

**House Committee on Science, Space, and Technology, Subcommittees on Research and Technology  
and Oversight Hearing**

**NEON Warning Signs: Examining the Management of the National Ecological Observatory Network**

**September 18, 2015**

**Introduction**

Distinguished Chairwoman Comstock and Chairman Loudermilk, Ranking Members Lipinski and Johnson, and other members of the Research and Technology and Oversight subcommittees, my name is Dr. James Collins. Thank you for the opportunity to testify today.

I serve as Chairman of the Board of Directors of NEON, Inc., a 501(c)(3) corporation established to implement NEON, or the National Ecological Observatory Network, which I will also refer to as the "Observatory." The NSF supports this project. From 2005 to 2009, I served as Assistant Director for Biological Sciences at NSF. Since 2010, I have had no formal affiliation with the agency.

In this testimony, I will first provide an overview of the importance of the NEON project and explain how we are on a path to achieving the project's scientific goals. I will then detail the positive and transparent working relationship that NEON, Inc. has with the NSF. I will also provide a closer look at the circumstances related to the discovery of potential cost overruns and how NEON, Inc. is working with NSF to craft a strategy designed to ensure that additional rescopes will not be necessary.

**Importance of the NEON Project and Its Commitment to High-Level Science Requirements**

NEON is an advanced research infrastructure for the study and analysis of the biosphere on a regional to continental scale. Living systems are experiencing some of the greatest rates of alteration caused by multiple changes in the environment. Understanding how these changes affect our natural resources and ultimately humans requires a fully integrated, multi-scale research infrastructure to detect, understand, and forecast changes. The project was designed by the ecological research community to address this need. With its geographically diverse network of cyber-enabled instruments and sensors, NEON provides the scale, infrastructure, and data we need to better understand our changing environment at an unprecedented level of detail and successfully forecast and respond to these changes.

NEON is not only an essential investment for continued U.S. scientific leadership and long-term competitiveness; it is also a vital component to sustaining our Nation's commitment to fueling scientific innovation and advancing cutting-edge ecological research. This research will allow us to analyze, as never before, the impacts of large-scale environmental changes on our ability to sustainably meet society's food, fiber, energy, and water needs.

At its conception, NEON adopted an approach commonly used by science projects of similar complexity and scale. The approach demands a stringent set of science requirements to meet the project's needs and produce the data to enable transformational science. A six-member NSF review panel and the 17-member NEON Science, Technology and Education Advisory Committee reviewed these requirements. Among the reviewers were distinguished university professors, members of the US National Academy of Sciences, and technology experts from private industry. These requirements are encapsulated in a July

2009 document titled “The NEON Strategy: Enabling Continental Scale Ecological Forecasting” produced by NEON, Inc.

### **Recent Changes Will Not Alter NEON’s Commitment to Science**

Despite recent changes to the project, NEON’s high-level science requirements have not and will not be compromised. As required by NSF’s Division of Acquisition and Cooperative Support management letter to NEON, Inc., we are aggressively working on the details of executing against the recommended strategies for rescoping the Observatory. We hold paramount the preservation of high-level science that give NEON the power to enable transformational continental-scale science.

The recent changes to, or “rescope”, of the Observatory was guided by a group of NSF, NEON Inc., and community experts convened in July 2015. But the discussion did not start then. Five months earlier, in February 2015, NEON, Inc. staff members initiated discussions to explore strategies for cost savings through improved efficiencies and restructured processes. During these discussions, the NEON, Inc. staff proposed recommendations that, ultimately, formed the backbone of the project rescoping. NEON, Inc.’s goal through these discussions was to scale back the project as necessary while preserving the geographical breadth and diversity of the Observatory’s footprint.

For 100 years, the Ecological Society of America (ESA) has represented the voice of the ecological community. As a testament to NEON, Inc. and NSF’s preservation of the project’s scientific integrity and continued utility, current and past presidents of the ESA recently issued a joint statement supporting the goals and missions of NEON notwithstanding the proposed changes.

Under the rescoped configuration, NEON will continue to build and then collect data at 81 of its original 96 sites. The essential “core” NEON sites – twenty scientific anchor-points that span the continent – all remain part of the national site constellation. Already, 33 NEON sites are publishing freely accessible data collected by field personnel and *in-situ* sensors. The NEON airborne observation platform – consisting of a state-of-the-art spectrometer, an advanced LiDAR system, and a high-resolution visible-wavelength camera – has thus far acquired imagery data over eight sites. The scientific community has resoundingly expressed its enthusiasm for this type of high-resolution airborne data, which has never before been acquired at the scale and frequency planned by NEON. Our expectation is that the project will yield significantly more data in 2016, and a completed Observatory by 2017, in line with our mandate from NSF.

The community recognizes the potential for transformational science enabled by free and open ecological data. Accordingly, NEON, Inc. scientific staff have presented at approximately 50 different venues every year for the past three years. Many of these are invited talks, reflecting the broad array of topics and disciplines about which the research community has expressed a desire to learn. Workshops are useful in pushing the community to think about new opportunities and research directions, and NEON, Inc. responded by organizing an average of six workshops every year between 2012 and 2014. These types of engagement activities are discussed regularly with the Board of Director’s Communications Committee, which, together with NSF observers, meets with NEON, Inc. staff members to assess emerging community needs.

### **NEON, Inc.’s Working Relationship with NSF**

NEON, Inc. works hard to maintain a strong working and transparent relationship with the NSF staff. To manage a project as scientifically and technically challenging as NEON, NEON, Inc. staff members have

weekly calls with the NSF lead Program Director, often accompanied by other NSF staff members. In addition, monthly Major Research Equipment and Facilities Construction, or “MREFC”, Cost Schedule and Technical Status reports are submitted to NSF. The information in these reports includes: a running, prioritized, summary risk register that lists project activities that may have an impact on the project’s schedule and costs, project performance metrics related to major components of the Observatory, an explanation of departures from expected metrics, status of securing permits for sites, and other information. The main purpose of these reports and meetings is to ensure that NSF is kept informed of the status of the project as work moves ahead.

External experts convened by NSF also perform reviews of the project’s progress at least annually. During these reviews, performance of the project is examined to ensure that resources are being used effectively, progress is on track, risks are being monitored, etc. It is important to note that these review committees operate independently of NSF and are composed of distinguished scientists, engineers, and managers of other MREFCs to ensure a thoughtful, insightful, and critical assessment of the project by some of the best minds in the scientific community. The major NSF reviews since the construction award in August 2011 are as follows:

- November 2011, business systems review;
- January 2012, operations review;
- October 2012, annual construction review #1;
- May 2013, baseline schedule and cost review;
- December 2013, annual construction review #2;
- August 2014, baseline schedule and cost review; and
- December 2014, annual construction review #3.

In short, NSF has been and remains a valuable partner of NEON, Inc. as we work to achieve the project’s unique and exciting mission.

But we do not rely exclusively on NSF-organized peer reviews. NEON, Inc. also convenes its own reviews. Such reviews involve external members of the community, are observed by the NSF staff, and are convened in consultation with the NEON, Inc. Board of Directors and the Board’s independent Science, Technology, and Education Advisory Committee, or “STEAC.” A Science Capability Assessment was conducted in September 2014 to develop a framework for assessing the capabilities of NEON’s infrastructure to help NEON, Inc. better understand how the infrastructure could be used by the research community. The report was developed by a panel of six scientists composed of two members of the NEON, Inc. Board of Directors, two STEAC members, and two distinguished members of the ecology community. In addition, a Cyberinfrastructure Architecture Assessment was conducted in March 2015 to provide independent critical assessment and guidance on the Database, Software, and System Architecture and its ability to meet the needs of NEON user communities.

A NEON Project Advisory Committee, or “NPAC”, also has provided independent critical assessment and guidance during the construction of the Observatory. The NPAC draws on expertise from the following areas: project management, systems engineering, engineering design and execution, project controls (schedule and budget), manufacturing, cyberinfrastructure design and development, large project contract administration and agreement structuring, and distributed operations management and oversight.

Findings from NSF and NEON reviews are shared with the NEON, Inc. Board of Directors. In almost all cases, the Board and STEAC appoint observers from within their ranks to attend such reviews. The Board convenes a conference call every month with senior NEON, Inc. staff members. Major developments, including the outcomes of reviews and important communications from NSF, are shared with the Board during such calls. Three in-person Board meetings are held every year, which further facilitates in-depth deliberation regarding strategic issues. NSF representatives attend these in-person Board meetings and regularly participate in the proceedings.

Our Board of Directors is also structured to afford the NEON user community a key voice in overseeing and reviewing the project. In accordance with the NEON, Inc. bylaws, roughly half of the Board members are elected by the NEON, Inc. institutional membership. The remaining members are elected by the Board itself to discharge essential oversight and fiduciary responsibilities. Fiduciary oversight is entrusted to a standing Finance Committee of the Board. The standing Communications Committee of the Board provides guidance to the staff on community interaction. Where relevant, NSF staff members also participate in committee meetings.

### **NEON's Construction Budget**

Your invitation letter indicates that the subcommittees would like to discuss NEON's construction budget and, specifically, a gap between the construction budget approved in 2011 and NEON's current construction budget. This gap, identified as \$80M, is the result of underestimated costs in three categories and their impacts cascaded across the project execution. The categories, and their relative contribution to the gap, are as follows:

- Production costs and technology development (approximately 50% of gap);
- Permitting challenges (approximately 25% of gap); and
- Transitioning of Observatory elements to Operations (approximately 25% of gap).

I will discuss each category in turn.

### Production & Technology

The establishment of a sustainable supply chain for procurement and production of sensor assemblies has presented challenges since the beginning of the project. For example, it was difficult to find the right suppliers who could adhere to a demanding project schedule while complying with the quality standards required of a thirty-year Observatory. In addition, actual costs for production materials during construction were higher than estimated. NEON, Inc. addressed these challenges during 2014 by re-organizing the complete supply chain to better facilitate the production process.

Standardized, quality-assured, and consistent data are integral to the design of NEON: the nature of the technology required to collect, process, and deliver data for a project of this scale is complex. In addition, delays in developing these technologies directly affect the project's ability to transition working field sites to Operations. To address computing and data delivery challenges, a Cyberinfrastructure Architecture Review was conducted during March 2015 by NEON, Inc.: resulting recommendations are currently being implemented and will lead to improvement of data generation and delivery efficiency, as well as the data product development process. Consequently, during the past year, NEON has published data from 30 additional sites to the NEON web portal for use by the scientific community.

## Permitting

Securing site permits and negotiating land use agreements has proven more difficult than expected during construction and has created a cascade of unanticipated construction costs. For example, the difficulty in negotiating land use agreements with some site owners resulted in further delays in finalizing the construction of observation sites and implementing organismal sampling. Additionally, the number of permits required per site to build the NEON infrastructure was underestimated by a factor of 10, as well as the effort required to obtain these permits. To remediate these issues, the Deputy Project Manager has direct supervision of permitting activities as of August 2014. This control measure has helped better identify the problem and address the permitting efforts more efficiently.

## Transition of Observatory Elements to Operations

Finally, delays in the transition of Observatory elements to operations contributed to the gap. Reaching a set of criteria for transitioning elements of the Observatory to operations continues to pose a challenge because the deliverables were originally defined with many interdependencies, making certification of completion difficult to accomplish. As a result, the transition to operations timeline has been delayed and the costs incurred stem from carrying these elements in construction. NEON, Inc. and NSF are currently collaborating to resolve this issue.

## **Rescoping of NEON**

The budget revisions discussed above necessitated the rescoping completed this past July. It is important to note that NEON, Inc. has not requested nor received additional construction funds; the rescoping activities are intended to enable the project to complete construction on time and on budget without compromising its scientific integrity. The rescoping included:

- Constructing 41 relocatable sites instead of 55 while retaining all core sites;
- Removing the STReam Experimental Observatory Network (STREON) component from the construction project due to permitting challenges; and
- Eliminating the Biogenic Gas Measurement System due to immature technology.

NSF has a strong track record in building MREFC projects that have proven to be scientifically transformative and successful. However, building complex, large-scale scientific projects is always challenging. Adjustments in scope are often necessary along the way given that these projects extend the boundaries of science, engineering, and technology; this process is iterative in nature. At least five previous NSF MREFC projects underwent scope revisions, management adjustments, and instrument configuration changes during construction based on challenges with increased costs for production of instrumentation, delayed site permitting, and schedule delays. In the long run, all of these facilities will enable scientific discovery far beyond current understanding and provide enormous benefit to American citizens.

## **Overarching Financial and Management Modifications to Prevent Further Rescoping**

NEON, Inc. is committed to ensuring that further rescoping will not be necessary in the future. Together with NSF and independently, we are taking steps not only to develop and share better information in a timelier manner, but also to fundamentally change the processes we undertake in order to ensure that NEON is on track, and within budget. Let me briefly discuss some of these steps.

First, and as noted, NEON, Inc. has addressed the issues that led to the rescoping by, among other things, reorganizing its supply chain to better facilitate the production process and imposing new control measures on permitting activities.

Second, NEON, Inc. is working closely with the NSF to revise cost estimates and to ensure that adequate systems and estimating methodologies are implemented. To assist in this process, NEON, Inc. has hired independent cost and schedule consultants who are working very closely with the project on detailed cost estimates. NEON, Inc. is also working with the NSF to evaluate the progress of the revised cost estimate, which is slated for completion by December 1st.

Third, NEON, Inc. is now providing a comprehensive monthly financial report to the NSF that includes detailed explanations of expenditures by budget line item and functional areas with the sources of funding clearly identified. In addition, NEON, Inc. is providing the NSF with complete general ledger detail of all transactions. This additional reporting and oversight will allow the NSF to review the expenditures in more detail on a monthly basis so that any areas of concern can be identified quickly and discussions and resolutions can take place immediately.

Fourth, NEON, Inc. is developing a comprehensive strategy for improving management efficiencies and identifying potential cost reductions in the construction project as well as the support functions. The strategies identified include reorganization of leadership of the company to improve effectiveness and to reduce overall costs of management of the company, a review of all staff positions to determine any duplications of effort and to identify potential consolidation of functions and possible reductions in force, an evaluation of outsourcing opportunities in various departments to ensure that staff is focused on its core functions and staff time is better utilized, a complete review of fringe benefits offered to all employees to identify potential cost reductions, and a complete review of all other cost categories to ensure that costs are maintained and kept to an appropriate level to support the project.

### **Closing**

NEON, Inc. understands that, in its pursuit of scientific goals, it must not sacrifice responsible stewardship of taxpayer dollars. That is a lesson to which we will strictly abide as we continue to monitor our construction schedule and budget and work toward completing the Observatory and deliver a ground-breaking research infrastructure for our nation's long term understanding of our ecosystems.

Thank you, and I welcome your questions.