

**NATIONAL GEOPHYSICAL FACILITY (NGF)
(FORMERLY THE GEODETIC FACILITY FOR THE ADVANCEMENT OF GEOSCIENCE (GAGE) AND THE
SEISMOLOGICAL FACILITY FOR THE ADVANCEMENT OF GEOSCIENCE (SAGE))**

www.earthscope.org/about/gage-sage-facilities/

**National Geophysical Facility Funding¹
(formerly the Geodetic Facility for the Advancement of Geoscience &
the Seismological Facility for the Advancement of Geoscience)**

(Dollars in Millions)

	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request	Change over	
				FY 2023 Base Plan Amount	Percent
GAGE	\$14.55	-	\$8.55	-6.00	-41.2%
SAGE	23.37	-	13.25	-10.12	-43.3%
National Geophysical Facility (NGF)	-	-	23.49	23.49	N/A
TOTAL	\$37.92	-	\$45.29	\$7.37	19.4%

¹ GAGE and SAGE will be consolidated into a single facility during FY 2025. Budget Year and outyear estimates for the consolidated facility are shown under a new line called the "National Geophysical Facility (NGF)".

Brief Description

NGF will be formed in FY 2025 from the current GAGE and SAGE. NGF will continue SAGE and GAGE legacies, combined into a single distributed, multi-user facility that enables a diverse research community to make advances in understanding Earth processes. Currently, GAGE operates networks of Global Positioning System (GPS) and Global Navigational Satellite Systems (GNSS) instruments, and SAGE operates global and regional networks of seismic sensors, such as the Global Seismographic Network. SAGE and GAGE both provide geophysical instrumentation for field experiments, support archiving, quality control, and distribution of data, and provide education and outreach activities that serve a wide range of audiences. The future unified NGF facility will support science reflective of the increased synergy between seismology and geodesy and will leverage efficiencies in operation and management of the two current facilities.

Meeting Scientific Community Needs

The current SAGE and GAGE facilities enable the research community to ask, and address, questions about a variety of Earth processes from local to global scales, such as earthquakes, volcanic eruptions, landslides, tectonic plate motion, and water cycle dynamics. GAGE and SAGE are organized under three primary service areas: 1) Geophysical Infrastructure, 2) Data Services, and 3) Education, Outreach, and Community Engagement. GAGE and SAGE users can access data and educational products via the internet at no cost. Scientists making use of equipment, training, and other resources provided by GAGE and SAGE typically are funded via awards from NSF, the U.S. Geological Survey (USGS), the National Aeronautics and Space Administration (NASA), and other agencies. NSF-sponsored users are generally supported by the Division of Earth Sciences (EAR), the Division of Ocean Sciences (OCE), and the Office of Polar Programs (OPP).

Demand for data, equipment, and other resources provided via GAGE and SAGE remains high.

Beginning in FY 2023 and through FY 2024, the GAGE and SAGE data centers are being redesigned and moved to cloud-based operations, enabling many new capabilities to users, including better access to high-throughput and high-performance computing resources. Together, GAGE and SAGE support over 150 field experiments annually, including equipment and field engineering assistance. GAGE and SAGE also facilitate a variety of educational and workforce development activities, including short courses and summer internship programs at the community college, undergraduate, and graduate school levels. These programs have consistently produced scientific and professional benefits for the participating students by advancing knowledge and awareness of geoscience career paths. Interns have also enhanced their computational and scientific communication skills.

Status of the Facility

GAGE and SAGE are currently operating in year five of seven-year NSF awards, and the capabilities provided by the facilities have evolved over time. Following a series of community engagement activities, including a National Academies of Sciences, Engineering, and Medicine decadal survey (2020), which included a workshop evaluating *Management Models for Future Seismological and Geodetic Facilities and Capabilities*,¹ and a portfolio review² by a subcommittee of the GEO Advisory Committee (2021), GEO/EAR announced that the two existing facilities would be integrated into a single, unified geophysical facility at the time of the next competition for the facility managing organization. The portfolio review report also emphasized the importance of developing partnerships in support of elements of GAGE and SAGE that are mission critical for other Federal agencies. EAR is actively working to enhance and expand Federal partnerships.

Governance Structure and Partnerships

NSF Governance Structure

NSF oversight is provided by EAR, working cooperatively with OPP, and staff from BFA's Research Infrastructure Office and Division of Acquisition and Cooperative Support, the Office of the General Counsel, and the Office of Legislative and Public Affairs. The GEO facilities team and the Chief Officer for Research Facilities also provide high-level guidance, support, and oversight.

External Governance Structure

The awardee that manages the GAGE and SAGE facilities is a 501(c)(3) nonprofit corporation governed by a Board of Directors elected by institutional representatives. As of January 1, 2023, the Incorporated Research Institutions for Seismology (IRIS), Inc. (which managed SAGE since the start of the current award in FY 2018) and UNAVCO (the managing entity for GAGE since the start of the current award in FY 2018) merged to form the EarthScope Consortium, Inc., with over 170 institutional members. This consortium now manages both GAGE and SAGE as discrete major facilities. Board members vet program decisions associated with GAGE and SAGE management and operation through consultation with EarthScope Consortium staff and GAGE and SAGE advisory committees, which are comprised of participants from the consortium's member institutions, partner agencies, and staff of other NSF Major Facility operators. The governance structure for the future unified NGF facility will be

¹ Management Models for Future Seismological and Geodetic Facilities and Capabilities: Proceedings of a Workshop | The National Academies Press. <https://nap.nationalacademies.org/read/25536/chapter/1>

² AC GEO Report on Portfolio Review of EAR Seismology and Geodesy Instrumentation | NSF - National Science Foundation at: www.nsf.gov/news/news_summ.jsp?cntn_id=302748&org=GEO

Major Facilities

determined during the next competition for the facility managing organization.

Partnerships and Other Funding Sources

NASA provides funding for GAGE to enable use of GPS and GNSS data for satellite orbit and clock corrections and the refinement of the International Terrestrial Reference Frame. Similarly, USGS provides support for GAGE to obtain data for operations of ShakeAlert, its earthquake early warning program. USGS also operates two-thirds of the Global Seismographic Network (GSN) in partnership with SAGE, which operates the remaining one-third. EarthScope Consortium leverages the GAGE award to partner with commercial entities that use the data for autonomous vehicle navigation.

Funding

Total Obligations for NGF (formerly GAGE and SAGE)

(Dollars in Millions)

	FY 2023	FY 2024	FY 2025	ESTIMATES ¹				
	Base Plan	(TBD)	Request	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
GAGE	\$14.55	-	\$8.55	-	-	-	-	-
SAGE	23.37	-	13.25	-	-	-	-	-
National Geophysical Facility ²	-	-	23.49	45.29	45.29	45.29	45.29	45.29
TOTAL	\$37.92	-	\$45.29	\$45.29	\$45.29	\$45.29	\$45.29	\$45.29

¹ Outyear estimates are for planning purposes only. The current cooperative agreement for SAGE and GAGE ends in September 2025. In 2020, NSF announced preparation for a competition for a future single, unified geophysical facility as the successor to SAGE and GAGE.

² GAGE and SAGE will be consolidated into a single facility during FY 2025. Budget Year and outyear estimates for the consolidated facility are shown under a new line called the "National Geophysical Facility (NGF)".

The FY 2025 Request supports O&M of NGF including NSF's implementation of recommendations from the research community and prior facility reviews. Innovations include updating the GAGE and SAGE capabilities to include sensors that enable more precise measurements of Earth's surface and to improve studies of near-surface processes (e.g., water storage and flux); moving data services for the facility to the cloud; and recapitalizing aging instrumentation. EAR is evaluating different strategies to address aging instrumentation and plans to phase in recapitalization over the remainder of the current GAGE and SAGE award period.

Reviews and Reports

In 2023, NSF conducted a full science and project management review of both the GAGE and SAGE facilities. Reviewers noted that, "SAGE and GAGE... are exemplary facilities that have provided excellent support for research, operations, and education for the geodetic and seismic communities." NSF is planning a follow up site visit in April 2024.

Renewal/Recompetition/Disposition

In 2020, NSF announced preparation for a competition for a future single, unified geophysical facility as the successor to GAGE and SAGE. Proposals for the operations and maintenance of the consolidated facility, the National Geophysical Facility, are due to NSF in June 2024. Through this

competition,³ NSF plans to streamline existing capabilities and support innovations to better enable cutting edge research in the Earth Sciences. The National Geophysical Facility is expected to begin operations at the start of FY 2026.

³ www.nsf.gov/pubs/2023/nsf23623/nsf23623.htm