Testimony of Mr. Scott Sternberg, President, Vaisala Inc.

Advancing Commercial Weather Data: Collaborative Efforts to Improve Forecasting

Submitted to the

Subcommittee on Environment

Committee on Science, Space and Technology,

United States House of Representatives

20 May 2015

Good morning, my name is Scott Sternberg. I am the president of Vaisala Inc., Vaisala is a global company with over 1600 employees. We deliver weather observation products, systems and services, with particular focus on scientific accuracy, precision, and reliability.

I want to first start by thanking Chairman Bridentstine, Vice-Chair Westerman, Ranking Member Bonamici, and the rest of the members of the Subcommittee on Environment for the opportunity to speak to you today about commercial weather data and its relationship to improving weather forecasting. My goal is to share with you some real world experiences as they relate to the integration of commercial weather data into the weather forecasting business carried out in both the public and private sectors. Moreover, I would like to comment on the importance of data quality for improved forecasts. Finally, I would like to stress the benefits that contractual clarity can bring to the evolving weather enterprise.

Vaisala has a long history in environmental sensing and data provisioning spanning more than seven decades. One of Vaisala's first customers was the Massachusetts Institute of Technology. In 1936, Vaisala delivered radiosondes, a device carried on weather balloons to measure the vertical characteristics of the atmosphere, to MIT in support of atmospheric research being conducted by the institution. Since that time, Vaisala has introduced a number of advanced, innovative technologies and solutions aimed at enhancing our understanding of weather and climate, including, but not limited to, ground-breaking temperature, pressure, and humidity measurements, automated weather stations, sky condition sensors, weather radars, and lightning detection systems. Today, Vaisala sensors can even be found on the Mars Rover Curiosity, safeguarding the Mona Lisa, in the Louvre Museum, and descending into severe storms in support of the assessment and prediction of hurricanes in the Atlantic basin.

Over the years, Vaisala has become recognized as a global market leader in such areas as meteorological research and operations, transportation, energy, and defense industries. In addition, Vaisala provides environmental measurement and monitoring capabilities that support demanding industrial applications and the life sciences sector. Our aspirations can be summed up through one simple phrase, "observations for a better world." Through the use of our products and services our customers are able to better understand past, present and future environments, reduce uncertainty, and make well-informed decisions. In the United States, our top customers include the National Oceanic and Atmospheric Administration (NOAA), Federal Aviation Administration (FAA), State Departments of Transportation, and power utility companies.

Accordingly, the data generated by a wide variety of Vaisala systems serves as the raw input for both global and domestic forecast models.

As a country, we are currently faced with a number of challenges related to effectively mitigating the impacts of extreme weather. Some of these challenges are associated with the fact that the population of the country continues to steadily grow and its distribution is such that weather-related hazards can potentially have an increased impact. Moreover, our dependence on progressively complex, integrated networks and infrastructure (e.g. the transportation network and its operation) is placing more demand on the country's need to have effective, efficient weather and climate services that are second to none. This is clearly demonstrated by several events in our recent history including hurricane Sandy in 2012, the Colorado floods of 2013, the Moore, Oklahoma tornado during the same year, and the western drought, which is ongoing[1]. These events alone are responsible for more than 70 billion dollars in losses and over 190 fatalities.

> ***A fundamental element associated with our ability to reduce the impacts of these extreme weather events is the availability and use of reliable, accurate weather data that can be used for research, real-time weather analysis, and to drive the forecast models that we have come to depend upon. Most importantly, our success is dependent on a well-balanced approach that includes surface-based observations, aerial measurements, and satellite-derived data.***

In order for our nation to regain its preeminence in weather assessment and forecasting, it is going to require well-defined, concerted efforts from the entire weather enterprise, in other words, the public, private and academic sectors. Proper utilization of the pillars that make up the Enterprise will result in improvements in the effectiveness and efficiency associated with research and development, including research to operations, operational readiness and execution, and the timely delivery of accurate, reliable data and information to key decision-makers and stakeholders. Towards this end, NOAA has introduced the Weather-Ready Nation initiative and has recognized ambassadors such as Vaisala for their continuing contributions to improving our nation's resilience as it relates to mitigating the impacts of weather, water, and climate extremes. NOAA should be applauded for its efforts, as it has catalyzed a sense of urgency amongst the weather enterprise, while also convening a conversation about priorities and dependencies throughout the enterprise.

One important area where this has been demonstrated is in the area of lightning detection, and lightning data delivery. I would like to take a few minutes to share with you one example of how Vaisala has worked with the public and academic sectors to ensure the delivery of critical weather data for weather research and operations.

Vaisala designed, deployed, owns, operates and maintains the National Lightning Detection Network, also known as the NLDN. It is the longest continuously operating lightning network in the world. The network has been providing precision real-time continental-scale lightning data since 1989, and continues to be the foundational lightning dataset for the US Federal government. Lightning data from the NLDN is used by not only the National Weather Service

[1] https://www.ncdc.noaa.gov/billions/events

(NWS) but also the Federal Aviation Administration (FAA), Bureau of Land Management, National Aeronautics and Space Administration (NASA), the US Navy, the US Air Force and Army. Further, NLDN data is referenced in over 1000 scientific publications and serves as the definitive database for researchers and those in weather operations. The technology deployed in the NLDN has served as a template for numerous meteorological agencies around the world who, like the National Weather Service, continue to rely on high-quality observations for their meteorological operations.

The history of the NLDN is a powerful example of people and organizations in the private, academic and government sectors working together to achieve a common goal. The evolution of the NLDN from its inception to present day has been due to the efforts and dedication of numerous individuals and organizations. It involves too many contributions to reference in this testimony; however, I would like to specifically mention some key contributors such as the University of Arizona, the University of Florida, the National Severe Storms Forecast Center (NSSFC), the National Severe Storms Laboratory (NSSL), the Bureau of Land Management (BLM), the Office of the Federal Coordinator for Meteorology, State University of New York at Albany (SUNYA) and the Electric Power Research Institute (EPRI). These organizations saw the importance of the NLDN for both research and operational applications.

1983: The first NLDN lightning data recorded: a great achievement that demonstrates what scientific discovery, inter-organization cooperation and technology can achieve.

1987: The NASA Atlas/Centaur rocket was launched from Cape Canaveral Air Force Station in Florida, but within one minute after launch this unmanned rocket carrying a Pentagon satellite was struck by lightning and destroyed. After this incident NASA was able to secure financial support to receive real-time NLDN data.

1989: The NLDN provided complete coverage across the continental U.S.A. and with this expansion, real-time and historic NLDN lightning data were made commercially available. New application-specific software development began and customers in insurance, electric power, telecommunications and airports expanded their use of the NLDN data to validate claims, protect structures, airplanes, ground personnel, machinery, utility infrastructure and other lightning sensitive processes.

1992: A major technological improvement through a network-wide sensor and central processor upgrade was deployed. Better data quality increased the value of the NLDN to the Electric Power Research Institute (EPRI) and to the electric power industry as a whole and in the same year, the National Weather Service (NWS) signed an agreement to receive NLDN data. The data proved to be an integral part of the NWS's mission to provide weather forecasts and warnings to protect life and property.

1998: The Canadian Lightning Detection Network was seamlessly integrated with the NLDN, which benefited Canadian and American meteorologists with better visibility of severe storms and exchange of weather data. The combined networks today make up the North American Lightning Detection Network.

Over 30 years there have been numerous upgrades to the technology deployed in the NLDN. Sensor technology advancements and central processing innovation has delivered constant improvements in performance (detection efficiency, location accuracy, and characterization) with rigorous quality control reinforced by scientific peer review to assure users that they are receiving the highest quality data available.

The latest sensor upgrade to the network came in 2013 when we deployed the LS7002 Advanced Total Lightning sensors providing the federal government and other Vaisala customers with a more comprehensive view of lightning activity across the USA. The location accuracy of the NLDN improved to about 150 m in the interior of the network, and lightning counts grew significantly with the availability of total lightning.

The Vaisala and NOAA relationship continues today with Vaisala supplying real-time data feeds of NLDN and GLD360, Vaisala's long-range global lightning dataset, which is distributed to over 100 regional Weather Forecast Offices across the U.S. As a data customer, the Federal Government ingests raw data that is used as input for severe weather warnings and forecasting. Further, the ever growing archive of the nearly 25 million lightning cloud-to-ground strikes occurring every year is routinely used in research and forensic studies to better understand the role of atmospheric electricity in severe storms.

Much of the success of this lightning data delivery model is based on the contractual arrangement that has created a balance where the Federal government's usage and application of the lightning data is clearly defined, enabling Vaisala to successfully pursue lightning related business in other sectors, as well as outside of the United States. This has allowed Vaisala to generate revenue from other customers and markets that rely on lightning data. Accordingly, financial resources become available to be reinvested to improve the technology and its performance, improvements that the federal government has been able to share.

These performance improvements include uniformity of detection across CONUS, detection efficiency, location accuracy, and Advanced Total Lightning, all characteristics of lightning detection performance that the federal government values. This state-of-the-art data results in improved information for forecasting and supports better understanding of severe weather, establishing a win-win situation for all parties involved.

It is important to understand the Weather Enterprise has changed substantially over the last few decades, with a significant growth in private sector companies across the United States. Recent statistics suggest that over 350 U.S. commercial weather companies generate approximately $3 billion dollars a year in revenue[2]. Many of these companies, including Vaisala, have a strong capacity to create new, innovative products and services for weather-sensitive sectors. This includes the production and management of novel datasets, advanced forecasting techniques, and applications to support critical, weather-based decision making.

[2] http://knowledge.wharton.upenn.edu/article/todays-forecast-for-the-weather-business-increased-revenues-and-a-focus-on-innovation/

Vaisala takes approximately 10% of its annual net sales, or roughly $30 - 35 million dollars and invests in research and development activities, enabling new and improved technologies, services and applications. Due to the maturation of the private sector, including the investments made in research, development, and operations, it is no longer necessary for the public sector to assume the entire burden of the end-to-end process related to the production and dissemination of weather data and information.

In the right instances, the public sector should look to private sector companies for products and services as a way to increase efficiency and effectiveness of their operations, while reducing costs. The provisioning of commercial weather data is one clear area of opportunity.

While the commercial sector is poised to provide data and services that would support the mission of weather-related agencies such as NOAA, it is imperative that the Federal Government and other organizations obtain data that is proven to be accurate, precise, and reliable. This is vital since accurate, timely assessment of the atmosphere is at the foundation of weather analysis and forecasting.

This can be accomplished through many means. For example, only acquiring data that has been thoroughly assessed and verified, as evident from peer-reviewed scientific literature, or working with potential data providers to establish a verification campaign before entering into a binding contract, or using a third-party to conduct verification studies on the data prior to acquisition.

The benefits of obtaining commercial weather data for use in federal operations can be great. In many cases it may be possible to reduce the total cost of ownership compared to the traditional approach of procurement deployment, operation and maintenance of infrastructure. However, both the government and private sector need to recognize their mutual dependence on each other.

Through proper contractual language, internal controls and appropriate data licensing and redistribution policies, the economic value of commercial data can be maintained while simultaneously serving as an important input to federal operations. Furthermore, as the concept of commercial data buys matures, the clarity of roles and responsibilities of the public, academic and private sectors becomes clearer. Through this balanced understanding it then becomes possible to create a symbiotic development environment that focuses on the sustainable evolution of the ecosystem that is the weather enterprise.

Thank you very much for the opportunity to present this testimony. I would be happy to answer any questions or provide more information at your convenience.