

NATIONAL OPTICAL ASTRONOMY OBSERVATORY

\$20,670,000
-\$1,320,000 / -6.0%

National Optical Astronomy Observatory

(Dollars in Millions)

FY 2016	FY 2017	FY 2018	Change Over	
			FY 2016 Actual	
Actual	(TBD)	Request	Amount	Percent
\$21.99	-	\$20.67	-\$1.32	-6.0%

The National Optical Astronomy Observatory (NOAO) was established in 1984 by uniting operations of the Kitt Peak National Observatory (KPNO) in Arizona and the Cerro Tololo Inter-American Observatory (CTIO) in Chile. As a Federally Funded Research and Development Center sponsored by NSF, the primary purpose of NOAO is to serve as the U.S. national center for ground-based optical and infrared (OIR) astronomy to coordinate, integrate, and operate observational, technical, and data-oriented capabilities available throughout the U.S. OIR system of federal and non-federal assets.

NOAO’s mission is to enable discovery in ground-based OIR astronomy. In pursuit of this mission, NOAO facilitates access for all qualified professional researchers to state-of-the-art observational capabilities and databases in OIR astronomy. NOAO enables the U.S. research community to pursue a broad range of modern astrophysical challenges from small bodies within the Solar System, to the most distant galaxies in the early universe, to indirect observations of dark energy and dark matter. NOAO is the gateway for the U.S. astronomical community to the Gemini Observatory through the U.S. National Gemini Office (US-NGO). NOAO coordinates community access to telescopes throughout the U.S. OIR system, and it facilitates connecting the scientific user to data archives by developing and maintaining data management capabilities. NOAO integrates community planning for future facilities and instrumentation projects under a national organization. In partnership with the community and NSF, NOAO works with colleges and universities to train the next generation of scientists and engineers, and promotes accomplishments to strengthen education and public awareness of the astronomical sciences.

NOAO facilities, telescopes, and data systems, are open to all qualified astronomers regardless of institutional affiliation. They serve nearly 1,200 U.S. and foreign scientists annually. Doctoral dissertation students and non-thesis graduate students from U.S. institutions use NOAO facilities for research projects. In FY 2016, NOAO employed 300 personnel in Arizona and Chile, including 45 support scientists and 10 postdoctoral fellows.

The Division of Astronomical Sciences in the Directorate for Mathematical and Physical Sciences (MPS/AST) conducted a community-based review of its portfolio in 2011-2012. The resulting Portfolio Review Committee (PRC) report, *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*²⁰, was released in August 2012 and included recommendations about all of the major AST telescope facilities.

The recommendations from the PRC report included divesting NSF support from three nighttime OIR telescopes located on Kitt Peak: The 4-meter Mayall telescope, the 2.1-meter telescope, and the 3.5-meter WIYN telescope, which is owned and operated by a consortium of University of Wisconsin, Indiana University, and NOAO. NOAO’s share of the WIYN telescope time for public access is 40 percent.

²⁰www.nsf.gov/mps/ast/ast_portfolio_review.jsp

Major Multi-User Research Facilities

The PRC recommendations were implemented as of October 1, 2015. The 2.1-meter telescope is now operated by the California Institute of Technology for a research program on cosmic transient phenomena. Starting in FY 2016, the NOAO base operations and maintenance budget excluded NSF funding for the Mayall and WIYN telescopes. Any subsequent NSF support for these telescopes is recorded as special projects with supplemental funding to NOAO.

Total Obligations for NOAO

(Dollars in Millions)

	FY 2016	FY 2017	FY 2018	ESTIMATES ¹				
	Actual	(TBD)	Request	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
NOAO Base O&M	\$17.61	-	\$18.57	\$19.13	\$19.70	\$20.29	\$20.90	\$21.53
<i>Tucson Operations</i>	8.61	-	9.02	9.29	9.57	9.86	10.15	10.46
<i>Chilean Operations</i>	8.00	-	8.49	8.74	9.01	9.28	9.56	9.84
<i>Kitt Peak Operations</i>	1.00	-	1.06	1.09	1.12	1.16	1.19	1.23
Special Projects: WIYN and Mayall	4.38	-	2.10	1.00	1.00	1.00	1.00	1.00
Total, NOAO	\$21.99	-	\$20.67	\$20.13	\$20.70	\$21.29	\$21.90	\$22.53

¹ Outyear funding estimates are for planning purposes only. The current cooperative agreements ends in September 2020.

Partnerships and Other Funding Sources: The managing organization for NOAO is the Association of Universities for Research in Astronomy, Inc. (AURA), which is comprised of 42 U.S. member institutions and five international affiliate members. A key NOAO partnership is ongoing with the Department of Energy (DOE) to conduct a survey of the southern sky to investigate the nature of dark energy. The five-year Dark Energy Survey began operation in August 2013 on the CTIO 4-meter Blanco telescope. NOAO is a partner in the 4.1-meter SOAR (Southern Astrophysical Research) telescope at CTIO. SOAR partners include the University of North Carolina, Chapel Hill; Michigan State University; and the Ministério da Ciência, Tecnologia, e Inovação do Brasil.

A large number of U.S. universities support their own astronomical facilities at KPNO and CTIO with reimbursed services provided by NOAO. Development of new telescopes, instrumentation, and sensor techniques is done in partnership with universities and with industry through subawards to aerospace, optical fabrication, and information technology companies. NOAO leverages NSF support with funding from other federal agencies and non-federal sources. NOAO typically receives approximately \$10.0 million each year for reimbursed services from partnerships and tenant observatory support, from the Kitt Peak Visitors Center, and from grants from other federal agencies.

Education and Public Outreach: NOAO supports U.S. education goals by promoting public understanding and support of science and by providing education and training at all levels. Over 200 U.S. and foreign graduate students observe on NOAO telescopes yearly and a significant fraction of the observations contribute to Ph.D. dissertations. The observatories introduce undergraduate students to scientific research by providing stimulating environments for basic astronomical research and related technologies through NSF's Research Experiences for Undergraduate Students (REU) program. NOAO has a diverse education program, visitor centers, and a web-based information portal at www.noao.edu.

NOAO Base O&M: \$18.57 million, \$960,000 above the FY 2016 Actual.

Tucson Operations: \$9.02 million, \$410,000 above the FY 2016 Actual: This covers the headquarters, offices, laboratories, and workshops in Tucson, Arizona.

Chilean Operations: \$8.49 million, \$490,000 above the FY 2016 Actual: This supports administration and labs in La Serena, Chile and mountain operations on Cerro Tololo and Cerro Pachón.

Kitt Peak Operations: \$1.06 million, \$60,000 above FY 2016 Actual: This provides support for basic infrastructure on the mountain for the benefit of the tenants. All facilities on the mountain are accounted as tenants.

Special Projects (WIYN and Mayall): \$2.10 million, \$2.28 million below the FY 2016 Actual.

WIYN telescope: \$1.0 million, no change from the FY 2016 Actual: The National Aeronautics and Space Administration (NASA) has identified the WIYN telescope as the preferred platform for an extreme precision Doppler spectrometer as a facility instrument for exoplanet follow up research. This instrument is the key component of a NASA-NSF partnership in Exoplanet Observational Research (NN-EXPLORE), which began in FY 2015 using existing instrumentation on WIYN. A Memorandum of Agreement between the agencies for NN-EXPLORE was signed in FY 2015, and a Joint Oversight Group was formed early in FY 2016.

Mayall Telescope: \$1.10 million, \$2.28 million below the FY 2016 Actual: The decrease from FY 2016 anticipates an increase in DOE support for the telescope. In FY 2015, DOE identified the Mayall telescope as the preferred platform for the Dark Energy Spectroscopic Instrument (DESI) to carry out a dark energy science survey sponsored by DOE, starting in FY 2019. DESI passed the DOE Critical Decision 3 (Approve Start of Construction) milestone in FY 2016.

Management and Oversight

- NSF Structure: An NSF program officer in AST provides continuing oversight, including consultation with an NSF program review panel of external reviewers that meets once a year. The program officer reviews detailed annual program plans, annual long range plans, quarterly technical and financial reports, and annual reports submitted by NOAO. The NSF program officer also attends AURA governance committee meetings. Governance committees are formed from the national astronomical community and provide additional avenues for input of community priorities and concerns. The AST program officer works closely with other offices at NSF, particularly the Office of General Counsel, and the Division of Acquisition and Cooperative Support and the Large Facilities Office in the Office of Budget, Finance, and Award Management.
- External Structure: AURA is the managing organization for NOAO. The NOAO director reports to the president of AURA, who is the principal investigator on the NSF cooperative agreement that began in FY 2016. AURA receives management advice from an observatory council composed of members of its scientific and management communities. NOAO uses a Users Committee, comprised of community scientists, to advise the NOAO director on all aspects of user experiences at the Observatory.
- Reviews: In addition to reviews held mid-way through all cooperative agreements, NSF conducts both periodic and ad hoc external reviews of AURA management. A comprehensive review of the managing organization's performance will be carried out in FY 2019, the fourth year of the five-year cooperative agreement.

Renewal/Competition/Termination

The last competition for management and operation of NOAO was completed with the issuance of a new cooperative agreement with AURA starting October 1, 2015 and ending September 30, 2020.