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A Vision for the Future of Earth Science

Today I wanted to speak a little about the future of earth sciences, where I think we are headed and what it means for the space community.

Where the last century was clearly defined by a look to the heavens, I believe the 21st century could be remembered by a change in the way we interact with the planet.

Where we've been

Seeing where we're going requires understanding where we've been.

The earth science community has a history of being quite disjointed. There have rarely been common goals that the entire community works towards and often scientists and programs focus on their specific disciplines without giving much thought to the bigger picture.

Incidentally, when I arrived at NOAA, the agency mimicked this reality. We were made up of several different stovepipes which were all focused on their individual programs and weren't focused on common goals.

During my tenure at NOAA, we have worked hard to tear down those stovepipes. We instituted a budget process to tie budget priorities to results. And we set up program structures that cross traditional line office borders.

The earth is an integrated system and if we're going to monitor global processes effectively, study environmental changes and manage natural resources we had better be similarly integrated.

Historically, transferring research to operations for earth sciences could be described as ad-hoc at best and a wide gap has traditionally existed between the two. Instead of focusing on an end game such as providing products and services, earth sciences has focused mostly on the scientific side of things and increasing our understanding of the planet's systems.

Contrast this with the manned space program which has gone through several phases from reaching orbit to walking on the moon to an international space station and now to Mars. During each of these phases both the science and the operational community were focused on the same singular goal.

Where we are

I'm sure most of you are very familiar with the National Academies Decadal Study on earth science applications from space. The report was a comprehensive look at these very issues and it made a number of important recommendations. One of the underlying themes of the whole report was improving the transition from research to operations.

In a time when every dollar counts, it is all the more important that we define our operational requirements to help guide scientific missions.

This isn't strictly a space-based challenge, but it is clearly more pronounced in space given the long lead times and relatively larger budgets required to complete missions. I am happy to say that we continue to improve our relationship with NASA and other partners in order to continue to close this gap between research and operations.

A NOAA/NASA team formed to look at research-to-operations issues, recently established a joint working group to develop a dual- or multiple-agency process to transition NASA measurement capabilities to NOAA for operational service.

It tentatively selected satellite altimetry as the first demonstration of a transition from NASA research to NOAA operations. This will allow NOAA to improve forecast accuracy and lead-times of ocean and atmosphere conditions.

To further advance research to operations planning, NOAA and NASA are setting up an Interagency Transition Office to put in place a more comprehensive planning environment.

This re-focused partnership with NASA is already paying dividends. The President's decision to include $74 million in the FY2009 budget to re-manifest climate sensors is a direct area where this partnership is paying off. We have opportunities with the Jason (satellite altimetry) follow-on efforts to score further victories.

We have also learned some important lessons from our current satellite programs that are helping us change the way we do business. I am proud to report NPOESS is now on a sound track. We have announced plans to re-manifest some of the sensors removed from NPOESS during the Nunn-McCurdy process.

GOES-R continues to progress and we're applying lessons learned from NPOESS to ensure GOES-R's success.

Specifically, we have recognized the need to make requirements explicit and clear, the need to conduct independent reviews early and often and the need to utilize and stick with smart budgeting practices.

I know many of you are closely involved with these two important programs and I want to thank you personally for your hard work.

Where we're going

As we look to the future, our first priority is obviously continuity of operations. From weather forecasting to climate monitoring, there simply can't be any gaps in coverage.

However, in the future there will be an increased need for new products and services developed by earth observations. Population growth, coastal development, food and energy resource use and increased globalization will ensure that demand for these products remains strong.

Obviously where those demands exist, there will be business opportunities for all of you working in this realm. I encourage all of you, if you aren't already, to be thinking about how you can provide solutions for a changing planet.

It is really an exciting time in the earth sciences. We're literally standing on the threshold of a whole new era. Our understanding of this field is still in its infancy and we're just beginning to grasp what our capabilities might be.

For example, I think before long we will have the capability to monitor accurately air quality and air chemistry with more refined instrumentation from space.

I also think space will be a key frontier in the climate change debate in terms of understanding the carbon measuring cycle. If we're going to implement any sort of regulations on carbon emissions we will need to establish a baseline, then verify the disposition of carbon and its real impact on earth systems. Space-based instruments hold a great deal of promise in this area.

We currently have ground stations that can monitor a multitude of different compounds. Is it really a stretch to think that in the future some of these ground stations can provide calibration for new space instruments to give us a truly global picture.

As we look to the future, it is clear we will still need a backbone of space assets, like weather as well as environmental satellites. However, the space community also needs to be more involved with *in situ* measurement capabilities. You would be well-served to engage with those communities to better understand their requirements and future needs. I think you would find a lot of areas for collaboration.

That's what makes this whole idea of creating a Global Earth Observation System of Systems so exciting. GEOSS will link thousands of observation platforms around the world in the sea, on the land, in the sky and in space giving anyone, anywhere a real-time look at all of the earth's systems interacting together.

Inherent in this process are people from different disciplines collaborating to meet society's needs. If you want to talk about transferring research-to-operations, GEOSS personifies it in seemingly real-time.

GEOSS is all about the data – getting the right data into the hands of the right people at the right time. Perhaps the most revolutionary change GEOSS will bring will be to change the way people view data. Instead of earth observation data being proprietary, it will instead be open for all to access at any time.

I'd like to ask you to think for a moment about what it could mean in your daily life if you had access to perfect information about what the environment was doing at any given moment and more detailed forecasts of the future.

Imagine driving home at night when suddenly the console in your car lights up to warn you that around the next corner will be a patch of black ice.

Imagine doctors being able to predict with great accuracy where specific strains of the flu will flourish and who should be given specialized vaccines. We now know that many diseases like the flu, West Nile or the bird flu are very closely associated with environmental conditions. Improving our monitoring capability and scientific understanding will allow us to predict outbreaks and respond to them in ways that are not possible now.

Imagine the agriculture industry moving towards "just-in-time" production where a perfect understanding of global crop demands at any given moment meets a perfect understanding of when and where to plant crops for maximum yield and minimum waste.

In the future, the key will become who can use the data in the most innovative ways. Achieving competitive advantage will shift from being the one with the data to being the one who can solve the most problems by using the data.

This is particularly important because I'm quite certain that the future, like now, we will have to do more with less. It is difficult to imagine a scenario where we aren't operating under incredibly tight budgets.

That being said, because of the long-term nature of earth science programs, particularly those with a space component, future success depends on enhancing budget support in the present. We need strong support for our budget this year in order to maintain our progress into the future. A small setback now will lead to larger setbacks in the future.

As many of you know, we are entering a critical period right now with our next generation geostationary satellite program, GOES-R. This next generation is critical for the continuity of our nation's weather forecasts. The President's budget has

requested an increase of more than $200 million dollars in FY2009 to support the continued development of the GOES-R system.

To support this significant effort and ensure it comes in on time and within budget, it is important we support this and future increases to the NOAA budget to advance these key space-based Earth observation investments for the nation.

What it means for the space community

So what does all this mean for the space community? There will clearly be increased opportunities, but there will also be a need to make some changes in the status quo.

You will be called upon more and more to meets society's earth science needs. From communications to data collection, much of this simply can't be done with land assets.

We are actively engaging the space community to explore new opportunities. In January we held an Industry Day to spell out our future requirements and to solicit specific ideas from you that we can review and incorporate into our future planning.

This process in and of itself, is a new one and inherently requires a broadening in how we at NOAA meet our mission requirements and how the space community does business.

The winners will be those who can ensure instruments are delivered on-time and at a lower price.

To succeed we are all going to have to be much more creative than the current practice of taking decades to build a satellite system and the inevitable "mission creep" as well as cost and schedule "creep" that accompanies these problematic programs.

Along those lines, I believe the vehicle will matter much less than the data provided. While there may still be needs for "big bus" satellites, we will also be looking at single-use satellites, specialized missions and even to the private sector to provide data as a supplement to our next generation NPOESS and GOES-R missions.

New business models must reflect the need to be nimble to increased demands for new information.

Challenges

Despite the increased need for earth science data and solutions, the road ahead will be challenging. Although earth sciences and the environment have rightfully risen to the forefront of our nation's attention, the space segment of earth sciences hasn't quite yet reached the same level of inspiration and awe as manned space exploration.

The implications of this on everything from budgetary support to public awareness to the ability to attract young students to the earth sciences are clear. Yet, it is a reality and a challenge to overcome.

The vision I've spelled out today will require skills and understanding far beyond what we're capable of now. None of this will happen if we aren't developing future generations of earth scientists and then bringing them into our agencies and companies.

The space community can be great leaders in this effort, as the Maryland Space Business Roundtable has shown with its dedication to education. I applaud your efforts.

Again, we have to be creative. There are now X-Prizes for the moon, the human genome and even a 100 mpg car but where is our X-prize for earth science? We need something that can at the same time excite, engage and enlighten us to solve some of the most fundamental problems of our time.

I believe we must continue to challenge ourselves because that is the only way we continue to achieve.

The space community led the march towards innovation in the last century as we sought to escape the confines of Earth. Clearly you are positioned to similarly lead this century as we utilize the unique medium of space to examine, monitor and forecast conditions of Earth.