

OTHER ASTRONOMICAL FACILITIES

\$11,850,000
+\$11,850,000 / NA%

Other Astronomical Facilities

(Dollars in Millions)

FY 2016 ¹ Actual	FY 2017 (TBD)	FY 2018 Request	Change over FY 2016 Actual	
			Amount	Percent
-	-	\$11.85	\$11.85	N/A

¹ Beginning in October 2016, funding for these facilities as stand-alone entities is provided separately from National Radio Astronomy Observatory (NRAO).

Prior to FY 2017, the National Radio Astronomy Observatory (NRAO) operated major radio telescopes at the Green Bank Observatory (GBO) in Green Bank, West Virginia, including the Robert C. Byrd Green Bank Telescope (GBT), and at 10 telescope array sites spanning the U.S. from the Virgin Islands to Hawaii, together constituting the Very Long Baseline Array (VLBA). Beginning in FY 2017, GBO and the VLBA were separated from NRAO. GBO now operates the GBT, and the newly formed Long Baseline Observatory (LBO) operates the VLBA. Associated Universities, Inc. (AUI), remains the managing organization for GBO and LBO through a cooperative agreement with NSF. This narrative presents the combined FY 2018 Budget Request for GBO and LBO.

In 2010, the National Research Council conducted its sixth decadal survey in astronomy and astrophysics. In their report, *New Worlds, New Horizons in Astronomy and Astrophysics*,²⁶ the NRC committee recommended that “NSF-Astronomy should complete its next senior review before the mid-decade independent review that is recommended in this report, so as to determine which, if any, facilities NSF-AST should cease to support in order to release funds for (1) the construction and ongoing operation of new telescopes and instruments and (2) the science analysis needed to capitalize on the results from existing and future facilities.” In response to this recommendation, the Division of Astronomical Sciences (AST) in the Directorate for Mathematical and Physical Sciences (MPS) conducted a community-based review of its portfolio. The resulting Portfolio Review Committee report, *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*,²⁷ was released in August 2012 and included recommendations about all of the major AST telescope facilities.

In 2012, the Portfolio Review Committee recommended, under constrained budgets, divestment of the GBT and VLBA from AST funding because of a less compelling mapping than other facilities onto the science questions of the 2010 decadal survey. As announced in a Dear Colleague Letter, NSF 13-074,²⁸ NSF partitioned GBT and VLBA from the competition for NRAO management and operations, which increased flexibility for exploring cost-efficient operational models and sustainable partnerships for GBO (comprising GBT and the Green Bank site and facilities) and VLBA. Existing partnerships are described below, and additional partner discussions with governmental and non-governmental entities are ongoing. In FY 2016, an engineering firm produced feasibility reports for divestment alternatives of both GBO and VLBA; those reports include baseline structural and environmental surveys of GBO and VLBA. In FY 2017, NSF began a formal environmental review of GBO to develop an Environmental Impact Statement (EIS) considering future alternatives for GBO, and the EIS process is expected to conclude in FY 2018.

In FY 2016, AST received a proposal from AUI, to continue management and operation of GBO and LBO in FY 2017 and FY 2018, separate from the management and operation of NRAO. Previously, the

²⁶ www.nap.edu/catalog.php?record_id=12951

²⁷ www.nsf.gov/mps/ast/ast_portfolio_review.jsp

²⁸ <http://nsf.gov/pubs/2013/nsf13074/nsf13074.jsp>

Major Multi-User Research Facilities

obligations for GBO and VLBA were heavily matrixed and not separable from the overall obligation for NRAO. Hence, GBO and VLBA, which were previously included in the NRAO narrative, were first presented as stand-alone entities in the FY 2017 Budget Request. The table below does not separate funding for GBO and LBO, and the detailed breakdown between the two depends on anticipated and achieved partnerships. Notional funding beyond FY 2018 is shown as flat, although it is expected that the out-year numbers will change significantly as partnerships evolve.

Total Obligations for Other Astronomical Facilities

(Dollars in Millions)

	FY 2016	FY 2017	FY 2018	ESTIMATES ²				
	Actual ¹	(TBD)	Request	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Operations & Maintenance	-	-	\$11.85	\$11.85	\$11.85	\$11.85	\$11.85	\$11.85

¹ Beginning in October 2016 (FY 2017), funding for these facilities as stand-alone entities is provided separately from National Radio Astronomy Observatory (NRAO) funding.

² Outyear funding estimates are for planning purposes only. The operating award for GBO and LBO is expected to run through the end of September 2018.

Partnerships and Other Funding Sources: In FY 2018, GBO and LBO are expected to receive approximately \$8.60 million from other sources, roughly half from non-federal partners and half from other federal sources. Thus, the FY 2018 Budget Request represents about 58 percent of the total budget for GBO and LBO. Many of these partnerships involve guaranteed allocations of observing time on the GBT or VLBA. In FY 2016, GBO began a 10-year partnership with Breakthrough Listen and also had funding partnerships with West Virginia University and the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) consortium that are expected to continue through FY 2018. (The NANOGrav funding comes from the NSF award to the NANOGrav Physics Frontier Center.) In addition, the GBO partnership with the RadioAstron space mission is continuing in FY 2017, and other partner discussions are ongoing. In FY 2017, NSF and LBO established an agreement with the U.S. Naval Observatory to provide observing time and data in exchange for substantial support of LBO/VLBA operations.

Education and Public Outreach: The Green Bank Science Center at GBO currently supports nearly 50,000 visitors per year and carries out dedicated programs for professional educators and school groups.

GBO and LBO Operations and Maintenance, \$11.85 million: This encompasses support for direct telescope operations at GBO and LBO, including maintenance, infrastructure upgrades, and telescope management, as well as funds allocated for Education and Public Outreach.

Management and Oversight

- **NSF Structure:** In consultation with community representatives, a dedicated AST program officer carries out continuing oversight and assessment for GBO and LBO by making use of detailed annual program plans, technical and financial reports, and annual reports submitted to NSF. The AST program officer attends AUI governance and advisory committee meetings. To address issues as they arise, AST works closely with other NSF offices, such as the Office of General Counsel, the Office of International Science and Engineering, the Division of Acquisition and Cooperative Support, and the Large Facilities Office in the Office of Budget, Finance, and Award Management.
- **External Structure:** Management is through a cooperative agreement with AUI. AUI manages the observatories through its own community-based oversight and users committees. The GBO and LBO directors report directly to the AUI Vice President for Radio Astronomy.
- **Reviews:** NSF reviewed the proposal for FY 2017 and FY 2018 funding and conducts annual reviews of the Program Operating Plan and reports.

Renewal/Competition/Termination

GBO and LBO are currently supported through a cooperative agreement, which ends on September 30, 2018. A six-month transition award in FY 2016 provided for implementation costs of separating GBO and LBO from NRAO (see the NRAO narrative for more details), and the FY 2018 funding provides for GBO and LBO as stand-alone entities. Management of GBO and LBO after FY 2018 will be based on the further development of collaboration opportunities and the EIS process mentioned above.