process that requires dissemination of the warning and an understanding by people in coastal areas on how to deal with it.

Mr. WHITFIELD. I hear the term, when we talk about this global warning system, interoperable, and I know that our system has to work with the systems of other countries, but interoperable, would you expand on exactly what that means to you?

Vice Adm. LAUTENBACHER. Well, it has to be interoperable in a sense that we have to have interfaces that allow the data to be exchanged, so as—there—for instance, we have different satellites in orbit today, but—and they are run by different countries, but we have standards that bring the data down to a central place and allow it to be distributed through a global telecommunications system that the WMO, the World Meteorological Organization, sponsors. So the ablate to be able to get the data in a standard format is the critical piece, and the building of the instruments and the operation of the instruments is a national or an international organization prerogative, but in the end, it has to come to a standard interface.

Mr. WHITFIELD. But what—from your perspective, we do have adequate science and technology. And I think somewhere where the major problem may be the public policy part of this or the political part, would you agree with that?

Vice Adm. LAUTENBACHER. Yes, sir. There are two major issues. One is what I would call the business models that every nation has for data. Some countries sell data. In other words, they don't—the United States has more of a split between public good and private industry. So we have a certain set of data that we provide for public good, because we believe that is the right way to go. We need open information, and the decisions on which you base economic—the future of our economy should be open to the public for scrutiny, so there are a certain set of data that is free.

In other countries, that is not true. They have less data available for free so that you must pay for it, or at least internally pay for it within the government.

The other issue is that there are national security concerns from nations that are worried about trading data that might—they think might be sensitive to their own internal needs, and we have to work through that and assure them that we are looking for the kind of data that helps everyone. We are not trying to pry into their military secrets.

Mr. WHITFIELD. Now I understand that Europe is one of the areas that charges for information. Will GEOSS have—will we have to pay for information from the Europeans or——

Vice Adm. LAUTENBACHER. We would hope that we do not have to pay for information from the Europeans. Now what we have today, in effect, in fact, a hazard system is the way in. When we work in the weather area, we are able to exchange data on—for weather systems on a large level, because it is information that helps us prevent disasters or to mitigate against disasters and warn people. And at the political level, just about every nation in the world today agrees that that is the kind of data that they ought to provide free for the world. So we need to expand those types of relationships.

Mr. WHITFIELD. Okay. Admiral, my time is expired, so at this time, I will turn the questioning over to Mrs. DeGette.

Ms. DEGETTE. Thank you so much, Mr. Chairman.

And before I start, Admiral, I would like to say that Mr. Stupak is very sorry he couldn't be here today. He just had back surgery so——

Vice Adm. LAUTENBACHER. I am sorry.

Ms. DEGETTE. [continuing] he is resting this week, but he will be back in the saddle, we hope, next week.

I wanted to talk to you a little bit about an issue I raised in my opening statement, and first of all, to thank you for your personal dedication in establishing the system. I think it is really going to be important, not just for tsunamis, but for predicting climate change and weather all around the world, wouldn't you agree?

Vice Adm. LAUTENBACHER. I agree, absolutely.

Ms. DEGETTE. Now I have been told recently that it would cost, worldwide, about $5 billion to $6 billion a year just for meteorological observations. And my question is what would you anticipate the cost of supporting—of both establishing and then supporting a global system that will bring all of the data together, the kind of system we are talking about with GEOSS?

Vice Adm. LAUTENBACHER. I think that the speculation on what a full system would be is—we are not at a stage where I can say it is $5 billion, $10 billion, $20 billion. But what I want everyone to recognize is that we already, today, invest billions of dollars in the developing nations for the systems that are in place. And so the first thing to do is to harvest the synergy that we can gain from connecting our satellites to Russia's, to India's, to—and we are doing that.

Ms. DEGETTE. Right.

Vice Adm. LAUTENBACHER. In satellites we are much further along than we are on ground data. But—and then to take an inventory of where the gaps are and to look at how we are going to approach the funding of them, but as you have——

Ms. DEGETTE. But let—I mean, you are exactly right. Most of those systems are in place and we shouldn't replicate them. We need to coordinate. How much is that going to cost? Do you have some sense?

Vice Adm. LAUTENBACHER. I don't have a sense for—let me—I don't have a number that I can give you, but let me—I am going to—if you would want to press on this, first of all, the satellite—we have today satellite—complete satellite coverage at the equator. So we have geostationary satellites all around the world, and we have an organization that coordinates that.

Ms. DEGETTE. Right.

Vice Adm. LAUTENBACHER. So that is pretty good.

Ms. DEGETTE. Yes.

Vice Adm. LAUTENBACHER. Okay. So what we—all we need to do there is to continue to invest in those satellites, as we do today.

Ms. DEGETTE. Okay.

Vice Adm. LAUTENBACHER. So I ask for your support of my question.

Ms. DEGETTE. You just basically don't know how much this is going to cost.

Vice Adm. LAUTENBACHER. We don't. This could go—this is a system which will be—will go on for years and be developed over years.

Ms. DEGETTE. Sure. So—but——

Vice Adm. LAUTENBACHER. There are very minor enhancements. Like the tsunami system. We are asking Congress to fund a tsunami system, which will be our part of a worldwide warning system.

Ms. DEGETTE. Right. But——

Vice Adm. LAUTENBACHER. We are asking for the next generation of instruments to put on, which will help us turn a geostationary satellite into a true environmental satellite. So there are incremental pieces there.

Ms. DEGETTE. Exactly. Exactly. And I guess the reason I am concerned is because in the President's recent budget submission for 2006, there are deep and many cuts to NOAA. And a lot of the data-gathering programs that you are talking about within NOAA that are gathering data right now see heavily reduced funding, and that is like the oceanic and atmospheric research, the national environmental satellite data and information service, the national weather service. And so my question is, if we are already having cuts in our existing information gathering systems, and you are not really, really sure how much it is going to cost, at least at each stage, do we really have the national ability to commit to such a grand scheme like GEOSS financially?

Vice Adm. LAUTENBACHER. Well, first of all, I don't think—and I would be happy to go through the budget, you won't see cuts in the President's budget to observing issues. You will see elimination of some of the member interests that were added at the end of the last year. And there have been cuts in observing from the Hill, I am sorry to say, but we continue to ask for those, like the climate reference network that you have mentioned.

Ms. DEGETTE. Right. But——

Vice Adm. LAUTENBACHER. We—that is a top priority. I come back again for the fourth year asking for help with the climate reference network, so I agree with what you have said. It is an important piece.

Ms. DEGETTE. But see, like, in 2005, your agency's budget request was $24 million and $10 million of it was removed in—or for climate reference. That is right. For climate reference.

Vice Adm. LAUTENBACHER. Right.

Ms. DEGETTE. And almost half of it was removed in the omnibus bill. So I mean, I assume you felt like you needed the $24 million.

Vice Adm. LAUTENBACHER. Yes, ma'am. I came over and supported that, and I continue to support it. I asked members. I was told that there was no prejudice on the cut, and so we rearranged money to cover the continuation of the climate reference network, because it is an important priority for the President. So we——

Ms. DEGETTE. But you, in fact——

Vice Adm. LAUTENBACHER. [continuing] want to do this. So I—there is no——

Ms. DEGETTE. Well, I know, and I really commend you for wanting to do it. I want to do it, too. The question is can you really do it, and can you expand it the way you need to, given the cuts that you are seeing year in and year out from Congress? And I mean, you are under oath, so you have to answer truthfully and straightforward.

Vice Adm. LAUTENBACHER. I am answering—as I always do, I have always been straightforward.

Ms. DEGETTE. I know.

Vice Adm. LAUTENBACHER. The—obviously I don't like cuts in the program. I am passionate about this program. I am passionate about what NOAA does. And I come over here, and every year I support it, and I support it within the administration. So no, I don't like to see reductions to my budget. I am—but I am very grateful to the additions that Congress has made. Congress has added to many of these programs, so I am appreciative to many of the members that support what is going on. I do think we are on a—the right trajectory to be able to do this. I really believe that there are enough resources and the ramp and the understanding. You don't want to put too many resources into it. You want to fund when things are ready to go and provide the proper match of funding with technological capability, but I think we are on a ramp that can support this.

Ms. DEGETTE. What is your proposed 2006 budget for the climate observation program?

Vice Adm. LAUTENBACHER. We—in this area, we have requested all of the money that was cut last year, and we have added another $19 million or so for climate.

Ms. DEGETTE. So what is the total, Admiral?

Vice Adm. LAUTENBACHER. I don't know what the total is for the—for that——

Ms. DEGETTE. All right. Mr. Chairman, if we could have him——

Vice Adm. LAUTENBACHER. It is at least the $10 million and then the $19 million——

Ms. DEGETTE. 43 million?

Vice Adm. LAUTENBACHER. It is—the $10 million you have talked about, we have asked for that back. That is in our budget. And I have added to our roughly $200 million climate observing budget another $19 million that the President is supporting. So we have added money to that area.

Ms. DEGETTE. Okay. And you really feel like it is essential that you had that to both do what you need to do collecting data——

Vice Adm. LAUTENBACHER. Yes, I do.

Ms. DEGETTE. [continuing] and also expand to GEOSS?

Vice Adm. LAUTENBACHER. Yes, I do.

Ms. DEGETTE. Another concern I have is, and we were just sitting here talking about it, when we have these grand schemes or when we have an emergency like the recent tsunami, Congress is really quick to appropriate money for these exciting new programs. And the concern I have got is down the line, if we have a new NOAA administrator, maybe their commitment to GEOSS wouldn't be as much as yours, maybe a new administration or a different Congress. I am wondering what will make the U.S. keep its commitment to GEOSS, and one thing I was thinking about, you were talking about, in response to the chairman's question, the tsunami monitoring system that we have in the Pacific. As I understand, three of the buoys aren't working because we don't have the money to maintain them right now. So the question is what will we do in the future to be able to maintain this exciting system and expand it?

Vice Adm. LAUTENBACHER. The—on the buoys, we have been—we have repaired one buoy, so two of them are not working, but they are not being—they can't be repaired because of the weather. They are—they sit off the Allusion Islands. We need calm weather, and as soon as it gets there, we think probably the 1st of April or so we will be able to go out.

So that isn't a money issue.

Ms. DEGETTE. Oh, okay.

Vice Adm. LAUTENBACHER. Our issue was expanding it. We would not be able to expand it without the help—we were trying—we were going to go along at two buoys a year for the next 10 years to try to get a full system in place. We have asked in our supplemental to be able to do that at an accelerated pace and get them in within 2 years.

Ms. DEGETTE. So how are we going to be able to have some kind of a firm commitment to the GEOSS system in the future?

Vice Adm. LAUTENBACHER. Well, first of all, I think it will outlast me. I am not the only person that is talking about this. If you were—if you had—you would have been very pleased to listen to the statements in Brussels, the Iranians, the—every European nation got up and gave a speech at the ministerial level of how valuable and important this was. So there are many, many nations that are signed up to this. There are four co-chairs of this group, the South Africans Representing Developing Nations. They are all very passionate. You could have—bring any of them in and sit them in this chair, and just the fact that you all think this is such a good idea, I think it will long outlast me in terms of a commitment to do this.

Ms. DEGETTE. Well—and I hope you are right. According to a lot of recommendations, there were recommendations for two areas of action. One was to establish an organization structure, and the second one was to establish a permanent earth observation subcommittee charter for the temporary interagency working group. I am wondering what the status of that—the second part of that is, because it would seem to me that would institutionalize GEOSS if we had that permanent subcommittee.

Vice Adm. LAUTENBACHER. We will have that within a few weeks. I mean, we are working on that right now. This is—we have a strategic plan for our GEOSS produced by the 15 agencies, and I have agreement from the White House to set up a permanent committee, and so we are working out the details of how to do that. So I am optimistic that we will be able to institutionalize this very quickly.

Ms. DEGETTE. All right. Thank you very much.

Vice Adm. LAUTENBACHER. All right. Thank you.

Mr. WHITFIELD. This—at this time, we will recognize the chairman for his questions.

Chairman BARTON. And I won't take 10 minutes, but I am watching in my office. I have it on TV, and I saw that Mr. Bass stole my line about creative use of the clock. I thought that was pretty cute. The first hearing, you just stopped the clock so you don't go over.

Admiral, I am—my question is more of a practical nature. We are all for what you are trying to do, but this—I assume you were a part of the group that went to Brussels, is that correct?

Vice Adm. LAUTENBACHER. Yes, I was.

Chairman BARTON. Okay. These 59 other nations that were so passionate about this, are they willing to put money to finance the construction and operation of the system, and if so, how much?

Vice Adm. LAUTENBACHER. Well, they do already. These are the nations, at least the 30 or so that are invested heavily. And they are there with the assumption that we are that they are going to continue their investments and work together to improve the structure of the system. So I believe they are there. They have agreed to fund the organization.

Chairman BARTON. But what are we talking about? How much is the U.S. contribution and in the perfect world, if we contributed what they wanted us to, and they contributed what we thought they should, in order of magnitude, what are we talking about?

Vice Adm. LAUTENBACHER. Well, I have to go back to what current budgets are to tell you that, because that is—I mean, nobody has put a figure down on the—nobody has signed up and said, "We, the United States, are committing another $2 billion or $1 million," whatever it is. No one has done that. This is an organization that is bringing their assets to the table to try to work together——

Chairman BARTON. Well, just—you know, this is just kind of a general oversight hearing. I am not asking you to sign a blood oath that this is what it is going to cost, but generally, how much would it cost to do everything you guys wanted to do that met in Brussels? And what share of that would the U.S. pay and what share would the rest of the world pay?

Vice Adm. LAUTENBACHER. We are not far—that far enough along to answer that question. I can tell you what was——

Chairman BARTON. You don't even have a general ballpark?

Vice Adm. LAUTENBACHER. I can tell you what we spend today, and I can tell you what incremental systems will cost. The tsunami warning system for the United States share is the $37 million that we are asking for in the supplemental in the fiscal year 2006 budget. The increases to our satellite capability, which will allow us to do full environmental observing, is an increase to our budget of about $50 million. But that is a normal procurement ramp that we would have asked for anyway, because it benefits the United States. It doesn't—it is a section that provides direct value to us. Obviously, it will provide value to the world if we can connect it with other systems.

Chairman BARTON. Well, that is $87 million incrementally, if I—$37 and $50. What are they—what does the rest of the world put up?

Vice Adm. LAUTENBACHER. Actually, GMES is—that is the European contribution. It is about $700 million, and they are in the process of—they put money into that several hundred million already. So they are actually ahead of us in adding increments to their——

Chairman BARTON. And so they have a system that is—a satellite system that is operating?

Vice Adm. LAUTENBACHER. They have a satellite—they do have a satellite system that is operating. They are going to invest in future fully environmental satellite monitoring. They call it GMES, Global Monitory for Environment and Security. And it is one of their—Galileo is their other top program. Those are the—they have two space programs that they are funding, and GMES is more than space. It is the kind of—it is the European contribution, as I have mentioned, the U.S. contributions—the European is more than just space. And that is a $700 million or $800 million effort that they are embarking on and support.

Chairman BARTON. But to do this right, we are going to have to have these stations in the Indian Ocean and different parts of the Pacific, so is India and Thailand and, I guess, Kuwait and Saudi Arabia, are they all part of this group, and if so, how much are they putting in?

Vice Adm. LAUTENBACHER. India and Thailand are part of—are one—are some of the 60 nations that were at the—and they are interested in dealing with it. The Indians have agreed to $26 million for tsunamis and they, you know—millions of dollars, tens of millions of dollars have been offered to support it. I have people that are just leaving Paris now after a meeting of the IOC, which is where this work will be done, the Intergovernmental Oceanographic Council, working on a design for a system and the kinds—to answer the kind of question you are asking me, how much will this nation put in and how much will this nation, how much—for specifics. And that is kind of a first deliverable of what we are talking about.

Chairman BARTON. Well, I don't want to—I am—I have got to run to a radio interview. I am all for this. I think you are to be commended and the administration is to be commended for pushing it. What I don't want to see is us putting this system in place and the U.S. taxpayer end up paying a huge disproportionate share, like we normally do when we get involved in these international projects, so that—my role is going to be to serve as a watchdog for the U.S. taxpayer. We want to do good deeds, and we want to do them sooner than later, but we want—to the extent that the rest of the world can pay, we want those that can to participate and help to pay for it.

And with that, Mr. Chairman, I yield back.

Mr. WHITFIELD. Thank you.

Ms. Schakowsky is recognized for 10 minutes.

Ms. SCHAKOWSKY. Thank you. Thank you, Mr. Chairman.

I would like to take some exception, first of all, to this notion that when it comes to international things that the United States usually pays a disproportionate share. I mean, if we look in terms of international aid and compare that to other countries as a proportion of our budget, it is not really true.

But specifically on this, I wanted to ask you whether or not this strategic plan for the U.S., so this is our piece of it. And would that have to, in your view, precede moving ahead with the global efforts? I mean, is this what we need to do before we can get started and fully participate in GEOSS?

Vice Adm. LAUTENBACHER. I would say no. We need to do this. There is no question about doing this, but we are already engaged in the world today, and have been for many, many years——

Ms. SCHAKOWSKY. Right.

Vice Adm. LAUTENBACHER. [continuing] without ever having done this. So we are better off to do this now for sure, because it will help us internally do a better job and be more efficient in providing for economic and environmental sustainability. So I would say we definitely need to do this. We can do it in concert with the world.

Ms. SCHAKOWSKY. Well, let—here is my concern. It—there are certain things in there that we need to do just for us.

Vice Adm. LAUTENBACHER. Yes.

Ms. SCHAKOWSKY. And then in addition, in order to implement an international system, there would be additional costs. So I wanted to ask you about, in the appendix to the strategy plan, there is a discussion of near-term opportunities. And the first is for "comprehensive and integrated data management and communications to integrate the wide range of earth observations across agencies and disciplines." And it states that the data management is "a necessary first step to achieve the synergistic benefits" from the U.S. system and the data and products must be made readily available and accessible through data management systems. So I am asking in terms of that first near-term opportunity, where we are in beginning this effort.

Vice Adm. LAUTENBACHER. We have in place a number of data-sharing arrangements already within the United States that we use. We need more, and it needs to be more comprehensive. And we have data-sharing agreements with world organizations that do global observing. So there are pieces in place. But we are missing significant sections, such as our oceans and coasts. We don't have the complete integration of data that we need from the various observing stations that States have and universities have and some of our own agencies. We are looking forward to putting a budget initiative in this next budget that will help work on that particular part of the problem. So this is a—and this is a major concern, and when I say that it is near-term issues, that is one of the first issues that the permanent committee that we talked about is going to take on.

Ms. SCHAKOWSKY. When you say "in the next budget", are you saying in the one we are considering now that there will be funding for that?

Vice Adm. LAUTENBACHER. I am doing fiscal year 2007 as we speak here.

Ms. SCHAKOWSKY. Oh, so we are talking about fiscal year 2007?

Vice Adm. LAUTENBACHER. Yes, ma'am.

Ms. SCHAKOWSKY. Okay. The second near-term opportunity in this report is to improve observations for disaster warnings for events such as earthquakes and tsunamis, landslides and volcanoes. The plan states that "systematic widespread coverage" of observations is needed but is unmet. And it points out that existing systems are not being maintained or modernized, which is apparently what is happening with NOAA's climate observation systems. And we also don't have an operational radar satellite system, as Japan and Canada are getting ready to launch. The strategy plan states that such a system could "truly help in a real time manner, reduce hazards, help mitigate disasters, and realize goals of saving lives and reducing damage, all laudable and important goals. What is the outlook for getting this kind of investment from this Congress?

Vice Adm. LAUTENBACHER. Well, it has been good. In the last 2 years, one of the major problems we have had are our water level measuring systems that we have around the country. They were at—somewhere around 60 percent effectiveness. We obtained funding from the President and from Congress to get that up toward about—up to 85 percent, and I just—we got money from last Congress that will get it up to full—that system up to its full level. So they are—we have been able, with this effort going and the interest of many members and staff members to be able to start to backfill what I would call our inadequate funding of sustaining systems that we need to make the proper kinds of warnings for disasters.

Ms. SCHAKOWSKY. Yes. The operational radar satellite systems, such as Japan and Canada, where are we on that?

Vice Adm. LAUTENBACHER. Yes, I—that is an interesting issue. I believe that that is something that can—that we ought to look at internationally to deal with. For instance, we, for many years, were able to use the Canadian data straightforwardly, and there was no need for the United States and Canada to have a different satellite. The one satellite had the kind of coverage and provided the kind of parameters we needed. There now is a different business model that is out there, so we are going to have to deal with the fact that we don't have a piece or an interest in the follow on to the Canadian satellite. So I look to GEO to be able to deal with making—negotiating so that we can work on these very issues and be more efficient, not have everybody put up a radar satellite. I don't think everybody—my personal opinion is not everybody should put up a radar satellite. You need a couple of them, and we should have an international agreement in some way to be able to use this data as people need it for economic benefit.

Ms. SCHAKOWSKY. So you are saying part of the value of this international system is that we could end duplicative efforts and share——

Vice Adm. LAUTENBACHER. Absolutely.

Ms. SCHAKOWSKY. [continuing] information.

Vice Adm. LAUTENBACHER. Absolutely.

Ms. SCHAKOWSKY. You had mentioned in your opening statement that you thought the technology was actually the easy part and that the political or other kinds of problems—what are the obstacles, the more difficult obstacles that you see in specific?

Vice Adm. LAUTENBACHER. I will go back to the two that I mentioned. I think the fact is that each country does have a different business model, which means that it has to be—the scientists can't take it on. It has to be taken on at a political level, a high enough level to be able to say we are going to change the way we operate and we are going to fund it from the central government or we are going to do something else to get funding to be able to enter the systems——

Ms. SCHAKOWSKY. But when you talk about business model, are you talking about funding source or——

Vice Adm. LAUTENBACHER. Yes, I am sorry. I used a civilian term, but I am talking about how they—many—for instance, many weather services in other countries charge other parts of the government——

Ms. SCHAKOWSKY. Selling the data.

Vice Adm. LAUTENBACHER. [continuing] for the data so that it looks, on the books, as they are free. Of course they are not. We know that it is not free. They are being subsidized by the rest of their government. So that is why I call it a business model kind of a thing——

Ms. SCHAKOWSKY. I see.

Vice Adm. LAUTENBACHER. [continuing] because a lot of weather data, while it is useful in private sector quite heavily, it is a very important piece of government, and you need it to run—in almost any kind of government, you need weather data. So in my view, we are all paying for weather data, but other nations have a different way of putting it on the books. And that has to be worked out.

And the other issue is the issue of real time availability of the data. Many nations are very sensitive to getting the information directly, and if we are going to have a tsunami warning system that works, we have to do it the way we do it in the United States. We have to have instantaneous, real time data from—reporting through satellites and hard wires and Internet directly to regional centers, because that is how you get—gain time in being able to find out what is happening physically on the earth. Where is this wave going? And where is it hitting now? You have got to have that real time information, and many nations are hesitant to sign up to real time data gathering, because they think it would—may be, you know, disadvantageous to their national security.

Ms. SCHAKOWSKY. Thank you. I appreciate it, Admiral.

Vice Adm. LAUTENBACHER. Yes, ma'am.

Mr. WHITFIELD. Mr. Bass is recognized for 10 minutes.

Mr. BASS. Thank you, Mr. Chairman.

Admiral Lautenbacher, if there were a huge sloughing off of mud on the continental shelf on the East Coast, which could create an enormous tidal wave, how long would it take to reach the East Coast?

Vice Adm. LAUTENBACHER. You are talking about the——

Mr. BASS. Not that one. That is a volcanic——

Vice Adm. LAUTENBACHER. [continuing] example in the——

Mr. BASS. [continuing] issue. But one of the threats to the eastern United States is the possibility that a—there would be a landslide, if you will, on the continental shelf and that would create a reduction in the height of the water and then it would come back up again.

Vice Adm. LAUTENBACHER. Right.

Mr. BASS. It is about—I don't know. I am—I have never been there before, but it is just a few—maybe 50 or 30 miles off shore.

Vice Adm. LAUTENBACHER. Yes. In a case where you have that kind of short warning time, the first place it hits would have very little warning, because a landslide normally would not——

Mr. BASS. A few seconds?

Vice Adm. LAUTENBACHER. No, minutes. We are talking 5 or 10 minuets.

Mr. BASS. Do we have any kind of warning system in place today that would give the people of, let us say, New York or Boston or Cape Cod or Long Island, a 5 or 10-minute warning if this were to happen?

Vice Adm. LAUTENBACHER. At the exact place where it happened, no, but up and down the coast a little bit, yes, because we have tide gauges in place that are being monitored real time and you can provide warnings.

Mr. BASS. So let us say the—this event occurs and it takes 30 seconds for it to happen, let us say, I don't know how long a mud slide lasts underwater, and it happens at high noon, when would we find out in Boston about it?

Vice Adm. LAUTENBACHER. That—I am not sure. I could—would—you know, I am not sure.

Mr. BASS. All right.

Vice Adm. LAUTENBACHER. Speaking off the top of my head doesn't have any value.

Mr. BASS. Is there a system in place right now to identify the problem and communicate? What I am getting at is when you—who certified these tsunami safe cities and why are they tsunami safe?

Vice Adm. LAUTENBACHER. They are tsunami safe because they go through a checklist that has been worked up over years of experience by the National Weather Service in terms of getting information out. Now we have—when you start with the information NOAA weather radio, that is one direct way to get it to citizens that alarms you in your home et cetera——

Mr. BASS. Sure.

Vice Adm. LAUTENBACHER. [continuing] that can go out in about 7 minutes from the time you certify you have some information. Okay. And that comes out from our weather forecast offices. So you have got to get the information to the weather forecast office. And we have money to take it down to 2 minutes. So we are looking in the next 2 years to get it automated so that information will get out after 2 minutes from the weather service to the public. Then you have the—then there needs to be the emergency managers take over and do something. So normally 10 to 15 minutes is considered the minimum time to do anything, given——

Mr. BASS. Well, how long do you think it would take a tidal wave to reach the shore if it originated 30 miles off shore?

Vice Adm. LAUTENBACHER. I would say 10 minutes or so.

Mr. BASS. It takes that long?

Vice Adm. LAUTENBACHER. It takes—yes, it does. It takes time for it to—it is going to slow down. If it is on the shelf, it is going to go slowly. It is not the 500 miles an hour. The speed depends on the depth of the water. As the depth gets smaller, the speed gets slower.

Mr. BASS. So under the present situation, if we had such an event, there—are there—how soon after its occurrence would you know that it had happened?

Vice Adm. LAUTENBACHER. As soon as it reached the first nearest tide gauge. And we have a fairly robust system of tide gauges along the East Coast.

Mr. BASS. The tide gauges would show an immediate drop or rise in——

Vice Adm. LAUTENBACHER. Drop.

Mr. BASS. [continuing] the height of the water and that buoy is programmed to relay that information immediately?

Vice Adm. LAUTENBACHER. Not today. Not today. We—as I have mentioned earlier, we are trying to start to hook up tide gauges on the East Coast. We wouldn't be doing Boston first. I understand it is important where you are, but we would be doing the ones in the—towards the Caribbean where we have the active seismic plates and work our way up the coast. They are on real time. The question is you have to have some kind of a command center that is watching it——

Mr. BASS. So the tide buoys today are——

Vice Adm. LAUTENBACHER. There are no alarms on them today. There are no alarms on them.

Mr. BASS. So the tide buoys that are out there today are not designed to be any type of warning at all?

Vice Adm. LAUTENBACHER. They are not designed for tsunami warning, that is correct.

Mr. BASS. Or any type of warning?

Vice Adm. LAUTENBACHER. That is not true, because they are warning—they do warn of issues for entering port. We have port systems that are tied to the tide gauges that go into computers that let pilots bring ships in and out. So they are—that is a real time system that they go to a computer, can call up, stand there on the bridge of their ship and say, "Uh, oh. There is a big wind. There is a big current. There is an extra high tide. There is something going on. I am not going into port.” So we do have warning systems for that kind of idea——

Mr. BASS. When these buoys are all hooked up——

Vice Adm. LAUTENBACHER. And those are gauges that are sitting——

Mr. BASS. Gauges rather in a——

Vice Adm. LAUTENBACHER. Yes, they are gauges.

Mr. BASS. Oh, they are gauges?

Vice Adm. LAUTENBACHER. These are tide gauges, not buoys necessarily. They are tide gauges that are in the water, sometimes very close to land, sometimes a little further out in the——

Mr. BASS. How much further out? They are—if they are a gauge, they are not a buoy. They are attached to the bottom, so it must be pretty shallow where they are.

Vice Adm. LAUTENBACHER. They are. They are——

Mr. BASS. Are they really right on the shore?

Vice Adm. LAUTENBACHER. They are usually in places where you can get accurate readings: sheltered or in shallow water. So I mean, no more than a mile off the coast, but normally close to the coast.

Mr. BASS. So the first warning you would get would be when it was within a mile of the coast?

Vice Adm. LAUTENBACHER. At that very spot, but the point is, that wave also travels up and down the coast, and it takes a while for it to get there. If you got that warning, you would be able to clear beaches up and down the coast for miles and save lots of people who might normally be drowned by a wave.

Mr. BASS. I would suspect that you would get a warning pretty fast when it hit the beach without, you know, 10 seconds after it happened. That is the way the message would get communicated up and down the coast. I guess my question is—further question, after the—you have started linking all of these things together, what will you have that you don't have today?

Vice Adm. LAUTENBACHER. Well, on the tsunami warning system, you don't have anything on the East Coast or the Caribbean at all. You have no centralized monitoring station or an infrastructure for communication broadcasts or panelists to figure out what is going on and a network of prepared emergency managers to deal with the situation. After it is all hooked up, we hope that that is what we have, an end-to-end system that allows there to be a maximum saving of lives and protection of property up and down the coast.

Mr. BASS. Is the more long-term forecasting mechanism, drought and so forth, is that a buoy system or a satellite system or what?

Vice Adm. LAUTENBACHER. Long-term forecasting of drought is going to depend heavily on instrumentation of the ocean. We have to measure the cycles in the ocean. The most familiar one that people know is El Nino.

Mr. BASS. Sure.

Vice Adm. LAUTENBACHER. You hear of El Nino. That is only one cycle. We don't have enough systems in place to be able to talk about and measure the other cycles and how they are all connected. If we could do that, we would be able to predict drought conditions much further in advance and, as far as I am concerned, for maybe a decade or so.

Mr. BASS. All right. I am interested in briefly your discussing how kinds of restructuring would be required in order to get all of these Federal agencies to work with one another under IEOS.

Vice Adm. LAUTENBACHER. I—it is premature to talk about restructuring, but we would—this is my view anyway. We would put together some kind of a centralized office in which we can, first of all, take an inventory of everything that is going on so Congress can look at it and we can look at it to make sure there are no duplications, make sure we have got holes that we can work on. So there, first of all, is this setting up of some kind of a management structure to allow that integration or coordination to happen. And that is what we are working on right now.

Mr. BASS. Admiral, I would—let me return to the last—to my earlier line of questioning just for one final one. We are going to spend some money and we are going to create a new system. It is going to be very high tech. It is going to deal with long-term as well as short-term dangers, both in national security, natural phenomenon, and also some very short-term dangers. Is it possible that Americans would be lulled into thinking that they are a lot safer than they really might be from catastrophic natural disasters like tidal waves, tsunamis, or earthquakes, or even terrorist attacks because this money has been spent and the system is in place when, in reality, the only time you are going to be—have is to get from the first floor to the second floor, which might be helpful. But in a situation like Cape Cod, for example, or any of the—or the Hatteras or the—there is no where to go. Really, the warning times are going to be very, very short. Do you agree?

Vice Adm. LAUTENBACHER. I agree. That is a danger, and part of what we continually talk about is education. And public education needs to be part of this. We—that is, you know, part of our ethic inside of NOAA and part of what we are asking for with our funding.

Mr. BASS. Thank you, Admiral. I appreciate your answers.

Vice Adm. LAUTENBACHER. Thank you.

Mr. WHITFIELD. Mr. Inslee, you are recognized for 10 minutes.

Mr. INSLEE. Thank you. I appreciate it.

Admiral, first I want to thank you for your personal commitment to this project.

Vice Adm. LAUTENBACHER. Thank you.

Mr. INSLEE. I very much appreciate that. I also want to give a tip of the hat to Dr. Eddie Bernard and others out in Seattle. They have done a fantastic job educating the community and the tsunami. And of course, I will brag about Peril Systems that developed the tsunami detection system that can monitor a one-inch change of water depth in file miles of water. It is pretty incredible technology.

But how do you see this system working in a real world warning system context for tsunamis? Is that really part of this plan or not, or do we need to think of that as a secondary, associated but not integrated, system?

Vice Adm. LAUTENBACHER. This—the issue is, again, a two level kind of a thing. This is a—the tsunami piece is a technical piece of a system, and it would warn for tsunamis and do that. But it also could be—and we are designing our parts of it to be multi-purpose. So there will be more sensors on these buoys. The next generation of buoys will have more sensors on them and allow us to monitor for different things. There is no reason that a tsunami warning system can't also warn against storm surge associated with high winds and low pressure centers that are—that cause issues off—and also significant damage along the coast. So there is a multi-purpose nature to these systems.

In terms of the GEO effort, that is a large-scale effort to create agreements to be able to do this. The work will be done by nations that put things in place and by the U.N. organizations that already do this, like the WMO, the World Meteorological Organization, the IOC. And where we see that there is a hole missing, well, then we will look for an opportunity to provide some way to do that. But GEO is an empowering organization, something that will create oversight over everything that goes on today in sort of an independent way without a lot of thinking or planning.

Mr. INSLEE. So I—is it fair to say that, you know, GEOSS is going to help implement, ultimately, a worldwide tsunami warning system, ultimately?

Vice Adm. LAUTENBACHER. Yes, it is.

Mr. INSLEE. Is that a fair statement?

Vice Adm. LAUTENBACHER. That is a fair statement. It was an agreed resolution at the Third Earth Observing Summit to support and to empower the building and placement of a worldwide tsunami warning system. We have got agreement on that in a day from the 60 nations that were there at the table.

Mr. INSLEE. Great.

Vice Adm. LAUTENBACHER. So that is an element that will be part of the GEOSS.

Mr. INSLEE. Well, as a State with a fault line right off our—close to a subduction zone similar to Indonesia that had 30 to 50-foot waves on our Pacific beaches 300 years ago, we are appreciative of that. So keep up the good work.

I want to ask you now kind of tough questions and I will see how far you can go with it. There is sort of a—kind of an irony here. I know in my briefing material that on that same day that climate change treaty went into effect, so did the beginning of the GEOSS system with the U.S. and 59 other countries, which is wonderful. I think this is absolutely an incredible start. Unfortunately, the juxtaposition of those two things is kind of disheartening in that we are working with the rest of the world on research on this, but we are not working on the rest—with the rest of the world in actually implementing some even modest degree of changes to reduce global warming gas emissions. And I respect the need and desire at least for additional climate information that GEOSS will be wonderful in providing us, but we have an incredible wealth of information, indicating that we are now in a period of climate change, that humans are a significant contributor to that. It goes from the melting tundra in Alaska where, you know, buildings are sagging and permafrost is melting, to rising tree lines in Mt. Rainier and Denali National Forests, to the disappearing glaciers, we will have no glaciers in Glacier National Park in 75 years, to changes in the forest canopy in the Brazilian Rainforest, to changes in glacier activities all over the world, to incredible changes in the actions of various animal species. We are seeing fish off our coasts that haven't been seen in 250 years in the State of Washington. We are seeing the absolute disappearance of Gilamots off the Orkney Islands that are now gone because the species they have been fishing on for millenniums are gone. They have moved north because of this. We have seen, just this week, tremendous evidence of warming in the oceans of significant amounts, which I have surprised a lot of people. We wondered where all of that energy went. Now we are kind of getting a pretty good idea. It is in the ocean.

So we have this mountain of information that has led the rest of the world to take some actions, and we have basically stuck our finger in the eye of the rest of the world and said we are not going to work on this. We are just going to go off on our way and continue to write research papers. And I have to say, it is—and I am not holding you accountable for this. I am expressing a frustration that, you know, here we are going to spend some great taxpayer dollars generating great information, but if we continue to have policies that refuse to act on such a wide range of knowledge, you know, to what use is the information? I mean, we have this giant elephant staring us in the face, and yet we refuse to take any action. And I just don't want to see GEOSS be an excuse for inaction, No. 1, so I guess I would like you to assure that won't be the case, from at least your perspective, personally an agency-wide. And two, is there any suggestion that you could help us encourage this administration to become a leader worldwide in actually taking action to reduce the emissions of global climate gases? What can your agency do to move the administration in that direction or the U.S. Congress?

Vice Adm. LAUTENBACHER. And it is a good question, and I am—you make a great case for why we need the Global Earth Observing System of Systems. I do take exception with some of the characterizations of the administration's policy, but—and I was questioned in Europe on the same line of questioning.

Mr. INSLEE. I was much more polite, so——

Vice Adm. LAUTENBACHER. Yes, sir. The—and we didn't plan it that way. The—this summit would happen on the same day the treaty went into effect, so just to let that be known. The administration is doing a lot. The administration recognizes—the President has recognized that global warming is an issue and that there are, you know, anthropogenic effects that are going on today, and we have a program. Now the program apparently is not acceptable to everybody, because it doesn't have hard caps on CO_2. I mean, that is kind of what it comes down to. But I think to be fair, you have to look at the whole program. And the program has international leadership in at least six major consortiums that are working to solve the problem. First of all, if you believe the problem is the greenhouse gases, and there are some people I can bring in here that will say it is not, but let us—we won't get into the science arguments. It is not going to resolve by Kyoto. Kyoto is a treaty which is just going to allow the United States. We will be the only nation that does any cutting and everybody else will continue to grow, including everybody in the—I guess that is it? Am I out of time?

Mr. INSLEE. You still have 2 minutes.

Vice Adm. LAUTENBACHER. Okay. I still have 2 minutes.

It is going to allow nations like China and India and developing nations, as we cut, just to increase their emissions, which they are doing now as we go along, unchecked under Kyoto. So it is an unfair treaty to the United States. The Senate voted against it even before anybody acted on it. The President got up and called it what it was. So the issue is what should we be doing. We are looking at a program that will reduce the greenhouse gas emissions while not killing development. We would like to see people work on this intensity idea. And I think it is catching on more around the world than it has been, this idea of as you build economically, you must slow down and eventually stop and cap your greenhouse gases.

Mr. INSLEE. Right.

Vice Adm. LAUTENBACHER. And that is the 18-percent goal that we have set that takes, you know, 70 million—the equivalent of taking 70 million cars off the road. The issue is that mandatory or voluntary? We are tracking it, and I assure you if it doesn't work in the right direction, somebody will stand up and look at different ways to do it. And then the technology is the real issue. I mean, we are investing $5 billion in science and technology, $3 billion in technology to create non-carbon-producing, you know, types of energy systems, and that is being accepted very well by the very nations who have signed up to Kyoto.

Mr. INSLEE. Right. And I just want to make sure that you understand. I am not saying Kyoto is the end-all of treaties. It is just that we sense any lack of leadership to the next step. And I actually talked to the President about this, and he expressed discontent with Kyoto, and I said, "Well, you know, put what you have on the table." And we simply have not put anything on the table except these voluntary things. Well, voluntary things are a great way to run a bake sale, but it is going to fall flat in the ability to deal with this global challenge. And so that is our frustration, and I hope at some point you can help us out.

And again, thanks for your efforts on this. Thank you.

Vice Adm. LAUTENBACHER. Thank you very much, sir.

Mr. WHITFIELD. Admiral Lautenbacher, we want to thank you very much for your time today and your testimony. And we had intended to do another round of questions, but because we have a series of votes coming up, we have two other panels, we are going to be submitting some additional questions for you to answer. And once again, thank you for your leadership on this issue and the great job you did in Brussels, and we look forward to visiting with you again soon. So you are dismissed at this time.

Vice Adm. LAUTENBACHER. Chairman Whitfield, thank you very much and the rest—and the members of the committee. I appreciate the opportunity.

Mr. WHITFIELD. Thank you.

If the second panel would please come to the table. I would like to go on and introduce you all, and then when we come back, we can get started immediately with your testimony.

We have, in the second panel, Nancy Colleton, who is the cofounder of the Alliance for Earth Observations. We really appreciate your being with us today. We have Dr. Gregory Glass who is a professor of molecular microbiology and immunology at the

Bloomberg School of Public Health at Johns Hopkins University. Dr. Glass, thank you for being with us. We have Mr. Carroll Hood, the GEOSS chief architect for Raytheon Corporation. Thank you. And we have Dr. William Hooke, who is the Director of Policy Program at the American Meteorological Society. And we welcome all of you. Thank you very much for joining us this afternoon. We look forward to your testimony.

As you have heard when I was talking to Admiral Lautenbacher, we said that we have a policy of the Oversight and Investigations Subcommittee of swearing witnesses in, have you testify under oath. Do any of you have any objections to testifying under oath? Do any of you desire to have a counsel be with you today as you testify? Okay. Then if you would stand, I would like to swear you in now. I wanted to notify Ms. DeGette that I am standing.

[Witnesses sworn.]

Mr. WHITFIELD. Thank you.

Well, you are now under oath. And what we are going to do, we are going to recess. We are going to have a series of three votes, and as soon as that is over, we will be right back, and we will start with your 5-minute testimony. So thank you very much. We will be right back. Sorry for the inconvenience.

[Brief recess.]

Mr. WHITFIELD. We will reconvene the hearing at this time. And once again, I will thank you for your patience. And we will call on Ms. Colleton for her 5-minute statement.

TESTIMONY OF NANCY COLLETON, CO-FOUNDER, ALLIANCE FOR EARTH OBSERVATIONS; GREGORY E. GLASS, PROFESSOR, MOLECULAR MICROBIOLOGY AND IMMUNOLOGY, BLOOMBERG SCHOOL OF PUBLIC HEALTH, JOHNS HOPKINS UNIVERSITY; CARROLL A. HOOD, GEOSS CHIEF ARCHITECT, RAYTHEON; AND WILLIAM H. HOOKE, DIRECTOR, POLICY PROGRAM, AMERICAN METEOROLOGICAL SOCIETY

Ms. COLLETON. Mr. Chairman, members of the committee, my name is Nancy Colleton. I am the President of the Institute for Global Environmental Strategies and also the co-founder and Executive Director of the Alliance for Earth Observations headquartered in Arlington, Virginia.

Ms. DEGETTE. Ms. Colleton, is your microphone on?

Ms. COLLETON. It appears to be. Is it working now? Maybe we could switch seats.

Mr. WHITFIELD. Yes, maybe you could just move over and use this other microphone. They assured us the technology would never fail.

Ms. COLLETON. Okay. Thank you. All right. There we go.

As I said, my name is Nancy Colleton. I am the President of the Institute for Global Environmental Strategies and also the co-founder and Executive Director of the Alliance for Earth Observations, which is located in Arlington, Virginia. I would like to thank the subcommittee for inviting me to testify this afternoon and ask that my testimony be submitted for the record.

The institute is a non-profit 501(c)3 organization of which the Alliance for Earth Observations is a vital initiative. The Institute's mission is to advance knowledge of the earth system and promote use of technology tools that help us better understand our changing planet. We do this through education, public outreach, research, and international cooperative activities.

In December 2003, we, along with five proactive aerospace companies, established the alliance, an informal confederation of organizations. We have worked together over the last year to facilitate broad private sector awareness and participation in the planning for GEOSS. Our goal is to bring together the diverse members of the earth observations community, which are industry, academia, and non-governmental organizations, to work in partnership with government to maximize the value of earth observations.

I am pleased that representatives from our members are here this afternoon. And my prepared statement includes a full list of our membership.

The message I deliver to you today is simple. If the American people are going to fully realize the benefits, the social and economic benefits from a global earth observing system in the areas of public health, energy, and environment, then the private sector must be actively engaged in its planning and implementation.

There are several reasons why the role of the private sector is so critical.

First and foremost, the private sector represents an unparalleled technical resource. I am sure that you would agree that whether inside or outside the Federal Government, we should enlist our best and our brightest to meet the challenges posed by our changing planet and the global economy.

The private sector will also be a major user of GEOSS. In the area of public health, for example, we will be able to explore the links between environment and disease, such as malaria and West Nile virus. In the area of environment, for example, western Governors, like Montana's Governor Brian Schweitzer, as well as farmers, will be able to use improved integrated data systems to respond to the challenges related to the 7-year drought they are currently experiencing in that State. This quiet but volatile natural hazard threatens this State with wildfires this spring and summer.

The energy sector, as we well know, already uses earth observations in a variety of areas. Improved global information products as a result of GEOSS will only increase efficiency and provide greater savings to U.S. consumers. In addition, the private sector will also need to ensure that their systems are consistent with GEOSS and that their personnel are prepared to capitalize on the opportunity that these global observation systems will present. The private sector will also work in partnership with the government to contribute data to GEOSS.

We believe that GEOSS must address a robust, all-media, all-hazard warning system, and that its architecture must encourage system interfaces using international standards, such as the common alerting protocol.

As I said earlier, the Alliance has been working in close cooperation with the government to provide input to the national planning process. We applaud the effort of the Interagency Working Group on Earth Observations and the exceptional leadership of Vice Adm. Lautenbacher. We recommend that the effectiveness of this working group be enhanced by the establishment of a federally sponsored private sector earth observation advisory council. Such a council should include industry, academic, and non-governmental leaders representing the many business sectors that will contribute as well as benefit from GEOSS.

Were it not for the hard work of government worldwide, we would not be where we are today. On the cusp of the new era in earth observations, the Alliance is pleased to be part of this new era and believes that the time has come for the United States to forge new partnerships with the private sector to create GEOSS and deliver a greater benefit from earth observations to the American people.

Again, I thank you for this opportunity to testify before your subcommittee today, and I am pleased to answer any questions that you may have.

[The prepared statement of Nancy Colleton follows:]

PREPARED STATEMENT OF NANCY COLLETON, PRESIDENT, INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES AND EXECUTIVE DIRECTOR OF THE ALLIANCE FOR EARTH OBSERVATIONS

Mr. Chairman and members of the Committee, my name is Nancy Colleton. I am the President of the Institute for Global Environmental Strategies and Executive Director of the Alliance for Earth Observations headquartered in Arlington, Virginia. I would like to thank the House Committee on Energy and Commerce for the opportunity to testify at this hearing.

The Institute is a non-profit, 501(c)3 organization of which the Alliance for Earth Observations is an initiative. Our efforts are devoted to furthering knowledge of the Earth system and promoting the value and use of the technology tools that help us better understand our changing planet. The Institute's efforts include everything from developing resources for K-12 science education and teacher professional development, to facilitating international cooperative activities in Earth science and applications. However, I am here today to discuss the Alliance for Earth Observations—an informal confederation of organizations—and the importance of engaging the private sector (industry, academia, and non-governmental organizations) in the planning for and implementation of the Global Earth Observing System of Systems (GEOSS). As requested, I will address "The Implementation of GEOSS: A Review of the All-Hazards Warning System and its Benefits to Public Health, Energy, and the Environment."

The Alliance for Earth Observations—The Public Sector Stakeholders

If GEOSS is going to truly realize social and economic benefit in the public health, energy, and the environmental sectors, then the private sector must be actively engaged in its planning. Several reasons exists for this engagement:

- the private sector provides unparalleled technical expertise to help guide the design and development of GEOSS (e.g., data creation, exploitation);
- the private sector will be a major user of the GEOSS capabilities and therefore, must have the opportunity to determine sector-specific requirements (e.g., agriculture, transportation);
- the private sector must begin its planning and preparation to ensure that their systems are consistent and personnel prepared to capitalize on the opportunities that GEOSS will provide; and
- the private sector could work in partnership with government to contribute data to GEOSS.

The Alliance for Earth Observations was established to advance the private sector's involvement in the development, use, and integration of Earth observations and information for social and economic benefit. Just as the ad hoc Group on Earth Observations (GEO) and US Interagency Working Group on Earth Observations (IWGEO) were established to coordinate intergovernmental activities, the Alliance for Earth Observations was established to facilitate US private sector awareness and interest in GEOSS.

Like the Earth observation community itself, the Alliance membership is diverse and includes stakeholders such as system developers, data providers, geospatial technology firms, university-based research institutes, and a non-governmental organization that focuses on science applications for the conservation community. In addition to membership, the Alliance aggressively works to establish strategic partnerships with numerous organizations that will enable us to reach the potential GEOSS beneficiaries. Since our effort began in December 2003, we have engaged a wide range of groups including public health professionals to reinsurance, energy, transportation, and agricultural industry representatives. A listing of Alliance Members in included in Attachment B.

As a result of our efforts to reach out to the broad private sector community, the Alliance has been able to contribute to the national planning for GEOSS. For example, 40 representatives from 23 organizations participated in the Industry Workshop on GEOSS Architecture, held May 20, 2004. The workshop was conducted in cooperation with the Industry Advisory Council. The results, lessons learned and recommendations of this independent analysis were presented to the IWGEO.

Another major Alliance contribution was bringing together government and private sector leaders at the Forum on Earth Observations. Held in September 2004, the Alliance—in partnership with the National Oceanic and Atmospheric Administration—hosted the Forum and brought together 200 business, academic, and non-government organization executives with senior government executives to communicate plans for GEOSS. In addition, participants explored how Earth observations are currently being used in the energy, agriculture, public health and transportation sectors. The importance of US leadership in global Earth observations initiatives, the need to examine new, public-private partnerships, and the importance of the human architecture to support GEOSS were identified and discussed at the Forum.

Important parts of the business case supporting the needs for observations have already emerged. In the paper "Critical Use of Environmental Information in Industry Operational Decisions Aids and Scenario Building," Mary G. Altalo, Corporate Vice President, Science Applications International Corporation (SAIC), an Alliance member, states:

> For the U.S. economy, of the estimated $2.2 trillion revenue impacted annually as a result of adverse or severe weather events, the hotel and recreation sector's share was estimated at $147B, another $125B for agriculture, forestry, fishing; $89B in energy resource extraction; $2.7B in public utilities; $260B in finance and insurance; $373B in construction; $728B retail trade; and $218B in transportation (Dutton 2001). Thus, any advanced information that would mitigate the impact of these disasters is of highest priority for the industries.

Therefore, it is easy to understand why weather information, which is just one part of GEOSS, should be of such interest to the private sector. GEOSS could provide better information from a variety of sources to affect decision making in all sectors, including preparedness and response to natural disasters, which must include robust, all-hazard warning systems.

Implementation of GEOSS and the All-Hazards Warning System

You are well aware that in addition to integrating the world's surface, airborne and space-based Earth-observing instruments, the GEOSS effort will attempt to fill in large gaps between data points (blind spots). GEOSS will also facilitate development of new data processing and visualization tools, establish protocols for the sharing of data among countries, and improve the way environmental information is communicated in times of crisis. Potential benefits include improved forecasts of tsunamis, hurricanes and other natural disasters, and better management of agriculture, forests, energy and water resources, and public health.

In addressing GEOSS implementation and the All-Hazards Warning System, one of the key questions that needs to be asked is: Why should an organization such as the US Government invest its time, effort, or funds to collaborate with external organizations?

From an efficiency viewpoint the answer is "leverage"; from an effectiveness viewpoint, the answer is "synergy."

For example, to update its land use plans, a city needs current demographic data, transportation data, land ownership data, and many other kinds of data. Yet, much of this data is also needed by agencies at the County, State, and Federal levels. When these kinds of data are shared using common standards, each sharing agency leverages the investment made by any of the others. And, they typically have synergy as well, because the ability to correlate different sets of data increases the value of each set.

Earth observation data is needed not only for government agencies, but for companies evaluating prospective sites, farmers monitoring their crops, emergency managers dealing with threat situations, citizen groups engaged in public policy discussions, or parents checking the daily weather. Already, these users can take advantage of relevant data from satellite remote sensing, aerial surveys, ground-based monitoring systems, and a wealth of socio-economic data. But, the—Earth observation data being exploited today is a fraction of what could be available from existing systems, from observing systems soon to be operational, and from observing systems now in the early planning stages.

U.S. Federal agencies involved in Earth observations have a long tradition of sharing scientific data. Most are already deeply involved in building the U.S. National Spatial Data Infrastructure, which goes a long way toward realizing the vision of shared data based on agreed standards. The—agencies are building on this base but need to go even further in leveraging investments and realizing synergy across systems and governments. They need to exploit collaborative opportunities early in the design of new systems. They need to get deeper agreements on data standards, so that different sets of data can be more easily integrated to yield synergistic products that support a broader class of decision-makers.

Across national boundaries, the sharing of Earth observations data has a long record of success in the case of weather data. GEOSS broadens this tradition of sharing. In doing so, it leverages investments in many other multi-national observing systems and gains synergy across other societal benefit areas such as disaster reduction. A case in point concerns the disaster that occurred in December 2004.

On December 26, an undersea earthquake was reported by the Global Seismographic Network, one of the systems participating in GEOSS. When such an event occurs, warning centers should be ready to send an early warning to pre-designated authorities in nations that might be affected. As called for in the GEOSS plan, those nations would have prepared hazard maps showing vulnerable areas and evacuation routes, based on high-resolution maps.

Emergency management authorities interpret incoming alerts in their local context. They might decide to trigger an integrated public warning system to activate various communications media. The system converts an alert message automatically into forms suitable for available communication technologies. These might include voice on radio and telephones, text captions on television, messages on highway signs, or signals for sirens. This all-media, all-hazard public warning technology is consistent with the GEOSS architecture that encourages system interfaces using international standards such as the Common Alerting Protocol (CAP).

I want to mention that the Alliance for Earth Observations endorses the "Challenge of Public Warning," as expressed by the Internet Society. This call for collaborative action seeks to assure that societies worldwide can implement standards-based, allmedia, all-hazards public warning. We are joined in this by leading government agencies such as the National Weather Service, the U.S. Geological Survey, and the National Association of State Chief Information Officers. The challenge is endorsed as well by advocacy groups such as the Partnership for Public Warning, and key international organizations such as the UN International Strategy for Disaster Reduction, and the International Telecommunications Union. We are also joined in this call to action by other visionary groups representing the private sector, including the Emergency Interoperability Consortium, the AMBER Alert Consortium, and the ComCARE Alliance.

GEOSS should address all-hazards warning systems as a priority as ultimately—whether a tsunami, hurricane, or wildfire—the decision-making information resulting from GEOSS must also be broadcast as urgently and broadly as possible through various communication media, all of which must be compatible with GEOSS. The private sector must be engaged in this endeavor.

Involvement of the private sector is crucial to meeting the challenge of public warning. Involvement of the private sector is also crucial to the success of GEOSS. As stated earlier, last year, the Alliance for Earth Observations joined with the Industry Advisory Council to evaluate the proposed architecture of GEOSS. We concluded that the proposed GEOSS architecture is well aligned with current industry practice, and with trends in systems architecture. However, we need to assure that interaction with the private sector occurs on a regular basis. The Alliance—for Earth Observations is eager to help formalize such interaction.

Benefits to Public Health, Energy, and Environment

The Vision Statement presented in the *Strategic Plan for the U.S. Integrated Earth Observation System* states "Enable a healthy public, economy, and planet through an integrated, comprehensive, and sustained Earth observation system." The topics of public health, energy, and environment are recognized as priority areas with in the plan. And the IWGEO should be applauded for the extensive work that it has conducted over the last 18 months. However, as we begin in examine the GEOSS benefits to public health, energy, and environment, it must be recognized that our existing systems were originally conceived and developed by and for the science community are the same systems that are intended to support operational efforts for economic benefit. This is not to say that GEOSS should not be based on sound scientific data and information, because it should. It is to say that providing operational information products to benefit the public health, energy, and environmental communities are different than providing raw data to a research scientists and emphasize the critical link in creating information products for these different sectors. It also reinforces the importance of conducting sector-specific user requirement studies as a broad consensus of the data products required by these sectors does not exist.

We can, however, examine current efforts that provide the rationale for new information systems to support these sectors. The article, "The Business Case for the Global Observing System" published in April 2003 in *Oceanography,* discusses the relationship between climate and weather and the energy industry. According to the article, climate and weather have a direct and extensive impact on:

- Oil and gas exploration, development and production operations (accurate surveying and precise drilling)
- Refining and Transport Operations (planning natural gas supply and delivery strategies)
- Renewable Energy Operations (forecasting environmental impacts on hydropower)
- Electricity Generation, Transmission, and Distribution (Energy pricing/financing markets)
- Global Management (Destabilization of economies by weather, climate, and ocean hazards)

In regard to environmental benefits, at last week's Western Governor's Association meeting, Montana Governor Brian Schweitzer remarked that he and is fellow governors need better environmental information. In this particular case, he referred to the seven-year drought that Montana is experiencing and the critical need for an integrated drought information system. This drought system would be part of GEOSS and support the challenging decisions these governors face in dealing with drought—a quiet, but highly volatile natural hazard. As Governor Schweitzer described it, "Our forests could explode." Therefore, any decision support system that would contribute to the planning for and responding to wildfires, deploying an already over-subscribed National Guard, or coordinating tanker resources would be highly beneficial for Governor Schweitzer and others.

One of the most promising and exciting areas that could benefit from improved observations and data analysis is the area of public health. Observation information is already being applied to determine the connection between our environment and skin cancer, asthma, West Nile Virus, and malaria to name a few. In *Environmental Health Indicators: Bridging the Chasm of Public Health and the Environment* (National Academies Press, 2004), it states that environmental health professionals recommend more research of the environment to many other disease incidences. "This is a growing concern because, in the United States alone, chronic disease contributes to more than half of all deaths and illnesses at an annual cost of $325 billion. The role of the environment in disease is further questioned because of increase in the number of reported clusters for cancer, Parkinson's disease, multiple sclerosis, and Alzheimer's disease." We all know someone who has suffered and died from one of these debilitating diseases. And, there may not be a connection between the environment and these diseases. However, studies such as this one provide a unique insight on the great potential for making new discoveries or ruling out theories by providing a technological solution to integrate different types of data to determine if a link in fact exists. The potential value that could be derived from further application and integration of environmental and health data alone should urge us to embark on establishing GEOSS as soon as possible.

To capitalize on potential benefits, The Alliance for Earth Observations urges that a Federally-sponsored private sector Advisory Council be established to capitalize on this opportunity. Membership in the Council should include industry, academic, and non-governmental experts representing the many business sectors that will benefit from GEOSS. These sectors could include public health, energy, environment, agriculture, finance and reinsurance, transportation, and technology sectors. The Alliance would be pleased to assist in the development of this Council.

Summary

Although international political backing, especially that of the White House, has been critical to getting this project off the ground, the time has come to make the private sector—industry, academia and non-governmental organizations—an active partner in the design, development and implementation of GEOSS. To realize the full potential of Earth observations for social and economic benefit, the private sector must be an active partner in developing future observation and warning systems. There are certain and important technological solutions for which businesses, colleges and universities, and non-governmental organizations are best suited to provide.

Indeed, history has shown that government, in partnership with the private sector, can achieve so much more than it can on its own. It was the government that launched the first communications and weather satellites. But it has been the private sector that, since then, has played a critical role in developing the technology and value-added services that have sparked today's multibillion-dollar telecommunications and geospatial industries. A similar model based on public and private cooperation should be followed as the world's first global observation system takes shape.

Aerospace, telecommunications and information technology are just a few of the industries that should play an integral role in the early stages of this effort. The nation should harness the private sector's best and brightest—the same people who have built the tools and technologies that now enable us to receive weather reports and monitor the stock market via mobile phones—and engage them in new solutions to collect, compile, integrate and distribute key Earth-related information.

Were it not for the hard work of governments worldwide, we would not be where we are today—on the cusp of a new era in Earth observations. The time has come, however, for the United States to forge new partnerships with the private sector and reach new heights in the monitoring and management of our planet. We believe the GEOSS can demonstrate its early value by creating a robust all-hazards warning system. However, a greater value of GEOSS, which has potential to impact trillions of dollars in products and services, will only be realized if the private sector works in close partnership with government.

ATTACHMENT A

SUMMARY OF KEY POINTS

The Alliance for Earth Observations—an informal confederation of private sector organizations—has as its mission to advance the private sector's involvement in the development, use and integration of Earth observations and information for social and economic benefit.

The Alliance recommends that the private sector (industry, academia, and non-governmental organizations) be actively engaged in the development of the Global Earth Observing System of Systems (GEOSS).

GEOSS should address All-Hazards Warning Systems as a near-term priority and enlist the participation of the private sector to identify innovative solutions that might include voice on radio and telephones, text captions on television, messages on highway signs, or signals and sirens. This all-media, all-hazard public warning technology is consistent with GEOSS architecture and encourages system interfaces using international standards such as the Common Alerting Protocol (CAP).

GEOSS benefits to the public health, energy, and environmental sectors will only be realized if these sectors are engaged in GEOSS planning and implementation.

Although studies have been conducted to show the rationale and impact of observations on various business sectors such as public health, energy, and the environment, user requirements studies should be conducted to determine specific needs of the various sectors that will benefit from GEOSS.

The United States should establish a private sector advisory council to ensure that the interests and requirements of non-Federal entities are considered in GEOSS planning and implementation.

ATTACHMENT B

ALLIANCE FOR EARTH OBSERVATIONS MEMBERSHIP

Ball Aerospace & Technologies Corporation; Boeing; Center for International Earth Science Information Network (CIESIN) at Columbia University; ESRI; ITT Space Systems Division; Lockheed Martin; NatureServe; Northrop Grumman; Raytheon; Science Applications International Corporation (SAIC); and Scripps Institution of Oceanography.

Mr. WHITFIELD. Thank you, Ms. Colleton.

And Dr. Glass, you are recognized for 5 minutes.

TESTIMONY OF GREGORY E. GLASS

Mr. GLASS. I would like to thank Chairman Whitfield and the subcommittee for the opportunity to meet today to talk about the implementation of GEOSS as part of a public health warning system.

As you know, my name is Gregory Glass, and I work at the Johns Hopkins Bloomberg School of Public Health where I work on infectious diseases, though I am here today as a public health practitioner and a methods researcher.

The stated goal of public health is to prevent the occurrence of emergence of diseases in human populations by identifying the factors that are responsible for causing diseases and developing strategies to mitigate their facts.

Public health, therefore, is distinct from modern medicine in that its goal is prevention rather than treatment. And the field has had a long history of successfully identifying environmental conditions that are linked with health outcomes, whether these are exposures to chemicals in the workplace or as part of daily life or individual behaviors. And in some cases, we have been quite successful in actually being able to free populations from the risk of disease entirely.

What I believe has limited our ability to use public health approach to deal with many of the current problems and diseases that face us today has been our inability to extend health information that we gather at a local scale to regional, national, and international levels. To do this, we need to have leading environmental indicators or conditions over a scale that matters to citizens of this country. During the past 15 to 20 years, we have gained experience in linking diseases with these leading environmental indicators and—that could provide important clues to conditions that indicate impending outbreaks. A major goal of GEOSS is to integrate and incorporate many earth observing systems that currently exist that would increase our knowledge, but more importantly, our efficiency in recognizing these risks.

GEOSS provides an important component of the system that can move public health from a descriptive and reactive practice to a predictive and forecasting one that could truly mitigate against disease risk for the public in much the same way that we expect weather forecasters to provide sufficient warning of oncoming storm events, or as we have discussed today, development of tsunami warning systems to protect populations along the coasts.

I would note that GEOSS alone will not generate the warning system in public health that we really desire. A second key component that must be incorporated is the involvement and commitment of those members of the health community who hold access to health data at very high spatial resolution. The commitment of the public health community is critical, and one of their key issues that must be resolved is that the data that they hold is rightfully very sensitive. It will remain an important challenge, as we move forward with GEOSS, to identify strategies that will allow this information to be accessed and used for the good of the community while safeguarding the privacy of the individuals.

I do not doubt that there are many challenges that face us in developing an environmental monitoring system to improve public health, but I also believe the challenge is worth the effort. We do require a vision that will merge these fields together, and GEOSS appears to represent an approach that could create the system that would meet these goals.

I thank the committee for its time, and I would be happy to answer any questions.

[The prepared statement of Gregory E. Glass follows:]

PREPARED STATEMENT OF GREGORY E. GLASS, PROFESSOR, BLOOMBERG SCHOOL OF PUBLIC HEALTH, JOHNS HOPKINS UNIVERSITY

SUMMARY

The goal of public health is to prevent rather than treat diseases in populations of people. This requires identifying risk factors, many of which are related to environmental exposures. There has been a long history of successfully identifying risk factors for both environmental and infectious diseases that are influenced by the environment. These studies have been used to design interventions that reduce the burden of disease. This approach has been especially successful where individual behaviors or occupational exposures are responsible for disease.

However, many of our current public health problems are influenced by conditions that are more ubiquitous and frequently more subtle in their effects. To achieve the stated goal of health through prevention, public health practitioners therefore need to know what, where and when leading environmental conditions indicate that there are increased risks for these diseases and the environmental indicators must be monitored sufficiently frequently and over broad enough regions that they produce meaningful results for our citizens. GEOSS represents an important component of a public health program that is needed to make prevention a reality. The system captures many of the key environmental variables at appropriate spatial and temporal resolutions to implement environmental surveillance for many of the important infectious and environmental diseases affecting the country today. However, the data generated from GEOSS must be appropriately integrated with health outcome measures to create a fully functional public health warning system.

I would like to thank the committee and the chair for this opportunity to meet with you today concerning the implementation of GEOSS as part of a public health warning system. My name is Gregory Glass and I am a professor in the department of Molecular Microbiology and Immunology at the Johns Hopkins Bloomberg School of Public Health where I work on infectious diseases, though I am here today representing myself.

The stated goal of public health is to prevent the occurrence and emergence of diseases in human populations by identifying the factors responsible for causing diseases and designing strategies to mitigate their effects through education of the public and developing interventions to reduce people's exposures to these risk factors. Public health, therefore, is distinct from modern medicine in that its goal is prevention rather than treatment of diseased individuals, though there are many areas such as the creation of vaccines and more recent advances in bioinformatics, genomics and proteomics, where the two fields benefit greatly from one another.

Public health has had a long history of successfully identifying environmental conditions that are linked with health outcomes. The association between human exposures to chemicals either in the workplace or as part of daily life and health effects provide many clear examples of this approach that are amenable to behavioral or regulatory intervention. Similarly with infectious agents, such as Lyme disease bacteria or West Nile virus, understanding the environmental factors that favor the animal vectors of these pathogens allow us to create rational, targeted, interventions that can improve the health of the public.

The approach of linking of environmental conditions to human health and then acting can be so successful that we free the population from risk. For example, early in the last century citizens with sufficient resources would leave Washington DC, Baltimore and Philadelphia (as well as other Eastern cities) during the summer to escape both the heat and the mosquito-borne plagues of the summer. Studies followed by interventions such as environmental modification led to the control Yellow Fever, and malaria in this country and were so successful that we no longer think of these diseases as having occurred here.

What I believe has limited our ability to use the public health approach to deal with many of the current diseases that are influenced by the environment has been our inability to extend the health information we gather at a local scale (as part of our traditional public health data) to regional, national or international levels. To do this we need to monitor environmental conditions repeatedly over a geographic region that matters to the citizens of this country and provide that information before conditions become so severe that we are dealing with a health crisis.

During the past 15-20 years we have gained experience in linking diseases with leading environmental indicators that can provide important clues to conditions that indicate impending outbreaks. What we have discovered is that in many situations it is how the environment changes over days and weeks that provide important clues to disease risk. A major goal of GEOSS is to integrate and incorporate many Earth observing systems that repeatedly monitor conditions around the globe. This is a critical aspect to any strategy that will attempt to monitor changes in the environment. The likelihood that we can capture just the right time and place leading up to a disease emergence with a single environmental monitoring is slim and none. By contrast, we have found that data acquisition strategies exemplified by Landsat allowed us to retrospectively identify the environmental conditions that led to the outbreak of hantavirus pulmonary syndrome in the U.S. Southwest in the early 1990's and allows us to now anticipate when conditions favor new outbreaks.

By intending to integrate and coordinate sustained Earth observations, GEOSS provides an important component of the system that can move public health from a descriptive and reactive practice to a predictive and forecasting one that could truly mitigate against disease risks for the public in much the same we that we now expect weather forecasters will provide us with sufficient warning from oncoming storm events.

I would note that GEOSS, alone, will not generate a product that will give us "the West Nile virus forecast for the coming week". To function in the role of forecasting times and places of increased disease risk it will be necessary to establish the linkage between leading environmental conditions that predict health events and the health events themselves. This means that the second, key component of the system is the involvement and commitment from those members of the health community who hold access to the health data at a very high resolution so we can use historical information to establish the environment-health relationships. This is a challenge for two reasons. First, it requires the commitment from the public health community that this is a strategy that should be pursued. Second, the personal health information that they hold is rightly a very sensitive issue affecting many individuals. Particularly with the tremendous power of distributed data networks to disseminate information many health professionals remain challenged to identify strategies that will use this information to help the community while safeguarding the privacy of individuals. Finally, there is a critical need to incorporate these two sets of information in appropriate ways so that we can have the highest levels of confidence in the interpretation of the results. Again, these approaches are relatively straightforward but are only rarely applied at the scale we are discussing today.

I do not doubt there are many challenges that face us in developing an environmental monitoring system that can improve human health but I also believe the challenge is worth the effort. We require little if any major advances in technology or methods to make progress that will reward our citizens. We do require a vision that will merge these important fields together. GEOSS appears to represent an approach that will create a system to achieve these goals.

Mr. WHITFIELD. Dr. Glass, thank you very much.

And Mr. Hood, you are recognized for 5 minutes.

TESTIMONY OF CARROLL A. HOOD

Mr. HOOD. Mr. Chairman, Ms. DeGette, my name is Carroll Hood. I am the GEOSS Chief Architect for the Raytheon Company out of Aurora, Colorado, but today I speak to you as the Lead of the Information Creation Committee for the Alliance for Earth Observations. And on behalf of all members of the Alliance, I am grateful to have this opportunity to share my thoughts with you. I kindly request that my full written testimony be submitted with the record.

I am confident that your thoughtful investigation of the potential benefits of the Global Earth Observation System of Systems will reinforce our belief of the tremendous value that such a system could provide to both decisionmakers and the U.S. economy.

Today, we are talking about an all-hazard warning system, but there is a more fundamental question that needs to be addressed.

All hazard warning is just one of a number of applications that a global system of systems would enable. When one observes the current hazard warning processes, as you heard from the Admiral earlier, there is obvious room for improvement. We can do better. But the fundamental question is should we address this issue as a separate initiative or should we address it within the context of a worldwide environmental system of systems.

The answer to this question lies at the nexus of the fundamental reason why a global environmental system of systems is both desirable and economically beneficial. Currently, the U.S. spends billions of dollars supporting the creation, operation, and maintenance of environmental observing systems. Once the data from these systems have fulfilled their primary objective, can they be used to generate additional value for the U.S., for our people, and our economy?

In this case, value can be defined in a number of ways. The intelligent integration of environmental observations with data from other sectors will enable smarter, more informed decisions to be made that oftentimes have profound economic and societal impacts.

In addition to this, value can also be measured as the economic impact of spawning new and innovative value-added products and services. In some sense, that is what GEOSS represents. It is a development of the infrastructure required to maximize the value of earth observations. It represents that marginal investment would be required to enable better decisions on key issues and to facilitate and encourage private sector investment in related products and services.

Building a viable GEOSS will require us to recognize and overcome some fairly difficult challenges. And these challenges are business related, technical, and cultural. One of our key business challenges will be creating a business model that will accurately assess the value proposition for GEOSS and overlay that onto the reference technical architecture.

From a technical perspective, there are a couple of key enablers that will give GEOSS the opportunity to succeed. The first has to do with syntactic and semantic interoperability across discipline, domain, and GEO-political boundaries.

The second relates to developing service component architecture that will, among other things, support and catalyze capacity building. Fortunately, both of these areas are addressed to some degree within the reference technical architecture.

The last of the challenges, and perhaps the most important, are the social and cultural issues. These are the most important, because they represent the biggest obstacle for us to overcome. We can technically architect a wonderfully capable system, but if the human and social aspects are not properly addressed, then GEOSS will fail.

So based upon this backdrop, the Alliance for Earth Observations would like to make the following recommendations with regard to an all-hazards warning system.

No. 1, design and build an all-hazards warning system within the context of a larger system of systems architecture. Develop the syntax, semantics, and services in such a way as to fulfill the operational objective but also to enable, facilitate, and encourage other value-added applications and services to be developed downstream.

Two, proactively work the communication pathways to ensure all stakeholders have the opportunity to contribute throughout the development and operational life cycle.

And three, increment—utilize an incremental approach that provides early opportunities to prototype key functional requirements and demonstrate success.

In terms of the development of the U.S. IEOS, the Alliance would like to make the following additional recommendations.

No. 1, the government should establish an IEOS program office to serve as the formal government focused with this activity.

No. 2, the program office should take immediate steps to instantiate a more formal government, industrial, and academic partnership.

No. 3, the program office should use these partnerships to conduct near-term activities that will help clarify the reference architecture and the overall value proposition.

And No. 4, begin to immediately determine budget requirements for GEOSS. In the near-term, determine opportunities to fund demonstration projects that will illustrate and define value in the system. For the long-term requirements, ensure the effort is right-sized based upon the cost-benefit analysis established in the business case.

I thank you for giving me this opportunity, and I would be happy to answer any questions you might have for me.

[The prepared statement of Carroll A. Hood follows:]

PREPARED STATEMENT OF CARROLL A. HOOD, GEOSS CHIEF ARCHITECT FOR RAYTHEON COMPANY AND INFORMATION CREATION COMMITTEE LEAD OF THE ALLIANCE FOR EARTH OBSERVATIONS

Mr. Chairman, Mr. Ranking Member, members of the Committee, my name is Carroll Hood. I am the GEOSS Chief Architect for Raytheon Company. Today, I speak to you as the Lead of the Information Creation Committee of The Alliance for Earth Observations. I have been an active participant in the arena of environmental data management for over twenty years, both as a public servant and as a member of the private sector. On behalf of all of the members of the Alliance, I am grateful to have been given the opportunity to share my thoughts with you on this topic. I am confident that your thoughtful investigation of the potential benefits of a Global Earth Observations Systems of Systems (GEOSS) will reinforce our belief of the tremendous value that such a system could provide to both decision makers and the US economy.

I would like to begin by providing some context for my remarks; I will then discus some of the challenges and possible solutions within that context, and will conclude with some specific recommendations. I would then be happy to answer any questions that you might have.

CONTEXT

This is truly a unique time. Over fifty-five nations recently agreed to coordinate activities to develop and operate a Global Earth Observations System of Systems (GEOSS), collecting and sharing Earth observations data and information to help decision makers address important societal issues. The concept of sharing environmental observations is not novel; this goal has been pursued, albeit within discipline or domain stovepipes, for many years. What is unique about this initiative is the level of political will and support that has been vividly demonstrated over the past 18 months. Instead of a bureaucrat several layers down in a government agency/ministry representing his/her country, we now have ministerial level/cabinet-level visibility and participation, decision makers at the highest levels of government, to help bring this vision into reality. This is a tremendous opportunity.

Today we are talking about an all-hazard warning system, but there may be a more generic question that needs to be addressed. All-hazard warning is just one of a plethora of applications that a global system of systems would enable. The hurricane season of 2004 and the recent events in the Indian Ocean have underscored the gravity of this important issue. Human lives are at stake. When one observes the current as-is hazard warning processes, obviously there is room for improvement. We can do better. The fundamental question is, then, should we address this issue as a separate initiative or should we address it within the context of a worldwide environmental system of systems?

The answer to this question lies at the nexus of the fundamental reason why a global environmental system of systems is both desirable and economically beneficial. Currently, the US spends billions of dollars annually supporting the creation, operation, and maintenance of environment observing systems. These systems support the operational missions of various federal agencies, NOAA/NWS, DOT/FAA, EPA to name a few. Once these data have fulfilled their operational objective, can they be used to generate additional value for the US, our people, and our economy? In this case, value can be defined in a number of ways. The intelligent integration of environmental data with socioeconomic data, energy data, and health data, etc. will enable smarter, more informed decisions to be made that oftentimes can have profound economic and/or societal impacts. The impact of long-range forecasts of temperature and precipitation, for example, has been demonstrated and documented in a number of application areas such as drought mitigation, forest fire logistics planning, agricultural irrigation, transmission of vector-borne diseases, tourism, and even disaster mitigation. Witness the increase in the amount of warning time that the National Weather Service provides for severe weather events. I don't think that anyone would dispute that this improvement has saved lives. In addition to this, value can also be the measured as the impact of spawning new and innovative value-added products and services. Ten years ago, who would have predicted that the ubiquitous presence of the Internet would have spawned so many web-based applications? I live in Colorado, but can listen to the Tar Heels play basketball on the web within a few seconds of being live. That six-second lag is a far cry from the pre-ESPN days of waiting for the morning paper to check the score. In much the same way as the internet spawned the development of on-line applications, GEOSS (i.e., coordination of the collection of environmental observations plus improvements in our ability to easily discover, access, and exploit environmental data and information products) has the same potential to spawn a new wave of environmentally-related products and services. The spectrum of potential applications range from economic (when and where Colorado should invest in new reservoirs) to close to home (letting soccer moms plan their week based on more reliable five-day forecasts.) to retail (when do I introduce the fall product line in our New England stores?) to recreational (where can I catch the biggest fish today?) These represent a few examples; many of the applications that could be engendered have not even been defined yet (much the same as streaming audio of Tar Heel radio broadcasts was not a driving requirement for the advent of the WWW.)

In some sense, that's what the US Integrated Earth Observation System (IEOS) (the primary US contribution to GEOSS) represents. It is the development of the infrastructure required to maximize the value of Earth observations data and information resources. In most cases, these observations are already being collected! As we review our observing architecture and match that up against our national priorities, we may uncover observation gaps that may need to be filled. The cost of building any new observational infrastructure would need to be weighed against the value that such observations would generate. Thus, in general, the IEOS represents the marginal investment that would be required to enable better decisions on key issues and facilitate/encourage private investment in related products and services. "Marginal investment" is a dangerous phrase. In a budget-constraint environment, marginal investment may mean robbing Peter to pay Paul. This may be fiscal reality; we understand that difficult decisions based on national priorities must be made; however, we can only hope that both Peter and Paul have the opportunity to articulate their respective business cases, on a level playing field, and let the chips fall where they may. Thus, it is incumbent upon the proponents of a US IEOS to clearly define and articulate a viable business case for this marginal investment. We have the responsibility to quantify, to the best of our ability, value, in terms of both smarter decisions and economic stimulation. To date, we have done a poor job of doing this.

CHALLENGES AND SOLUTIONS

Building a viable US IEOS will require us to overcome many constraints and solve some fairly difficult challenges. These obstacles come in many flavors: business-related, technical, and cultural. In the previous section, I discussed one of the key business challenges. Creating a business model for the US IEOS and overlaying it onto the reference technical architecture will be a non-trivial task. Fortunately, US Industry has extensive experience in this area and can provide significant insight into the problem. Current methods of valuation (i.e., Contingent Value Method (CVM)) need to be examined within the context of a GEOSS-like endeavor. In a potential growth industry, such as the one that GEOSS/US IEOS hopes to engender, CVM may undervalue the potential benefits since many of the useful products and services have yet to be defined or developed.

From a technical perspective, there are a couple of key enablers that will give GEOSS the opportunity to succeed. The first has to do with the issue of interoperability across disciplines and domains; the second has to do with capacity building (i.e., enabling the developing world to share in the benefits of a GEOSS.) Fortunately, both of these areas are addressed to some degree within the reference technical architecture.

In the world of interoperability, there are three primary components: Syntactic interoperability, which refers to the structure of data and information products and services; semantic interoperability, which refers to the meaning of measurements and observations; and transport interoperability, which has to do with networks and data transmission. The GEOSS reference architecture addresses the issue of syntactic interoperability though avocation of relevant international syntax standards. The use of eXtensible Markup Language (XML) is a case in point. XML is a metalanguage for creating tags to describe the structure of data. The inclusion of a metalanguage within a system of systems architecture is a critically important point. This means that not every supplier of a certain type of data (e.g. sea surface temperature products) has to have the same physical format for their data and information products. (In the past, product format standardization was one method of improving interoperability.) A machine-readable XML representation of the internal structure would allow any user to understand and intelligently parse the dataset. In order for this to work properly, however, the issue of semantics must be addressed in parallel. Not only must a user understand the structure of the data, he/she must also understand what each data element actually means. Activities in semantic interoperability will enable producers to define the meaning of their products and services and for users to define their application space. Semantics, for example would enable a producer (and a user) to differentiate between bulk sea surface temperature vs. skin temperature, daily measurements vs. monthly averages, etc. all of which, to the uniformed user, fall into a single bucket called "sea surface temperature." Although not referenced explicitly in the GEOSS reference architecture, international standards for semantics also exist. XML-based Resource Description Framework (RDF) and Web Ontology Language (OWL) enable the development of a machine-readable representation of any knowledge domain. This machine-readable entity is called an ontology. The ability to create, evolve, and map ontologies will enable intelligent and optimized data discovery across disperate domains. Thus, the capability to leverage syntactic and semantic interoperability will be absolutely essential if we are to use GEOSS to discover, access, and integrate data from a variety of sources in order to make more informed decisions from a cross-domain perspective. This capability is also the key enabler for the market viability of products or services that cross or span discipline or domain boundaries.

The second big technical challenge relates to capacity building. Many issues are global in nature and will require both global data and a global response. Many developing nations have raised the concern that they may not be able to take advantage of the GEOSS due to their inability to support data collection or data exploitation activities. Once again, the GEOSS reference architecture provides a means to respond to this concern. The plan calls for the implementation of GEOSS services within a web-enabled, component-based architecture. Using international standards such as the XML-based Web Services Definition Language (WSDL) and Simple Object Access Protocol (SOAP) and registry protocols such as Universal Description, Discovery and Integration (UDDI), GEOSS information creation entities (the supply side) and GEOSS information exploitation entities (the demand side) can build a library of useful services that span the entire GEOSS life cycle. (data collection; product processing; metadata management; data discovery; data browse and visualization; and data integration and synthesis.) These services can be combined and/or connected to create specific value chains that will be able to meet the requirements of a variety of end-users.. As a result, no one organization or country will need a huge computational infrastructure to exploit GEOSS products and services. Although not explicitly referenced within the GEOSS Implementation Plan, it is expected that many of the basic services (e.g., data discovery; data access; routine processing; browse; simple, common integration tasks; ontology mapping; and perhaps more complex services that relate to fulfilling the "public good") will be in the public domain. More specific value-added services will likely be subject to normal market stimuli. This means that any country will be able to take advantage of the GEOSS infrastructure at very low marginal cost even if they have no data/observations to contribute to the collective.

The last set of challenges, and perhaps the most important, are the social and cultural issues. These may be the most important because they represent the biggest obstacle for us to overcome. We can technically architect a wonderfully capable system, but if the human or social aspects are not addressed properly, then GEOSS will fail. This includes the way that people, nations, and governments communicate and negotiate with each other; it has to do with our collective ability to establish, articulate, and focus on clear priorities; it has to do with our perception of the value of environmental information in our everyday lives; and it has to do with our willingness to embrace a new paradigm in which every person, every nation has the opportunity to become empowered, through equal access to relevant products and services, to make decisions that can lead to improvements in the quality of life.

Addressing these issues will be difficult. They cannot be solved by adopting an ISO standard or by developing the next "killer app". That's the bad news. The good news is that unlike technological issues, there is no bandwidth threshold to overcome. Driven by inspired leadership and an unwavering commitment to do the right thing, these issues can be addressed incrementally over time. Success breeds success. As we begin to make progress and demonstrate the value of environmental observations as both a means for improved decision making and a stimulus for economic growth, the required cultural shift will begin to move in the desired direction.

RECOMMENDATIONS

I have attempted to provide some context for the discussion of GEOSS along a brief characterization of a few near-term challenges. These items are relevant to any GEOSS application especially an activity like an all-hazards warning system. Thus, if we return to the fundamental question that I posed earlier, the Alliance for Earth Observations makes the following recommendations:

- Design and build an all-hazards warning system within the context of a larger system of system architecture. Develop the syntax, semantics, and services in such a way as to fulfill the operational objectives and to enable, facilitate, and encourage other value-added applications and services to be developed downstream.
- Proactively work the communication pathways to ensure that all stakeholders (primary, secondary, tertiary, etc) have the opportunity to contribute throughout the development and operational lifecycle.
- Utilize an incremental approach that provides early opportunities to prototype key functional requirements and demonstrate success. One area of focus will be services related to the Common Alert Protocol (CAP).

In terms of the development of the US IEOS, the Alliance would like to take this opportunity to make some further recommendations:

- The Government should establish an IEOS Program Office to serve as the formal Government focus for this activity. The Program Office should be a collaborative interagency initiative modeled after the US Climate Change Science Program (CCSP). We should continue to exploit DOC/NOAA's inspired leadership, but find a way to leverage other initiatives at other US Agencies as we begin to entrain existing assets into the US IEOS framework.
- The IEOS Program Office should take immediate steps to instantiate a more formal Government/Industrial/Academic partnership through the Alliance for Earth Observations.
- The IEOS Program Office should use these partnerships to conduct some near-term activities
  - Development of a viable business plan for the US IEOS that includes accurate valuations of the impacts of improved decision-making and the stimulation of value-added economic activity.
  - Initiation of a system-engineering based analysis of the proposed reference architecture consistent with Federal Enterprise Architecture (FEA) constructs.
  - Development of focused test beds and prototypes that address key technological impact areas related to:
    - Syntactic interoperability issues;

- Semantic interoperability issues;
- Identification and isolation of existing functional capabilities into a FEA-compliant, service component architecture;
- Development of robust, multi-sensor in-situ platforms;
- Georeferencing non-georeferenced data that are likely to be integrated with environmental data;
- Creation of decision support services;
- Identification and mitigation of security and information assurance issues.

- Several of these issues cannot wait until FY07 to be addressed. Therefore we suggest the Government evaluate the following approach for supporting these activities in the near-term:
  - Opportunities to leverage FY05 discretionary funds (small);
  - Opportunities for FY06 supplemental funding (medium);
  - Strategies for an FY07 integrated approach (right-sized based on the cost/benefit established in the business case).

Thank you for giving me the opportunity to address this Subcommittee, I would be happy to answer any questions that you may have.

Mr. WHITFIELD. Thank you, Mr. Hood.

And Dr. Hooke, you are recognized for 5 minutes.

TESTIMONY OF WILLIAM H. HOOKE

Mr. HOOKE. Chairman Whitfield, Ms. DeGette, I am very happy and thankful to have this opportunity to be with you and the other ladies and gentlemen in this room. My name is Bill Hooke. I direct the policy program of the American Meteorological Society.

I thought I would take a second to tell you about that society. We have 12,000 members. I did a calculation while you all were over voting, and I figure if we all moved to one of your two Districts, we would represent 2 percent of your electorate, so I have a feeling that we don't exactly represent a powerful group in terms of numbers.

However, all of our members are professionals in meteorology and oceanography, hydrology. They are engineers who build satellites and radars, the buoy systems that do the kind of earth sensing we have talked about. They are broadcast meteorologists. They are representatives of private sector weather firms, like Accuweather and Weather Channel, and so on. And we think we are real stakeholders in this. In fact, we have done a short policy study, which we have passed along to you all, and we are hoping both that and our more complete written statement will be entered into the record.

In the couple of minutes here, I would like to talk about six aspects of this discussion that I think are particularly important.

One is I want to reinforce what you have heard from every other speaker. These observing systems and their integration are one of the most important tasks facing our Nation. We heard a lot about tsunamis earlier, but we are trying to conduct our affairs in the U.S. in what is arguably the most hazardous weather in the world. And I could go into that a little bit. Some 20 to 30 percent of our economy, depending on how you do the numbers, is directly weather-inclement-sensitive. If we are looking to economic growth, at the same time those weather-sensitive and climate-sensitive sectors are becoming zero-margin sectors, for example the electrical utilities. We will find throughout our future that we need these observations for economic reasons. We have just heard that from the other panelist. And finally, we have interests in protecting the environment and ecosystems, not just within the U.S., but worldwide because of our position in world affairs.

The second point I wanted to make was that the government can't do this job alone. I think Nancy and Admiral Lautenbacher and the other panelists have reinforced that notion. Fortunately, having government and corporations and academia and NGO's work together is something that the U.S. is pretty good at, and so I think we have reasons for optimism on this score.

Third, the problems that we are talking about, and again every panelist has stressed this, are long-term. And the key to this, as Carroll Hood just indicated, is keeping track at every step of what the benefits are from continuing this work and taking a long-range view to it. We see the continuing evaluation of what is going on here as important to this process.

The—next, this is inherently an international activity. We can engage in other high-tech activities in the United States, and if we—if other countries of the world don't come into these activities with us, we can go it alone. That is true of mapping the human genome. It is true of nanotechnology. It is true of high-performance computing. But when it comes to understanding how the earth works as a whole, when it comes to doing something as simple as providing a multi-day forecast, we can not do that without international data-sharing and cooperation. The air that is going to be over Washington, DC on Monday is currently in the western Pacific, Siberia, Asia. If we don't know whether that air is moist or dry, if we don't know whether that air is hot or cold, we can not make a reasonable forecast about weather conditions here.

The next point I want to make is, as Admiral Lautenbacher stated, the major problems here are not scientific and technical. You can see from the words of Dr. Glass and Mr. Hood, that we are actually in pretty good hands. We have got a huge community working on this. We have policy issues that will determine how effective this investment is over the long term.

Finally, there are several things that the Congress can do to reinforce and foster these activities. Very quickly, they include: No. 1, providing some statutory language, some support, some sense of the Congress that says we really think that this is an important long-range investment for the country. Another thing that we can do, I have to look at my notes for that, my memory still provides all of the faculties it used to just no longer same-day service. Okay.

The second point is that we have got to resist the temptation that is going to be very natural in times of funding deficits to, you know, have the funding for this be intermittent and not steady. We have got to work—yes, ma'am. You raised that point in your opening remarks, and I think every representative made that kind of reference in one way or another. We have got to have steady funding for this. We have got to support research, because not all of the answers are in hand. And that will be true not only for the agencies you will hear from in the next panel, but also NASA where a focus on Mission to Mars threatens to take research dollars away from very important and very urgent earth-focused research. You can do a lot to foster dialog on these policy issues.

And finally, through oversight like this, and through requesting annual reports from the agencies and so on, you can do a lot to move this forward.

Thank you very much.

[The prepared statement of William H. Hooke follows:]

PREPARED STATEMENT OF WILLIAM H. HOOKE, DIRECTOR, AMERICAN METEOROLOGICAL SOCIETY POLICY PROGRAM

Mr. Chairman, Committee members, ladies and gentlemen, my name is William Hooke, and I very much appreciate this opportunity to appear before you on behalf of the American Meteorological Society (AMS), where I direct our Policy Program. The AMS strongly supports the Global Earth Observation System of Systems (GEOSS) under discussion today, as well as the Integrated Earth Observing System (IEOS), which embodies the U.S. contribution to GEOSS. In fact, our members—some 12,000 earth system scientists and engineers from government, from private industry, and from the university sector—are helping to plan and implement these systems, and are putting them to work for the benefit of the Nation and mankind.

The AMS has just completed a policy study on GEOSS/IEOS implementation. We have supplied the Committee with this material and ask that it be included as part of the record of this hearing.

First, some background.

Better observations of the Earth system—its atmosphere, oceans, land masses, biosphere and natural and human resources and hazards—are vital to comprehensive understanding of its behavior and our hopes for a safer, more efficient society. An extraordinary international effort is now underway to promote and plan "the development of a comprehensive, coordinated, and sustained Earth observation system of systems among governments and the international community to understand and address global environmental and economic challenges." Recognizing the crucial role data from those systems could play in protecting human health and safety, alleviating human suffering and poverty, and achieving sustainable development, more than 50 nations have agreed to cooperatively implement a Global Earth Observation System of Systems (GEOSS) to collect those data for the purpose of providing information for decision makers. GEOSS has the potential to provide substantial benefits to all nations. An ad hoc interagency Group on Earth Observations (GEO) is developing a 10-year implementation plan for GEOSS.

In parallel with this coordinated international planning, the U.S. has established the Interagency Working Group on Earth Observations (IWGEO) to prepare a strategic plan for the development and implementation of the U.S. Integrated Earth Observation System (IEOS). The strategy will reinforce U.S. leadership in GEOSS. Currently, the international GEO and the U.S. IWGEO are developing the case for an integrated system of Earth observations; characterizing some of the societal benefits and requirements; and addressing a range of issues, such as the need for convergence of observations, the opportunities for synergy, requirements for interoperability and architecture, data access and use, capacity building, outreach, governance and funding, performance indicators, and schedule.

The level and nature of investments made in this area in the coming few years will either sustain or limit—perhaps for decades—our ability to meet growing national and international needs for effective earth observations, science and services. The ultimate international response to the proposed effort to implement and, in the future, strengthen GEOSS will depend on how effectively global thinking, dialogue, and planning address a range of challenges.

While much of the planning effort is directed at the scientific and technical aspects of the task, there are a host of policy issues that must be resolved if the implementation of an integrated Earth observing system is to be successful. The IEOS and GEOSS planners must come to grips with these issues that are largely if not wholly external in character. They reflect far broader national and international political and economic realities, and must be addressed by a range of individuals, institutions, and nations. Of course, the effort to fully realize IEOS/GEOSS will extend over a decade, at least, and will require a commensurate evolutionary approach to resolving the associated policy issues.

With that preamble, here is our message, which has six points.

1. IEOS and GEOSS are vital to the future of our Nation and the world's peoples. As members of Congress you deal every day with major challenges facing our nation: public health and safety, economic growth, major federal budget deficits and international trade imbalances, national security, the aging of the population and corresponding drains on Social Security and Medicare, educational challenges (especially in the sciences) and many more. Superficially, none of these problems would seem to have anything to do with a Global Earth Observation System of Systems, or an Integrated Earth Observing System. In fact, however, the need for IEOS and GEOSS is woven through each and all of these issues. For example, U.S. agriculture is increasingly energy-intensive. The effectiveness of energy use in agriculture (embodied in the use of irrigation, fertilizers, herbicides, and pesticides) is highly sensitive to the accuracy of weather and climate forecasts. Similarly, energy deregulation and reliance on regional power grids has increased efficiency, but at the same time increased the vulnerability of electrical utilities to errors in forecasts of peak demand. Formerly such errors could be readily accommodated by excess generating capacity in the system. Today such errors can lead to spikes in spot prices for energy, or in some cases to brownouts and rolling blackouts. Today, all modes of transportation clog the existing infrastructure—highways, airports, and harbors—even under fair weather conditions. As a result, unforecast weather delays contribute to spiraling costs. Finally, estimating National requirements for future public health infrastructure will depend critically upon the long-term outlook for climate change, for aerosol concentrations, for changes in patterns of moisture and heat and their associated changes in the impact of vector-borne diseases, and for changes in the nature and patterns of extreme events. These are just a few of many examples. To address these and other national priorities will require the investments in IEOS and GEOSS under discussion today. Perhaps the best analogy in the national experience is the Manhattan Project. In World War II, development of atomic weapons was so urgent, the scientific and technical challenges so great, and the stakes for mankind so high, that no expense was spared in that effort. Today, similar statements can be made about the importance and urgency of earth observations to future human prospects.

2. The challenge cannot be met by government alone. To provide for public health and safety in the face of earth's extremes, to ensure the growth of commerce in weather-and climate-sensitive sectors, to protect the environment and ecosystems, and to meet the requirements of national security for Earth system science and services, government, private enterprise, universities, and NGO's such as the AMS must work together, in a structured way. End users of Earth system science and services must work with science and service providers to reconcile supply and demand such information, advance best practices, accelerate their widespread adoption, and anticipate future requirements. University researchers, government agencies, private enterprise, and NGO's such as the AMS all play a vital role. This will not be accomplished trivially. In our AMS policy study, we indicate some ways this might be achieved, by involving IEOS/GEOSS stakeholders: through ongoing, comprehensive stakeholder evaluations of IEOS value (by means of periodic stakeholder conferences, and coordinated multi-year studies), by establishing a clearinghouse or referral service for IEOS user applications and services, and by constituting an IEOS stakeholder advisory group.

3. The problems are truly long-range. Perhaps the greatest threat to GEOSS, IEOS, and realizing their full benefits lies in the clamor of other problems competing for national attention, and the natural tendency to lose track of the vital in the face of the merely urgent. To ensure the needed continuity of effort amid such distractions requires improving our characterization of the program's benefits, maintaining and enhancing funding levels, ongoing research to meet growing requirements, and sound programmatic oversight. The latter should be achieved by establishing a secretariat within the United States to oversee administration and management of IEOS, and a counterpart GEOSS secretariat and funding mechanism at the international level.

4. The challenge is not solely domestic. It is not enough for the United States to work in isolation to solve its own problems. Suppose we want to map the human genome, or develop nanotechnology, or a new cure for cancer. Suppose that other nations of the world do not wish to join with us. In these cases and many more, if we have to, we can go it alone. By contrast, if we want to produce a climate outlook, or assess the effect of climate change on the world's ecosystems, we must rely on international cooperation. This is even true of a weather forecast for more than the next few hours. To illustrate: the air that will be over Washington, DC in five days is currently over Asia and Siberia. Unless we know whether that air is moist or dry, hot or cold, we will not be able to predict its condition, and its consequences (will it produce rain or snow?), upon arrival here. Furthermore, to the extent that other countries fall prey to natural hazards, such as tsunamis, hurricanes, cycles of flood and drought, the effects are destabilizing and spill over into this country. Following Hurricane Mitch in 1998, which reduced Central American GDP by 50%, there was an uptick of illegal immigration into this country by Central Americans looking for work. Similarly, the aftermath of December's tsunami will continue to constrain the hopes and aspirations of peoples bordering on the Indian Ocean for years to come. Countries have shared meteorological data for decades, but the increasing value of such information and country-to-country differences in public and private roles in the provision of that information have led to some fraying of the international agreements in recent years. It is important for all nations to maintain commitments to full and open exchange of meteorological data. Countries can then extend that foundation into more problematic areas such as ecological data sharing. GEOSS is an important foreign policy opportunity for the United States—a major arena where we can be, and be seen as, a good neighbor. Again, the recent AMS policy study indicates some ways international data sharing might be strengthened and broadened, by developing a negotiating process to progressively remove data restrictions on a case by case basis.

5. The problems here are not purely technical. Policies at national, state, and local levels can either increase the utility of Earth science and services or squelch the potential benefits. For example, as mentioned earlier, electricity deregulation has had the hidden consequence of increasing vulnerability to forecast errors of peak demand. By contrast, the complex web of protocols governing management of this country's watersheds (through the operation of dams and reservoirs) has greatly constrained any ability to use seasonal outlooks to optimize decisions.

6. Congress can do much to foster progress. Congress can commit to such programs through statutory language. Congress can work with the Administration to resist the admittedly natural attempts to accomplish these goals merely through the rearrangement of existing resources. Congress can stress the importance of ongoing research. This is true of all federal agencies, especially those represented on previous panels and under your direct purview, but also including NASA, where recent emphasis on interplanetary exploration threatens to siphon off funding needed for Earth system science and applications of that science to national priorities. Congress can also work with NGO's and the federal agencies to understand better the role of policy formulation in defining national benefits in this area. Finally, Congress can use regular hearings such as this one to check progress.

In summary, I thank the Committee again for this opportunity to speak, and look forward to the discussion to follow. The AMS will be happy to continue a structured dialog with the Congress on these issues in the days and weeks following this hearing.

Mr. WHITFIELD. Dr. Hooke, thank you and thank all of you panel members for your fine opening statements. We appreciate your input very much.

How many of you actually attended the summit in Brussels, Belgium? Did all of you go and attend that? Do the four of you—in your organizations, do you find yourselves working with each other closely on this issue, the organizations represented here today?

Mr. HOOD. As a member of the Alliance, Nancy and I work on probably a daily basis to try to support this activity.

Mr. WHITFIELD. What about you, Dr. Glass?

Mr. GLASS. I am probably the least directly involved. I have worked with them and collaborated with them in conferences and so forth, but I am sort of out there on the edge.

Mr. WHITFIELD. And what about you, Dr. Hooke?

Mr. HOOKE. Well, yes. I have worked with these folks, also the folks on the panel that is about to testify. This is a big—well, it is a small community in terms of your Congressional District. It is a big community in terms of trying to "work closely" with everybody in it. Most of us can't do that.

Mr. WHITFIELD. Well, all of you obviously have some expertise in this area, and it is something that you are involved in because of your commitment to the program. And if you were offering advice to the Admiral and to the government officials in the U.S. as they work to implement this program, what advice would you give them from your perspective on this issue?

Mr. HOOD. I would say that we need to start with a firm foundation of requirements. We have kind of a wish list of data requirements based upon the nine needs that have been identified, but those need to be further decomposed in terms of the interoperability that Nancy was talking about. And there—when you are looking at bringing together a large number of existing entities into a system of systems looking at interoperability and enterprise architecture type considerations, it is a reasonable planning activity that probably should be conducted.

Mr. WHITFIELD. Nancy?

Ms. COLLETON. I would echo that, and I believe that if there is a gap in the current planning right now, it is the fact that we are talking about systems that have been developed by and for scientists. And I believe there is a great deal of work that needs to be done in reaching out to these different sectors to determine what those actual user requirements are.

Mr. WHITFIELD. And are you optimistic that that reaching out will occur or do you have a good feeling about that at this point?

Ms. COLLETON. In working—in just facilitating private sector involvement in the planning over the last year, I must say that the—you know, there is a public education task that needs to be done that we are working on very hard in getting in touch with as many people, letting them know about GEOSS. But I must say, very honestly, that people are very receptive to this idea. And I think as—the more we can develop the business case around GEOSS and show the values of it to people, the greater opportunity we are going to have for their engagement.

Mr. WHITFIELD. Yes, Dr. Hooke.

Mr. HOOKE. There are advantages and disadvantages to being older. And one of the disadvantages in this case has been—I have seen, for 20 or 30 years, the folks in my line of work try to reach out to users, and it has been fairly difficult.

Now I want to make two comments about that. One has to do with the reasons why it is difficult. And the second has to do with why things may be changing. Okay. So let me talk first about the difficulty here. In most of these businesses that we are talking about, whether it is public health or agriculture or energy or transportation, there is sort of a primary set of issues that folks are focusing on. In agriculture, for example, it is the price of the commodities that you are growing, not just locally, but globally. It is the subsidies, you know, kind of framework that you are operating in and changes on that and so on. So weather might be down there, as you know, No. 3 or something in that area. If you were in energy, weather might be—it wouldn't be No. 1, but it wouldn't be out of the top ten. If you were in construction, the same thing is true. So weather tends to be a secondary factor in many of these areas of application.

Second, the past is an inadequate guide to your need for this weather and climate and air quality information. I said earlier we are moving to kind of a zero-margin society. It used to be that in agriculture you had all of this deep layer of humus soil, and you could grow anything in it. These days, we are talking about highly energy-intensive actions. You are putting fertilizer out there. You are digging wells and doing energy-intensive irrigation and so on. So you are building up more and more sensitivity to weather in the course of that. So you are lagging in your understanding of its importance to you. Now I said things were about to change, and that is because these problems are, No. 1, growing more urgent. They are much more visible then they used to be, these environmental problems. And No. 2, the capabilities of the environmental—the earth sciences community and the remote sensing community, much more able to deal with it.

Mr. WHITFIELD. Thank you.

Yes.

Mr. HOOD. I was going to say what Nancy was talking about the evaluation process, and we heard earlier a statement that a one-degree improvement in the accuracy of a forecast could save $1 billion in certain segments. So that—and those types of benefits in those areas stand by themselves, but I don't want to forget the secondary and tertiary valued-added product that will help stimulate the economy as a result of this and use the Internet as kind of—as a model saying 15 years ago who would have imagined the type of applications that are now available on the Internet and the access to, you know, worldwide environmental data may have that same type of effect and be able to spawn a large number of value-added industries, a lot of applications that we haven't even considered at this point, and that is an important aspect as well.

Mr. WHITFIELD. Ms. Colleton really had some interesting references to business benefits from this in her testimony, which we appreciate.

Ms. DeGette, you have 5 minutes.

Ms. DEGETTE. Thank you, Mr. Chairman.

I think all of you will agree that we think it is important to put together a national integrated—an international integrated earth observation system and that the United States really plays a key role. So my question to each one of you, and we will start with Dr. Hooke—well, wait. Before I do that, I forgot to say hello to Mr. Hood, who is my neighbor to the east from my Congressional District, and it is really—I know we have been talking a lot about buoys here today. That always makes me nervous, being from Colorado, but the implications of this system for drought conditions in the west and for, as I said in my opening, public health, as Dr. Glass was talking about, are enormous. So I do look out for our drought situations in the west.

So Dr. Hooke, I would really like to start with you and ask each one of the panelists if you can tell me if you think we have the political will in the Federal Government right now to do this in a sustained fashion and if we have the financial commitment to do so. And if not, what do we need to do? Because I think everybody, Mr. Whitfield and everybody else on this panel, agrees this is really important. But what do we need to do to move it forward and sustain it?

Mr. HOOKE. I would dearly loved to have been last in this—in answering this, but let me take a stab at it, and maybe you will cut me some slack, and if I have something that I thought I should have said at the end, you will let me come back to it?

Ms. DEGETTE. Sure. You can ask the chairman, but I——

Mr. HOOKE. Okay. You asked basically two questions. You are saying do you think we have the will and the financial wherewithal to do this. Yes, I think we have both. It is easy to look in the past and to feel that the participants in the past had this sense of manifest destiny that knew how things were going to turn out. Well, this is our time on the stage here, and I don't think this is a given. It is not an easy problem, but we have faced tough problems as a country before. We have always managed to hit it. In a case like this, I think we will. I said earlier that these problems are growing more urgent. That helps build consensus. That helps build commitment to the resources. And I think if we are content to feel our way through this rather than think we have to put the whole program down full blown at the beginning of the 10 years or so, we will find that we have navigated ourselves through it over a period of several years.

Ms. DEGETTE. Thank you.

Mr. HOOD. Do we have the political—well, I think we have a lot of good evangelists who are out there spreading the word. I am not sure we have the grass roots support that we need to push something through here. Do we have the financial capability to make this happen? The answer is yes, but it is one issue in a matter of several important national priorities. To be honest, if we, the proponents, can not put together and articulate a viable business case that provides valuation for the products and services that will be provided, I believe you in Congress should not support it. I think it is our responsibility to articulate and to quantify that benefit as much as we can, given the fact that many applications are not out there. I am convinced that the valuation is high, the benefits are high, the potential impact on the economy in secondary and tertiary products and services is high, and I think it is our responsibility to demonstrate that. And success breeds success. As we demonstrate, in an incremental sense, that we can do that, then that will help push the culture and build that grass roots support that we would need.

Ms. DEGETTE. Thank you.

Mr. GLASS. I tried to find the right button.

I would reiterate what the other panelists have said. I don't think it is an issue of will, and from my experience, we are already doing, at least in public health, perhaps very first steps of what needs to be done to create the kind of warning systems that we would like to see in place. I think probably the big challenge will be, as Dr. Hooke mentioned, building the consensus among the right groups of individuals. And certainly in my field, we have realize that the real information for health-related issues lies at many different levels, not only in the Federal agencies, but also in the State and county agencies. And there needs to be the cross talk developed and the consensus developed vertically throughout the public health community that this system provides a really useful value-added product that will really help the community that we believe we should be serving.

Ms. COLLETON. Thank you. In regards to the political will, I just wanted to point out that I think that there is a very strong political will that—behind GEOSS at this point, and I just wanted to point out that Secretary Bodman sat in the U.S. chair at the very first summit that took place in July 2003. He is a very familiar with GEOSS and was involved with helping move the summit forward.

Second, Secretary Leavitt currently at HHS led the U.S. delegation to Tokyo for the second Earth Observation Summit. Secretary Gutierrez, you all probably have a copy of his remarks made at the third Earth Observation Summit, and recently I had an opportunity to meet Secretary Johans at the Western Governors Association, and he is very familiar with GEOSS, specifically because of the national integrated drought information system that would be part of this scenario.

So I can't think of another time in earth observations where we have had people at that level of government in four different agencies that are—that have bought in, essentially, to this system or improving earth observations. I think the key point here is that, as Carroll said, I believe we need to show value. And in the short term, I think one of the key demonstrations that we can have that will show the value of the global earth observing system is to put in place a demonstration of an all-media, all-hazards warning system. I mean, some of the things—and that is why it is so important to include the private sector. I mean, think of telecommunications and what we can do now. Before this subcommittee hearing started, I was talking with Dr. Hooke about one of the meteorologists in my office was showing me yesterday that, you know, the snow would stop within the next hour because he had real time radar data into his cell phone. I mean, these same people that allow us to monitor the stock market or whatever, you know, on our cell phones should be engaged to come up with technical solutions that help get the word via zip codes that there is severe weather in the west or whatnot.

Ms. DeGette. Thank you.

Did you want to add, Dr. Hooke?

Mr. Hooke. No, I think I will stand by what I said. Thanks.

Mr. Whitfield. Dr. Burgess, you are recognized for 5 minutes.

Mr. Burgess. Thank you, Mr. Chairman, and I apologize for being out of the room as this second panel convened. I was simply trying to save highway funding in my State.

Dr. Glass, the statement that you have in here about the data acquisition strategy allowed for the identification of the outbreak of hanta-virus, can you tell us what the data acquisition strategy that was used to help outline that outbreak of—that viral outbreak?

Mr. Glass. Yes, I would be very happy to, Doctor.

What it involved was, in fact, the retrospective study that built on work that was done during the initial outbreak by Centers for Disease Control and Prevention, Indian Health Service, and a number of universities, including the University of New Mexico and a number of other institutions in the Four Corners area. And by gathering that health information, we were then able to link that, knowing the times and places of when cases of disease occurred, link that with earth observation systems, particularly satellite imagery, identify a classifier, build a model that would let us look over years of where did conditions seem suitable for outbreaks to occur. That has continued on an ongoing basis, supported by NASA, NOAA, I believe EPA as well as Centers for Disease Control and Prevention, and a whole host of other government agencies at various levels to provide annual updates to forecast and predict how many cases we expect to see in the U.S. southwest each year. And to date, we have been really quite successful. As you know, the southwest has gone through a fairly dry period the last few years and associated with that has been a substantial reduction in the numbers of cases. With the winter snows this year, the increased precipitation, our suspicion is that, in fact, what we are looking at is the potential for further outbreaks over the next year or so. And that information then is provided to the appropriate agencies who then evaluate the information and provide that to their constituents.

Mr. BURGESS. And now—so you are able to do this because of, what, the amount of moisture in the air, the aridity or dryness of the air?

Mr. GLASS. What it appears to be is it is related to soil moisture and the retention of soil moisture near the surface. It tends to be, therefore, associated, obviously, with certain land class or vegetation types but not exclusively. So it is not simply a matter of saying, "Oh, it will occur in Evergreen Forest." In fact, we can be very specific down to 30 or 40 meters in terms of locating where, for instance, we are going to find infected mice. And in collaboration with the folks at the University of New Mexico, we have actually been using that as a way of monitoring the increase in rodent populations that are carrying virus out there.

Mr. BURGESS. And then you are able to get that data into the hands of health care providers in that area?

Mr. GLASS. Yes, sir.

Mr. BURGESS. But that is not the flu you are seeing this week?

Mr. GLASS. As far as I know, that is not the flu. That is another project. No, and actually one of the tremendous advantages for us in terms of making this work is that it looks like we can lead the potential health effects for people by up to 10 months, so we can actually forecast about 10 months in advance what the conditions are likely to be like, and we obviously continue to monitor them monthly so that we can modify that projection as time goes by.

Mr. BURGESS. Are there any other pathogens that fall into this category that you can provide that type of data for?

Mr. GLASS. We are—have just finished up a study on West Nile virus here in the—it is supposed to be—from where I am from, we call it the Baltimore-Washington area. Is that okay?

Mr. BURGESS. It is the Washington-Baltimore area, as I understand it.

Mr. GLASS. Yes. I have tickets for the Orioles, too.

And what we can show is that, again, using satellite imagery as well as merging this with the work that the Maryland Department of Agriculture, who is responsible for vector control, their data, with satellite imagery, we can not only—we can distinguish sites where the mosquitoes that carry West Nile virus occur. We can distinguish those from sites where the same species occurs but doesn't have the virus. And we can do that beginning in the spring, March, April, and May, and as you have probably experienced if you were here over the last couple of years, most human cases don't start showing up until July, August, and September. And so again, we can provide identification of system monitors as well as some lead-time to local health departments to intervene as they see appropriate.

Mr. BURGESS. Very well. Thank you.

I yield back, Mr. Chairman.

Mr. WHITFIELD. Thank you, Dr. Burgess.

Dr. Glass, I might want to question here. The Center for Disease Control, how do they play into this?

Mr. GLASS. My experience with the Centers for Disease Control and Prevention is that the level at which this analysis occurs varies. It tends to be, oftentimes, at the branch or division level in different portions of CDC. So, for example, at Fort Collins, there is a very active collaboration with CSU and CDC looking, for instance, at plague and relating the potential for plague outbreaks in the U.S. southwest to meteorological conditions that are being monitored by satellite imagery and insight to monitoring. It has been very successful. Another group there has been using similar sorts of procedures to look at risks for Lyme disease across the entire U.S. again using sort of similar strategies. And so, I mean, my impression of their work is that it is outstanding. I mean, it is a very good procedure, but—or very good set of procedures.

Other groups that, in my personal opinion, could probably benefit from them, you know, what they perceive to be appropriate strategies for monitoring the diseases that they are responsible for. And so again, as I was saying, you know, part of this challenge, at least from my perspective for public health, is convincing the community who does public health or who is responsible for public health, that you know, there are some real advantages to be gained by looking at this approach.

Mr. WHITFIELD. Right.

And Dr. Hooke, to conclude this panel, you had mentioned statutory action on the part of Congress. Would you elaborate on that a little bit more?

Mr. HOOKE. You mean unburdened by legislative experience and so on when I have recommendations for specifically what you do? You all have a great influence on the progress of things, and particularly when you agree. And if you can come up with some sense of the Congress that says hey—and to look at the 20 or so problems that are really pressing the country, whether it is jobs or the aging of the population or the health of Social Security. In the middle of all of those other problems, we think this ability to monitor the earth system to forecast what it is going to do, reduce our vulnerability to the bad stuff, to help us take advantage of the opportunities that weather and climate offer. And we recognize that this is pretty much of a long-term project, that there will always be things that seem more urgent. But we feel that if we are going to navigate through this next couple of decades, we need to commit to this somehow. So that is the first step.

The second step involves kind of looking at the resources that are available for it, because again, it is going to be very tempting in the next few years to just put resources into things where the voices are the loudest, and this thing will always be vital and hardly ever be urgent.

And finally, again, there is nothing like looking on the activity periodically and summoning folks up here and saying how is it going.

Mr. WHITFIELD. Well, I want to thank you all so much. We appreciate your being here. We appreciate your—excuse me. I will pick up where I left off. Thank you. And now, if the third panel will come up, we will commence with that. We look forward to staying in touch with you all.

Dr. Allen Dearry, Associate Director, Division of Research Coordination, Planning, and Translation at the National Institutes of Health. We have Dr. Gary Foley who is the Director of the National Exposure Research Laboratory with the U.S. Environmental Protection Agency. And we have Dr. Ari Patrinos, Associate Director for Biological and Environmental Research at the United States Department of Energy. Thank you all for your patience. I know it has been a long afternoon. We genuinely appreciate your being here. You—these are some exhibits that were provided to us by various witnesses, and I move that we enter these documents into the record, and without objection, so ordered.

You all are aware that this is an Oversight and Investigations hearing, and as you well know now, we ask that we swear the testimony in. And I would ask you, do you have any objection to testifying under oath. And do any of you feel a need to have counsel with you today? If not, if you would join me, and I would swear you in at this time.

[Witnesses sworn.]

Mr. WHITFIELD. Thank you very much. You are now under oath, and Dr. Dearry, we will start with you. If you will give your 5-minute statement, please, sir.

TESTIMONY OF ALLEN DEARRY, ASSOCIATE DIRECTOR, DIVISION OF RESEARCH COORDINATION, PLANNING, AND TRANSLATION, NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES, NATIONAL INSTITUTES OF HEALTH; GARY FOLEY, DIRECTOR, NATIONAL EXPOSURE RESEARCH LABORATORY, U.S. ENVIRONMENTAL PROTECTION AGENCY; AND ARISTIDES PATRINOS, ASSOCIATE DIRECTOR FOR BIOLOGICAL AND ENVIRONMENTAL RESEARCH, U.S. DEPARTMENT OF ENERGY

Mr. DEARRY. Thank you, Mr. Chairman, members of the subcommittee, and staff.

I am pleased to be here to discuss very briefly with you the benefits to human health and well being from establishing a GEOSS.

GEOSS represents a means of bringing useful, health-related, environmental data to researchers, to public health, and medical providers, and to policymakers in a user-friendly format. This type of comprehensive data system can provide a powerful tool that actively supports prevention, early warning, research, health care planning and delivery, and can provide a variety of timely public health alerts.

The availability of a global observation system plays an important role in fostering our understanding of the earth and its many interconnected systems: oceans, land, atmosphere, and importantly the manmade human constructs, such as cities. Only by fully exploring and understanding the complex interrelationships between both natural and manmade environments can we begin to better implement a holistic ecosystem-based management approach that provides for productive economy, sustainable development, and the protection of human health and well being.

Improvements in the quality of life and longevity will require a better understanding of the causes, development, and progression of common diseases and disorders and how they relate to environmental factors. So as you have heard a little bit about already, we need to have a better understanding of the specific environmental causes and factors that contribute to underlying burgeoning increases in vector-borne diseases, such as malaria and West Nile virus. A well designed, coordinated, global earth observation system would contribute to providing data on many environmental factors that influence human health.

One of the most difficult challenges that is faced by researchers and policymakers in this field is really being able to monitor and assess the degree of environmental exposures to which we are exposed daily. GEOSS really offers an excellent opportunity for improved data and data products to assist in this process of exposure assessment.

And then we need to be able to combine those environmental exposure data with the health status data, such as the information we obtain from CDC and other agencies. And by combining these in situ and remote observations with disease tracking data, we will have a better understanding of the links between environmental exposure and health status. And together, this information then can be distributed widely and thereby effectively provide tools for the public and for policymakers to make individual and community decisions about their daily lives.

Data relevant to human health and well being that can be obtained from GEOSS include: air quality; water quantity and quality; fate and transport of chemicals in the environment; the impact of environmental changes and manmade activities on bio-diversity; importantly, the search for natural organisms and substances that have the potential to be developed as beneficial products of medicinal and commercial value, so this is not all just what might harm human health but what might actually be health-promoting; the environmental conditions that influence disease transmission from vectors to humans; land use, urban form, population data, and transportation patterns for planning and for health impact assessment.

All of the components of an integrated earth observation system can contribute to improving human health and well being. The enhanced availability of a variety of earth observations will allow development of improved predictive models that could open the door to better forecasting of the occurrence of environmentally related disease and possibly to controlling or preventing these diseases in human populations. Enhanced earth observations can lead to improved data on air quality and contribute to improvements in human health by reducing morbidity and mortality due to asthma, chronic obstructive pulmonary disease, atherosclerosis, myocardial infarction, and other respiratory and cardiovascular diseases. And similarly, both the quantity and quality of water on local, national, and global scales impacts human health. You may, for example, have heard about the dead zones that occur at different locations along the coast of the U.S., the most prominent being the Gulf of Mexico, but they also take place in the Chesapeake Bay. These are harmful not only socially, culturally, and economically to the fishing industry, for example, but they also have a potential impact on human health due to their contribution to the growth of algal blooms, some of which are harmful or toxic to humans.

So GEOSS actually represents an excellent opportunity for us to be able to better assess environmental exposures and how they contribute to human health.

Thank you for your time. I will be glad to answer any questions you may have.

[The prepared statement of Allen Dearry follows:]

PREPARED STATEMENT OF ALLEN DEARRY, ASSOCIATE DIRECTOR FOR RESEARCH COORDINATION, PLANNING AND TRANSLATION, NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES, NATIONAL INSTITUTES OF HEALTH

Good afternoon. I am Dr. Allen Dearry, Associate Director for Research Coordination, Planning and Translation at the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health, DHHS. NIEHS is a member of the Interagency Working Group on Earth Observations. I am pleased to be here to present testimony on the benefits to human health and well-being from the interagency initiative to develop the U.S. component of a global Earth observation system of systems (GEOSS). GEOSS will be a means of bringing useful health-related environmental data to the health communities (researchers, service providers, and policy makers) in a user friendly form. Comprehensive data sets are powerful tools that support prevention, early warning, research, epidemiology, health care planning and delivery, and provide a variety of timely public alerts.

At its most fundamental level, this activity acknowledges the critical role that the availability of comprehensive and sustained global observations plays in enabling our understanding of the earth and its many interconnected systems—oceans, atmosphere, land, and man-made constructs such as cities. Only by fully exploring and understanding the relationships between natural and man-made environments will we be able to implement holistic, ecosystem-based management and provide simultaneously for a productive economy, sustainable development, and protection of human health and well-being.

Health status is determined by the interplay of a complex array of factors--genetic susceptibility, age, nutrition, stress, and environmental exposures. With the sequencing of the human genome, rapid progress in understanding the role of human genetic susceptibility in disease causation and progression is expected. Continued improvements in quality of life and longevity will require a better understanding of the causes, development, and progression of common diseases and disorders—and how they relate to environmental factors. For example, what are the specific environmental factors underlying burgeoning increases in vector-borne diseases, such as malaria and West Nile virus, and chronic diseases already linked to environmental exposures, such as breast cancer, Parkinson's disease, and asthma? How can we improve prediction of outbreaks of both acute and chronic diseases? A well-designed, coordinated global earth observation system of systems (GEOSS) would contribute significantly to providing data and data products on many environmental factors that influence human health, from extreme weather events, to availability of food, to air and water pollution.

One of the most difficult challenges faced by researchers and policymakers is monitoring and assessment of environmental exposures. To assess exposure adequately, investigators must know as much as possible about the environmental media into which a substance is released (air, surface water, groundwater, soil surface or subsurface), how quickly the substance can move through those media, how physical and chemical properties change under environmental conditions, and how these changes affect the potential for harming populations or the environment. GEOSS will offer improved data and data products to aid in exposure assessment.

Over the past fifty years, an increasing demand for environmental health knowledge to inform personal and societal decision-making has been expressed by service providers, policymakers, and the public at large. The optimal approach to achieve this knowledge base is to combine in situ and remote observations with disease tracking data. Together, this information can be distributed widely, using information systems, and thereby effectively provide tools for the public and for policymakers to make individual and community decisions about daily lives and potential regulations that influence human health and well-being.

Data and data products relevant to human health and well-being that can be obtained from GEOSS include, but are not limited to, the following areas:

- Air quality and pollution transport.
- Water quantity and quality, especially for human use.
- Hot spots of pollution in wetland and coastal areas.
- Fate of pathogens in marine and other low oxygen environments, such as aquifers, mountain tops and caves.
- Fate and transport of chemicals in the terrestrial, aquatic, and marine environments.
- Impact of environmental changes and man-made activities on terrestrial and aquatic biodiversity.
- Search for natural organisms and substances having the potential to be developed as beneficial products of medicinal and commercial value.
- Environmental conditions that influence disease transmission from vectors to humans, including those that affect the spread and control of emerging or reemerging diseases.
- Safe and adequate supply of food.
- Land use, urban form, population data, and transportation patterns for planning and health impact assessment.
- Human activities and location for exposure assessment and resource management.
- Weather and climate.
- Invasive species, particularly those affecting humans.

All the components of an integrated earth observation system can contribute to improving human health and well-being. Researchers, service providers, policymakers, and the public can use earth observations to make decisions and take actions. These decisions and actions help reduce the impact of disasters, protect and manage natural resources, adapt to and mitigate climate variation, support sustainable agriculture, forecast weather, protect areas valued for recreational, religious, or aesthetic purposes, and prevent disease/dysfunction due to environmental exposures or conditions that increase the likelihood of transmission of water- or vectorborne diseases. For diseases influenced by environmental factors, the enhanced availability of a variety of earth observations will allow the development of improved predictive models that could open the door to forecasting occurrence and possibly controlling or preventing these diseases in human populations.

Enhanced earth observations that lead to improved data on air quality and an enhanced ability to predict air pollution episodes will contribute to improvements in human health by reducing morbidity and mortality due to asthma, chronic obstructive pulmonary disease, atherosclerosis, myocardial infarction, and other respiratory and cardiovascular diseases. In addition, air pollution affects the environment in many ways that ultimately impact human health and well-being: by reducing visibility; damaging crops, forests, and buildings; acidifying lakes and streams; stimulating the growth of algae in estuaries; and the build-up, or bioaccumulation of toxics (e.g., mercury) in fish and animals. Rapid development and urbanization around the globe has increased air pollution that threatens people everywhere as these contaminants can travel great distances across oceans and national boundaries.

Both the quantity and quality of water on local, national, and global levels pose similar concerns. For example, an annual dead zone has developed in the Gulf of Mexico, beginning as early as February and sometimes lasting until mid-fall. This zone consists of water where the oxygen content is so low that its denizens cannot survive. Although the precise timing and size of the Gulf's dead zone varies with the weather, in many years it encompasses 22,000 square kilometers, a parcel of underwater real estate roughly the size of New Jersey. There's no mystery as to what triggers this annual hypoxic zone. Into the Gulf of Mexico, the Mississippi River deposits water that is heavily enriched with plant nutrients, principally nitrate. This pollutant fertilizes the abundant growth of algae. As blooms of algae go through their natural life cycles and die, they fall to the bottom and create a feast for bacteria. Growing in unnatural abundance, bacteria use up most of the oxygen from the bottom water. Caused almost exclusively by human activities, coastal dead zones are becoming increasingly common and recurrent. In the Chesapeake, scientists worry that a growing dead zone in the bay each summer is creating a habitat that favors jellyfish over commercially valuable finfish, crabs, and oysters. Despite the nation's most aggressive state and local efforts to curtail nutrient releases into local waters, last year's dead zone in the Chesapeake was the largest ever measured. In addition to economic and social impacts, these changes in marine biology and chemistry affect human health by promoting growth of toxic or harmful algal blooms and decreasing our capacity to obtain reliable, valuable food sources. Improving our ability to measure and monitor land- and water-based environmental change contributing to such outcomes will significantly expand our capability to protect both marine resources and human health.

Mr. WHITFIELD. Thank you, Dr. Dearry.

And Dr. Foley, you are recognized for a statement.

TESTIMONY OF GARY FOLEY

Mr. FOLEY. Well, thank you, Mr. Chairman, and thank you to the committee and the staff for this opportunity to talk today.

First, I would like to recognize and thank all of the——

Mr. WHITFIELD. Is your microphone on, Dr. Foley?

Mr. FOLEY. I am sorry.

First of all, I would like to thank all of the agency partners and industrial partners that have participated in this effort. It has been quite an experience working with so many people with such diverse interests. And I especially want to put my recognition in for Vice Adm. Lautenbacher for his dedicated leadership in making the vision for GEOSS real. I have gone with him to most of the GEO meetings and have seen his leadership in action.

GEOSS has the potential to be a very important source of information to inform policies, especially in the environmental arena. And our former Administrator, Mike Leavitt, recognized this in using the phrase that “GEOSS would take the pulse of the planet.” EPA’s mission is to protect human health and safeguard the natural environment, and so, therefore, we believe we have an important continuing leadership role to play in GEOSS.

By comparing the goals and objectives in EPA’s strategic plan with the societal benefit areas identified in the Strategic Plan for the U.S. Integrated Earth Observation System, it is very clear that GEOSS has the potential to make a significant contribution to environmental protection. It is for this reason that EPA has joined with the other agencies to be an active contributor and a leader in both the interagency and international GEOSS efforts.

EPA is very dependent on observational data for our environmental decisionmaking as well as for the increased understanding of our environmental problems and in order to look at our performance in addressing these environmental problems. To fulfill our mission, EPA has a long tradition of partnering with other Federal agencies to access and share data and information.

EPA was a co-chair of the international “User Requirements and Outreach” subgroup that was formed under the ad hoc Group on Earth Observations. And one of the tasks of this group was to draft the first set of societal benefits that ultimately got negotiated and became part of the framework for this plan.

We at EPA are an important partner in GEOSS, because we are both a data provider and a data user, contributing to all of the nine societal benefit areas. Like the international model for the GEOSS architecture, EPA in its partnership with Federal agencies, States, tribal governments, and local environmental agencies, collects many types of environmental monitoring data and develops and validates environmental models that support decisions about the environment.

In addition, EPA is helping these same State, tribal, and local environmental agencies and their decisionmakers to address the challenge of defining and tracking environmental stewardship with outcome-based performance metrics. As information from GEOSS becomes available, we will be able to refine these metrics even more.

EPA stands ready and willing to further its already strong support on the implementation of GEOSS, working with all of our international and domestic partners.

And again, thank you for inviting EPA to appear before this subcommittee, and I look forward to your questions.

[The prepared statement of Gary Foley follows:]

PREPARED STATEMENT OF GARY FOLEY, DIRECTOR OF THE NATIONAL EXPOSURE RESEARCH LABORATORY, OFFICE OF RESEARCH AND DEVELOPMENT, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

INTRODUCTION

Good afternoon Chairman Whitfield, Ms. DeGette, and Members of the Subcommittee. Thank you for the opportunity to appear before this Subcommittee to discuss the role of the Environmental Protection Agency (EPA) in the Global Earth Observation System of Systems (GEOSS). EPA's mission is to protect human health and to safeguard the natural environment, and therefore we have an important, continuing role to play in GEOSS. It is my pleasure to discuss this role with you this afternoon.

EPA'S UNIQUE GEOSS ROLE IN EARTH OBSERVATION LINKAGES

As previous speakers have said, GEOSS is an excellent example of science serving society. Over time, GEOSS will provide important scientific information for sound policy and decision making in every sector of society. EPA recognized immediately that GEOSS aligned with our mission and that we could potentially make a significant contribution.

The (2003-2008 EPA Strategic Plan: (Direction for the Future(emphasized that EPA's mission is clear: to protect human health and to safeguard the natural environment. The vision for GEOSS is to realize a future wherein decisions and actions are informed by coordinated, comprehensive, and sustained Earth observations and information. By comparing the Goals and Objectives in EPA's Strategic Plan with the Societal Benefit areas identified in the Strategic Plan for the U.S. Integrated Earth Observation System (IEOS), it is clear that GEOSS has the potential to make a significant contribution to environmental protection. EPA recognized this in 2003 as the first Earth Observation Summit (EOSI) was being planned, and has joined with other Agencies to be an active contributor and leader in both the interagency and international effort.

Under the authority of numerous environmental statutes, EPA strives to implement environmental protection as science and technology continuously advance. As an agency, EPA depends on observational data to assist in environmental decision making, as well as to increase our understanding of environmental problems and how best to address them. EPA has traditionally partnered with other Federal Agencies to access and share data and information for other programs. For example, in air quality, EPA and National Oceanic and Atmospheric Administration (NOAA) continue to benefit from a partnership that started 50 years ago by the Public Health Service and the Weather Service. In water quality, EPA, NOAA, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey have worked together for the last decade assessing U.S. coastal conditions. This effort recently produced a second National Coastal Condition Report. In recent years, there has been an effort across all agencies to strengthen these partnerships, which have become the backbone of both IEOS and GEOSS. It is important to emphasize that the IEOS is the U.S. contribution to GEOSS.

EPA brings to GEOSS experience in scientifically sound environmental policy and decision making. Over time, opportunities to link information from GEOSS observations to environmental decision making may be numerous, and some of these links are underway now. EPA faces the challenge of addressing environmental problems at different geographic scales and of improving environmental performance in a holistic manner. Compounding this challenge is the need to be flexible enough to embrace innovative approaches to demonstrate improved environmental performance at less cost. Addressing these challenges can require harmonizing our own and others(vast environmental data resources. For data to be useful to the broad community of stakeholders to inform their environmental decisions and to measure their success, the systems of different observations, models, and decision support tools all need to be interoperable. EPA has been actively encouraging and facilitating the development of interoperable systems, both working with the Federal community, as well as with the state, tribal, and other environmental agencies.

EPA AS A GEOSS LEADER

In November of 2003, former Administrator Michael Leavitt arrived at EPA with his "Enlibra Principles," an awareness of GEOSS, and the desire to play a leadership role along with the heads of other Agencies. Administrator Leavitt led the U.S. delegation to Tokyo, Japan for the second Earth Observation Summit in April 2004, where he combined his recognition of Earth Day with the adoption of the GEOSS Framework Document, remarking that GEOSS "will give us the pulse of the planet."

From the very beginning, at both the international and U.S. levels, EPA has been one of the leaders of GEOSS. Acting EPA Administrator Marianne Lamont Horinko as she closed the first Earth Observation Summit on July 31, 2003, remarked about the historic, unprecedented, and huge challenges before all of us. Horinko emphasized, "You are building a global partnership to protect the global community. You're strengthening the human ties that link all people everywhere. Through information, you will inspire a deeper understanding of who we are and where we live."

Also, EPA became a co-chair of the international "User Requirements and Outreach" subgroup formed under the ad hoc Group on Earth Observations (GEO). One of the principal tasks of this group was to draft the Societal Benefit areas, to come up with compelling rationale for the importance of the benefits, and to then draft a broad "first cut" of the observational requirements to meet these Societal Benefits.

This concept was emphasized by EPA Administrator Michael Leavitt in Tokyo 2004. "The tools provided by GEOSS will aid us in managing our watersheds, improving our drinking water, protecting our food supply and ensuring a safe transportation system. It will help us avoid disease outbreaks and secure a reliable energy supply. GEOSS will help us sustain people, promote prosperity and protect our planet. The potential benefits are limited only by our imaginations." Under the U.S. Interagency Working Group on Earth Observations (under the Committee on Environment and Natural Resources of the National Science and Technology Council), EPA continues to play a role as the agencies develop and begin to implement the opportunities under the Societal Benefit areas. EPA's leadership role is being reaffirmed by the Administrator nominee, Stephen L. Johnson, who recently said, "I am thrilled with the promise of GEOSS. It can provide us with better information to use in decision-making, producing better decisions that are better informed with more data points. If confirmed as EPA's administrator, I hope to help make the promise of GEOSS a reality."

The identification of user requirements is an ongoing and dynamic effort that many Agencies and countries are undertaking. In concert with our stakeholders, we at EPA continue to identify additional scientific gaps that GEOSS could address and how best to fill these gaps. At this point, our users include the breadth of stakeholders concerned about using the information available to make the best possible environmental decisions.

Also, because of EPA(s effort to develop a Report on the Environment, EPA is in a good position to provide information and guidance on human health and environmental indicators that meet user needs. In addition, EPA's Air Now Program is a "trail blazer" in providing meaningful air quality indicators to the public in realtime. Partnerships have been established with NOAA and the National Aeronautics and Space Administration (NASA) to further develop models and observations to improve the indicators and forecasts that states, tribes and local agencies can use.

Implementing environmental protection across our country has become a network of state and tribal partnerships. With the evolution of GEOSS, this partnership network will expand across countries.

ACHIEVING AND MEASURING ENVIRONMENTAL PROGRESS

Like GEOSS, EPA in partnership with Federal, state, tribal and local environmental agencies, collects many kinds of environmental monitoring data, and develops and validates environmental models that support decisions about the environment.

At the same time, EPA is helping state, tribal, and local environmental agencies and their decision makers address the challenge of defining and tracking "environmental stewardship" with outcomebased performance metrics. EPA is a leader in using data to measure and evaluate environmental progress.

To improve accountability, EPA made a commitment in our Strategic Plan to measure our performance. As part of this commitment, EPA published our first " Draft Report on the Environment" in 2003, providing the first EPA national look at the condition of human health and the environment. The Draft Report on the Environment also served as a capstone report on the state of the science of environmental health indicators, identifying gaps and limitations and starting EPA down a path towards comprehensive real-time environmental health indicators that will be widely accepted and used.

In addition to our strong network with state, tribal and local environmental agencies, EPA also has a strong international network. Consistent with the notion that the Earth is one integrated interoperable system and that the environment knows no political boundaries, GEOSS will require concerted and long-term international cooperation to achieve many of the internationally shared health and environmental goals. EPA has a history of international environmental partnerships, where the transfer of technology and knowledge benefits all parties.

At EOSII in Japan 2004, EPA Administrator Michael Leavitt put the GEOSS efforts in a familiar context. "The world is beginning to intuitively organize itself into networks. Similar to the way we communicate with computer networks, we will solve environmental problems best by connecting multiple disciplines and finding a common language. Doing this well is the new frontier in productivity." In my view, GEOSS will help facilitate a common language and understanding by building the technical and social networks, improving our ability to monitor and predict changes, and enabling citizens and policy makers to make more informed decisions affecting their environment.

EPA stands ready and willing to further its already strong support on the implementation of GEOSS with all our partners. For example, EPA has an advanced monitoring initiative in the FY 2006 President's Budget, which is part of GEOSS. This initiative will enable pilot efforts to demonstrate how new data and information can be quickly brought into environmental applications and make a difference. Thank you for the opportunity to speak with you today. I look forward to your questions.

Mr. WHITFIELD. Thank you, Dr. Foley.

And Dr. Patrinos, you are recognized for 5 minutes.

TESTIMONY OF ARISTIDES PATRINOS

Mr. PATRINOS. Thank you, Mr. Chairman and members of the subcommittee. It—I am indeed honored to testify on behalf of the Department of Energy.

Like the other sister agencies you have heard from, the Department of Energy is an enthusiastic participant in the activities of GEOSS. The business of energy, Mr. Chairman, can be a major beneficiary of improved observations and of better forecasts that would be derived from these improved observations. For example, better weather forecasts can help us better stage power plant operations. Also, better predictions of rainfall and snow pack can greatly aid the operation of hydroelectric stations. We stand to significantly benefit in terms of improved efficiency, energy security, and decreased reliance on foreign sources of energy.

Another area of great interest to the Department of Energy is that of climate variability and climate change, whether it is from natural causes or because of increases in greenhouse gases from fossil fuel burning.

Climate change prediction is, frankly, more complicated than weather forecasting, because we are generally searching for a small signal against large natural variations. Even though many observations benefit both the weather forecasting and the prediction of climate change, there are some special measurements that need to be made for predicting climate change more reliable. These additional measurements are mostly fluxes, whether they are of greenhouse gases or fluxes of atmospheric radiation and atmospheric water in its various phases.

Observations from satellites are essential for studying both weather and climate because of their wide area coverage. The recent decades have brought us dramatic increases in the number of satellites and the instruments on these satellites, and this increase has clearly been reflected in the improvements of both weather forecasting and climate change prediction.

However, satellite-observing systems must continue to be augmented with ground-based observing systems. Ground-based systems that provide sustained and continuous measurements provide a complementary look to the atmosphere as well as serve to calibrate and validate the satellite observations.

The Department of Energy supports some of those ground-based measurements that are particularly important for the study of climate change. The Department of Energy's Atmospheric Radiation Measurement program, the ARM program, as we call it, provides such high-quality measurements at three permanent stations at the Oklahoma-Kansas border, on the north slope of Alaska, and the tropical western Pacific, and with its mobile site, which is currently located in California and expected to be moved to Niger, Africa next January.

The ARM program measures the continuous fluxes of atmospheric radiation of water and of aerosols as well as cloud properties with great precision. These sites will be part of GEOSS, including the U.S. integrated earth observation system, as spelled out in the integrated earth observation system draft strategic plan that you have seen.

DOE also supports over 15 Ameriflux sites around the U.S. and Canada. These facilities measure the continuous flux of carbon for various ecosystems and help us better understand the global carbon cycle, including its principal sources and sinks.

Finally, I would like to mention an exciting new dimension of earth observations, and that is that of environmental genomics. This has come about because of the successful human and microbial genome sequencing that DOE has played such an important role in. This particular measurement involves sequencing all of the DNA that is captured in a gram of soil, a cc of seawater, or a liter of air. You may have seen the article in the paper this week about Craig Ventor's sampling of the atmosphere above New York City. He is one of our PIs in this very exciting project. From the DNA sequence, we can infer the diversity of living systems in various locations. Eventually, we may be able to monitor that diversity across space and time and acquire a new and more sensitive way to check on the health of the planet.

Genomics sampling is, of course, still at the very early stage, but eventually I am convinced and very bullish about the possibility that it could become a part of the GEOSS system.

I would be delighted to answer any questions.

[The prepared statement of Aristides Patrinos follows:]

PREPARED STATEMENT OF ARISTIDES PATRINOS, ASSOCIATE DIRECTOR OF SCIENCE FOR BIOLOGICAL AND ENVIRONMENTAL RESEARCH

Mr. Chairman and Members of the Subcommittee: Several energy related interests are addressed and benefits derived from global earth observations. These interests and benefits include improving weather and climate forecasts which allow us to better project energy demand in the future and to better understand and assess the potential for consequences of future climatic changes. Such forecasts are also essential for predicting the future capacity of hydroelectric systems which depend, of course, on precipitation and runoff.

Most of the current earth observing systems have been designed primarily for the needs of weather forecasting. Weather forecasting is an "initial condition" problem. By that, we mean that the success of the forecast is heavily dependent on the quality of the specified initial state of the atmosphere. Thus, weather forecasting observing systems tend to focus on determining the three-dimensional values of the state variables of the system (the atmosphere)—namely, air temperature, humidity, and the three components of the wind vector. While weather forecasting requires accurate observations, spatial patterns and relative accuracy across those patterns are the primary concerns.

Climate, on the other hand, is a "boundary condition" problem; that is, climate simulation depends on knowing the energy fluxes into and out of the system and the quantities of components such as carbon dioxide and water vapor which affect the flow of those energy fluxes in the system. Consequently, climate observing systems need to extend beyond measurements of state variables to measurements of fluxes of radiation, energy and water. The focus on energy and water cycles is because they are involved in the dominant forms of energy transfer in the climate system (solar energy, thermal infrared energy, evaporation and condensation). Further, because forecasting climate is a search for small system trends and imbalances in the midst of large weather variability, climate observations require a much higher degree of precision than do weather observations.

Satellite instruments are essential for both weather and climate observing systems. Satellites provide wide area coverage by their orbital characteristics and the use of cross-track scanning instruments. The past several decades have brought a dramatic increase in the number of satellites and instruments, their measurement resolution and variety, and their calibration. This trend has benefited both weather forecasting and climate. It is now possible to routinely measure temperature profiles, water vapor path amount and some profiles, cloud occurrence and other properties, wind direction and speed by tracking cloud movements, aerosol column amount, and a wide variety of other parameters.

Satellite observing systems must continue to be augmented with ground-based observing systems for climate in particular, but also for other applications such as weather forecasting, environmental prediction systems, and research. Ground based systems provide high temporal resolution measurements, usually on the order of seconds. These measurements, when acquired continuously, provide a complementary look at the atmosphere compared to the broad spatial resolution of satellite instruments. It is technically possible to acquire simultaneous measurements of many different quantities in the atmosphere and at the surface, including both state variables and energy fluxes. The combination of active and passive sensor measurements to retrieve atmospheric properties is now a well established technique that will allow scientists to investigate climate and weather processes in unprecedented detail. In addition, these ground-based measurements provide the best way to evaluate the accuracy and representative nature of satellite measurements and vice versa. The climate observing system of the future must be a combination of satellite and ground-based systems.

DOE supports some of the ground-based measurements at its three stationary Atmospheric Radiation Measurement (ARM) facilities, and at a new mobile facility that is just being deployed. These ARM facilities will be part of the GEOSS, including the U.S. Integrated Earth Observation System that is spelled out in the IEOS draft strategic plan.

As we look to the future of climate change, climate research, and climate modeling, there is no doubt that progress in this arena will be intimately connected to data availability. Climate observing systems must include a balanced approach that is based on a combination of satellite and ground-based systems; neither is adequate by itself. *In situ* observations must also be included as a critical component for evaluation and assessment of accuracy. Without an integrated observing system, it is extremely unlikely that we will be able to develop or validate the climate models that we require to understand and forecast future climate variability and change.

I would be pleased to answer your questions.

Mr. WHITFIELD. Thank you, Dr. Patrinos.

Dr. Dearry, in your testimony, you referred to the dead zones in the Gulf of Mexico and also in the Chesapeake Bay. And I think that you said that the dead zone in the Chesapeake Bay was larger than it has ever been in its history, is that correct?

Mr. DEARRY. That is correct, yes.

Mr. WHITFIELD. Now how concerned are you about that and what—how will GEOSS help in that situation?

Mr. DEARRY. Well, this is a growing concern, not only in this country, but around the world. The incidents of these types of dead zones is really increasing on a global level. The dead zone that is in the Gulf of Mexico, for example, is an area the size of the State of New Jersey. It is 22,000 square kilometers. And these are mostly manmade in terms of their causation. They are due to non-point source pollution and runoff of plant nutrients, principally nitrates. And what happens is that those nitrates then lead to these types of blooms of algae. The algae eventually die and fall to the bottom of the water column, and they are consumed by bacteria. And it is that bacterial process that actually depletes water of its oxygen content. And what happens as a result of that is that the normal denizens of that area of water leave because oxygen is no longer there in the water to support them. So the potentially useful foods in terms of human consumption, shellfish, fin fish, leave those areas and are no longer available to us as a reliable, viable source of food, and those algae that grow as a result are also, in many cases, harmful because they release toxic compounds that can be taken up by humans through either inhalation or direct exposure dermally.

So this is a growing concern, I think, for those of us in the U.S. as well as elsewhere around the world. There is a lot of focus on a regional level within this country, for example, in the whole Mississippi delta system, on a State basis, to try to address what leads to these types of dead zones and what we can do through both policy and other regulatory considerations to try to decrease their occurrence.

Mr. WHITFIELD. Well, allowing these runoffs, I am assuming that is a violation of existing environmental laws or is it not?

Mr. DEARRY. Not really. You know, in many cases, this is regulated at a State level.

Mr. WHITFIELD. Okay.

Mr. DEARRY. And Maryland, for example, has had, really, the most aggressive policy, I would say, of trying to regulate that type of runoff on a State level, but it is not as if Maryland has total control of the Chesapeake Bay. You know, those waters originate in Upstate New York.

Mr. WHITFIELD. Right.

Mr. DEARRY. And so it really takes at least a regional, if not a national, strategy to try to address those problems.

Mr. WHITFIELD. Dr. Foley, in your testimony, you mentioned, I believe, that the GEOSS system would be helpful in identifying additional scientific gaps.

Mr. FOLEY. That is correct. Yes.

Mr. WHITFIELD. Would you elaborate on that a little bit?

Mr. FOLEY. Well, we start with the fact that societal benefits that EPA tries to produce come from—as a result of environmental decisions that we make. As we look and talk to the environmental decisionmakers, we recognize that they are very dependent on observational data, usually acquired from the fixed-site monitoring networks, local ones. Those networks, as best as you can have them today, are far from perfect. And so we see where in these environmental decisions better data could lead to better decisions. Then the question is how can you augment these fixed site monitoring networks that you have, either for the air or for water quality, with satellite data and with more robust modeling. And by combining the data sets of—from the three things, the modeling, the satellite data, and the fixed site monitors, you can provide a more robust data set that can improve the understanding that goes into the decisionmaking. And as we are able to make satellite measurements on a finer and finer scale as we move into the future, we should be able to do this even better. And again, as computers get faster, the models get better. And so we see ways of bringing this altogether to improve decisionmaking. And we are trying this out in areas of air pollution and areas of water pollution working with States or local communities to actually do proof of concepts that this really works and you could get these benefits. And as we do it, the word spreads and more people want to try this with us.

And so it seems to be an approach that works.

Mr. WHITFIELD. Okay. Thank you.

Ms. DeGette.

Ms. DEGETTE. Thank you, Mr. Chairman.

I think all of us agree that, as well as an intellectual commitment from the various agencies to support this type of system, we also need to have a financial commitment. And I am—I just have one question. I would like to ask each one of you if you can tell me what your agencies have proposed in the 2006 budget to advance the initiative, starting with Dr. Dearry.

Mr. DEARRY. On the part of the National Institutes of Health, we are actually very engaged in trying to foster the collection of environmental data and communicating that to end-users, to public health and to medical providers. So—and for example, we have worked with our partners at the National Science Foundation to develop a set of Centers for Oceans and Human Health, which are actively carrying out more research efforts to enable us to develop better sensors in the oceans, not only for ocean chemistry, for changes in temperature or salinity, oxygen, but also biological sensors so that, for example, we might be able to better analyze some of these harmful algal blooms.

Ms. DEGETTE. Doctor, I hate to interrupt you. I only have——

Mr. DEARRY. Okay.

Ms. DEGETTE. —5 minutes.

Mr. DEARRY. Okay.

Ms. DEGETTE. And I know you have wonderful efforts going on. My question is do you have any specific financial line item in your budget for the GEOSS system and your agency's role?

Mr. DEARRY. Do we have a line item in the budget for GEOSS?

Ms. DEGETTE. Yes. Or do you have an idea how much it is going to require to integrate your agency with GEOSS?

Mr. DEARRY. We do not have a line item in the budget for GEOSS. What we are doing is supporting a variety of research efforts with our own budget to try to accomplish the goals of GEOSS.

Ms. DEGETTE. Okay. Great.

Dr. Foley.

Mr. FOLEY. We have a line item in the budget for GEOSS advanced monitoring of $5.3 million. This augments a base resource of related research that is probably about 4 to 5 times that. And our expectation is with this program we will be trying to leverage funding from other agencies to work with us to the tune of about $10 million. But our line item is $5.3 million.

Ms. DEGETTE. And do you think that is sufficient for the 2006 cycle?

Mr. FOLEY. Considering that we are doing a lot now without it, we think we can do quite a lot more with it. And then we would look to increase that, possibly, in the future.

Ms. DEGETTE. Great.

Dr. Patrinos.

Mr. PATRINOS. We don't have a specific line item.

Ms. DEGETTE. I think you need to turn on your microphone.

Mr. PATRINOS. We do not have a specific line item for GEOSS. However, many of our climate programs, and also some of our biological programs, some of which I have described in my oral remarks, have been sensitized to the possibilities of integration across other agency programs and also internationally.

Ms. DEGETTE. Thank you.

Let me just say, Mr. Chairman, I know this is our last panel, and these are my last questions. I mean, I think we all agree Admiral Lautenbacher has a fabulous commitment to this. We all think it is a great idea, but as we see with this panel and also the previous panel—well, actually all three panels today, it is all a little bit sketchy. Everybody thinks it is a great idea, and they are doing their best. I think we really need to have some clear goals from all of the agencies and also some clear budget directives from Congress, because if we are just sort of hoping this happens, then we all know it may not. It may not happen in the time or the way we want.

So thank you for having this hearing.

Mr. WHITFIELD. Well, very good point. We all were quite disappointed with the omnibus bill and the omnibus process. And all of us are trying to be determined not to have another omnibus bill.

But with that, Dr. Burgess, you have 5 minutes.

Mr. BURGESS. Thank you, Mr. Chairman.

And yes, let me go on record as saying I don't want to end up in the omnibus process again this year, either.

Ms. DEGETTE. It is unanimous.

Mr. BURGESS. Dr. Dearry, on—what can you tell us about currently using some of our earth observation system of systems to, say, help someone with a specific disease, like asthma?

Mr. DEARRY. See, I think there is a lot of potential to be able to collect better air pollution data than we are now able to do. Most of this on an ongoing basis now is done at very localized sites. There is no large-scale global effort to try to collect these data and to integrate them on either a State or a national scale. So that offers a lot of potential for us to be able to better utilize information related to particulate matter, to different air pollutants, such as sulfates and nitrates, which have been shown to be triggers of asthma, to exacerbate asthma attacks. So having better sources and better integration of those types of data on a larger scale will enable us to better predict where those types of risks arise for people who have asthma.

Mr. BURGESS. Is anyone correlating that sort of data with syndrome surveillance, watching purchases at drug stores, over-the-counter purchases of medications or prescription medications, emergency room visits, and that type of thing?

Mr. DEARRY. There is a fair amount of that work ongoing, especially with regard to emergency room visits. A lot of this we carry out in concert with our other colleagues within the Department of Health and Human Services, such as CDC and FDA, to be able to start to assess some of those links between environment exposures and health impacts. There is really no national tracking or surveillance system for asthma, for example. Some municipalities, some States have the beginnings of that type of tracking system on their own, but there is nothing on a national level. Nevertheless, we are working with CDC to start to develop an environmental public health tracking system that would have exactly that goal. How is it that we can better examine both indoor and outdoor air environments and track those, relate those to the incidence of asthma?

Mr. BURGESS. It seems to me that there possibly even could be a homeland security implication in this as well, if, for example, there was a disconnect between what was happening at the drug store and emergency room level and what you were seeing on your observational system. So I would just encourage you to continue that, and it sounds like a very attractive area of research.

And then—which leads me to the next point about the environmental genomics. And could you just expound upon that a little bit? What all is involved in that? Or how are you taking these samples? How large a sample? And do you relate it back to things like algal blooms? Or do you check the DNA of the bacteria that are growing as a result of that?

Mr. PATRINOS. Sure. The sampling is, in fact, fairly straightforward. In the oceans, we take certain—a certain amount of liters, and then we filter it with varying size filters. And we collect, essentially, all of the DNA that is caught in the filter. And then we shotgun sequence it through this innovative sequencing approach that, in fact, Craig Ventor pioneered a few years back. And now we already have in our data bases the sequences of many life forms, including a lot of microbes. And we look for matches on the data bases. So we infer from the bits of DNA that we have sequenced what life forms there are, what microbes exist in that particular sample. We can do that also in land, as we have done it in acid mines in California, for example. And very recently this week, there was this article that Craig Ventor did in terms of sampling the air above New York City, filtering the air that was captured, and again sequencing the DNA that was captured on the filters. Every new sequence that we discover, every new bacteria that we discover, is stored in the data bases. So in a sense, the data base grows by the day. And ultimately, we get matches, so we know basically what exists in that particular sample, whether it is in the ocean, whether it is in the air, or it is on land. And in some way, it becomes a question of not just necessarily finding the life forms that are there, but the collection or the diversity of genes that are there. So one can look at the diversity of life in a particular ecosystem as the diversity of genes that are acting in that particular ecosystem. And ultimately our goal when sequencing can become much cheaper and much faster, is to be able to monitor a lot of that in real time and also check its variability across space and time and therefore give us an entirely new way, as I mentioned, to check on the health of an ecosystem, ultimately the health of the planet.

Mr. BURGESS. But—and, too, there also does seem to be a homeland security implication in that as well.

Mr. PATRINOS. Indeed.

Mr. BURGESS. Okay. Thank you.

Mr. WHITFIELD. That concludes today's hearing. I want to thank you for being with us. We appreciate your commitment and your—and we will keep the record open for 30 days for any additional testimony or material that may come in, but we look forward to working with you as we continue to implement the GEOSS system. And thank you very much for being with us today.

Mr. DEARRY. Thank you.

Mr. FOLEY. Thank you.

Mr. PATRINOS. Thank you.

[Whereupon, at 6:17 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows:]

**QUESTIONS SUBMITTED FOR THE RECORD TO
VICE ADMIRAL CONRAD LAUTENBACHER, JR. (U.S. NAVY, RET.)
UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE
AND NOAA ADMINISTRATOR
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE**

**FOLLOWING AN OVERSIGHT HEARING ON THE GLOBAL EARTH
OBSERVATION SYSTEM OF SYSTEMS (GEOSS)**

**BEFORE THE
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS
COMMITTEE ON ENERGY AND COMMERCE
U.S. HOUSE OF REPRESENTATIVES
MARCH 9, 2005**

QUESTIONS SUBMITTED BY THE HONORABLE JOHN D. DINGELL

1. **In your testimony, you stated that you had agreement from the White House to set up a permanent earth observation subcommittee as recommended in the strategy plan for the Integrated Earth Observation System. Please describe the status of this subcommittee, its proposed membership, and tasks to which it will be assigned, and its funding. If there are any documents establishing such a subcommittee, please attach them.**

Answer: To address your opening statement, I'd like to note the interagency process to integrate earth observations in the United States is taking place under the auspices of White House leadership, and we have had strong support from the Executive Office of the President dating back to the first Earth Observation Summit in July 2003.

The U.S. Group on Earth Observations (USGEO) was established in March 2005 as a standing subcommittee of the National Science and Technology Council's Committee on Environment and Natural Resources (CENR). The USGEO replaces the Interagency Working Group on Earth Observations (IWGEO), which dissolved following completion of the Strategic Plan for the U.S. Integrated Earth Observation System. Membership of the new subcommittee is the same as IWGEO, though we are currently examining what other agencies may need to be at the table. The subcommittee itself does not make funding decisions, but one of the goals of this group is to examine methods to more efficiently and effectively leverage research and development investments across agencies.

The charter for the new subcommittee is still undergoing clearance within the CENR. A final copy of the Strategic Plan for the U.S. Integrated Earth Observation System can be found at http://iwgeo.ssc.nasa.gov/. Please see the chapter titled *Next Steps in Implementation*, which outlines some of the early tasks and functions of the subcommittee. In short, the subcommittee will carry on the work begun by the IWGEO in continuing development of the integration plan for the U.S. system, as well as providing input into international GEOSS development.

2. **This Subcommittee would then work with external stakeholders, establish a process to prioritize observation system investments across agencies and assess current and potential societal benefits. Other witnesses at the hearing stated that it is critical to involve the user community in establishing priorities for use and implementation of an earth observation system. The Alliance for Earth Observations, which is a self-selected, voluntary organization largely funded by commercial interests, appears to be operating in this role as a de facto advisory committee to government agencies. Its discussions, however, are not open to the public or subject to review under the Federal Advisory Committee Act. If a permanent subcommittee is established, does the Administration intend to establish a more diverse advisory committee to represent a broader user community and to be subject to public scrutiny?**

Answer: As noted in the Strategic Plan, we are working to involve industry, academia, and state, local, regional and tribal governments in our planning process, consistent with the Federal Advisory Committee Act. In developing an integrated system that is truly comprehensive, it is important to engage private-sector partners in both retrospective and prospective assessments of our planning and implementation processes.

The USGEO is an interagency body, and operates as an ad hoc advisory committee. The USGEO is currently exploring different ideas for including non-federal participation in our planning and implementation processes. It is also assumed that each member agency brings to the table the ideas and interests of its own unique stakeholder communities, which largely accounts for the broad scope of the Strategic Plan goals.

The public meeting forum is one method of obtaining comment and ideas for planning, which has proven successful thus far. We have held three public workshops to discuss Earth observations, the most recent being on May 9-10, 2005, at the Reagan Center Building and International Trade Center. Nearly 400 people attended this most recent meeting, where the societal benefit areas of the Strategic Plan were discussed, and near-term opportunities were explored. This type of venue allows stakeholder communities to provide ideas on current, as well as proposed, Earth observation activities.

3. **The second goal under the strategy plan is to develop a common system architecture, which is described as a "necessary key enabler" for the U.S. system. The first step would be to establish a multi-year process to develop and sustain the Federal Enterprise Architecture Framework for the U.S. observation system and complete an inventory of the existing systems. What is the status of both of these tasks?**

Answer: The final Strategic Plan has been released and progress has recently begun on these tasks (see http://iwgeo.ssc.nasa.gov/ for link to the report). With stakeholder input from the May 9-10 workshop, the USGEO will continue to develop the Framework for six near-term opportunity areas, including data management, and will complete the inventory of existing systems.

4. **How much would it cost to develop a common system architecture for the U.S. system?**

Answer: The cost has not been determined, and will depend upon the architecture chosen. This decision will be based upon recommendations provided by the U.S. Group on Earth Observations (USGEO).

5. **In the appendix to the strategy plan, there is a discussion of "near-term opportunities." The first is for a "comprehensive and integrated data management and communications to integrate the wide range of earth observations across agencies and disciplines." It states that data management is a "necessary first step to achieve the synergistic benefits" from the U.S. system, and that data and products must be made readily available and accessible through data management systems. What is the status of this effort?**

Answer: For all near-term opportunities identified in the Strategic Plan, the first step is the development of a framework integration plan for Integrated Earth Observation System Data and Information Management. This framework integration plan is currently under development; stakeholders participated in a planning session on this subject during the May 10, 2005 meeting in Washington D.C. Additional near-term opportunities were also discussed with stakeholders at the May 10 meeting, and comments from workshop participants will be taken into consideration in development of the final framework integration plan. Currently the plan outlines a number of steps including: (1) inventory of existing data management systems, (2) developing a process where contributors can agree on standards to support the functional requirements, the system's architecture, the degree of the interoperability of the system, and a governance to drive the integrated data management system, and (3) establishing a prototype or pilot for various components of the system. The plan recommends that each participating agency select manageable pieces that have been identified and can currently be performed to begin piloting or prototyping approaches that can lead to full integrated solutions in subsequent years.

6. **The second near-term opportunity is to improve observations for disaster warnings for events such as earthquakes, volcanoes, tsunamis, and landslides. The plan states that "systematic, widespread coverage" of observations is needed, but is unmet. Meeting this coverage requires "maintaining and modernizing existing in situ atmospheric, ground-based, and ocean observing systems." There are plans already in place for such work. Please list what systems need to be maintained and modernized, describe the status of and budget allocations for that work.**

Answer: Improving observations for disaster warning was also discussed at the May 10, 2005, public workshop. The USGEO has established a **USGEO/SDR** Task Group on National

Tsunami Warning and Response Planning in response to the December 2004 Indian Ocean tsunami, and the USGEO is developing a U.S. plan for improved disaster observations and all hazard warnings. The near-term opportunity to improve observations for disaster warnings for such events as earthquakes, volcanoes, tsunamis and landslides is directly linked to the Administration's 2-year commitment to strengthen the U.S. Tsunami Warning Program. Specifically, under this effort the Administration will:

- Make significant improvements to the Global Seismographic Network (GSN) by adding new real-time reporting seismographs to yield more accurately/timely determinations of earthquake's epicenter and magnitude. The U.S. Geological Survey (USGS) is the lead for this effort.

- Expand its limited (Pacific Basin only) 6-station, Deep Ocean Assessment and Reporting of Tsunami (DART) buoys to that of a 39-station DART buoy array with 32 DARTs deployed in the Pacific and 7 DARTs deployed in the Caribbean Sea/Atlantic Ocean. The National Oceanic and Atmospheric Administration (NOAA) is the lead for this effort. NOAA received $17.2 million for this effort in the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005.

- Expand the National Water Level Observation Network (NWLON) by adding 12 new NWLON (real-time reporting) stations and upgrading 33 existing NWLON sites to real-time (one-minute sampling) tsunami reporting. NOAA is the lead for this effort.

In addition, the U.S. Agency for International Development (USAID) has designated a portion of the tsunami relief funds in the Emergency Supplemental Appropriations Act for the development of an All-Hazards Warning System for the Indian Ocean, including early detection and warning for tsunami. NOAA expects to support the deployment of seismic, water-level and tsunami detection (DART-technology) systems as part of this effort.

7. We do not have an operational radar satellite system, such as Japan and Canada are getting ready to launch. The strategy plan states that such a system could "truly help in a real-time manner, reduce hazards, help mitigate disasters and realize goals of saving lives and reducing damage." In your testimony, you stated that in the past Canada has shared radar information with the U.S., and that you did not believe that two such radar systems were necessary. What steps is your agency or the Administration taking to assure that the U.S. will continue to have access to this data?

Answer: As formal partners in Canada's RADARSAT-1 mission, NOAA and the National Aeronautics and Space Administration (NASA) have benefited from access to Canadian synthetic aperture radar (SAR) data for U.S. Government research and operational purposes. NOAA is in discussion with Canada and other U.S. Government agencies with regard to access to radar data from follow-on Canadian missions. Likewise, NOAA expects to be able to arrange access to Japanese rain radar and cloud radar missions that are under development.

NOAA is also in discussions with the European Space Agency (ESA) access to its ENVISAT-ASAR. With a focus in GEOSS on sharing of environmental data and on international cooperation to address data gaps and overlaps, NOAA will seek to leverage access to foreign SAR data.

8. Another area of concern is our global land observing system, which is used to support land management decisions. The Landsat satellite is reaching the end of its life. What is the status of a replacement system?

Answer: As background, there are two dedicated Landsat satellites in orbit, operated by the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA). Landsat 5 has been in orbit over 20 years, providing real-time data only. Landsat 7 has been in orbit over 6 years and has experienced 1 of 3 gyros fail (2 are needed for operations). The Landsat 7 sensor had a scanline corrector failure in May 2003. Failure of the scanline corrector caused degradation of the data, however, USGS developed software to fill gaps and make the images useable.

The Executive Office of the President (the Office of Management and Budget (OMB), the Office of Science and Technology Policy (OSTP), and the National Security Council (NSC)) formed an interagency working group to define options for Landsat data continuity in December 2003. After 9 months and a multi-agency study, Dr. John Marburger III, Director of OSTP, signed a memorandum on August 13, 2004, stating "the Departments of Defense, Interior, and Commerce and the National Aeronautics and Space Administration have agreed to transition Landsat measurements to an operational environment through the incorporation of Landsat sensors on the NPOESS platform."

The fiscal year 2006 budget language directs Landsat observations to be made by a new imager, called the Operational Land Imager (OLI), on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Satellites. NASA will manage development and production of two OLI instruments and provide a science team. USGS will be responsible for command planning, data processing, archive and distribution. NOAA will be responsible for integration of the OLI sensors on the mid-morning NPOESS operational satellites (called C1 & C4), commanding, and data recovery from the NPOESS SafetyNet™ sites.

Landsat users were still concerned about the potential gap between the current Landsat satellites and the first sensor on NPOESS. The OSTP memorandum called for continuing the review to establish the level of requirements and alternatives to mitigate this gap. Because no single satellite or company can meet the need, plans are being developed to buy both U.S. and foreign imagery, merge the data sets, and produce the minimum essential data until the NPOESS satellite is launched.

As for current status, NASA is completing preparations to release a request for proposal (RFP) to industry for development of the Operational Land Imager. The NPOESS program office has given direction and funding to the NPOESS contractor to support NASA's development, interface control document development, integration planning, and other aspects. The USGS has sent an employee to work with the NPOESS team to ensure coordination with NOAA efforts.

Four agencies (NOAA, NASA, USGS, and the Department of Defense) have a memorandum of agreement in coordination. The fiscal year 2006 budget request includes funding to accomplish agency responsibilities.

9. **The U.S. also does not have an operational sea level observing system or an integrated drought information system. We are facing the most severe drought in 70 years in the western United States. The Western Governors' Association has developed standards for a national integrated drought information system. What is the status of such a system?**

Answer: The U.S. ***does*** have an operational sea level observing system, though it is not a comprehensive system. Components of the system include continuous, long-term data collection; data management and quality control; and production of routine sea level products as part of a broad suite of products for a broad user community. (See for instance: http://tidesandcurrents.noaa.gov.) NOAA is the major contributor to the U.S. sea level observing system, which consists of key in situ components of the National Water Level Observation Network (NWLON) and the University of Hawaii Sea Level Center (UHSLC). The NWLON consists of approximately 175 stations located in U.S. waters, including the Great Lakes and U.S. Territories. Many of the stations have been operating over a century, providing continuous sea-level data. The NWLON generated operational products including relative mean sea-level trends and monthly mean sea-level anomalies. The UHSLC operates a NOAA-funded research-oriented network of approximately 37 tide stations around the globe (generally outside of U.S. waters), in partnership with host countries. Subsets of both the NWLON and UHSLC networks contribute to the international Global Sea Level Observing System (GLOSS). Information from both the NWLON and UHSLC systems are used to calibrate and evaluate ongoing satellite altimetry missions that are beginning to contribute to the understanding of global sea level change. By analyzing NWLON data sets and satellite altimetry and developing inundation maps, NOAA is constructing a strategy for the application of regional sea level trends to understanding the impacts of sea level rise.

NOAA is currently working on development of a National Integrated Drought Information System (NIDIS), in cooperation with the Western Governors' Association (WGA), to improve and expand the compilation of reliable data on the various indicators of droughts. Physical and hydrological data (such as a national surface observing network) and socio-economic and environmental impacts data (such as agriculture losses and wildfire impacts) are used. The NIDIS will integrate and interpret these data, providing timely and useful information to decision-makers and the general public. NOAA's fiscal year 2006 Budget Request includes $8.3 million in support of the Western Governors' Association call for a National Integrated Drought Information System (NIDIS).

The *Strategic Plan for the U.S. Integrated Earth Observation* System has identified the Sea Level Observing System and the National Integrated Drought Information System as Near Term Opportunities for collaboration at the interagency level. The envisioned Sea Level Observation system will allow us to determine the rate of change in global sea level, understand the interaction of factors that cause sea level rise, and predict future state of sea level and its impact on coastal areas. The National Integrated Drought Information System will encompass a comprehensive, user-friendly, web accessible system to serve the needs of policy and decision makers at all levels – local, state, regional, and national – concerned with U.S. drought preparedness, mitigation, and relief/recovery.

10. In his written testimony, Dr. Hooke stated that international agreements for the sharing of meteorological data, which have been in effect for decades, are beginning to "fray" apparently because some countries are attempting to sell or otherwise restrict access to their meteorological data. Meteorological data is essential to an earth observation system. Please describe the situation with these international agreements, and what steps your agency is taking to make sure they remain in place.

Answer: With the pledge of nations at the July 31, 2003, Earth Observation Summit, and in the follow-on Group on Earth Observations (GEO), to share data "in a full and open manner with minimum time delay and minimum cost, recognizing relevant international instruments and national policies and legislation," there is recent evidence to indicate a reversal of trends of the previous decade among European nations, in particular, to sell or otherwise restrict access to their data. Senior French and United Kingdom authorities have commented that their governments are mindful of the pressure for new data practices that would treat data as a public good (WMO Resolution 40, GEOSS). EUMETSAT, the European counterpart to NOAA, recently announced a data policy for its upcoming Polar System (EPS) "essential" category of satellite data and products that will be made available to all users worldwide freely, without any restriction and without requirement of a license. Some countries, notably India, continue to restrict data for national security reasons. NOAA seeks to obtain foreign data on a reciprocal basis, in accordance with its policy of providing U.S. data on a full and open basis, either free of charge or at the cost of filling a user request.

QUESTIONS SUBMITTED BY THE HONORABLE MARSHA BLACKBURN

1. Admiral, from what I understand, is that GEOSS will mostly be environmental data collected and generated by each nation. Will there be a "central" location such as the UN that all data from the 60 nations will be stored? Will GEOSS be linked to a "central" computer architecture where data be used in forecast models? If so, what standards will be used to determine which forecast models will be used? Will each nation be responsible for storing its own data?

Response: GEOSS will build upon the infrastructure of systems that are already in place. As such, there will not be a "central" location that would store all the data. Each nation will maintain the responsibility for its own observing systems and data. In place of a central repository, contributing nations would share observations and products through interoperability standards, interfaces, protocols, and agreements. Consideration of a World Data Center for GEOSS has not yet been discussed.

As a point of clarification, GEOSS will be more than a place to store environmental data. GEOSS will also enable the development of tools that, for the first time, provide access to data across disciplines and nations, and would result in the following expected outcomes:

- Users will access an unprecedented amount of environmental information.
- Data will be integrated into new data products that would benefit societies and economies worldwide.

2. GEOSS potential success will be largely dependent on widespread global participation. How likely is it that the participating nations will have the financial resources and/or political will to follow through with this program? To what degree should wealthier nations like the U.S. subsidize countries that are less able to implement needed systems?

Answer: One of the primary reasons for the growing participation in GEO is that all nations are invited to participate, regardless of wealth or economic status. The developed countries of the world are participating enthusiastically; the United States, Europe, Asia, and others have already made investments in Earth observation technologies. Unfortunately, our investments are largely isolated and sometimes duplicative. GEOSS provides a venue for us to look at our current investments and figure out ways to leverage them, so that we are collectively more efficient and effective.

Since we focus both our national and international plans on societal benefits, it is important for developing countries to be at the table to identify gaps in global coverage, as well as to prevent or mitigate disasters that cost billions in response dollars. Everyone benefits when we have a better understanding of how the systems of the planet interact.

The international plan has a strong emphasis on capacity building, which will allow information from Earth observations to benefit both the developing and developed worlds.

3. Assuming that nations cooperate and this system comes to fruition, would there be any procedures or regulations proposed to ensure global cooperation and participation should potential harm from events or long-term environmental changes be identified?

Answer: The GEOSS initiative is based on voluntary contributions and efforts, rather than legally binding commitments. The international cooperation engendered and the momentum already experienced should help to ensure ongoing cooperation, particularly in the event of short-term disaster coordination or longer-term environmental changes. GEO countries have agreed to facilitate the development and availability of shared data and products required across diverse societal benefit areas and to encourage the adoption of standards to support broader use of such data and information.

4. **Later this year, I do believe there will be a formal 10-year plan adopted to implement GEOSS. Will this plan include a detailed timeline that addresses specific actions by each of the 60 nations to conform to this plan? What performance and accountability measures be included? Will this plan address how data will be standardized so it can be used by all nations?**

Answer: In the international 10-year GEOSS Implementation Plan, endorsed by participating countries at the Third Earth Observation Summit in February 2005, there are nine chapters on societal benefit, describing targeted activities for the next two, six and 10 year periods. In total there are almost 200 targeted activities.

The international Group on Earth Observations (GEO) met in early May to discuss a work plan on how to accomplish those targets. At that meeting, GEO worked towards establishing its own governance structure that will determine the metrics for tracking accomplishments of these targets. A 12 member Executive Committee was elected, with the United States maintaining its leadership role as one of 4 co-chairs of the effort.

The 10-Year Implementation Plan has a detailed chapter on architecture of the Global Earth Observation System of Systems (GEOSS), which describes a pathway for standards, protocols and formats necessary to effectively share data.

5. **How will security concerns be addressed in the implementation plan?**

Answer: The GEOSS 10-year Implementation Plan will address security concerns through development of procedures and systems architecture that ensures that each nation is able to make decisions to protect its information systems and data without impeding the data sharing necessary for GEOSS to be effective.

The U.S. Strategic Plan for the U.S. Integrated Earth Observation System states the following about information assurance and security: "Services providing access to Earth observations data and products often include significant requirements for assuring various aspects of security and authentication. These range from authentication of user identity for data with restricted access, to notification of copyright restrictions for data not in the public domain, and to mechanisms for assurance that data are uncorrupted. The U.S. Integrated Earth Observation System will promote convergence on common standards for these various aspects."

The implementation plan for the U.S. Integrated Earth Observing System (currently being developed) will ensure that each component system, the data sharing procedures, and the "system-of-systems" that will support the Integrated Earth Observing System will protect U.S. security interests, including information assurance and technology export. The plan will ensure that the U.S. Integrated Earth Observing System will conform to all security-relevant Federal law and policy.

Responses to Questions
Posed by
The Honorable John Dingell

US House of Representatives
Committee on Energy and Commerce
Subcommittee on Oversight and Investigations

Regarding:
"The Implementation of GEOSS: A Review of the All-Hazards Warning System and its Benefits to Public Health, Energy, and the Environment"
Hearing Held on 9 March 2005

Responses generated by:
Nancy Colleton
Executive Director, Alliance for Earth Observations

1. **In the 2005 supplemental appropriations bill, Congress eliminated $10 million of the $24 million allocated to the National Oceanic and Atmospheric Administration, making it very difficult to maintain and modernize the Climate Reference Network (CRN) and the atmospheric monitoring network. Science Magazine described these cuts as jeopardizing GEOSS. Please provide your evaluation of the effect of these cuts, and whether they indicate a lack of legislative commitment to either the national or international Earth observations systems.**

Response:

The CRN and atmospheric monitoring network are considered the world's best source of long-term, reliable data on trace greenhouse gases. Eliminating funding for these sites is truly unfortunate for our nation's effort to monitor long-term changes in greenhouse gases. Clearly, the loss of funding will add much uncertainty to debates about how much or whether climate is changing and for what reasons.

In regard to jeopardizing the Global Earth Observation System of Systems (GEOSS), we often talk about GEOSS as "taking the pulse of planet Earth" or that GEOSS will provide information on Earth's "vital signs." Not having comprehensive and consistent climate and atmospheric information for the planet is like not having daily blood pressure readings for a patient suffering from hypertension. These measurements are part of understanding the Earth's "vital signs." Therefore, CRN and the atmospheric monitoring network data are key to the GEOSS mission. GEOSS and the US IEOS have as a key societal benefit area to "Understand, assess, predict, mitigate, and adapt to climate variability and change."

Both the Group on Earth Observations (GEO) 10-year Implementation Reference Document and the Strategic Plan for the US IEOS call for a better understanding of greenhouse gas accounting and carbon management as a key to meeting this objective. Additionally, each of the other benefit areas have climate-related observation requirements that would be impacted by long-term climate variability. Thus, understanding climate variability is a key element for the overall success of GEOSS. The GEO 10-year Implementation Plan Reference Document explicitly supports the continuation of in-situ atmospheric monitoring networks, in part, because space-based observations have not been optimized for long-term climatic studies (reference 4.4.3).

CRN and the atmospheric monitoring network are just two operations within a myriad of stovepipe programs that would exist in an integrated GEOSS. Although the cuts could be perceived as indicating a lack of U.S. legislative commitment to Earth observations, it is important to note that GEOSS is about integrating systems. In other words, the GEOSS effort will ensure disparate systems are integrated to allow more users access to information and to allow new information products to be produced. Therefore, there is always going to be a system in this "system of systems" that may undergo change. There will be systems that no longer obtain new information and will only be used for historical data. And, there will be new systems that feed into GEOSS. The significant step that GEOSS takes is ensuring that all of these systems can be integrated and communicated in a consistent manner, through common standards and protocols.

2. **An important aspect of the Earth observation projects, both nationally and internationally, is building the common architecture and managing the vast amount of data that will be collected. Who should do this and how much will it cost?**

<u>Response:</u>

The U.S. government should build the common architecture and manage the vast amounts of data. An Integrated Earth Observations Program Office should be established to coordinate efforts across all agencies. It seems appropriate that NOAA should house this function, with support from other U.S. agencies much the way the Climate Change Science Program is facilitated with a cross-agency office.

The US private sector also has a role to play in the development and implementation of GEOSS and should be engaged in its planning.

Not only should the Government build an enterprise architecture framework for the US IEOS, it is required by law (Clinger-Cohen Act of 1996) to do so. What that in mind, recall that an architecture framework is not an end, it is a means to an end. Clearly, within a system-of-systems paradigm, when much of the work will be directed towards evolving legacy assets within an interoperability philosophy based on relevant international standards, the engineering discipline and rigor that an architecture framework brings (especially with respect to technology refresh) will help us define priorities and spend our scarce resources more wisely.

The cost to build and manage the Integrated Earth Observation System (IEOS, the U.S. system, which will contribute to the global system) would be substantially different than the cost to build and manage GEOSS (international).

At the current time, since the architecture and technical priorities have not been established, it is impossible to accurately identify the costs associated with building and maintaining IEOS and GEOSS.

Currently, the common architecture of GEOSS is based on voluntary collaboration and open standards rather than assigning overall management or funding responsibility to any single organization or nation. Right now, thousands of separate data systems are operated by many nations worldwide, distilling information from raw observations and predicting outcomes using models of Earth systems. These systems and their associated infrastructure will continue to be managed and funded under their own mandates. The GEOSS architecture simply allows such individual systems to be more effective and efficient by adopting the agreed principles of interoperability.

For instance, meteorologists work with weather observations and physical models for complex hazards like hurricanes. But to understand the impact of severe weather on people, they also need mapping data that locates population centers and transportation networks. Yet, meteorologists themselves need not manage or fund the production of such data; they only need to interoperate with socioeconomic data systems maintained by others. In the same way, decision support for managing ecosystems needs interoperability with weather and climate systems, as well as with mapping data systems.

The potential interconnections among data systems are almost endless, as are the complex interactions among natural systems. Clearly, no "master data system" could ever encompass all of the interacting parts and do justice to the myriad science and technology aspects. The beauty of interoperability is that each system can be as different as it needs to be to serve its primary users. Separate systems can each evolve at their own pace, and problems in any one system have minimal impacts elsewhere. Yet, the contributions of each such system can be readily integrated so that the synergy among systems is realized. Interoperability also drives down costs, not only by avoiding redundant observing systems, but also by allowing for shared reuse of data and components across interoperable systems.

GEOSS is designed to be a system of systems that supports comprehensive, coordinated, and sustained Earth observation. Its essential building blocks encompass Earth observation systems operated separately within their own mandates but also supporting interoperability. Almost all of the management and funding of systems participating in GEOSS will remain decentralized to organizations across all levels of government. The many billions of dollars they continue to spend will be leveraged by a relatively small investment in supporting the process of adopting appropriate standards. By adhering to the selected international standards given in the GEOSS architecture, the rich and vast diversity of Earth observation data worldwide will become more readily accessible, comparable, and understandable; thus, improving the value that we all receive.

3. **What is the U.S. National Spatial Data Infrastructure that some federal agencies are developing, and how does it fit into the larger system?**

Response:

NSDI encompasses tools, processes and standards, and organizational partnerships that facilitate the sharing and building of distributed, accurate geographic information throughout the nation; NSDI envisions a sharing community that includes federal, state, county, and rural and urban local governments, both urban and rural.

NSDI provides a set of products and services that are being developed in a manner that is consistent with a service-component architecture. The Open Geospatial Consortium (OGC) and others are making a significant contribution in this area.

The FGDC http://www.fgdc.gov/ , Geospatial One-Stop (http://www.geo-one-stop.gov/) and The National Map (http://nationalmap.gov/) are three federal programs with responsibility for helping to develop different aspects of NSDI. FGDC is responsible for standards, policies, and training. The Geospatial One-Stop is an e-government initiative, a portal on the Internet that allows users to register, search for, and access geographic information. The National Map provides trusted content for base mapping information following the guidelines of the United States Geological Survey topographic mapping program.

The central U.S. contribution to GEOSS is the Integrated Earth Observation System (IEOS). The Strategic Plan for IEOS (see http://iwgeo.ssc.nasa.gov) asserts:

> Currently, most of the data and information related to Earth observations are encompassed within the U.S. National Spatial Data Infrastructure, and integration of Earth observations will be implemented within that legal, policy, and institutional framework.

Federal policy in this area includes OMB Circular A-16 (revised, August 19, 2002). Circular A-16 "provides direction for federal agencies that produce, maintain or use spatial data either directly or indirectly in the fulfillment of their mission. Circular A-16 establishes a coordinated approach to electronically develop the National Spatial Data Infrastructure (NSDI) and establishes the Federal Geographic Data Committee (FGDC)." Among other requirements, Circular A-16 directs such agencies, "both internally and through their activities involving partners, grants, and contracts" to:

> (1) Prepare, maintain, publish, and implement a strategy for advancing geographic information and related spatial data activities appropriate to their mission, in support of the NSDI Strategy. [...]
>
> (2) Collect, maintain, disseminate, and preserve spatial information such that the resulting data, information, or products can be readily shared with other federal agencies and non-federal users, and promote data integration between all sources. [...]
>
> (4) Use FGDC data standards, FGDC Content Standards for Digital Geospatial Metadata, and other appropriate standards, documenting spatial data with the relevant metadata, and making metadata available online through a registered NSDI-compatible Clearinghouse node. [...]
>
> Before the obligation of funds, ensure that all expenditures for spatial data and related systems activities financed directly or indirectly, in whole or in part, by federal funds are compliant with the standards and provisions of the FGDC. All Information Technology systems which process spatial data should identify planned investments for spatial data and compliance with FGDC standards within the Exhibit 300 capital asset and business plan submission (see OMB Circular A-11, sec. 300).

The E-Government Act of 2002 established in law the authorities and responsibilities of the FGDC under Section 216, "Common Protocols for Geographic Information Systems." The law requires:

> The development of common protocols for the development, acquisition, maintenance, distribution, and application of geographic information [...]
>
> The common protocols shall be designed to (1) maximize the degree to which unclassified geographic information from various sources can be made electronically compatible and accessible; and (2) promote the development of interoperable geographic information systems technologies.

(This law defines "geographic information" as "information systems that involve locational data, such as maps or other geospatial information resources.")

Both the U.S. National Spatial Data Infrastructure and the Integrated Earth Observation System are aligned with the U.S. Federal Enterprise Architecture. The purpose of the Federal Enterprise Architecture is to identify opportunities to simplify processes and unify work across federal agencies. The FEA provides a common framework for describing different agencies' data and information systems, with an objective to facilitate interoperability among those systems.

4. **You have recommended that federal agencies need to go further in leveraging their investment, realizing synergy across systems, collaborate early in design of new systems, and get deeper agreements on data standards so they can integrate data more easily. Do you see any of this happening yet? If you do, please provide some examples.**

Response:

We see a number of important examples in place for achieving the objectives stated in the plan for building from existing systems and improving metadata access, both for preoperational and operational; and for enabling the science community as well as the "e-citizen." The Geospatial One-Stop (GOS) (www.geodata.gov) European Geo-Portal (Inspire) (http://eu-geoportal.jrc.it/) and NSDI for India (http://gisserver.nic.in/nsdiportal/gotogos.jsp) are three examples of operational web portals that provide free access to geospatial data. All three portals are built to International Standards Organization (ISO) and W3C standards, which are recognized as integral to the data management aspects of IEOS/GEOSS. We strongly recommend using these portals when considering the near term opportunities that highlight the urgent needs for data management that offer web services to the citizenry.

Most U.S. civil agencies and state agencies are similarly attempting to integrate multiple systems for more effective information utilization. The U.S. must do more work in this area to realize and create greater synergy across various GEOSS domains.

Under OMB Circular A-16, most U.S. federal agencies actively participate in the U.S. NSDI and others not yet fully active are expected to respond to recent encouragements by oversight agencies such as OMB and GAO. Much remains to be done, but the NSDI is clearly a success story for leveraging investments, realizing synergy, collaborating in design of new systems, and getting deeper agreements on data standards.

However, opportunities for synergy extend beyond the purview of Circular A-16 to include information sharing within classified systems and to include many other systems that are not specifically geographic. The new information sharing program in the intelligence community is a case in point for realizing synergies within classified systems.

Outside the realm of geographic information, there is tremendous potential for synergy across federal information systems. For example, there are hundreds of thousands of federal agency Web servers and many thousands of other sources of government information, such as the libraries participating in the Federal Depository Library Program. Virtually all of these resources provide facilities for information search, using any of a few dozen search technologies. Yet, few of the maintaining agencies have made these search facilities interoperable as required under federal law (44 USC 3511) and policy (OMB Memorandum 98-5).

A recommendation on standards for interoperable search was required by the E-Government Act of 2002. That recommendation re-asserts existing policy that agencies adopt the same search interoperability standard adopted already by the NSDI, GEOSS and IEOS, the international standard ISO 23950. This is the same standard already in use for searching by virtually all of the world's online library catalogs and most of the major online information services.

5. **We all remember that in the December tsunami, hundreds of thousands of people died because they were not educated about tsunamis and received no warning messages. Our tsunami center said it had no one in other governments with whom to communicate. You described the "Challenge of Public Warning" in our testimony. Could you explain how this would work and its stage of implementation?**

Response:

The "Challenge of Public Warning" has been stated by the Internet Society as this:

> Collaborative actions are necessary to assure that standards-based, all-media, all-hazards public warning becomes an essential infrastructure component available to all societies worldwide. (http://www.isoc.org/challenge)

In light of the disaster from the tsunami of 2004, providers of information and communications technologies are challenged to find ways to improve public warning so that people can act to reduce the damage and loss of life caused by natural or man-made hazard events. A key point of agreement is that warning systems should be able to alert the public about all major hazards and should communicate warning messages via all available notification technologies. This point has been emphasized by the United States and many other governments, intergovernmental organizations, and nongovernmental organizations.

The "Challenge of Public Warning" has been endorsed by key United Nations agencies such as the International Telecommunications Union and the UN International Strategy for Disaster Reduction. Major providers of emergency management software and infrastructure providers such as MCI, as well as the AMBER Alert Consortium, the Cellular Emergency Alert Service Association, the ComCARE Alliance, and the National

Association of State Chief Information Officers (CIOs) have endorsed the "Challenge". The Alliance for Earth Observations also endorses the "Challenge for Public Warning."

When public warning is necessary, emergency managers need to get timely and appropriate alerts to everyone who needs them, and to only those who need them. Authoritative alert messages should transmit on all available communications media as appropriate, including broadcast or individual targeting. Alerts should be converted automatically and securely into forms suitable for each technology: Internet messages, news feeds, text captions on television, messages on highway signs, voice on radio and telephones, signals for sirens, etc. An example of such all-media alerting can be seen in implementations of Amber Alert systems focused on child abduction. (An amendment to the 9/11 intelligence reform bill mandates a pilot study to improve distribution of warnings and cites Amber Alert as a possible model.)

The content of alert messages is being standardized across all hazard types, including severe weather, fires, earthquakes, and tsunami. In 2004, the Common Alerting Protocol (CAP) was agreed as an international standard for all-hazard alert messages. All-media distribution of CAP messages is being implemented on ever-larger scales, types of alerts, and throughout ranges of technologies. Operational systems have shown that a single authoritative and secure alert message can quickly launch Internet messages, news feeds, television text captions, highway sign messages, and synthesized voice over automated telephone calls or radio broadcasts.

Several aspects are notable as to the current state of implementation for this vision. Demonstrations of the key technologies and standards have been held in many venues, including Congress itself. The Amber Alert Web portal system deployed in several states is being upgraded to support CAP. On an experimental basis, the U.S. National Weather Service provides about 80 kinds of weather-related messages in the CAP standard format (http://www.weather.gov/alerts). Demonstrations of applying CAP in the context of chemical, biological, nuclear, and radiological threats are underway. By the end of September, the U.S. Geological Survey will provide CAP messages for earthquakes, landslides, volcanoes, and geomagnetic storms. There are also discussions of exhibiting such standards-based, all-media, all-hazards warning technology at the next World Summit on the Information Society.

In many nations, common carriers such as radio, television, and telephone networks have implemented particular public alert technologies for hazards or threats such as weather events or civil defense. From the societal perspective of public warning investments, it makes no sense to continue building a separate public warning system for each particular threat. Efficient use of funds as well as effectiveness of public warning both argue for using standards and combining the public warning requirement for all-media coverage with the requirement for an all-hazards approach.

A standards-based, all-media, all-hazards public warning strategy not only makes sense for governments who need to alert the public, it makes sense for a wide range of information technology providers and communications carriers as well. As providers of information and communications migrate to digital technologies, services are being offered that integrate radio and television with cellular and satellite telephone and with a variety of Internet-based and other network services. A service that supports all-hazard alerts and warnings is no longer a matter of designing specialized communications technology, it is a matter of simply agreeing on common standards for the content and handling of such alerts, tailored to the needs of the recipients.

It is important to note that effective public warning involves many distinct aspects not addressed here, including public education, training, building codes, policy, science, and research, among many others. Where alerting involves existing operational systems, any implementation of new technology will begin in parallel with current operations to assure there is no disruption of service or source of confusion. Technologies supporting public warning must take into account that false alarms can be disruptive, expensive, and can degrade public confidence.

Another important point is that socioeconomic observations in the response and recovery effort are extremely valuable. Knowing population densities in the affected coastal areas, together with information on residents' livelihoods and access to roads (civil infrastructure), was an asset in the tsunami response and recovery. These observations can be obtained from the integration of various types of observing systems (such as national censuses), which need to be a part of GEOSS if the system of systems is to realize the social benefits it seeks to provide. The observing systems concerned with socioeconomic and civil infrastructure data have must receive greater emphasis in IEOS/GEOSS planning.

Responses to Questions
Posed by
The Honorable John Dingell

US House of Representatives
Committee on Energy and Commerce
Subcommittee on Oversight and Investigations

Regarding:
"The Implementation of GEOSS: A Review of the All-Hazards Warning System and its Benefits to Public Health, Energy, and the Environment"
Hearing Held on 9 March 2005

Responses Generated by:
Carroll A. Hood
Raytheon
On behalf of the Alliance for Earth Observations

Question 1:

You gave the Subcommittee a detailed description of inter-operability issues. Who should be responsible for resolving those issues on a national level? How much will it cost?

Response:

During the first Earth Observation Summit in July 2003, the intergovernmental *ad hoc* Group on Earth Observations (GEO) was formed to develop a 10-year plan for implementing an integrated Earth Observation System, later named the Global Earth Observation System of Systems (GEOSS). Subsequently, the Interagency Working Group on Earth Observations (IWGEO) was formed to develop a strategic plan for implementing the Integrated Earth Observation System (IEOS), the primary US contribution to GEOSS. In March 2005, the United States Group on Earth Observations (US GEO) was established as a standing subcommittee of the National Science and Technology Council (NSTC) Committee on Environment and Natural Resources (CENR) to replace the *ad hoc* IWGEO. As a result the US GEO is clearly the body that will approve interoperability requirements/guidelines for the US IEOS.

It is anticipated that this interoperability framework will be based upon relevant international standards and will be consistent with the high-level principles articulated in the *GEOSS 10-Year Implementation Plan Reference Document*. However, having the US GEO serve as the vanguard of an overall strategic approach to interoperability is not enough. Like most things, the devil is in the details. The difference between talking about interoperability standards and actually applying them in a real world situation can be non-trivial. The US GEO needs to be backed-up with appropriate technical expertise and coordination. The various Federal Agencies have the expertise; the best way to effectively coordinate these assets is the key question.

In my testimony, I recommended the instantiation of a US IEOS Program Office (PO) as a focus for IEOS design and implementation. This is analogous to the creation of the Climate Change Science Program Office (CCSPO) for the Climate Change Science Program. The proposed US IEOS PO would work under the guidance of the US GEO, but would have the ability, authority and resources to provide the day-to-day oversight and assistance to US Federal Agencies, State and local entities as well as private sector (academia and industry) organizations that desire to contribute products or services into this system of system architecture. A US IEOS PO, once created, would be the logical place for the resolution/adjudication of technical and programmatic issues related to interoperability for IEOS/GEOSS at the national level.

The cost of resolving these issues is difficult to project. Clearly, we will need to move forward on high-priority, high-leverage issue areas such as those defined in Appendix 2 of the *Strategic Plan for the US Integrated Earth Observation System*. As we build expertise and experience in solving key interoperability issues, technology transfer, reuse, and lessons learned will help drive down the marginal cost of applying these approaches to different domains or problem spaces. We will be able to address the cost issue more precisely as soon as we complete an assessment of where we are (our as-is architecture) and match it against our vision (our to-be architecture) and priorities (which transition elements proceed first?)

Question 2:

Do you think data generators today are planning properly to achieve inter-operability with their new systems?

Response:

There are two issues here. The first relates not so much with NEW systems as the need to evolve the capability of LEGACY systems and assets into the desired interoperability framework. Although some effort is being made in this area (e.g., the Data Management and Communications Subsystem of the Integrated Ocean Observing System), there does not appear to be any coordinated, prioritized approach for completing this task across all relevant domains. Establishing an enterprise architecture framework for the US IEOS and determining clear and unambiguous priority problem areas will help determine which legacy assets need to evolve in this direction.

The second issue relates to NEW system development. We have the opportunity to build-in GEOSS-compatible interoperability as part of the design of any new environmental collection, archive or processing system. In order to achieve this goal, however, there needs to be a requirement in the Statement of Work (SOW) that captures that intent. In addition, including GEOSS-compatibility within mission suitability evaluation criteria will ensure that potential implementers take the requirement seriously. Building in interoperability constructs after-the-fact is typically a more expensive proposition than designing it in at the onset. A recent RFP for a large environmental data collection system (let after the release of the *Strategic Plan for the US IEOS*) did not mention GEOSS-level interoperability. This represents an opportunity lost.

So the specific answer to the question is no, data generators have not yet optimized their planning efforts to achieve interoperability within their systems. However, there are some simple steps, outlined above, that would improve the overall situation.

April 13, 2005

The Honorable Ed Whitfield
Chairman
Subcommittee on Oversight and Investigations
U.S. House of Representatives
Committee on Energy and Commerce
Washington, DC 20515-6115

Dear Mr. Whitfield:

I continue to be grateful for the opportunity to appear before the Subcommittee on Oversight and Investigations at the hearing entitled "The Implementation of GEOSS: A Review of the All-Hazards Warning System and its Benefits to Public Health, Energy, and the Environment." On March 9, 2005.

Enclosed are my answers to the questions submitted by the Honorable John Dingell. The responses have been e-mailed as well to the Legislative Clerk (Michael.Abraham@mail.house.gov) in Word format.

With every good wish,

William H. Hooke
Director,
AMS Policy Program

Cc: The Honorable John Dingell
The Honorable Bart Stupak

Attachments

Responses to the questions raised by the Honorable John D. Dingell.

1. **In your written testimony, you referred to the "fraying" of international agreements that have provided for the sharing of meteorological data for decades because of the increasing value of such information and difference in views of various countries on public and private roles. Please give an example of such "fraying." Since meteorological data is critical to all earth observations systems and benefits, what steps are being taken to strengthen these agreements through the World Meteorological Organization or elsewhere? In your opinion, are these steps sufficient?**

1. In the early 1990's, some meteorological services, mainly those in Europe, started to engage actively in commercial activities in an attempt to recover a significant part of their operating costs. In order to recover costs, the European Services were competing with private sector providers of similar services. These meteorological services believed that providing meteorological and related data and products at minimal cost to competitors, either from other national services or from the private meteorological sector, would limit their capabilities to recover costs. Therefore, some of them began to limit the data that they would exchange. In an attempt to allow all meteorological services to continue to have access to those data and products essential for the protection of life and property, while not giving undue advantage to competitors, some countries suggested that the international exchange of meteorological data and products under the auspices of WMO should have restrictions introduced relating to their commercial use. Several developing countries' services, mostly in South America and west Africa, agreed with the concept of imposing restrictions because of their concern that foreign providers of meteorological services were damaging the credibility of their organizations.

This situation seriously threatened the long standing World Meteorological Organization (WMO) endorsed practice of free and unrestricted exchange of global data, collected by every country in the world. These data are used for global analyses and forecasts, which have economic value to nations, such as transportation (air/sea/land), agriculture, energy, and safety of life and property.

In 1995, at a WMO Congress, the U.S. delegation sought an international agreement to deal with this problem based on four principles, namely (1) it should codify, for the first time, the principle of free and unrestricted international exchange of meteorological and related data and products; (2) it should NOT adopt a restrictive international data exchange practice; (3) it should place responsibility for settling conflicts over commercial activities on the country originating the data using available mechanisms; and (4) guidelines should be adopted for relations among National Meteorological Services and between National Meteorological Services and the private sector that would lead to amicable settlement of problems involving commercial activities. As a result of substantial and lengthy discussions, the four elements of the U.S. position were incorporated in the resolution that was finally approved.

These steps have codified the basic principle of freely sharing a minimum set of essential data and products "required to accurately describe and forecast weather and climate" and "free and unrestricted access to all data and products exchanged under WMO auspices for the research and education communities for their non-commercial use." Other meteorological data can be exchanged under the condition that they cannot be re-exported outside the receiving country for commercial purposes.

Thus, a conflict over the sharing of meteorological data in a competitive environment has been resolved by a compromise agreement, but the long-standing tradition of totally unrestricted sharing of those data has been weakened.

2. **In the 2005 supplemental appropriations bill, Congress eliminated $10 million of the $24 million allocated to the National Oceanic and Atmospheric Administration, making it very difficult to maintain and modernize the Climate Reference Network (CRN) and the atmospheric monitoring network. Science Magazine described these cuts as jeopardizing GEOSS. Please provide your evaluation of these cuts, and whether they indicate a lack of legislative commitment to either the national or international earth observation systems (IEOS).**

2. The Climate Reference Network (CRN) and the atmospheric monitoring network are essential components of the current U.S. meteorological observing system. As such, they are significant portions of the backbone of a future Integrated Earth Observation System (IEOS) which, in turn, is the U.S. portion of the Global Earth Observation System of Systems (GEOSS). Therefore, if these vital networks are not adequately maintained, expanded and/or improved through technological enhancements, there will be a significant impairment in the U.S. capability to observe the atmosphere, as well as, to predict and monitor important atmospheric phenomena. In turn, IEOS and GEOSS will be negatively impacted if the U.S. has a diminished observational capacity. It is my understanding that, in 2005, NOAA is trying to apply available resources to minimize the impact of the budget shortfall, but only NOAA can evaluate the effect of those cuts after they have minimized the impact.

Currently the U.S. investment in monitoring the weather and climate is about 0.1 percent of gross domestic product. At the same time, weather and climate sensitive sectors of the U.S. economy (agriculture, energy, transportation, commerce, etc.) constitute a third of our economy. An increase in federal funding for this monitoring effort is clearly a wise investment and, therefore, should be a relatively high priority legislative commitment.

3. **In a study issued last year by the American Meteorological Society, AMS stated that "GEOSS can only succeed if the U.S. effectively implements IEOS."**

Describe what concrete steps have been taken to implement IEOS effectively. Is there currently a sufficient funding commitment to effectively implement IEOS?

3. The AMS study of the IEOS/GEOSS implementation issues did include the finding that "GEOSS can only succeed if the U.S. effectively implements IEOS." The initial steps that the Interagency Working Group on Earth Observations (IWGEO) have included the drafting of a Strategic Plan for IEOS and participating in the drafting and reviewing of the GEOSS 10-year Implementation Plan. These steps are vital to successfully implement IEOS. Of course, there is still much to be done including a careful analysis of the funding requirements for IEOS. It is also an absolute necessity, as our study points out, that representatives of the full range of IEOS/GEOSS stakeholders must be involved in the planning for implementation. These steps should be completed before the necessary funding commitments can be fully assessed.