



Science and Engineering Alliance, Inc. (SEA) and the
National Ecological Observatory Network, Inc.
(NEON) Partnership



Broadening Participation In Large-Scale Research Initiatives

The SEA-NEON Partnership

The Science and Engineering Alliance, Inc. (SEA) and the National Ecological Observatory Network (NEON), Inc., propose to build the foundations for the participation of underrepresented minority institutions and students in NEON science and education. The SEA-NEON Partnership will broaden the awareness and increase the capacity of the Historically Black Colleges and Universities (HBCUs) and Minority-Serving Institutions (MSIs) to conduct and participate in NEON ecological, engineering, cyber-infrastructure, and social science research and development (R&D) opportunities.

This partnership will increase networking with NEON and its partners. These opportunities will be afforded to these institutions as NEON evolves over its expected life cycle of 30+ years. The ongoing inclusion of faculty members and undergraduate and graduate students at the HBCUs and MSIs is essential to the success of NEON science as national demographics for minorities and women change in the coming years. This expected outcome of increased awareness and broadened participation of the HBCUs and MSIs in NEON supports the NEON goal to expand capacity for science and education to traditionally underrepresented groups.

The benefits of the SEA-NEON Partnership to the HBCUs and MSIs are their increased awareness of and understanding of what NEON is and how their involvement can broaden participation of minorities in the ecological and environmental sciences. An ongoing problem with HBCUs and MSIs over the past years has been students and faculties at these institutions are disproportionately underrepresented in the ecological and environmental sciences. This Partnership serves to broaden the faculties', administrations', and students' (both undergraduate and graduate) outlook on climate change and its impact on their surrounding communities and the continental-scale ecology through the NEON vision and mission. In addition, this Partnership serves to support NEON's education and outreach goals to:

- ❑ Promote and facilitate public understanding of ecological science (i.e., ecological literacy), including the fundamental ecological principles;
- ❑ Diversify the ecological research community;
- ❑ Provide tools for students, educators and decision-makers to use NEON data to make informed decisions about ecological issues; and
- ❑ Educate the next generation of ecologists to understand complex ecological systems and their associated changes.

About SEA

SEA was founded in 1990 as a nonprofit consortium to serve four state-supported HBCUs and the Lawrence Livermore National Laboratory (LLNL). The four HBCUs are Alabama A&M University (AAMU), Jackson State University (JSU), Prairie View A&M University (PVAMU) and Southern University and A&M College in Baton Rouge (SUBR). SEA's mission is to enhance the combined research and training capabilities of the consortia and thus to ensure that qualified scientists and engineers are prepared for the workforce.



The SEA uses the combined strengths of the consortium as a "virtual university" to meet the research and development needs of the public and private sectors. SEA's purpose is to ensure the nation has an adequate supply of globally competitive American scientists to meet the nation's workforce needs now and into the future. SEA services include technical marketing and community relations; development of training and experimental programs for faculty and students; and creation of partnership opportunities with public and private sectors.

In 2005, SEA was invited to join in the NEON discussion. In 2006, SEA received funding from the National Science Foundation (NSF) to support the creation of a team of individuals from HBCUs and other MSIs to develop a proposal to address pertinent issues in environmental science relative to the NEON science questions. Later in 2006, a team of research faculty at HBCUs and MSIs was brought together to learn more about NEON. In 2007, the team submitted a response to the NEON Request for Information (RFI) in the area of Phosphorous Dynamics.

About NEON

NEON is a continental-scale research platform for discovering and understanding the impacts of climate change, land-use change, and invasive species on ecology. NEON will gather long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere, and atmosphere. NEON is a national observatory consisting of distributed sensor networks and experiments across 20 domains, linked by advanced cyberinfrastructure to record and archive ecological data for at least 30 years. Using standardized protocols and an open data policy; NEON will enable better understanding of the management and impacts of biofuels, watersheds, grazing lands, coastal ecosystems, and other vital systems. The Observatory will provide data streams for next-generation ecological forecasting capability, catalyzing the use of ecological forecasts for resource decisions and adaptive management in a range of situations. NEON will support an early warning system for the impacts of climate change, invasive species, and emerging diseases. Specifically, NEON is designed to investigate:

- ❑ Climate change impacts
- ❑ Land use impacts
- ❑ Invasive species
- ❑ Biogeochemistry
- ❑ Ecohydrology
- ❑ Biodiversity
- ❑ Disease ecology

Current NEON science experiments are:

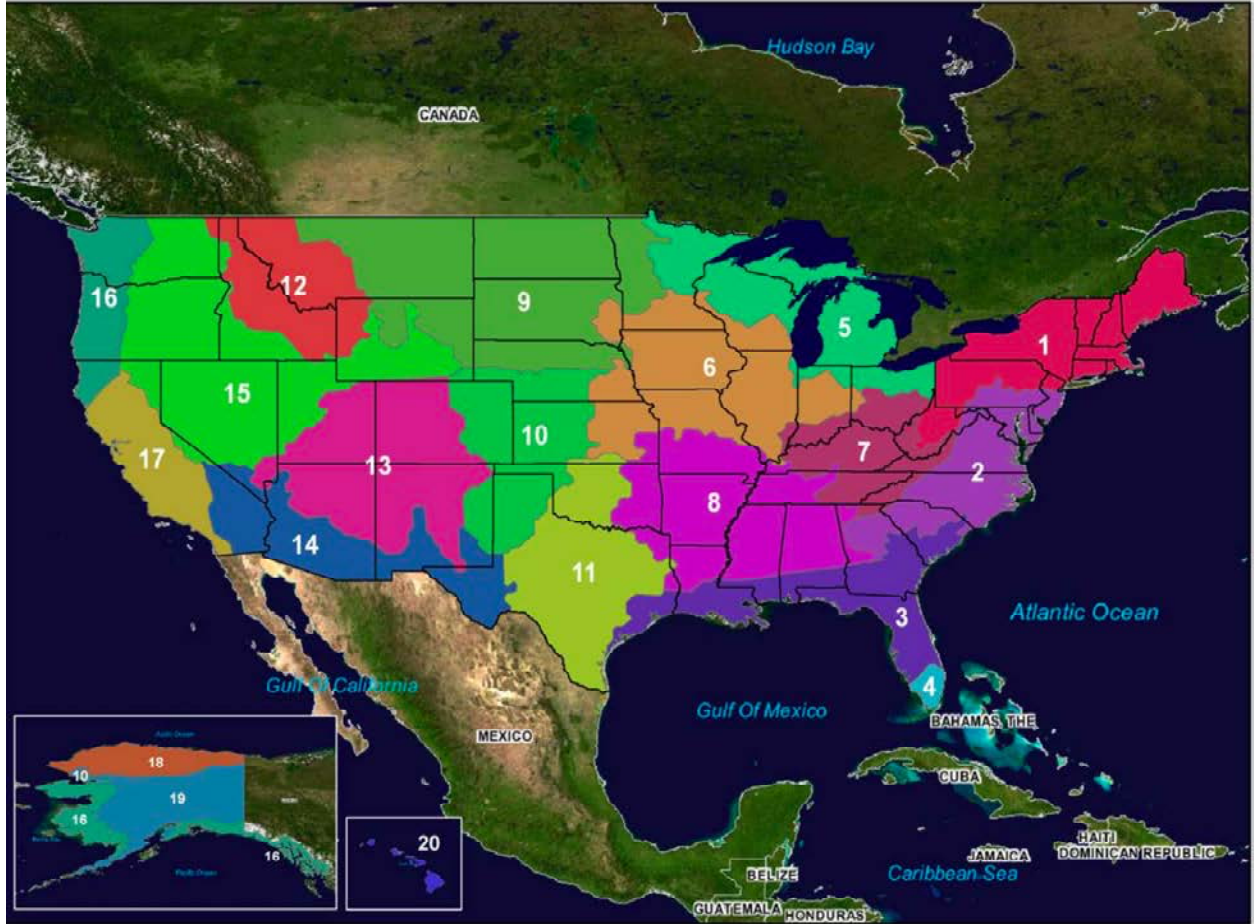
- ❑ Fundamental Sentinel Unit (FSU),
- ❑ Fundamental Instrument Unit (FIU),
- ❑ Aerial Observatory Platform (AOP),
- ❑ Mobil Deployment Platforms (MDPs),
- ❑ Land Use and Analysis Package (LUAP),
- ❑ Cyberinfrastructure (CI), and
- ❑ NEON Satellite Site ((NSS).



NEON Domain Core Sites

NEON Domain Core Site Locations			
No.	Domain Location	Domain Name	Domain Relocatable Strategy *
1	Northeast	Harvard Forest	C, L
2	Mid-Atlantic	Smithsonian Conservation and Research Center	L, I
3	Southeast	Ordway-Swisher Biological Station	L
4	Atlantic	Neotropical Guánica Forest (Puerto Rico)	L
5	Great Lakes	University of Notre Dame Environmental Research Center (UNDERC)	L
6	Prairie Peninsula	Konza Prairie Biological Station	L
7	Appalachians/Cumberland Plateau	Walker Branch Watershed (Oak Ridge National Laboratory)	C
8	Ozarks	Complex Talladega National Forest	C
9	Northern Plains	Woodworth Field Station	L
10	Central Plains	Central Plains Experimental Range (1)	C
11	Southern Plains	Caddo/LBJ National Grassland (Unit 41)	I
12	Northern Rockies	Yellowstone Northern Range	L
13	Southern Rockies / Colorado Plateau	Niwot Ridge (1)	L
14	Desert Southwest	Santa Rita Experimental Range	C, L
15	Great Basin	Onaqui-Benmore	L
16	Pacific Northwest	Wind River Experimental Forest	L
17	Pacific Southwest	San Joaquin Experimental Range NEON Krew Courtwright Road	C
18	Tundra	Toolik Lake (2)	C
19	Taiga	Caribou-Poker Creeks Research Watershed (2)	C
20	Pacific Neotropical	Laupahoehoe Forest Unit/ Hawaii Experimental Tropical Forest	I

* Key: C = Climate Change Impacts
 L = Land Use Impacts
 I = Biological Invasion



- domains
- | | | | |
|-------------------------|--------------------|----------------------|---------------------|
| 1 North East | 6 Praire Peninsula | 12 Northern Rockies | 18 Trundra |
| 2 Mid Atlantic | 7 Appalachia | 13 Southern Rockies | 19 Taiga |
| 3 Southeast | 8 Ozarks | 14 Desert Southwest | 20 Pacific Tropical |
| 4 Atlantic Neo Tropical | 9 Northern Plains | 15 Great Basin | |
| 5 Great Lakes | 10 Central Plains | 16 Pacific Northwest | |
| | 11 Southern Plains | 17 Pacific Southwest | |

NEON will make observations across the continental United States (including Alaska, Hawaii, and Puerto Rico). Using a rigorous statistical analysis, NEON partitioned the United States into 20 eco-climatic Domains that represent the ecological and climate diversity of the continental United States.

Across these 20 Domains NEON will include three types of ground-based deployment or observing systems: Core, Relocatable, and Mobile sites. Each domain will host a fully instrumented core site in a wildland area. Two Relocatable units, on the average, will be deployed in each domain to address intensively impacted ecosystems. The Relocatables will be in place for 3 – 5 years, and can be moved in future deployments. Each domain will have a domain relocatable strategic theme related to the research questions attributed to that geographical area, e.g.: C = Climate Change Impacts, L = Land Use Impacts, and I = Biological Invasion. In addition, NEON mobile systems (on vehicles or towed by vehicles) will be deployed in each domain to study sudden changes to the landscape, such as wildfires or the emergence of an invasive species. These mobile systems may also be deployed for educational and outreach purposes.

A secondary outcome of this SEA-NEON Partnership will be a listing of the research and development (R&D) and education and outreach (E&O) capabilities of HBCUs and MSIs that can be utilized to facilitate the NEON Mission, which is “to provide the capacity to forecast future states of ecological systems for the advancement of science and the good of society.”

Increasing the awareness and understanding of NEON provides a unique opportunity for the science faculty to subsequently teach ecology at larger spatial and temporal scales than possible through traditional field and lab experiences. The site visits and presentations serve to provide an awareness of the factors that influence of negative ecological outcomes and the roles faculty and students can play to reverse these trends (4). The continual involvement of the schools in NEON science coupled with the availability and quantity of NEON data offers an unprecedented opportunity for faculty and students to be at the forefront of ecological research either through NEON-related curriculum development, classroom exercises, through research and development projects, or through long-term careers in NEON-related science.

NEON Science Packages

The Fundamental Instrument Unit (FIU) will observe physical and chemical climate, soil properties, and carbon fluxes. Instrumental measurements of water quality are included. The FIU consists of fixed towers in wildland or managed areas, co-located with soil and aquatic sensor arrays. The FIU will be deployed in core, relocatable, and mobile versions.

The Fundamental Sentinel Unit (FSU) supports measurements of organisms, soil, hydrology, and aquatic processes using teams of trained local field crews, supervised by local scientists and specialists in regional flora and fauna. The FSU will observe and sample a variety of organisms, including deer mice, birds, fish, mosquitoes, ground beetles, microorganisms, and vegetation. Samples will be stored for future analyses. FSU observations will be made at core, relocatable, and mobile sites.

Fundamental Instrument Unit (FIU)

The Airborne Observation Platform (AOP) features an aircraft mounted hyperspectral instrument and LiDAR used to collect the three-dimensional distribution of plant canopies and topographic data. These instruments will provide regional information for scaling and extrapolation of data from all NEON research sites, which will give researchers detailed information at core, relocatable, and target-of-opportunity sites.

The Land Use Analysis Package (LUAP) will support comprehensive assessment and analysis of patterns, change, and drivers of land use, land cover, and land management. It will provide geographical information to the ecological community through a capable and user-friendly interface. The LUAP will include land use and land management data from remote sensing imagery, as well as governmental and private archives.



Land Use & Analysis Package



Aerial Observatory Platform

The Mobile Deployment Platforms (MDPs), which provide basic FIU capabilities and FSU support in a rapidly deployable package, will be used for a variety of NEON educational and scientific activities. MDPs will include a transportable laboratory containing basic working space, data communications for the sensor network and data store and forward capability to record and secure data. MDPs will include power distribution for NEON and investigator-supplied instruments that can be connected to line, generator or photovoltaic systems. The MDPs will be built using the same basic designs as the FIU as implemented at Core and relocatable sites. Components will be optimized for rapid setup and takedown, to maximize research time. A main design of a MDP is that most data transfer will be wireless to decrease installation time and materials cost and to increase installation flexibility.

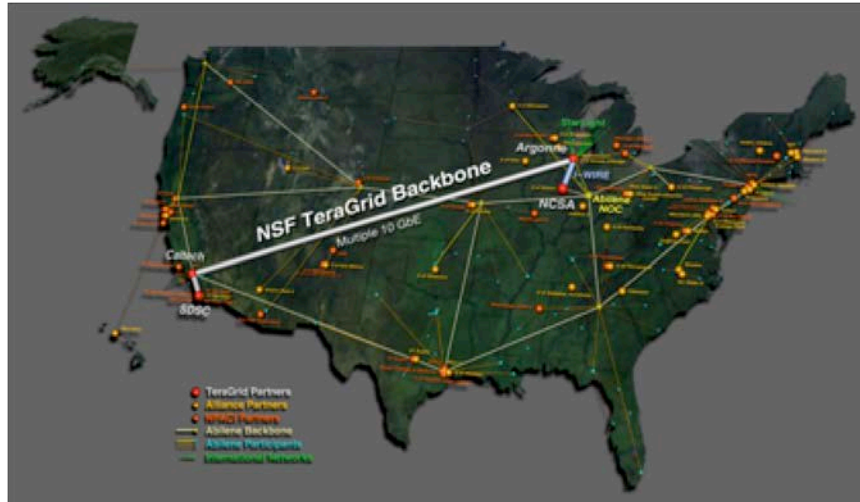
The MDPs will also serve as a base for FSU activities, and will include plot marking and locating equipment, a library of FSU protocols, data entry forms, field equipment and field data entry devices. FSU field crews on MDPs would normally be trained by NEON staff, but will be staffed and funded by the requesting investigator(s). MDPs will provide on-the ground capability to respond to abrupt ecological or environmental events such as forest fires or floods. MDPs events will be managed to retain the flexibility to react in very short turn-around times to these events.



Mobile Deployment Platforms (MDPs)

Cyberinfrastructure

The NEON cyberinfrastructure (CI) will transform data generated from the FIU, FSU, AOP, LUAP and NSS into information that can be used for next-generation ecological forecasting. Raw data are transformed into measurements and different levels of data products through a set of well-documented algorithms with rigorous quality control at sensor, measurement, and product levels. The algorithms themselves will be developed in the scientific community as an integral part of research activities. NEON will identify the initial suite of data products and define the mathematical, statistical, and computational requirements for the algorithms that compute them. Additional requirements that will be identified include the documentation, curation, and dissemination of data products for a variety of scientific and educational audiences.



NEON Cyberinfrastructure Backbone

SEA NEON Satellite Site (NSS)

SEA is developing and implementing a series of modular designed operations across the domains that are designated as NEON Satellite Sites (NSSs). A NSS is a mechanism that allows investigators, faculty, students (undergraduate and graduate), citizens, educators, and other interested groups from underrepresented communities and the public to access NEON's data and data products and their physical and information infrastructures to address science questions that impact their communities and that in turn address the seven grand challenges. A NSS may incorporate into its infrastructure, depending on the scope and complexity of proposed scientific experiments, certain aspects of the FIU, FSU, CI, and LUAP. The NSS infrastructure will include as a key component its reliance on adherence to NEON data, calibration and validation, and performance standards. These standards will define how instruments and observations interface to the overall NEON infrastructure. For the sensors, instruments, data products and methodologies used in NSS experiments, the standards for data format, and metadata will be defined, documented and publicly available. The NSS experiments proposed by the SEAPON institutions, HBCUs, MSIs and other smaller majority schools shall be assessed by NEON staff for management and technical feasibility and for scientific merit by the NEON Program Assessment Committee (PAC).



NEON, INC.

**Science & Engineering
Alliance, Inc.**

NEON Satellite Site (NSS) Framework
(Mission to "broaden participation of underrepresented groups in NEON science")

**NSS User Group
1**

**Locations:
Domain Core
Site**

Prospective Users:

- HBCUs
- MSIs
- Smaller Majority Schools
- Organizations with interest in Ecology

**NSS User Group
2**

**Locations:
Within Domain,
but not at a Core
Site**

Prospective Users:

- HBCUs
- MSIs
- Smaller Majority Schools
- Organizations with interest in Ecology

**NSS User Group
3**

**Locations: Access
through EO web
portals**

Prospective Users:

- Citizen Science Groups
- K - 12 Schools & Educators
- Decision-Makers
- Undergraduates
- HBCUs, MSIs
- General Public
- Smaller Majority Schools
- Organizations with interest in Ecology

The next series of tables presents NEON activities that SEA representatives participated in over the past nine months.

Summary of SEA Participants in NEON Events

Event/Location/Date	Attendee representing SEA	Summary
<p>NEON Cyberinfrastructure (CYI) Review Boulder, CO February 10-11, 2009</p>	<p>Dr. Zhengmao Ye, Ph. D Assistant Professor Department of Electrical Engineering Southern University Baton Rouge, LA</p>	<p>The CYI subsystem review panel was charged to evaluate the CYI the maturity and completeness of the CI requirements, the robustness of the design, and review the current budget and construction [planning. NEON CYI Product Team will address the panel's comments in preparation for the Preliminary Design Review (PDR) in June 2009.</p>
<p>Aerial Observatory Platform (AOP) Subsystem Review Boulder, CO February 12-13, 2009</p>	<p>Dr. Frank Archer, Professor and Director, Office of Institutional Research and Planning (OIRP), Alabama A&M University Normal, AL</p>	<p>This purpose of the 1.5-day review was to have a panel of five subject matter experts review AOP technical requirements, system design and operations concepts, and to assess the balance of capability, cost and technical/programmatic risk that is proposed. This review was an essential step in the NEON development process to guarantee that the AOP will serve the scientific community in advancing our understanding of the impacts of climate change, land-use change, and invasive species on ecology at the continental-scale.</p> <p>The panel's overall assessment of AOP design as captured in the panel report was "highly positive." The panel endorsed the early findings of both the NEON Science, Technology, and Education Advisory Committee (STEAC) and the NSF review panels that a third payload would provide an important backup, reduce risk in the tightly constrained operations schedule, and provide a significant increase in NEON's ability to acquire remote sensing data for targets of opportunity events and associated principal investigator-lead science. In this review, important comments and recommendations were given for improving the design, development and operations of the NEON AOP. These items will be addressed in preparation for the June NEON PDR.</p>

Event/Location/Date	Attendee representing SEA	Summary
<p>Fundamental Instrument Unit (FIU)/Engineering (ENG) Subsystem Review Boulder, CO April 23-24, 2009</p>	<p>Dr. Paulinus Chigbu Associate Professor & Director, NOAA Living Marine Resources Cooperative Science Center University of Maryland, Eastern Shore Princes Anne, MD</p>	<p>The review of the FIU subsystem outlined the scientific and technical requirements, the integration with Engineering, and the FIU program elements. Documents reviewed including the science requirements, technical and operating requirements, data products, system architecture requirements, and design document and construction and operations budgets. The review also discussed the effect of NEON project de-scoping on FIU science and traceability.</p> <p>The Product Leads for FIU and ENG are addressing each of the comments to ensure that the FIU design meets its scientific and infrastructure requirements and is assessing their recommendations for further planning activities. A review panel responded positively to the FSU design and had minor suggestions for design modifications to be included in the June PDR.</p>
<p>Fundamental Sentinel Unit (FSU)/Aquatics/Stream Experimental Observatory network (STREON) Subsystem Review Boulder, CO April 21-22, 2009</p>	<p>Dr. Paulinus Chigbu Associate Professor & Director, NOAA Living Marine Resources Cooperative Science Center University of Maryland, Eastern Shore Princes Anne, MD</p>	<p>FSU held a subsystem design review in Boulder on April 21-22. A review panel responded positively to the FSU design and had minor suggestions for design modifications. FSU will respond to the review comments by the PDR in June.</p> <p>This review also included review of the Aquatic/STREON subsystems. Aquatic/STREON is designed to measure the effects of climate change, land use change, and disturbance on aquatic ecosystem structure and function. The review panel generally had only minor suggestions for the AQU/STREON subsystems for preparation for the PDR to be held in June 2009.</p>

Event/Location/Date	Attendee representing SEA	Summary
<p>Education and Outreach Subsystem Review Boulder, CO April 8-9, 2009</p>	<p>Dr. Mary McKenna Associate Professor Department of Biology Howard University Washington, DC</p>	<p>The EO Subsystem Panel reviewed EO documents to assess the robustness of the EO design and completeness of the budget and deployment planning. The EO Panel was to consider the following questions:</p> <ul style="list-style-type: none"> • Does the EO plan meet the goals of NEON EO? • Is the EO Plan sufficiently defined to allow program planning to commence? • Are there recommendations for further planning activities or documentation that should be done before the PDR in June? <p>The panel recommended changes to the construction budget, operations budget, education sections of the EO section of NEON operations plan, schedule, and staffing plan for Education component of project. Changes were made and presented at the PDR in June 2009.</p>
<p>Preliminary Design Review (PDR) Boulder, CO June 9-12, 2009</p>	<p>Dr. Robert Shepard Executive Director, SEA Washington, DC</p> <p>Mr. Don Bowie SEA NEON Program Manager SEA Washington, DC</p>	<p>NEON, Inc. teams presented detailed project scope, budgets, designs, risks, and project management strategies for construction and operations of the NEON project to construct a continental-scale ecological observatory to a panel of reviewers convened by the NSF. The panelists evaluated project plans and outlined issues the NEON project must address prior to Final Design Review (FDR) in November 2009.</p> <p>NEON, Inc. passed the PDR by the NSF, a major milestone in the design and execution of the project and is preparing final design and operational documents for the FDR...</p>

Event/Location/Date	Attendee representing SEA	Summary
<p>National Science Foundation Large Facilities and AST Safety Workshops April 14-18, 2009 Tucson, AZ</p>	<p>Mr. Don Bowie SEA NEON Program Manager SEA Washington, DC</p> <p>Dr. Mokola Abdullah Dean, Florida A&M University (FAMU) College of Engineering Sciences, Technology and Agriculture (CESTA) Tallahassee, FL.</p> <p>Mr. Shelton Swainier Assistant Dean for Operations & Strategic Initiatives College of Science, Engineering & Technology Jackson State University Jackson, MS</p> <p>Dr. Safwat H. Shakir Professor, Computer Science Department and Director of Texas Gulf Coast Environmental Data Center (TEXGED) Prairie View A&M University, Prairie View, TX</p>	<p>Scientists from the three SEA schools and the SEA NEON PM attended these workshops. Three workshops, cosponsored by the National Optical Astronomy Observatory (NOAO), were conducted over four days:</p> <ul style="list-style-type: none"> • NEON Workshop (April 14, 2009) NEON workshop of ecologists and other potential NEON users to discuss issues associated with large scientific facilities and collaborations, thus allowing attendees to learn from the experiences of users of scientific infrastructure in other fields. • AST Safety Workshop (April 14 - 15, 2009) Astronomical facilities pose unique safety challenges. This one and a half day workshop brought together staff from NSF funded large facilities such as the National Earthquake Engineering Simulation (NEES), the OOI, and the Arecibo Observatory in Puerto Rico, to discuss safety issues and share best practices. • NSF Large Facilities Workshop (April 16 - 17, 2009) The 2009 NSF Large Facilities Workshop was designed to bring together representatives of these facilities to discuss common issues and learn from each other's experiences. The emphasis is on facility operation rather than scientific research. Specific goals included discussions of facility operating experiences, development of personal contacts between facilities, education on current issues, and discussions of current concerns.

Summary. Attendance at these workshops provided a comprehensive overview of the challenges and lessons learned associated with the management, i.e., the planning, operations, and control of

large facility operations. Much of this information can be utilized in the development of the design, management, and operations document for the SEA NEON Satellite Site in the coming months.

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