

THE NATIONAL ECOLOGICAL OBSERVATORY NETWORK (NEON)

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No MREFC funds are requested for NEON in the FY 2019 Request. This narrative provides an update on the project’s status.

Construction funding totals an estimated \$469.30 million, which includes the \$35.51 million increase in the Total Project Cost (TPC) established in 2016 in conjunction with the change in the managing organization. The increase in the TPC has been funded via transfers of R&RA funds from BIO. Roughly 88 percent of the approved project funds for construction have been spent, with Observatory capability at approximately 93 percent complete. Construction is expected to be complete by the fall of CY 2018. NEON operations and maintenance (O&M) will be funded through the R&RA account.

Appropriated and Requested MREFC Funds for the National Ecological Observatory Network
(Dollars in Millions)

	Prior Years	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual	FY 2016 Actual	FY 2017 Actual	FY 2018 Request	FY 2019 Request	Total Project Cost ¹
Previous Funding Profile	\$12.65	\$60.30	\$91.00	\$93.20	\$96.00	\$80.64	-	-	-	\$433.79
Revised Funding Profile	12.65	60.30	91.00	93.20	96.00	100.64	15.51	-	-	469.30
Change from Previous Profile	-	-	-	-	-	20.00	15.51	-	-	35.51
<i>Appropriation Transfers</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>20.00</i>	<i>5.86</i>	-	-	<i>25.86</i>

¹ In June 2016, the National Science Board (NSB) approved an increase in NEON's Total Project Cost (TPC) from \$433.79 million to \$469.30 million. The \$35.51 million increase was anticipated to be provided through transfers from the R&RA account to the MREFC account, at levels of \$20.0 million in FY 2016 and up to \$15.51 million in FY 2017. The full \$20.0 million was transferred in FY 2016 but of the possible \$15.51 million in FY 2017 funds, only \$5.86 million was required and transferred from the R&RA account to the MREFC account.

The transfer from R&RA into MREFC so far has been less than the initial estimate of \$35.51 million projected in FY 2016 because the project requirements, under the management of Battelle Memorial Institute, Inc. (Battelle), have been below the estimated levels. Of the planned \$35.51 million R&RA transfer amount, only \$25.86 million has been transferred to the MREFC account in two installments, \$20.0 million in FY 2016 and \$5.86 million in FY 2017. Several factors have accounted for the \$9.65 million reduction from the anticipated level for the transfer, including lower than anticipated environmental compliance costs and updates to the estimated-to-complete (ETC), based on information that was not available when the TPC was revised in June 2016. Project requirements are being closely monitored by NSF to determine if any of the remaining \$9.65 million of the approved transfer amount will be needed to complete the project.

Baseline History

NEON consists of geographically distributed field and lab infrastructure networked into an integrated research platform for regional to continental scale ecological research. Cutting-edge sensor networks, instrumentation, observational sampling, natural history archive facilities, and remote sensing will be linked via the internet to computational, analytical, and modeling capabilities to create NEON’s integrated infrastructure.

In 2004, the National Research Council evaluated the original NEON design of loosely confederated observatories and recommended that it be reshaped into a single integrated platform for regional to continental scale ecological research. Congress appropriated initial funding in FY 2007. A Preliminary Design Review was completed in June 2009 and a Final Design Review (FDR) was completed in November 2009. The FDR also included a formal construction baseline review and cost review; an additional baseline review was conducted in April 2011 prior to initiation of construction that confirmed the baseline scope, cost, and schedule. Project planning continued until construction began in August 2011.

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Total Funding Requirements for NEON

(Dollars in Millions)

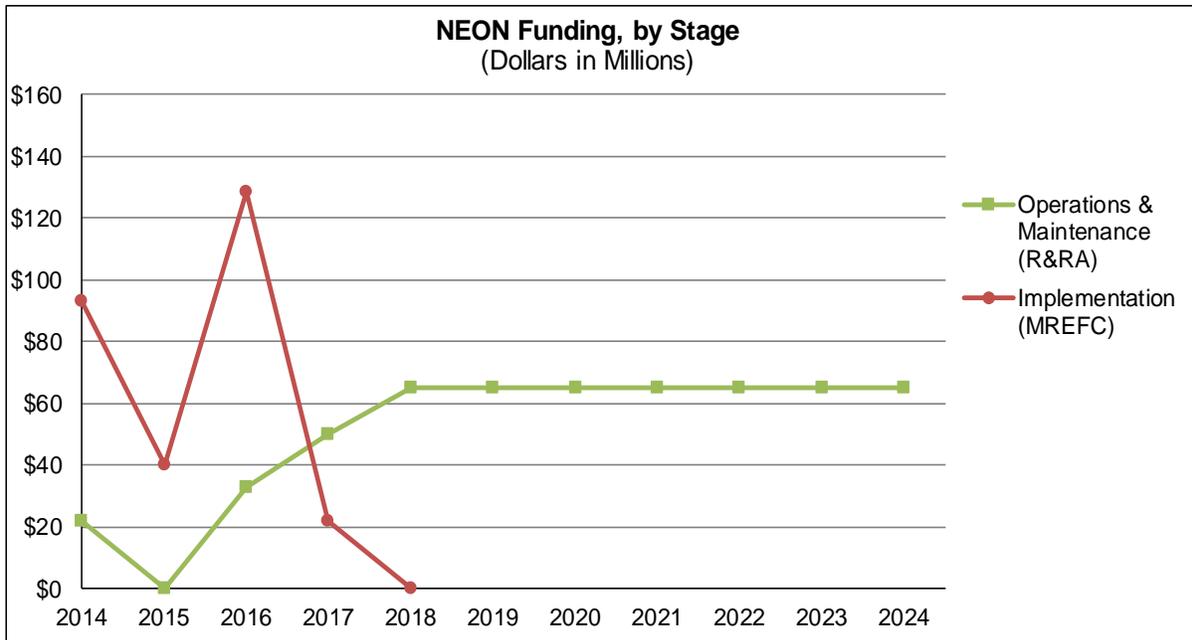
	Prior	FY 2017	FY 2018	FY 2019	ESTIMATES				
	Years ¹	Actual	Request	Request	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
<i>R&RA:</i>									
Concept & Development	\$104.85	-	-	-	-	-	-	-	-
Operations & Maintenance ^{2,3}	32.97	50.26	65.00	65.00	65.00	65.00	65.00	65.00	65.00
ARRA	9.96	-	-	-	-	-	-	-	-
Subtotal, R&RA	\$147.78	\$50.26	\$65.00	\$65.00	\$65.00	\$65.00	\$65.00	\$65.00	\$65.00
<i>MREFC:</i>									
Implementation ^{3,4}	425.38	22.10	-	-	-	-	-	-	-
TOTAL REQUIREMENTS	\$573.16	\$72.36	\$65.00						

¹ Concept & Development funding and Implementation funding are cumulative of all prior years; Operations & Maintenance funding reflects prior year actual obligations only.

² Funding for O&M is currently capped at \$65.0 million per year for planning purposes, pending the results from an initial period of operations under Battelle's management. Future O&M requests will be based on a more thorough analysis of science capabilities and affordability.

³ In FY 2016, consistent with the revised TPC, \$20.0 million of FY 2016 R&RA appropriated funding was transferred to the MREFC account. In FY 2017, \$5.86 million of FY 2017 R&RA appropriated funding was transferred into the MREFC account.

⁴ A total of \$14.21 million of FY 2017 MREFC funding was carried over into FY 2018. Of this amount, \$11.06 million will be obligated in FY 2018 to complete project construction requirements. The remaining \$3.15 million is being held by NSF as management reserve and will only be obligated based on realized risks.



Note: \$20.0 million in FY 2016 and \$5.86 million in FY 2017 was transferred from the R&RA account to the MREFC account for NEON Implementation.

MREFC Project Plan

NEON is the first research platform and the only national experimental facility specifically designed to collect consistent and standardized sensor and biological measurements across 81 sites nationwide. This was reduced from 106 sites following NSF's decision in FY 2015 to de-scope the project in order to prevent a potential \$80.0 million cost overrun. Measurements will enable basic research on complex phenomena driving ecological change and at the scales appropriate for studying many grand challenge questions in ecology. NEON allows researchers to expand the scale of their research to understand continental-scale dynamics affecting ecosystems.

A NEON cyberinfrastructure gateway provides resources to support formal and informal public education and provide opportunities for citizens to participate in scientific investigations. NEON data are open-access via web portals and available as soon as possible, once basic quality assurance and quality control procedures have been applied.

NEON enables research on the impacts of climate and land use change, water use, and invasive species on the Nation's living ecosystems at temporal and spatial scales. NEON's unique statistically-determined, continental-scale design, with data products, data management, and standardization supports research on the dynamics of complex coupled systems needed for modeling and understanding rates of change on regional and continental scales. No other standalone system—federal or private—can provide the scientifically validated suite of data measurements that NEON will deliver. The scientific techniques, sensor data, and basic research knowledge gained through NEON will inform federal resource management decisions necessitated by climate and land use change, water use, and invasive species.

Management and Oversight

- **NSF Structure:** The NEON program is managed by the Division of Biological Infrastructure (DBI) within BIO. Managing the NEON program in DBI helps foster its associations with other BIO facilities and infrastructure investments and its connections to broader biological and interdisciplinary science activities. Within BIO/DBI, a Science Advisor (working with division leadership) provides overall programmatic oversight for BIO's mid- and large-scale research infrastructure, while the day-to-day program management is done by dedicated cognizant program officers with assistance from a project manager experienced with other MREFC projects. The cognizant program officers for construction and operations coordinate the direct oversight of NEON construction, operations and maintenance, and science utilization. An NSF Integrated Project Team (IPT) chaired by the NEON program officers, with representatives from the Office of Budget, Finance, and Award Management which includes the Large Facility Office, the Office of Legislative and Public Affairs, the Office of the Director, and program representatives from other NSF large facilities, helps ensure coordinated agency oversight to the project. The Office of the General Counsel provides ongoing technical advice on the National Environmental Policy Act (NEPA) compliance and NSF environmental policy and also has representation on the IPT. Additionally, NSF has initiated a forum for consultation with federal landowners at several NEON sites – the NEON Interagency Working Group (NIWG).
- **External Structure:** As of June 2016, the NEON project is managed by Battelle Memorial Institute, Inc. (Battelle), a non-profit, membership-governed corporation with extensive experience managing large research projects, government contracts, and related activities.

Reviews

- **Technical reviews:** The NEON Observatory Design Review (including site selection and deployment design) was successfully completed in February 2009.
- **Environmental review:** The NEPA environmental assessment was completed in November 2009. NSF signed a "Finding of No Significant Impact" in December 2009; the U.S. Fish and Wildlife Service concurred with this finding, as well as with NSF's compliance with the Endangered Species Act. In

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July 2011, the NSF Record of Decision was signed.

- NSF conducted a Readiness Review to assess Battelle's competence to assume management of the NEON project in June of 2016.
- Construction, Cost, and Schedule reviews:
 - In June 2015 the NEON, Inc. estimate to complete included a projected cost overrun of \$80.0 million above the approved budget. A baseline Re-Scope Review was held in July 2015 to assess reductions in scope to bring the costs within the approved budget in accordance with NSF's "No Cost Overrun" policy.
 - In July 2015, NSF directed NEON, Inc. to reduce the project scope and deliver revised project documents, construction schedule, and cost proposal to reflect the scope reduction.
 - A revised proposal was submitted December 2015 which indicated the potential for an additional \$19.0 million cost overrun and further schedule slip leading NSF to make its decision to transfer management responsibility.
 - An independent cost estimate (ICE) was obtained by NSF to support its internal cost analysis and award to the new managing organization.
 - In June 2016 NSF conducted a site visit in order to review Battelle's readiness to assume full responsibility for the remaining construction and initial operations of the NEON Observatory.
 - A Construction and Transition to Operations Review will be conducted in CY 2018.
- National Science Board (NSB) Review: The NSB reviewed and authorized NEON construction in May 2010 and authorized initial NEON Operations and Maintenance (O&M) in February 2013. In September 2015, it established an ad hoc Task Force on NEON Performance and Plans to review and monitor NSF's oversight of the project. In 2016, after review of a new construction cost proposal (including the ICE), Battelle's successful management of the project to-date, and the remaining project risks, the NSB authorized an increase in the total project cost from \$433.79 million to \$469.30 million.
- Management, Business, and Operations Reviews:
 - NSF conducted a Business Systems Review and issued a final report in November 2011.
 - An Operations Review of the project's operating plan and costs for the first three years of operations was held in January 2012.
 - Beginning in May 2015, NSF conducted a series of site visits to work with NEON, Inc., on improving business systems including reporting capabilities, cost sufficiency and estimation, and supply chain issues including procurement and contracting.
 - Delays in construction have impacted rollout of operations by one year. With the transition to Battelle, an extension of the initial operations award is anticipated to allow the project to stabilize. An external review of an extension of the initial operations funding was held in February 2017 with an associated site visit in March 2017. A pre-award financial review of the cost proposal was conducted in FY 2017.
 - An incurred cost review of the NEON, Inc. construction award will be conducted in FY 2019.
 - Annual Operations Reviews will continue once construction is complete.

Project Status

Ninety-three percent of the Observatory research capabilities have been achieved with one hundred percent capability planned to be completed by the fall of 2018. This includes construction for the remaining terrestrial locations and aquatic sites.

In FY 2018, carryover MREFC funds will support completion of components of NEON's assignable assets. This includes completion of the third Airborne Operations Platform (AOP3) and the Mobile Deployment Platforms (MDPs).

Scope Management and De-scoping: Delays in permitting of selected sites, cyberinfrastructure development, and procurements signaled the potential for significant construction cost overruns. Estimates

received in June 2015 prompted NSF to assemble leaders from the science community to assess possible scoping strategies for maintaining the project with the approved budget in accordance with NSF's no cost overrun policy. A major objective of the meeting was to ensure the delivered Observatory would still enable the transformative regional to continental science as framed in the original NEON Science Strategy. This decision to de-scope was confirmed by the NSF/BIO Advisory Committee. De-scoping decisions were finalized and implemented in late July 2015.

In FY 2018, \$65.0 million was requested from the R&RA account to support NEON's operations and maintenance. The initial operations award, to NEON, Inc., that began in FY 2014 was transferred to Battelle in June 2016. Following NSB authorization, NSF has awarded additional funding for three years, which will take operations into FY 2020, allowing Battelle time to identify project efficiencies, minimize costs, and maximize science delivery. Final costs for observatory O&M will be determined on the basis of these management efforts and analyses.

Cost and Schedule

The original projected length of the construction stage was six fiscal years, with six-months of schedule contingency included. Under Battelle's management, the planned project end date is now estimated as the fall of CY 2018 and the TPC has been re-established as described above. Roughly 88 percent of the approved project funds for construction have been spent, with Observatory capability at approximately 93 percent complete. Focused management by Battelle and oversight by NSF continues to be rigorously implemented in an effort to keep the project within budget and on schedule.

Risks

Technical: While the bulk of NEON's infrastructure and instrumentation will be "commercial off-the-shelf," NEON's scientific and networking design required certain technological innovations for a small number of components. Consequently, BIO has provided R&RA funds for advanced research and development activities in the areas of sensors, cyberinfrastructure, and remote sensing technology. These development activities are progressing and risks to schedule are being monitored. Technical risk is considered low at this point in construction.

Deployment: Environmental assessment and permitting continues to have an impact on schedule. Risk mitigation strategies include the direct contracting of the environmental assessments by NSF, the hiring of experienced, national firms by Battelle for engineering and permitting, and the identification of alternative sites if primary sites still hold significant risk. All environmental compliance activities are actively underway and nearing resolution.

Management: Management risk has been mitigated by NSF based on the decision to replace NEON, Inc. with Battelle. The transition to new management is an inherently risky proposition but was necessary in this case. Battelle continues to work closely with NSF oversight personnel to clearly communicate process, standards, timelines, costs, and expectations.

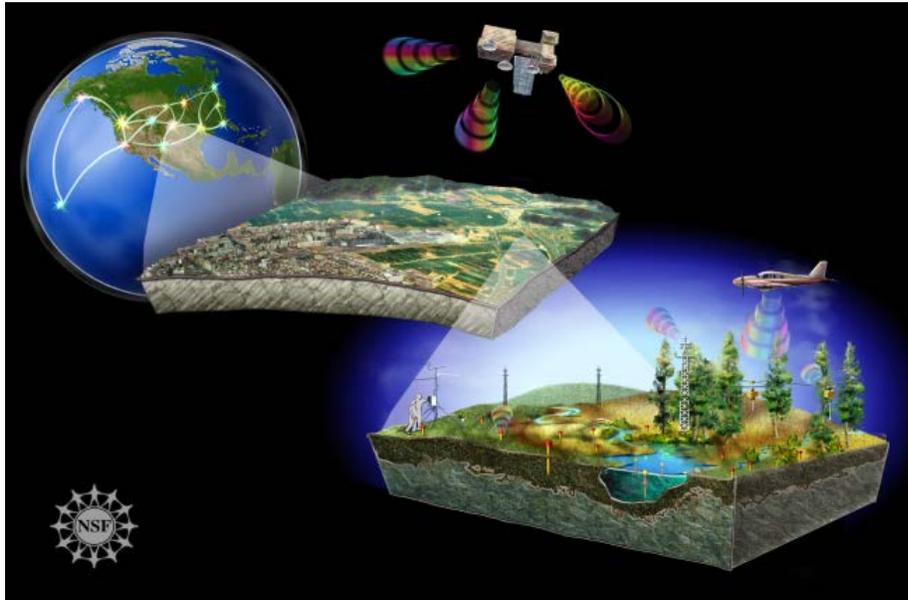
Future Operations Costs

NEON is the first research observatory that will maintain and operate in-situ instrumentation and conduct biological sampling in 20 domains (81 locations) including three airborne observatories, a central operating facility, and a cyberinfrastructure center. Field support will be provided to monitor the sensors, and receive, process, and archive data from all measurement systems. NEON operations include significant labor costs due to the manual processes still required for biological sampling and data collection in some fields. NEON is reliant on sensors and cyberinfrastructure that have a defined lifecycle, so operations costs include scheduled replacement and refreshing of sensor, instrumentation, and cyberinfrastructure technology. Operations activities and associated costs will ramp up as sites are commissioned and the planned relocation of sites within domains is considered. Battelle is accelerating the transition of infrastructure to operations

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whenever possible to appropriately manage construction costs.

A three-year initial award for O&M began September 2014 to allow NEON, Inc. to explore opportunities for schedule and cost efficiencies and provide a basis for funding the full Observatory operations during out-years. This award was transferred to Battelle in FY 2016. An extension of the initial operating period through FY 2019 under Battelle was authorized and awarded to allow the project to stabilize prior to re-competition. For FY 2019, O&M funding will be \$65.0 million.



NEON will be a collaborative research platform of geographically distributed infrastructure connected via the latest information technology. By combining in-situ sensing with remote sensing observations, NEON will address pressing environmental questions on regional to continental scales. *Credit: NSF.*