

DIVISION OF ASTRONOMICAL SCIENCES (AST)

\$246,550,000
+\$2,390,000 / 1.0%

AST Funding
(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over	
				FY 2015 Estimate Amount	Percent
Total, AST	\$238.36	\$244.16	\$246.55	\$2.39	1.0%
Research	64.04	67.08	62.72	-4.36	-6.5%
CAREER	4.76	4.82	4.72	-0.10	-2.1%
Education	6.24	5.90	6.66	0.76	12.9%
Infrastructure	168.08	171.18	177.17	5.99	3.5%
Arecibo Observatory	4.50	4.00	4.10	0.10	2.5%
Atacama Large Millimeter/submm Array (ALMA)	34.27	40.17	40.35	0.18	0.4%
Daniel K. Inouye Solar Telescope (DKIST)	2.00	7.00	11.00	4.00	57.1%
Gemini Observatory	19.58	20.61	19.77	-0.84	-4.1%
Nat'l Optical Astronomy Obs. (NOAO)	25.50	25.50	21.75	-3.75	-14.7%
Nat'l Radio Astronomy Obs. (NRAO)	43.14	43.14	41.73	-1.41	-3.3%
Nat'l Solar Observatory (NSO) ¹	8.00	8.00	9.50	1.50	18.8%
Mid-Scale Innovations Program (MSIP)	14.15	13.00	18.72	5.72	44.0%
Research Resources	10.35	9.76	10.25	0.49	5.0%
Facilities Pre-Construction Planning (total)	6.59	-	-	-	N/A
Large Synoptic Survey Telescope (LSST)	6.59	-	-	-	N/A

Totals may not add due to rounding.

¹ The totals presented in FY 2015 and FY 2016 do not include \$5.0 million and \$9.0 million, respectively, for operations and maintenance support for the DKIST facility construction project. That funding is captured within the total presented on the DKIST line above.

AST is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation and manages the electromagnetic spectrum for scientific use by the entire NSF community.

In general, 24 percent of the AST portfolio is available for new research grants and 76 percent is available for continuing grants and cooperative awards.

AST supports research to understand the origins and characteristics of planets, stars, and galaxies, as well as the structure that has evolved in the Universe since its origin more than 13 billion years ago. The results of this research will lead to a better understanding of the cosmos in which we live, of the possibility of life existing on planets circling other stars, and of the nature of the mysterious dark matter and dark energy that comprise more than 95 percent of the mass-energy of the Universe.

Approximately 72 percent of AST's budget supports the forefront instrumentation and facilities needed

for progress at the frontiers of observational astronomy, while the remaining 28 percent supports the research of individual investigators. Through the MREFC account, AST also oversees the construction of the Large Synoptic Survey Telescope (LSST) and the Daniel K. Inouye Solar Telescope (DKIST).

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*,¹⁰ 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, AST conducted a community-based review of its portfolio. The resulting Portfolio Review Committee (PRC) report, *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*,¹¹ was released in August 2012 and included recommendations about all of the major AST telescope facilities.

In FY 2012 and FY 2013, AST began to engage actively in facility partnership discussions with other federal agencies and with university-based groups. In FY 2014, AST continued those discussions, and NSF brought a general engineering contractor on-board for all its engineering and environmental reviews. In FY 2015, that contractor is producing feasibility reports for divestment alternatives, which will provide the results of baseline structural and environmental surveys of a number of individual telescopes and observatories. Once NSF has identified viable options for divestment, it will embark on formal reviews (in FY 2015 and FY 2016) to evaluate environmental impacts of these options, including partnership opportunities that could have impacts to the environment. Details for individual facilities are described in the Facilities chapter of this Budget Request.

FY 2016 Summary

All funding decreases/increases represent change over the FY 2015 Estimate.

Research

- Astronomy and Astrophysics Research Grants program (-\$2.74 million to a total of \$41.36 million): Following an increase in FY 2015 that was enabled by the conclusion of construction planning and development for LSST, in FY 2016 this program is decreased.
- The Theoretical and Computational Astrophysics Networks program executed in conjunction with NASA is decreased 100 percent (-\$1.50 million to zero). A joint program evaluation with NASA will be conducted to determine whether another cycle of this program is instituted in FY 2017.

Education

- Astronomy and Astrophysics Postdoctoral Fellowship program (+\$100,000 to a total of \$2.40 million): Increased funding enables one additional fellowship award in FY 2016.
- Partnerships in Astronomy and Astrophysics Research and Education (+\$1.0 million to a total of \$2.0 million): AST enhances its efforts to diversify the astronomical research community by increasing support in this program by 100 percent.

Infrastructure

- Atacama Large Millimeter/Submillimeter Array (+\$180,000 to a total of \$40.35 million): Funding sustains the transition from construction to full operations. A major operations review will take place

¹⁰ www.nap.edu/catalog.php?record_id=12951

¹¹ www.nsf.gov/mps/ast/ast_portfolio_review.jsp

in FY 2015 to evaluate future funding requirements.

- Daniel K. Inouye Solar Telescope (+\$4.0 million to a total of \$11.0 million): Funding represents the second year of the ramp to full DKIST operations, expected in FY 2019. The total is comprised of \$9.0 million for basic DKIST operations support provided through the National Solar Observatory and \$2.0 million in a separate award as part of the cultural mitigation process for DKIST construction. (See the MREFC chapter for more on DKIST.)
- Gemini (-\$840,000 to a total of \$19.77 million): Funding represents a flat operations budget (\$18.02 million) and a decrease in new instrumentation funding (-\$840,000 to \$1.75 million) as Gemini transitions to a new partnership model emphasizing in-kind instrumentation contributions.
- National Optical Astronomical Observatory funding (-\$3.75 million to a total of \$21.75 million): The observatory will transform to a new operations model emphasizing data science, with a reduction in base associated with a reduction in telescope operations. This includes initiation of a joint NSF-NASA Exoplanet Research Program (NN-EXPLORE) on the 3.5m WIYN telescope and discussions regarding potential partnerships for the Mayall telescope.
- National Radio Astronomical Observatory (-\$1.41 million to a total of \$41.73 million): The funding reduction for domestic, non-ALMA NRAO represents a return to the baseline NRAO plan.
- National Solar Observatory (+\$1.50 million to a total of \$9.50 million): This increase includes a decrement of \$1.0 million to basic NSO operations (for a total of \$7.0 million) and a one-time increment of \$2.50 million for refurbishment of the Global Oscillation Network Group (GONG) telescopes in order to facilitate robust space-weather predictions. The total presented does not include \$9.0 million in support of the ramp to operations for DKIST; that funding is captured within the DKIST line in the table above. For more information, see the Facilities chapter.
- Mid-Scale Innovations Program (MSIP) (+\$5.72 million to a total of \$18.72 million): A significant funding increase supports the second AST solicitation for MSIP proposals, sustaining experiments, student instrumentation training, and access to non-federal observatories and data sets at funding levels of up to ~\$20.0 million for individual projects, a research scale not accessible for normal individual investigator grants.