

**WASHINGTON ROUNDTABLE  
ON SCIENCE & PUBLIC POLICY**

**The Global Earth  
Observation System**

By Vice Admiral Conrad Lautenbacher, Jr.

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Washington, D.C.

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# *The Global Earth Observation System*

by

Vice Admiral Conrad Lautenbacher, Jr.

The George Marshall Institute  
Washington, D.C.

**Retired Navy Vice Admiral Conrad C. Lautenbacher**, Ph.D., currently serves as the Under Secretary of Commerce for Oceans and Atmosphere and directs the day-to-day operations of the National Oceanic and Atmospheric Administration (NOAA). He directed an internal review and reorganization of the NOAA corporate structure to meet the environmental challenges of the 21st century. He spearheaded the first-ever Earth Observation Summit, which hosted ministerial-level representation from several dozen of world's nations in Washington July 2003. The effort culminated at the Second Earth Observation Summit held in Tokyo in April 2004 where forty-seven nations formalized the plans for international cooperation on the construction and maintenance of a global Earth observing system. Admiral Lautenbacher holds an MS and Ph.D. from Harvard University in applied mathematics.

# The Global Earth Observation System\*

Admiral Conrad Lautenbacher, Jr.  
Under Secretary of Commerce for Oceans and Atmosphere  
October 12, 2004

**Jeff Kueter:** Good afternoon everyone and thank you all for coming today. I am Jeff Kueter, the Executive Director of the Marshall Institute. It is my great pleasure to play host at another installment of the Washington Roundtable on Science and Public Policy. Today's Roundtable is unique in the sense that we have a policymaker here who will talk about what we think to be an incredibly important development in the collection of real observational data about the Earth.

The Global Earth Observation System (GEOS) is envisioned as "a large national and international cooperative effort to bring together existing and new hardware and software, making it all compatible in order to supply data and information at no cost." We believe this is an important development because it will provide scientists with long-term, reliable, high-quality data that can help answer many of the questions that we face in regards to many issues, including climate change.

There is no one more capable of talking about this program than our speaker today, Vice Admiral Conrad Lautenbacher, the Under Secretary of Commerce for Oceans and Atmosphere. He is also the Administrator of the National Oceanic and Atmospheric Administration (NOAA) where he directed an internal review and reorganization of the NOAA corporate structure to meet the environmental challenges of the 21st century. He has spearheaded the first-ever Earth Observation Summit, which hosted a ministerial-level representation from several dozen of world's nations in Washington in July 2003. The effort culminated at the Second Earth Observing Summit held in Tokyo in April of this year, where forty-seven nations formalized the plans for international cooperation on the construction and maintenance of the global Earth observing system. He holds an MS and Ph.D. from Harvard University in applied mathematics. Please join me in welcoming Admiral Lautenbacher.

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\* The views expressed by the author are solely those of the author and may not represent those of any institution with which he is affiliated.

**Admiral Lautenbacher:** Thank you very much. It is indeed a great pleasure to be with you. Free lunches get me out for lots of things. The idea of Earth observation is a powerful idea that is just starting to “gain legs” around the world and in our own country. It is a big concept, but what does it mean in a practical sense? It has the power to transform our world, to improve our society, to improve our environment, and to improve our ability to deal with the challenges we see around us in this next century in a whole variety of fields. We are also proud of Earth observation because it is an issue in which the US is leading. It obviously has environmental impacts as well as economic and social impacts and it can be seen as a baseline of data for the future.

In developed societies and countries like ours, our investment decisions, our environmental decisions, and our social decisions are based on lots of data: we have weather data, data on vegetation, flood data, and lots of other data that we use. We take this for granted in the United States, but in the rest of the world, they do not have much of this information. How do people make wise investments to leverage the world’s power to maintain and increase their standard of living? They do it with a foundation of an understanding of the environment and natural resources in the system they are in, and Earth observation is the way to get at that. Not only would it help developing nations, but it would help us too, because there are many things that we could do better if we had a more comprehensive and a more advanced observing system to provide a baseline of data. Thirty percent of our GDP is fully dependant on the kinds of data that NOAA provides. When we make decisions about agriculture, tourism, construction, transportation, insurance, management of coastal zones, oceans and fishing, all of those baselines activities that touch many of our natural resources, those decisions are made on the basis of the kinds of data NOAA provides on the ocean and atmosphere. If you add the rest of the federal agencies (and we have lots of them which provide very important data on the land as well as the oceans and the atmosphere), you will go beyond thirty percent, but I am only speaking for NOAA today.

There are two parts to this pitch. First of all, I want to give you the central idea about what this is and how to understand it, and second, where we are going with it on the international level. Some of this bureaucratic stuff gets a little boring after a while, but it is important. That is the hard part, actually.

Why is it called the Global Earth Observing System of Systems (GEOSS)? That acronym was agreed to by the nations of the world and

remember, this is a consensus type of organization. The United States invited thirty-four nations who expressed interest to come to the first summit, but we did not have this name at that time. It has taken only a year to get a name, but that is not bad; acronyms are hard to work with, as you well know. The “system of systems” is an interesting add-on which does two things: first of all, it expresses the idea that this is so big that it should not be conceived of as just one integrated system. It also says, from a geopolitical point, that there is no single big command center that runs the Earth. That is very comforting to nations and international organizations today that run their own observing systems that are part of this. So the objective of bringing people together collaboratively is fostered by the idea of a system of systems, because it allows people to come in a non-threatening way and bring their contributions to understanding the world a little better. So it is a distributed system of systems.

Today there are certainly thousands if not millions of individual observation stations, platforms, and sources of data around the world. Many of them are connected in small networks, some are connected globally, and many are not connected at all, but they are providing useful information. At the first level, the system provides a way to bring this information together in a comprehensive format, to expand the global Earth coverage and to bring the assets that we already have together in a synergistic way to provide more coverage and advanced data to the nations of the world.

The next point is that many people automatically think of their own existing observing systems, but we are talking about more than just these systems. Global Earth observation starts with space and goes to the bottom of the ocean for a full three-dimensional range. Any device that you can conceive of to collect data can be used and connected to this system. It could be ships, aircraft or robotic vehicles in the ocean, in the air, or on the land. Obviously the satellite age has made this possible; when satellites first came into being and Sputnik was launched, people began talking about gaining a full comprehensive view of the Earth. People began to think of it as a space-based system, but it is clearly not just space-based. It has been talked about for thirty years and today we have reached the point where we need it and we can do it.

By having a GEOSS, we have identified gaps in our global capacity. The oceans are under-observed today. I have heard testimony where people say that we have only three data points in the ocean. That may be an exaggeration, but we have very few places in the ocean where we get a comprehensive understanding of what is going on. We are in the process

of building a global ocean observing system which would be a component of a global Earth observing system, but it is nowhere near being completed yet and it needs the help of a global-level organization to bring it about.

Exchange of data is a critically important part of this. The data will be open and freely available to exchange to all the nations of the world. Remember, a coalition of governments is working on this and that presents some tough problems, because every country has a different business model. Some countries like to think of the concept of cost recovery, which means you pay for data. In many countries, one agency will buy data from another agency, so even within a single government, there is the issue of what the business model is. We have to work through that. The best example we have today is the World Meteorological Organization (WMO), which has agreements at a high level to exchange data that affects human safety and disaster management, so large-scale weather is generally traded or passed on an open exchange basis. The bottom line is that this allows people to make better decisions based on sound science. It is not only policymakers inside governments, it is people who make economic and social decisions, in fact, the whole society, who need this kind of information. So it is extraordinarily valuable for improving our standard of living and our economy.

Why is this happening now? As I said, this idea has been around for thirty years; it was not invented just yesterday. But there is a pressing need as population growth continues to the point where there are six billion people on the Earth today. The current estimates are nine billion, another fifty percent, in the next twenty to forty years, depending on whose estimates you look at. We also now have proven technologies that were in their infancies two or three decades ago. Thirty years ago, satellites were new and people did not know what they could do. We did not have the information or data management technologies that we have today, moving information on fiber and satellites around the world. We did not have the high capacity computing capability that exists today. So there is technology available, it has been proven and we have examples of how using this data provides benefits to people today.

The real key, though, is that we have been able to get the political will here. The people who govern the nations of the world see the same thing that we do in the United States. Their decisions on making policy, from whether they should sign the Kyoto treaty or not, to where to dig the next well on farmland, to how to produce agricultural improvements, depend on this data. The governing bodies of most of the nations of the

world agree to that. Despite the fact that we have had other policy differences, thirty-four nations came to the table over a year ago to talk about this and these are nations that didn't necessarily agree with us about Iraq and Kyoto and a number of other things. But they do agree on this. We are now at fifty-three countries — we started with thirty-four — and twenty-nine international organizations.

The first groups of people who were really interested and realized the potential here were those groups of international and intergovernmental bodies, in the UN, connected to the UN and outside the UN, that either manage observing systems or use the data from observing systems to allow them to contribute to the benefit of mankind. The Food and Agriculture Organization (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and even the UN Framework Convention on Climate Change (UNFCCC) belong to this organization now as users and procurers and developers of data. If you look at the documentation on the World Summit on Sustainable Development, you will see a long list of wonderful things that we need to do to make the world better and help improve the standard of living. It is a marvelous assortment, but in every one of the sections, you will notice that we cannot do any of it without the data: every piece of it, from agriculture to water to energy to coastal management to droughts to human health and disease control, all of it requires observing systems. So if we are ever going to achieve all of those wonderful goals to improve the standard of living on the Earth, we have to have this foundation of data.

The Group of Eight members recognized this as well and made it one of the three top science and technology initiatives a year and a half ago. In their meeting last spring, it was again supported strongly by the United States and led by a United States effort. It continues to be an item of strong interest and was re-emphasized at the last G-8 meeting on Sea Island, Georgia. As you may know, the United Kingdom takes over that presidency and they are very much interested in the climate and in the kinds of data and the information that we can gain from having a comprehensive system, which depends on more than just the atmosphere over the UK. That is the point of this: it is a global system, it is connected. The nations are connected, so we need to connect the data as well and bring it together so we can make wise decisions across all the countries.

We have had Earth Observation Summits I and II. Japanese Prime Minister Koizumi hosted the most recent summit in April where ministers of science, environment, or natural resources from over forty nations at-

tended. The U.S. delegation was led by Michael Leavitt, the Administrator of the Environmental Protection Agency (EPA) of the United States, and Dr. John Marburger, the President's Science Advisor.

These activities demonstrate that there is international will, so this is not just a scientific hobbyhorse or a new toy for the people who love technologies. It is supported by policymakers and people who run governments. It is also being supported very strongly by the United States government. We have the national political will and we now have a group of fifteen agencies, including three White House offices, which are working together to build a national plan. The United States sees a great benefit from this because, as I said, thirty percent of our GDP is dependent on what NOAA provides. The groups that are in that coalition right now form the Interagency Working Group on Earth Observation and they have produced a plan which is on their website with a request for comments, along with a Federal Register notice requesting public comments. The comment period closes on November 8 and we hope that interested people will provide their inputs. Our plan is important as the U.S. continues to provide leadership in the international effort.

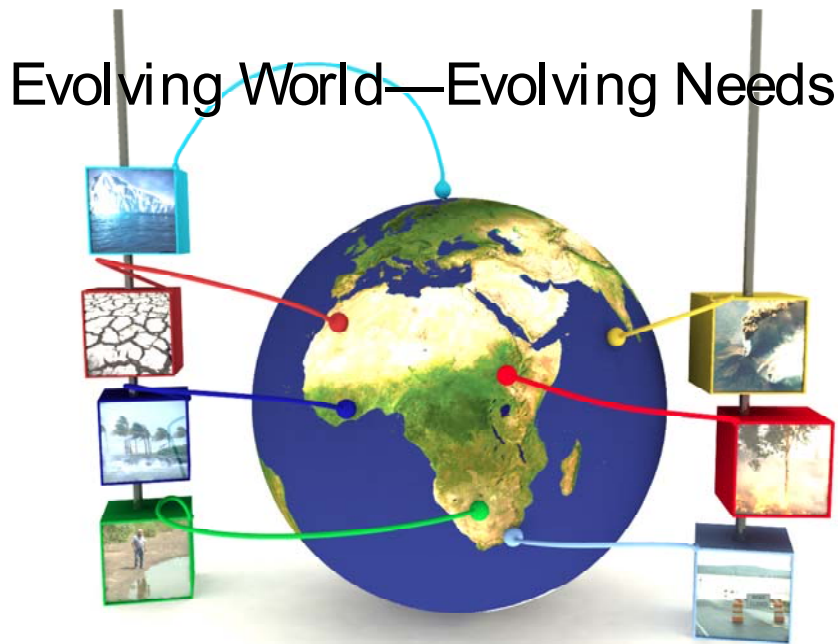


Figure 1

Now let's go back to why we are doing what we are doing here. Figure 1 shows that we are wiring the world. Inside the blocks are many of the issues that we have, the environmental types of issues that are at the foundation of our society and our economic and social conditions. We need to figure out how to deal with them from around the world. In this latest iteration of a global Earth observing system, we have tried to avoid just talking about the marvelous technology and the satellites and the computers and the data links that we have and bring it down to a benefits point of view: what does it mean, what does it provide and how does it provide?

The intergovernmental group has agreed to three summits; the first one, which brought countries to agree to the system, was held by the United States; the second one, which provided a framework document for the system, was held by the Japanese, and the third one, in which we are supposed to deliver a plan for a ten-year implementation plan for building a global Earth observing system of systems, will be hosted by the European Commission. In the course of the summits, we have managed to take the dialogue from the scientific into the very specific benefit focus. There are nine agreed-upon societal benefit areas that we will work on and that this plan will be designed to support. The plan does not talk about the global ocean or global space or global water quality or water monitoring, it talks about natural and human-induced disasters and how we can improve human health and well-being by improving weather information and forecasting warnings. That actually fits in everything here, but it is such an important category that people wanted to list it separately. This negotiation took quite a while, because you can imagine other taxonomies for listing benefits that you can gain from Earth observing, such as sustainable agriculture, water resources, energy, etc. We included biodiversity and the terrestrial, coastal and marine systems. In the national plan, we have put in the term "ecosystems" for biodiversity and essentially incorporated the coastal and marine theme into the oceans theme, so it is similar but not exactly the same as the international list. It will allow us to support the development of a global Earth observing system and the world looks to the United States for leadership in this area, so we need to be there.

I want to talk a little bit about the benefits side and maybe pique your imagination about them. The most common interest that the nations of the world have today is coping with natural and induced disasters. Even enemies will help each other in these situations, so disaster management is an area where we can bring nations together. I have to echo what Mike Levitt said: "Today we have computers that talk to each other and we have wires that go around the world. Basically our computers talk together bet-

ter than people talk together.” This is really an issue of how we can bring organizations and political groups together to build a coalition that will allow us to build a global Earth observing system of systems. The technology is readily available and the needs are obvious, in many cases. The issue is getting the nations to support it.

This is something that brings us together. We have had huge losses in the United States from natural disasters and those of you who have been in Florida recently can see the damage that the hurricanes have caused. But they caused a lot less damage than they would have if we had not had warnings that these hurricanes were coming and if we were not able to protect our property and move people out of the way. That does not happen in Bangladesh. It did not happen in Haiti, just around the corner, where they were not able to handle the problem. Of course, the problem was not just the decisions that were made on the hurricane; it is the decisions that were made for years on how they manage their environment, their natural resources and their economic pressures.

But what if you had access to all of our systems? What if you had precise assessment of current phenomena, better models, and more accurate forecasts? What if you had a global disaster reduction and warning system that provided the kinds of information that we think we can generate by having a comprehensive observing system available to all nations of the world? That is a carrot and that is why people are joining us. We have gone from thirty-four to fifty-three and many of the developing nations are signing up now because they realize that they can benefit, just at this simple level. From a conceptual point of view, this is easy to understand.

*Drought.* I have listed this one because while it has had worldwide implications for a long time, right now it has the attention of the western governors, who have been suffering a long-term drought in the west for five years. Now people are saying, “What is going on here?” Maybe we need to manage our water. Maybe we need to decide where we should plant crops or not plant crops. Maybe we should have a better system to monitor the snowcaps and the melt-off and all of the systems that manage water, the provision of groundwater issues, and the wells, all of the bottom-line economic impacts. We have annual losses of \$6-8 billion. A lot of that could be eliminated by having better up-front information on predicting droughts. We are using this as a baseline system and actually we want to do it for the entire country.

Our United States program is working on integrating the data that we have today, which comes from a number of agencies and from regional and local authorities. There is a lot of water data, meteorological data, groundwater data, vegetation data, and all of these things come from different sources and have different bases for quality and coverage. If we put this together, start building some decent models and start getting information out to the right decision makers in time, we are going to save a lot of money, a lot of heartburn and a lot of heartache. If I had spoken to you about this three years ago, we would have talked about the eastern governors because we were in an intense drought in the eastern part of the United States then. Farmers around here were going out of business because of the drought. So it is useful for the whole country, even though right now it particularly has the attention of the western governors.

We are talking about getting a handle just on seasonal indications. If you talk about the next planning season or the next harvest season, you have an enormous edge, but if you can figure out these Earth cycles, such as the interaction between the ocean and the atmosphere and transport across the land, you will be able to make much longer predictions on cycles. Right now we understand very little about how those cycles work.

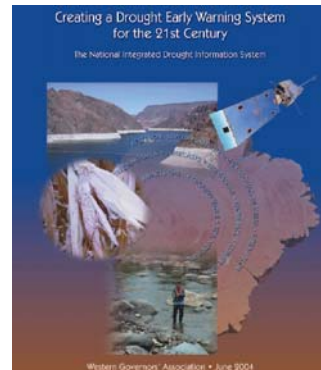


## National Integrated Drought Information System (NIDIS)

Supported by Western Governors

### Key Components

- ⊕ Integrated National Drought Monitoring & Forecasting System
- ⊕ Multi-agency collaboration; NOAA lead
- ⊕ Facilitates information exchange between local, state and federal agencies
- ⊕ Proactive, Not Passive, Drought Response
- ⊕ Improve Drought Indicator Data/Networks (Physical, Hydrological, Socio-Economic, Impacts)
- ⊕ Integrate & Interpret that Data with Easily Accessible & Understandable Tools



9 Near-term Outcome of U.S. Plan

Figure 2

Figure 2 shows the National Integrated Drought Information System report from the Western Governors, outlining the idea for, among other things, a drought monitoring forecast system. This is a multi-agency collaboration, and NOAA has stepped into the lead to try to do this. It is a pro-active, not passive, drought response and it is listed as a near-term outcome of the US plan. We are using technology to show that there are benefits and to produce those benefits. This illustrates a substantial increase in our ability to manage agriculture and water resources because of current environmental conditions.

*Wildfires.* By interlinking the right kinds of satellites in the right kind of places, we can spot wildfires almost immediately. This goes directly to the improvements we could have here in the United States by having comprehensive coverage and an immediate connection to firefighters and emergency managers on the ground. An awful lot of damage occurs from wildfires. Improved observations are just one piece of it; there are other variables in solving the wildfire problem, but a global Earth observation system promises to provide information for better prediction, tracking of fires, smoke plume detection and improved response and recovery. It is a rather simple promise, but in many parts of the world, fires burn and go unnoticed and by the time people can get to them, they are out of control. We lose a great deal of economic benefit from the fact that we do not or cannot get this information globally and disseminate it globally.

*Energy resources.* Figure 3 shows the impact of the last series of hurricanes that we had in the Gulf. The damage that occurred in the Gulf resulted in a rise of \$5 to \$6 in the price of a barrel of oil, about 14 cents on a gallon of gas. Remember that twenty-seven percent of US production of natural gas comes from the Gulf of Mexico, and twenty-seven percent is a big chunk. 1.2 billion barrels of crude oil per day of US production and forty-nine percent of the oil refined come through the Gulf of Mexico refineries, so even if we do not get the crude from offshore, we get much of it from tankers coming in. So weather and our understanding of what is going on in the Gulf of Mexico have an enormous impact on our energy usage and our energy sources in the United States.

It is difficult to make calculations on the value of an improved hurricane forecast information, but we estimate that if a 24-hour forecast – just 24 hours – would produce a benefit of \$10.5 million and a 48-hour forecast, another \$8.1 million of benefits received, far exceeding the operating budget of, say, the National Hurricane Center. So there are calculations, in some cases, of what the benefits would mean.



# Energy Resources

## Impact from Recent Hurricanes

- ④ Disruption to production, damaged pipelines, delayed shipments
  - ④ Add \$5-\$6 to price of a barrel of oil (14¢ per gallon of gas)
- ④ Gulf of Mexico
  - ④ 49% of oil refined for U.S. comes through Gulf of Mexico refineries
  - ④ 60% of imports come through Gulf of Mexico ports
- ④ Value of improved hurricane forecast information
  - ④ \$10.5 million for 24 hour forecast
  - ④ \$8.1 million for 48 hour forecast
    - Exceeds operating budget of National Hurricane Center



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Figure 3

But obviously the implications for lives and property saved by being able to predict more precisely what is going on are huge. We are not able to predict the intensity of hurricanes very well, as you know from watching the forecasts. We also do not understand the tracks of hurricanes very well once they have touched land. Once they become involved with the systems over land, it becomes much more of an art than a science to determine where they are going next. So there is a great deal of room for improvement in the United States systems, let alone what the world would need to improve itself.

Here is a simple question about the environment which we still cannot answer today: how fast is the sea level rising? We cannot answer that question because there is no single answer. It would seem to be easy: the ice is melting and the sea is rising. Well, it is not that simple. We have to understand what might be the sources of the rise and change – let us call it change because in some areas there is land subsidence and in other areas the land moves upwards due to eruptions and other factors and the sea level actually drops. And remember, we are talking about a rise in sea level of a couple of millimeters a year, a very, very small amount. If you have gone down to the shore and watched the waves crash in, you might wonder

how we can determine whether there is a two-millimeter difference this year. It is not an easy question. We need a global system to be able to do this, just to observe it. There are model productions on global sea level rise based on varying sets of assumptions: in 100 years, it could go up nine cm or eighty-eight cm. That is a big difference. One hundred million people live within one meter of sea level around the world, so that is a huge question. We could at least answer the question of what is going on today if we had a comprehensive observing system.

We have talked about this as a short-term effort to deliver something beneficial from global Earth observing. Today half of the tide-level stations in the world are not reporting or not functional so we basically do not have the data. These are simple technologies; it is not technologically demanding to put in a tide gauge and get the data, but they are not reporting. According to the scientific community, we need 170 tide-gauge stations and they need to report data hourly in real-time so we can get an idea of the dynamics of the system. We need GPS receivers so we can measure the vertical movement not of just the sea, but both the fixed land and the ocean. We have just started the satellite altimetry (and when I say just, I mean in the history of mankind we have just started satellite altimetry; it has been going for a few years), but we need to get a consistent record of satellite altimetry because that gives us the height of the ocean all around the world and if we calibrate that, we can be able to start dealing with these millimeters of change we are talking about in the sea level.

*Upper ocean temperature and salinity structure.* We need to answer questions about what heat is doing to the ocean and polar ice. Three thousand Argo profiling floats have been decided upon by a consortium of fourteen nations. They are going into the ocean today. The United States has agreed to fund and put half of these into the ocean and the other half are coming from our partners. That will give us an improved understanding of the redistribution of water mass on the surface of the Earth and maybe we can start to answer the question of how fast the sea level is rising. I assure you the science is not settled in this area. We do not have the data or the understanding to be able to answer that question, but a global Earth observing system will help us do it.

Let's talk about the bureaucratic aspects of this project. How do we get people to talk together and make this happen? We have a working group called the Group on Earth Observations (GEO) which includes agency heads, like me, from the nations around the world that we have talked about. We have organized ourselves into five subgroups. We have

had four meetings, plus a special meeting, starting last July; it has been a rather intensive effort for an international group to meet this often and to try to get something done between each one of these meetings, but we have. As I said, we have gone from nowhere to a framework for an international ten-year plan. We have managed to get the world to talk about societal benefits instead of the toys of technology. We have an implementation plan task team in place that has four writers designated to write this plan, who were nominated by the four international co-chairs. I am one of the co-chairs for this hemisphere, one is from the European Commission for the European side of the world, one is from South Africa to cover the developing part of the world, and one is from Japan to cover the Pacific side of the world. Those four writers are writing this plan right now and it is about to be delivered in draft form for us to work on at the next meeting. We finalized the framework earlier this year at the Tokyo summit.

The next meeting is GEO V in Ottawa at the end of November. At that point our goal is to have negotiated a ten-year implementation plan to present to the third summit. It will have to be a relatively short document because every word counts when you are negotiating internationally. With this number of nations, it gets very tricky. Then there will be a reference document, the state of the art of the technology for global Earth observing that we will provide to the ministerial level as the basis. I think we will agree on some way to keep updating that, to keep it moving. There will also be a communiqué saying that this is wonderful and we great political figures of the world have decided to do something good. Then we will go to Earth Summit III in Brussels on February 16, and, I hope, we have that plan and it will be approved and we will talk about how to transition to a more permanent and rigorous oversight or implementation plan for bringing this about.

What do we do beyond these three summits? Does this just stop, because people thought it was a great idea and they all signed a nice agreement on working together? The consensus, and this is strong consensus, is that we continue this. If we have an implementation plan, part of that plan should include a way to monitor and improve and build upon our work and to ensure that we can make progress. What type of organization should we have to work on this? It has to be a ministerial-level group, so we can keep the political membership involved, it has to be open to all countries, there have to be regular meetings, and the international scientific community has to be involved. There should be no new international UN organization created, but it has to have some kind of terms of reference and have some kind of authority over the systems that we have today. That

is what is being discussed and I think we are getting close to an answer on that. It is very difficult.

The key issues are:

*Data policy.* As I pointed out, these are difficult economic models. How do we get free and openly traded data passed from one nation to another and get agreement? That is a huge issue and it is going to take a while. You are not going to reform everybody's economic systems overnight to do this. It is going to be a long-term task, but I think it can be done.

*Integration.* How do you bring together the different systems that are out there now? There are many "system of systems" already operating and they can be brought together. Merging the different types of standards and protocols is tough.

*Data management.* Just in the United States alone, we will see a hundred-fold increase in the amount of data that we can bring down from satellites in our observing stations on the Earth. So while we have great capability for data management capacity, we are nowhere near where we need to be to really make this a reality.

*Engaging developing countries.* As more people find out about the benefits from this, many more people will join it and we have to figure out how do we deal with that by addressing capacity building, technologies, and how we can get the coverage we need. Much of the ground coverage that we need is in developing nations.

So this is the vision for the United States contribution to GEOSS. If you have not seen the website<sup>1</sup> and you want to make comments, please do because we want not only to bring all the government agencies together, but to bring the rest of the country in as well.<sup>2</sup> Industry can contribute, our academic institutions have great scientific capacity, and NGOs do a great deal of work in capacity building, both in and outside of the United States. The government does not do anything by itself, as you may have heard me say before, because we have a strong economy, strong industry, and strong public involvement in the whole spectrum of public interest groups that are

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<sup>1</sup> <http://iwgeo.ssc.nasa.gov/draftstrategicplan>

<sup>2</sup> [IWGEOcomment@noaa.gov](mailto:IWGEOcomment@noaa.gov)

involved. This website is designed to bring people in and I encourage you to take a look at it and make comments.

A quote from Carl Sagan: “Extraordinary claims require extraordinary evidence.” This is a little bit of a sales pitch there – the Earth is like a system. Perhaps you cannot call it a system, but it works together. It has systems that are interrelated and we need to be able to study them in that way. We have to get the observations and to assemble multidisciplinary teams and we have to have the sound science. To use a medical analogy, we hope for the first time to be able to take the pulse of the planet. We will be able to give the planet an MRI in all respects and to get the kinds of comprehensive information we need to understand the interrelationships between the systems that determine the environment in which we live. There are the two websites, one for the intergovernmental and international effort and the other for the national effort.<sup>3</sup> I think you will find them very interesting.

I have reached the end of my presentation and I thank you very much for your time and attention today.

### ***Questions and answers.***

**Question:** What is the role of the World Meteorological Organization (WMO) in this enterprise?

**Lautenbacher:** That is a good question. The WMO has offered to host a secretariat for the organization. We are working through that because it has to be agreeable to all the nations. I think it is a very good proposal; it is on the table and it is being discussed. The object would be to create a continuation of this GEO group that we already have, supported by a small secretariat based on voluntary contributions from the nations of the world, and with which everybody is comfortable. The WMO has made some very strong statements. At the last summit, we actually had five UN organizations make a single statement; they gave up their individual time so that they could have a joint statement. I find that absolutely incredible. Everybody always likes his time in the sun to read his own statement. But UNESCO, including its IOC, WMO, FAO, and UNEP actually joined together agreeing on a series of principles supporting this, and stated that they were willing to work together, which I find an extraordinary achieve-

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<sup>3</sup> <http://earthobservations.org> and <http://iwgeo.ssc.nasa.gov>.

ment. But the WMO is very supportive and they are looking strongly at that possibility.

**Question:** You mentioned data management. One of the things that struck me as you were talking is the information model. It seems that as part of the international agreement, you are going to have to have agreement on how to standardize the data presentation. All these varied users are all going to want to manage that data on their own. Can you give us an insight as to where you think that breakdown is going to be between the standardization of an open format versus the end users managing that data themselves?

**Lautenbacher:** We are not going to have the answer to that question by February. What we will have will be a discussion of the principles on which it can be decided. There is a recognition that we have to trade high-level data which is international in scope, but that at some point, national interests take over in each country. Some of the data is public and some is private. So we have to have the ability to transition and to use the open architecture standards as well as internally be able to use off-the-shelf software and those kinds of things. This is going to be a long and difficult task, but as I said, we have some examples today where we do share data, at a high-level, internationally with protocols and standards that are in place.

**Question:** I imagine there will still be many data storage problems to resolve.

**Lautenbacher:** There are. There are storage libraries, if you want to call it that; many of the nations of the world already have archives, so that the object then is to get the output from these archives to standards where everybody can draw from those archives in a way that is compatible. That is not going to be easy to do. But the international and national data has to be able to connect to the private sector and public sector. Those are pretty much ingrained in the discussions right now.

**Question:** You talked about how the system would be helpful in protecting energy resources, such as oil or natural gas in the Gulf, through better hurricane prediction. Are there other ways this could be helpful in best determining where new resources are or helping improve the power supply in any way, on the land looking at transmission?

**Lautenbacher:** A comprehensive global Earth observing system with a multiple system of sensors will help with all of those. We will be able to

chart the most likely places to find energy sources, and they do it today, for that matter; we will be able to chart places where transmission is possible, we will be able to tell where it is dangerous or not. Another side of it is that these observing systems will help to locate energy resources. But remember, I am here speaking as the head of NOAA and we have the Departments of Transportation and Energy and a whole collection of people who would be obviously more capable of talking to you about the details of finding energy.

The other point is energy usage. By having a better understanding of environmental conditions, we will be able to stockpile, ration, and use energy in a much better way. A study that was done for the TVA a few years ago shows that if we were able to cut down the variance of temperature just a degree, we could save a billion dollars in energy costs, just in today's bills. So there are some near-term benefits to be gained from having a more accurate understanding of environmental conditions that require energy use. Is it going to be a warm winter, a cold winter, a wet winter, a hot summer? People today are starting to trade energy and weather futures and there is insurance on weather to help ameliorate some of these additional costs. So there are two sides of that.

**Question:** On the national plan, how many other countries are doing one and how does that fit into the international process?

**Lautenbacher:** I do not really have a good handle on how many other countries are doing one. I know some are. The Europeans already have something they call Global Monitoring for Environment and Security (GMES), which is the European Union's contribution. We have not taken an inventory of how many nations are doing it internally. One of the questions I frequently get at international forums is, "How do you get the U.S. Agencies to work together to build a plan? We would like to figure out how to do it ourselves." Then I discuss how our arcane bureaucracy works and they say, "Well, I will talk to you later." So it is not a trivial issue. I am hoping that showing an example of what one looks like and how to do it and what we are trying to get out of it will help jump-start other nations to think about the methods of doing it.

**Question:** Is the National Academy of Science doing some kind of study or report on this process? What is the purpose of that?

**Lautenbacher:** Yes, they are. We felt that it would be good, and this is supported by the US agencies, to have the National Research Council

(NRC) take a look at what would be reasonable plans for the future in looking at Earth-observing types of technologies and systems from space. There is a NASA enterprise called Earth observation, but remember, NOAA operates and runs the operational Earth environmental satellites. (The satellite images that you generally see in pictures on the news are not typically from NASA satellites, although they are very good satellites and we like them and they contribute to our satellites.) We were trying to develop a ten-year or twenty-year vision and see what kind of elements we can bring to this, so it is a scientific adjunct to what an Earth observing system can do and where we ought to go.

**Question:** This project seems to require a lot of funding. The Mission to Planet Earth funding was cut, so how certain are you that this current GEOSS will be fully funded at a level needed to fulfill your objectives?

**Lautenbacher:** I have been in the battle for resources for a long time in the various jobs I have held and it is never easy. I would not stand up here and say that I am incredibly confident that all the money in the world will drop down into this system. But what I will tell you from my experience is that you do not get any money unless you have public benefits and you can demonstrate them. The organization is working to build a plan that makes sense and that can capture the imagination of the public so they will make it a priority and put more money into this part of our system. And I think it will come. When we held the first observing summit, the President committed another hundred million dollars to Earth observing. So there are small new items on the table. We already spend probably four or five billion in Earth observing in the United States today and we are not the only people that have big satellite systems. Russia, China, India, Japan, Europe, all have multi-billion dollar programs as well, so there is already a sizable body of resources that are devoted to this task. How much more can we mine out of the money that is there? I think that by putting these systems together and making the data available, much can be done today for very little or no additional cost, and a great deal of benefit can be obtained. And we can get more global recognition of where we need help, where we are missing systems, where we are missing national involvement, and where we can help other nations build capacity. This is a journey that we are moving on slowly.

**Question:** With the international negotiations operating on a compressed timetable and given that the presumed benefits discussed in your presentation are something that everyone would want to see, what do you see as the stumbling blocks or the key issues that have to be negotiated in the up-

coming meetings? Is there any way that people at this meeting can help provide you with arguments to overcome these barriers?

**Lautenbacher:** That is a very good question. I think one of the blocks is that it is a relatively new effort; it has only been going for a year and a half, if you look at it in terms of when it arose to the level of cognizance at the international level. So it's brand-new and quite frankly, we have not figured out the bumper sticker slogan yet. We have talked about sound bites. How do you gain public knowledge? I was asked a question the other day at the Carnegie Institute. I went through the government's policy on climate change and one question came up, "You have gone through a whole list of accomplishments, why aren't you getting any credit?" My answer is that it is too complex: you go through a long laundry list and pretty soon you have lost it, because you do not have the sound bite. It is not a one-word sound bite like "Kyoto," As in: "Sign Kyoto and everything gets better!" Most people know that's not true, but I don't have that one word yet; I don't have a nice "taking the pulse of the planet" or "wiring the world" advertising slogan. We have not figured out a way to describe this so that it captures the imagination, particularly with the issues that we have today in national security and the economy which can be benefited by a global observing system. But how do we get this concept across? I think it will gradually build up steam because it has a pretty good international following at this point. Certainly the people who make decisions on natural resources, on the environment, on investments, on policy get it, mostly. Any help in advertising to come up with ways to describe what this means in simple terms would be very beneficial. Spreading it to the private sector has been largely an internal government exercise and we are trying to get it out to the public at this point.

**Question:** Is this independent of the UN? It seems to me that the IPCC would be very fearful and would consider this a threat, because if you gather more data, it would tend to undermine their model that they are using for all their objections. I was just wondering how it relates to them?

**Lautenbacher:** It relates very strongly. Some people in the IPCC might be fearful, but remember that a member of this group right now is the United Nations Framework Convention on Climate Change. They are the founding father of IPCC and the Global Research Plan and the Global Climate Observing System. They are very much interested in developing the right kinds of data. Now there may be people that are disappointed, but I have to believe that when people are faced with the facts, they are going to be rational. I do believe that. Sometimes policy and science get confused,

but I think as we get more data and more information, that information will carry the day. Not many people today run on a platform of violating the law of gravity; everybody accepts that. When we get to the point where we have this irrefutable data and understanding of what is going on, I think people will come around.

**Question:** As for the U.S. needs for the system, what are the gaps that bother you and how would you fill them?

**Lautenbacher:** First of all, I am an ocean enthusiast and what bothers me most is the fact that we do not have an ocean which is instrumented. That is a huge problem because most of the ocean is in the Southern hemisphere and not much of the bits of land that we have down there is developed. So it is difficult to get enough nations to take responsibility for instrumenting the oceans in the southern hemisphere. That is why the Argo partnership that I mentioned, where the developed nations of the world are putting some of these buoys in the water around the globe, is huge. I really believe that we have to have a much better understanding of ocean cycles. The oceans are the heat memory of the Earth. People do not really relate to that a whole lot; we stand on the land and we do not think about what the oceans are doing. But if you approached the Earth from space from the southern hemisphere, you would be hard-pressed to find some land; you would be looking at a blue planet with seventy percent of the surface covered with water.

Next, we need to start filling in the data gaps on understanding what is in the atmosphere and the transfers between the Earth, the oceans, the atmosphere, and carbon cycles, all the so-called greenhouse gases and the forcing functions that we have from aerosols. We need to put observing systems into place that can tell us what is going on and that can cut down on the multiple hypotheses that we have on what is happening with carbon and methane and all of that. We can do that, we can define that much better than we have today and eliminate some of the far-out hypotheses and get down to where that really is. I do not know exactly where that is, but I know that we can get closer to it.

**Question:** Could you put testing instruments in the air and float them in the air just as you do in the water?

**Lautenbacher:** There is a concept where we could do that. You could monitor some of the upper air. We do it today with balloons in many places, but we do not do it over the oceans very well. Most of our data

comes from land. We have weather balloons that take soundings in the air. We could take one squadron of UAVs and cover the whole Pacific. Considering the world GDP, we could do this very cheaply. We could monitor it from space, from geosynchronous orbit, from low-Earth orbit, then down in the upper troposphere, at the surface, and in the ocean and have the whole column. If we could do that on a continuous basis, we could cut out many of the competing hypotheses out there today about what is going on. And yes, we could do the same thing with robotic vehicles, taking soundings selected points in the atmosphere. It is a very feasible concept and we have many new ideas on the table to do that.

**Jeff Kueter:** Please join me in thanking the Admiral for an enlightening presentation.

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