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BEFORE THE HOUSE SUBCOMMITTEE ON ENVIRONMENT  
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

ADDRESSING THE RESTORAL OF U.S. LEADERSHIP IN WEATHER FORECASTING

May 23, 2013

Chairman Stewart, Ranking Member Bonamici and distinguished members of the Subcommittee: It is a privilege for me to be present here today and provide testimony to you in the absence of my colleague and our company's CEO, Vice Admiral Conrad Lautenbacher, Ret., former NOAA Administrator from 2002-2008. The Admiral sends his regards, and regrets his inability to be here today. He and I will be happy to provide any follow-up comments needed by the Subcommittee.

The U.S. weather forecasting capabilities are in need of repair and attention not solely because of technical shortcomings, inadequate computing power, or deficient weather models – but also because of the explosive growth in the cost of acquiring critical weather data from satellites and the resulting significant delays in new satellite programs. The status quo -- of continuously purchasing costly systems and marginally-effective improvements in current weather sensors -- effectively blocks investments in potentially new, more potent, lower cost, and proven data sensing instruments, and is damaging our Nation's ability to keep pace in weather observations and predictions.

The irony is that the costs of technologies of every kind – some of the very technologies used in the very newest satellite weather sensors – have plummeted over the past 20 years, except, conspicuously, in the space domain. A transition of weather data acquisition to 21st century methods, both technical and economic, is overdue and the weather-dependent economy depends on it. The Bureau of Economic Analysis reported to the National Research Council in the National Academy Press publication, *The Atmospheric Sciences Entering the Twenty-First Century*:

*“There can be no doubt that weather is important to the U.S. economy and to the health and safety of its citizens. Estimates vary, but 25% to 42% of the U.S. gross domestic product is affected by weather, and hundreds of millions of dollars are saved each year by taking action based on improved forecasts and weather warnings.”*

The 2011 figure for the Gross Domestic Product is \$14.99 trillion. Using these estimates, the range of the economy directly impacted by weather is \$3.3-\$6.3 trillion. These comments were published in 1998 as we entered the 21<sup>st</sup> Century. Since weather conditions affect so much of the US economy it only makes sense in this century to have the best sensing instruments to provide critical weather data at a cost we can afford.

The genius of American innovation and initiative has had technical and market solutions to the weather data crisis at the ready for many years now. It is no longer cost-effective for the government to keep these solutions on the sidelines. One working government case study for this already exists with NASA. Instead of operating a fleet of costly space shuttles, NASA has contracted with the private sector for its payload needs and works through cooperative agreements with scientific space programs from other countries. With this model in mind, the focus might be better placed on achieving data quality, accuracy and excellence – from wherever data might come – rather than weather data infrastructure ownership. Economic imperatives beg such a new perspective. It is time for the government to start tangibly augmenting this transition – with no less than the U.S. weather forecasting program at stake.

One step: We respectfully recommend that you enable federal agencies to purchase satellite weather data from commercial providers, aided by contingent, milestone-based contracting vehicles and procurement process that both enable competition and incentivize the private sector to take action. There are a number of competitive, creative companies that will promptly respond to supply the Nation with a bounty of new weather data – vastly more data, better quality data, new kinds of data – and do so far more quickly, far more inexpensively, and with zero financial risk to the taxpayer. Another working model exists wherein the satellite-based communications industry provides the US Government a large majority of its needed bandwidth, commercially. In yet another, the satellite-based imagery industry also provides the US Government with much of its needed imagery, commercially. It is time for the government to encourage commercial providers of satellite-based weather data infrastructure to address similar needs of the earth observation and remote sensing community.

A little recent history: In early 2007, the Office of Space Commercialization (OSC), under the leadership of Vice Admiral Conrad Lautenbacher, then Administrator of NOAA, instituted a fledgling satellite data purchase program. The OSC met with private sector companies and solicited data suppliers of all kinds. In July 2007 OSC issued its first Request for Information for commercial solar irradiance data. In the Fall 2007 they issued a comprehensive RFI for satellite weather and environmental data, listing a dozen critical products. Dozens of private companies responded with creative ideas of every description.

In 2008, NOAA followed up by releasing a formal Request for Quotes from private companies to supply those satellite weather and environmental products. They funded several dozen studies by companies large and small, each laying out a plan for providing data commercially, quoting firm prices. Companies were told that by spring 2009, NOAA would select the initial products for acquisition, that funding for purchase of that data would be requested for FY2010 – or FY2011 at the latest. NOAA was on a proactive path to filling the looming weather data gap long before it would ever materialize. Companies across the Nation mobilized to provide commercial data, new enterprises were formed, and the private sector raised capital preparing to offer these new products.

Unfortunately, on the road to this would-be commercial realization, the program was shelved. Inquiries to NOAA from bidding companies continued to be met with encouraging words. But little to no substantive progress has occurred since.

In the meantime, the average cost-to-in-orbit-delivery per sensing instrument on NPOESS/JPSS has gone from \$80 million in 2005 to over \$500 million today, and the JPSS launch has slipped

another ten years. The annual budget for JPSS is less than the program's annual cost growth. Its future remains clouded. Please consider the following: With \$80 million – the original estimate for *one* JPSS instrument – a private sector company can deploy a constellation of a dozen small satellites, each carrying a state-of-the-art sensor able to measure atmospheric temperature, pressure, density, and other critical weather parameters with accuracies and resolutions far surpassing those of any instrument that will fly on JPSS, and with far greater forecast impact per measurement, as documented by NOAA's own impact studies. With \$500M a private sector company could put up more than 100 such satellites. The first instruments could be flying 18 months from now, at no up-front investment by, and thus no financial risk to the government.

The ultimate increased cost to government, and to those served by less than the best possible forecasts, is incalculable. The Space Act of 1998 and its successors, and current national remote sensing policy, explicitly encourage the development of private satellite data suppliers and forbid the government from deploying competing systems. Yet in practice, we have not seen any tangible encouragement to transition government practice to these laws and policies; and to support the technical and economic engines of American private enterprise in an arena where their innovations are most urgently needed.

Moreover, the fruits of the cellular/mobile technologies that we all carry in our pockets are seemingly sheltered from the critical mission of forecasting severe weather. These examples have transformed our lives and commerce in the past decade – the smartphone, tablets, and numerous others. Infinitely more powerful than what we knew just 10-15 years back, these devices are ubiquitous, affordable and accessible to those of the most modest means. The same benefits of these technologies offer the US weather forecasting infrastructure greater power and greatly reduced costs, and they are available now to the earth observation and remote sensing satellite arena -- but have yet to be captured.

Excellent examples of our own efforts are available on our website - [www.geooptics.com](http://www.geooptics.com) - and can be described more expansively in written documents that we would be happy to provide to the Subcommittee. We want to emphasize that today our government – and as a consequence our economy and citizens – is facing a weather data crisis that can be relieved almost immediately through the simple act of unleashing the resourcefulness and genius of American private enterprise. In doing so the government will foster a vibrant and innovative free market in satellite weather data, a new “weather data economy” that will be supported by “weather data security” that will once again stock our shelves with the best possible weather products and services.

To amplify the point of the value of data excellence, and having access to cost-effective and efficacious data sources, in lieu of data infrastructure ownership, please consider what was recently reported in the Washington Post on March 3, 2013 by Professor Richard Rood, an atmospheric scientist at the University of Michigan:

*“In contrast, the European Centre for Medium-Range Weather Forecasts (ECMWF), which owns no instruments, can and does identify the [weather data] observations that would most improve the forecast. ECMWF invests in observation quality control and the observation-use interface. In the past decade, ECMWF has been able to implement advanced methods that blend or assimilate observed [data] information into the weather*

*model. As early as 1995, the weather forecasts from the ECMWF were emerging as higher quality than U.S. weather products. U.S. scientists and science managers found this development a matter of great concern.*

*ECMWF knows to invest in software and to spend on computers. For example, when faced with a paradigm shift in computational technology, as in the late 1990s, ECMWF invested, far in advance, in both software and sustained vendor-based benchmarking in order to be ready when the paradigm shift occurred. This practice has continued. In the United States, we remain largely reactionary to the evolution of high-performance computing systems. Therefore, each shift in computing technology is a moment in time that the forecast gap is increased.*

*ECMWF has integrated research and operations together with institution-wide attention to science-based, validated products. This stands in contrast to the United States, where we draw sharp contrasts between research and operations. In the United States scientists and science-program managers place high value on research, especially basic research. There is lower value on use-driven research; synthesis of research to provide products; the complex entanglement of observational, computational and scientific capabilities that must be brought together to produce a product; and the operations, monitoring and assessment of those products.”*

In sum, we highlight the following recommendations:

1. Shift the focus of our US Government weather agencies and users away from a bias of ownership of data infrastructure to an operational focus on data excellence and operational application of data, information and solutions. Shift that bias to the best, most effective and cost-efficient data – no matter where it comes from.
  - a. Move to a weather enterprise biased toward operationally focused outcomes and the production of operationally driven forecasting products and technologies – supported and enabled by the research community. Start with the outward, market-oriented uses and desired outcomes of our weather community – and work inward towards the research community in a more seamless, pragmatic research-to-operations model.
  - b. As the initial step in making this change, make a general announcement that to alleviate the weather data crisis the government, as of now, is in the market to buy satellite weather and space weather data from private suppliers; that this will be an ongoing program, so long as qualified suppliers remain; that the ultimate purpose is to establish a vibrant, innovative, self-sustaining weather data economy in the U.S. that will be a model for the world.
2. To actually deliver on this new focus, the US Government must take the necessary action to articulate and implement procurement reform.
  - a. Create a new contingent, milestone-based pay-on-delivery procurement policies, procedures and process that enable US agencies to contract for services that they need now – from private companies that can provide them -- which will help underwrite financing for these very companies and aid in rapid manufacturing and deployment of needed products and services.
3. Under these newly established procurement policies, announce the government's intention to sign actual data purchase contracts immediately upon the review and

selection of proposals. These contracts need not include significant (or any) up-front payments. They can be purely pay-on-delivery of validated data, thus exposing the government to no financial risk whatever. We advocate a new method for procurement and contracting – one that places risk on the private sector and increases competition to develop better, more robust technologies that will boost the Nation’s critical weather forecasting infrastructure and, as a result, help grow the economy.

4. Establish specific programs within both NOAA and the Air Force (AFWA and SSAEM), and possibly other agencies, with budget authority beginning in FY2015. We recommend satellite data purchase line items of \$10M each for NOAA and the Air Force in FY2015, growing to \$50M each by 2020.
5. As soon as possible, release an RFQ or BAA on behalf of NOAA and the Air Force soliciting proposals for commercial data provision beginning in FY2015.

It is these recommendations and actions that are necessary to ensure that the US is never again lagging behind any country or consortium of countries in weather prediction or forecasting. Opening up the government to very economical, proven and reliable data services – that meet the standards and specifications of NOAA, US Air Force and other users – will be the act that infuses innovation and creativity into our nation’s weather enterprise. The results of this change to the weather enterprise will not only enhance public safety – the protection of life and property -- through better forecasting, but will feed our economy with an important source of jobs and help participants in our economy manage vital risk.

Environmental data – big, voluminous, flowing and open – will also create an industry with new and un-thought-of ideas, uses, applications, markets, products and solutions to weather and environmental problems. And, by implementing procurement reform policies that enable and incentivize the private sector to act *now*, our government can actually act *immediately* to: 1) resolve weather data gaps and; 2) add value to society and economy.

Thank you. I would be happy to answer your questions.