

FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDCS)

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH (NCAR)

\$99,700,000
-\$26,640,000 / -21.1%

National Center for Atmospheric Research Funding

(Dollars in Millions)

FY 2018 Actual ¹	FY 2019 (TBD)	FY 2020 Request	Change over	
			FY 2018 Actual Amount	Percent
\$126.34	-	\$99.70	-\$26.64	-21.1%

¹ FY 2018 Actual includes \$26.64 million in additional FY 2018 one-time funding above the requested amount.

NCAR is an NSF-sponsored FFRDC serving a broad research community, including atmospheric and geospace scientists and researchers in complementary areas of the environmental sciences and geosciences. Based in Boulder, Colorado, NCAR is managed under a cooperative agreement between NSF and the University Corporation for Atmospheric Research (UCAR), a university-governed and university-serving organization comprising 117 degree-granting academic institutions.

As of September 2018, NCAR supported a total of 700.0 full time equivalents (FTEs), of which, 316.7 are funded under the NSF primary award to UCAR.

Number of FTEs Supported at NCAR

FTEs	Primary	All
	Award ¹	Funding
Career Scientists	70.7	96.7
Scientific Support ²	214.5	480.5
Other Staff ³	31.5	122.8
Total	316.7	700.0

¹ The primary award supports substantial facility infrastructure that does not include staff costs.

² Scientific Support includes Associate Scientists, Project Scientists, Postdocs, Software Engineers, Engineers,

³ Other Staff includes Administrative positions, Managers, Paid Visitors, Pilots and Mechanics.

NCAR provides world-class research programs, services, and facilities that enable the research community to advance our understanding of the sun-atmosphere system. These include the NCAR-Wyoming Supercomputing Center, the Mauna Loa Solar Observatory, two research aircraft, a transportable ground-based radar system, an atmospheric sounder, and other surface sensing systems. NCAR staff work in close partnership with academic and other researchers. In 2018, 90 percent of NCAR's 805 peer-reviewed publications were published in collaboration with authors at other institutions, and NCAR hosted academic visitors from 333 different institutions. NCAR provided support in field campaigns that included staff from a total of 40 institutions.

Total Obligations for NCAR

(Dollars in Millions)

	FY 2018	FY 2019	FY 2020	ESTIMATES ²				
	Actual ¹	(TBD)	Request	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
Aircraft Support	\$10.07	-	\$10.00	\$10.00	\$10.00	\$10.00	\$10.00	\$10.00
Computational Infrastructure	32.38	-	32.50	32.50	32.50	32.50	32.50	32.50
Other Facility Support	26.55	-	26.50	26.50	26.50	26.50	26.50	26.50
Research & Education Support	30.70	-	30.70	30.70	30.70	30.70	30.70	30.70
Facility Upgrades	26.64	-	-	-	-	-	-	-
Total	\$126.34	-	\$99.70	\$99.70	\$99.70	\$99.70	\$99.70	\$99.70

¹ FY 2018 Actual includes \$26.64 million in additional FY 2018 one-time funding above the requested amount.

² Outyear estimates are for planning purposes only.

Facility Upgrades: In FY 2018, NSF awarded \$26.64 million for essential upgrades to NCAR’s facilities and programs. These one time funds supported critical maintenance at the NCAR Mesa Laboratory, major upgrades to the NCAR Research Aviation Facility, and a new Early Career faculty visitor’s program.

Partnerships and Other Funding Sources: NCAR leverages NSF support with funding provided by other federal agencies and non-federal sources. In FY 2018, NCAR received approximately \$38.34 million in support from other federal agencies, including the National Oceanic and Atmospheric Administration (NOAA), the Department of Energy (DOE), and the Federal Aviation Administration (FAA), and \$18.63 million from non-federal sources. This funding supports research collaboration that enhance NCAR’s NSF-supported research goals or facilities missions.

Major Investments in FY 2020: In FY 2020, investments at NCAR will focus on fundamental research aimed at improving our ability to predict atmospheric, chemical, and space weather hazards, and increasing our understanding of the variability in the Earth’s climate system at regional and global scales. In all of these areas, NCAR scientists will work with their university colleagues to further understand the fundamental processes that control the Earth’s climate and weather systems. This will include research thrusts in areas such as the role of the chemical composition of the atmosphere, better understanding of the structure and nature of hurricanes and other severe weather events, and the impacts of processes on the surface of the Sun on space weather and weather on Earth. A continuous process of community prioritization will inform activities undertaken in FY 2020.

Aircraft Support: NCAR operates two NSF aircraft: a C-130Q Hercules and a Gulfstream-V (the ‘G-V’), both of which are highly modified and equipped with specialized instrumentation, to enable the support of research activities designed to provide new insights into atmospheric chemical processes, the dynamics and coupling of the atmosphere’s layers, and interactions between the atmosphere and Earth’s surface. The two aircraft will support community-originated projects deemed by NSF, via separately-managed external peer review, to be of exceptional scientific merit, consistent with the research prioritization mentioned above.

Computational Infrastructure: NCAR operates a petascale supercomputing facility in Cheyenne, Wyoming (the NCAR-Wyoming Supercomputing Center), that supports high-end community modeling programs in atmospheric, solar, and other Earth Systems processes and has over 1,700 unique users. These include the Community Earth System Model (CESM), the Weather Research and Forecasting Models (WRF), and the Model for Prediction Across Scales (MPAS), which use mathematical formulas to simulate and better understand the chemical and physical processes that drive Earth’s climate and weather system. NCAR leads the development of these community models and supports many thousands of researchers in the U.S. and worldwide – for example in 2018, the cumulative number of registered WRF users exceeded 45,000, and was growing by an average of 4,400 per year. NCAR also maintains extensive data archives, providing access to a vast collection of observational, experimental, and modeling data, together with sophisticated

Major Multi-User Research Facilities

analysis and visualization facilities, and training and support for users of all levels.

Other Facility Support: In addition to the C-130 and G-V aircraft, NCAR provides support for a number of other atmospheric and solar observing platforms through its Earth Observing Laboratory (EOL) and High Altitude Observatory (HAO), including specialized Doppler weather radars, lidar systems, upper atmosphere observing capabilities, an advanced coronagraph, and other experimental systems.

Research and Education Support: As an internationally recognized center of excellence, NCAR operates scientific research programs that include the following areas:

- studies of large-scale atmospheric and ocean dynamics that contribute to an understanding of the past and present Earth System processes;
- global and regional atmospheric chemistry, including atmospheric connections to geochemical and biogeochemical cycles;
- the variable nature of the sun and the physics of the corona and the interaction of the solar wind with the Earth's magnetic field;
- the physics of clouds, thunderstorms, precipitation formation, and their interactions and effects on local and regional weather; and
- examination of human society's impact on atmospheric composition, weather, and climate, and response to global environmental change.

Research collaborations with university colleagues are integral to NCAR's success as an institution, and NCAR serves as a focal and meeting point for the broader atmospheric and related sciences community. NCAR also maintains extensive partnerships and collaborations with the private sector through directed research and technology transfer. This work focuses on developing information and analysis platforms tailored to the specific needs of stakeholders in a variety of sectors, including energy, aviation, and agriculture.

Educational activities include the SOARS (Significant Opportunities in Atmospheric Research and Science) program that integrates research, education, and mentoring to bridge the undergraduate-to-graduate transition and to broaden participation in the atmospheric and related sciences. NCAR further supports the scientific community by providing fellowships, internships, workshops, and colloquia for students and visiting scientists, and disseminates knowledge of the geosciences. Professional training courses, innovative and award-winning science education websites, as well as the directed activities of NCAR's education and outreach programs, are further examples of how NSF's goal of integrating research and education is attained through NCAR activities.

Management and Oversight

- **NSF Structure:** NSF's Division of Atmospheric and Geospace Sciences (AGS) within GEO and the Division of Acquisition and Cooperative Support (DACS) oversee NCAR and the cooperative agreement under which UCAR manages NCAR. The cooperative agreement encourages interactions between NCAR scientists and AGS staff and ensures close coordination between AGS and NCAR management. The cooperative agreement contains requirements for AGS's oversight of the NCAR program and UCAR management activities that affect NCAR. UCAR submits for AGS approval an annual program plan for NCAR that details how resources will be used, and an annual report on the previous year's scientific accomplishments and achievements. UCAR also reports annually to NSF on its activities as NCAR's manager. Annual strategic planning between AGS, UCAR, and NCAR ensures that scientific and facility priorities align with those of NSF.
- **External Structure:** UCAR works in partnership with NSF and the university community to ensure that NCAR's strategic mission is implemented effectively and for the benefit of NCAR's stakeholders in the atmospheric and geospace sciences.

- Reviews: A Committee of Visitors (COVs) is convened periodically to evaluate AGS oversight of NCAR. The most recent COV was conducted in FY 2015, with the next anticipated in FY 2020. In FY 2018, as part of the recompetition process (see below), NSF conducted an extensive review of UCAR's financial viability and accounting systems. No significant issues were raised.
- In 2016, AGS conducted a comprehensive review of NCAR's science programs and facilities, and UCAR's management of NCAR. The review was conducted as a series of site visits to NCAR by teams comprising members of the research community with expertise in the atmospheric and related sciences and in the management of scientific centers and facilities. The site visit teams found that NCAR continues to be a world-leading research center, providing essential services and capabilities that foster excellence throughout the atmospheric and geospace sciences community.

Renewal/Recompetition/Termination

The cooperative agreement for the management and operation of NCAR was recently recompleted. Following an extensive and robust proposal review process, a new award was made to UCAR. This award began on October 1st, 2018, and is for five years, extendable for a further five years subject to satisfactory performance. The decision on whether to extend the award will be based upon the outcome of a comprehensive review of NCAR's science programs and management.



The NCAR Mesa Laboratory, designed by architect I.M. Pei, in Boulder, CO. *Credit: UCAR.*