DIRECTORATE FOR GEOSCIENCES (GEO) $1,365,410,000
+$61,020,000 / 4.7%

GEO Funding

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Atmospheric and Geospace Sciences (AGS)	$250.85	$251.15	$262.88	$11.73	4.7%
Earth Sciences (EAR)	177.81	177.20	188.21	11.01	6.2%
Integrative and Collaborative Education and Research (ICER)	83.53	83.74	95.20	11.46	13.7%
Ocean Science (OCE)	356.27	355.95	369.61	13.66	3.8%
Polar Programs (PLR)	452.87	436.35	449.51	13.16	3.0%
U.S. Antarctic Logistical Support (USALS)	*[68.94]*	*[67.52]*	*[67.52]*	-	-
Total, GEO	**$1,321.32**	**$1,304.39**	**$1,365.41**	**$61.02**	**4.7%**

Totals may not add due to rounding.

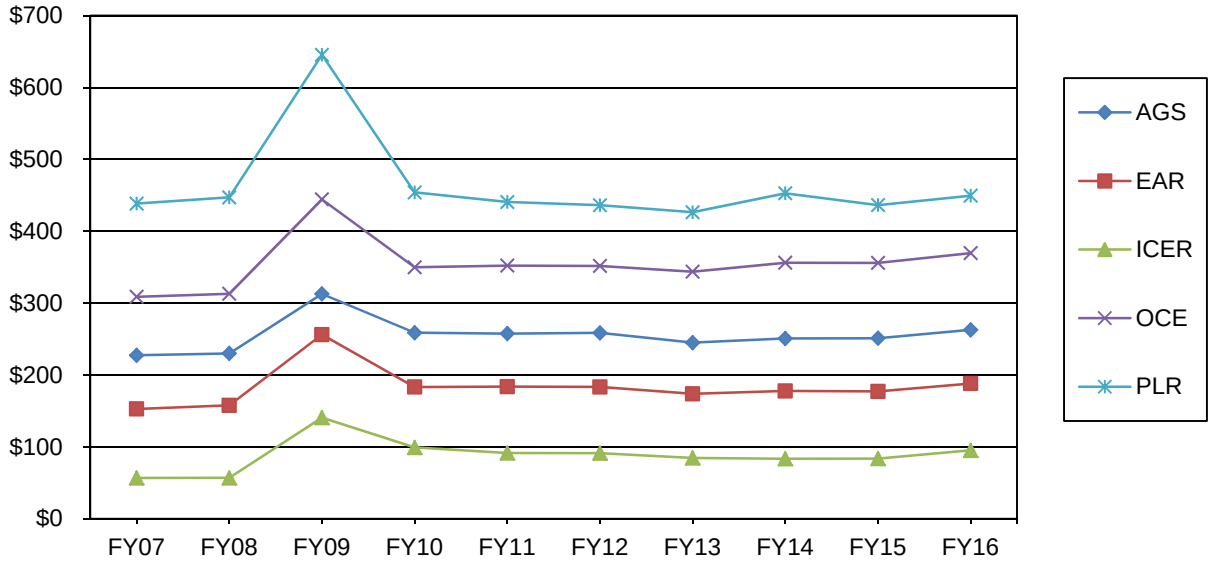
About GEO

GEO supports basic research that advances the frontiers of knowledge and drives technological innovation while improving our understanding of the many processes that affect the global environment. These processes include the planetary water cycle, geologic interactions that cross the land-ocean interface, and the behavior of ice sheets. Lives are saved and property is preserved through better prediction and understanding of natural environmental hazards such as earthquakes, tornados, hurricanes, tsunamis, drought, and solar storms. Basic research supported by GEO enables preparation for and subsequent mitigation of, or adaptation to, the effects of these and other disruptive natural events. Support is provided for interdisciplinary studies that contribute directly to national research priorities such as: mitigating the impacts of hazardous events; developing and deploying integrated ocean observing capabilities to support ecosystem-based management; and understanding future availability and distribution of fresh water. Another focus is understanding the Earth's polar regions – research that spans not only atmospheric, earth, and ocean processes, but other NSF-supported disciplines.

As the primary U.S. supporter of fundamental research in the polar regions, GEO provides interagency leadership for U.S. polar activities. In the Arctic, NSF helps coordinate research planning as directed by the Arctic Research Policy Act of 1984. The NSF Director chairs the Interagency Arctic Research Policy Committee created for this purpose, which is now a component of the President's National Science and Technology Council (NSTC). In the Antarctic, per Presidential Memorandum 6646, GEO manages all U.S. activities as a single, integrated program, making Antarctic research possible for scientists supported by NSF and by other U.S. federal agencies. The latter include the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), the Smithsonian Institution, and the Department of Energy. The U.S. Antarctic Program research activity funded by NSF also supports leadership by the U.S. Department of State in the governance of the continent and Southern Ocean under the aegis of the Antarctic Treaty.

GEO provides about 61 percent of the federal funding for basic research at academic institutions in the geosciences.

GEO Subactivity Funding
(Dollars in Millions)



FY 2009 funding reflects both the FY 2009 omnibus appropriation and funding provided through the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

FY 2016 Summary by Division

- AGS's FY 2016 Request emphasizes support for two new NSF-wide emphasis areas: 1) the Risk and Resilience activity through PREEVENTS (Prediction of and Resilience against Extreme Events), and 2) the Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS) investment. Support continues for the NSF-wide Science, Engineering, and Education for Sustainability (SEES) investment as it ramps down. AGS priorities include maintaining support for disciplinary and interdisciplinary research activities and the observational infrastructure required to conduct modern research, including overseeing operation of the National Center for Atmospheric Research (NCAR)-Wyoming Supercomputing Center.

- EAR's FY 2016 Request is focused on support for PREEVENTS and INFEWS. Supporting SEES, maintaining support for disciplinary and interdisciplinary research activities, and the observational infrastructure required to conduct modern research also remain priorities.

- ICER's FY 2016 Request includes support for PREEVENTS and INFEWS. Support will continue for priority areas such as Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21) and SEES. Funding for Improving Undergraduate STEM Education (IUSE), led by the Directorate for Education and Human Resources (EHR), is reduced and funds are redirected to the new NSF-wide Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (NSF INCLUDES) activity as well as Research Experiences for Undergraduates (REU). GEO is also initiating through the ICER division a new activity to support mid-scale research infrastructure, which will address those projects that are above the ceiling for the Major Research Infrastructure (MRI) program but below the threshold for Major Research Equipment and Facilities Construction (MREFC) consideration. ICER will also

provide some support for the operations and maintenance of the Ocean Observatories Initiative (OOI), enabling OCE to maintain a strong research portfolio.

- OCE's FY 2016 Request includes support for PREEVENTS and INFEWS. It also supports SEES. OCE is strongly supporting the President's Executive Order establishing a National Ocean Policy (NOP) through enablement of research, education, and infrastructure. OCE continues to support OOI. OCE is continuing to invest in research infrastructure and planning for potential new Regional Class Research Vessels (RCRV).

- PLR's FY 2016 Request is focused on maintaining strong disciplinary programs; targeted basic research in cross-foundation and interagency priorities; and supporting and improving the efficiency of critical facilities that enable research in both polar regions, including planning to realize NSF's long-term vision for continued U.S. presence in Antarctica. Support is also provided for PREEVENTS and INFEWS.

Major Investments

GEO Major Investments

(Dollars in Millions)

Area of Investment	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
CAREER	$18.47	$15.64	$16.65	$1.01	6.5%
CIF21	15.25	11.00	14.21	3.21	29.2%
I-Corps™	1.09	1.38	0.60	-0.78	-56.5%
NSF INCLUDES	-	-	2.44	2.44	N/A
INFEWS	-	-	14.78	14.78	N/A
INSPIRE	0.69	2.17	2.17	-	-
IUSE	-	10.90	6.00	-4.90	-45.0%
Mid-Scale Infrastructure	-	-	9.31	9.31	N/A
NRT[1]	2.21	6.63	4.43	-2.20	-33.2%
Risk and Resilience	-	-	23.50	23.50	N/A
SEES	68.00	59.00	34.00	-25.00	-42.4%

Major investments may have funding overlap and thus should not be summed.

[1] Outyear commitments for Integrative Graduate Education and Research Traineeship (IGERT) are included in the NRT line and are $2.21 million in FY 2014, $2.04 million in FY 2015, and $0.61 million in FY 2016.

- CAREER: GEO support for the CAREER program will increase 6.5 percent, from $15.64 million in the FY 2015 Estimate, to $16.65 million in the FY 2016 Request, reflecting GEO's commitment to supporting the next generation of scientists.

- CIF21: GEO's investment will increase by nearly 30 percent in FY 2016, from a FY 2015 Estimate level of $11.0 million to a FY 2016 Request level of $14.21 million in FY 2016. The increase is largely related to GEO's participation in the new Data Science Pilots activity that will be initiated in FY 2016.

- I-Corps™: GEO support decreases relative to FY 2015 Estimate to a total of $600,000, reflecting the end of GEO direct support for I-Corps™ Sites. GEO continues to support I-Corps™ Nodes.

- NSF INCLUDES: In FY 2016, NSF emphasizes a new program, NSF INCLUDES, which aims to promote broader participation in the sciences. GEO support totals $2.44 million in FY 2016.

- INFEWS: In FY 2016, NSF is building a new interdisciplinary investment to study the food-energy-water nexus, Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS). Initial support for this activity in FY 2016 totals $14.78 million.

- INSPIRE: GEO will maintain an investment of $2.17 million in INSPIRE.

- IUSE: Support for the NSF-wide IUSE (Improving Undergraduate STEM Education) activity decreases by $4.90 million, to a total of $6.0 million. Funds are redirected to Research Experiences for Undergraduates (REU) and NSF INCLUDES.

- Mid-Scale Infrastructure: Support for this new activity will enable GEO to invest in emerging infrastructure beyond the scope of the MRI program, but smaller than what is typically funded through NSF's MREFC account. GEO funding is $9.31 million in FY 2016.

- NSF Research Traineeship (NRT): GEO will continue to fund STEM graduate students in areas of national priority and support the development of transformative and scalable models for STEM graduate education.

- Risk and Resilience: In FY 2016, NSF is initiating a new activity to enhance national risk and resilience to hazardous events. GEO plays a key role in advancing understanding of natural hazards such as tornados, hurricanes, earthquakes, and disruptive space weather events, and is investing $23.50 million in PREEVENTS in FY 2016.

- SEES: SEES programs began a planned ramp-down in FY 2015, and in FY 2016, this phase-out will continue. GEO support for SEES decreases by $25.0 million, to a total of $34.0 million in FY 2016. Funds are largely being reinvested in the Risk and Resilience activity and INFEWS.

GEO Funding for Centers Programs and Facilities

GEO Funding for Centers Programs

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, Centers Programs	**$14.32**	**$10.32**	**$5.00**	**-$5.32**	**-51.6%**
Science & Techology Centers (AGS, OCE, PLR)	14.32	10.32	5.00	-5.32	-51.6%

Totals may not add due to rounding.

For detailed information on individual centers, please see the NSF-Wide Investments chapter.

- FY 2016 sees the planned retirement of two Science and Technology Centers (STC): the Center for Multiscale Atmospheric Processes and the Center for Coastal Margin Observation and Prediction. In

OCE, support continues for the Center for Dark Energy Biosphere Investigations at a level of $5.0 million.

GEO Funding for Facilities

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, Facilities	**$633.94**	**$629.35**	**$641.18**	**$11.83**	**1.9%**
Academic Research Fleet[1] (OCE)	84.86	87.00	88.00	1.00	1.1%
Arctic Research Support and Logistics (PLR)	44.08	38.64	40.27	1.63	4.2%
Arecibo Observatory (AGS)	3.50	4.00	4.10	0.10	2.5%
Geodesy Advancing Geosciences and EarthScope (GAGE)	11.58	11.58	12.33	0.75	6.5%
IceCube Neutrino Observatory (PLR)	3.45	3.45	3.45	-	-
International Ocean Discovery Program (OCE)	50.00	48.00	48.00	-	-
National Center for Atmospheric Research (AGS)	96.60	98.20	99.00	0.80	0.8%
National Nanotechnology Coordinated Infrastructure (ICER)	-	0.30	0.30	-	-
National Nanotechnology Infrastructure Network (ICER)	0.30	-	-	-	N/A
Ocean Observatories Initiative (OCE and ICER)	49.30	55.00	55.00	-	-
Seismological Facilities for the Advancement of Geosciences and EarthScope (EAR)	24.35	24.35	25.10	0.75	3.1%
U.S. Antarctic Facilities and Logistics (PLR)	196.99	191.31	198.11	6.80	3.6%
U.S. Antarctic Logistical Support (PLR)	68.94	67.52	67.52	-	-

Totals may not add due to rounding.

[1]Academic Research Fleet includes funding for pre-construction planning for Regional Class Research Vessels: $1.86 million in FY 2014, $2.0 million in FY 2015, and $3.0 million in FY 2016.

For detailed information on individual facilities, please see the Facilities chapter.

- Support for the Academic Research Fleet increases from $87.0 million in FY 2015 to $88.0 million in FY 2016, reflecting the ramp-up in planning for the possible construction of up to three Regional Class Research Vessels.

- Arctic Research Support and Logistics increases by $1.63 million to a total of $40.27 million in FY 2016, reflecting higher operating expenses.

- Arecibo Observatory support increases $100,000 to $4.10 million in FY 2016. The Directorate for Mathematical and Physical Sciences (MPS) leads this activity.

- Support for Geodesy Advancing Geosciences and EarthScope (GAGE) increases from a FY 2015 level of $11.58 million to $12.33 million in FY 2016. This increase is required for the facility to continue supporting the user community at current levels.

- The National Center for Atmospheric Research (NCAR) will increase by $800,000 to a total of $99.0 million in FY 2016. The increase will allow deferred maintenance needs on NSF-owned assets to be addressed.

- Support for Seismological Facilities for the Advancement of Geosciences and EarthScope (SAGE) increases from a FY 2015 level of $24.35 million to $25.10 million in FY 2016. This increase is required for the facility to continue supporting the user community at current levels.

- U.S. Antarctic Facilities and Logistics support increases to $198.11 million in FY 2016. This includes an additional $1.0 million, to a total of $3.0 million, for the Antarctic Infrastructure Modernization for Science (AIMS) preconstruction planning project. The majority of the $6.80 million increase above the FY 2015 level is associated with support for increased science demands and mandatory military pay raises.

Summary and Funding Profile

GEO supports investment in disciplinary and interdisciplinary research and education as well as research infrastructure such as the National Center for Atmospheric Research (NCAR), the Academic Research Fleet, and research stations in the Arctic and Antarctic.

In FY 2016, the number of research grant proposals is expected to stay about the same as in FY 2015 and GEO expects to award about 1,600 research grants. Average annual award size and duration are not expected to materially fluctuate in FY 2014 through FY 2016.

Operations and maintenance funding for GEO-supported user facilities and infrastructure comprises about 52 percent of GEO's FY 2016 Request. GEO has increased operations budgets for some facilities in FY 2016 in order to maintain current operational capacity.

GEO Funding Profile

	FY 2014 Actual Estimate	FY 2015 Estimate	FY 2016 Estimate
Statistics for Competitive Awards:			
Number of Proposals	5,797	6,100	6,100
Number of New Awards	1,494	1,600	1,600
Funding Rate	26%	26%	26%
Statistics for Research Grants:			
Number of Research Grant Proposals	5,306	5,600	5,600
Number of Research Grants	1,268	1,350	1,350
Funding Rate	24%	24%	24%
Median Annualized Award Size	$141,121	$145,000	$145,000
Average Annualized Award Size	$200,471	$195,000	$210,000
Average Award Duration, in years	2.7	2.7	2.8

Program Monitoring and Evaluation

- External Program Evaluations and Studies: In January 2015, OCE received a Decadal Survey of

Ocean Sciences from the Ocean Studies Board of the National Research Council. This survey:

- Summarized ocean science advancements from the past decade;
- Identified ocean science priorities for the next decade;
- Analyzed the ability of current research infrastructure to address those priorities;
- Recommended an infrastructure portfolio that is needed to advance those priorities; and
- Assessed opportunities for NSF to meet research priorities by complementing ocean science research conducted by other federal agencies.

Committees of Visitors (COV):

- In 2014, COVs reviewed the AGS Geospace Section, EAR, and the OCE Integrative Programs Section. The COV reports were presented to the GEO Advisory Committee at their October 2014 meeting. While broadly complimentary of the work of the reviewed activities, some recommendations for improvement were made. Recommendations included suggestions for improved efficiency in the use of infrastructure, streamlining programmatic structure to better assist the research community, and to continue efforts to educate proposers on NSF's expectations with regard to broader impacts.
- In 2015, COVs will be held to review Ocean Research and Education programs and the National Center for Atmospheric Research (NCAR) and Facilities Section within AGS.
- In 2016, COVs will review the Atmosphere Section in AGS, and PLR's Antarctic Sciences, Antarctic Infrastructure, and Arctic Sciences Sections.

Workshops:

- With NSF and NASA funding, the Interagency Ocean Observation Committee's Biological Integration and Observation Task Team of 35 participants with a wide range of expertise from the ocean observing community conducted a workshop in November 2014 to identify and prioritize crosscutting biological and ecosystem observation needs.
- To encourage interactions between the Hydrologic Science and Physical and Dynamic Meteorology research communities in advancing this critical research, a community workshop was held in September 2014.

The Performance chapter provides details regarding the periodic reviews of programs and portfolios of programs by external Committees of Visitors and directorate Advisory Committees. Please see this chapter for additional information.

Number of People Involved in GEO Activities

	FY 2014 Actual Estimate	FY 2015 Estimate	FY 2016 Estimate
Senior Researchers	5,316	5,700	5,600
Other Professionals	3,500	3,200	3,700
Postdoctorates	661	600	700
Graduate Students	2,556	2,800	2,700
Undergraduate Students	3,012	2,400	3,200
Total Number of People	**15,045**	**14,700**	**15,900**

DIVISION OF ATMOSPHERIC AND GEOSPACE SCIENCES (AGS) $262,880,000 +$11,730,000 / 4.7%

AGS Funding

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, AGS	**$250.85**	**$251.15**	**$262.88**	**$11.73**	**4.7%**
Research	**122.42**	**123.39**	**133.28**	**9.89**	**8.0%**
CAREER	8.43	6.21	6.67	0.46	7.4%
Centers Funding (total)	3.32	2.66	-	-2.66	-100.0%
STC: Multiscale Modeling of Atmospheric Processes	3.32	2.66	-	-2.66	-100.0%
Education	**4.14**	**2.54**	**3.00**	**0.46**	**18.1%**
Infrastructure	**124.29**	**125.22**	**126.60**	**1.38**	**1.1%**
Arecibo Observatory	3.50	4.00	4.10	0.10	2.5%
National Center for Atmospheric Research (NCAR)	96.60	98.20	99.00	0.80	0.8%
Research Resources	24.19	23.02	23.50	0.48	2.1%

Totals may not add due to rounding.

The mission of AGS is to extend intellectual frontiers in atmospheric and geospace sciences by making responsible investments in fundamental research, technology development, and education that enable discoveries; nurture a vibrant, diverse scientific workforce; and help attain a prosperous and sustainable future. AGS supports activities to further understanding of the dynamics of the Sun and the physics, chemistry, and dynamics of the Earth's atmosphere and near-space environment. AGS provides support for: 1) basic science projects and 2) the acquisition, maintenance, and operation of observational and cyber-infrastructure facilities and services that enable and support modern day atmospheric and geospace science research activities. Although the majority of AGS support is through traditional "individual investigator" merit reviewed, multi-year grants, the division also supports small-scale, limited duration exploratory research projects; collaborative or multi-investigator group projects focusing on a particular project, subject, or activity; large center or center-like projects; and funding for the research conducted at facilities provided by NSF's National Center for Atmospheric Research (NCAR), which extends and enhances research at universities. More information on NCAR is available in the Facilities chapter. The division will continue support in key areas of fundamental atmospheric and geospace science, including efforts to improve understanding of the dynamics, predictability, and impacts of extreme atmospheric and space weather events, and development of fundamental knowledge to support preparedness and improve adaptation to short and long-term variability in weather.

Recognizing the close interplay between the division's support for science and the provision of facilities to support that science, AGS seeks to properly balance such support. Approximately 50 percent of the annual budget of AGS is used to support observational and computational facilities, as well as NCAR, a Federally Funded Research and Development Center, and the Arecibo Observatory, which is co-funded with the Division of Astronomy (AST) within the Directorate for Mathematical and Physical Sciences (MPS). The remaining half of the AGS budget is for individual, small group, and center-like research

grants. In general, of the 50 percent of the AGS budget available for research grants, about 30 percent is available for new research grants. The remaining portion of the AGS budget funds continuing grants made in previous years.

FY 2016 Summary

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

Research

- Support for the AGS disciplinary and interdisciplinary research programs is maintained to fund basic research into understanding weather and precipitation variability, and extreme atmospheric and space weather phenomena.
- AGS will support NSF's INFEWS activity at a level of $2.50 million, new in 2016.
- An NSF-wide thrust on Risk and Resilience research, new in FY 2016, will be supported at $5.25 million through GEO's PREEVENTS activity.
- Investments in the SEES portfolio decrease by $3.0 million, to $10.0 million, as the SEES program focused on earth system modeling ramps down.
- $500,000 is provided for the Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) program.
- Support for early-career researchers remains an AGS priority. The division increases its support for CAREER grants to a total of $6.67 million. This funding is consistent with GEO and AGS objectives.
- Funding for the Center for Multi-scale Modeling of Atmospheric Processes (CMMAP) has come to a close, reflecting the planned sunsetting of this Class of 2006 STC.

Education

- The education portfolio increases to $3.0 million in FY 2016, reflecting the division's commitment to the Research Experiences for Undergraduates (REU) program and support for postdoctoral fellows.

Infrastructure

- Funding for the Arecibo Observatory will increase $100,000, to a total of $4.10 million, equivalent to the level of co-funding support from MPS/AST.
- NCAR support is increased by $800,000, to a total of $99.0 million, to fund needed research infrastructure for advancing the understanding of high-impact atmospheric and space weather hazards.
- Research Resources are allocated $23.50 million to support the deployment of lower atmosphere observing facilities and to support access to data and software for the research community.

DIVISION OF EARTH SCIENCES (EAR) $188,210,000
+$11,010,000 / 6.2%

EAR Funding
(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, EAR	**$177.81**	**$177.20**	**$188.21**	**$11.01**	**6.2%**
Research	**117.09**	**114.32**	**122.58**	**8.26**	**7.2%**
CAREER	6.87	5.50	5.87	0.37	6.7%
Education	**4.29**	**4.95**	**5.45**	**0.50**	**10.1%**
Infrastructure	**56.43**	**57.93**	**60.18**	**2.25**	**3.9%**
Geodesy Advancing Geosciences and EarthScope (GAGE)	11.58	11.58	12.33	0.75	6.5%
Seismological Facilities for the Advancement of Geosciences and EarthScope (SAGE)	24.35	24.35	25.10	0.75	3.1%
Research Resources	20.50	22.00	22.75	0.75	3.4%

Totals may not add due to rounding.

EAR supports fundamental research into the structure, composition, and evolution of the Earth, and the life it has sustained over the four and a half billion years of Earth history. The results of this research will lead to a better understanding of Earth's changing environment (past, present, and future), the natural distribution of its water, food, and energy resources, and provide methods for predicting and mitigating the effects of geologic hazards such as earthquakes, volcanic eruptions, floods, and landslides.

Through its Surface Earth Processes section, EAR supports research in geomorphology and land use, hydrologic science, geobiology and low temperature geochemistry, and sedimentary geology and paleobiology. The division's Deep Earth Processes section maintains programs in geophysics, tectonics, petrology and geochemistry, and integrated earth systems. In addition to these fundamental research programs, EAR has an Instrumentation and Facilities program that supports community-based, shared-use facilities and the acquisition and development of instrumentation by individual investigators; EarthScope, a large-scale facility with an associated science program focused on studying the structure and tectonics of the North American continent; and an education program that funds a number of activities to attract and support students and young investigators to the field of earth science.

Approximately 68 percent of EAR's budget is used to support individuals and small groups of researchers, while about 32 percent of the budget goes to instrumentation and facilities. The two largest facilities supported by EAR are Seismological Facilities for the Advancement of Geosciences and EarthScope (SAGE) and Geodesy Advancing Geosciences and EarthScope (GAGE). In general, 38 percent of the EAR portfolio is available for new research grants. The remaining 62 percent is utilized to support grants made in prior years, along with the research infrastructure necessary for the conduct of cutting-edge research on a variety of earth science topics.

FY 2016 Summary

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

Research

- EAR will support INFEWS at a level of $6.50 million, new in 2016.
- EAR will continue its participation in SEES at a level of $1.50 million, a reduction of $7.0 million below FY 2015.
- An NSF-wide thrust on Risk and Resilience research, new in FY 2016, will be supported at $5.25 million through GEO's PREEVENTS activity.
- In FY 2016, EAR's support for the INSPIRE program will be $500,000.
- CAREER funding will be supported at a level of $5.87 million, an increase of $370,000 over FY 2015, reflecting EAR's continued commitment to supporting early career investigators.

Education

- EAR's support for education activities in FY 2016 will be $5.45 million, an increase of $500,000 over FY 2015. Research Experiences for Undergraduates (REU) sites will increase from $1.50 million to $1.74 million, and support for EAR Postdoctoral Fellowships will increase from $1.70 million to $1.96 million, reflecting EAR's commitment to workforce development.

Infrastructure

- SAGE and GAGE will increase funding by 3.1 and 6.5 percent, respectively, allowing these key facilities to continue to serve growing communities of researchers.
- Increased funding of $750,000 to a total of $22.75 million will enable EAR's Instrumentation and Facilities Program to provide more support for multi-user regional and national facilities.

DIVISION OF INTEGRATIVE AND COLLABORATIVE EDUCATION AND RESEARCH (ICER) **$95,200,000**
+$11,460,000 / 13.7%

ICER Funding
(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, ICER	**$83.53**	**$83.74**	**$95.20**	**$11.46**	**13.7%**
Research	**76.36**	**50.80**	**55.12**	**4.32**	**8.5%**
CAREER	0.09	0.40	0.40		
Education	**6.87**	**18.64**	**16.47**	**-2.17**	**-11.6%**
Infrastructure	**0.30**	**14.30**	**23.61**	**9.31**	**65.1%**
National Nanotechnology Coordinated Infrastructure (NNCI)	-	0.30	0.30	-	-
National Nanotechnology Infrastructure Network (NNIN)	0.30	-	-	-	N/A
Ocean Observatories Initiative (OOI)	-	14.00	14.00	-	-
Mid-Scale Research Infrastructure	-	-	9.31	9.31	N/A

Totals may not add due to rounding.

ICER supports novel, complex, or partnership projects in both research and education. These investments cut across traditional boundaries within the geosciences, encouraging interdisciplinary activities and responding directly to critical needs of the entire geoscience community. ICER's principal goals are to develop innovative means to initiate and support geoscience education, attract underrepresented groups to careers in the geosciences, foster the interchange of scientific information nationally and internationally, and to join with other parts of NSF in major integrative research and education efforts. In FY 2016, the division will make strategic investments in new multidisciplinary research areas, international activities, education, diversity, and human resource development.

In general, 43 percent of the ICER portfolio is available for new research grants. The remaining 57 percent supporting continuing grants made in previous years.

FY 2016 Summary

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

Research

- ICER will support NSF's INFEWS investment at a level of $3.78 million, new in 2016.
- A new NSF-wide thrust on Risk and Resilience research will be supported through GEO's PREEVENTS activity at $3.0 million.
- ICER will support activities in SEES totaling $10.0 million in FY 2016, a reduction of $5.0 million, reflecting the phasing out of this activity. Funds will be redirected to INFEWS and Risk and Resilience.
- ICER supports a varied portfolio of international collaborative activities. In FY 2016, this will total $6.50 million, and emphasize collaborative research across the Americas and activities sponsored by

the Belmont Forum, a group of the world's leading and emerging funding agencies focused on providing international, multi-lateral research opportunities for sustainability.

Education

- In FY 2016, GEO is decreasing support for the NSF-wide Improving Undergraduate STEM Education (IUSE) activity to a total of $6.0 million, a decrease of $4.90 million. Funds are being redirected to support additional Research Experiences for Undergraduates awards and NSF's new broadening participation activity, NSF INCLUDES ($2.44 million, new in FY 2016).
- ICER houses most of GEO's support for Integrative Graduate Education and Research Traineeship (IGERT) and NSF Research Traineeship (NRT), which combined total $3.52 million within ICER in FY 2016 (a decrease of $1.10 million). IGERT is being phased out as NRT support ramps up.

Infrastructure

- ICER provides GEO's contribution to the National Nanotechnology Coordinated Infrastructure, totaling $300,000.
- ICER continues to provide $14.0 million in support of operation and maintenance for the Ocean Observatories Initiative (OOI). This temporary support, from FY 2015 - FY 2017, enables the Division of Ocean Sciences (OCE) to maintain a strong research portfolio while the Decadal Survey of Ocean Sciences report is being prepared and recommendations considered. This report is expected to guide GEO's future investment decisions in the ocean sciences.
- Mid-Scale Infrastructure: Support for this new activity will enable GEO to invest in emerging infrastructure beyond the scope of the Major Research Instrumentation (MRI) program, but smaller than what is typically funded through NSF's Major Research Equipment and Facilities Construction (MREFC) Account. GEO funding is $9.31 million in FY 2016.

DIVISION OF OCEAN SCIENCES (OCE) $369,610,000
+$13,660,000 / 3.8%

OCE Funding
(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, OCE	**$356.27**	**$355.95**	**$369.61**	**$13.66**	**3.8%**
Research	**158.60**	**169.17**	**184.08**	**14.91**	**8.8%**
CAREER	2.07	1.96	2.06	0.10	5.1%
Centers Funding (total)	8.32	7.66	5.00	-2.66	-34.7%
STC: Coastal Margin Observation and Prediction	3.32	2.66	-	-2.66	-100.0%
STC: Dark Energy Biosphere Investigations	5.00	5.00	5.00	-	-
Education	**5.22**	**4.98**	**2.73**	**-2.25**	**-45.2%**
Infrastructure	**192.45**	**181.80**	**182.80**	**1.00**	**0.6%**
Academic Research Fleet	83.00	85.00	85.00	-	-
International Ocean Discovery Program (IODP)	50.00	48.00	48.00	-	-
Ocean Observatories Initiative (OOI)	49.30	41.00	41.00	-	-
Research Resources	8.29	5.80	5.80	-	-
Facilities Pre-Construction Planning (total)	1.86	2.00	3.00	1.00	50.0%
Regional Class Research Vessels (RCRV)	1.86	2.00	3.00	1.00	50.0%

Totals may not add due to rounding.

Research, education, and infrastructure funded by OCE address the central role of the oceans in a changing Earth and as a national strategic resource, as recognized in the President's 2010 Executive Order establishing a National Ocean Policy (NOP) and creating a National Ocean Council (NOC) to implement the policy. OCE supports interdisciplinary research to better understand changing ocean circulation and other physical parameters, biodiversity and the dynamics of marine organisms and ecosystems, and changing ocean chemistry as exemplified by ocean acidification. OCE also supports research on the geology of the ocean margins and sub-seafloor to investigate past conditions, stability of methane hydrates, natural hazards associated with earthquakes and volcanic eruptions, and microbial life deep below the seafloor. Ocean education emphasizes undergraduate REU programs and the interdisciplinary nature of ocean sciences. Since ocean science requires access to the sea, OCE supports research vessels, deep submergence capability including submersibles and autonomous vehicles, and technologically advanced sensors and instrumentation.

In FY 2016, research emphases in OCE will continue to be guided by "*Science for an Ocean Nation: Update of the Ocean Research Priorities Plan*," which was published by the NSTC Subcommittee on Ocean Science and Technology in 2013. This report identifies national research priorities in key areas of interaction between society and the ocean. These priorities include improved understanding of marine ecosystems, marine biodiversity, the impact of increased atmospheric carbon dioxide on ocean acidification, ocean observing, changing conditions in the Arctic, hazards and extreme events, and the enhancement of infrastructure to support ocean and coastal research. Beginning in FY 2014, The National Research Council's Ocean Studies Board began the first Decadal Survey of Ocean Sciences at the request of NSF. The survey objectives are to review the current state of knowledge, identify compelling scientific questions for the next decade, analyze infrastructure needed to address these

questions versus the current NSF portfolio, and identify opportunities to maximize the value of NSF investments. The report is expected to be delivered in early 2015 and will provide valuable community input as the ocean sciences portfolio of research and infrastructure is shaped to maximize scientific return in the coming years.

In general, 27 percent of the OCE portfolio is available for new research grants. The remaining 73 percent supports continuing grants made in previous years and research infrastructure.

FY 2016 Summary

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

Research

- OCE's research budget will increase by $14.91 million, largely through temporary support of OOI operations and maintenance from ICER. The additional funds will go largely towards bolstering ocean science disciplinary and interdisciplinary research programs, which had been reduced in recent years.
- In FY 2016, OCE will maintain support for the Long-Term Ecological Research (LTER) program at a level of $4.75 million.
- OCE will support NSF's INFEWS activity at a level of $1.0 million, new in 2016.
- A new NSF-wide thrust on Risk and Resilience research will be supported by OCE at $7.25 million through GEO's PREEVENTS activity.

Education

- OCE will increase support for REU programs to $2.20 million, an increase of $200,000.
- OCE is ending the postdoctoral fellowship program in FY 2016, as the activity was not attracting the diverse pool of applicants initially envisioned (-$1.50 million).
- Other disciplinary ocean science education efforts will be reduced by $1.0 million, to a total of $500,000 in FY 2016.

Infrastructure

- OCE will increase investment in planning and design for fleet renewal with Regional Class Research Vessels (RCRVs) as a candidate MREFC project by $1.0 million, to a total of $3.0 million.
- Funding for operations and maintenance of the Ocean Observatories Initiative (OOI) will be at $41.0 million in FY 2016. These funds will be supplemented by $14.0 million from ICER, bringing the total operations and maintenance for OOI to $55.0 million, maintaining level support for the program.
- Funding is requested for continued support for operations of the drilling vessel, *JOIDES Resolution (JR)*, as part of the U.S. contribution to the International Ocean Discovery Program (IODP). The FY 2016 request of $48.0 million maintains level funding.
- Funding for operation of the Academic Research Fleet is maintained at $85.0 million.

DIVISION OF POLAR PROGRAMS (PLR) $449,510,000
+$13,160,000 / 3.0%

PLR Funding
(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate Amount	Change Over FY 2015 Estimate Percent
Total, PLR	**$452.86**	**$436.35**	**$449.51**	**$13.16**	**3.0%**
Research	**129.57**	**125.39**	**130.95**	**5.56**	**4.4%**
CAREER	1.01	1.57	1.65	0.08	5.1%
Centers Funding (total)	2.68	-	-	-	N/A
STC: Center for Remote Sensing of Ice Sheets	2.68	-	-	-	N/A
Education	**2.77**	**3.80**	**2.71**	**-1.09**	**-28.7%**
Infrastructure	**320.52**	**307.16**	**315.85**	**8.69**	**2.8%**
Arctic Research Support and Logistics	44.08	38.64	40.27	1.63	4.2%
IceCube Neutrino Observatory (IceCube)	3.45	3.45	3.45	-	-
U.S. Antarctic Facilities and Logistics	196.99	189.31	195.11	5.80	3.1%
U.S. Antarctic Logistical Support (USALS)	68.94	67.52	67.52	-	-
Polar Environment, Health and Safety (PEHS)	7.07	6.24	6.50	0.26	4.2%
Facilities Pre-Construction Planning (total)	-	2.00	3.00	1.00	50.0%
Antarctic Infrastructure Modernization for Science (AIMS)	-	2.00	3.00	1.00	50.0%

Totals may not add due to rounding.

The Division of Polar Programs (PLR) is the primary U.S. supporter of, and has NSF interagency leadership responsibilities for, fundamental research in the polar regions. Arctic Sciences supports research in social, earth systems, and a broad range of natural sciences; its Research Support & Logistics program responds to research by assisting researchers with access to the Arctic and the planning and sharing of results with local Arctic communities. Antarctic Sciences funds research in a broad range of areas for which access to Antarctica and/or the Southern Ocean is essential to advancing the scientific frontiers. Antarctic Infrastructure & Logistics enables research in Antarctica on behalf of the U.S. government through a network of stations, labs, equipment, and logistical resources. The Environment, Health, and Safety section provides oversight for the environmental, health, and safety aspects of research and operations conducted in polar regions.

PLR's FY 2016 Request reflects three key priorities: (1) maintaining strong disciplinary programs that provide a basis for investments in cross-disciplinary science programs; (2) focusing basic research on cross-foundation (e.g., INFEWS) and interagency priorities; and (3) supporting and improving the efficiency of critical facilities that enable research in both polar regions. For Antarctica, the primary objective is to continue progress on a multi-year commitment toward more efficient and cost-effective science support as recommended by the U.S. Antarctic Program (USAP) Blue Ribbon Panel (BRP) report, *More and Better Science in Antarctica through Increased Logistical Effectiveness.*[1] NSF issued a formal response to this report in March 2013.[2] Emphases include safety and health improvements, investments with positive net present value, and facilities renewal at McMurdo and Palmer stations. Additionally, the Antarctic Sciences community is planning for the more effective observational

[1] www.nsf.gov/od/opp/usap_special_review/usap_brp/rpt/index.jsp
[2] www.nsf.gov/news/news_summ.jsp?cntn_id=127345&org=NSF&from=news

approaches that were outlined in the 2011 National Research Council report, *Future Science Opportunities in Antarctica and the Southern Ocean*,[3] and endorsed by the BRP. For the Arctic, shared cross-directorate basic research objectives, the Interagency Arctic Research Policy Committee's (IARPC) *Arctic Research Plan: FY 2013-2017*,[4] and the *National Ocean Policy Implementation Strategy*[5] inform science investment priorities.

As with most GEO divisions, PLR funds both research and the necessary research support in the form of logistics and infrastructure. The research budget is approximately 30 percent of the total division budget. Of this amount for research, 50 percent is available for new grants each year. The supporting logistics and infrastructure budget is 70 percent of the overall budget.

FY 2016 Summary

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

Research

- Funding for research increases by $5.56 million. There is a $5.50 million reduction in SEES investments, to a total of $3.0 million, as focus areas related to earth systems modeling and Arctic sustainability end. Approximately $4.11 million is redirected toward observation and modeling to advance knowledge about the role of polar oceans in carbon uptake from the atmosphere and the effects of ocean acidification on polar ecosystems. The remaining $1.39 million, together with an increase of $6.01 million, funds basic research supporting national research objectives and fundamental discovery.
- CAREER funding increases by $80,000, to a total of $1.65 million, to encourage participation of early career scientists in research in the polar regions.
- An investment of $1.0 million in the new cross-directorate INFEWS activity will fund research for understanding the mechanisms that enable sustainability and resiliency of global water, food, and energy resources.
- An investment of $2.75 million will fund polar research efforts contributing to the cross-directorate Risk and Resilience emphasis area through the PREEVENTS program.

Education

- In FY 2016, PLR supports IGERT continuing grants at $360,000 and NRT at $550,000.

Infrastructure

- Arctic Research Support & Logistics: This program provides support for Arctic researchers, including airplanes, helicopters, access to icebreakers, and field camps for approximately 150 projects in remote sites in Alaska, Canada, Arctic Scandinavia, Russia, and the Arctic Ocean. Summit Station on the Greenland ice cap operates as a year-round international site for a variety of atmospheric and geophysical measurements. An increase of $1.63 million, to a total of $40.27 million, enables increased use of marine platforms, such as the newly available *Sikuliaq*, for oceanographic research.
- IceCube Neutrino Observatory: PLR continues to match the MPS contribution of $3.45 million for operation and maintenance of the Observatory.

[3] www.nap.edu/catalog.php?record_id=13169
[4] www.nsf.gov/od/opp/arctic/iarpc/arc_res_plan_index.jsp
[5] www.whitehouse.gov/administration/eop/oceans/implementationplan

  - U.S. Antarctic Facilities & Logistics: Funding provides all necessary infrastructure, instrumentation, and logistics for scientists from all disciplines performing research in Antarctica. This support includes forward staging facilities in New Zealand and South America; operation of three year-round stations in Antarctica; Department of Defense fixed-wing aircraft, contracted rotary- and fixed-wing aircraft; two leased research vessels; and icebreaking services from the U.S. Coast Guard in support of annual resupply efforts. An additional $5.80 million, to a total of $195.11 million, supports increased science demands and mandatory military pay raises.
  - The FY 2016 Budget Request for U.S. Antarctic Facilities & Logistics also focuses on continuing progress on Antarctic infrastructure investments recommended by the BRP, such as continued investment in lifecycle replacement of outdated and obsolete equipment, and investment in IT systems, including communications, software, and network upgrades to provide continued connectivity for science and operational needs. Total funding is $18.50 million.
  - An additional $1.0 million, to a total of $3.0 million, for the Antarctic Infrastructure Modernization for Science (AIMS) project to continue the Preliminary Design Review for, among other things, replacing the Palmer Station pier for long-term access to unique research and redeveloping McMurdo Station to be a more efficient and effective facility for supporting Antarctic science. This comprehensive redevelopment of McMurdo involves replacement and reconfiguration of core science, operations, and logistics support facilities. AIMS also includes key area infrastructure upgrades for communications, runway and ship support.
- Polar Environment, Safety and Health: Funding is provided for implementation of both environmental protection and environmental stewardship to minimize the environmental impact of PLR-supported activities in polar regions, as well as programs to ensure the safety and health of participants in Antarctica, and certain Arctic operating locations. An increase of $260,000 permits review of management plans for specially managed or protected areas for which the United States has primary responsibility.