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REVIEW OF NASA-FUNDED INSTITUTES

June 9, 2016

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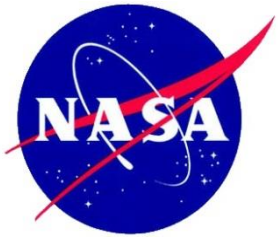

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Acronyms

ARMD	Aeronautics Research Mission Directorate
FAR	Federal Acquisition Regulation
FY	Fiscal Year
GRI	GeneSys Research Institute
HEOMD	Human Exploration and Operations Mission Directorate
IGES	Institute of Global Environment and Society
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
OIG	Office of Inspector General
PA&E	Program Analysis and Evaluation
SMD	Science Mission Directorate
STEM	Science, Technology, Engineering, and Mathematics
STEREO	Solar Terrestrial Relations Observatory
STMD	Space Technology Mission Directorate
USRA	Universities Space Research Association

NASA Centers and Facilities

Ames	Ames Research Center
Armstrong	Armstrong Flight Research Center
Glenn	Glenn Research Center
Goddard	Goddard Space Flight Center
Johnson	Johnson Space Center
JPL	Jet Propulsion Laboratory
Kennedy	Kennedy Space Center
Langley	Langley Research Center
Marshall	Marshall Space Flight Center
Stennis	Stennis Space Center
Wallops	Wallops Flight Facility

INTRODUCTION

Since its beginnings in 1958, NASA has been at the forefront of science and space exploration, serving as the engine behind numerous scientific discoveries and technological innovations. The Agency has relied on contributions from NASA's civilian and contractor workforce, and also from academic establishments, research entities, and other organizations – referred to collectively in this report as "institutes" – to provide expertise in a variety of fields. NASA uses these institutes to conduct research, review and analyze scientific data, develop equipment and technologies to meet mission requirements, and leverage knowledge. For example, the National Space Biomedical Research Institute in Houston, Texas, provides space medicine research relevant to NASA's human space flight program while the Planetary Science Institute in Tucson, Arizona, manages instruments on the Agency's Mars Odyssey, Dawn, and Juno spacecraft.[1]

In this report, we reviewed 60 NASA-funded institutes and examined their alignment to Agency missions, their history and funding profile, and examples of their contributions to NASA. See Appendix A for details of the audit's scope and methodology.

Background

In 2008, NASA conducted a study to identify Agency institutes established for general research purposes, evaluate their continued relevance to NASA's mission, and develop performance measures for evaluating and assessing their performance. The study team defined an institute as:

- A distinct entity established to perform research, to develop and/or transfer technology, and to provide services to the scientific community and the public;
- An organization responsible for facilitating scientific and industrial community access to NASA's space and ground-based assets; and/or
- An organization facilitating, developing, or leveraging intellectual capital of the academic community in fulfillment of NASA's mission.

The study team further refined its definition to include only organizations with a period of performance of 5 years or longer that had received at least $5 million from NASA and to exclude groups funded primarily by grants.

[1] Mars Odyssey launched in April 2001 and collects information on the chemical and radiation environment of Mars. Dawn launched in September 2007 and, after investigating the protoplanet Vesta in 2011-2012, is now orbiting the dwarf planet Ceres. The Juno mission launched in August 2011 and is scheduled to arrive at Jupiter in July 2016 for a 20-month investigation to examine the planet's origin and evolution.

The team found NASA obligated approximately $700 million in fiscal year (FY) 2007 to fund 16 "umbrella institutes" composed of approximately 55 "sub-institutes."[2] In addition, while almost all the institutes aligned to at least one of NASA's strategic goals, they found limited coordination between institutes and two-thirds without clearly defined performance metrics. The team also noted that NASA had no definition of an institute and no policy guidance for their establishment or use.

The study results were presented to senior NASA managers and initiated a several-years-long effort to develop a standardized definition and update an expired NASA policy. However, ultimately none of the study's results were incorporated into Agency policy.[3] Given the amount of funds expended annually on institutes and the importance of their work, we attempted to identify as many as possible and describe their scientific and financial relationship with NASA.

Review Methodology

For purposes of our review, we began with the 2008 study team's definition of an institute and expanded it to include any establishment, foundation, society, or similar organization that received funding from NASA in FYs 2013 through 2015.[4] NASA was not able to provide us with a comprehensive list of Agency-funded institutes, so we identified our universe through Internet research and collaboration with Agency officials, and in doing so identified 60 organizations that met our criteria (see Appendix B).[5] We sent each institute a standardized questionnaire to solicit information on its history, funding, and science and technical contributions to NASA. We did not independently verify all of the information provided, but afforded each institute the opportunity to review our two-page descriptive summary presented in this report. In accordance with our usual practice, we provided NASA with a draft of the full report for its review and comment.

[2] The study defined an umbrella institute as an entity that gathers industry and academic institutions to coordinate activities and pool resources, and a sub-institute as any entity or organization participating and operating under or receiving funding support from a NASA umbrella institute.

[3] NASA Procedures and Guidelines 5000.1, "Establishing a Science and Research Institute," April 26, 1999, was cancelled on February 15, 2004.

[4] For purposes of this review, we defined the term institute broadly so as to include as many NASA-funded organizations as possible. However, we excluded individual persons, for-profit companies, foreign-based entities, and solely academic establishments. See our full definition of institute in Appendix A.

[5] We eliminated 45 additional organizations because they no longer exist, had been absorbed by another institute, no longer receive NASA funding, or are an education program (see Appendix C).

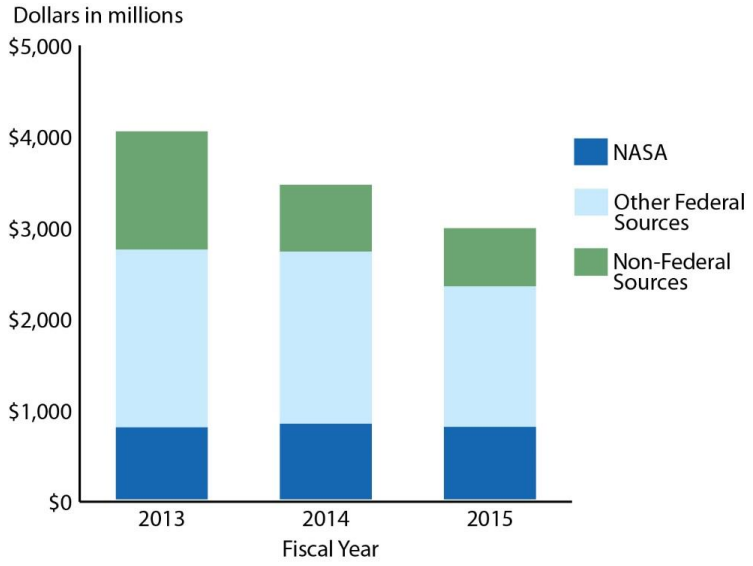
NASA Makes Significant Financial Investments in Institutes that Support All Aspects of the Agency's Mission

From conducting fundamental research to developing and operating scientific instruments, NASA-funded institutes play a vital role in enabling NASA to accomplish its multi-faceted science, exploration, and aeronautics mission. Each NASA Center and the four Mission Directorates fund institutes using a variety of procurement vehicles. The Agency's annual investment in the 60 institutes we identified was more than three quarters of a billion dollars or 4.6 percent of the Agency's total operating budget for the 3 years we examined.

Funding

The 60 institutes received an average of about $800 million per year from NASA between 2013 and 2015. As shown in Figure 1, many also received substantial funding from other sources, including other Federal agencies such as the Department of Defense and private entities like BP p.l.c.[6] NASA funding ranged from $137,739 for the Imaging Research Center located at the University of Maryland, Baltimore County, to almost $379 million for the Southwest Research Institute in San Antonio, Texas.

Figure 1: Total Institute Funding, FYs 2013–2015



Source: Data collected from institutes.

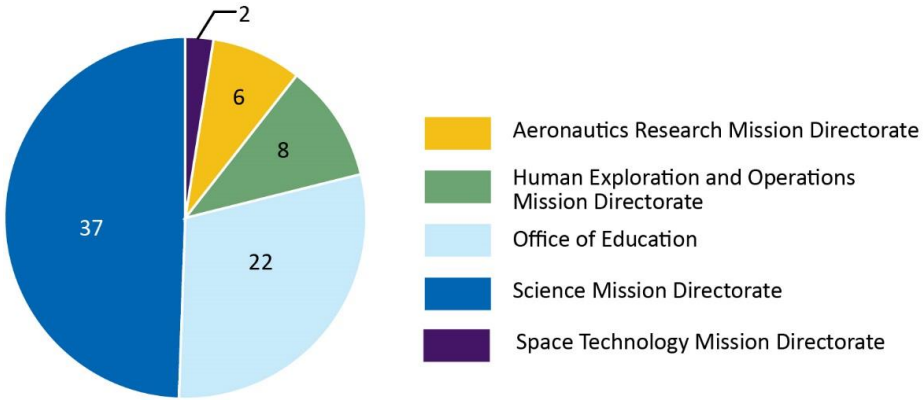
[6] Because we collected data for FY 2015 funding prior to the end of the fiscal year, the figure reported may not include all funding for that year.

Overall, NASA is a significant source of funding for the 60 institutes. Specifically,

- 18 of the 60 institutes received 95 percent or more of their total funding from NASA;
- NASA provided 23 percent of the total funding received by the 60 institutes; and
- NASA funding represented 31 percent of all Federal funds provided to the 60 institutes.

The institutes received funding from all four Mission Directorates, the Office of Education, and each NASA Center, and in most cases from a combination of these sources. The Science Mission Directorate provided funding to 37 institutes (49 percent), the most at the Directorate-level (see Figure 2).

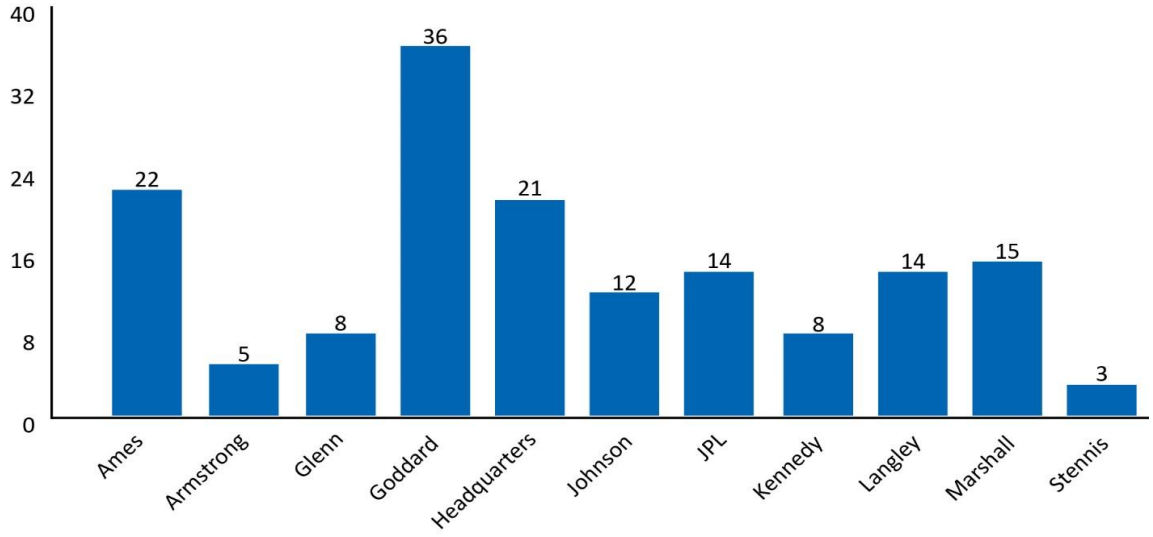
Figure 2: NASA Mission Directorate Affiliation



Source: NASA Office of Inspector General (OIG) analysis of information collected from institutes.

As shown in Figure 3, Goddard Space Flight Center provided funding to 36 institutes, the most among the Centers.

Figure 3: NASA Center Affiliation



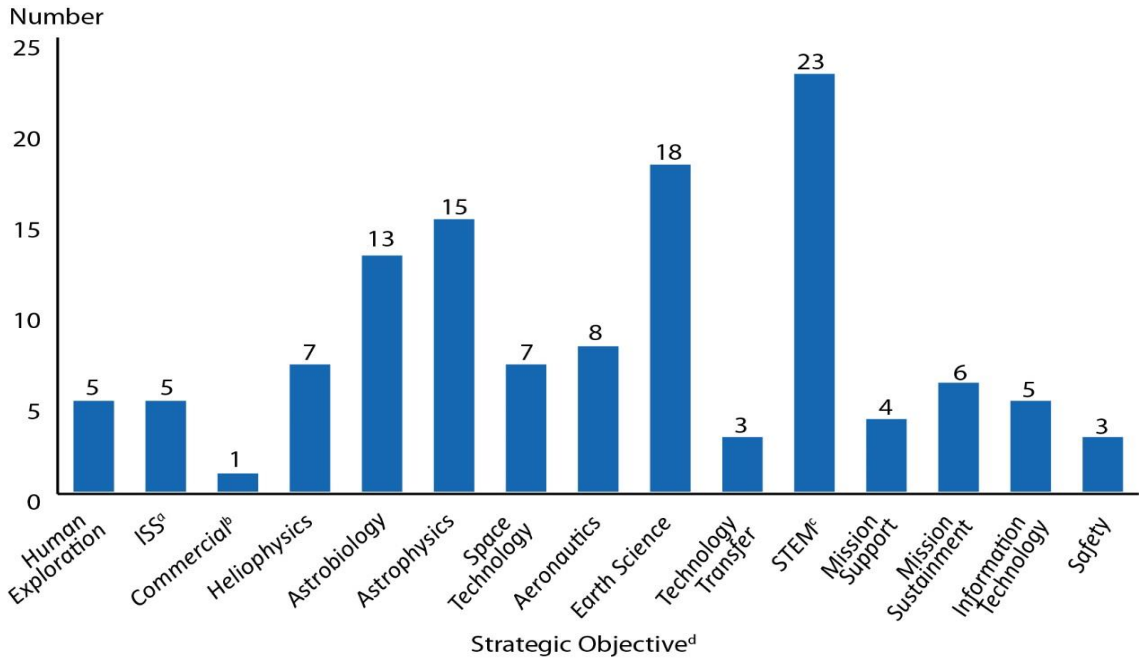
Source: NASA OIG analysis of information collected from institutes.

The institutes' main offices are spread over 20 states and the District of Columbia. California leads the states with 13 institutes, followed by Maryland with 9.

Contribution to Mission Objectives

The work of each of the 60 institutes aligned with at least one of the Strategic Goals and Objectives set forth in NASA's 2014 Strategic Plan (see Appendix D).[7] These Strategic Goals and Objectives cover the Agency's full spectrum of activities in civil aeronautics research, space exploration, science, education, and advanced research and development. Figure 4 shows the number of institutes supporting individual objectives.[8]

Figure 4: Distribution of Institutes by Strategic Objective



Source: NASA OIG analysis of information collected from institutes.

[a] ISS refers to the International Space Station.
[b] Commercial refers to the commercial crew and cargo programs.
[c] STEM refers to science, technology, engineering, and mathematics education.
[d] For descriptions of NASA's Strategic Goals and Objectives, see Appendix D.

As indicated in the figure, institutes are highly represented in the areas of Earth science, planetary science, astrobiology, astrophysics, and STEM education. For example, the Florida Space Institute is investigating shape memory metallic alloys that demonstrate a unique ability to recover their initial shape after being deformed and can potentially be used to self-repair fatigue damage in metallic structures of aerospace vehicles; the National Institute of Aerospace manages a consortium of public

[7] NASA Policy Directive 10001.0B, "2014 NASA Strategic Plan," March 12, 2014, available at https://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf (accessed June 1, 2016).

[8] Science, technology, engineering, and mathematics (STEM) funding combined with other objectives and therefore is not represented solely in educational funding.

and private partners investigating composite materials that could improve the performance of aircraft; and the Southwest Research Institute provided instruments and the principal investigators for NASA's Juno and New Horizons missions.[9]

Institute personnel also use Agency-collected data to conduct research and publish papers that contributed to the overall body of scientific knowledge. For example, scientists from the Goddard Planetary Heliophysics Institute used data collected from NASA's Wind and Solar Terrestrial Relations Observatory (STEREO) missions to publish research papers relating to the Sun and solar activity.[10] More recently, scientists from the SETI Institute and Space Science Institute collaborated with other researchers and published a paper using data from NASA's Cassini mission that detailed their finding of a global, subsurface ocean on Enceladus, a moon of Saturn.[11]

Parent Organizations

Academic institutions or other institutes handled the administrative aspects of NASA funding for some institutes. In many cases, funding is disbursed by NASA to a university, college, or other institute which then provides the funding to the institute. We identified six institutes that received more than $107 million under this type of "pass-through" funding mechanism in FYs 2013 through 2015.[12] For example, the Earth Research Institute received $7.4 million in NASA funding as a pass-through from the University of California, Santa Barbara.

We also found one institute, Universities Space Research Association (USRA), was administratively overseeing nine other institutes.[13] USRA is an independent, nonprofit research corporation that acts as a parent organization through which universities cooperate with one another, the Government, and other entities to further space science and technology and promote education in these areas. For example, USRA operates the Lunar and Planetary Institute under a cooperative agreement that focuses on research and education in space-related science and engineering. We calculated that approximately $950 million or 39 percent of NASA's FYs 2013 – 2015 total $2.4 billion funding to the 60 institutes was managed, handled, or flowed through USRA.[14]

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[9] The principal investigator is a person with the authority and responsibility for conducting the research activity and reporting its results. New Horizons launched in January 2006 and investigated Pluto and its moons.

[10] Wind was launched in November 1994 to observe solar wind before it impacts the Earth's magnetosphere. STEREO was launched in 2006 and employs two nearly identical space-based observatories to observe the structure and evolution of solar storms.

[11] The Cassini mission launched in October 1997 and entered orbit around Saturn in June 2004. Icarus, "Enceladus's measured physical libration requires a global subsurface ocean," Volume 264, January 15, 2016, available at http://www.sciencedirect.com/science/article/pii/S0019103515003899 (accessed June 1, 2016).

[12] The six institutes are the Desert Research Institute; Earth Institute; Earth Research Institute; Goddard Planetary Heliophysics Institute; Institute for Astrophysics and Computational Sciences; and Massachusetts Institute of Technology Kavli Institute for Astrophysics and Space Research.

[13] The institutes that USRA administratively oversees are the Center for Research and Exploration in Space Science and Technology; Goddard Earth Sciences Technology and Research; Institute for Global Environmental Strategies; Lunar and Planetary Institute; National Space Biomedical Research Institute; Research Institute for Advanced Computer Science; Southwest Research Institute; Space Science Institute; and Space Telescope Science Institute.

[14] It was not possible to tell whether USRA passed through all or some of the funds NASA provided. Accordingly, this figure may be overstated.

Procurement Strategies

NASA has the authority to engage outside organizations using a variety of procurement vehicles.[15] We found NASA utilizes contracts, grants, cooperative agreements, blanket purchase agreements, and Space Act Agreements to make awards to institutes (see Table 1).[16]

Table 1: FY 2015 Institute Award Types

Award Type	Number
Contract	24
Grant	45
Cooperative Agreement	33
Blanket Purchase Agreement	1
Space Act Agreement	3
NASA Program Funding[a]	4

Source: NASA OIG analysis of institute and NASA data.

Note: Some institutes received NASA funding via more than one type of award; hence, the total number of awards is greater than 60.

[a] NASA program funding includes Agency appropriated funds provided to support specific programs and projects.

For the 60 institutes we identified, grants and cooperative agreements accounted for 74 percent of NASA awards. The grants and cooperative agreements were generally used to obtain research related to NASA science and space activities. We also identified 36 institutes that received a combination of contracts, grants, cooperative agreements, blanket purchase agreements, and Space Act Agreements.

NASA can make awards through either competitive or non-competitive selection. Non-competitive awards are generally either unsolicited proposals or sole-source contracts. The Federal Acquisition Regulation (FAR) defines an unsolicited proposal as a written proposal for a new or innovative idea submitted to an agency on the initiative of the offeror for the purpose of obtaining a contract with the Government that is not in response to a request for proposals or any other Government-initiated solicitation or program. Sole-source acquisition refers to a contract for the purchase of supplies or services entered into by an agency after soliciting and negotiating with only one source. Unless permitted by a FAR exception, contracting without providing for full and open competition or full and open competition after eliminating other potential sources is a violation of the FAR. We found 48 institutes received funds that had been competitively awarded, while 25 received non-competitive awards. Thirteen institutes received a combination of competitive and non-competitive awards. Of the non-competitive awards, 29 percent were awarded to unsolicited proposals and 71 percent were awarded as sole source contracts.

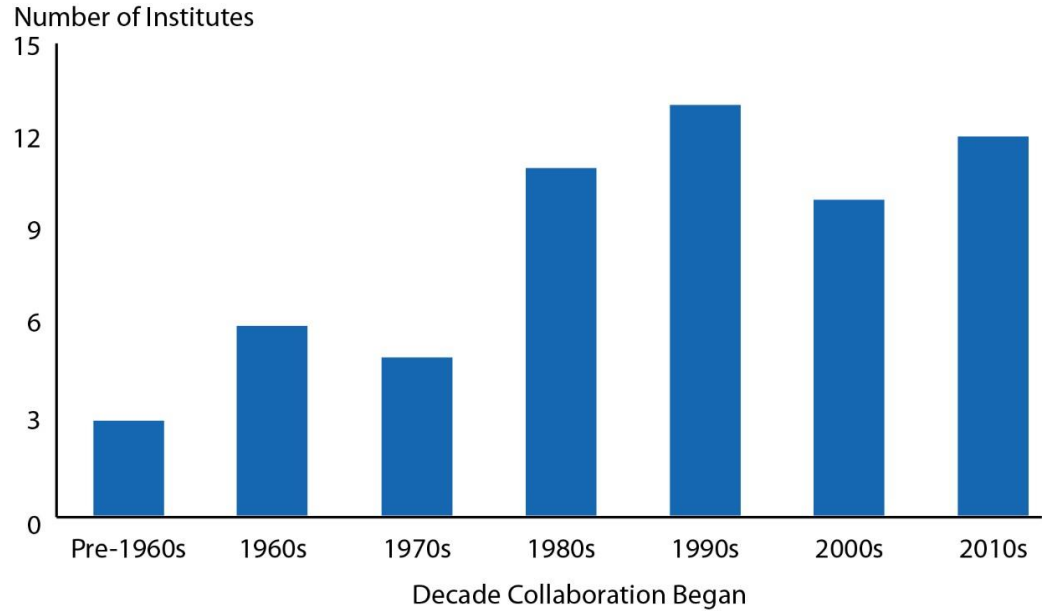
[15] 51 U.S.C. § 20113(e) (2010), 31 U.S.C. § 6304, "Using Grant Agreements," 31 U.S.C. § 6303, "Using Procurement Contracts."

[16] Pursuant to its authorizing legislation – the National Aeronautics and Space Act (51 U.S.C. § 20113(e) (2010)) – NASA may "enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate . . . ." NASA refers to agreements conducted under the Space Act's "other transactions" authority as Space Act Agreements.

Long-Standing Relationships

NASA has long-term relationships with many of the 60 institutes we reviewed. Approximately 68 percent have worked with NASA for at least 15 years, with seven institutes having an ongoing relationship with the Agency for more than 50 years. Figure 5 shows in what decade NASA began working with the institutes.

Figure 5: NASA-Institute Collaboration by Decade

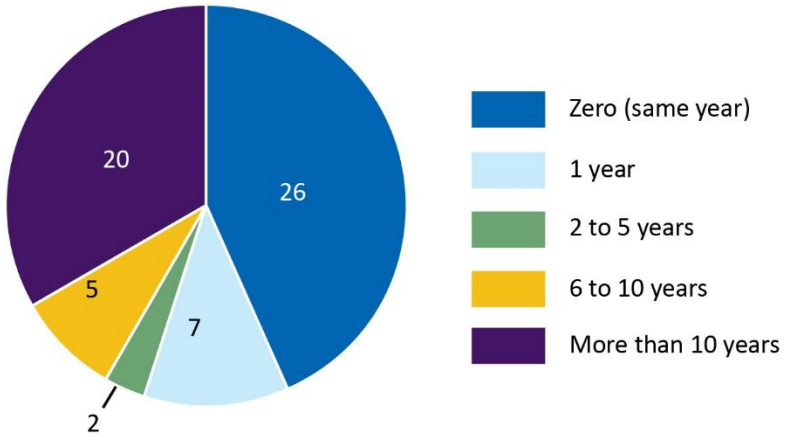


Source: NASA OIG analysis of information collected from institutes.

Relationship between Establishment of the Institute and NASA Funding

In many cases, NASA funding has been essential for the existence of institutes. While some of the 60 institutes we reviewed existed for many years before working with NASA, approximately 55 percent were established within a year of receiving NASA funding. Specifically, 26 of the 60 institutes were founded the same year they began working with NASA and another 7 began working with NASA within a year of their founding. For example, the Research Institute for Advanced Computer Science was founded in 1983 and began working with NASA that same year. Figure 6 illustrates how long an institute was in existence before beginning work with NASA.

Figure 6: Length of Time between Establishment of the Institute and Relationship with NASA



Source: NASA OIG analysis of institute data.

In FYs 2013 through 2015, for the 26 institutes established the same year as they first received NASA funding:

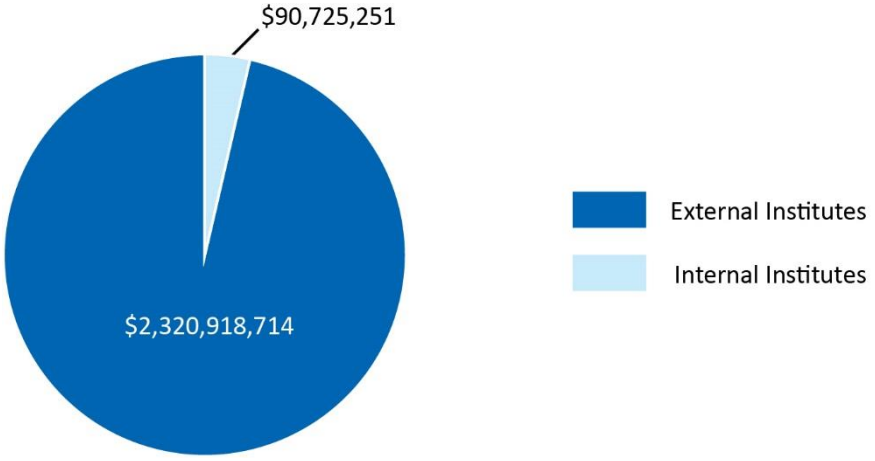
- Six received 100 percent of their funding from NASA;
- Nine received at least 90 percent of their funding from NASA;
- Five received between 50 – 89 percent of their funding from NASA; and
- Five received less than 50 percent of their funding from NASA.[17]

External vs. Internal and Brick and Mortar vs. Virtual Institutes

Institutes have an external or internal relationship to NASA management and a physical location or virtual presence. Internal institutes have NASA management and leadership, while external institutes are led by a contractor or other individual not employed by the Agency. In FYs 2013 – 2015, $2.3 billion or 96 percent of NASA's institute funding went to external institutes while $91 million or 4 percent went to internal institutes such as the National Institute for Rocket Propulsion Systems and NASA Astrobiology Institute (see Figure 7).

[17] We were unable to determine this information for 1 of the 27.

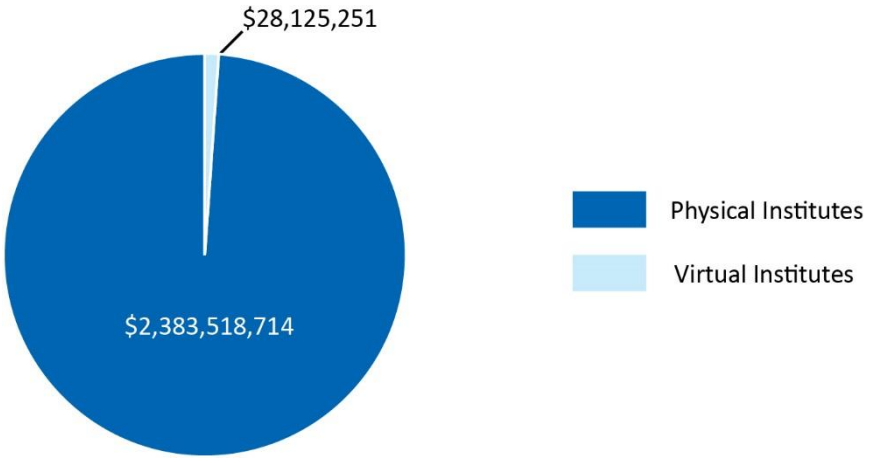
Figure 7: Funding Distribution for External and Internal Institutes



Source: NASA OIG analysis of information collected from institutes.

Our universe also contained institutes that had a physical location, meaning they had "brick and mortar" offices or laboratory locations, or virtual, meaning they lacked an actual or "centralized" physical location and conducted their work primarily via the Internet or other electronic means. In FYs 2013 through 2015, approximately $2.4 billion (99 percent) went to institutes with physical locations, while $28 million or 1 percent was awarded to virtual institutes such as the NASA Aeronautics Research Institute and the National Institute for Rocket Propulsion Systems (see Figure 8).

Figure 8: Funding Distribution for Physical and Virtual Institutes



Source: NASA OIG analysis of information collected from institutes.

OTHER MATTERS FOR CONSIDERATION

No Agency-Wide Guidance for Institutes

We found NASA does not aggregate information on the universe, status, or funding levels for the many institutes it supports. The absence of this information makes it difficult for Agency leaders to strategically evaluate the scope or purpose of its institute investments or for Congress and other stakeholders to understand how NASA is spending more than three-quarters of a billion dollars of its budget annually. Moreover, the Agency has not defined what constitutes an institute or established guidance and metrics on their management, use, or expectations for return on investment. Such guidance may enable the Agency to gain a better understanding of how funds directed to institutes are utilized to accomplish its mission and goals, increase its return on investment, and evaluate institutes' performance.

Instances of Financial Instability

During the course of this review, we became aware of two institutes – GeneSys Research Institute (GRI) and the Institute of Global Environment and Society (IGES) – under investigation by the Federal Government for alleged grant fraud. GRI declared bankruptcy and the status of its work under two NASA grants of approximately $500,000 is unknown.[18] Likewise, the status of IGES work under approximately $500,000 of NASA funding is also unknown.[19] In past work we found NASA lacked a standard process to assess a potential grantee's financial condition prior to grant award or to impose additional reporting or oversight requirements that such a condition may warrant.[20] Without such a mechanism, NASA risks making uninformed investment decisions.

Potential Duplication of Investments

As discussed previously, NASA made a substantial investment in work conducted by institutes across the spectrum of the Agency's activities. Absent comprehensive, centralized information about these investments, it may be difficult for NASA to avoid duplication among its efforts.[21]

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[18] GRI was unresponsive to our request for additional funding data; therefore, we are unsure if this is the total of NASA funding.

[19] As of September 2015, IGES had no staff following a June 2013 decision to dissolve after all projects were completed. Therefore, we were unable to contact IGES personnel and instead obtained funding data as reported in the Federal Procurement Data Information System. We are unsure that this is their complete funding position.

[20] Our "Audit of NASA Grants Awarded to the Alabama Space Science Exhibit Commission's U.S. Space and Rocket Center" (IG-12-016, June 22, 2012) found the Rocket Center's liabilities exceeded assets in 2005 through 2010, the Center suffered operating losses in four of those years, and these conditions created an uncertainty as to the Rocket Center's viability. In response to our recommendation, the Agency agreed to work with the Office of Management and Budget to evaluate reforms related to performing pre-award reviews of the fiscal viability of prospective awardees.

[21] Similarly, in our report on NASA's management of its space technology portfolio, we found the Agency could better guard against duplication of efforts by implementing a more formal and integrated process for initiating projects and by measuring and tracking its return on investment. NASA OIG, "NASA's Efforts to Manage Its Space Technology Portfolio" (IG-16-008, December 15, 2015).

MANAGEMENT'S RESPONSE

Although this report made no specific recommendations to NASA, in response to a draft of this report the Agency said it will review the issues raised in the "Other Matters for Consideration" section and adjust NASA guidance, if necessary. Management's response to our report is reproduced in Appendix F. Technical comments provided by management have been incorporated, as appropriate.

Major contributors to this report include Raymond Tolomeo, Science and Aeronautics Research Director; Diane Choma, Project Manager; Amy Bannister; Scott Collins; Wayne Emberton; GaNelle Flemons; Benjamin Patterson; and Keren Stick.

If you have questions about this report or wish to comment on the quality or usefulness of this report, contact Laurence Hawkins, Audit Operations and Quality Assurance Director, at 202-358-1543 or laurence.b.hawkins@nasa.gov.

Paul K. Martin
Inspector General

NASA-FUNDED INSTITUTES

The following two-page summaries provide a profile of each of the 60 institutes we reviewed. On the first page, we present a general description of the institute's function, program essentials (e.g., affiliation with NASA and strategic alignment), contract structure (e.g., type and nature of award, and period of performance), and funding for FYs 2013 – 2015. On the second page, we provide a historical perspective of the institute and examples of its contributions to NASA.

Institute Overview

In the initial overview, we provide the primary focus of the institute, which varied widely among the 60 reviewed and spanned the entirety of NASA's research portfolio. For example, the Ohio Aerospace Institute – a joint initiative between NASA's Glenn Research Center and the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base – was established to enhance aerospace competitiveness through research, technology development, and engagement. The Space Telescope Science Institute located on the campus of Johns Hopkins University operates the science program for the Hubble Space Telescope and similarly, will be responsible for coordinating science and flight operations for the James Webb Space Telescope. In another example, the University of Maryland Center for Environmental Science conducts research and education to improve understanding of the environment and natural resources.

Program Essentials

In the program essentials graphic, we list the Center(s) and Mission Directorate(s), if identified by the institutes, with which the institute has performed work or is otherwise associated. In some cases, such as the Goddard Planetary Heliophysics Institute, the institute has a single NASA affiliation. In others, such as USRA, their activities span much of the Agency. We also list the NASA strategic objectives to which the institute's work aligns and the amount of funding NASA provided to the institute in FY 2015.

Funding Mechanism

Within the funding mechanism graphic, we list the type of award (i.e., contracts, grants, cooperative agreements, blanket purchase agreements, Space Act Agreements, or NASA Program funding) NASA used to procure goods or services from the institute; nature of the award (competitive or non-competitive – sole source or unsolicited proposal); period of performance of the awards (through what year); and category of the institute (i.e., contractor- or NASA-led, as well as physical location or virtual presence). Many of the institutes we reviewed had a variety of awards related to their work for NASA. However, exceptions such as the Center for Gravitational Wave Astronomy at the University of Texas at Brownsville conduct work for NASA under a single grant award.

Funding Profile

The funding profile includes the FYs 2013, 2014, and 2015; shows NASA funding, funding from other Federal sources, and funding from non-Federal sources; and presents the information in both table and graphics layout. In some cases, NASA was a minor contributor, such as with the National Academy of Sciences where NASA accounted for less than 2 percent of the institute's funding. In other cases, NASA was the major contributor such as with the Harvard-Smithsonian Center for Astrophysics where NASA provided approximately 85 percent of the institute's total funding.

Historical Perspective

The historical perspective contains background information on the institute, its origins, and relevant information regarding its work for NASA.

Contributions to NASA

The contributions to NASA section provides a few examples of the institute's work for NASA. For example, the Research Institute for Advanced Computer Science, a joint collaboration between NASA's Ames Research Center and USRA, supports the development of the Quantum Artificial Intelligence Laboratory – a program designed to assess the potential of quantum supercomputers in performing calculations beyond the capabilities of conventional supercomputers. Similarly, Resources for the Future – an independent, nonpartisan, nonprofit organization – works with NASA on a range of projects including the International Space Station and commercial space, as well as researching issues related to deforestation and carbon monitoring.

America Makes – National Additive Manufacturing Innovation Institute

America Makes – National Additive Manufacturing Innovation Institute (NAMII) is a public-private partnership with the goal of advancing research, discovery, creation, and innovation in additive manufacturing and 3D printing technologies. America Makes is operated by the National Center for Defense Manufacturing and Machining (NCDMM), a nonprofit corporation.

Program Essentials

NASA Affiliation: Marshall

NASA Strategic Alignment: 1.1, 1.7

FY 2015 NASA Funding: $0

Funding Mechanism

Type of Award: Grant

Nature of Award: Non-competitive (sole source)

Period of Performance: Through March 2015

Category: Contractor-led, physical presence

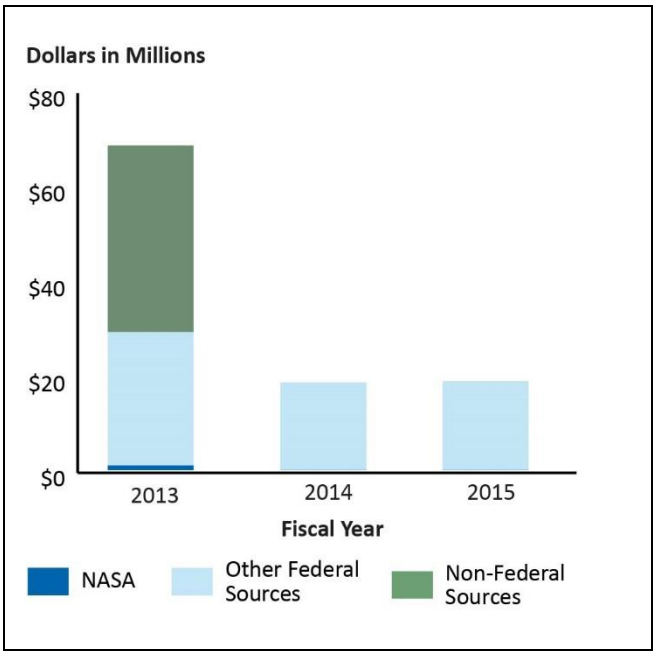
Funding Profile

America Makes' Federal sponsors include the Department of Defense, Department of Energy, NASA, NSF, and the Department of Commerce's National Institute of Standards and Technology. At its inception in August 2012, Federal agencies invested $29 million in America Makes, with an additional $40 million provided from non-Federal sources, mostly industry and the states of Ohio, Pennsylvania, and West Virginia. NASA contributed less than 1 percent of America Makes' total budget for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$1,000,000
	Other Federal Sources[a]	$28,103,784
	Non-Federal Sources	$39,903,692
	Total	**$69,007,476**
2014	NASA	$0
	Other Federal Sources	$18,465,923
	Non-Federal Sources	$0
	Total	**$18,465,923**
2015	NASA	$0
	Other Federal Sources	$18,696,884
	Non-Federal Sources	$0
	Total	**$18,696,884**

[a] For FY 2013, other Federal sources includes funding from August and September 2012.



Historical Perspective

Established in August 2012 and based in Youngstown, Ohio, NAMII was created as a multi-agency, public-private partnership managed by the National Center for Defense Manufacturing and Machining to serve as a training and collaboration center for research and technology in additive manufacturing, also known as 3D printing.[1]

In October 2013, NAMII was rebranded as America Makes – National Additive Manufacturing Innovation Institute and widened its membership to include hobbyists and entrepreneurs.

America Makes serves as a pilot institute for the National Network for Manufacturing Innovation (NNMI), a Federal initiative to create institutes that will bring together industry, academia, Federal agencies, states, and regional economic development agencies to focus on new manufacturing technologies with broad applications in defense, energy, space, and other commercial sectors. America Makes seeks to bridge the gap between basic research and product development and provides asset sharing among additive manufacturers.

Contributions to NASA

America Makes facilitates competitive project call solicitations, and as a result of the 2013 project call, awarded two projects that aligned to NASA's 3D Printing and Additive Manufacturing objectives. The projects were executed as "NASA Add-Ons" such that the NASA objectives would leverage the America Makes "core" projects. The two projects include maturation of fused deposition modeling for component manufacturing and high temperature selective laser sintering technology and infrastructure for polyetherketoneketone.[2]

In 2015, America Makes and NASA's Centennial Challenges Program at Marshall announced a $2.25 million 3D Printed Habitat Challenge, which tasks participants with designing and building a 3D printed habitat for deep space exploration. In phase one, participants developed an architectural concept of the habitat incorporating 3D printing capabilities. Phase two will involve fabricating technologies needed to manufacture structural components using a combination of indigenous materials and recyclables and fabricating full-scale habitats using indigenous materials. America Makes is currently pursuing sponsorship funding to initiate phase two. The Centennial Challenge activity by America Makes is covered under a Space Act Agreement between NASA and NCDMM.

[1] Three-dimensional, or "3D," printing creates products by depositing thin layers of material using a digital blueprint until the desired component is created.

[2] Fused deposition modeling builds concept models, functional prototypes, and end-use parts in standard, engineering-grade, and high-performance thermoplastics; and is the only 3D printing technology that uses production-grade thermoplastics, so parts are unrivaled in mechanical, thermal, and chemical strength. Polyetherketoneketone is a semi-crystalline thermoplastic with high-heat resistance, chemical resistance, and the ability to withstand high mechanical loads.

American Institute of Aeronautics and Astronautics

The American Institute of Aeronautics and Astronautics (AIAA) supports the global aerospace profession by providing aerospace technology, engineering, and science information. The Institute documents the history of research and developments associated with aerospace, enhancing the exchange of technical knowledge among aerospace professionals.

Program Essentials

NASA Affiliation: Armstrong, Glenn, Goddard, Headquarters, Johnson, Kennedy, Langley, Marshall

NASA Strategic Alignment: 3.2, 3.3

FY 2015 NASA Funding: $1,000,000

Funding Mechanism

Type of Award: Contract

Nature of Award: Non-competitive (sole source)

Period of Performance: Through September 2018

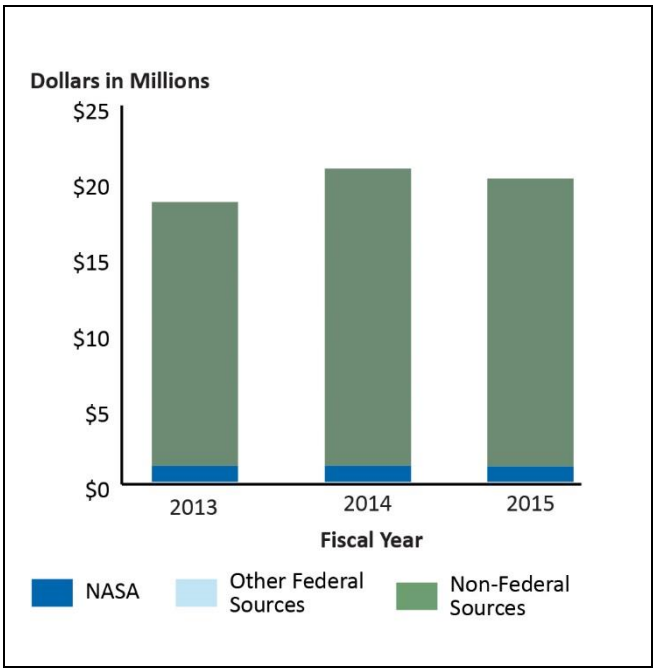
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 5 percent of AIAA's total funding for FYs 2013 through 2015. The Institute's non-Governmental customers include universities, aerospace professionals, engineers, scientists, aerospace manufacturing and research firms, and private individuals.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,037,000
	Other Federal Sources	Unknown
	Non-Federal Sources	$17,417,000
	Total	**$18,454,000**
2014	NASA	$1,044,000
	Other Federal Sources	Unknown
	Non-Federal Sources	$19,619,000
	Total	**$20,663,000**
2015[a]	NASA	$1,000,000
	Other Federal Sources	Unknown
	Non-Federal Sources	$19,000,000
	Total	**$20,000,000**



Note: AIAA reported that revenue is tracked by product and project and, therefore, the Institute could not provide total contributions for other Federal sources.

[a] FY 2015 funding is projected.

Historical Perspective

Formed through the merger of the Institute of Aerospace Sciences, established in 1932, and the American Rocket Society, established in 1930 as the American Interplanetary Society, AIAA officially began operation in February 1963 in New York City. AIAA has more than 95 corporate members and 30,000 individual members from 88 countries. The Institute's mission is to inspire and advance the future of aerospace for the benefit of humanity.

AIAA organizes events for aerospace students and professionals, including engineers, educators, researchers, and manufacturers to present technical papers; participate in technical discussion panels; attend continuing education courses; and, network with peers.

The Institute advocates for the aerospace community and contributes technical expertise to the Government. AIAA publishes technical journals, a monthly magazine, books, and provides information on the role aerospace plays in the U.S.'s economy, national security, and technological future.

In 1996, AIAA created the AIAA Foundation to administer funded awards and scholarships and typically awards over $150,000 annually in scholarships and grants to students.

The American National Standards Institute accredits AIAA to establish aerospace industry standards for engineering and technical requirements. AIAA also administers two space-related subcommittees for the International Organization of Standardization and assists the Consultative Committee for Space Data Systems in the development of data and information system standards.

Contributions to NASA

NASA provides AIAA about $1 million per year for standards program management to support the Consultative Committee for Space Data Systems and to assist in developing space communications standards for NASA's Space Data Standards Program.

As part of this Program, the Space Communications and Navigation Data Standard Project develops a portfolio of internationally agreed to and interoperable space communications standards for use by Agency missions to lower life-cycle costs and risks, provide advanced capabilities for current and future missions, and promote interoperability and cross support among cooperating space agencies.

NASA Centers also subscribe to AIAA's electronic journal, paper archives, publications, online and published physics journals, and scientific instrument reviews. Agency employees also attend AIAA science conferences, which serve as a forum for industry, Government, and academic scientists and engineers to share scientific knowledge and research results that identify new aerospace system technologies.

CENTER FOR COMPUTATIONAL RELATIVITY AND GRAVITATION

A Research Center of Excellence at Rochester Institute of Technology (RIT), the Center for Computational Relativity and Gravitation (CCRG) focuses on numerical relativity and relativistic astrophysics, gravitational-wave physics and its connection to experiments and observations, high-performance computation, and scientific visualization.

Program Essentials

NASA Affiliation: SMD, Headquarters

NASA Strategic Alignment: 1.6

FY 2015 NASA Funding: $224,669

Funding Mechanism

Type of Award: Grant

Nature of Award: Competitive

Period of Performance: Through February 2017

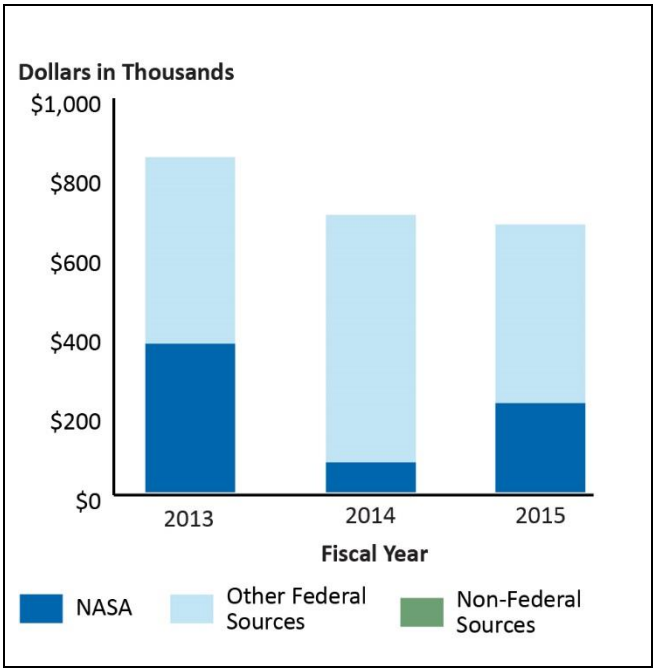
Category: Contractor-led, physical presence

Funding Profile

CCRG is supported by a combination of sponsored research awards from NASA, the National Science Foundation (NSF), and the Space Telescope Science Institute and funds from RIT's Office of the Vice President for Research. CCRG has also received equipment donations from an industry sponsor, Opticool Technologies. NASA contributed 30 percent of CCRG's total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$373,929
	Other Federal Sources	$469,959
	Non-Federal Sources	$0
	Total	**$843,888**
2014	NASA[a]	$75,000
	Other Federal Sources	$623,359
	Non-Federal Sources	$0
	Total	**$698,359**
2015[b]	NASA	$224,669
	Other Federal Sources	$449,839
	Non-Federal Sources	$0
	Total	**$674,508**



[a] The decrease in funding resulted from the completion of grants in FYs 2013 and 2014.

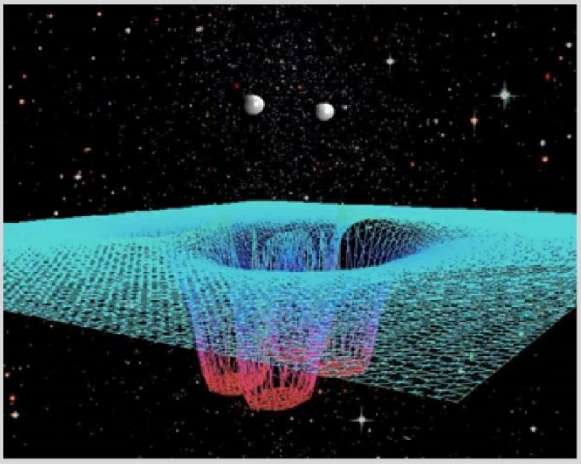
[b] Funding for FY 2015 was projected.

Historical Perspective

CCRG was founded as part of the School of Mathematical Sciences at RIT in January 2007. Between 2007 and 2015, the Center doubled in size and received $7 million in research funding from NASA and NSF.

CCRG's mission is to advance the discovery and knowledge of astrophysical phenomena in the universe, including merging black holes, neutron stars, supernova explosions, supermassive black holes, rapidly spinning neutron stars, sources of gravitational radiation, gamma ray bursts, and highly relativistic jets. The Center focuses on six research areas: gravitational wave detection, numerical relativity, galactic dynamics, computational astrophysics, high performance computing, and scientific visualization. The Center is governed by a director and an executive committee composed of RIT faculty and research scientists.

Computer Model of Merging Black Holes



Source: CCRG.

CCRG consists of faculty, postdoctoral researchers, and students across several colleges, schools, and departments at RIT, as well as affiliate researchers, external collaborators, and visiting scientists. The Center also operates laboratories in high-performance computation and visualization, and manages several externally funded projects and collaborations, including a project on Computing Supermassive Black Hole Mergers in association with Johns Hopkins University, the University of Virginia, and Princeton University, and The Einstein Toolkit – an open-source general relativistic multi-physics infrastructure for relativistic astrophysics with the California Institute of Technology, Georgia Institute of Technology, and Louisiana State University. A team of researchers were the first to simulate the merger of two black holes on a supercomputer, solving the 10 interrelated equations for strong field gravity that comprise Einstein's theory of general relativity.

Contributions to NASA

CCRG conducts research for NASA on numerical relativity, magnetohydrodynamical simulation of supermassive black holes in their astrophysical environments, and gravitational wave astrophysics and observations.[1]

One research project focused on exploration of the central structure of galaxies as observed by instruments like the Hubble Space Telescope in order to improve understanding of how these structures form and are modified through galaxy mergers. The project also improved understanding of the evolutionary tracks of binary, supermassive black holes during mergers.

Another research project studied mergers of neutron star-neutron star and black hole-neutron star binaries to investigate whether they are likely sources of short-hard gamma ray bursts and what observation of these binaries reveal about the physical parameters of the systems. This research furthers NASA's goal of understanding the nature of gravity and phenomena near black holes.

Between 2013 and 2015, CCRG principal investigators also received four NASA grants to study the "Dynamics of Galactic Nuclei," "Binary Compact Object Mergers as Short-Hard Gamma Ray Burst Progenitors," "Binary-Induced Jet Precession in Post-AGB Stars and Planetary Nebulae," and support "Cage Scientifique Rochester."

[1] Magnetohydrodynamical simulation is the study of the magnetic properties of electrically conducting fluids such as plasmas, liquid metals, and salt water.

CENTER FOR GRAVITATIONAL WAVE ASTRONOMY

In 2003, the Center for Gravitational Wave Astronomy (CGWA) at the University of Texas at Brownsville (UTB) was created by a $6 million grant from NASA's University Research Centers Project.[1] The core mission of CGWA is to further scientific research and education in gravitational wave astronomy, which is the science of making observations though the measurement of gravitational waves.

Program Essentials

NASA Affiliation: Goddard, JPL

NASA Strategic Alignment: 1.6, 2.4

FY 2015 NASA Funding: $272,935

Funding Mechanism

Type of Award: Grant

Nature of Award: Competitive

Period of Performance: Through August 2015

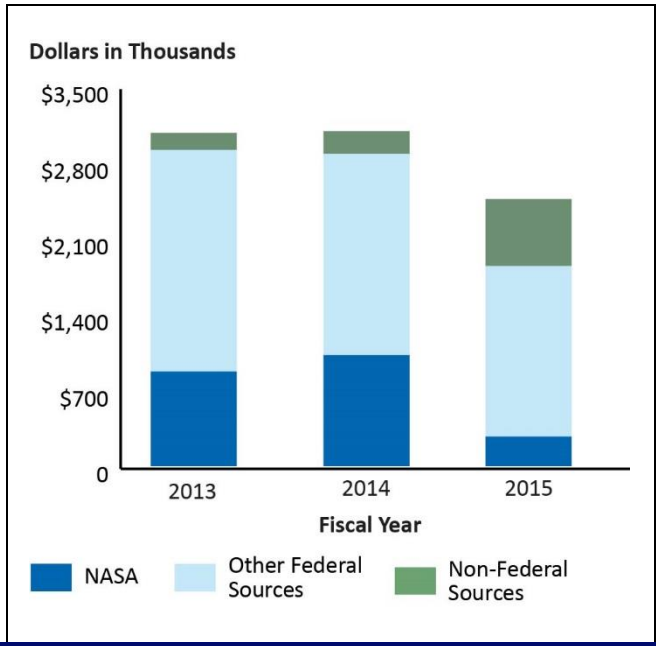
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 25 percent of CGWA's total funding for FYs 2013 through 2015. CGWA has a varied portfolio of extra institutional funding, including Federal funding totaling approximately $3 million per year in FYs 2013 and 2014 from NASA, NSF, and the Department of Defense. NASA's National Space Grant College and Fellowship Program also provides grant funds to the Texas Space Grant Consortium, which forwards $15,000 per fiscal year to CGWA for research and public outreach efforts. For FYs 2015 and 2016, CGWA's projected non-Federal funding derives from 16 organizational sources, including UTB institutional funds. CGWA does not expect to receive any direct NASA funding in 2016.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$873,490
	Other Federal Sources	$2,042,650
	Non-Federal Sources	$157,660
	Total	**$3,073,800**
2014	NASA	$1,023,725
	Other Federal Sources	$1,855,295
	Non-Federal Sources	$210,550
	Total	**$3,089,570**
2015	NASA	$272,935
	Other Federal Sources	$1,572,345
	Non-Federal Sources	$617,240
	Total	**$2,462,520**



[1] The University Research Centers Project is designed to achieve a broad-based, competitive aerospace research capability among the Nation's higher education minority institutions.

Historical Perspective

CGWA's research encompasses various aspects of gravitational wave astronomy, including astrophysical source modeling; the study of gravitational wave sources; gravitational wave data analysis and detector characterization; instrumentation, specifically lasers and optical components; and multi-messenger astronomy, specifically radio and optical astronomy.

The Center is a member of the Laser Interferometer Gravitational-Wave Observatories (LIGO) Scientific Collaboration, comprised of approximately 800 scientists worldwide collectively working with LIGO. Interferometers are located in Germany, Italy, and Japan. CGWA also collaborates with VIRGO – a gravitational wave detector managed by a French and Italian consortium in Italy. The global network of gravitational wave detectors allows scientists to see and study the universe and many of its more puzzling components, such as black holes, without depending on light.

CGWA has also focused on supporting outreach programs that inform students about science and engineering careers; encourage students to pursue degrees in NASA-related fields; increase undergraduate and graduate student enrollment in the physical sciences, computer science, and engineering; improve regional scientific literacy and education; and improve the rate at which individuals of Hispanic descent are awarded advanced degrees in basic sciences.

Contributions to NASA

Since 2003, CGWA has received more than $30 million in Federal funding through grant awards, and UTB faculty members have published approximately 50 publications per year. In 2009, NASA awarded a $5 million competitive University Research Center grant to CGWA to foster new aerospace science and technology concepts, increase participation of minority faculty and students in research activities, increase the number of advanced degrees awarded in NASA-related fields, and increase the Nation's base for aerospace research and development. The NSF also funds CGWA through a $5 million grant from the Centers for Research Excellence in Science and Technology Program. While NASA initially supported CGWA's gravitational wave research, NSF now primarily funds U.S. gravitational-wave observatories.

CGWA was awarded a grant by NASA in 2009 for the development of the Laser Interferometer Space Antenna, a joint project with NASA and the European Space Agency; however, the project has since been delayed. As a result, CGWA has reoriented its work towards observational optical astronomy, such as following up on Gamma Ray Burst triggers from the NASA Fermi Gamma Ray Space Telescope, and diversified its research to include more applied projects in material science, optics, and LIGO detector characterization and calibration. The Center has also expanded research into experimental and applied physics that will benefit NASA's science missions and created laboratories for laser and photonics, materials science, and radio astronomy.

CENTER FOR RESEARCH AND EXPLORATION IN SPACE SCIENCE AND TECHNOLOGY

The Center for Research and Exploration in Space Science and Technology (CRESST) is a collaboration between NASA, two Maryland universities, and USRA to build capabilities in space science.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 1.4, 1.5, 1.6

FY 2015 NASA Funding: $14,900,000

Funding Mechanism

Type of Award: Cooperative agreement

Nature of Award: Competitive

Period of Performance: Through September 2016

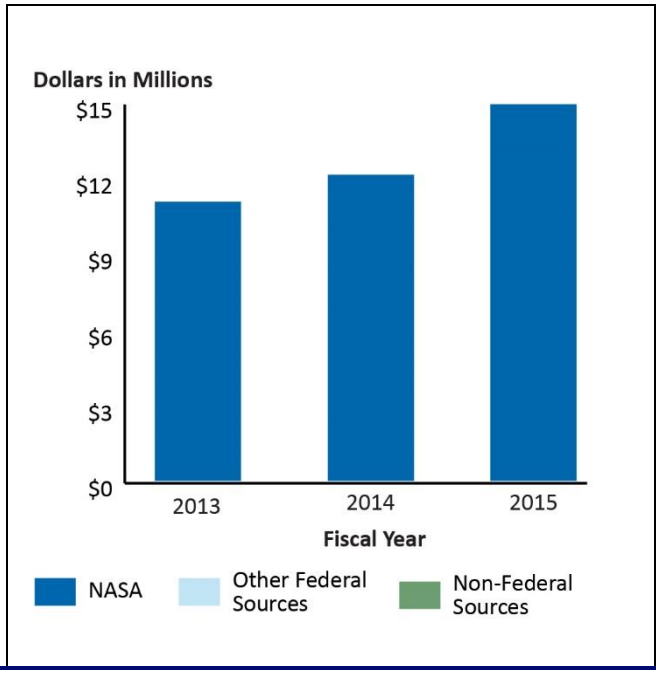
Category: Contractor-led, physical presence

Funding Profile

NASA provided CRESST 100 percent of its funding for FYs 2013 through 2015 through a 10-year cooperative agreement that began in September 2006, and is estimated at more than $116 million.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$11,045,217
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$11,045,217**
2014	NASA	$12,112,579
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$12,112,579**
2015	NASA	$14,900,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$14,900,000**



Historical Perspective

Established in 2006 through a cooperative agreement with NASA, CRESST is a collaboration between Goddard's Sciences and Exploration Directorate, the University of Maryland College Park (UMCP), the University of Maryland Baltimore County (UMBC), and USRA. CRESST employs approximately 109 science-related employees, including 91 doctoral-level scientists. At the end of 2014, CRESST employees were working on 204 projects with 120 NASA civil servant collaborators.

Under the terms of the cooperative agreement, CRESST carries out observational, experimental, and theoretical research supporting NASA's science objectives related to the Sun and solar system, stars, galaxies, and the universe; informational and computational sciences related to systems that interpret data from space sciences; and development of technology required to support research related to these objectives.

Each of CRESST's participating organizations contributes specific research expertise to the collaboration. For example, UMCP's astronomy and physics departments focus on space science, including high-energy astrophysics, galaxy structure and dynamics, star formation, planetary science, space physics, gravitational theory and particle astrophysics. UMBC operates two multimillion-dollar NASA research institutes that also collaborate with Goddard - the Goddard Planetary Heliophysics Institute and the Joint Center for Earth Systems Technology.

Contributions to NASA

CRESST's collaboration with Goddard's Science and Exploration Directorate focuses on astrophysics, planetary science, heliophysics, and space physics. Initial research included the study of neutron stars, black holes, and extremely hot gases throughout the universe. CRESST's scientists have also analyzed space observatory data collected by numerous NASA and international missions, including Swift, Suzaku, INTEGRAL (INTErnational Gamma-Ray Astrophysics Laboratory), XMM-Newton (X-ray Multi-Mirror Mission), Fermi Gamma-ray Space Telescope (GLAST), Herschel, Spitzer Space Telescope (Space Infrared Telescope Facility), and the Chandra X-ray Observatory (Advanced X-ray Astrophysics Facility), and have published detailed research papers based on collected data.

Since 2006, CRESST's scientists have authored or co-authored more than 1,671 science publications and contributed to over 373 awarded scientific proposals. They also have served as principal investigators on 17 proposals and co-investigators on 39 proposals awarded funds from NASA in FY 2015 for research conducted on a variety of Agency observatories, as well as for the development of instrumentation.

CRESST scientists are also involved in several planned Goddard-sponsored missions. For example, a research engineer is working with the Japan Aerospace Exploration Agency to perform integration and operational testing and complete an initial proposed alignment method of the joint ASTRO-H X-ray astronomy satellite's high-resolution X-ray calorimeter spectrometer before delivery to Japan's Tanegashima Space Center. In addition, a CRESST senior research scientist serves as the deputy principal investigator on the Neutron Star Interior Composition Explorer (NICER) mission, and several other CRESST scientists work on the project.[1]

[1] NICER is an International Space Station payload devoted to the study of neutron stars by deploying an X-ray timing and spectroscopy instrument.

DESERT RESEARCH INSTITUTE

The Desert Research Institute (DRI) is a non-profit, environmental research facility in the Nevada System of Higher Education. DRI conducts applied research on air, land and life, and water quality across Nevada, the United States, and on all continents to apply technology to improve people's lives.

Program Essentials

NASA Affiliation: Ames, Goddard

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $230,751

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through 2017

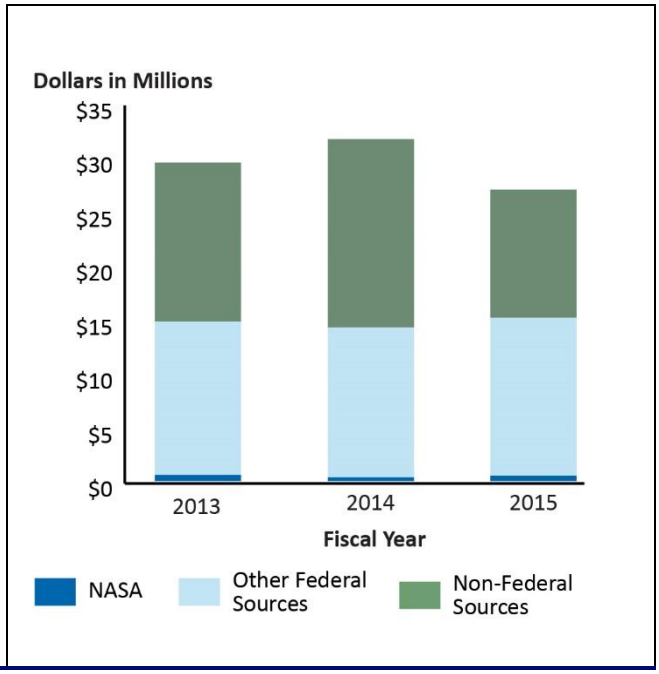
Category: Contractor-led, physical presence

Funding Profile

DRI has 7 grants, 1 cooperative agreement, and 16 pass-through sub-awards with NASA. The Agency contributed less than 2 percent of the Institute's total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$546,396
	Other Federal Sources	$14,194,903
	Non-Federal Sources	$14,714,351
	Total	**$29,455,650**
2014	NASA	$326,383
	Other Federal Sources	$13,881,522
	Non-Federal Sources	$17,419,070
	Total	**$31,626,975**
2015	NASA	$482,205
	Other Federal Sources	$14,628,916
	Non-Federal Sources	$11,837,724
	Total	**$26,948,845**



Historical Perspective

In 1959, the Nevada state legislature created a division within the University of Nevada System devoted to conducting research. Around the same time, a small group of scientists, academic leaders, and entrepreneurs created DRI to combine basic research with applied interdisciplinary research across multiple scientific disciplines. The Institute focuses research activities on addressing global environmental issues and conducts studies on every continent. DRI's faculty members are nontenured, entrepreneurial, and responsible for their own salaries generated from external grants and contracts. With more than 500 employees and campuses in Reno and Las Vegas, the Institute generates $50 million in total annual revenue.

Contributions to NASA

DRI works with NASA on research related to climatology through a variety of projects. For example, the Institute is assessing and evaluating drought and water usage in Nevada as a member of the LandSat Science Team — a collaboration between NASA and the U.S. Geological Survey that provided a 40-year history of high resolution optical and thermal satellite images the Institute is using in its assessment. DRI also collaborated with the Goddard Institute for Space Studies on the discovery of a type of wildfire soot particle that contributes up to 90 percent greater warming than other types of soot particles used in current climate models.

A 5-year research collaboration by DRI, scientists from JPL, Montana State University, and University of California, Riverside, resulted in publication of a scientific article on how the decomposition of organic matter in thermokast lake sediments can produce up to three times more biological methane gas emissions when subjected to increased temperatures in a simulated environment. The research also found that methane detected in the lake sediments in this region can arise from both ancient theremogenic sources deep in the Earth or shallow contemporary biological sources.

EARTH AND SPACE RESEARCH

Earth and Space Research (ESR) is a Seattle-based, nonprofit institute specializing in oceanographic research intended to increase understanding of the Earth system through scientific research and public education. ESR's research covers a wide range of topics from polar oceanography to equatorial studies and is funded primarily by governmental agencies.

Program Essentials

NASA Affiliation: Goddard, JPL

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $1,546,857

Funding Mechanism

Type of Award: Grant

Nature of Award: Non-competitive (sole source)

Period of Performance: Through 2018

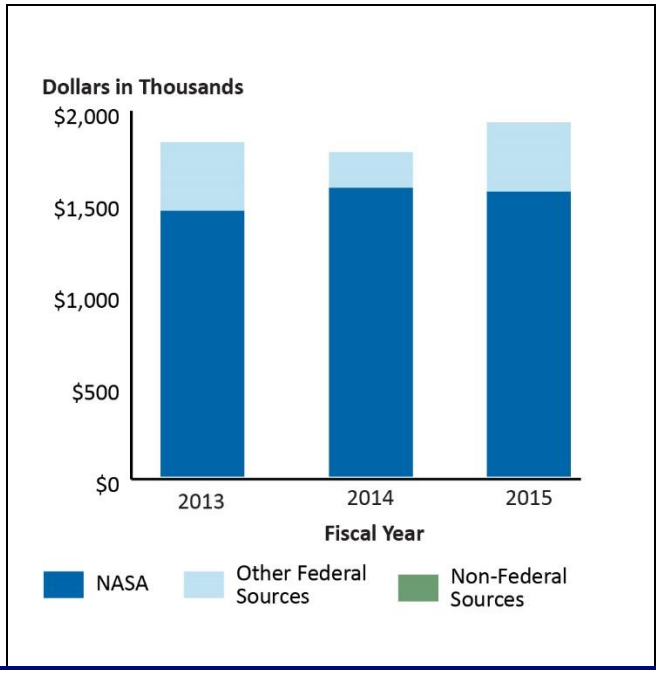
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 83 percent of ESR's total funding for FYs 2013 through 2015. ESR is funded primarily by Government agencies such as NASA, NSF, and Office of Naval Research. In FY 2015, ESR had six active grant agreements and a contract with NASA that began in January 2004 for consultation on the Agency's Aquarius/Satélite de Aplicaciones Científicas-D (SAC-D) mission, NASA's first satellite mission dedicated to measuring global observations of ocean salinity. For FYs 2004 through 2014, the contract was valued at $7,587,403.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,443,100
	Other Federal Sources	$373,075
	Non-Federal Sources	$0
	Total	**$1,816,175**
2014	NASA	$1,567,836
	Other Federal Sources	$193,997
	Non-Federal Sources	$0
	Total	**$1,761,833**
2015[a]	NASA	$1,546,857
	Other Federal Sources	$374,416
	Non-Federal Sources	$0
	Total	**$1,921,273**

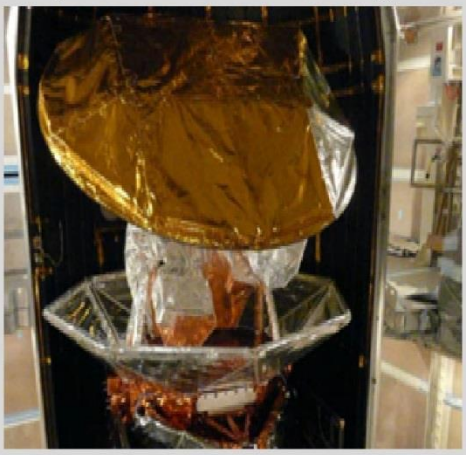


Historical Perspective

ESR encourages scientific inquiry by utilizing a management team and a diverse group of research scientists who manage projects and share knowledge directly with the public. ESR advances basic scientific research on climate and environment topics, including ocean, atmospheric, solid Earth biosphere, ionosphere, magnetosphere, solar activity, and space environment studies. Because ocean salinity levels have profound effects on how the oceans circulate, freshwater cycles, and the Earth's climatology understanding the associated regional and global processes is important.

NASA launched the Aquarius/SAC-D satellite in June 2011 to study ocean salinity. JPL and Goddard constructed Aquarius, the primary mission instrument. Argentina's Comision Nacional de Actividades Espaciales (CONAE) space agency provided the SAC-D spacecraft, microwave radiometer, and additional science instruments and also conducts mission operations. France and Italy also contributed instruments and Brazil participated as well. The partner instruments perform a secondary mission of determining how land wetness fluctuates with the seasons and weather phenomena. Numerous university, corporate, Government, and international organizations were also involved in the Aquarius/SAC-D mission.

Acquarius/SAC-D in Launch Fairing



Source: Acquarius Mission.

ESR's president serves as NASA's Principal Investigator on the Aquarius/SAC-D mission and is responsible for the overall mission, including the design, implementation, and flight operations phases. ESR researchers serve on various project teams and represent the organization on NASA's Ocean Salinity Science Team. ESR researchers also worked on the Internal Tides in the Indonesian Seas Project, which was funded by the Office of Naval Research; National Oceanic and Atmospheric Administration's Ocean Surface Current Analyses – Real Time (OSCAR) project; and NSF-funded polar programs.

NASA funded a collaborative Aquarius/SAC-D team led by co-investigators from the U.S. Department of Agriculture and Goddard to develop the secondary mission to retrieve soil moisture data from SAC-D's microwave radiometer. These readings allow scientists to better understand the climate system and advance climate models, weather forecasts, drought monitoring, and flood prediction to improve water management decisions and aid in predictions of agricultural productivity.

Contributions to NASA

ESR is involved in a number of other NASA projects, including: studying the Antarctic ice shelf to develop a detailed history of and identify stress changes to the ice shelf, developing high-resolution records of surface elevation on the ice shelf from 1992 to 2016, relating observed mass and fine-scale topography changes in the ocean and atmosphere to global climate models, and analyzing Greenland's ice sheet to ocean change.

ESR's ongoing NASA grant research project, OSCAR, seeks to improve the calculation of ocean surface currents from satellite data and validation methods. The Institute is attempting to advance scientific understanding of the transfer between the atmosphere and the ocean to improve OSCAR data quality and wind climate data records. Accurate calculation of hourly and yearly wind driven currents is important for understanding the transport of ocean salt, heat, momentum, and nutrients. OSCAR data is used for fishery management research, marine animal migrations studies, and other maritime applications.

THE EARTH INSTITUTE

The Earth Institute at Columbia University in New York City comprises more than 30 research programs, including the Lamont-Doherty Earth Observatory, and concentrates on research on climate change and environmental degradation, poverty, disease, and the sustainability of Earth's resources.

Program Essentials

NASA Affiliation: Goddard, Marshall

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $8,541,976

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through 2018

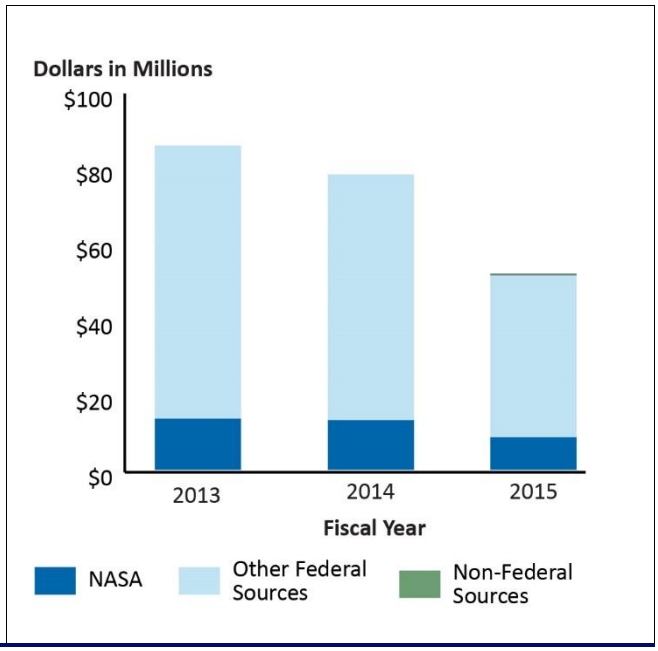
Category: Contractor-led, physical presence

Funding Profile

NASA contributed about 16 percent of the Institute's total funding for FYs 2013 through 2015 via contracts, grants, cooperative agreements, and pass-through funding projects. The Agency primarily funds four of the Institute's research units: Center for Climate Systems Research, Center for International Earth Science Information Network, International Research Institute for Climate and Society, and the Lamont-Doherty Earth Observatory.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$13,481,697
	Other Federal Sources	$72,032,489
	Non-Federal Sources	N/A
	Total	**$85,514,186**
2014	NASA	$13,041,197
	Other Federal Sources	$64,823,427
	Non-Federal Sources	N/A
	Total	**$77,864,624**
2015	NASA	$8,541,976
	Other Federal Sources	$42,706,270
	Non-Federal Sources	$486,485
	Total	**$51,734,731**



Historical Perspective

The Institute was established in 1995 to examine environmental sustainability challenges resulting from rapid population growth, climate change, poverty, and infectious diseases. Currently the Institute manages more than 30 research programs at Columbia University involving approximately 850 scientists, students, postdoctoral fellows, and staff conducting research in engineering, biology, Earth sciences, health sciences, and social sciences.

The Lamont-Doherty Earth Observatory is the Institute's largest research unit, which studies issues ranging from Earth's deep core interior to its outer atmosphere boundaries. Observatory staff were the first to map the entire ocean seafloor, develop a computer model that predicts El Nino weather events, provide proof for the theory of plate tectonics, and reveal the oceans' role in triggering abrupt climate change. The Observatory also operates a federally funded research ship, *Marcus G. Langseth,* that uses seismic data to map the sub-seafloor to identify faults and other earthquake hazards.

The Center for Climate Systems Research conducts interdisciplinary Earth and climate systems research at Columbia University and the Goddard Institute for Space Studies. The Center for International Earth Science Information Network focuses on applying current information technology to Earth data and to research problems related to human interactions in the environment. The International Research Institute for Climate and Society works with developing countries to understand and manage the impacts of climate change within their environment.

Contributions to NASA

The Institute's research units have contributed to numerous NASA projects related to biology and the Earth's environment; geochemistry; marine geology and geophysics; ocean and climate physics; and seismology, geology, and tectonics over the past 20 years. In 2015, the Institute conducted NASA-funded projects related to climate modeling and the impact of climate change, the fundamental radiative properties of ice clouds, agricultural productivity assessments and prediction systems for East Africa, and developing climate analysis for the President's Malaria Initiative Impact Evaluation Reports in three countries.

The Lamont-Doherty Earth Observatory also supports NASA's Operation IceBridge – a 6-year mission, which is the largest airborne survey of Earth's polar ice, to evaluate the changing features of the Greenland and Antarctic in order to develop a three-dimensional view of Arctic and Antarctic ice sheets, ice shelves, and sea ice. The annual flights will continue through 2018 when NASA plans to launch the ICESat-II satellite to continue assessing polar ice changes.

Other Observatory projects for NASA include an assessment of the vulnerability of the U.S. Atlantic coast to hazards associated with extreme weather and time series analysis of sea surface nitrate and nitrate-based production in the oceans.

EARTH RESEARCH INSTITUTE

The Earth Research Institute (ERI) was established in July 2010 by merging the University of California at Santa Barbara's Institute for Crustal Studies and Institute for Computational Earth System Science. Building upon the existing research of its founding organizations, ERI is fostering new multidisciplinary collaborations to further its mission of supporting research and education in Earth sciences.

Program Essentials

NASA Affiliation: Goddard, JPL

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $2,363,781

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Non-competitive (sole source)

Period of Performance: Through at least FY 2017

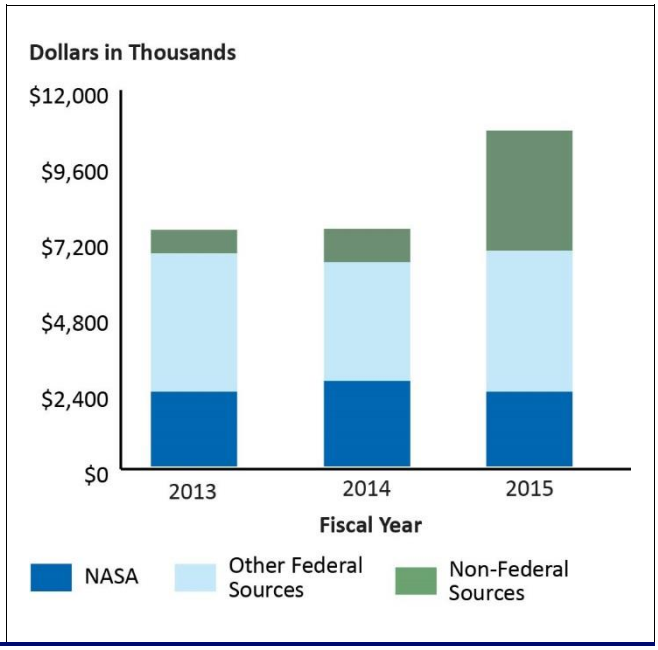
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 29 percent of total funding to ERI for FYs 2013 through 2015. Between FYs 2010 and 2014, ERI received approximately 76 percent of its funding from Federal agencies, of which 60 percent came from the National Science Foundation, 32 percent from NASA, and 8 percent from other agencies. For FYs 2012 through 2014, ERI had 20 active grants, 7 pass-through funded subcontract grants, and 4 active cooperative agreements with NASA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$2,364,187
	Other Federal Sources	$4,380,341
	Non-Federal Sources	$749,661
	Total	**$7,494,189**
2014	NASA	$2,708,404
	Other Federal Sources	$3,756,051
	Non-Federal Sources	$1,057,488
	Total	**$7,521,943**
2015	NASA	$2,363,781
	Other Federal Sources	$4,467,786
	Non-Federal Sources	$3,804,169
	Total	**$10,635,736**



Historical Perspective

ERI conducts research in the following four areas:

- **Natural Hazards.** Impact of Earth processes, such as earthquakes, volcanic eruptions, landslides, floods, droughts, storms, wildfires, and erosion, on society.
- **Human Impacts.** Pollution and remediation, land use and land cover change, food and fresh water security, erosion, fire, conservation, and natural resource management (e.g., forestry, fisheries).
- **Earth System Science.** Earth's subsystems – atmosphere, hydrosphere, lithosphere, cryosphere, biosphere, and anthrosphere – and interactions between them.
- **Earth Evolution.** Processes and rate of change in crust, climate, and animal and plant life from Earth's formation to the present day.

ERI supports extramurally funded research. Approximately 73 independent research groups conduct research using ERI facilities and resources such as conference rooms, laboratories, administrative employees, and computer system administrators. ERI also holds seminars throughout the academic year related to past and current NASA projects.

Contributions to NASA

ERI coordinates with NASA on several long-term research projects, including the Bermuda Bio-Optics and Global Chromophoric of Dissolved Organic Matter (CDOM) projects. The Bermuda Bio-Optics Project is studying radiometric data to corroborate measurements from NASA's Sea-Viewing Wide Field-of-View Sensor Project, which is examining optical properties in ocean waters. The CDOM Project's research focuses on dissolved organic matter cycling in open, surface, and deep water oceans as well as the chemical transformations that occur during processes that regulate CDOM abundance, distribution, and optical characteristics.

ERI also initiated the Measures Ocean Color Project for NASA to assist in understanding heterotrophic production, photochemistry, light budget, physiology, phytoplankton functional type, ocean particle size distribution, particulate organic carbon concentration, and net particulate production rates.[1]

A fourth project led by ERI's Snow Hydrology Research Group supports NASA's Research, Education and Applications Solutions Network investigation of "Multi-Resolution Snow Products for the Hydrologic Sciences." This project is providing satellite-derived maps that measure snow-covered areas, the reflective power of snowfall, and snow water equivalence, as well as supporting research related to snow metamorphism, snow-climate interactions, and snowmelt runoff.[2]

In 2013 and 2014, ERI awarded 30 fellowships for the study of significant natural hazards and human impacts on Earth, as well as Earth system science and Earth evolution issues. In August 2014, ERI and the University of California, Los Angeles began examining 30 years of NASA Landsat images of coastal kelp areas around the globe to determine whether and how climate change has impacted coastal kelp canopies.

[1] Heterotrophic production relates to an organism that cannot manufacture its own food and instead obtains its food and energy by taking in organic substances such as plant or animal matter.

[2] The shape and structure of each snow crystal never stops changing from the time it falls from the sky until it melts – known as snow metamorphism, more specifically it determines if individual snow crystals are becoming stronger or weaker.

FLORIDA SPACE INSTITUTE

Florida Space Institute (FSI) supports space research, development, and education activities and the development of Florida's civil, defense, and commercial space economy. FSI also houses the Florida Space Grant Consortium for NASA and operates the Space Research Initiative (SRI) for the State of Florida.

Program Essentials

NASA Affiliation: Headquarters, Kennedy

NASA Strategic Alignment: 1.5, 2.4

FY 2015 NASA Funding: $14,628,646

Funding Mechanism

Type of Award: Contract, grant

Nature of Award: Competitive

Period of Performance: Varies, ending by 2020

Category: Contractor-led, physical presence

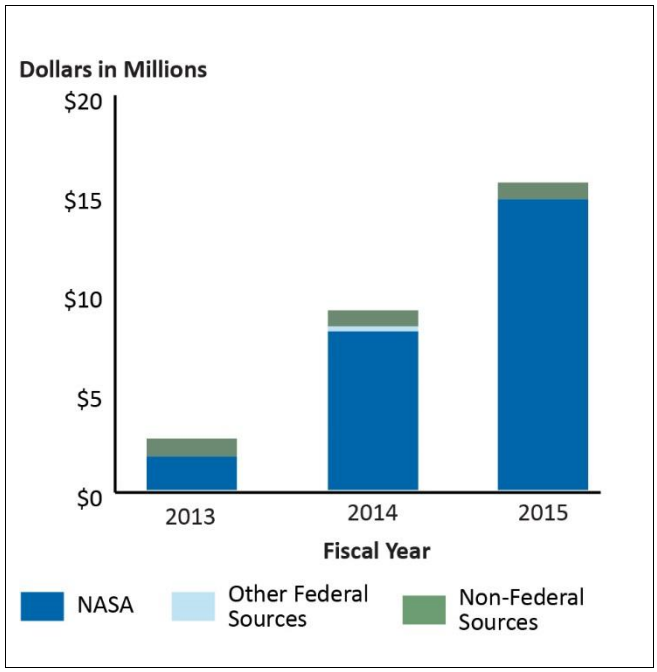
Funding Profile

NASA contributed approximately 90 percent of FSI's total funding for FYs 2013 through 2015. The significant rise in overall NASA funding from FYs 2013 to 2015 relates to the Global-scale Observations of the Limb and Disk (GOLD) Project, planned for launch in 2017.[1]

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,666,666
	Other Federal Sources	$0
	Non-Federal Sources	$904,500
	Total	**$2,571,166**
2014	NASA	$7,968,783
	Other Federal Sources	$256,032
	Non-Federal Sources	$808,400
	Total	**$9,033,215**
2015[a]	NASA	$14,628,646
	Other Federal Sources	$0
	Non-Federal Sources	$831,135
	Total	**$15,459,781**

[a] FY 2015 figures are estimates.



[1] GOLD will image Earth's thermosphere and ionosphere as a hosted payload on a commercial communications satellite.

Historical Perspective

Established in 1996 by the State of Florida as part of the state's university system, FSI is comprised of researchers, educators, and staff from member universities. The University of Central Florida (UCF) manages FSI.

FSI supports space research, development, and education activities for member universities in Florida, as well as the development of Florida's civil, defense, and commercial space economy. The Institute's research efforts include studies of the Earth's upper atmosphere, the origins of solar system planets, the characteristics of asteroids, and propulsion technologies for aerospace vehicles. FSI also conducts research involving high altitude rocket launches, suborbital flights, NASA's Cassini mission to Saturn, and NASA's Explorer program that provides spaceflight opportunities for scientific investigations in heliophysics and astrophysics.

Contributions to NASA

The Florida Space Grant Consortium headquartered at FSI is an association of 17 public and private Florida universities and colleges, including UCF; the Astronaut Memorial Foundation; Space Florida; Kennedy; and the Orlando Science Center. The Consortium helps students become involved in science, technology, engineering, mathematics, and space-related organizations to prepare them for future employment.

FSI has collaborated with Kennedy on a variety of technology development projects, such as surface acoustic wave research that seeks to integrate sensor devices and active and passive wireless platforms for remote communications between the sensors and the receiving base station. These wireless sensing devices are useful for monitoring systems in NASA spacecraft as well as in monitoring applications in aircraft systems, tire pressure monitors, engine oil pressure monitors, and health equipment.

FSI, UCF, and Deep Space Industries were awarded a NASA Small Business Innovative Research award to develop simulated asteroid materials to facilitate ground-based testing technologies.

In 2013, the GOLD mission was selected by NASA through a solicited award to FSI as a Heliophysics Explorer Mission of Opportunity to image Earth's thermosphere and ionosphere from a geostationary orbit. GOLD, planned for launch in 2017, will operate for at least 2 years on a commercial communications satellite in order to conduct simultaneous measurements, using an imaging spectrograph, of temperature and composition in order to learn how the spectrograph responds to geomagnetic storms, solar radiation, and upward propagating waves and tides.

GeneSys Research Institute

GeneSys Research Institute (GRI), along with the Center of Cancer Systems Biology (CCSB), face the common challenge of gaining insight into the development and evolution of cancer, including identification of dynamics and interactions that modulate carcinogenic transformation, tumor progression, or dormancy.

As of September 2014, GRI was under investigation by the Federal Government, including NASA OIG, for grant fraud.[1] In July 2015, GRI declared bankruptcy, and we were informed by Counsel that our request for information would be honored as one of the creditors in the bankruptcy proceedings. Therefore, information included in this brief was obtained via internet searches and not from GRI.

Program Essentials

NASA Affiliation: Ames, Johnson

NASA Strategic Alignment: 3.4

FY 2015 NASA Funding: $0

Funding Mechanism

Type of Award: Grants

Nature of Award: Competitive

Period of Performance: Through 2014

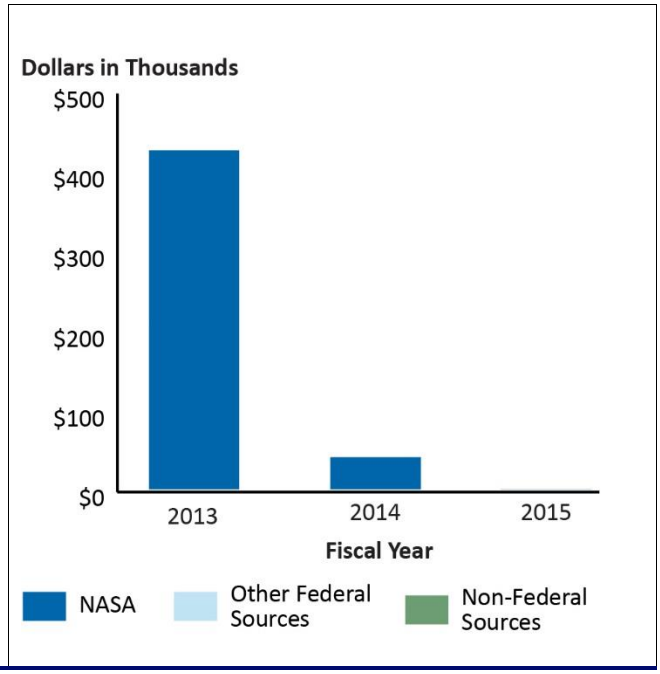
Category: Contractor-led, physical presence

Funding Profile

Federal sources of funding include grants from the Department of Energy, NASA, and the National Cancer Institute. While we identified two GRI research grants from NASA, totaling $464,985, we were unable to identify the amount of any additional funding sources and are unsure that the two grants are the entirety of funding provided by NASA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$424,985
	Other Federal Sources	N/A
	Non-Federal Sources	N/A
	Total	**$424,985**
2014	NASA	$40,000
	Other Federal Sources	N/A
	Non-Federal Sources	N/A
	Total	**$40,000**
2015	NASA	$0
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**$0**



[1] In February 2016, the NASA OIG closed its investigation after not identifying any mischarging or misuse of grant funds.

Historical Perspective

As part of the Integrative Cancer Biology Program (ICBP) network, CCSB's and GRI work to augment the current understanding of carcinogenesis and identify how tumor cell-to-cell interactions and interactions between tumors and the surrounding environment affect disease development and progression. The ICBP network collaborates with researchers at New York University's Langone Medical Center; the University of California, Berkeley; and the Lawrence Berkeley National Laboratory to expose students, scientists, and the public to the conceptual underpinnings of cancer systems biology through educational opportunities.

CCSB and GRI have constructed both theoretical and computational models that predict the evolutionary course of cancers by taking into account interactions that underlie and modulate cancer dynamics. Specifically, they have quantitatively examined the influence of four essential determinants of population-level control of tumor growth: tumor-stromal interactions, cancer stem cell composition of tumors, angiogenic carrying capacity, and intercellular spatial constraints.

Contributions to NASA

For Ames, GRI studied ionizing radiation-induced deoxyribonucleic acid (DNA) damage repair mechanisms. For Johnson, GRI created an augmented conceptual framework for use in estimation of carcinogenesis risk from space radiation.

GODDARD EARTH SCIENCES TECHNOLOGY AND RESEARCH

Goddard Earth Sciences Technology and Research's (GESTAR) scientists and staff work in collaboration with NASA and others to develop new space-based missions, provide mission requirements, conduct research to explain the behavior of Earth and other planetary systems, and create media content describing NASA's story of exploration and discovery on Earth and beyond.

Program Essentials

NASA Affiliation: Goddard, Headquarters

NASA Strategic Alignment: 1.5, 1.6, 2.2, 2.4

FY 2015 NASA Funding: $24,445,426

Funding Mechanism

Type of Award: Grants, cooperative agreement

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through 2016, with option to extend 5 years

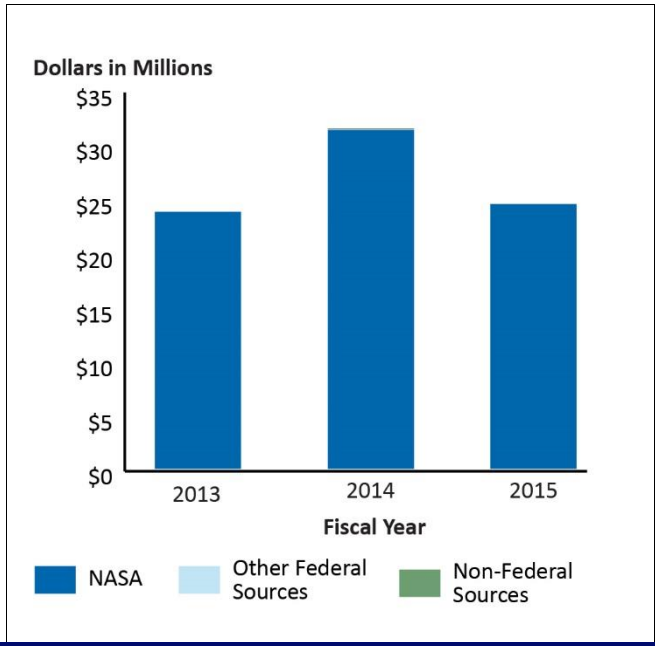
Category: Contractor-led, physical presence

Funding Profile

NASA contributed almost all of GESTAR's funding for FYs 2013 through 2015. GESTAR's 5-year cooperative agreement has a projected agreement value of $117 million, including grant proposals.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$23,737,789
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$23,737,789**
2014	NASA	$31,286,514
	Other Federal Sources	$64,709
	Non-Federal Sources	$75,779
	Total	**$31,427,002**
2015	NASA	$24,445,426
	Other Federal Sources	$0
	Non-Federal Sources	$8,364
	Total	**$24,453,790**



Historical Perspective

In May 2011, Goddard awarded a 5-year cooperative agreement to USRA and other partners including Morgan State University, I.M. Systems Group, Johns Hopkins University, Ball Aerospace and Technologies, and the Institute for Global Environmental Strategies to create and fund GESTAR. GESTAR maintains and seeks new cooperative relationships between Goddard and local academic institutions, nonprofit science organizations, and the Government to develop a comprehensive theoretical and experimental research program.

GESTAR is staffed with experts in bioenvironmental sciences; experimental robotic and modeling capabilities; atmospheric, oceanic, and hydrospheric sciences; Earth and planetary science; and information technology.

GESTAR initiated a visiting fellowship program to attract university professors on sabbatical and graduate students to conduct research on topics relevant to Earth science.

Contributions to NASA

GESTAR primarily conducts research for Goddard's Earth Sciences Division and supports other collaborative research activities within the Solar Systems Exploration Division, Office of Education, and Office of Public Affairs.

GESTAR has conducted research and public affairs activities related to the ozone hole in the Earth's atmosphere. A GESTAR research associate from the Climate and Radiation Laboratory co-authored a study investigating atmospheric aerosol loading, which, in conjunction with a previous NASA study, identified changes in aerosol composition and load in the atmosphere and suggested reasons for the changes. In 2014, a GESTAR research assistant developed an article for Goddard's website on ozone depleting compounds, which described the discovery of large amounts of carbon tetrachloride in the Earth's atmosphere contributing to ozone hole growth.

A senior GESTAR research scientist was the lead author of an article that explains the relationship between stratospheric chlorine and the Antarctic ozone hole. This research was explained in a 2015 video, "Big Ozone Holes Headed for Extinction by 2040," which was produced at Goddard with GESTAR employees for the Center's YouTube channel.

A GESTAR research associate joined the Greenland Aquifer Expedition, co-led by a NASA glaciologist, in 2013 to examine a water reservoir trapped in ice. The research associate returned in 2014 to collect GPS measurements to monitor ice velocity and flow direction and wrote articles for the NASA Earth Observatory website during the expedition.

GESTAR's lead test bed operator works on developing and testing experiments that use the Sample Analysis at Mars (SAM) instrument on the Mars Science Laboratory, which landed on Mars on August 6, 2012.[1] The operator has co-authored several publications related to SAM discoveries, including a 2014 *Science* article describing the detection of methane on Mars.

GESTAR scientists also began Goddard Maniac Talk Seminars to promote interaction between early career and experienced scientists.

[1] The SAM instrument was designed to conduct inorganic and organic chemical analyses of the atmosphere and the surface regolith and rocks to help evaluate the past and present habitability potential of Mars.

GODDARD PLANETARY HELIOPHYSICS INSTITUTE

GΦ

In May 2011, the Goddard Planetary Heliophysics Institute (GPHI) was established when the University of Maryland, Baltimore County (UMBC) was awarded a cooperative agreement to create a science center for collaborative research in Solar-Planetary Sciences at Goddard.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 1.4

FY 2015 NASA Funding: $1,320,000

Funding Mechanism

Type of Award: Grants, cooperative agreement

Nature of Award: Competitive

Period of Performance: Through May 2017

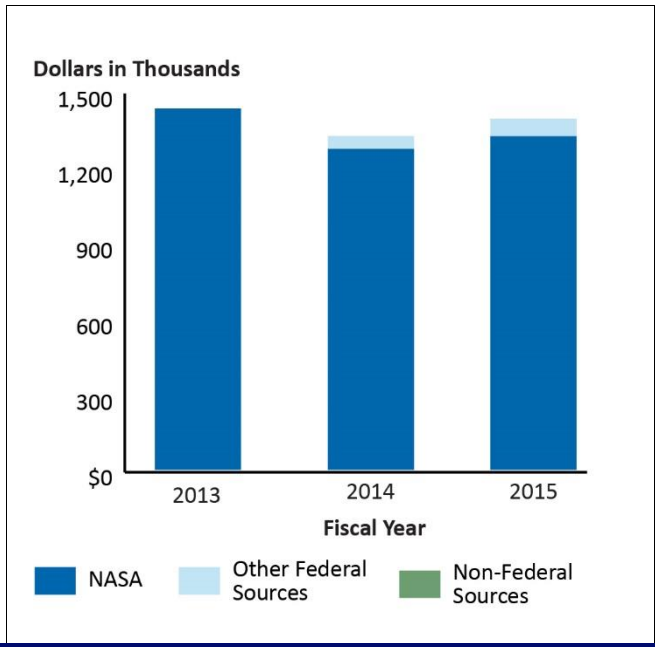
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 97 percent of GPHI funding for FYs 2013 through 2015 through six grants, a cooperative agreement, and pass-through funding for two additional grants. The total value of the cooperative agreement was estimated at just under $1 million for the 5-year period beginning May 2011. As a public research university, UMBC receives direct funding for several NASA projects, as well as for GPHI and other research institutes.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,430,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$1,430,000**
2014	NASA	$1,270,000
	Other Federal Sources	$50,000
	Non-Federal Sources	$0
	Total	**$1,320,000**
2015	NASA	$1,320,000
	Other Federal Sources	$70,000
	Non-Federal Sources	$0
	Total	**$1,390,000**



Historical Perspective

In May 2011, GPHI's Science Center was established by UMBC and its partners, University of Maryland College Park and American University, to assist Goddard's Heliophysics Science Division in achieving NASA's strategic goals in solar physics, heliospheric physics, geospace physics, and space weather.

Working primarily with Goddard scientists, GPHI's initial work focused on devising new space-based missions, providing mission requirements, and conducting research that explains the Sun, geospace, planetary space plasma environments, and interactions among these phenomenon.

Contributions to NASA

In FYs 2012 through 2014, GPHI scientists published 56 manuscripts and 178 peer-reviewed research articles, many of which were authored with NASA scientists. GPHI faculty members also worked on NASA and National Oceanic and Atmospheric Administration (NOAA) missions.

A GPHI scientist who developed new ion scientific model tools for the ARTEMIS (Moon) and MESSENGER (Mercury) missions was selected as a mission guest investigator for the Lunar Atmosphere and Dust Environment Explore (LADEE) mission. Launched in September 2013, LADEE studied the Moon's thin exosphere and lunar dust environment. In 2012, several GPHI scientists authored an article on "Metallic Species, Oxygen and Silicon in the Lunar Exosphere: Upper Limits and Prospects for LADEE Measurements" that was printed in the Journal of Geophysical Research.

GPHI also supported NASA's Magnetospheric Multiscale (MMS) mission, a part of the Solar Terrestrial Probes Program. MMS is comprised of four identically instrumented spacecraft that will use Earth's magnetic field (magnetosphere) as a laboratory to study the microphysics of three fundamental plasma processes: magnetic reconnect, energetic particle acceleration, and turbulence. These processes play an important role in space weather which affects modern telecommunications networks, GPS navigation, and electrical power grids. In support of a mission, a GPHI scientist conducted data analyses of calibration and project tests for MMS's Fast Plasma Instrumentation and developed new techniques and methods for geometric data trending that allowed the mission to compute space density for all sky maps measured inflight.

A GPHI scientist served as the primary magnetometer instrument scientist for the Deep Space Climate Observatory (DSCOVR), a partnership between NOAA, NASA, and the U.S. Air Force, launched in February 2015 to conduct solar wind observations. The satellite's observations are critical to the accuracy and lead time of NOAA's space weather alerts, forecasts, warnings, and space weather events like geomagnetic storms caused by changes in solar wind, which can affect public infrastructure systems, power grids, telecommunications systems, and avionics aboard aircraft. In support of the satellite's mission, the scientist developed DSCOVR's Magnetometer User's Guide for inflight operations of real time space weather monitoring, performed the magnetometer's calibration and commissioning, and developed its test procedures for conducting DSCOVER's static magnetic field test at Goddard.

GPHI also supports NASA's Wind spacecraft, which characterizes solar wind and how it affects the Earth and other planets. An Institute scientist processes and validates solar energetic particle data obtained by the spacecraft to derive complete pitch-angle distribution of arriving energetic particles. In 2013, GPHI scientists authored an article in the American Institute of Physics Conference Series on the "Magnetic Field Turbulence Spectra Observed by the Wind Spacecraft."

In late 2014, several GPHI scientists authored a research paper using data collected from the Solar Terrestrial Relations Observatory (STEREO). Launched in 2006, STEREO was the third mission in NASA's Solar Terrestrial Probes Program and employs two nearly identical space-based observatories--one ahead of the Earth in its orbit and the other trailing behind, which provides scientists with an opportunity to see the structure and evolution of solar storms. In October 2014, communications were lost with the trailing spacecraft, and after a year of silence, the spacecraft has entered a region where it can begin receiving signals.

HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS

The Harvard-Smithsonian Center for Astrophysics (CfA) was established in July 1973 as a research collaboration between Harvard University and the Smithsonian Astrophysical Observatory (SAO) to coordinate Harvard College Observatory (HCO) and SAO research activities. CfA's mission is to advance knowledge of the Universe through astronomy, astrophysics research, fundamental physics, and geophysics. Their combined resources and research facilities are used to study the physical processes that determine the nature and evolution of our Universe.

Program Essentials

NASA Affiliation: SMD, Goddard, Headquarters, JPL

NASA Strategic Alignment: 1.5, 1.6

FY 2015 NASA Funding: $88,732,816

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive and non-competitive (sole source)

Period of Performance: Through 2017

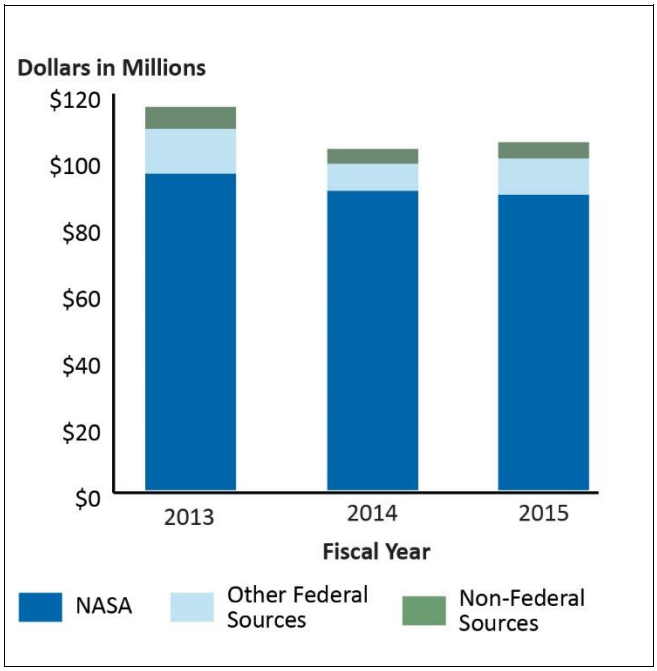
Category: Contractor-led, physical presence

Funding Profile

NASA contributed approximately 85 percent of CFA's total funding for FYs 2013 through 2015. In FY 2015, NASA expects to provide approximately $89 million to CfA through approximately 112 contracts, 396 grants, and 5 cooperative agreements. In FY 2015, NASA funded approximately 92 percent of SAO's operations, with private industry, universities, and other institutes funding the remainder. NASA is projected to contribute 24 percent of HCO's funding for FY 2015, with other funding coming from SAO and the Space Telescope Science Institute.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$95,048,032
	Other Federal Sources	$13,454,579
	Non-Federal Sources	$6,643,911
	Total	**$115,146,522**
2014	NASA	$89,888,486
	Other Federal Sources	$8,159,988
	Non-Federal Sources	$4,438,851
	Total	**$102,487,325**
2015	NASA	$88,732,816
	Other Federal Sources	$10,885,432
	Non-Federal Sources	$4,906,069
	Total	**$104,524,317**



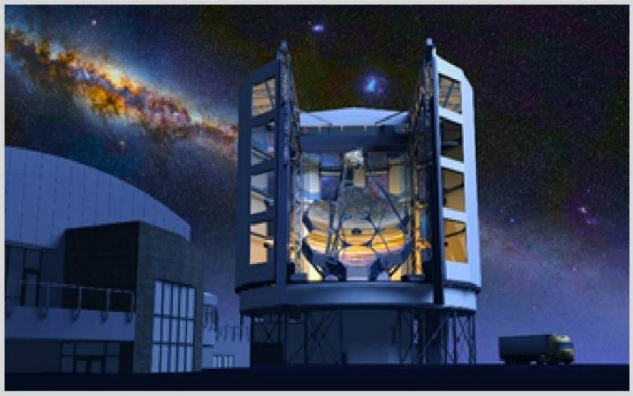
Note: Funding shown is a combination of HCO and SAO funding.

Historical Perspective

Founded in 1839, HCO focuses its research in astronomy and astrophysics. HCO and SAO CfA researchers are a collaborative partner in the Giant Magellan Telescope Project – a consortium of 11 universities and research centers funding the telescope's $1.5 billion cost of construction and its expected annual operating budget of $36 million upon completion in 2021.

SAO was founded in 1890 to study solar infrared radiation. Current research focuses on the Sun's stellar properties, atmosphere, corona, and its effects on Earth. In addition, SAO has focused on orbiting observatories and large ground-based telescopes, applying computers to astrophysical problems, integrating laboratory measurements, and theoretical astrophysics to measure the slow drift of Earth's continents and charting the thousands-of-kilometers-per-second recession of galaxies.

Artistic Rendering of the Giant Magellan Telescope



Source: http://www.gmto.org/gallery.

HCO and SAO first partnered in 1955 on space science research. This affiliation led to the 1973 creation of CfA to better coordinate related research activities in atomic and molecular physics; high energy and theoretical astrophysics; optical and infrared astronomy; radio and geoastronomy; and, solar, stellar, and planetary sciences. CfA has research programs in astronomy, astrophysics, and Earth and space sciences. While CfA was created to improve coordination on research activities, the observatories retain their separate identities and each is responsible to its respective institution.

Contributions to NASA

CfA has contributed to numerous NASA missions and projects. For example, in 1978 CfA began operating the Minor Planet Center, which collects, catalogs, and disseminates information about near-Earth objects – comets and asteroids that come within 28 million miles of Earth's orbit. In 2008, the Minor Planet Center announced the predicted impact area of an asteroid, which marked the first ever successful impact prediction. Earlier in 1988, CfA's observations at the Oak Ridge Observatory provided evidence of an exoplanet.

CfA has contributed instruments and satellites to NASA missions, including an instrument aboard the Solar and Heliospheric Observatory satellite that produced the first images of the Sun's extended atmosphere and detected both "fast" and "slow" solar wind and the Submillimeter Wave Astronomy Satellite that studies the chemical composition of interstellar gas clouds. CfA also contributed the Infrared Array Camera for the Spitzer Space Telescope, which is examining cosmic regions hidden from optical telescopes to study failed stars, extrasolar planets, giant molecular clouds, and organic molecules; the Atmospheric Imaging Array Instrument for the Solar Dynamics Observatory, which provides ultra-high-definition images of the Sun; and a solar telescope for the Interface Region Imaging Spectrograph Sun-watching spacecraft, which is helping to increase scientific understanding of how heat and energy move through the lower levels of the solar atmosphere.

Separate from its work with CfA, SAO has also contributed instruments and operated satellites for NASA missions, including the X-ray optics and a third-generation high resolution camera for the Chandra X-ray Observatory. SAO hosts the Chandra X-ray Center, which operates the satellite, solicits and plans observations, provides data analysis tools, processes the data, and distributes it for scientific analysis. SAO also developed and built an X-ray telescope in conjunction with the Japan Aerospace Exploration Agency for the Hinode sun-watching spacecraft.

In 2012, NASA selected SAO to serve as Principal Investigator for the Tropospheric Emissions Monitoring of Pollution Instrument Project, including the science team, ground systems, instrument operations, science data processing, and education and public outreach.

IMAGING RESEARCH CENTER

Located on the University of Maryland, Baltimore County (UMBC) campus, the Imaging Research Center (IRC) is focused on ways to communicate and disseminate information through various media platforms. Research is conducted using 3D visualization, interactive or virtual installations, feature-length films, social media, and mobile device applications.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 2.4

FY 2015 NASA Funding: $5,404

Funding Mechanism

Type of Award: Cooperative agreement

Nature of Award: Competitive

Period of Performance: Through 2015

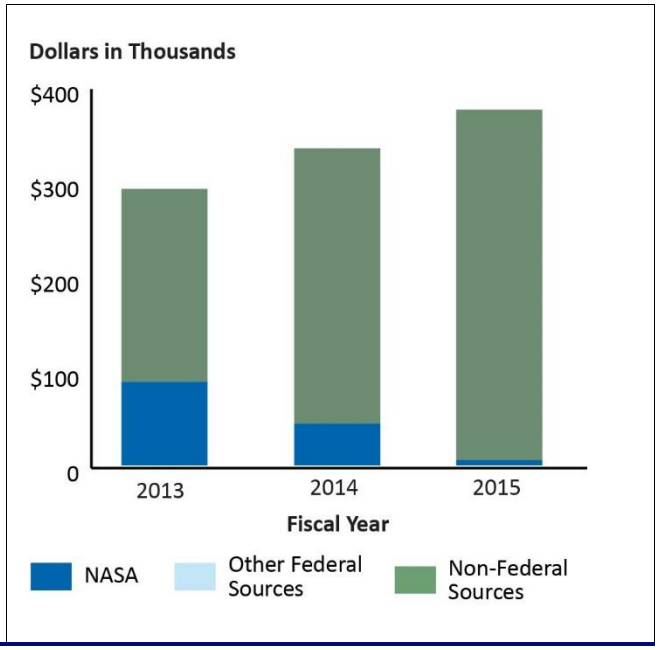
Category: Contractor-led, physical presence

Funding Profile

Between 2000 and 2011, IRC conducted work for NASA through a UMBC agreement with Goddard, and performed NASA work through a USRA agreement. NASA provided approximately 14 percent of IRC's total funding between FYs 2013 and 2015. Non-Federal funding sources from the past 3 years have included the National Academy of Sciences, Maryland Institute College of Art, Deutsch Foundation, Maryland Historical Society, and Surdna Foundation.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$88,213
	Other Federal Sources	$0
	Non-Federal Sources	$203,632
	Total	**$291,845**
2014	NASA	$44,122
	Other Federal Sources	$0
	Non-Federal Sources	$290,588
	Total	**$334,710**
2015	NASA	$5,404
	Other Federal Sources	$0
	Non-Federal Sources	$370,181
	Total	**$375,585**



Historical Perspective

Founded in 1987, IRC collaborates with artists, researchers, scholars, and industry leaders on research projects that combine art and technology to create visual content and develop animation technologies. IRC has worked with the Baltimore Museum of Art, Interactive Children's Television, National Gallery of Art, National Academy of Sciences, BBC Television, Discovery Channel, and PBS Television, among other organizations.

Contributions to NASA

IRC's work with NASA includes development of technical and conceptual visual animations, interactive exhibits, and imagery to enrich the general public's understanding of the Earth's climate and our place in the universe. The imagery included animation of how various Earth systems operate.

IRC provided animation and visualization services for NASA TV at Goddard, including the development of animations explaining the operation of missions and science findings, visualizations of future missions, and animations for the NASA TV-produced "Science on a Sphere" films.

"Science on a Sphere" Displaying Imagery of the Western Hemisphere

Source: NASA.

These films use the NOAA-developed visualization system displaying data on the outside of a suspended sphere using computer and video projectors. Within Goddard's "Science on a Sphere" video library are the films "Frozen: Cold Matters," "LARGEST," and "Loop."

INFORMATION SCIENCES INSTITUTE

A unit of the University of Southern California's (USC) Viterbi School of Engineering, the Information Sciences Institute (ISI) is a computer research institute focusing on intelligent systems, Internet and networking systems, informatics, computational systems and technology, and advanced electronics. ISI also researches space systems and technology in partnership with USC's Space Engineering Research Center.

Program Essentials

NASA Affiliation: Ames, Goddard

NASA Strategic Alignment: 1.7

FY 2015 NASA Funding: $750,000

Funding Mechanism

Type of Award: Grant

Nature of Award: Competitive

Period of Performance: Through 2017

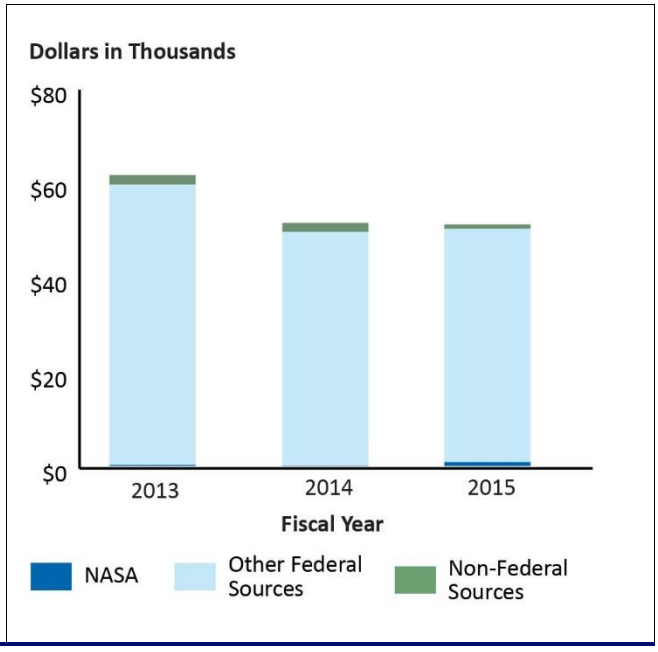
Category: Contractor-led, physical presence

Funding Profile

ISI receives funding from more than 15 Federal agencies, including the Air Force Office of Scientific Research (AFOSR), the Defense Advanced Research Projects Agency (DARPA), the Department of Education, the Department of Energy, the Department of Homeland Security, the Department of Justice, NASA, the National Institutes of Health, NSF , the Army, and the Navy. NASA provided less than 1 percent of ISI's total funding for FYs 2013 through 2015 and funded two projects through grant awards in FY 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$149,000
	Other Federal Sources	$59,195,000
	Non-Federal Sources	$2,014,000
	Total	**$61,358,000**
2014	NASA	$35,000
	Other Federal Sources	$49,377,000
	Non-Federal Sources	$1,841,000
	Total	**$51,253,000**
2015	NASA	$750,000
	Other Federal Sources	$49,313,000
	Non-Federal Sources	$888,000
	Total	**$50,951,000**



Historical Perspective

Established in 1972, ISI brings together experts from academia and industry to collaborate in researching computer networking, informatics systems, robotics, quantum computing, and cyber security. In the 1970s, ISI contributed to refining Transmission Control Protocol and the Internet Protocol, key components of the Internet.

Additionally, in 1974 during an era when the internet was still being developed, ISI collaborated with the Massachusetts Institute of Technology's Lincoln Laboratory to conduct a series of speech transmission experiments through packet switching that later resulted in the development of the "Voice over Internet Protocol" capability.[1] This effort earned the Lincoln Laboratory and ISI the Institute of Electrical and Electronics Engineers Milestone Award in 2012. ISI also conducts basic and applied research that include core engineering and computer science discovery to design and modeling of innovative prototypes and devices.

Over the years, ISI research activities have progressed to include research and application for statistical machine translation and space systems. The research initiated at ISI has contributed to the approach used by Google's translation system. Under its Space Systems and Technology Division, ISI has built and monitored satellites.

ISI currently employs about 350 engineers, research scientists, graduate students, and other staff.

Contributions to NASA

ISI received support from AFSOR, DARPA, NASA, and NSF for the Modular, Multifunctional, and Reconfigurable SuperBot. A robotic solution to perform complex tasks in space environments, SuperBot is built with multiple functionalities for performing different tasks at different mission stages. For example, SuperBot can reconfigure into an "extended arm" for extravehicular inspection and maintenance, become a "rover" to explore a flat environment, or perform exterior inspection of a habitat. SuperBot consists of 100 reconfigurable modules with four configurations or functionalities, including transportation and landing, traveling on flat terrain, climbing and descending slopes, and performing applications such as drilling, building, and sample collecting.

ISI has also been collaborating with the Goddard SpaceCube team for more than 10 years, with its research focusing on design tools, hybrid architectures, and radiation upset mitigation techniques for commercial radiation-tolerant devices used in spaceflight applications. ISI's current collaborative research is focused on supporting the development of the computing architecture for "SpaceCube X," the next generation of SpaceCube being developed to enable future Earth science "data intensive" and "intelligent" instruments that require extreme on-board computing power. This technology would also be applicable to other disciplines that require significant on-board computing power, such as astrophysics and heliophysics missions, robotic servicing, and planetary exploration.

[1] Packet switching delivers data from source to destination using network switches and routers.

INFRARED PROCESSING AND ANALYSIS CENTER

The Infrared Processing and Analysis Center (IPAC) at the California Institute of Technology (Caltech) is dedicated to science operations, data archiving, and community support for astronomical and planetary science missions, with a special emphasis on infrared-submillimeter astronomy and exoplanet science.[1]

Program Essentials

NASA Affiliation: Ames, Goddard, JPL

NASA Strategic Alignment: 1.6

FY 2015 NASA Funding: $33,040,000

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through September 2017

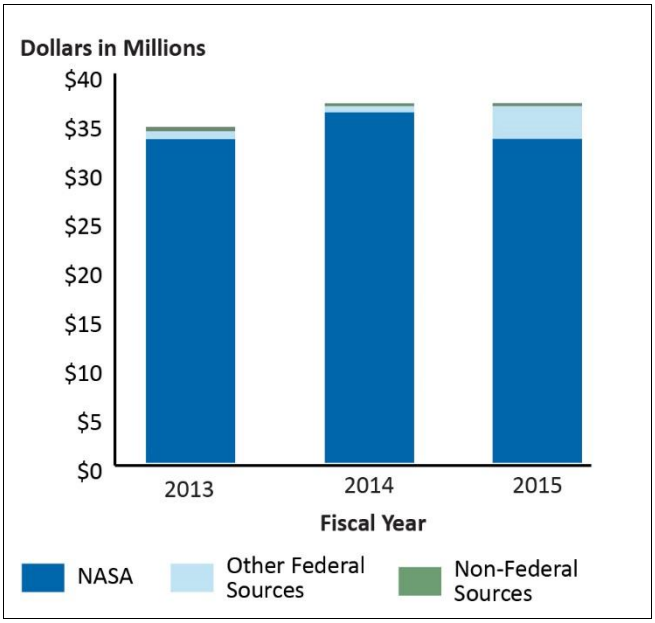
Category: Contractor-led, physical presence

Funding Profile

NASA has provided approximately 95 percent of IPAC's total funding for FYs 2013 through 2015. Other Federal funding comes from NSF, which supports the Large Synoptic Survey Telescope and the Zwicky Transient Facility.[2]

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA[a]	$33,000,000
	Other Federal Sources	$792,000
	Non-Federal Sources	$479,000
	Total	**$34,271,000**
2014	NASA	$35,746,000
	Other Federal Sources	$616,000
	Non-Federal Sources	$300,000
	Total	**$36,662,000**
2015[a]	NASA	$33,040,000
	Other Federal Sources	$3,345,000
	Non-Federal Sources	$300,000
	Total	**$36,685,000**



[a] NASA's funding does not include JPL overhead and research grants to the science community, which vary each year and were approximately $13 million in FY 2014. The amounts do represent all activities, including the NASA Exoplanet Science Institute and the Spitzer Science Center.

[1] Exoplanet science relates to a planet that revolves around a star other than the sun.

[2] The Large Synoptic Survey Telescope, being built in Chile, will survey the sky over a 10-year period with its 27 foot mirror and 3,200 megapixel camera. The Zwicky Transient Facility in San Diego County, California, uses a new camera and a 48-inch telescope to enable discovery of supernova less than 24 hours after explosion.

Historical Perspective

IPAC was established in 1985 at Caltech to conduct the Infrared Astronomical Satellite (IRAS) extended mission, which was the first all-sky survey at far-infrared wavelengths studying dust in the solar system to distant luminous galaxies and quasars. IPAC processed the data from IRAS – producing sky images and source lists for scientific analysis – to make them more readily usable for scientific interpretation by researchers. In 1990, the NASA/IPAC Extragalactic Database, the world's largest database of cross-correlated multiwavelength data for extragalactic objects, was created to support research by providing a systematic fusion of information integrated from large sky surveys and research publications.

In 1993, IPAC was designated as the NASA Infrared Science Archive, which curates scientific data products from NASA's infrared and sub-millimeter projects and missions; enables scientific exploration of the data by astronomers; and supports planning for, operation of, and data generation from the Agency's missions.

In 1997, IPAC was assigned responsibility for the Spitzer Science Center (SSC) to support science operations for the Spitzer Space Telescope. IPAC manages the science program; schedules the telescope; and calibrates, archives, and disseminates data collected from the telescope. In addition to managing SSC, IPAC also manages the Michelson Science Center (now the NASA Exoplanet Science Institute), and other science centers. As the parent organization for these centers, IPAC provides administrative support, staffing management, data center systems engineering, office computing and conference support, financial analysis, and facilities.

Contributions to NASA

IPAC conducts science operations functions for NASA missions and carries out data management tasks that enable and enhance the information derived from major projects, including the Great Observatories or all-sky surveys.[3] IPAC also provides media, outreach, and education support for many of these projects.

In 2009, NASA became a partner in the European Space Agency's Herschel Space Observatory mission. NASA provided mission-enabling instrument technology and sponsored the NASA Herschel Science Center at IPAC, which provides the U.S. astronomical community with science and observational support throughout the Herschel mission.

IPAC also managed and operated the Wide-Field Infrared Survey Explorer's (WISE) science data processing for NASA's Science Mission Directorate. Placed in hibernation mode in 2011 after having twice scanned the entire sky, WISE was reactivated, and renamed NEOWISE, to assist the Agency's efforts in identifying the population of potentially hazardous near-Earth objects. IPAC conducts NEOWISE's science operations and data processing.

In October 2014, NASA established the Euclid NASA Science Center at IPAC (ENSCI) to support US-based investigations using Euclid, a European Space Agency mission designed to measure the expansion of the universe and help understand the nature of dark energy and dark matter. ENSCI will participate in the Euclid Consortium's Science Ground Segment, providing algorithm and software development, conducting data quality assurance, and performing data processing.

[3] The Great Observatories are a group of NASA Astrophysics projects consisting of the Compton Gamma Ray Observatory, the Hubble Space Telescope, the Chandra X-ray Observatory, and the Spitzer Space Telescope.

INSTITUTE FOR ASTROPHYSICS AND COMPUTATIONAL SCIENCES

The Institute for Astrophysics and Computational Sciences (IACS), located at the Catholic University of America (CUA), promotes cooperation between Government, industry, and the University to develop research programs in astrophysics and computational sciences.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 1.4, 1.6, 2.4

FY 2015 NASA Funding: $6,482,893

Funding Mechanism

Type of Award: Grants, cooperative agreement

Nature of Award: Competitive

Period of Performance: Through June 2020

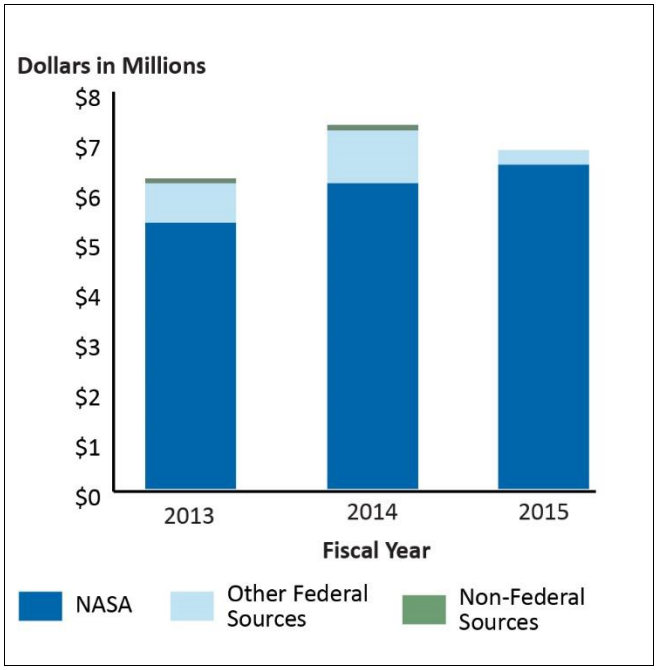
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 88 percent of IACS' total funding for FYs 2013 through 2015, including $107,000 per year in pass-through funding from the Space Telescope Science Institute. Part of NASA's contribution included an Intergovernmental Personnel Act agreement between the Agency and CUA costing approximately $140,000 annually for a researcher assigned to NASA.[1] NSF is the primary contributor of IACS' other Federal funding.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$5,317,983
	Other Federal Sources	$789,448
	Non-Federal Sources	$102,123
	Total	**$6,209,554**
2014	NASA	$6,111,787
	Other Federal Sources	$1,057,284
	Non-Federal Sources	$111,209
	Total	**$7,280,280**
2015	NASA	$6,482,893
	Other Federal Sources	$286,272
	Non-Federal Sources	$0
	Total	**$6,769,165**



Note: IACS' fiscal year runs between May 1 and April 30.

[1] The Intergovernmental Personnel Act Program provides for the temporary assignment of personnel between the Federal Government and state and local governments, colleges and universities, Indian tribal governments, federally funded research and development centers, and other eligible organizations.

Historical Perspective

In October 1996, CUA established IACS to develop astrophysics and computational sciences research and educational programs. In 2011, NASA awarded CUA a 5-year cooperative agreement to develop a science center and perform collaborative research in solar-heliospheric sciences for Goddard's Sciences and Exploration Directorate. IACS performs the broad requirements of the cooperative agreement, including envisioning new space missions and providing mission requirements. The Institute also conducts research on how the Sun, interplanetary matter, and interstellar matter interact with each other.

About 60 IACS personnel, comprised of CUA faculty and research staff, work with Goddard researchers, engineers, computer programmers, technologists, and others to develop technology resources for space-based research. The researchers have cooperated in observational, experimental, and theoretical research in support of NASA's Heliophysics program.

Contributions to NASA

In 2015, IACS offered undergraduate and graduate students research positions within the Institute or Goddard's Sciences and Exploration Directorate to research solar physics, heliospheric physics, geospace physics, climate and radiation, atmospheric chemistry, ocean sciences, hydrological sciences, biospheric sciences, astroparticle physics, planetary systems, and instrument and computer systems.

In June 2015, IACS had two active Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) research projects reapproved for extended operations on NASA's Heliophysics System Observatory. Initially named the High Energy Solar Spectroscopic Imager, and launched on February 5, 2002, the instrument was renamed to honor NASA scientist Reuven Ramaty. RHESSI's primary mission was to explore the basic physics of particle acceleration and explosive energy release in solar flares, which drive space weather and present significant dangers in space and on Earth.

A research article, coauthored by several researchers, including from Goddard and IACS, was published online on June 9, 2015, for the American Geophysical Union. The article, entitled "Predicting the Magnetic Vectors within Coronal Mass Ejections Arriving at Earth: 1. Initial Architecture," concluded that while forecasting magnetic vectors within coronal mass ejections remains elusive, additional statistical work and better quantifying uncertainties within the process may improve the approach taken by earlier forecasting systems.

IACS researchers also support space weather model development and validation at Goddard's Community Coordinated Modeling Center. The Modeling Center works with scientists worldwide to study space weather processes, as well as conduct education and outreach activities. Space weather impacts navigation, communication, satellite operations, aviation, and electric power distribution.

INSTITUTE FOR GLOBAL ENVIRONMENTAL STRATEGIES

The Institute for Global Environmental Strategies (IGES) focuses on applying space-based Earth observations and information technology to further science, provide information for decision-making, and advance education. The Institute's mission is to further understanding of global environmental change.

Program Essentials

NASA Affiliation: Headquarters

NASA Strategic Alignment: 2.2, 2.4

FY 2015 NASA Funding: $1,251,453

Funding Mechanism

Type of Award: Grant, cooperative agreement

Nature of Award: Competitive, non-competitive (unsolicited proposal)

Period of Performance: Through 2015

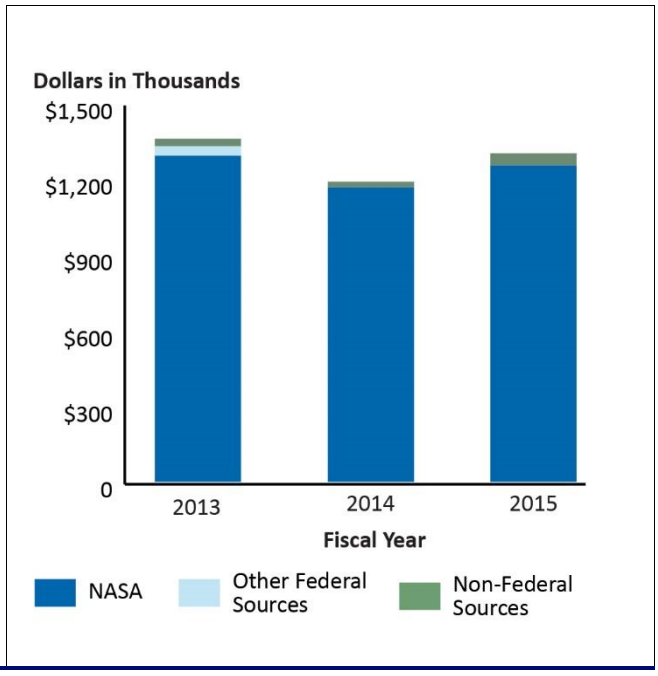
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 96 percent of IGES' total funding for FYs 2013 through 2015. During this period, IGES was awarded one grant and two cooperative agreements with NASA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,290,218
	Other Federal Sources	$37,420
	Non-Federal Sources	$30,000
	Total	**$1,357,638**
2014	NASA	$1,164,790
	Other Federal Sources	$0
	Non-Federal Sources	$23,000
	Total	**$1,187,790**
2015	NASA	$1,251,453
	Other Federal Sources	$0
	Non-Federal Sources	$48,000
	Total	**$1,299,453**



Historical Perspective

Incorporated in August 1994 to advance understanding of global environmental change and sustainable development, IGES is a nonprofit organization located in Arlington, Virginia, supported by public and private entities. IGES' founders shared an interest in environmental studies, and seek to better inform the public of the role space technologies play in understanding and responding to global environmental change, the importance of interagency and international cooperation, and the need for leadership in the area of Earth science education.

Over the past 20 years, IGES has concentrated on Earth and space science education, communication and outreach, and fostering national and international cooperation in global Earth observations. These efforts were designed to improve understanding of and response to global environmental change requiring multidisciplinary approaches to addressing complex social, environmental, and economic challenges.

Contributions to NASA

Beginning in October 2012, IGES helped to develop the NASA Wavelength portal, which brings together science education resources in a single digital collection for educators. The portal is organized by topic and audience level (elementary to college and out-of-school programs) and features over 2,000 resources, developed by SMD research missions and grant programs. IGES partnered with the University of California, Berkeley, and the Adler Planetarium to define, test, and launch Wavelength.

As of October 2009, IGES served as the lead organization for the NASA Earth Science Mission and Public Outreach Forum. This forum, funded by SMD through a cooperative agreement, includes teams of scientists and educators who work with NASA to organize education and public outreach activities.

IGES also manages an independent peer review process for NASA Earth and space science education materials. Sponsored by SMD, scientists and educators involved in the peer review examine educational products distributed by NASA to ensure accuracy and provide feedback to product developers.

INSTITUTE FOR MEDICAL RESEARCH

IMR
Institute For Medical Research

The Institute for Medical Research (IMR) is a nonprofit institute at the Durham, North Carolina, Veterans Affairs (VA) Medical Center. IMR's mission is to support research and education that enhances the health and lives of veterans, their families, and the public. The Institute conducts research in areas including cancer and post-traumatic stress disorder.

Program Essentials

NASA Affiliation: Kennedy

NASA Strategic Alignment: 1.2

FY 2015 NASA Funding: $372,411

Funding Mechanism

Type of Award: Grants

Nature of Award: Competitive

Period of Performance: Through July 2016

Category: Contractor-led, physical presence

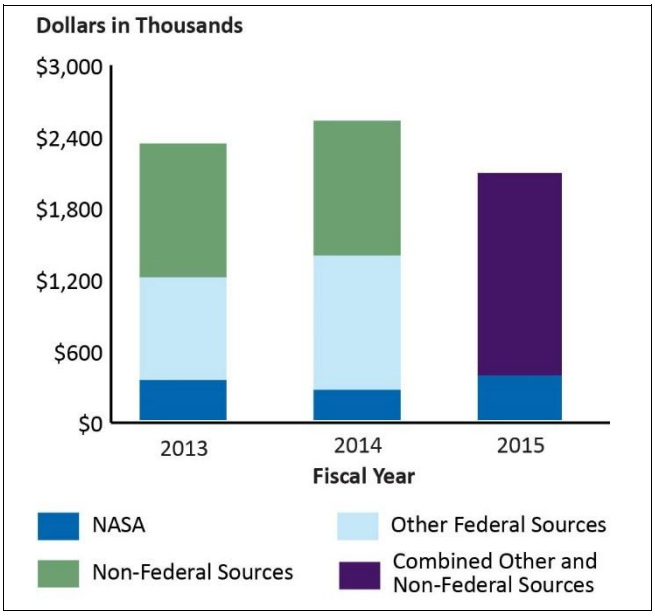
Funding Profile

NASA contributed 14 percent of IMR's total funding for FYs 2013 through 2015. Other sources of Federal funding include the Center for the Advancement of Science in Space (CASIS), the Centers for Disease Control and Prevention, the Department of Defense, the National Institutes of Health, and the VA.[1]

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$335,934
	Other Federal Sources	$861,524
	Non-Federal Sources	$1,124,117
	Total	**$2,321,575**
2014	NASA	$253,719
	Other Federal Sources	$1,127,573
	Non-Federal Sources	$1,130,752
	Total	**$2,512,044**
2015[a]	NASA	$372,411
	Other Federal Sources	$1,700,000
	Non-Federal Sources	
	Total	**$2,072,411**

[a] As of June 2015, IMR projected approximately $372,411 in funding from NASA and a combined $1.7 million in other Federal and non-Federal sources.



[1] CASIS works with NASA to attract private research aboard the International Space Station.

Historical Perspective

In 1988, Congress authorized VA medical centers to establish nonprofit research corporations. Initially, these corporations facilitated research at their associated medical centers; however, this authority was later expanded to include supporting VA patient and staff education and training. The VA has over 80 state-chartered corporations at medical centers throughout the country, all of which are subject to VA oversight and regulation.

IMR was established in 1989 as a nonprofit state-chartered research corporation to conduct research and educational activities in partnership with the Durham VA Medical Center, Government agencies, private companies, foundations, and academic institutions. Through these partnerships, IMR developed a broad research portfolio to advance health and well-being of the public.

The Institute is organizationally separate from the VA, and its Board of Directors and Executive Director provide oversight for approximately 70 principal investigators.

Contributions to NASA

IMR and NASA collaborate on the National Pathfinder Vaccine Program, allowing researchers to observe bacterial genetic properties in space with the expectation of deriving new processes to prevent bacteria growth on Earth. Ongoing vaccine research using yeast chemical genomics studies new uses for existing drugs and evaluates potential new drugs such as cancer therapeutics.

In 2011, vaccine research at IMR and aboard the International Space Station sought vaccines for two common infections – salmonella, a common contaminant in the food chain, and Methicillin-Resistant Staphylococcus Aureus, a bacterial agent found in combat infections and health care facilities. In May 2011, Space Shuttle Endeavour launched with a National Pathfinder research payload to examine two new vaccines for these bacteria. This research was funded by both commercial organizations and the Government.

INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS

The Institute of Geophysics and Planetary Physics (IGPP) is a multi-campus research unit based at the University of California, Los Angeles (UCLA), that focuses on the application of physical and life sciences to understand the origin and evolution of life, the Earth's space environment, the interior structure of the Earth and planets, and the socio-economic problems resulting from global climate change.

Program Essentials

NASA Affiliation: Goddard, Headquarters, Langley, Marshall

NASA Strategic Alignment: 1.4, 1.5

FY 2015 NASA Funding: $7,207,856

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through November 2020

Category: Contractor-led, physical presence

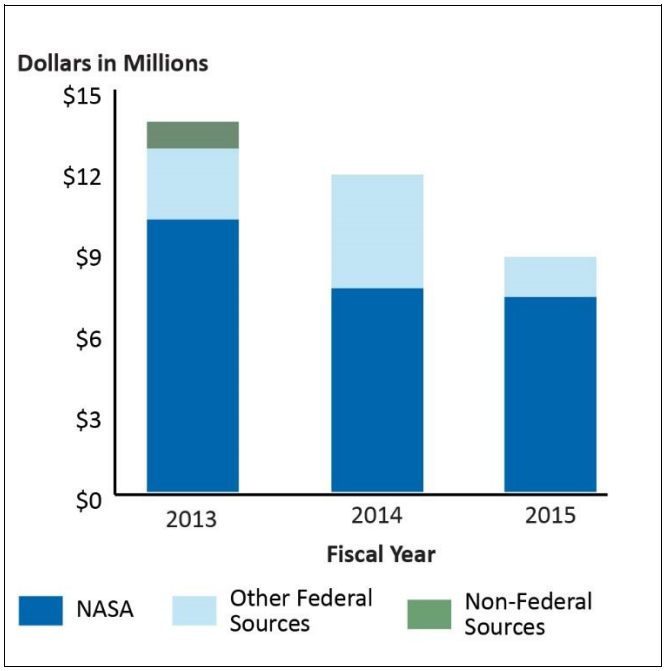
Funding Profile

As of June 8, 2015, IGPP had 1 contract, 12 grants, and 11 subawards with NASA. The Agency contributed approximately 73 percent of IGPP's total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$10,074,391
	Other Federal Sources	$2,629,462
	Non-Federal Sources	$995,711
	Total	**$13,699,564**
2014	NASA	$7,532,533
	Other Federal Sources	$4,178,612
	Non-Federal Sources	$9,195
	Total	**$11,720,340**
2015[a]	NASA	$7,207,856
	Other Federal Sources	$1,476,679
	Non-Federal Sources	Unknown
	Total	**$8,684,535**

[a] FY 2015 funding is estimated and non-Federal sources are unknown.



Historical Perspective

Founded in 1946, IGPP was established to perform research and provide education in the geoscience field. In addition to UCLA, IGPP has facilities on four other University of California campuses – Irvine, Riverside, San Diego, and Santa Cruz – and at two national laboratories – Los Alamos National Laboratory in New Mexico and Lawrence Livermore National Laboratory in California. IGPP consists of three science centers aligned to specific areas of expertise: the Center for Planetary Sciences (CPS), the Center for Earth Systems Research (CESR), and the Space Physics Center (SPC).

CPS, formed in 1993, explores the origins and evolution of planets within other solar systems, the factors that make life possible on Earth, the habitability of other planets, and whether those planets are inhabited. CPS also seeks to understand the processes that form low-mass stars and how various solar systems resemble and differ from one another.

CESR, established in 1989, conducts research in physics and biogeochemistry associated with the Earth's atmosphere, cryosphere, and oceans.[1] Observational, theoretical, numerical, and laboratory-based climate change studies are used to understand the impacts of climate change on the environment.

SPC, formed in 1962, focuses on space plasma simulation, planetary plasma physics, and space physics.[2] Its role is to develop technology for research, data management, and education in the study of solar wind and the magnetospheres, the ionospheres, and the atmospheres of the Earth and other planets.[3]

Contributions to NASA

NASA's Planetary Data System (PDS) is an online catalog of archived data from the Agency's planetary missions organized into disciplines called Nodes. SPC manages the Planetary Plasma Interactions Node that collects, archives, and makes available digital data from planetary missions related to interactions between solar wind and planetary winds with planetary magnetospheres, ionospheres, and surfaces.

In order to maximize the long-term usefulness of the data stored in PDS, SPC staff assist data providers in organizing and documenting digital data to make it consistent with PDS standards. This involves providing criteria for validating archival products and coordinating with data providers to establish delivery schedules for those products. SPC staff also conduct peer reviews of submitted data to ensure accuracy and scientifically usable content.

IGPP is also the home of the Dawn mission's science team. Dawn is a nearly decade-long mission to study the asteroid Vesta and dwarf planet Ceres. By studying both these two distinct bodies with the same complement of instruments on the same spacecraft, the Dawn mission hopes to compare the different evolutionary path each took as well as create a picture of the early solar system overall. Data returned from the Dawn spacecraft could provide opportunities for significant breakthroughs in our knowledge of how the solar system formed.

[1] The cryosphere is the frozen water part of the Earth system.

[2] Plasma is a gas that is so hot that some or all its constituent atoms are split up into electrons and ions, which can move independently of each other.

[3] The magnetosphere is the region surrounding a planet where the planet's magnetic field dominates, and the ionosphere is the layer of the Earth's atmosphere that contains a high concentration of free electrons as a result of ionizing radiation entering the atmosphere from space.

INSTITUTE OF GLOBAL ENVIRONMENT AND SOCIETY

The Institute of Global Environment and Society (IGES) was an independent nonprofit research institute founded to improve understanding and prediction of the Earth's climate variations through scientific research and to share this research, along with research tools, with society. The mission of the Institute was to apply scientific knowledge for sustainable economic development, resource management, and public health and safety.

As of October 2015, IGES was under investigation by the U.S. House of Representatives Committee on Science, Space, and Technology for alleged participation in partisan political activities while receiving Federal funds. The Committee requested that NASA provide all documents and communications pertaining to any contract, grant, or other financial award made to IGES from January 1, 2009, to the present. As of September 2015, IGES was no longer in existence. Therefore, information included in this brief was obtained via internet searches.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $0

Funding Mechanism

Type of Award: Grant

Nature of Award: Non-competitive (unsolicited proposal)

Period of Performance: Through July 2014

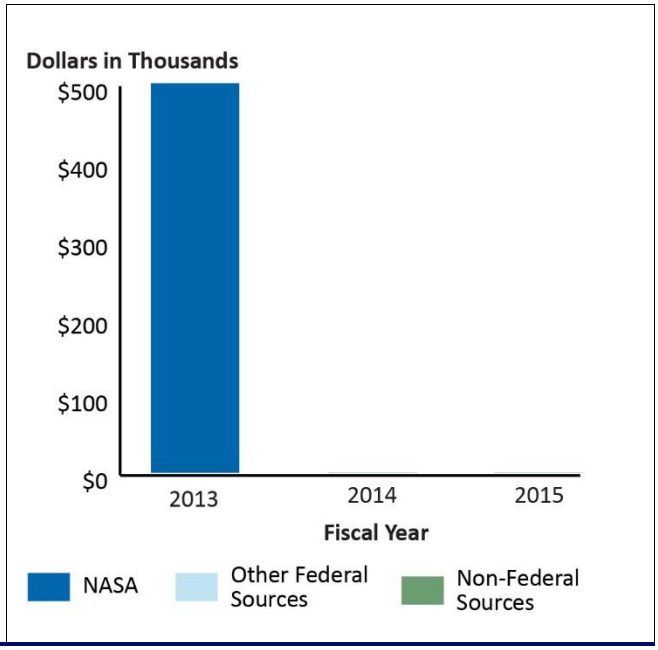
Category: Contractor-led, physical presence

Funding Profile

In August 2009, NASA awarded IGES a 5-year, $2.5 million research grant for continuation of the enhancement of climate predictability.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$500,000
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**$500,000**
2014	NASA	$0
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**Unknown**
2015	NASA	$0
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**Unknown**



Historical Perspective

Founded in 1993 by a George Mason University professor, IGES is a nonprofit research institute located in Maryland, which interacted with climate research organizations throughout the world. The Institute established two centers of excellence dedicated to basic Earth science research – the Center for Ocean-Land-Atmosphere Studies (COLA) and the Center for Research on Environment and Water (CREW) – both located at George Mason University.

COLA, established in 1983, is dedicated to basic research of the Earth's climate to explore, establish, and quantify the predictability of seasonal variability within the climate. The scientific basis of COLA's research is that, although the chaotic nature of the atmosphere is known to impose a limit on the predictability of climate at any given instant, there is a predictable element of the Earth's climate that makes it possible to forecast climate variations. COLA conducts research through the use of dynamical coupled ocean-atmosphere generated circulation models and new techniques to analyze observational and model data.

CREW was established in 2005 to conduct basic research of the Earth's water cycle to quantify and predict water cycle and environmental consequences of Earth system variability through observation, modeling, and application. CREW also quantified long-term water cycle trends and variability, modeling and predicting of the Earth's water cycle using "operational" system models, creating links to other Earth system components, and engaging the public and research community through education.

Contributions to NASA

IGES contributed to NASA through independent evaluation of the characteristics of U.S. models for climate variability and climate change, improved understanding and prediction of climate variability on seasonal to inter-annual time scales, and information technology for the exchange and utilization of climate model and observational data. The Institute also conducted a multi-model investigation of climate in the global land-atmosphere system through prediction and variability of the present climate; study of the coupling processes between land and atmosphere; and predictability of changing climate influenced by changing greenhouse gases, aerosols, and land use on the interactive ocean-atmoshere-land-cryosphere system.

COLA has developed and supports the Grid Analysis and Display System, an interactive tool integrating data access, analysis, and visualization that NASA uses for quantitative analysis of Earth system observations and model simulations. CREW is also focused on developing and deploying NASA's Land Information System, which provides terrestrial modeling and data assimilation by integrating satellite and ground-based observational data products with advanced modeling techniques.

JOINT CENTER FOR EARTH SYSTEMS TECHNOLOGY

The Joint Center for Earth Systems Technology (JCET) was established in July 1995 to foster collaborative research between the University of Maryland, Baltimore County (UMBC) and Goddard.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 2.2, 2.4

FY 2015 NASA Funding: $5,616,000

Funding Mechanism

Type of Award: Grant, cooperative agreement

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through 2020

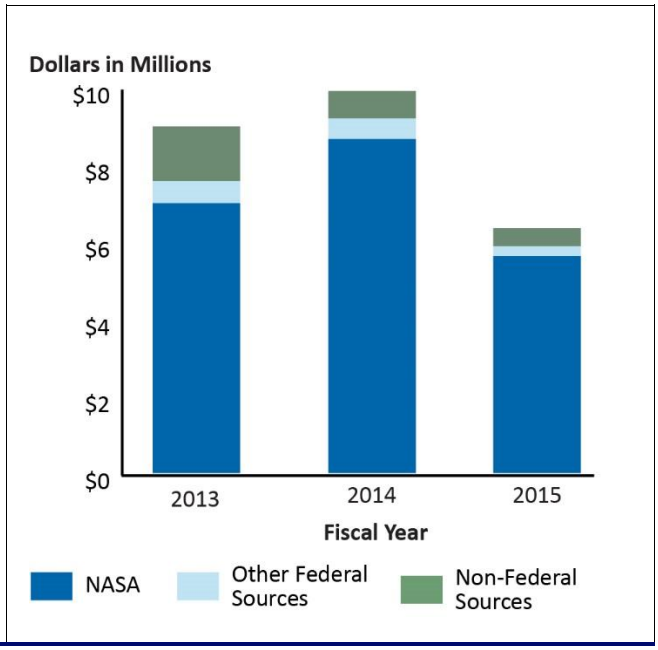
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 84 percent of JCET's total funding for FYs 2013 through 2015. During the same period, JCET also received funding from private industry, university research institutes, nonprofits, and the state of Maryland. For FY 2015, JCET received 28 competitive grants and 1 non-competitive cooperative agreement from NASA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$6,987,810
	Other Federal Sources	$566,800
	Non-Federal Sources	$1,417,850
	Total	**$8,972,460**
2014	NASA	$8,647,295
	Other Federal Sources	$530,970
	Non-Federal Sources	$717,860
	Total	**$9,896,125**
2015	NASA	$5,616,030
	Other Federal Sources	$255,990
	Non-Federal Sources	$468,690
	Total	**$6,340,710**



Historical Perspective

JCET has a cooperative agreement with NASA to develop environmental remote sensing technology supporting advanced concepts research for observing the Earth, planets, and their atmospheres via ground stations, aircraft, and space-based platforms. Between FYs 2011 and 2015, JCET conducted 25 research projects focused on Earth science related to atmospheric processes and chemistry, climate, and geophysics.

JCET's staff includes UMBC faculty members who are encouraged to teach every other year and mentor both graduate and undergraduate students working on NASA-related research at Goddard's Earth Sciences Division and at the University to attract, train, and employ the next generation of Earth scientists.

Contributions to NASA

JCET faculty work collaboratively with researchers at Goddard's Earth Science Division; actively participate on NASA-funded research grants as principal investigators; provide scientific leadership; assist the scientific community through peer reviews on scientific journals, proposals, and research grants; and contribute to Goddard and JCET public outreach programs.

A JCET researcher recently served as the Earth Polychromatic Imaging Camera (EPIC) Instrument Scientist on the Deep Space Climate Observatory (DSCOVR). DSCOVR, launched from Cape Canaveral in February 2015, is a joint mission of NOAA, the U.S. Air Force, and NASA to provide in-situ solar wind measurements to enable operational space weather forecasting. The EPIC instrument provides global spectral images of the entire sunlit face of Earth, which will be used in a number of science applications, including the measurement of ozone amounts, aerosol amounts, cloud height and phase, vegetation properties, hotspot land properties, and ultraviolet radiation estimates at Earth's surface.

Another JCET researcher leads the Hyper-Angular Rainbow Polarimeter (HARP) team that plans to use CubeSat satellite technology to develop lower cost instruments for characterizing aerosol and cloud properties and measuring microphysical properties of cloud water and ice particles. The HARP mission is a joint effort among several entities: UMBC and JCET, which will provide sensor hardware and scientific analysis; Space Dynamics Laboratory, a nonprofit unit of Utah State University Research Foundation that will provide spacecraft and mission operations; Science Technology Corporation, funded by NOAA, which will lead algorithm development and science applications; and Wallops, which will support instrument environmental testing and mission communications and operations.

In 2014, a JCET researcher who serves as Principal Investigator of a project that is part of SMD's Advanced Information Systems Technology Program was awarded a NASA Earth Science Technology Office Award for the Next Generation Unmanned Aerial Vehicle (UAV) Based Spectral Systems for Environmental Monitoring. The project is intended to produce science-quality spectral data from UAVs suitable for scaling ground measurement comparisons against airborne and satellite sensors and make UAV data readily available without the cost, scheduling, and logistical limitations of satellite or piloted aircraft missions.

LOGISTICS MANAGEMENT INSTITUTE

LMI

Logistics Management Institute (LMI) is a nonprofit Government consulting firm that supports acquisition, financial, infrastructure and information management, organizational improvement, as well as policy and program support.

Program Essentials

NASA Affiliation: Ames, Glenn, Headquarters, Langley

NASA Strategic Alignment: 2.1, 3.2

FY 2015 NASA Funding: $5,080,000

Funding Mechanism

Type of Award: Contracts, blanket purchase agreements

Nature of Award: Competitive

Period of Performance: Through January 2017

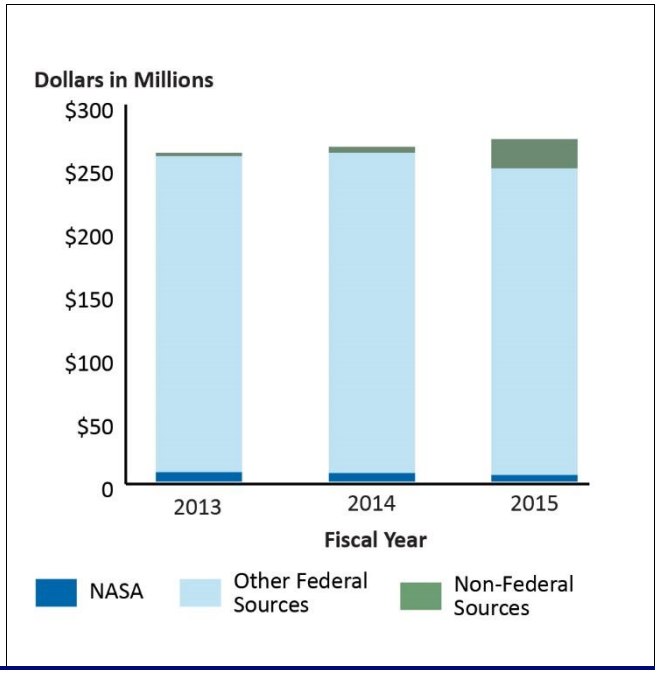
Category: Contractor-led, physical presence

Funding Profile

NASA provided 2.4 percent of LMI's total funding for FYs 2013 through 2015 through firm-fixed-price contracts and Blanket Purchase Agreements (BPA). The total value of the contracts was approximately $4.2 million, and the BPAs approximately $12 million. LMI also receives funding for performing consulting services for more than 25 Federal agencies, including the Department of Defense, the United States Postal Service, and the Securities and Exchange Commission.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$7,300,000
	Other Federal Sources	$249,900,000
	Non-Federal Sources	$2,500,000
	Total	**$259,700,000**
2014	NASA	$6,500,000
	Other Federal Sources	$253,200,000
	Non-Federal Sources	$4,800,000
	Total	**$264,500,000**
2015	NASA	$5,080,000
	Other Federal Sources	$242,290,000
	Non-Federal Sources	$23,190,000
	Total	**$270,560,000**



Historical Perspective

In September 1961, Secretary of Defense Robert S. McNamara advised President Kennedy that the United States could achieve major breakthroughs in logistics management if the Department of Defense established a full-time organization concentrating on logistics through the use of business management specialists. The President agreed with this proposal, and LMI was established in October 1961. In 1985, the Deputy Secretary of Defense established LMI as a federally funded research and development center (FFRDC).

By 1998, LMI had grown and faced limitations from restrictions on FFRDC funding, which forced the Institute to turn away long-standing clients that required research and analysis support while demand was growing for this support across the Government. As a result, LMI ended their status as an FFRDC, and returned as a nonprofit Government consulting firm. This allowed LMI to maintain the cultural practices and ethics developed as a FFRDC, but allowed them to pursue Government consulting work without restriction. LMI pursues consulting work in defense, intelligence, healthcare, energy, environment, homeland security, and other Government sectors.

Contributions to NASA

In 2014, an LMI team performed a congressionally-mandated review for the National Research Council of procedures for manning and operating air traffic control facilities in the United States. The team assessed staffing and operations at 315 facilities and issued a report identifying potential impacts concerning development of the Next Generation Air Transportation System, an air traffic modernization effort by NASA and the Federal Aviation Administration to shift from ground-based radar to satellite systems.

In 2013, a team led by LMI was awarded a 5-year, $20 million BPA to provide aeronautical system analysis augmenting NASA's current capabilities for ARMD. The team, which included business organizations with backgrounds in strategy, aviation and aero sciences, technology, as well as university partners, conducted system analysis to help ARMD understand and focus its research portfolio and develop investment strategies for achieving NASA's strategic objectives.

In 2014 and 2015, an LMI team worked with NASA's Office of Human Capital Management to develop an enterprise human resources portal for Agency employees. The team also developed a multimedia strategy on portal functions and features to encourage its adoption, conducted training on new modules within the portal, and provided results to Agency leadership on how well the portal met employee needs.

LUNAR AND PLANETARY INSTITUTE

Located near Johnson in Houston, Texas, the Lunar and Planetary Institute (LPI) is a research institute providing support services to NASA and the planetary science community. Although the Institute's original focus was on the Moon, LPI now focuses on the origin and evolution of the solar system and the potential for life elsewhere in the universe.

Program Essentials

NASA Affiliation: SMD, Johnson

NASA Strategic Alignment: 1.5, 2.4

FY 2015 NASA Funding: $832,561

Funding Mechanism[a]

Type of Award: Grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through 2015

Category: Contractor-led, physical presence

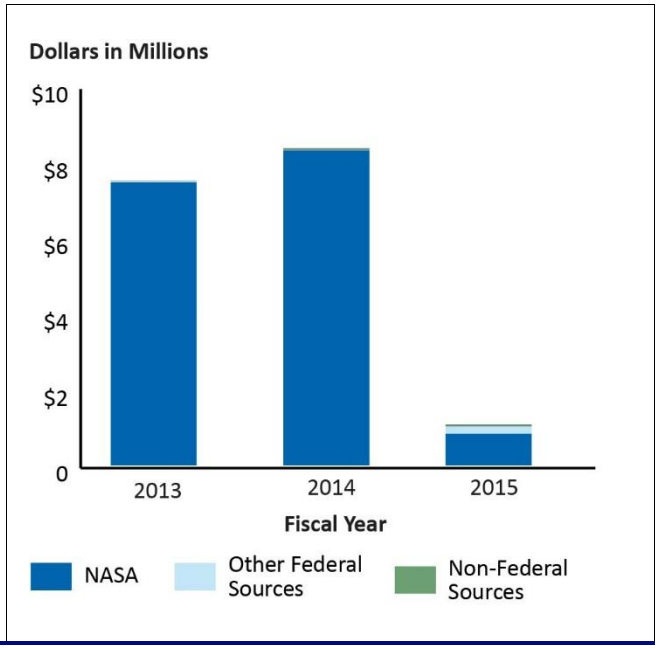
[a] LPI's awards are from NASA through USRA, therefore, the information in this section relates to USRA awards to LPI and not direct awards from NASA.

Funding Profile

In December 2014, the cooperative agreement expired between NASA and USRA to manage LPI, but was extended through December 2015. NASA has solicited proposals from academic institutions, nonprofit organizations, and consortiums to continue operation of LPI. The new cooperative agreement, which is anticipated to be awarded in spring 2015, will have an initial 5-year performance period with additional option years. Funding for the awardee will be disbursed on an annual graduated scale, such that higher levels of support are provided in the earlier years of the agreement, with individual awards of approximately $6 million over the initial 5-year period. Funding in the following table reflects NASA funds designated for LPI passed through USRA. The drop in FY 2015 funding reflects the conclusion of the cooperative agreement between NASA and USRA/LPI. Funding is expected to increase once a new cooperative agreement is signed between NASA and USRA. NASA contributed 98 percent of LPI's total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$7,467,576
	Other Federal Sources	$31,700
	Non-Federal Sources	$15,952
	Total	**$7,515,228**
2014	NASA	$8,312,535
	Other Federal Sources	$8,594
	Non-Federal Sources	$52,039
	Total	**$8,373,168**
2015	NASA	$832,561
	Other Federal Sources	$194,910
	Non-Federal Sources	$50,778
	Total	**$1,078,249**



Historical Perspective

In a March 1968 speech at the Manned Spacecraft Center (later the Johnson Space Center), President Johnson outlined the formation of the Lunar Science Institute (LSI). LSI was established to stimulate lunar research and encourage scientists to visit the Manned Spacecraft Center and use its laboratories, lunar photographs, and lunar rock samples. The Institute was formalized later that year in a contract between NASA and the National Academy of Sciences, which established USRA to manage LSI.

In the late 1970s, the focus of LSI was expanded to include the study of the entire solar system, and its name was changed to the Lunar and Planetary Institute (LPI) in 1978. Since then, USRA has operated LPI under a series of grants and cooperative agreements. The Institute seeks to maintain critical research and exploration capability in planetary science and foster greater involvement of the science community in the accomplishment of NASA's planetary science goals.

LPI serves as a scientific forum for visiting scientists, postdoctoral fellows, students, and resident experts; supports the research community through newsletters, meetings, and other activities; collects and disseminates planetary data; facilitates researchers' access to NASA science; engages the public about space science; and conducts educational programs.

Contributions to NASA

LPI's contributions align with NASA's strategic objectives to "ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere" and "advance the Nation's STEM education and workforce pipeline…to engage students, teachers, and faculty in NASA's missions and unique assets." The Institute also supports scientific, mission, and engagement activities for NASA's Planetary Science Division as outlined in the Agency's Science Plan and the Planetary Science Decadal Survey.

LPI's staff scientists, postdoctoral fellows, visiting scientists, students, and interns conduct research on the formation, evolution, and current state of the Moon, planets, comets, asteroids, planetary satellites, cosmic dust, and solar system as a whole by analyzing data and samples obtained through NASA's missions. The Institute also disseminates fundamental, peer-reviewed scientific research; sponsors topical science projects; and participates in space missions. Additionally, LPI staff scientists and postdoctoral fellows participate in mission activities and NASA exploration and analysis groups.

LPI also provides support services to NASA and the broader planetary science community. For example, the Institute provides scientific and technical support for NASA proposal review panels; manages the Regional Planetary Image Facility; manages library and resource collections; and manages logistical, technical, and scientific support of NASA's analysis/assessment groups. LPI also supports the Curation and Analysis Planning Team for Extraterrestrial Materials, which provides a forum for discussion and analysis of issues concerning the collection and curation of extraterrestrial samples, as well as acts as a standing review panel for evaluation of proposals to allocate extraterrestrial samples contained in NASA collections.

Scientist at Johnson Examining Interstellar Dust Track Particles for the Stardust Project

Source: NASA.

LPI also contributes to NASA's education and public outreach efforts for lunar and planetary science by conducting local and national educational programs and teacher training efforts.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
KAVLI INSTITUTE FOR ASTROPHYSICS AND SPACE RESEARCH

The mission of the Massachusetts Institute of Technology's (MIT) Kavli Institute for Astrophysics and Space Research is to facilitate and conduct MIT faculty and staff research programs related to astrophysics and space research.

Program Essentials

NASA Affiliation: Ames, Goddard, JPL, Marshall

NASA Strategic Alignment: 1.6

FY 2015 NASA Funding: $19,617,492

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through September 2020

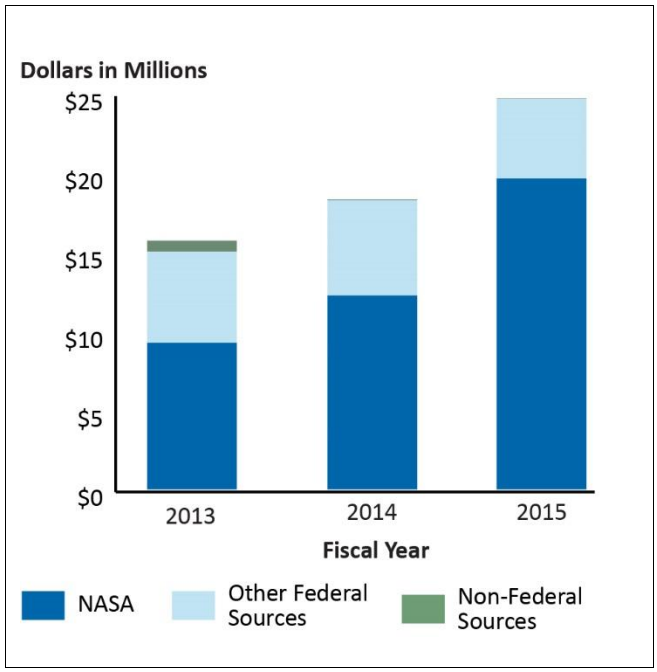
Category: Contractor-led, physical presence

Funding Profile

For FYs 2013 through 2015, NASA provided 70 percent of the Institute's total funding. The Institute also receives pass-through funding via the Space Telescope Science Institute from Goddard for astrophysics and space research and for Hubble Space Telescope observations. Additionally, the Institute receives funding from Marshall for operation of the Smithsonian Astrophysical Observatory and to conduct observations with the Chandra X-Ray Observatory.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$9,246,561
	Other Federal Sources	$5,762,184
	Non-Federal Sources	$688,100
	Total	**$15,696,845**
2014	NASA	$12,231,944
	Other Federal Sources	$6,015,682
	Non-Federal Sources	$59,312
	Total	**$18,306,938**
2015	NASA	$19,617,492
	Other Federal Sources	$5,035,698
	Non-Federal Sources	$14,746
	Total	**$24,667,936**



Note: The Institute's fiscal year ends on June 30th.

Historical Perspective

In 1959, as part of early space research efforts, MIT scientists and engineers submitted proposals to NASA for exploratory satellite experiments. In 1962, MIT proposed studies to support human space flight, as well as inertial navigation instrumentation and experiments in space communications and radio and radar astronomy. Discussions between the NASA Administrator and MIT's President concerning the University's space research efforts and collaboration with the Agency led to the formation of the Center for Space Research in 1963.

Early research efforts at the Center were concentrated in gamma- and x-ray astronomy, interplanetary plasma, human space flight, and radio-wave propagation in space. Other research programs focused on space-based optical and far-infrared astronomy, radio, gravitational wave, and theoretical studies. In 2004, the Center was renamed the Kavli Institute following a gift from the Kavli Foundation to MIT for astrophysics and space research.

Contributions to NASA

The Institute has participated in a series of space flight programs and observatories over several decades. For example, in 1967 NASA launched the Third Orbiting Solar Observatory carrying a gamma-ray experiment fabricated by the Institute that identified for the first time a concentration of celestial gamma rays in the Milky Way and gamma ray sources at the centers of distant galaxies now known as giant black holes. In 1995, NASA launched the Rossi X-ray Timing Explorer with an All Sky Monitor and on-board data system provided by the Institute. The Explorer identified 10 potential new sources of black holes.

Another Institute team, in collaboration with scientists from The Pennsylvania State University, developed the Advanced Charge-Coupled Device Imaging Spectrometer, which launched on the Chandra X-Ray Observatory in 1999. The Imaging Spectrometer recorded an X-ray image of Cassiopeia A, a nebular remnant of a giant star destroyed in a supernova explosion. A second MIT team developed Chandra's High-Energy Transmission Grating Spectrograph for high resolution X-ray views of stars and other remote objects.

NASA's Transiting Exoplanet Survey Satellite (TESS) mission, scheduled to launch in 2017, is led by a principal investigator from the Institute. TESS will use an array of telescopes to monitor more than 200,000 stars for temporary drops in brightness, which occur when a planet's orbit places it directly in front of its star as viewed from Earth. TESS will perform detailed characterizations of exoplanets and their atmospheres and is expected to find more than 3,000 transiting exoplanets, including about 500 Earth-sized or larger, as well as smaller rock and ice planets.

The Institute was selected by Goddard to participate in ground software development and calibration for instruments to be used in the ASTRO-H X-ray Observatory mission, scheduled to launch in 2016. A collaboration between the Japanese Aerospace Exploration Agency and Goddard, the Institute assumed a leadership role in coordinating calibration for all ASTRO-H instruments and will develop ground processing software to ensure scientific quality and future availability of inflight data.

A team from the Institute has also delivered silicon drift detectors and signal processing electronics for the 56 cameras that constitute the Neutron star Interior Composition ExploreR (NICER) instrument. NICER will be launched to the Space Station in August 2016.

Medical University of South Carolina Foundation for Research Development

The Medical University of South Carolina Foundation for Research Development has coordinated technology transfer between the Medical University of South Carolina and industry to faciliate the discovery of products and services for general use by the public.

Program Essentials

NASA Affiliation: Johnson

NASA Strategic Alignment: 1.1, 2.4

FY 2015 NASA Funding: $169,668 (Projected)

Funding Mechanism

Type of Award: Grants

Nature of Award: Competitive

Period of Performance: Through 2019

Category: Contractor-led, physical presence

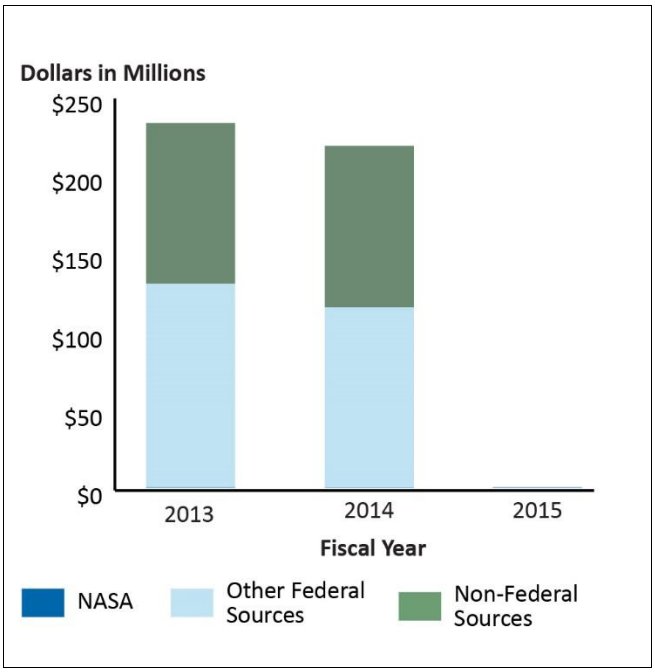
Funding Profile

NASA contributed less than 1 percent of the Foundation's total funding for FYs 2013 through 2015, providing approximately $412,000 through two research grants. Other funding sources include The Boeing Company, the Department of Veterans Affairs, National Cancer Institute, National Institutes of Health, and other government and private organizations.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$180,896
	Other Federal Sources	$129,943,508
	Non-Federal Sources	$102,496,001
	Total	**$232,620,405**
2014	NASA	$61,614
	Other Federal Sources	$114,969,723
	Non-Federal Sources	$102,993,728
	Total	**$218,025,065**
2015[a]	NASA	$169,668
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**$169,668**

[a] FY 2015 other Federal sources and non-Federal sources are unavailable.



Historical Perspective

Founded in 1995 in Charleston, South Carolina, the nonprofit Foundation collaborates with industry to transform discoveries into solutions for current medical problems. Since its inception, the Foundation has filed over 200 patent applications with 50 patents issued, and created 30 startup entities. The Foundation generates revenue for its operations, technology and product inventors, and for the Medical University of South Carolina to support research, education, and patient care.

The Medical University of South Carolina, founded in 1824, trains more than 3,000 students, and has a budget exceeding $1.7 billion used to operate a 750-bed medical center. The Medical University's Division of Finance and Administration is responsible for administration of sponsored grants and contracts awarded to the Foundation.

Contributions to NASA

NASA funds biomedical research as a means to further understanding of the physiological responses to space flight, including the effects of microgravity – the condition of near-weightlessness that accompanies space flight – on the cardiovascular and musculoskeletal systems. Foundation investigators are conducting research related to NASA's biomedical research aims, including investigations of the effects of microgravity on cells and tissue and development of biomaterials and tissue fabrication procedures.

In FY 2013, NASA awarded two grants to the Foundation to investigate brain structural and cerebral autoregulation changes in astronauts following long-term missions aboard the International Space Station.[1] Data from these studies will help develop fundamental theories describing intracranial adaptation to microgravity and serve as a basis for interpretation of inflight data collected.

The University has also assisted NASA research focused on how medical tests will be conducted on future missions. A University medical student was part of a NASA Human Exploration Research Analog Mission in which the crew spent 2 weeks in a hangar at Johnson Space Center on a simulated trip to an asteroid. Researchers monitored the crew's behavioral and biological responses from stress, sleep deprivation, and communication problems.

[1] Cerebral autoregulation is the physiological mechanisms that maintain blood flow at an appropriate level during changes in blood pressure.

NASA Aeronautics Research Institute

The NASA Aeronautics Research Institute (NARI) was established by NASA's Aeronautics Research Mission Directorate (ARMD) to obtain aviation concepts and technologies that can be introduced into existing ARMD programs and projects, industry, and the federally funded Small Business Innovative Research (SBIR) Program.

Program Essentials

NASA Affiliation: ARMD and all 10 NASA Centers (mainly Ames, Armstrong, Glenn, and Langley)

NASA Strategic Alignment: 2.1

FY 2015 NASA Funding: $1,000,000

Funding Mechanism

Type of Award: NASA program funding

Nature of Award: Competitive

Period of Performance: Through 2019

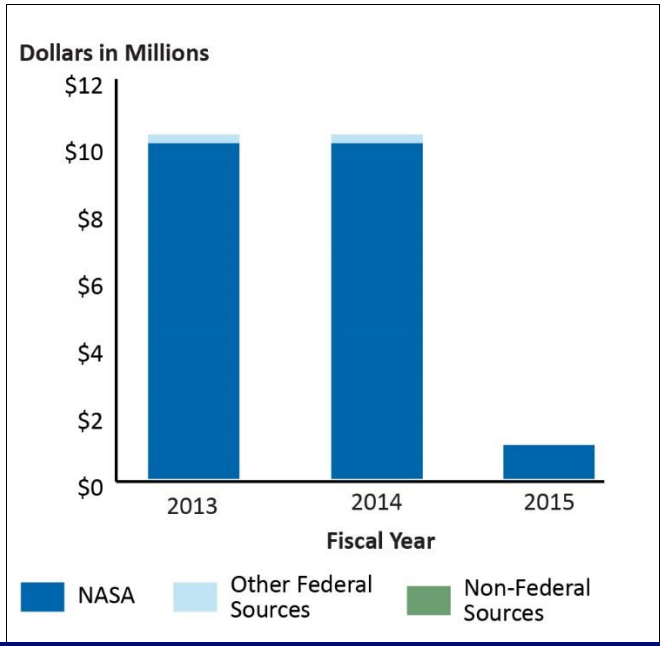
Category: NASA-led, virtual presence

Funding Profile

NASA contributed approximately 98 percent of NARI's total funding for FYs 2013 through 2015. A component of NASA, NARI is projected to receive $1 million per year for FYs 2015 through 2019. Prior to 2015, NARI's portfolio included the Seedling Fund, which provided annual awards to NASA civil servants supporting research activities related to early-stage efforts not currently funded by ARMD programs and projects, and the Leading Edge Aeronautics Research for NASA (LEARN) Fund, which supported similar research activities outside of NASA. During a reorganization of ARMD in 2015, both Seedling and LEARN projects and funds (totaling $9 million) were reassigned to the Transformative Aeronautics Concepts (TAC) Program, another ARMD program that supports the LEARN Fund and the Convergent Aeronautics Solutions Project, which in turn supports the Seedling Fund.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$10,000,000
	Other Federal Sources	$250,000
	Non-Federal Sources	$0
	Total	**$10,250,000**
2014	NASA	$10,000,000
	Other Federal Sources	$250,000
	Non-Federal Sources	$0
	Total	**$10,250,000**
2015	NASA	$1,000,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$1,000,000**



Historical Perspective

NARI was established in March 2012 to further ARMD's objective of investing in innovative, early-stage aviation concepts and technologies. Through internet and web-based seminars, NARI promotes the use of virtual collaborative techniques to share information and generate knowledge between diverse technical disciplines and organizations across the aeronautics community. The Institute is hosted by Ames, which also hosts two other virtual institutes: the NASA Astrobiology Institute and the NASA Solar System Exploration Research Virtual Institute.

Contributions to NASA

Since 2012, NARI has funded a total of 122 projects – 97 NASA-led and 25 externally-led – supported through the Seedling and LEARN funds. Recent projects using Seedling funds include research on air traffic management, aircraft design, energy storage, and flight controls. The Institute recently awarded LEARN funds for research of combustion technology, electrical machine power density, propulsion wing concept, and data mining in air transportation.

NARI's research activities have resulted in the production of virtual seminars, conferences, and technical talks, which were made available to the public via the Internet. These seminars also serve as a platform for researchers to share the results of their work, receive technical feedback, and disseminate technology developed for NASA projects to the wider aeronautical community. NARI also facilitates collaborations between ARMD project research teams and NARI partners, including other Government agencies, academia, industry, and professional societies, and organizes prize competitions designed to promote breakthroughs in aeronautics solutions.

LEARN and Seedling are components of the TAC Program, which adapts a short-term strategy to developing solutions to large-scale aeronautics problems through a cycle of technology feasibility studies, experiments, and trial and error. The capabilities developed through this approach may be further developed by other NASA aeronautics programs or industry.

NASA Astrobiology Institute

The NASA Astrobiology Institute (NAI) is an organization of competitively-selected teams that integrate astrobiology research and training programs. NAI's mission is to advance the field of astrobiology by carrying out, supporting, and catalyzing collaborative interdisciplinary research; training the next generation of researchers; providing scientific and technical leadership for current and future space missions; exploring new approaches using modern information technology to conduct interdisciplinary and collaborative research among widely-distributed investigators; and supporting outreach efforts by providing scientific content for education programs.

Program Essentials

NASA Affiliation: SMD, Ames

NASA Strategic Alignment: 1.5, 2.2,

FY 2015 NASA Funding: $21,500,000

Funding Mechanism

Type of Award: NASA program funding

Nature of Award: Competitive

Period of Performance: Through 2019

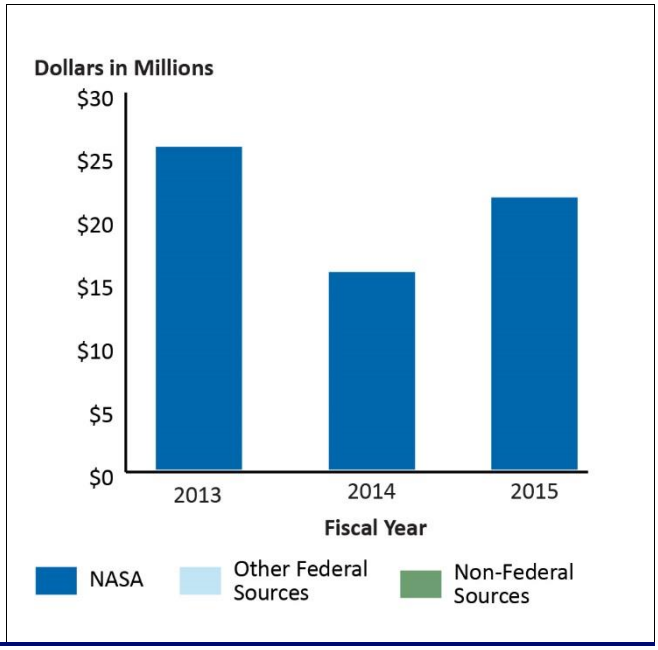
Category: NASA-led, physical presence

Funding Profile

NASA contributed 100 percent of NAI's funding for FYs 2013 through 2015. NAI is funded through transfers from NASA Headquarters to Ames, where NAI is headquartered, or to other NASA Centers or Federal laboratories on behalf of the Institute. NAI teams are supported through cooperative agreements between NASA and the teams' respective institutions.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$25,500,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$25,500,000**
2014	NASA	$15,600,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$15,600,000**
2015	NASA	$21,500,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$21,500,000**



Historical Perspective

In 1998, NASA established NAI to bridge disciplinary and organizational boundaries within the Agency, provide a scientific framework for NASA flight missions, and help develop the field of astrobiology. An element of NASA's Astrobiology Program, NAI consists of 12 teams and involves the work of approximately 600 investigators distributed across approximately 100 institutions. Managed from NASA Headquarters principally by the Planetary Science Division of SMD, the Institute's day-to-day functions are administered by a director and small staff, all of whom are located at Ames.

Artist Rendering of Solar System and DNA

Source: NAI.

The Institute's research encompasses the search for habitable environments in our solar system and on planets around other stars; the search for evidence of prebiotic chemistry or life on solar system bodies such as Mars, Jupiter's moon Europa, and Saturn's moon Titan; and research into the origin, early evolution, and diversity of life on Earth. In pursuit of these goals, NAI has produced approximately 700 peer-reviewed papers per year.

Contributions to NASA

NAI-funded research has resulted in a number of scientific discoveries important to NASA's mission and research goals, including an investigation using ancient zircons (minerals crystallized in the Earth's crust) that produced evidence for an ocean and hydrological cycle in the first 500 million years of Earth's history; sponsorship of collaborative deep-drilling projects and isotopic studies that produced new evidence of oxygen before the biologically induced appearance of molecular oxygen in Earth's atmosphere known as the Great Oxidation Event; and support of fieldwork that provided high-resolution stratigraphic and geochemical data needed to refine the hypothesis that Earth was, at times, completely covered with ice during a period from 850 million to 630 million years ago.

An NAI-supported team has also reported the detection of methane in the Martian atmosphere. Because under Martian conditions methane has a lifetime of only a few centuries, the research may indicate a current active source of the gas on the planet and suggests a line of research that could lead to the first positive evidence for extant life beyond Earth.

The Institute is also involved in investigating the theory that comets and the other small bodies in our solar system may be the source of Earth's water and the organic molecules needed for life. This research will inform the search for habitable environments in our solar system and around other stars. Additional research is seeking to produce guiding principles to improve the understanding of where to search for life, what to search for, and how to recognize evidence of past or current life in support of NASA's Mars 2020 rover mission.

NAI is also examining the history of oxygen in Earth's atmosphere and oceans between 3.2 billion and 700 million years ago – the time range in which the amount of oxygen is thought to have increased. This work will address how Earth has remained persistently inhabited, as well as provide NASA scientists with a template to investigate the presence of habitable conditions on Mars and other planetary bodies.

NASA Exoplanet Science Institute

The NASA Exoplanet Science Institute (NExScI) provides software, science operations, and consulting support to the Agency's Exoplanet Exploration Program and associated communities. Operated by the California Institute of Technology (Caltech) in coordination with JPL, NExScI administers NASA's time on the Keck telescopes, archives data from Keck instruments and the Large Binocular Telescope Interferometer (LBTI), and supports the exoplanet science community through an archive of exoplanet data, fellowships, and workshops.

Program Essentials

NASA Affiliation: JPL

NASA Strategic Alignment: 1.5, 1.6

FY 2015 NASA Funding: $10,069,000

Funding Mechanism

Type of Award: NASA program funding to JPL contract

Nature of Award: Non-competitive (unsolicited proposal)

Period of Performance: Through 2017

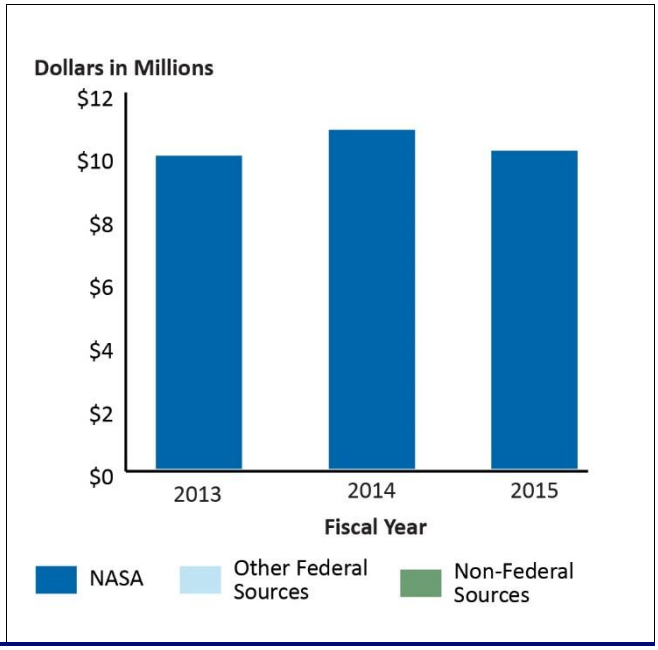
Category: Contractor-led, physical presence

Funding Profile

NExScI is funded exclusively by NASA's Astrophysics Division through the Exoplanet Exploration Program (previously the Origins and Navigator Programs). A significant portion – approximately 40 percent – of this funding is allocated to external grants for NASA Keck Principal Investigator data awards and for Sagan Fellowships.[1]

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$9,909,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$9,909,000**
2014	NASA	$10,730,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$10,730,000**
2015	NASA	$10,069,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$10,069,000**



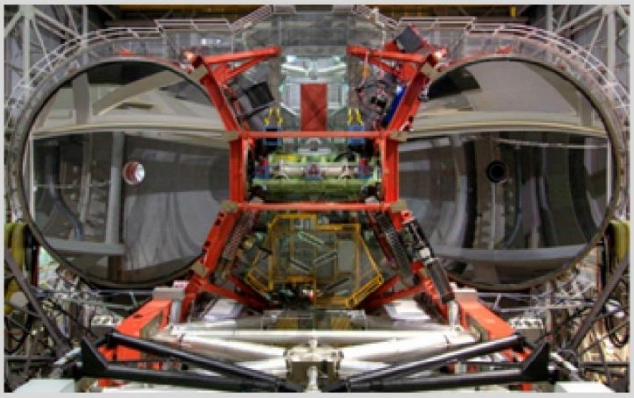
[1] Keck Principal Investigator data awards allocate NASA time on the Keck telescopes in Hawaii to support the detection and characterization of extrasolar planets; conduct investigations of our solar system; investigative the structure and origin of the Cosmos; and provide direct NASA mission support. Sagan Fellowships support postdoctoral scientists in conducting independent research related to the science goals of the NASA Exoplanet Exploration Program.

Historical Perspective

NExScI was initially established as the Interferometry Science Center to serve NASA's Space Interferometer Mission – a space telescope intended to search for Earth-sized planets orbiting the habitable zones of nearby stars. In 2000, it was renamed the Michelson Science Center (MSC) and charged with science operations, data processing, archiving, and scientific interactions for the Space Interferometer Mission. After that mission was cancelled in 2011, the MSC was renamed NExScI.

The Institute provides funding for postdoctoral fellowships and conducts workshops for the exoplanet research community; science operations support for the Keck telescopes in Hawaii, including proposal evaluation and grant funding; science operations for LBTI; and an archive for all confirmed exoplanets as well as selected datasets from NASA's Kepler mission's data pipeline.

Large Binocular Telescope Interferometer



Source: NExScI.

NExScI also provides operational software infrastructure and support, archiving of and access to observational data, and expertise in optical interferometry. By providing technical and scientific expertise, the Institute seeks to make NASA's Exoplanet Exploration Program missions accessible to the broadest scientific community.

Contributions to NASA

NExScI archives data from the LBTI, an Agency-funded instrument built and operated by the University of Arizona to study extrasolar planetary systems. The telescope has completed its first study of dust in the "habitable zone" around a star, enabling new methodologies to find Earth-like planets and help in the design of future space missions to take photographs of those planets.

NExScI also maintains several public astronomy data archives and software tools, including the NASA Exoplanet Archive that serves the user community working with exoplanet data. The archived space-based data is from Kepler and the Convection, Rotation and planetary Transits mission (led by the French Space Agency in conjunction with the European Space Agency and other international partners), and other space- and ground-based facilities. The archive provides long-term data curation of Kepler products and documents, as well as analysis tools. NExScI also maintains the Keck Observatory Archive that catalogues observations made with all of the instruments available on the two Keck telescopes. The data provides precursor or follow-up observations in support of SMD and solar system space missions.

NExScI is also responsible for administration of the Sagan Program for the NASA Exoplanet Exploration Program, which includes both the Sagan Fellowship Program and the Sagan Exoplanet Summer Workshop. The Sagan Program supports recent postdoctoral scientists in conducting independent research related to exoplanet exploration. The Sagan Exoplanet Summer Workshops are held annually and provide opportunities for students, postdoctoral candidates, and researchers to learn about the engineering and scientific techniques relevant to exoplanet-related research.

NATIONAL ACADEMY OF SCIENCES

The National Academy of Sciences (NAS) is a private, nonprofit membership organization established to provide the Federal Government with independent, objective advice on scientific and technological matters affecting the Nation. NAS conducts a variety of activities geared toward the advancement of research and knowledge in science, engineering, and medicine.

Program Essentials

NASA Affiliation: Goddard, Headquarters, Langley

NASA Strategic Alignment: 3.1, 3.2

FY 2015 NASA Funding: $7,000,000

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Non-competitive (sole source)

Period of Performance: Through December 2020

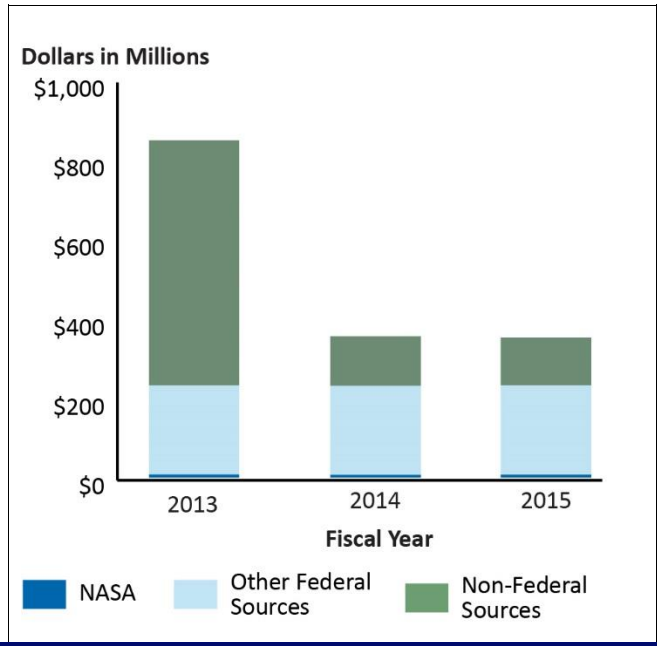
Category: Contractor-led, physical presence

Funding Profile

NASA contributed less than 2 percent of NAS' total funding for FYs 2013 through 2015. NAS' non-Federal funding comes from contributions, publication sales, registration fees, and investment returns. The large increase in non-Federal funding for FY 2013 resulted from receipt of $500 million for research studies from BP as part of the settlement of claims related to the 2010 Gulf of Mexico oil spill.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$7,586,000
	Other Federal Sources	$223,709,000
	Non-Federal Sources	$616,171,000
	Total	**$847,466,000**
2014	NASA	$6,468,000
	Other Federal Sources	$224,303,000
	Non-Federal Sources	$123,872,000
	Total	**$354,643,000**
2015	NASA	$7,000,000
	Other Federal Sources	$225,000,000
	Non-Federal Sources	$120,000,000
	Total	**$352,000,000**



Historical Perspective

Founded in March 1863, NAS began with a charter group of 50 members and as of August 2015, the organization had grown to approximately 2,250 members. Due to high demand for advice regarding military preparedness, NAS established the National Research Council (NRC) in 1916 to recruit specialists from the larger scientific and technological community. The National Academy of Engineering (NAE) and the National Academy of Medicine (NAM), formerly the Institute of Medicine, were founded in 1964 and 1970, respectively, under the NAS charter. The NAS, NRC, NAE, and NAM are collectively referred to as the "national academies."

Soon after launch of the Soviet Union's small Earth-orbiting satellite, Sputnik, in the autumn of 1957, the United States launched its first satellite into Earth's orbit, Explorer I, under the auspices of NAS. As a result of the successful launch of Explorer I and fear that the United States could fall behind the Soviet Union in space exploration, Congress passed the National Aeronautics and Space Act of 1958, forming NASA.

Contributions to NASA

NAS provides scientific and technical input to NASA through studies, workshops, and program reviews. As of the beginning of FY 2015, NASA funded over 20 active NAS projects. Generally, NAS forms ad hoc committees to review a particular area of science and then issues a report documenting the results of the committee's work. For example, beginning in 2015, an NRC committee is reviewing the scientific potential of small 10 centimeter cube-shaped satellites known as CubeSats. Another committee reviewed planetary protection requirements for areas on Mars deemed to have a high potential for life. Since the 1960s, NAS has been conducting "decadal surveys" of NASA's science and aeronautics research programs. These surveys provide NASA with the relevant scientific community's consensus regarding the programs and projects NASA should pursue over the next 10 years.

NAS also develops research agendas that prioritize research projects based on the current goals, guidance, and plans of the Federal government. One example is "Propulsion and Energy Systems to Reduce Commercial Aviation Carbon Emissions," which discusses reducing life-cycle carbon emissions through prioritization of research projects, technologies, and capabilities in lower-carbon propulsion and energy system research efforts.

In August 2013, NAM started a 5-year review of NASA's evidence reports on human health risks during long-term exploration space flights. Evidence reports contain information on human health risks that include behavioral health and performance, physical health (nutrition, immunology, cardiac and pulmonary physiology, etc.), radiation, and exploration medical capabilities. The study will assesses NASA's process for developing evidence reports and identify whether the reports contain sufficient information.

National Center for Advanced Manufacturing

NCAM
National Center for Advanced Manufacturing

Formed in 1999, the National Center for Advanced Manufacturing (NCAM) is located at NASA's Michoud Assembly Facility (Michoud) in New Orleans, Louisiana, and is applying advanced manufacturing technologies to lightweight composite and metallic materials in support of NASA and aerospace industries, as well as supporting workforce development programs and outreach activities.

Program Essentials

NASA Affiliation: Marshall

NASA Strategic Alignment: 2.3, 2.4, 3.1

FY 2015 NASA Funding: $600,000

Funding Mechanism

Type of Award: Cooperative agreement

Nature of Award: Non-competitive (unsolicited proposal)

Period of Performance: Through August 2017

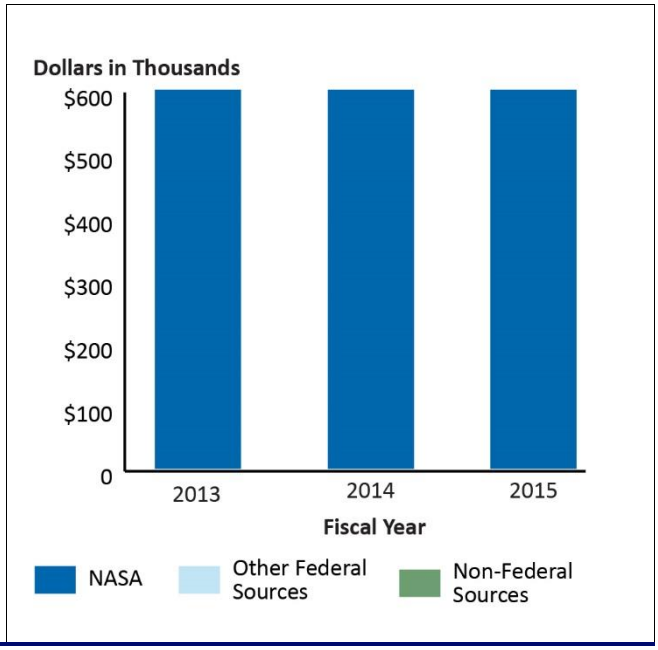
Category: Contractor-led, physical presence

Funding Profile

NASA provided 100 percent of NCAM's total funding for FYs 2013 through 2015. Under the terms of a 2012 cooperative agreement, the Louisiana Center for Manufacturing Sciences (LCMS) will assume the role of Manager of NCAM. Working under subcontract to the Louisiana State University (LSU), LCMS will be responsible for developing expanded research collaborations at NCAM among government, industry, and academia.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$600,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$600,000**
2014	NASA	$600,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$600,000**
2015	NASA	$600,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$600,000**



Historical Perspective

NCAM was formed in 1999 from a partnership between NASA, LSU, the University of New Orleans (UNO), and the UNO Research and Technology Foundation. NCAM is a public-private partnership that has evolved into a multi-tenant facility at Michoud to include 80,000 square feet of manufacturing space. NCAM houses large-scale, multi-axis robotic equipment focused on advanced manufacturing processes, including friction stir welding, automated fiber placement, high speed machining, nondestructive evaluation, and dimensional inspection.

NCAM seeks to strengthen the competitiveness of the United States in aerospace and other commercial markets that require large structures manufacturing; address research and technology development needs of NASA and industry while building the technology base for manufacturing the next generation of launch vehicle systems; serve as a resource for research and development and enable the transfer of technology to industry and educational institutions; enhance the economic competitiveness and scientific and the technical capabilities of the United States; and, advance manufacturing engineering and product development.

In August 2012, leaders from the State of Louisiana, NASA, LSU, and UNO committed to a 5 year extension of the original 1999 cooperative agreement to support and develop NCAM. Under the new cooperative agreement, NASA and other NCAM partners will continue to work jointly to improve manufacturing processes and efficiencies across the U.S. industrial and technology base. NCAM partners will also develop new commercial markets and facilitate technology transfer to industry nationwide.

NCAM also sponsors a consortium of research universities in Louisiana to develop advanced materials and manufacturing technologies for the production of aerospace hardware and structures. In September 2012, the Louisiana Council of Engineering Deans convened to recognize the NCAM partnership with NASA and encourage faculty to work collaboratively on research projects centered on advanced manufacturing, with NCAM serving as the clearing house for these research partnerships.

Contributions to NASA

NCAM provides manufacturing space at Michoud for tenant operations, including Boeing, which manufactures the Space Launch System; Lockheed Martin, which manufactures the Orion Multi-Purpose Crew Vehicle; and, the Vivace Corporation, an aerospace manufacturer of commercial flight hardware.

National Center for Atmospheric Research

The National Center for Atmospheric Research (NCAR) is a federally funded research and development center providing tools and technology to the atmospheric and geoscience research community to help observe, interpret, and use atmospheric observations. NCAR is managed by the University Corporation of Atmospheric Research.

Program Essentials

NASA Affiliation: Ames, Goddard, Headquarters, Kennedy, Langley

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $17,212,618

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Non-competitive (sole source)

Period of Performance: Through March 2020

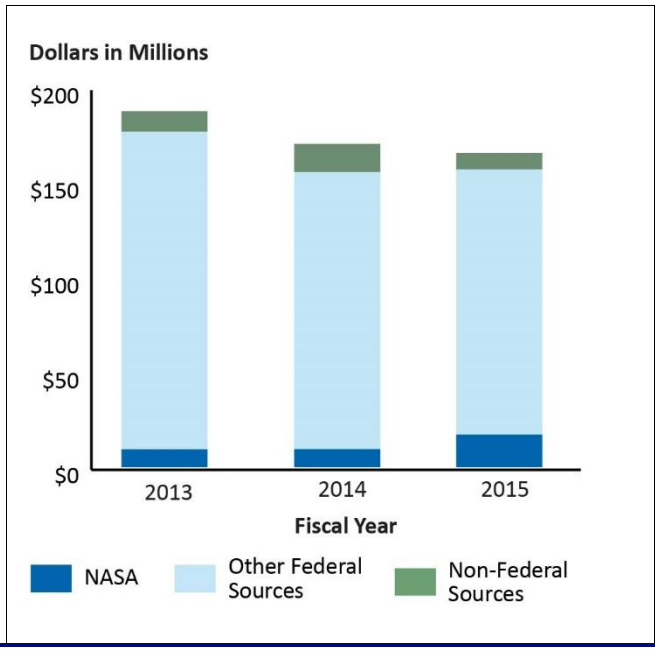
Category: Contractor-led, physical presence

Funding Profile

Approximately 93 percent of NCAR's funding comes from Federal sources, including the Department of Defense, Department of Energy, Environmental Protection Agency, Federal Aviation Administration, NASA, NSF, and NOAA. NASA provided approximately 7 percent of the total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$9,372,801
	Other Federal Sources	$167,446,493
	Non-Federal Sources	$10,708,324
	Total	**$187,527,618**
2014	NASA	$9,455,877
	Other Federal Sources	$146,028,044
	Non-Federal Sources	$14,875,919
	Total	**$170,359,840**
2015	NASA	$17,212,618
	Other Federal Sources	$139,629,462
	Non-Federal Sources	$8,726,277
	Total	**$165,568,357**



Historical Perspective

NCAR was established in 1960 through a partnership between the University Corporation of Atmospheric Research and NSF to facilitate understanding of fundamental atmospheric problems and establish facilities to support these research activities. The Center is headquartered in Boulder, Colorado, and has observatories and laboratories in Broomfield, Colorado; Cheyenne, Wyoming; and, Hilo, Hawaii.

NCAR collaborates with researchers in academia and the public and private sectors in a number of research areas, including atmospheric chemistry, climate, weather science, weather hazards to transportation, weather decision support systems, effects of the Sun upon the Earth, computer science innovation, atmospheric electricity, and the effects of weather and climate on society and national security. The Center conducts its research to better understand atmospheric behavior and its related physical, biological, and social systems.

Contributions to NASA

NCAR has collaborated with NASA on a variety of research activities. In FY 2012, NCAR performed research with the assistance of NASA and the German Aerospace Center examining the behavior of air beneath the stratosphere when influenced by thunderstorms. While conducting research, the teams developed the Mission Coordinator Display system, a software system that enables ground-based researchers to view rapid-refresh visuals of evolving weather situations from satellites or aircraft and interact with airborne crews through real-time chat, directing them to areas of interest.

In FY 2014, NCAR partnered on two projects that provided researchers a view of air masses over the Pacific Ocean as part of the NSF-funded Convective Transport of Active Species in the Tropics field campaign, which studied how storm activity and intensity over the Pacific might affect the atmosphere. In NASA's Airborne Tropical Tropopause Experiment, NCAR used a Global Hawk unmanned aerial vehicle to study upper-atmospheric water vapor and its influences on global climate. The other, Britain's Coordinated Airborne Studies in the Tropics, focused on air near the ocean surface.

In FY 2015, NASA awarded a 3-year, $1.3 million award to NCAR to develop a capability to provide a detailed 48-hour air quality forecast to predict the chance of high ozone levels and fine particulate matter. The new capability is expected to utilize NASA satellite sensors as well as other computer models and techniques currently being used to forecast atmospheric conditions.

Atmospheric Conditions Visible Over Los Angeles, California

Source: NCAR.

NCAR has also partnered with NASA on research to determine the carbon dioxide absorption rates of tropical forests. Some scientists believe that, if left undisturbed, such carbon dioxide absorption could slow down the effects of global warming. Through the process of photosynthesis, the study determined that forests currently remove 30 percent of carbon dioxide emissions from the atmosphere. Also, through the process of carbon dioxide fertilization, the study showed that tropical forests use carbon emissions to grow at a faster rate. This study allows for a direct comparison between carbon dioxide absorptions versus emissions.

NCAR also partners with NASA, other Government agencies, and academia for the development of launch criteria that is used for avoidance of triggered lightening during launch ascents.

National Institute of Rocket Propulsion Systems

The National Institute of Rocket Propulsion Systems (NIRPS) is a virtual institute established to help align Government and private industry rocket propulsion capabilities and technologies to meet present and future U.S. commercial, civil, and defense space needs. NIRPS is hosted by Marshall.

Program Essentials

NASA Affiliation: Glenn, Marshall, Stennis

NASA Strategic Alignment: 1.7

FY 2015 NASA Funding: $2,724,036

Funding Mechanism

Type of Award: NASA Program Funding

Nature of Award: Competitive

Period of Performance: Through 2016

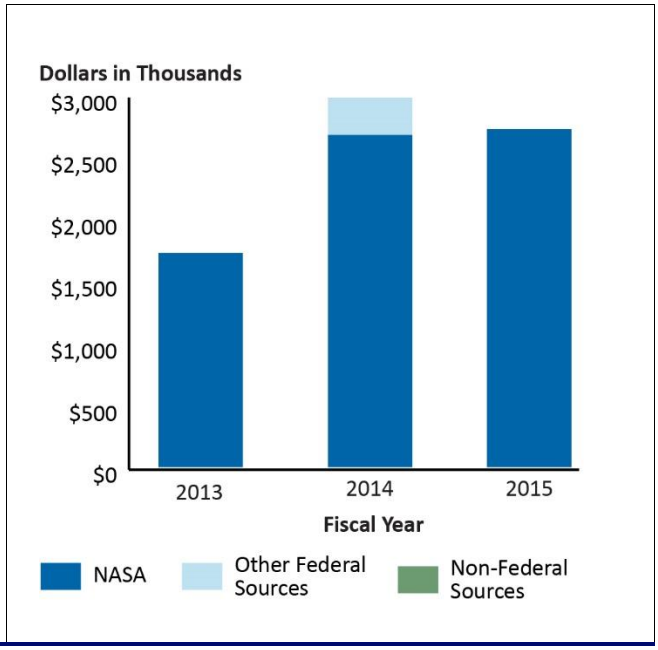
Category: NASA-led, virtual presence

Funding Profile

Since 2011, NIRPS has been funded through Marshall's Center Management and Operations (CM&O) budget. However, Marshall officials do not see this as a long-term, sustainable funding strategy and are searching for alternative funding mechanisms. As of September 2015, no other mechanism had been identified; however, NIRPS will continue currently planned activities in FY 2016. NASA contributed approximately 96 percent of the Institute's total funding for FYs 2013 through 2015. In FY 2014, NIRPS received $300,000 from the U.S. Air Force for combustion stability testing and analysis.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,724,370
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$1,724,370**
2014	NASA	$2,676,845
	Other Federal Sources	$300,000
	Non-Federal Sources	$0
	Total	**$2,976,845**
2015[a]	NASA	$2,724,036
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$2,724,036**



Historical Perspective

Founded in May 2011, NIRPS was established in response to concerns about the preservation of U.S. rocket propulsion capabilities. NIRPS has worked collaboratively with Government agencies, academia, and industry in defining what constitutes a healthy rocket propulsion industrial base and developing metrics for determining the health of that base. Results of this assessment were presented at the American Institute of Aeronautics and Astronautics Space Conference and Exposition in September 2013.

Since NIRPS' inception, NASA's Human Exploration and Operations Mission Directorate and Office of Chief Engineer have used the Institute to analyze the rocket propulsion industrial base and cross-cutting activities.

Contributions to NASA

NIRPS has led initiatives resulting in the development of reports, surveys, tools, and industry plans for the benefit of the rocket propulsion community. For example, in collaboration with the Department of Defense (DOD), NIRPS supported the completion of assigned actions in the 2012 National Defense Authorization Act, which directed NASA and DOD to support the development of a rocket propulsion strategy for the United States and to increase collaboration and communication across the Government on issues relating to the rocket propulsion industrial base.

This collaboration resulted in the expansion of the Joint Army, Navy, NASA, Air Force (JANNAF) Interagency Propulsion Committee to include a Programmatic and Industrial Base (PIB) Executive Committee and seven working groups. NIRPS is the co-chair of the PIB Executive Committee, coordinates NASA's participation on Committee working groups, and manages the operations and administrative support contract for JANNAF.

NIRPS developed the National Rocket Propulsion Strategy, which includes a description of how the end of the Space Shuttle Program and termination of the Constellation Program affected DOD programs that rely on the rocket propulsion industrial base. The Strategy also sets forth a plan for DOD and NASA for mitigating the impact of the end of these programs, as well as a methodology for strengthening the industrial base.

NIRPS is also partnering with the Department of Commerce to develop a survey to collect data on the health of the U.S. propulsion industrial base. This should enable the Institute to develop a suite of metrics to gauge the health of the industrial base and enable informed decisions by NASA leadership.

In March 2014, NIRPS worked with the Aerospace Corporation to develop the Propulsion Supplier Integrated Modeling and Analysis (PropSIMA), which analyzes supplier demand scenarios and the effect of procurement selections on the rocket engine industrial base. PropSIMA supports NASA's Space Launch System Exploration Upper Stage Engine selection.

In FY 2014, in support of NASA's domestic launch propulsion program, NIRPS teamed with the Air Force Space and Missile Center to secure funding for testing and analysis work related to combustion stability at Marshall and Stennis.

National Institute of Aerospace

The National Institute of Aerospace (NIA) is a nonprofit research and graduate education institute that conducts aerospace and atmospheric research developing new related technologies to operate satellites with little human interaction, reduce noise and vibration in aerospace, and advance technologies in sensors and microsystems for NASA. Formed by a consortium of universities that includes Georgia Institute of Technology, Hampton University, North Carolina A&T State University, North Carolina State University, the University of Maryland, the University of Virginia, Virginia Tech, Old Dominion University, the College of William and Mary, as well as the American Institute of Aeronautics and Astronautics Foundation, NIA partners with Langley and the aerospace community to integrate research and graduate education and create partnerships between the Government, academia, and industry.

Program Essentials

NASA Affiliation: Headquarters, Langley

NASA Strategic Alignment: 2.1, 2.4,

FY 2015 NASA Funding: $20,151,118

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements, Space Act Agreements

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through July 2019

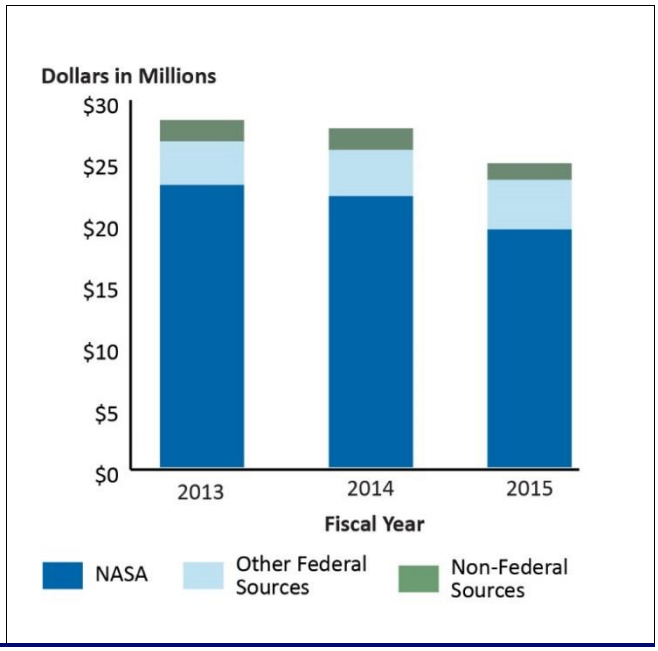
Category: Contractor-led, physical presence

Funding Profile

Between FYs 2013 through 2015, NIA received more than $64 million in funding from NASA (approximately 80 percent of all funding), and over $11 million from other Federal funding sources. The Institute received over $4.8 million from non-Federal sources, including Airbus, ADNET Systems, Alcoa, Boeing, and Lockheed Martin. NIA anticipates the majority of its non-Federal funding for FYs 2015 through 2019 will continue to come from these same sources.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$22,903,710
	Other Federal Sources	$3,531,329
	Non-Federal Sources	$1,740,112
	Total	**$28,175,151**
2014	NASA	$21,994,193
	Other Federal Sources	$3,745,994
	Non-Federal Sources	$1,752,687
	Total	**$27,492,874**
2015	NASA	$19,293,415
	Other Federal Sources	$4,009,873
	Non-Federal Sources	$1,343,262
	Total	**$24,646,550**



Historical Perspective

In 2002, as the result of a Langley-issued competitive research announcement, NASA awarded NIA both a contract and a cooperative agreement to establish a research and education institute to foster and advance partnerships between the Agency and the research and academic communities. In 2012, NIA created the Research and Innovation Laboratories to foster technology and economic development projects. NIA faculty, students, and staff collaborate with NASA and other partners on NIA-led research endeavors.

National Institue of Aerospace Laboratory

Source: NIA.

Another effort, the NIA Samuel P. Langley Professor Program, is an on-site graduate education program established by Langley for Center personnel and NIA graduate students to ensure a pipeline of trained new employees. Langley professors are leading scholars in fields complementary to the future strategic research direction at Langley. The professors also facilitate arrangements whereby graduate students work with Langley researchers at both NIA and Langley. Branch Heads at Langley's Research Directorate regularly use Langley professors for collaborative research or to obtain research advice and direction.

Contributions to NASA

NASA sponsors the NIA-administered event Revolutionary Aerospace Systems Concepts – Academic Linkage, with Johnson hosting the Exploration Robo-Ops Competition (Robo-Ops). In June 2014, eight university teams composed of 169 students and faculty advisors participated in Robo-Ops through the demonstration of how remotely operated rovers would be used either on the Moon or the surface of Mars. The teams designed, built, and conducted field tests of planetary rover prototypes at Johnson's Rock Yard, including the negotiation of specified up-and-down-slopes, traversing sand and gravel pits, driving over large rocks, and collecting and stowing specific rock samples.

While 34 students traveled with their rovers to Johnson, other participating team members remained back at their respective home university's mission control centers to operate the rovers remotely, based solely on the real-time video feeds transmitted by on-board cameras. The remote operation component, complete with communications delays, allowed teams to replicate how robots and astronauts would work together in deep space exploration missions.

As of November 2014, NIA and the National Institute for Aviation Research (NIAR) at Wichita State University are assisting NASA with research that involves a newly developed wireless technology sensor that could revolutionize aircraft health monitoring. NIA, NIAR, and NASA engineers are conducting analysis and simulations to optimize the Sans Electrical Connection Smart Skin Design for use on composite aircraft structures. The sensor provides aircraft lightning strike protection, damage detection, and diagnoses.

In 2015, NASA's Advanced Composites Project at Langley established a public-private partnership with the Federal Aviation Administration; General Electric Aviation in Cincinnati, Ohio; Lockheed Martin Aeronautics Company in Palmdale, California; Boeing Research and Technology in St. Louis, Missouri; Pratt & Whitney in Hartford, Connecticut; and NIA to advance knowledge about composite materials that could improve performance on future aircraft. Composites are innovative new materials for building aircraft that can enhance strength while retaining their lightweight characteristics. NASA selected NIA to manage administration of the Advanced Composites Consortium, which is working to improve composite materials research and certification.

National Snow and Ice Data Center

The National Snow and Ice Data Center (NSIDC) researches Earth's frozen regions (cryosphere) to understand the changes occurring in those regions. The NSIDC Distributed Active Archive Center (DAAC) is 1 of 12 NASA data centers that serve as the data management and user services arm of NASA's Earth Observing System Data and Information System (EOSDIS).

Program Essentials

NASA Affiliation: Goddard, Headquarters, JPL

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $9,016,759

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through 2018

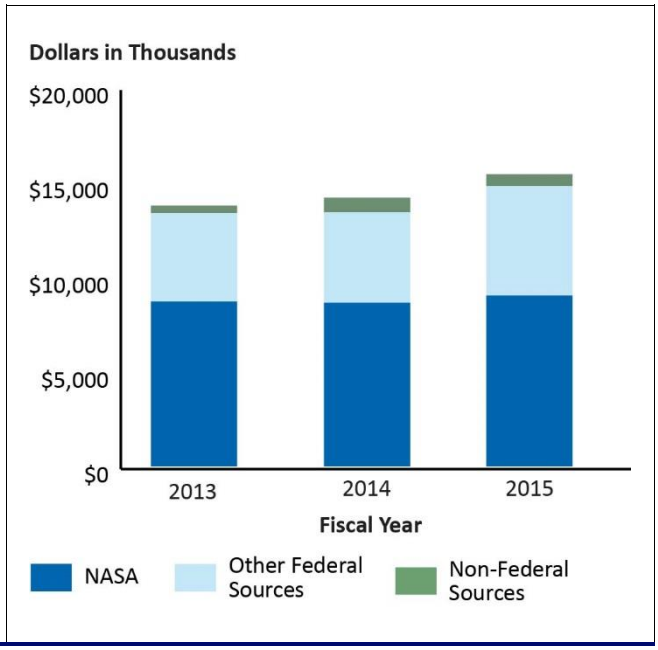
Category: Contractor-led, physical presence

Funding Profile

NASA funds 26 NSIDC projects through a mix of contracts and grants, one of which funds the Snow and Ice DAAC. NASA contributed approximately 61 percent of NSIDC's total funding for FYs 2013 through 2015. NASA first awarded NSIDC a contract to operate the DAAC in 1993, and as of FY 2015, the Agency is in the second year of their fifth DAAC contract with NSIDC.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$8,708,080
	Other Federal Sources	$4,675,330
	Non-Federal Sources	$383,334
	Total	**$13,766,744**
2014	NASA	$8,638,507
	Other Federal Sources	$4,773,275
	Non-Federal Sources	$774,199
	Total	**$14,185,981**
2015	NASA	$9,016,759
	Other Federal Sources	$5,776,270
	Non-Federal Sources	$632,524
	Total	**$15,425,553**



Historical Perspective

Founded in 1957 as the World Data Center for Glaciology, an archive for glaciological information, NSIDC was established in 1976 following the transfer of the Center from the U.S. Geological Survey to the NOAA's Data Information Service.[1] Headquartered in Boulder, Colorado, NSIDC has expanded to include management of selected Arctic and Antarctic data and metadata (information describing stored data) for NASA and NSF. Today, NSIDC is part of the Cooperative Institute for Research in Environmental Sciences, a partnership of NOAA and the University of Colorado, Boulder, whose mission is to conduct environmental research for advancing the understanding of the relationship between humans and the environment.

Contributions to NASA

The NSIDC DAAC houses data from past and current NASA satellite and field measurement programs focused on the study of the cryosphere. One of these programs – NASA's Operation IceBridge – collects data from multiple instruments to map ice surface and bedrock topography, ice and snow thickness, and sea ice thickness distribution. Initiated in 2009, the Operation IceBridge mission serves to bridge the gap between NASA's Ice, Cloud, and land Elevation Satellite (ICESat) and ICESat-2 missions.[2]

NSIDC's Passive Microwave Earth System Data Record is a NASA-funded program that reprocesses microwave satellite records from 1978 to the present to make them more compatible with modern technology. These products will be archived at EOSDIS data centers and distributed to researchers monitoring cryospheric and hydrological time series data.[3]

NASA also funds the Arctic Sea Ice News and Analysis (ASINA) Project, which provides daily data and imagery and monthly scientific analysis of the Arctic sea ice cover. Findings are posted on ASINA's website, http://nsidc.org/arcticseaicenews (last accessed February 4, 2016), and imagery is archived at the DAAC.

Example of Sea Ice Cover Imagery

Source: NSIDC.

[1] Glaciology is the branch of geology that deals with the nature, distribution, and action of glaciers and their effect on the Earth's topography.
[2] The ICESat mission launched January 13, 2003, and the ICESat-2 mission is scheduled for launch in 2017.
[3] Hydrology is the science dealing with the occurrence, circulation, distribution, and properties of the waters of the Earth and its atmosphere.

National Space Biomedical Research Institute

The National Space Biomedical Research Institute (NSBRI) is a partnership between NASA, academia, and industry with the goal of advancing biomedical research and ensuring a safe and productive long-term human presence in space. The Institute tries to bridge the gap between the technological and clinical expertise of the biomedical community and the scientific, engineering, and operational expertise of NASA. NSBRI also addresses key technologies required to enable space exploration, such as providing medical monitoring, diagnosis, and treatment in the extreme environments experienced during exploration missions.

Program Essentials

NASA Affiliation: HEOMD, Johnson

NASA Strategic Alignment: 1.1, 1.2

FY 2015 NASA Funding: $20,112,000

Funding Mechanism

Type of Award: Cooperative agreement

Nature of Award: Competitive

Period of Performance: Through 2017

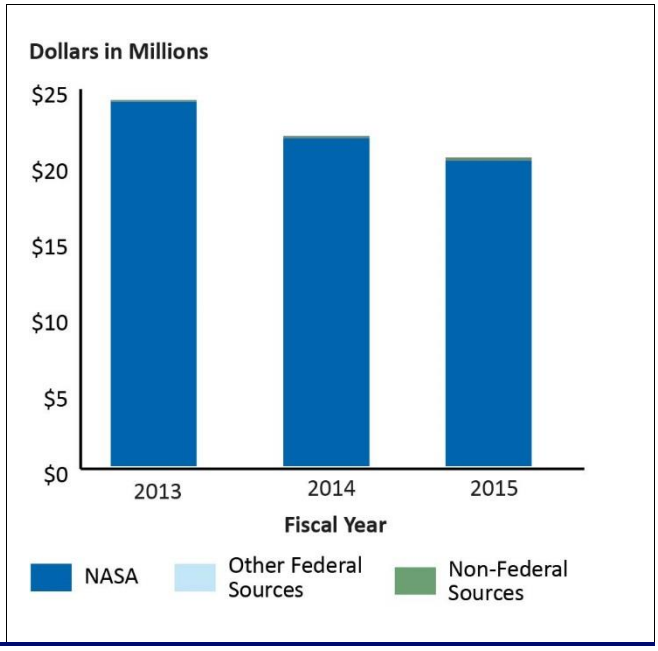
Category: Contractor-led, physical presence

Funding Profile

NSBRI's original cooperative agreement with NASA was competitively selected in March 1997 and was for 5.5 years with three 5-year option periods. NASA exercised the final option period in October 2012, extending the agreement through September 2017 and bringing its total value over the life of the agreement to $484.2 million. While primary support for NSBRI's activities is furnished by NASA (99 percent for FYs 2013 through 2015), the Institute receives a small amount of non-Federal funding from other sources such as member institutions. Approximately 85 percent of NSBRI costs are expended on research, 8 percent on headquarters administration, and 7 percent on education and public outreach. NASA's FY 2015 funding to NSBRI represented a 16 percent decrease over its NASA funding from 2 years prior due to sequestration and Human Research Program budget reductions.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$24,000,000
	Other Federal Sources	$0
	Non-Federal Sources	$120,000
	Total	**$24,120,000**
2014	NASA	$21,600,000
	Other Federal Sources	$0
	Non-Federal Sources	$150,000
	Total	**$21,750,000**
2015	NASA	$20,112,000
	Other Federal Sources	$0
	Non-Federal Sources	$228,000
	Total	**$20,340,000**



Historical Perspective

In 1996, NASA issued a cooperative agreement notification to form a space institute and encourage development of scientific expertise across various agencies. As a result of this competition, NSBRI was established in 1997. NSBRI is a consortium of 12 institutions led by Baylor College of Medicine, which oversees the Institute's operations on behalf of the consortium. The other institutions include Brookhaven National Laboratory, Harvard Medical School, The Johns Hopkins University School of Medicine and Applied Physics Laboratory, Massachusetts Institute of Technology, Morehouse School of Medicine, Mount Sinai School of Medicine, Rice University, Texas A&M University, University of Arkansas for Medical Sciences, University of Pennsylvania Health System, and University of Washington. International institutions also participate in NSBRI-conducted research initiatives. NSBRI headquarters is located in Houston, Texas, at Baylor.

Funding for the Institute is distributed on a competitive basis to academia, state government, and industry. For FY 2015, approximately 60 institutions in 25 states received NSBRI funding.

The Institute's primary objective is to support NASA in ensuring safe and productive human space flight. One of the major issues NSBRI research addresses is the development of countermeasures to the health-related problems and physical and psychological challenges humans will face on long-duration missions. In particular, NSBRI scientists and physicians are developing technologies to provide medical monitoring, diagnosis, and treatment on space missions. More than 75 percent of NSBRI's research projects translate terrestrial science and technology to space-based applications to mitigate human spaceflight risk.

Simulation of Astronaut Treadmill Exercise

Source: NSBRI.

NSBRI's initial peer-reviewed research program consisted of 8 research teams carrying out 37 3-year projects and 4 1-year synergy projects designed to foster interdisciplinary research. As a result of two open research announcements in 2000, the Institute expanded to 12 research teams and 85 research projects during its fourth year. Between 2000 and 2001, the number of research teams was consolidated to 11 and an integrated NSBRI-NASA space medicine program was added.

Contributions to NASA

NSBRI research teams work on projects identified by NASA, including research on space medicine relevant to the human spaceflight program, integrating space biomedical research with ongoing NASA space flight operations, and developing and implementing education programs. NSBRI researchers and managers coordinate frequently with NASA, providing reports and demonstrations on the science being conducted.

In addition, NSBRI research teams and NASA investigators work closely to integrate NSBRI research into Agency medical operations. NSBRI research has contributed to advancements in space and Earth-based biomedical care, including the use of ultrasound devices aboard the International Space Station and other research that increases understanding of medicine and biomedical issues related to human spaceflight.

In May 2014, following a joint annual solicitation, NASA's Human Research Program and NSBRI had selected to fund 26 projects ranging in duration from 1 to 3 years. These projects – from 16 institutions in eight states – will receive a total of approximately $17 million. NASA will manage 21 of the projects while NSBRI will manage 5, bringing NSBRI's total managed projects to more than 60 for FY 2014. The projects will investigate the impact of the space environment on various aspects of astronaut health, including visual impairment, behavioral health, bone loss, cardiovascular alterations, human factors and performance, neurobehavioral and psychosocial factors, sensorimotor adaptation, and the development and application of smart medical systems and technology.

Ohio Aerospace Institute

The Ohio Aerospace Institute (OAI) is a nonprofit science institute established in 1989 to enhance the aerospace competitiveness of member entities through research and technology development, workforce preparedness, and engagement with global networks for innovation and advocacy. OAI is a joint initiative among the Glenn Research Center (Glenn); the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base near Dayton, Ohio; the State of Ohio; 10 Ohio public and private universities; and aerospace companies.

Program Essentials

NASA Affiliation: Office of Education, Ames, Glenn, Goddard, Headquarters, Johnson

NASA Strategic Alignment: 2.1, 2.4

FY 2015 NASA Funding: $7,003,497

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through June 2018

Category: Contractor-led, physical presence

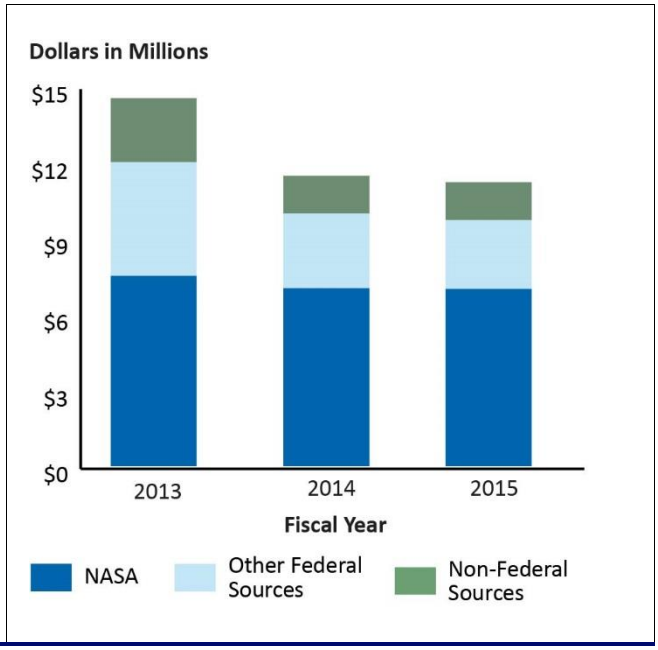
Funding Profile

One of the first university-industry-Federal Government collaborative organizations to be supported by NASA, OAI is funded primarily through contracts and grants from the Government and contracted services within the aerospace industry. As of June 2014, OAI has received and managed more than $286 million in funds over approximately 25 years, including more than 250 Federal awards, with at least 65 awards from NASA.

NASA awards to OAI are for specific programs or research efforts rather than to support overall Institute operations. For FYs 2013 through 2015, about 58 percent of OAI's budget came from NASA. Because the Government is the largest source of funding for the Institute, Federal budget sequestration has impacted the organization's budget and, as a result, OAI is seeking to increase its level of non-Federal funding.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$7,518,151
	Other Federal Sources	$4,499,493
	Non-Federal Sources	$2,526,356
	Total	**$14,544,000**
2014	NASA	$7,028,007
	Other Federal Sources	$2,956,242
	Non-Federal Sources	$1,491,751
	Total	**$11,476,000**
2015	NASA	$7,003,479
	Other Federal Sources	$2,721,050
	Non-Federal Sources	$1,496,533
	Total	**$11,221,062**



Historical Perspective

OAI works closely with the State of Ohio's two aerospace-related Federal research laboratories – the Air Force Research Laboratory at Wright-Patterson Air Force Base and Glenn in Cleveland, Ohio; multiple aerospace-related companies, including Airbus, Boeing, GE Aviation, Parker Hannifin, Pratt and Whitney, Rolls-Royce, Timken, and other small businesses; and Ohio universities with doctoral and research programs in aerospace-related fields.

OAI Facility in Cleveland, Ohio

Source: OAI.

OAI supports students pursuing degrees in aerospace-related fields through the Ohio Space Grant Consortium, which is part of the National Space Grant College and Fellowship Program. The Institute has also supported NASA's STEM educational goals through teacher pre-service training and K-12 experiential learning activities designed to draw students into STEM, as well as programs supporting faculty fellowships and student internships at Glenn.

The Institute was also responsible for updating and improving safety and mission assurance curriculum content and assessing the progress of system learners in NASA's SATERN Learning Management System, which provides web-based access to training and career development resources to NASA employees.

OAI previously acted as the business management organization for NASA's One-Stop Shopping Initiative (OSSI), which the Agency utilizes for recruitment, application, selection, and career development of undergraduate and graduate students in STEM disciplines with a leading role in OSSI-outcome documentation and NASA Office of Education's program evaluation efforts.

Contributions to NASA

The Institute contributes to NASA's research and technology missions in a number of ways. For example, OAI works with Nastec, Inc., on a Phase II Small Business Innovative Research award to commercialize technology related to aircraft engine health monitoring. OAI is also developing a new noise prediction code that will be used to assess jet noise in support of the NASA Advanced Air Vehicles Program's goals. This Program seeks to develop technological capabilities to overcome national challenges in air transportation, including reducing noise, emissions, and fuel consumption, and increasing mobility through a faster means of transportation.

OAI research has supported ice-crystal engine icing testing in Glenn's Propulsion System Laboratory, which provides the ability to conduct full engine icing tests. OAI hosted a NASA National Research Council and Federal Aviation Administration research collaboration meeting that served as a forum for NASA's ice-crystal scaling approach, addressing the problem of ice formation in gas turbine engines due to flight at high altitudes and low temperatures, a situation identified as an aviation safety hazard.

OAI collaborates with USRA on the NASA Advanced Research and Technology Support contract, which has an estimated total value for OAI of $20 million over the life of the contract. Under this contract, Glenn secures and sustains specialized research and development activities to support NASA programs in the Mission Directorates. Specifically, OAI supports opportunities for visiting senior scientists to train and further develop their scientific knowledge in Johnson laboratories.

Research teams at OAI are also demonstrating diagnostic techniques at Glenn's Rocket Combustion Laboratory that will enable assessment of plume properties of more environmentally friendly propellants that could be integrated into future commercial spacecraft.

In addition, OAI collaborated with Glenn, the Cleveland Foundation, and the American Institute of Aeronautics and Astronautics to bring 150 area high school students to Cleveland in 2013 for STEM-oriented programming at Glenn's Technology Days.

PLANETARY SCIENCE INSTITUTE

The Planetary Science Institute (PSI) is a private, nonprofit corporation studying the origin, characteristics, and evolution of our solar system, including Earth, and planetary systems around other stars. PSI's research results are shared with the scientific community and public for use in the human and robotic exploration of space and to promote science education and literacy.

Program Essentials

NASA Affiliation: Ames, Goddard, JPL, Marshall

NASA Strategic Alignment: 1.5

FY 2015 NASA Funding: $11,914,246

Funding Mechanism

Type of Award: Contracts, grants, and cooperative agreements

Nature of Award: Competitive and Non-competitive (sole source)

Period of Performance: Through 2020

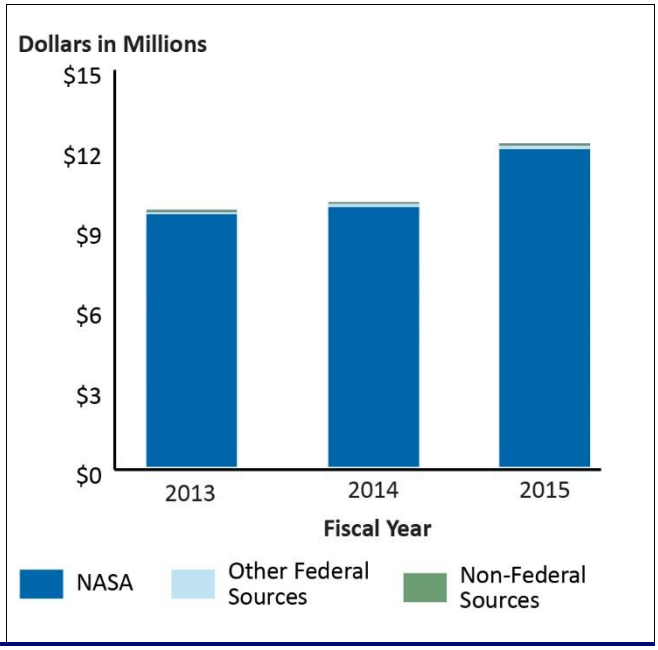
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 98 percent of PSI's total funding for FYs 2013 through 2015, and the Institute holds 199 awards from the Agency: 91 grants, 2 cooperative agreements, and 106 subawards.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$9,473,651
	Other Federal Sources	$83,550
	Non-Federal Sources	$91,681
	Total	**$9,648,882**
2014	NASA	$9,741,662
	Other Federal Sources	$123,965
	Non-Federal Sources	$64,474
	Total	**$9,930,101**
2015	NASA	$11,914,246
	Other Federal Sources	$136,778
	Non-Federal Sources	$87,044
	Total	**$12,138,068**



Historical Perspective

In 1972, Science Applications International (SAI), a for-profit corporation, established PSI as a nonprofit division located in Tucson, Arizona. PSI's roots go back to the late 1960s, when several doctoral candidates who had graduated from the University of Arizona established a Tucson office for the Illinois Institute of Technology Research Institute.

In 1995, PSI separated from SAI (now Science Applications International Corporation or SAIC) and merged as a new division with the San Juan Capistrano Research Institute (SJCRI), a nonprofit corporation with a similar mission to PSI. PSI has continued to operate in Tucson; however, financial management functions were assumed by SJCRI's San Juan Capistrano office. In 2000, SJCRI formally changed its name to PSI, and now has staff in 21 states and several foreign countries.

Contributions to NASA

In the 1970s, PSI participated in the Mariner 9 mission to Mars, which was the first spacecraft to orbit another planet. Additionally, PSI scientists developed the modern theory of the origin of the Moon – formed from debris ejected after Earth suffered an impact by a Mars-sized object.

In the 1980s, PSI ground-based telescope programs advanced the understanding of asteroid and comet mineralogy, including the development of a methodology for estimating the ages of geological formations, such as ancient volcanoes, on Mars.

In the 1990s, PSI supported NASA's Galileo Mission to Jupiter by planning the mission and analyzing photos of Jupiter's moons. In addition, PSI supported the Mars Observer mission and the Mars Global Surveyor imaging team.

More recently, PSI has been involved with or supported NASA in other solar system exploration missions including MESSENGER, LRO, MRO, Mars Exploration Rovers, Mars Science Laboratory (Curiosity), Mars InSight, Dawn, OSIRIS-Rex, Juno, and WISE (NEOWISE). PSI currently manages instruments on the Mars Odyssey, Dawn, and Juno spacecraft.

PSI is also supporting NASA's Atsa Suborbital Observatory, which will fly a human-tended telescope on commercial suborbital space flights to conduct quick response observations and observations too close to the Sun for other space-based assets.

Research Institute for Advanced Computer Science

The Research Institute for Advanced Computer Science (RIACS) is a collaboration between Ames and USRA. RIACS conducts basic and applied research in computer science and related fields for a broad range of aerospace research topics, including quantum computing, cloud computing, supercomputing, nanotechnology, and autonomous systems.

Program Essentials

NASA Affiliation: HEOMD, Ames

NASA Strategic Alignment: 1.7, 2.3, 3.3

FY 2015 NASA Funding: $1,850,000

Funding Mechanism

Type of Award: Contracts, cooperative agreements, Space Act Agreements

Nature of Award: Competitive and non-competitive (unsolicited proposal)

Period of Performance: Through 2017

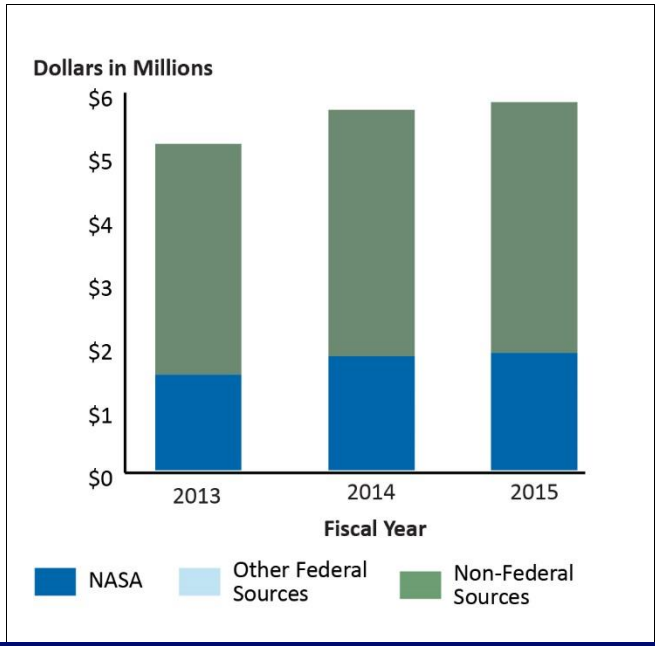
Category: Contractor-led, physical presence

Funding Profile

Between June 1983 and July 2007, NASA used a series of funding vehicles to provide funding to USRA for operation of RIACS. In 2007, NASA's contractual relationship with RIACS ended; however, USRA kept the name as an organizing entity within the Association and sought additional funding sources to carry on the stated purpose of RIACS. USRA now has a portfolio of funding vehicles and agreements with NASA and other organizations that are managed through RIACS, allowing USRA to continue RIACS-related research. NASA contributed 31 percent of RIACS' total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$1,508,130
	Other Federal Sources	$0
	Non-Federal Sources	$3,640,637
	Total	**$5,148,767**
2014	NASA	$1,796,926
	Other Federal Sources	$0
	Non-Federal Sources	$3,889,627
	Total	**$5,686,553**
2015	NASA	$1,850,000
	Other Federal Sources	$0
	Non-Federal Sources	$3,958,207
	Total	**$5,808,207**



Historical Perspective

Formed in 1983, RIACS facilitates collaboration between Ames and the academic community on research related to advanced computer science, engineering, and applied mathematics as well as the application of computers to NASA's scientific and engineering challenges. Through RIACS visiting scientists program, U.S. and international university-based researchers participate in ongoing research activities at Ames.

RIACS was founded the same year as Ames' Advanced Supercomputing Division, and the Institute has collaborated with the Center on supercomputing, computational fluid dynamics, and quantum computing. The Institute has also worked with the Intelligent Systems Division at Ames to develop and infuse new software in autonomous systems, intelligent information management and data understanding, and human-centered computing.

RIACS research projects have historically focused on three areas of information technology research that NASA has identified as necessary to meet future challenges: developing technology to enable self-guiding and self-correcting spacecraft that will require little or no human intervention; developing sophisticated computational aids amplifying human cognitive and perceptual abilities; and improving the performance of computing and networking.

Contributions to NASA

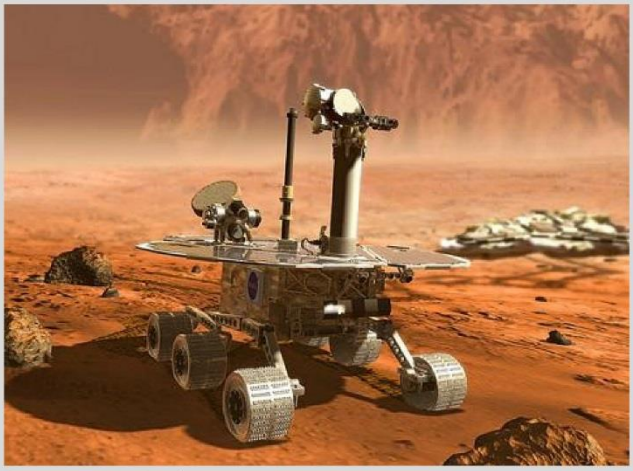
RIACS has developed breakthroughs in high performance computing, autonomous systems, and other aerospace-related technologies in collaboration with Ames, which serves as NASA's Center of Excellence in Information Technology.

These collaborations have resulted in a number of new technologies, including the Autoclass Bayesian discovery system, the first artificial intelligence program to make an astronomical discovery. RIACS researchers used theories and techniques of probability to discover new classes of infrared stars as a part of the Infrared Astronomical Satellite mission, a joint collaboration among the United States, the United Kingdom and the Netherlands. The same system has since been used by researchers to discover new classes of proteins, introns, and other patterns in DNA/protein sequence data.

The Institute also worked with NASA on the Livingstone model-based diagnostic system, the first artificial intelligence control system to control a spacecraft without human supervision. The system flew on Deep Space 1, a NASA mission that launched in 1998 and tested 12 advanced, high-risk technologies in space, and flew on the Earth Observing Mission 1, an advanced land-imaging NASA mission, which launched in 2000, designed to demonstrate new instruments and spacecraft systems.

RIACS collaborated on the MAPGEN tactical activity planner, a constraint-based planning system used during the Mars Exploration Rover mission and credited with boosting the mission's scientific return an estimated 20 percent; the Clarissa voice-operated procedure browser deployed on the International Space Station and the first spoken-dialogue system used in space; and the Program Management Tool, which NASA uses to manage many NASA programs and projects.

Artist's Rendering of Mars Rover



Source: www.pics-about-space.com.

The Institute also supports the development and management of facilities and programs in collaboration with NASA, including the Quantum Artificial Intelligence Laboratory, a program designed to assess the potential of quantum supercomputers in performing calculations beyond the capabilities of conventional supercomputers, and the International Research Initiative for Innovation in Aerospace Methods and Technologies, a cooperative agreement between USRA and NASA facilitating research on high performance computing technologies and sponsoring visiting scientists from the international research community who collaborate with USRA and NASA on aerospace research.

RESOURCES FOR THE FUTURE

Resources for the Future (RFF) is an independent, nonpartisan, nonprofit organization with a focus on environmental economics and utilizing research and analysis to propose solutions to the world's natural resource and environmental challenges.

Program Essentials

NASA Affiliation: Goddard, Headquarters, Johnson, JPL, Langley

NASA Strategic Alignment: 1.2, 1.3, 2.2

FY 2015 NASA Funding: $629,064

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through November 2016

Category: Contractor-led, physical presence

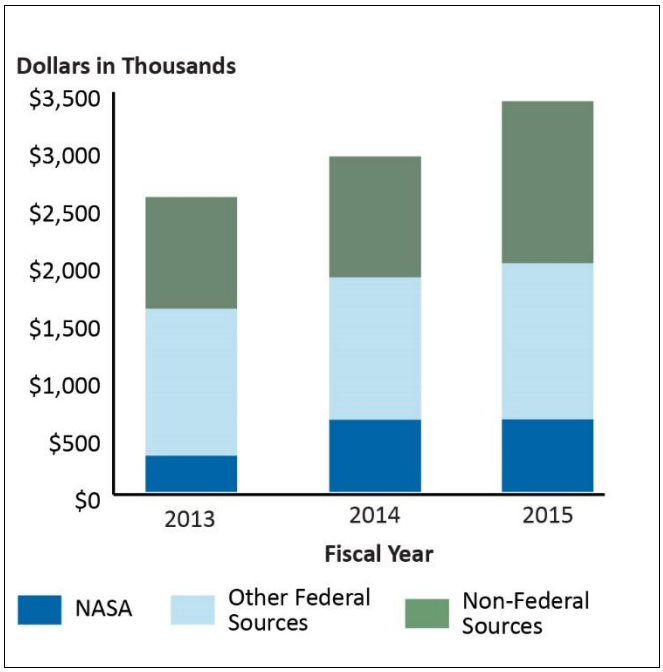
Funding Profile

NASA contributed 18 percent of RFF's total funding for FYs 2013 through 2015. RFF receives Federal funding from the Army Corps of Engineers, Centers for Disease Control and Prevention, Department of Agriculture, Department of Defense, Department of Energy, Department of Health and Human Services, Department of Transportation, Environmental Protection Agency, NOAA, NSF, and U.S. Geological Survey.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$312,944
	Other Federal Sources	$1,277,199
	Non-Federal Sources	$972,491
	Total	**$2,562,634**
2014	NASA	$626,729
	Other Federal Sources	$1,237,313
	Non-Federal Sources	$1,051,332
	Total	**$2,915,374**
2015[a]	NASA	$629,064
	Other Federal Sources	$1,356,511
	Non-Federal Sources	$1,409,767
	Total	**$3,395,342**

[a] RFF reported all FY 2015 funding as projected.



Historical Perspective

Founded in 1952 by a U.S. presidential commission, RFF, located in Washington, D.C., provides nonproprietary research and economic or cost-benefit analysis in support of policy decisions that aim to reduce or eliminate the tension between economic growth and environmental protection issues. RFF brings together economists and other experts who focus on environmental, natural resource, and energy issues. The institute's mission is to advance the use of economic and policy analysis in natural and environmental resources and new technologies associated with their management.

RFF staff are called to testify before Congress and to advise other organizations, such as the National Research Council and the National Academy of Sciences, on policy issues. The staff work to develop methods derived through economic analysis to reduce carbon emissions while enhancing U.S. energy security by evaluating the benefits of investing in conservation, analyzing the risks and benefits of increased use of natural gas, examining how the risks generated by today's environmental management decisions will affect future generations, identifying ways to adapt to climate change, weighing trade-offs to address scarcity of resources, evaluating the cost-effectiveness of environmental regulations, and establishing frameworks to value intangibles such as clean air and water.

Contributions to NASA

RFF works with NASA on a range of projects, including the International Space Station (ISS) and commercial space, as well as researching issues related to deforestation and carbon monitoring. RFF has carried out economic analyses for NASA; specifically, in economic value of information studies for use of Earth observations in water quality, drought, forest conservation, and ISS research.

RFF is measuring research performance on the ISS through a peer-reviewed framework and analysis that will be used in the design of an atlas that will visualize knowledge created from the ISS's National Laboratory. RFF is also examining how NASA and its commercial partners could ensure and accelerate the success of commercial space at a reasonable cost to investors and taxpayers. Specifically, RFF is reframing risk in order to inform how the public perceives and decision-makers respond to human space flight risk.

RFF research work includes the use of Earth observation data to improve the accuracy and total cost-effectiveness of the Spatially Referenced Regressions On Watershed Attributes tool, which assess water quality, and is used for U.S. water quality management and policy. Additional research relates to NASA's Carbon Monitoring System (CMS), characterizing the economic importance of CMS data products, and enhancing CMS's relationships with the broader academic, application, and user communities, as well as the activities of other Federal agencies.

NASA also provided funding for RFF to develop up-to-date, fine-scale spatial data on forest coverage change within Latin America and user-friendly decision support tools to enable regional policymakers to use this information to formulate and evaluate decisions.

Further, while working under a cooperative agreement with NASA, RFF computed the theoretical societal value – $2 trillion to $30 trillion depending upon the detailed assumptions – of information to be obtained from the proposed NASA and NOAA space-borne Climate Absolute Radiance and Refractivity Observatory system compared to current operational space-borne systems.

SCRIPPS INSTITUTION OF OCEANOGRAPHY

The Scripps Institution of Oceanography (SIO), founded in 1903, is one of the oldest and largest centers for ocean and Earth science research in the world, and the Institution's mission is to seek, teach, and communicate understanding of the oceans, atmosphere, Earth, and other planets for the benefit of society.

Program Essentials

NASA Affiliation: Goddard, Headquarters

NASA Strategic Alignment: 1.5, 2.2, 2.4

FY 2015 NASA Funding: $5,535,704

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through January 2018

Category: Contractor-led, physical presence

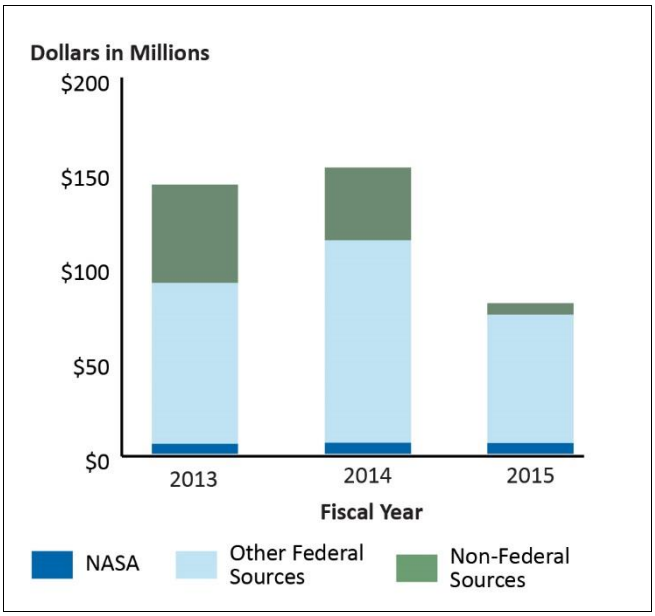
Funding Profile

SIO has annual research expenditures of more than $130 million, and as of September 2015, held 29 active research awards from NASA, through 27 grants and 2 cooperative agreements, which totaled 4.4 percent of the Institution's funding for FYs 2013 through 2015. Most of SIO's funding for basic research comes from Federal agencies, including the Department of Energy, NOAA, NSF, NASA, and the U.S. Navy. Funding from the state of California, private gifts, and endowments also provide an important source of funding.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$5,186,775
	Other Federal Sources	$84,917,875
	Non-Federal Sources	$51,906,090
	Total	**$142,010,740**
2014	NASA	$5,699,872
	Other Federal Sources	$106,926,624
	Non-Federal Sources	$38,475,919
	Total	**$151,102,415**
2015[a]	NASA	$5,535,704
	Other Federal Sources	$67,830,429
	Non-Federal Sources	$6,068,673
	Total	**$79,434,806**

[a] FY 2015 figures are year-to-date as of June 30, 2015.

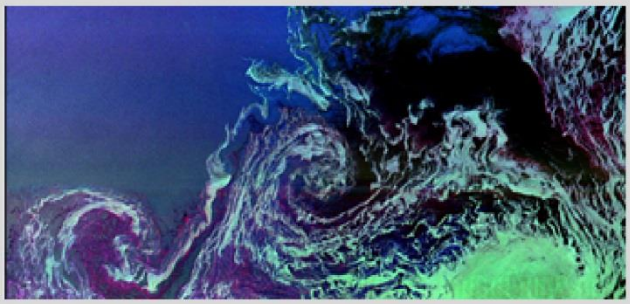


Historical Perspective

SIO has a staff of 1,300, including approximately 100 faculty, 300 scientists, and 240 graduate students, as well as hundreds of research programs focusing on biological, physical, chemical, geological, and geophysical studies of the oceans and Earth. The Institution focuses on marine biology, physics, chemistry, geology, biology, and the climate to determine how Earth systems work and interact. SIO's research has expanded through its collaboration with NASA to include materials returned to Earth from the Moon. Many of these research programs are multidisciplinary in that they link discoveries in one subject area to advances in others to explore global change, ocean pollution, and marine resources.

The Institution uses extensive shipboard, ground, and aerial operations, including remote sensing by satellites and wide-ranging networks to determine how Earth systems work and interact.

Ocean Circulation



Source: JPL.

In addition to basic research, global observations, and related applications, SIO focuses on teaching and offers undergraduate and graduate degrees related to its areas of research, as well as educating the public.

Contributions to NASA

SIO's relationship with NASA has been primarily in the form of grants for specific research activities; however, the Institution has two active cooperative agreements with the Agency and has received fellowship support for its graduate students. The majority of these research activities are related to atmospheric sciences, biochemistry, Earth sciences, geophysics, oceanography, and marine biology.

SIO was one of the research teams involved in the NASA-funded development of the Urey instrument for the European Space Agency's ExoMars rover which was to provide analysis of any possible past and present existence of biological compounds on Mars' surface. Additionally, SIO scientists are working with the science definition team for NASA's Ice, Cloud, and land Elevation Satellite-2 (ICESat-2).

SIO has also been involved in a joint project with NSF, the Department of Defense, the U.S. Geological Survey, and NASA testing a Real-time Earthquake Analysis for Disaster (READI) Mitigation Network. READI is intended to reduce the time required to characterize larger earthquakes and increase the accuracy of subsequent tsunami predictions, thereby assisting prompt disaster response and more accurate tsunami warnings. The project uses real-time GPS measurements from nearly 500 stations throughout California, Oregon, and Washington to automatically calculate the vital characteristics of large earthquakes such as location, magnitude, and details about fault rupture.

Another SIO study used data collected from NASA's Clouds and Earth's Radiant Energy System (CERES) instrument to show that the retreat of sea ice in the Arctic Ocean is diminishing Earth's albedo, or reflectivity, by an amount considerably larger than previously estimated. Previous studies have used a combination of computer models and observations in their calculations to estimate ocean energy absorption. In contrast, SIO directly correlated albedo measurements made by CERES instrument data with observations of sea ice collected through Defense Meteorological Satellite Program satellites.

SIO also participates in NASA's STEM education goals. The newly formed Oceans of Data Institute develops and tests digital tools and curriculum materials that will support the incorporation of professionally collected data into K-16 STEM coursework. In addition, SIO is assisting with development of a year-long course entitled "Foundations Science: Earth Science," which will be highly data-intensive and build upon the National Research Council's framework for Next Generation Science Standards.

SETI Institute

The SETI Institute is a private, nonprofit organization dedicated to scientific research, education, and public outreach. SETI stands for "search for extraterrestrial intelligence," and the Institute's mission is to explore, understand, and explain the origin and nature of life in the universe.

Program Essentials

NASA Affiliation: Ames

NASA Strategic Alignment: 1.5

FY 2015 NASA Funding: $14,432,374

Funding Mechanism

Type of Award: Grants, cooperative agreements, Space Act Agreements

Nature of Award: Competitive, non-competitive (sole source and unsolicited proposals)

Period of Performance: Through December 2019

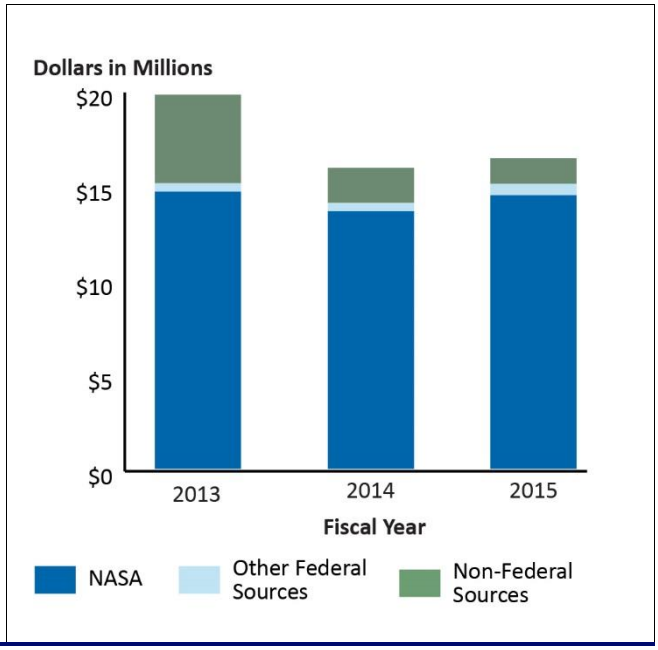
Category: Contractor-led, physical presence

Funding Profile

NASA provided 82 percent of the Institute's total funding for FYs 2013 through2015. Since inception, the Institute has administered more than $250 million in funded research with the majority – 80 percent – of its funding coming from Government contracts, with the remaining 20 percent from contributions, gifts, and grants.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$14,624,277
	Other Federal Sources	$443,412
	Non-Federal Sources	$4,669,214
	Total	**$19,736,903**
2014	NASA	$13,598,326
	Other Federal Sources	$427,802
	Non-Federal Sources	$1,854,236
	Total	**$15,880,364**
2015	NASA	$14,432,374
	Other Federal Sources	$597,847
	Non-Federal Sources	$1,357,502
	Total	**$16,837,723**



Historical Perspective

The SETI Institute began operations on February 1, 1985, and focuses its efforts on understanding the nature and origins of life and participates in the search for life beyond Earth. As of 2010, the Institute was hosting more than 100 active projects and had 140 employees, including 55 principal investigator-level scientists and educators.

Institute employees focus on research and development as well as on specific observing projects such as analyzing data taken by the Hubble Space Telescope, using the Allen Telescope Array to search for radio signals from nearby star systems, and making observations on NASA's airborne observatory, the Stratospheric Observatory for Infrared Astronomy. The Institute has also pursued research into the history and habitability of nearby planets, such as Mars, and the moons of Jupiter and Saturn. SETI has also participated in NASA's New Horizons mission to Pluto and the Kepler space telescope's search for extrasolar planets. The Institute has also developed both new hardware and software to increase the speed of its search for extraterrestrial intelligence using the Allen Telescope Array, a "Large Number of Small Dishes" array designed for both targeted and wide-field surveys of the sky for radio signals. The array began operations in October 2007.

Contributions to NASA

In 2005, NASA awarded a grant to the Institute for signal detection work on the Allen Telescope Array. In April 2013, NASA's Astrophysics Explorer Program selected the Transiting Exoplanet Survey Satellite (TESS) mission to launch in 2017. Following in the footsteps of NASA's Kepler mission, TESS will conduct observations for Earth-size exoplanets using an array of four telescopes to perform an all-sky survey. The goal is to identify terrestrial planets in the habitable zones of nearby stars best suited for extensive follow-up observations and characterization. A SETI scientist is the co-investigator for data processing for both TESS, as well as Kepler, and will lead the development, design, and operation of the TESS Data Processing Group at Ames.

In July 2014, SETI was chosen by Wyle Incorporated as a partner to support scientific and technical mission and project services at Ames. NASA awarded the Fully Integrated Mission Support Services contract with Wyle Incorporated, a provider of scientific, engineering, and technical services to the Government, serving as the prime contractor.

Solar System Exploration Research Virtual Institute

NASA's Solar System Exploration Research Virtual Institute (SSERVI) examines scientific questions fundamental to understanding the Moon, near-Earth asteroids, the Martian moons Phobos and Deimos, and the near space environments of these bodies. SSERVI fosters collaboration between competitively selected domestic research teams, the broader lunar science community, and international partners.

Program Essentials

NASA Affiliation: Ames

NASA Strategic Alignment: 1.6, 2.4, 3.2

FY 2015 NASA Funding: $15,200,000

Funding Mechanism

Type of Award: Cooperative agreements

Nature of Award: Competitive

Period of Performance: Through February 2019

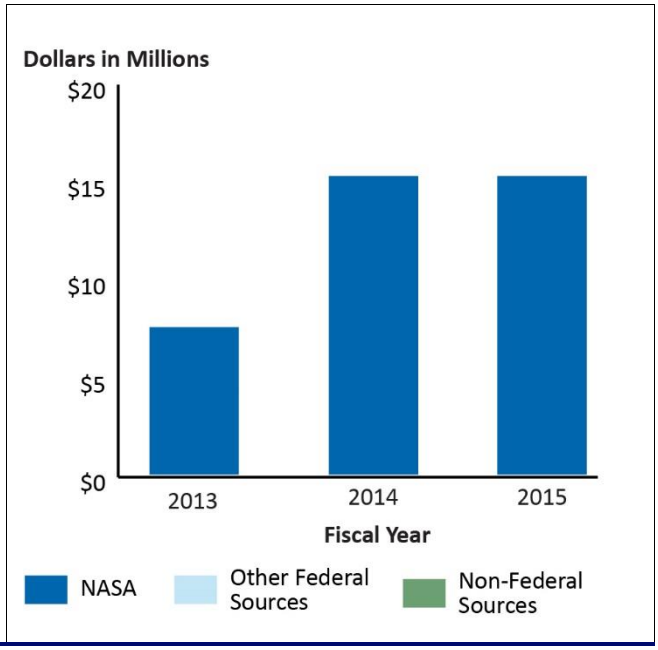
Category: Contractor-led, physical presence

Funding Profile

SSERVI teams are supported through cooperative agreements with NASA that are funded for 5 years, with notices issued every 2 to 3 years to allow overlap between teams and to respond to changes made by the Agency. For FYs 2013 through 2015, NASA contributed 100 percent of funding to the Institute.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$7,500,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$7,500,000**
2014	NASA	$15,200,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$15,200,000**
2015	NASA	$15,200,000
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$15,200,000**



Historical Perspective

The NASA Lunar Science Institute (NLSI), SSERVI's predecessor organization, was founded in 2008 to focus on lunar exploration, which at the time was the Nation's goal for human exploration. A change in exploration goals to include near-Earth asteroids and the moons of Mars as a precursor to eventual human exploration of Mars led to NLSI's transition in 2013 to SSERVI. The Institute's administrative office is located at Ames, with senior management positions held by Ames civil servants. The administrative office oversees the operation of nine research teams located across the United States, as well as a growing number of international partners. Each of the nine teams share laboratories, equipment, staff, and ideas.

SSERVI Scientists

Source: SSERVI.

SSERVI is jointly funded by SMD and HEOMD through the Joint Robotics Research Activity, a budget line item contained within each Mission Directorate.

Contributions to NASA

SSERVI integrates research conducted across the Agency's science divisions and Centers, as well as research supported by the Advanced Exploration Systems Division within HEOMD. The Institute's nine teams directly support research at Ames, Goddard, Johnson, Kennedy, and Marshall in addition to academic and research institutions.

The Center for Lunar Science and Exploration, a support center for activities managed jointly by the Lunar and Planetary Institute and SSERVI, runs the Exploration of the Moon and Asteroids by Secondary Students (ExMASS) program. ExMASS supports student research to promote careers in science. SSERVI also supports the Next Gen Lunar Scientists and Engineers Workshop, a professional development program; LunGradCon, a science conference for graduate students; multiple NASA postdoctoral fellowships; coordinates a student exchange and training program; and student award competitions at the Science Forum.

SSERVI is tasked with expanding NASA's scientific research activities by connecting others to Institute-funded teams. Most notably, SSERVI organizes and sponsors the annual Science Forum held at Moffett Field, California, which brings together several hundred researchers. Activities at the forum include discussions on topics ranging from modeling proposed ideas such as the charge and mobilization of dust on near-Earth Asteroids to the science and technology used on NASA missions to space. SSERVI also conducts the Director's Seminar Series, which brings together the scientific research community via monthly videoconferences during which experts discuss lunar science research. The Institute's "Workshops Without Walls" is a virtual conference that provides access to leaders on topics related to NASA's mission and those of interest to the broader scientific community.

SOUTHWEST RESEARCH INSTITUTE

The Southwest Research Institute (SwRI) is one of the oldest and largest independent, nonprofit, applied research and development organizations in the United States. Originally a center for automotive testing, environmental research, and radio direction finding, the Institute now has technical divisions that include chemistry, space science, microencapsulation, nondestructive evaluation, automation, engine design, mechanical engineering, and electronics.[1]

Program Essentials

NASA Affiliation: Ames, Goddard, Johnson, Marshall

NASA Strategic Alignment: 1.4, 1.6, 1.7

FY 2015 NASA Funding: $127,000,000

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through August 2019

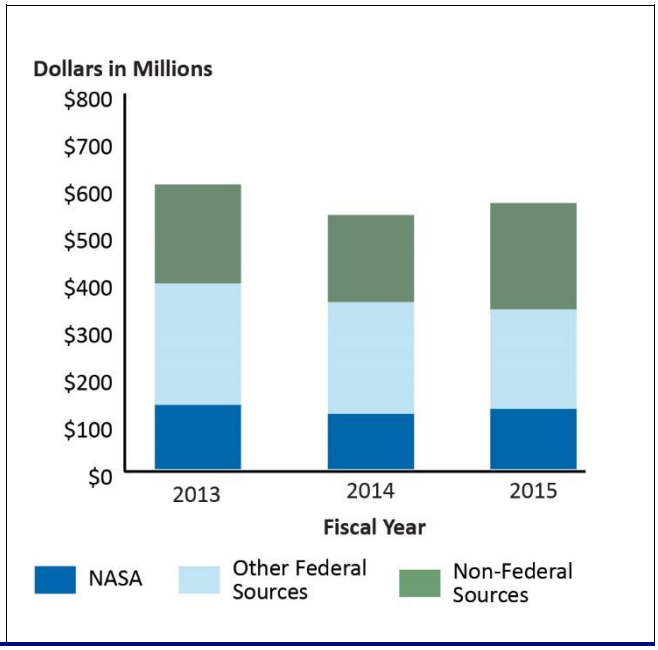
Category: Contractor-led, physical presence

Funding Profile

Historically, the Institute has had more than 4,000 projects open at any one time. Projects are funded almost equally between the government and commercial sectors with NASA contributing 22 percent of SwRI's total funding for FYs 2013 through 2015. For FY 2015, SwRI's anticipated total revenue is $562 million.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$135,259,984
	Other Federal Sources	$256,911,533
	Non-Federal Sources	$209,427,009
	Total	**$601,598,526**
2014	NASA	$116,403,942
	Other Federal Sources	$235,984,899
	Non-Federal Sources	$184,518,043
	Total	**$536,906,884**
2015	NASA	$127,000,000
	Other Federal Sources	$210,400,000
	Non-Federal Sources	$224,950,000
	Total	**$562,350,000**



[1] Microencapsulation is the process by which individual particles or droplets of solid or liquid material (the core) are surrounded or coated with a continuous film of polymeric material (the shell).

Historical Perspective

Founded in 1947 in San Antonio, Texas, SwRI provides contract research and development services to government and commercial clients in the United States and abroad with the goal of benefiting both the public and private sectors through the development of innovative science and technology.

SwRI has 10 technical divisions that conduct multidisciplinary approaches in a number of areas including engine design and development, emissions certification testing, fuels and lubricants evaluation, chemistry, space science, nondestructive evaluation, automation, mechanical engineering, and electronics. The Institute's Space Science and Engineering Division supports NASA missions through heliospheric and solar physics; terrestrial and planetary magnetospheres; planetary geology and atmospheres; comets, asteroids, and other small solar system bodies; planetary system origins and formation; and high-energy astrophysics.

SwRI employs approximately 3,000 scientists, engineers, and support personnel. In 2014, Institute employees published 620 papers; made 504 presentations at technical conferences, seminars, and symposia around the world; submitted 54 invention disclosures; filed 42 patent applications; and received 73 U.S. patent awards.

Contributions to NASA

In 2013, NASA selected SwRI to operate the Institute for the Science of Exploration Targets, part of the Agency's Solar System Exploration Research Virtual Institute (ISET). The $4 million, 5-year effort combines computer modeling with interpretation of spacecraft data to explore celestial bodies humans may visit over the next several decades.

ISET is working to build fundamental knowledge of the Moon, near-Earth asteroids, and the satellites of Mars by researching their origin, evolution, and physical properties to learn more about the history of the solar system. ISET is also researching near-Earth asteroids known as mini moons, which have the potential for cost-effective and practical human exploration.

SwRI has also developed instruments that are flying on a number of NASA and European Space Agency spacecraft. For example, the Institute has developed microsatellites for space-based Earth observation, including NASA's Cyclone Global Navigation Satellite System (CYGNSS) mission, and ultraviolet spectrometers and plasma instruments for NASA's Juno and New Horizons spacecraft, which are exploring Jupiter and Pluto, respectively. The Institute is also developing advanced solid-state recorders for the joint NASA-Indian Space Research Organization Synthetic Aperture Radar satellite.

Magnetospheric Multiscale Mission Launch

Source: SwRI.

SwRI also acts as the Principal Investigator for the Juno, New Horizons, and Interstellar Boundary Explorer missions, and leads the science investigation for NASA's four-spacecraft Magnetospheric Multiscale mission, which is investigating the interaction between the magnetic fields of the Sun and the Earth.

SPACE POLICY INSTITUTE

SPACE POLICY INSTITUTE
ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

The Space Policy Institute (SPI) at George Washington University (GWU) is a university-chartered research center that supports research projects on space policy issues and sponsors seminars, lectures, workshops, and conferences featuring University faculty, outside experts, policymakers, and international leaders.

Program Essentials

NASA Affiliation: Ames, Goddard, Headquarters

NASA Strategic Alignment: 2.4, 3.1, 3.2

FY 2015 NASA Funding: $201,194

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through December 2015

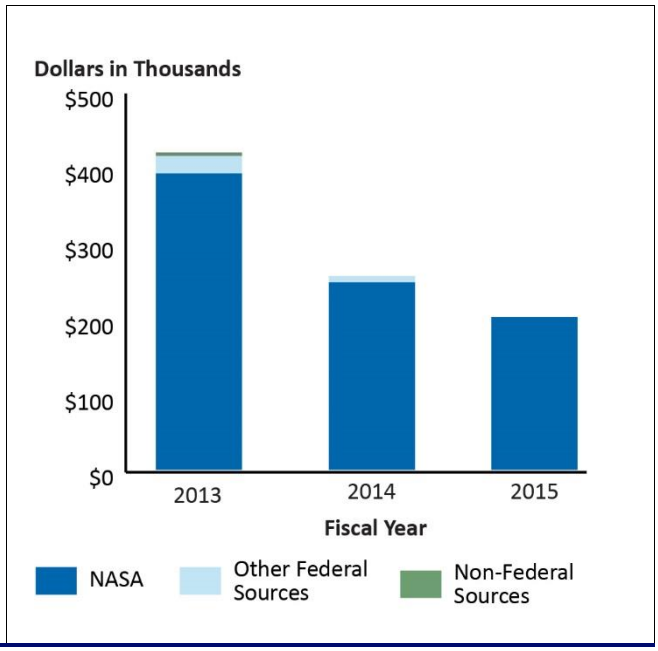
Category: Contractor-led, physical presence

Funding Profile

The Institute receives funding from GWU, individuals, corporations, foundations, and government sources, including NASA. Affiliated faculty have also received NASA grants. For FYs 2013 through 2015, NASA contributed approximately 96 percent of SPI's total funding.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$391,046
	Other Federal Sources	$22,830
	Non-Federal Sources	$4,742
	Total	**$418,618**
2014	NASA	$247,347
	Other Federal Sources	$7,856
	Non-Federal Sources	$0
	Total	**$255,203**
2015	NASA	$201,194
	Other Federal Sources	Unknown
	Non-Federal Sources	Unknown
	Total	**$201,194**



Historical Perspective

Established in 1987, SPI conducts policy-related and other research on dual-use space technologies, including space launch, global positioning systems, remote sensing, and space communications; the global economic impact of space activities; space law; space program and project management; and the history of U.S. and international space activities. The Institute also organizes seminars, symposia, and conferences on various topics and offers graduate courses on space policy.

SPI operates as a research and policy program of the Center for International Science and Technology Policy of GWU's Elliott School of International Affairs but also draws on faculty from other parts of the University. SPI's activities are centered on policy issues concerning the broader U.S. space program and its relationship to the space programs of other countries. The Institute facilitates cooperation between researchers, analysts, and students related to future exploration of space. SPI hosts short- and long-term visitors from the United States and overseas, providing a venue in which to pursue individual research interests as well as providing them with access to U.S. space policy decision-makers.

Administrator Bolden with SPI Students

Source: SPI.

SPI frequently collaborates with other organizations to conduct research on space policy and astrobiology. SPI is an affiliate of the International Space University, a private, nonprofit institution located in France that specializes in graduate-level training to the global space community, and The Aerospace Corporation, a company specializing in the provision of independent technical and scientific research, development, and advisory services to national security space programs. SPI also has formal agreements with the European Space Policy Institute and Beijing Institute of Technology's Institute of Space Law.

Contributions to NASA

SPI is involved in the Organism/Organic Exposure to Orbital Stresses (O/OREOS) Flight Project developed by Ames' Small Spacecraft Division, O/OREOS launched on November 19, 2010, into low Earth orbit, and is expected to re-enter Earth's atmosphere in 2032. An SPI science team conducted data analysis for the project, which resulted in peer-reviewed publications and presentations at national and international conferences. In 2013, the Institute supported the organization of a NASA workshop to explore science opportunities focused on astrobiology suitable for flight on small satellites. The O/OREOS Lead Project Scientist is a member of SPI and was also a member of the Independent Assessment Team for NASA's Mars 2020 Rover.

A University of Wisconsin researcher serves as a lead investigator for the NASA Astrobiology Institute and is a member of SPI.[1] SPI researchers serve as team members on the EXPOSE-R-2 experiments, including the Biology and Mars Experiment (BIOMEX) that will explore the stability and degradation levels of certain materials in contact with a terrestrial and Martian environment, and the Photochemistry on the Space Station (PSS) experiment, which is investigating the stability of organic compounds and biomarkers on the International Space Station.

SPI provides technical and policy support to the Space Communications and Navigation division at NASA Headquarters through a 5-year contract with ASRC Research and Technical Solutions. Recently, the Institute worked with NASA and the U.S. Air Force to secure approval of placing space laser reflectors on future Global Positioning System (GPS) satellites, which will benefit NASA's Earth science geodetic measurement research. SPI researchers also worked with the Air Force's GPS Directorate to update pseudo-random noise codes, a sequence of repeated pulses used on GPS satellites to locate specific satellites and limit possible misuse by foreign position location services.

[1] The NASA Astrobiology Institute is a virtual, distributed organization of competitively-selected teams that integrates astrobiology research and training programs in concert with national and international science communities.

SPACE SCIENCE AND ENGINEERING CENTER

The Space Science and Engineering Center (SSEC) is a research and development center at the University of Wisconsin-Madison focused on geophysical research and the development of technology to enhance understanding of the Earth's atmosphere, other planets in the Solar System, and the Cosmos. SSEC also receives, manages, and distributes geophysical data while developing software for studying weather, climate, and atmospheric processes and phenomena.

Program Essentials

NASA Affiliation: Ames, Armstrong, Glenn, Goddard, Headquarters, Johnson, JPL, Langley, Marshall

NASA Strategic Alignment: 1.6, 2.2

FY 2015 NASA Funding: $8,093,198

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through July 2018

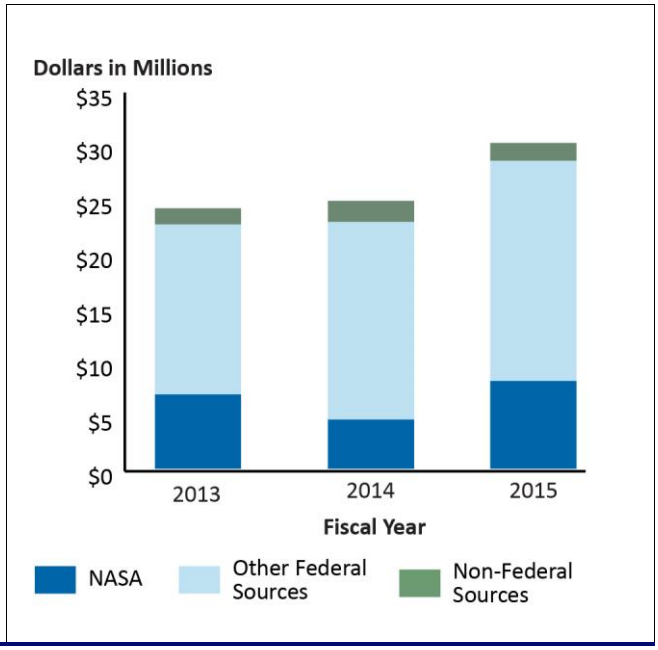
Category: Contractor-led, physical presence

Funding Profile

SSEC is largely funded from Federal Government sources such as the Department of Defense, Department of Energy, NASA, NSF, and NOAA. NASA contributed approximately 25 percent of SSEC's total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$6,857,211
	Other Federal Sources	$15,704,456
	Non-Federal Sources	$1,497,276
	Total	**$24,058,943**
2014	NASA	$4,541,448
	Other Federal Sources	$18,254,306
	Non-Federal Sources	$1,939,476
	Total	**$24,735,230**
2015	NASA	$8,093,198
	Other Federal Sources	$20,337,329
	Non-Federal Sources	$1,665,306
	Total	**$30,095,833**



Historical Perspective

SSEC was created in the mid-1960s by two University of Wisconsin-Madison professors as part of an effort to develop a camera that could obtain continuous satellite imagery of a fixed point on Earth at 20-minute intervals. Since that time, SSEC's mission has expanded to include atmospheric, oceanic, environmental, and astronomical research using space-based techniques. SSEC has designed and built new observing systems for spacecraft, aircraft, and ground-based platforms. The Center is also involved in managing geophysical data from various geostationary and polar orbiting satellites and developing software to visualize and analyze data for insight into weather, climate, and atmospheric processes and phenomena. A goal of SSEC is to share tools and knowledge with scientists and the wider research community around the world to enhance global research in Earth and space science.

SSEC is also home to the Cooperative Institute for Meteorological Satellite Studies (CIMSS), which develops products from geostationary and polar orbiting weather satellites to improve weather forecasts, including the development of tools to track tropical cyclones and severe storms. In partnership through a memorandum of understanding between NASA, NOAA, and the University of Wisconsin-Madison, CIMSS conducts its own research while fostering collaboration among its partner organizations, serving as a center of excellence in weather and climate forecasting, and training scientists and engineers.

Contributions to NASA

SSEC has supported NASA space flight programs by collaborating with Government agencies, private industry, and academia to develop instruments for planetary exploration and deep space measurements. For example, SSEC has collaborated on the development of the Small Probe Net Flux Radiometers for the Pioneer Venus Multi-probe mission, Galileo Jupiter entry probe's Net Flux Radiometer, the High Speed Photometer (one of the original Hubble Space Telescope instruments), and the Diffuse X-Ray Spectrometer that flew on the Space Shuttle. SSEC also advises NASA on large instrument programs, including developing requirements and technical specifications for imaging and sounding instruments for the U.S. Geostationary Operational and Polar Orbiting Environmental Satellite programs and NASA's Earth Observing System satellite suite.

SSEC also led a team that developed an advanced geostationary sounder concept called the High-resolution Interferometer Sounder (HIS) and proved the predicted vertical resolution improvement with an aircraft version of HIS flown on the NASA U2/ER2 airplane.[1] Supported by the Department of Energy and later NASA and NOAA, SSEC also developed the Scanning HIS aircraft instrument that generates images of high spectral resolution data by scanning side-to-side across the flight track.

Technician Integrates the Scanning HIS into the Wing Pod of NASA Research Aircraft

Source: SSEC.

HIS and Scanning HIS have been used extensively for atmospheric research and satellite data validation of instruments on several NASA projects, including the Earth Observing System satellites and Suomi National Polar-orbiting Partnership (Suomi NPP) satellite. In addition, they demonstrated technology and data processing techniques that have been employed Suomi NPP to obtain the high resolution atmospheric temperature and moisture profiles needed for improving regional and global scale weather forecasts.

SSEC personnel also provided support and developed the infrared prototype for NASA's Climate Absolute Radiance and Refractivity Observatory interferometry program and were responsible for developing the on-board calibration system for the Agency's Geostationary Imaging Fourier Transform Spectrometer – a demonstration of technology for future weather satellites.

[1] An interferometer sounder is designed to measure the infrared spectrum of radiant heat given off by the Earth, atmosphere, and water vapor, and can resolve fine details of atmospheric temperature, water vapor, ozone, methane, nitrous oxide, and other gases.

SPACE SCIENCE INSTITUTE

The Space Science Institute (SSI) is a nonprofit corporation headquartered in Boulder, Colorado, with researchers in the United States and abroad. SSI strives to create new, affordable, efficient, and far-reaching models for Earth and space science research that are accessible to a broad population, while promoting STEM education.

Program Essentials

NASA Affiliation: Ames, Goddard

NASA Strategic Alignment: 1.6, 2.4

FY 2015 NASA Funding: $909,392[1]

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through July 2018

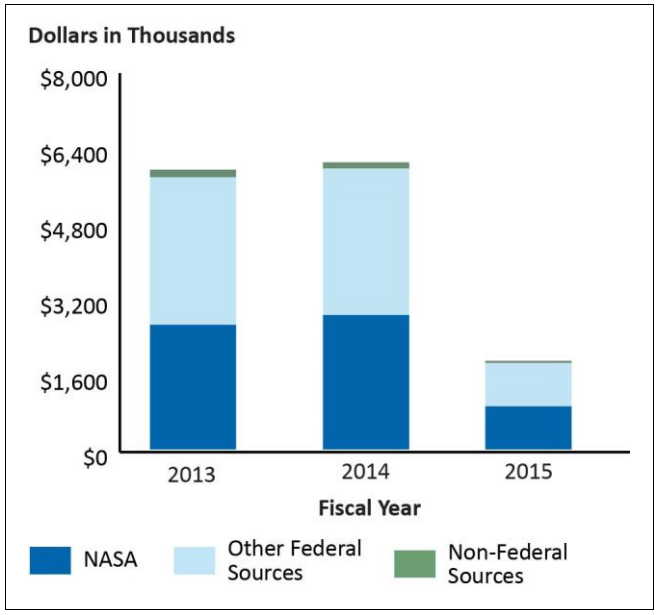
Category: Contractor-led, physical presence

Funding Profile

SSI researchers are supported through a combination of grants and contracts awarded primarily by NASA and NSF, with NASA contributing 46 percent of SSI's total funding for FYs 2013 through 2015. In this same timeframe, SSI has sought to expand its funding sources beyond the Federal Government.

Program Funding

Fiscal Year	Funding Sources	Funding
2013	NASA	$2,631,776
	Other Federal Sources	$3,116,376
	Non-Federal Sources	$157,213
	Total	**$5,905,365**
2014	NASA	$2,837,706
	Other Federal Sources	$3,090,982
	Non-Federal Sources	$131,679
	Total	**$6,060,367**
2015[a]	NASA	$909,392
	Other Federal Sources	$915,848
	Non-Federal Sources	$44,647
	Total	**$1,869,887**



[a] Funding for FY 2015 is through April 30, 2015.

[1] Funding for FY 2015 is through April 30, 2015.

Historical Perspective

Founded in 1992, SSI has more than 60 employees and offsite researchers in 18 states and 3 countries. As of June 2015, SSI is the recipient of more than 100 active grants and contracts, and has nearly $6 million in annual revenue. SSI's mission is to bring together researchers and educators from a variety of backgrounds and institutions to advance scientific understanding of Earth and the Universe, engage the public in STEM learning opportunities, and inspire youth to pursue STEM careers.

SSI describes its efforts as providing a nontraditional research structure, meaning the Institute possesses the ability to work outside of the typical "bricks and mortar" setting by remotely employing scientific researchers who fund themselves through a combination of grants and contracts, primarily from NASA and NSF. This offers researchers and scientists personal and professional flexibility to conduct research and collaborate with other researchers. SSI provides organizational, legal, and administrative support so that researchers can conduct work outside traditional universities and research institutes with colleagues in the United States and abroad.

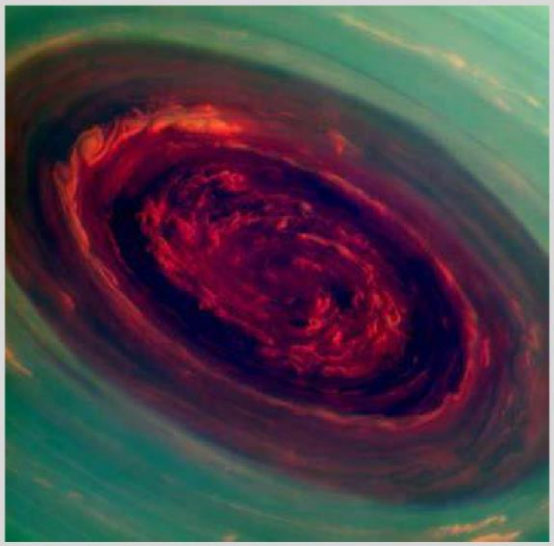
SSI has five major branches: Research, Cassini Flight Operations, National Center for Interactive Learning, Business Operations, and Information Systems and Technology. The Institute's Research Branch investigates physical phenomena in astrophysics, planetary science, exoplanetary science, space physics, and Earth science.

Contributions to NASA

SSI's researchers participate in a number of NASA's robotic and space observation missions, including the Mars Science Laboratory, Mars Exploration Rover Mission, Hubble Space Telescope, Nuclear Spectroscopic Telescope Array, Fermi, Kepler, and the Stratospheric Observatory for Infrared Astronomy. The majority of SSI's NASA funding is for research conducted by principal investigators, including selecting Mars rover sites, and activities such as operating a web-based free astronomy education game called Starchitect and traveling library exhibitions, such as the From Our Town to Outer Space: "Discover NASA" program.

SSI's Cassini Flight Operations Branch operates the Cassini Imaging Central Laboratory for Operations (CICLOPS) that provides uplink and downlink of imaging science experiments on the Cassini-Huygens mission to Saturn and its rings and moons. Images produced by Cassini's cameras are archived in CICLOPS' databases for use by imaging team members, researchers, and the public. Approximately 50 scientists from the United States and Europe comprise the imaging team that uses Cassini's cameras to investigate Saturn's system and publish findings from their investigations.

Photo of the Rose of Saturn Taken by Cassini



Source: NASA.

SSI's research and education programs provide increased access to STEM learning for cross-generational and often underserved audiences. SSI's National Center for Interactive Learning fosters collaboration between scientists and educators to bring educational opportunities through the Internet directly to people where they are already engaged, including public schools, libraries, and museums. Related programs span a range of audience needs and delivery methods, including traveling museum exhibitions; educational films, videos, and websites; hands-on teaching resources and activities; and educator workshops.

SPACE TELESCOPE SCIENCE INSTITUTE

The Space Telescope Science Institute (STScI) is a standalone science center located at Johns Hopkins University and operated for NASA by the Association of Universities for Research in Astronomy. STScI operates the science program for the Hubble Space Telescope (Hubble), will conduct science and mission operations for the James Webb Space Telescope (JWST), supports other astronomical research programs, and conducts research.

Program Essentials

NASA Affiliation: Ames, Goddard, JPL

NASA Strategic Alignment: 1.6

FY 2015 NASA Funding: $119,345,000

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive and non-competitive (sole source and unsolicited proposal)

Period of Performance: Through October 2019

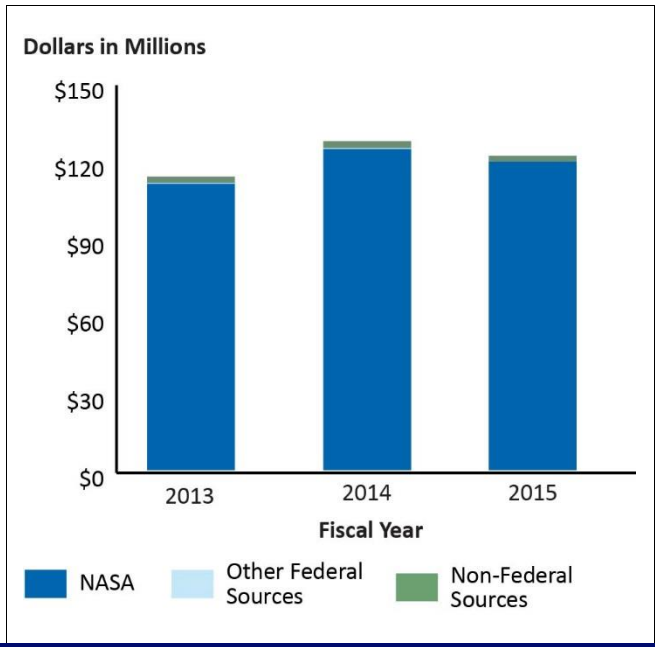
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 98 percent of STScI's total funding for FYs 2013 through 2015. Although STScI has previously received funding from other Federal agencies, as of 2015 there is no assurance such funding would continue after FY 2015. The majority of STScI's non-Federal funding is provided by the European Space Agency.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$110,882,971
	Other Federal Sources	$365,158
	Non-Federal Sources	$2,326,746
	Total	**$113,574,875**
2014	NASA	$124,284,896
	Other Federal Sources	$304,333
	Non-Federal Sources	$2,766,599
	Total	**$127,355,828**
2015	NASA	$119,345,000
	Other Federal Sources	$0
	Non-Federal Sources	$2,311,000
	Total	**$121,656,000**



Historical Perspective

STScI was established in 1981 as the science operations center for Hubble as a result of recommendations from a National Research Council (NRC) study. The study recommended an institutional arrangement to provide long-term guidance and support for the astronomical community, engage the participation of astronomers throughout the world, and provide a means for dissemination and utilization of observation data from instruments in space. The NRC study also recommended the arrangement be operated by a broad-based consortium of universities and nonprofit institutions under contract with NASA.

The Institute's mission is to enable excellence in astronomical research by optimizing science from state-of-the-art observational instruments in space. STScI supports a wide range of astronomical programs and conducts scientific research and internationally recognized education and public outreach programs, including science operations for space telescopes, archives for research data, and a data management center. In 1997, the Multi-Mission Archive at STScI – now the Mikulski Archive for Space Telescopes – was created to archive Hubble data and data from other NASA optical and ultraviolet observation missions, such as the International Ultraviolet Explorer.

In 2002, based on STScI's success with serving as the science operations center for Hubble, NASA selected the Institute to operate the JWST science and operations center. Today, the Institute is conducting a wider array of activities than those originally envisioned in the NRC study.

Contributions to NASA

STScI supports the science operations of a number of NASA missions through initiating the call for proposals, running telescope time allocation review processes and informing the astronomical community of the allocations, scheduling approved science observations, generating data acquisition command sequences sent to telescopes, capturing data from mission operations centers, placing data into the Multi-Mission Archive, providing archive services for data products provided by the astronomical community, producing high-level data products, verifying and optimizing the performance of supported missions through instrument and observatory trending analyses, and distributing data and performing outreach to the astronautical community and the public.

In January 2014, NASA and STScI released a call for proposals for Hubble observations, which included funding for archival research and theoretical research programs.[1] Participation was open to all types of domestic and foreign organizations, including educational institutions, for-profit and nonprofit organizations, NASA Centers, and other Government agencies.

[1] Archival research is the study of older existing data, while theoretical research is the study of existing theories and hypothesis.

TEXAS A&M ENGINEERING EXPERIMENT STATION

For more than a century, the Texas A&M Engineering Experiment Station (TEES) has conducted engineering and technology-oriented research and facilitated educational collaborations. TEES partners with government, industry, communities, and academic institutions to help improve the quality of life, promote economic development, and enhance the educational systems of Texas.

Program Essentials

NASA Affiliation: Johnson, Langley, Marshall

NASA Strategic Alignment: 1.1, 1.7, 2.4

FY 2015 NASA Funding: $1,800,000

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through August 2018

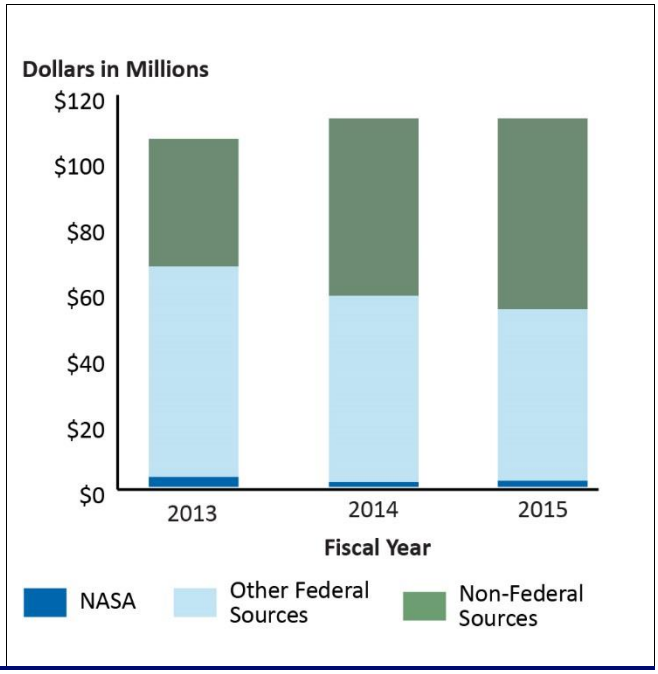
Category: Contractor-led, physical presence

Funding Profile

Approximately 75 percent of TEES' funding comes from contracts and grants, of which, as of 2014, 48 percent came from Federal sponsors. NASA funding has represented, on average, approximately 2 percent of TEES total funding over the last 5 fiscal years. Texas provides approximately 13 percent in funding for seed money for large-scale pilot demonstration projects, advancements in water resources management, construction of a new building to house the Center for Infrastructure Renewal, as well as funds for specialized research equipment, facilities, and sustaining research activities. The remainder of funding comes from miscellaneous sales and services and investment income.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$2,994,284
	Other Federal Sources	$63,976,187
	Non-Federal Sources	$38,797,384
	Total	**$105,767,855**
2014	NASA	$1,476,985
	Other Federal Sources	$56,620,668
	Non-Federal Sources	$53,914,677
	Total	**$112,012,330**
2015	NASA	$1,800,000
	Other Federal Sources	$52,200,000
	Non-Federal Sources	$58,000,000
	Total	**$112,000,000**



Historical Perspective

One of seven agencies within the Texas A&M University System, TEES was established in 1914 to aid the industrial development of Texas by investigating and disseminating information related to engineering and industrial problems. TEES has partnered with industry, communities, and academic institutions to improve the quality of life, promote economic development, and enhance the educational systems of Texas. TEES also works to expose public school teachers and students to opportunities in technological careers and investigates problems in health and the environment.

Since the 1960s, NASA has provided funding to establish a space course at Texas A&M University and a TEES Space Technology Division programs – The Teague Space Science Center. In 1985, an agreement between NASA and Texas A&M University resulted in development of the Space Research Center, which focuses on life support systems and space power. A $5 million grant from NASA created the Center for Commercial Development of Space Power/Center for Space Power (CSP). In 1989, Texas A&M University became a National Space Grant College, part of a national network of colleges and universities working to expand opportunities for Americans to understand and participate in NASA's aeronautics and space projects by supporting and enhancing science and engineering education and research.

Between 2008 and 2009, the TEES Spacecraft Technology Center and CSP combined to form the Space Engineering Research Center (SERC), which provides space-related services and technologies to government and industry, often in close collaboration with Texas A&M University faculty and students. In 2014, SERC became ASTRO (AeroSpace Technology, Research and Operations), assigned to Texas A&M's Aerospace Engineering Department, and is led by a former NASA astronaut.

The TEES Aerospace Vehicle Systems Institute has a Space Act Agreement with Langley, and the Texas A&M University System signed a Space Act Agreement with Johnson in 2014.

Contributions to NASA

ASTRO has participated in parabolic aircraft flights sponsored by Johnson and conducted as part of the NASA Flight Opportunities Program. Johnson led a team of researchers from ASTRO, Jet Learning Laboratory, and Advanced Cooling Technologies to evaluate a gas-liquid separator designed by ASTRO researchers under microgravity conditions. Researchers also participated in a series of parabolic flights, part of Microgravity Multiphase Flow Experiment for Suborbital Testing, that are testing systems, particularly those that involve fluids, to determine whether they will operate properly in space.

ASTRO Researchers on Parabolic Flight

Source: TEES website.

ASTRO researchers adapted an existing capability to develop a star field simulator for Marshall that provides a realistic simulation of what space-based telescopes would observe through a variety of conditions in order to test star trackers and other space cameras. NASA's configuration required a star catalog of millions of stars.

TEES engineers also worked with NASA space suit engineers to design a soft shoulder design concept for human spaceflight pressurized space suits for use in both extravehicular activity operations and during launching and landing of spacecraft. This design concept features a shoulder joint with increased flexibility and mobility for use under any circumstances. Early space suit designs provided limited shoulder mobility when pressurized in an emergency.

THE SAMUEL ROBERTS NOBLE FOUNDATION

The Samuel Roberts Noble Foundation (Noble Foundation), headquartered in Ardmore, Oklahoma, is an independent, nonprofit institute that conducts plant science research and supporting programs to enhance agricultural productivity.

Program Essentials

NASA Affiliation: Kennedy

NASA Strategic Alignment: 1.2

FY 2015 NASA Funding: Projected $229,183

Funding Mechanism

Type of Award: Grants

Nature of Award: Competitive

Period of Performance: Through 2015

Category: Contractor-led, physical presence

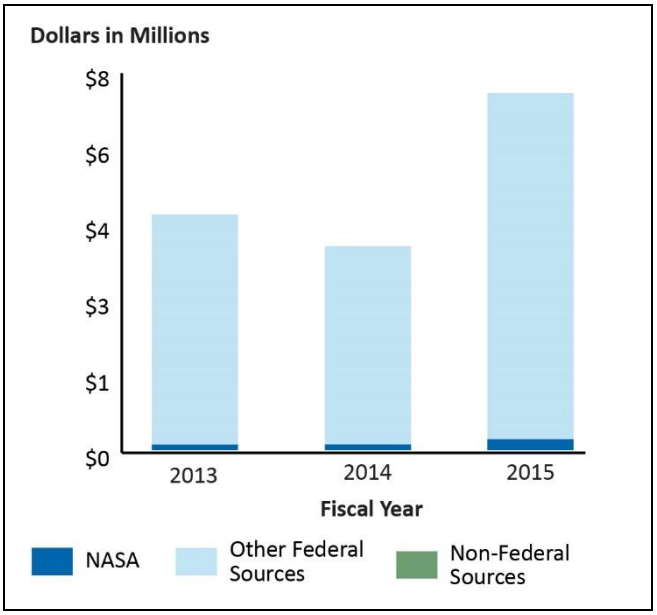
Funding Profile

NASA provided the Noble Foundation with approximately $464,417 in research grants – about 3 percent of the Foundation's Federal funding – for FYs 2013 through 2015. Other Federal funding sources include the Department of Energy, NSF, and the National Institutes of Health.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$116,170
	Other Federal Sources	$4,849,270
	Non-Federal Sources	Unknown
	Total	**$4,965,440**
2014	NASA	$119,064
	Other Federal Sources	$4,176,690
	Non-Federal Sources	Unknown
	Total	**$4,295,754**
2015[a]	NASA	$229,183
	Other Federal Sources	$7,299,900
	Non-Federal Sources	Unknown
	Total	**$7,529,083**

Note: The Foundation preferred not to disclose non-Federal sources for business reasons.



Historical Perspective

Founded by Lloyd Noble in 1945, the Noble Foundation seeks to improve agriculture production techniques and advance plant science through research and discovery. The Foundation conducts fundamental gene and trait discovery research in plants, performs translational and developmental research to incorporate innovations and discoveries into cultivar development of plants, and establishes resources to place improved crops in the production agricultural environment for evaluation, value assessment, and demonstration.

The Noble Foundation has three divisions: Agricultural, Plant Biology, and Forage Improvement. At its 800-acre Ardmore campus, the Foundation has more than 500,000 square feet of research and administrative space and an air conditioned greenhouse of more than 44,000 square feet. Approximately 325 staff members, from more than 25 countries, work at the Foundation.

Contributions to NASA

The Noble Foundation supports the Human Exploration and Operations Mission Directorate's Space Life and Physical Sciences Research and Applications Division in researching how microgravity and other characteristics of the space environment affect fundamental biological processes. In addition, NASA's Fundamental Space Biology Program, which sponsors competitive research on how biological systems adapt to space and develops technologies to facilitate biological research in space flight, awarded the Foundation two grants to advance and increase knowledge of the role and influence of gravity on plants.

In 2010 and 2012, the Noble Foundation obtained NASA grant funding to improve understanding of how microgravity affects plant growth and development. In the future, plants will become an important component of enclosed life support systems that will enable humans to explore space without the need for continuous resupply missions from Earth. In these systems, plants will provide a food source, replenish oxygen, promote astronauts' psychological well-being, and help recycle waste.

Foundation scientists have conducted experiments on the Space Shuttle and the International Space Station to examine how plants adapt to a microgravity environment. In February 2015, the Foundation began to wind down the operations phase of its experiments to extract biologically meaningful information from plant specimens. The Foundation hopes this information will benefit agriculture on Earth and be used to develop plants that will accompany astronauts as they explore other worlds in the future.

THE SCRIPPS RESEARCH INSTITUTE

The Scripps Research Institute (TSRI), which traces its origin to the Scripps Memorial Hospital, was established as an independent organization in 1993 to conduct research in the biosciences.

Program Essentials

NASA Affiliation: SMD

NASA Strategic Alignment: 1.5

FY 2015 NASA Funding: $546,000

Funding Mechanism

Type of Award: Contracts, grants

Nature of Award: Competitive

Period of Performance: Through May 2018

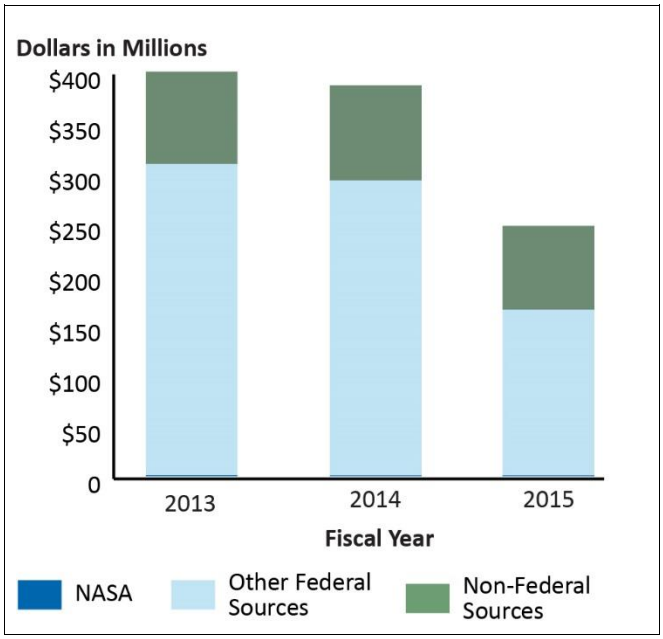
Category: Contractor-led, physical presence

Funding Profile

Most of TSRI's funding comes from Federal agencies, primarily the National Institutes of Health. NASA contributed less than 1 percent of TSRI's total funding for fiscal years 2013 through 2015. Gifts from individuals, private foundations, and other nonprofit entities make up the remainder of TSRI's funding.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$866,000
	Other Federal Sources	$307,762,000
	Non-Federal Sources	$91,271,000
	Total	**$399,899,000**
2014	NASA	$652,000
	Other Federal Sources	$291,616,000
	Non-Federal Sources	$93,963,000
	Total	**$386,231,000**
2015[a]	NASA	$546,000
	Other Federal Sources	$164,052,000
	Non-Federal Sources	$82,860,000
	Total	**$247,458,000**

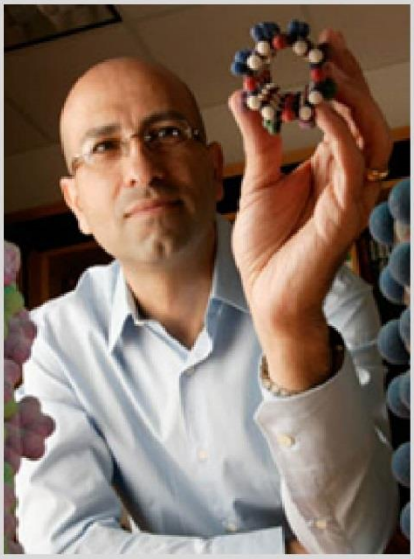


[a] FY 2015 funding is for October 1, 2014, through May 31, 2015.

Historical Perspective

Headquartered in La Jolla, California, with a second campus in Jupiter, Florida, TSRI consists of approximately 3,000 scientists, technicians, graduate students, and staff. Initially a division of the Scripps Clinic and Research Foundation, the Institute separated from the Foundation in 1993. Today, TSRI is a nonprofit research institution that emphasizes the creation of basic knowledge in the biosciences for application in medicine, the pursuit of fundamental scientific advances through interdisciplinary programs and collaborations, and the education of researchers preparing to meet the scientific challenges of the future.

Scripps Scientist with DNA Analog



Source: TSRI.

TSRI also operates the Kellogg School of Science and Technology, a graduate school in La Jolla, California, that provides an interdisciplinary program in chemical and biological sciences, as well as outreach programs for high school and middle school students and teachers.

Contributions to NASA

Two TSRI scientists, supported by a NASA grant and a postdoctoral fellowship from the NASA Specialized Center for Research and Training in Exobiology, created an enzyme based on a "binary" genetic code – one containing only two different subunits. This research demonstrated that Darwinian evolution can occur in a genetic system with only two bases, and supported a theory that an early form of life on Earth may have been restricted to two bases.

Research funded in part by the NASA Astrobiology Institute helped TSRI scientists create a biological polymer that can discriminate between two types of building blocks and use similar blocks to build copies. This experiment provided evidence that the process could play an important role in the development of life on Earth and perhaps elsewhere in the universe. A multidisciplinary research program at the University of Florida, which includes TSRI researchers, addresses issues relevant to astrobiology from several distinct but interrelated perspectives. For example, research has focused on whether genetic molecules in water contain a universally repeating charge. Scientists hope this research will lead to tools able to detect signs of life during NASA missions beyond Earth.

In a project supported in part by NASA's Earth and Space Science Fellowship Program and SMD's Planetary Science Division, a team of TSRI scientists created a new analogue to DNA that assembles and disassembles itself without the need for enzymes. According to TSRI researchers, because the new system comprises components that might reasonably be expected in a primordial world, the new chemical system could answer questions about how life on Earth developed.

UNIVERSITIES SPACE RESEARCH ASSOCIATION

Universities Space Research Association (USRA) was founded in 1969 as an independent, nonprofit research corporation to advance space science and technology through university-based efforts. USRA supports research in biomedicine, planetary science, astrophysics, and engineering.

Program Essentials

NASA Affiliation: Ames, Armstrong, Glenn, Goddard, Headquarters, Johnson, JPL, Kennedy, Langley, Marshall, Stennis, Office of Education

NASA Strategic Alignment: All except 1.3

FY 2015 NASA Funding: $91,013,182

Funding Mechanism

Type of Award: Contracts, grants, cooperative agreements

Nature of Award: Competitive, non-competitive (sole source)

Period of Performance: Through April 2019

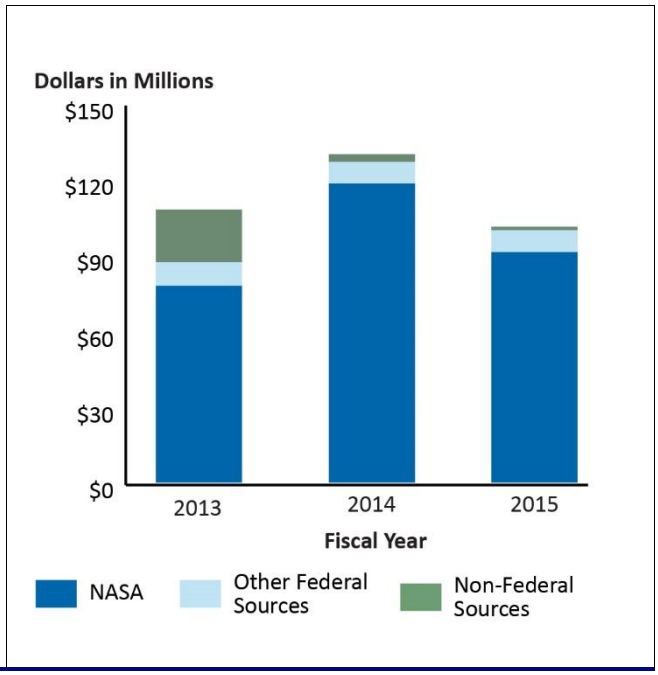
Category: Contractor-led, physical presence

Funding Profile

NASA contributed 85 percent of USRA's total funding for FYs 2013 through 2015. In FY 2013, non-Federal funding came from a contract with Google, while the increase in Agency funding in FY 2014 came from an award from Ames for work on the Stratospheric Observatory for Infrared Astronomy (SOFIA) Program.[1]

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$77,655,790
	Other Federal Sources	$9,360,474
	Non-Federal Sources	$20,862,765
	Total	**$107,879,029**
2014	NASA	$118,213,990
	Other Federal Sources	$8,492,720
	Non-Federal Sources	$3,028,284
	Total	**$129,734,994**
2015	NASA	$91,013,182
	Other Federal Sources	$8,616,622
	Non-Federal Sources	$1,468,775
	Total	**$101,098,579**



[1] SOFIA uses a modified Boeing 747 fitted with a 9-foot telescope that is exposed to the night sky through a door at the rear of the aircraft to investigate the formation of massive stars and planets. For more information, see NASA OIG, "SOFIA: NASA's Strategic Observatory for Infrared Astronomy" (IG-14-022, July 9, 2014).

Historical Perspective

In 1966, the National Academy of Sciences created a committee to study relations between NASA and U.S. universities as the Academy considered developing an institute to facilitate academic and public-sector space research. The following year the committee recommended formation of the Lunar Science Institute operated by a consortium of universities to better strengthen ties between NASA and the wider academic community. In October 1968, 45 universities met to discuss the committee's recommendation, leading to the formation of USRA in March 1969.

USRA initially concentrated on managing the Lunar Science Institute (renamed the Lunar and Planetary Institute in 1978), but by 1970 began to explore additional interactions with NASA. In the early 1970s, USRA received a grant and a contract from Marshall to study potential materials processing in space. Since then, USRA has collaborated with NASA and other Government agencies in materials science, astronomy, advanced concepts, computer science, Earth science, microgravity science, space flight engineering, and space technology.

As of February 2016, USRA consisted of more than 100 member universities and employs more than 400 scientific, technical, and professional staff at its Columbia, Maryland headquarters and at six facilities co-located near NASA Centers. USRA facilitates cooperation between universities and other research organizations with the Federal Government, foreign governments, and other organizations on space-related science, technology, and engineering. It also develops and manages programs and facilities in support of the Federal Government, foreign governments, and other organizations.

In addition, USRA supports research and development efforts including fostering advanced scientific activities, managing schedule and cost, and coordinating efforts of multiple entities to achieve NASA goals at all 10 NASA Centers and Headquarters, as well as at some NASA-funded institutes, including the Center for Research and Exploration in Space Science and Technology, Goddard Earth Sciences Technology and Research, Lunar and Planetary Institute, National Space Biomedical Research Institute, Research Institute for Advanced Computer Science, Southwest Research Institute, Space Science Institute, and Space Telescope Science Institute.

Contributions to NASA

In October 2015, SMD announced that USRA would participate with Goddard on a future planetary mission to Venus through NASA's Discovery Program. This proposed mission, the Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging, will send a probe on a journey down through Venus' atmosphere, ending in the planet's roughest and most geologically complex terrain. A USRA scientist at the Lunar and Planetary Institute is a member of the investigation team of the proposed mission.

Recent USRA contributions to NASA include support of SOFIA's ground mission, and science operations at Ames. In September 2015, USRA was selected to operate the NASA Postdoctoral Program through a 5-year, $100 million contract.

Another USRA scientist at the Lunar and Planetary Institute is producing global maps of Pluto and one of its five moons, Charon, by interpreting the images returned from NASA's New Horizons spacecraft. The spacecraft entered Pluto's atmosphere in July 2015 and will send its data back to Earth over the next 16 months where scientists will review and interpret 10 years' worth of data.

USRA and NASA also collaborate with Google to study how quantum computing supports artificial intelligence and machine learning. Since 2013, researchers at Ames have used a D-Wave quantum computing system to explore quantum computing's potential and its applicability to a broad range of complex problems such as Internet search, speech recognition, air-traffic management, and robotic missions to other planets.

University Affiliated Research Center

The University Affiliated Research Center (UARC) was established in September 2003 to increase the safety, effectiveness, and scientific impact of NASA's missions through the infusion of new technologies and research.

Program Essentials

NASA Affiliation: Ames

NASA Strategic Alignment: 2.1, 2.4, 3.3

FY 2015 NASA Funding: $32,156,085

Funding Mechanism

Type of Award: Contract

Nature of Award: Competitive

Period of Performance: Through 2015

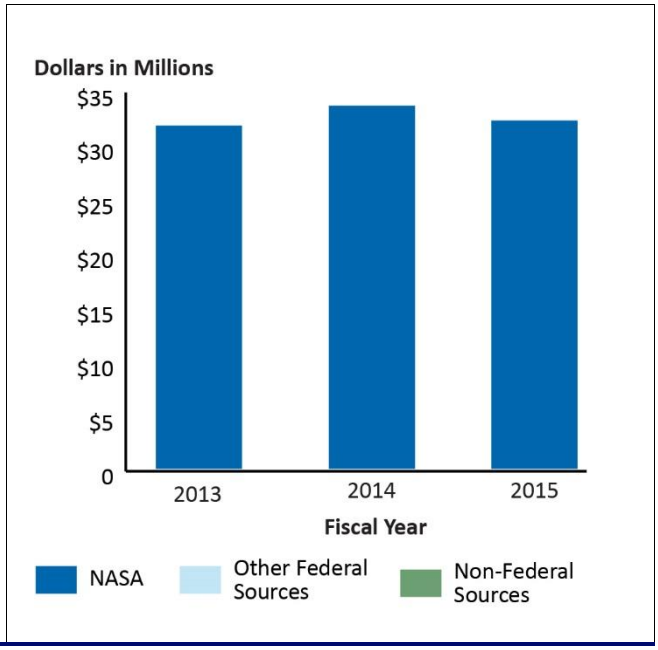
Category: Contractor-led, physical presence

Funding Profile

In 2003, Ames awarded a 10-year, $330 million performance-based task-order research contract, consisting of a 5-year base with two option periods, to the University of California (UC), administered by the University of California Santa Cruz (UCSC), to form UARC. The Center is currently operating in its second extension year. NASA is the sole funder of UARC for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$31,681,229
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$31,681,229**
2014	NASA	$33,531,705
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$33,531,705**
2015	NASA	$32,156,085
	Other Federal Sources	$0
	Non-Federal Sources	$0
	Total	**$32,156,085**



Historical Perspective

UARC was established to provide mission-driven multidisciplinary research supporting NASA's long-term requirements. The Center fosters scientific collaboration between UC faculty and students and Ames scientists.

UARC conducts multidisciplinary research in aerospace systems, Earth science, exploration technology and computer sciences, quantum computing, space sciences, nano sciences, and synthetic biology at Ames and at several UC campuses through two research programs – the Aligned Research Program and the Systems Teaching Institute. The Aligned Research Program funds research by UC faculty and students collaborating with Ames scientists on projects directly aligned with NASA's priorities. The Systems Teaching Institute provides students seeking to become scientists, engineers, and educators the opportunity to work with UCSC faculty and Ames scientists.

Contributions to NASA

Ames has requested UARC conduct research into aerospace systems, including air traffic management and rotorcraft research; Earth science; information sciences; space science; and nanotechnology.

UARC researchers and UCSC scientists also support Ames' Intelligent Systems Division, which works on missions that utilize automated design, adaptive control, data mining, exoplanet detection, machine learning, robotics, and software. Researchers are also working on anomaly detection, diagnostics, and prognostic for aerospace vehicle and systems; control algorithms for aerospace vehicles; coronagraph system development supporting exoplanet research; aerospace vehicle design automation; learning or optimization algorithms for decentralized control of air traffic management systems; and quantum computing research.

UARC also supports NASA's space exploration and aerospace mission by providing guidance and traceability for developing Agency information architectures; providing a basis for uniform representation of information and for active use in the development of software, communication, documentation, and vehicle systems; supporting relationships with stakeholders; defining the current state of information technology systems; and developing information architectures for Kennedy and the 21st Century Ground Systems Program.

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

NCAR | University Corporation
UCAR | for Atmospheric Research

The University Corporation for Atmospheric Research (UCAR) focuses on research and training on atmospheric and related Earth system sciences.

Program Essentials

NASA Affiliation: Ames, Goddard, Headquarters, Kennedy, Langley

NASA Strategic Alignment: 1.4, 2.4

FY 2015 NASA Funding: $546,615

Funding Mechanism

Type of Award: Grant, cooperative agreement

Nature of Award: Non-competitive (sole source)

Period of Performance: Through March 2020

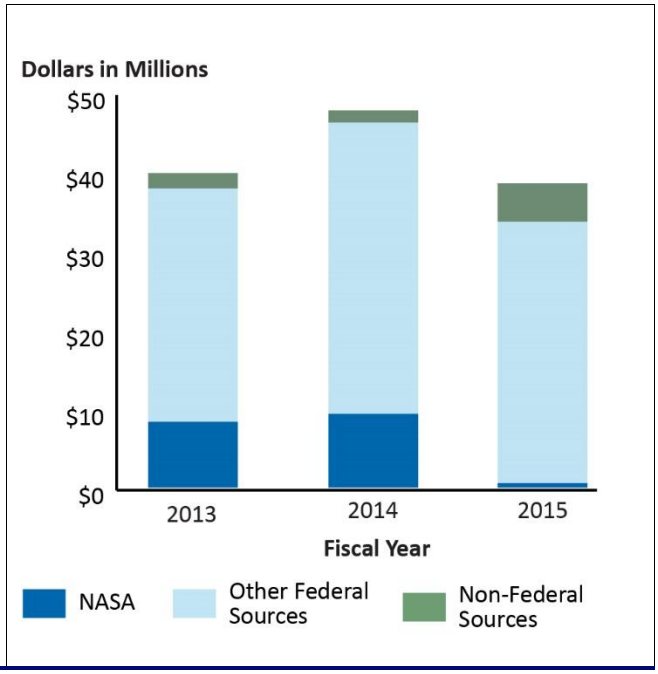
Category: Contractor-led, physical presence

Funding Profile

UCAR receives approximately half of its funding from NSF, with the remainder funded by other Federal agencies, foreign governments, and the private sector. NASA contributed over 14 percent of UCAR's total funding for FYs 2013 through 2015. An entity within UCAR, the National Center for Atmospheric Research (NCAR) – not included in the funding below – also receives funding from NASA and other Federal and non-Federal sources.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$8,311,374
	Other Federal Sources	$29,489,308
	Non-Federal Sources	$1,971,198
	Total	**$39,771,880**
2014	NASA	$9,308,430
	Other Federal Sources	$36,827,068
	Non-Federal Sources	$1,555,916
	Total	**$47,691,414**
2015	NASA	$546,615
	Other Federal Sources	$33,053,805
	Non-Federal Sources	$4,873,136
	Total	**$38,473,556**



Historical Perspective

In 1960, scientists from 14 U.S. universities founded UCAR as a nonprofit organization with the goal of advancing scientific programs in atmospheric and related Earth science systems research.

UCAR Members Circa 1960s

Source: UCAR.

UCAR provides services to more than 100 U.S. institutions of higher education and international affiliates to address challenges in integrating research, developing technology, and advancing education across the Earth sciences. The Corporation supports its member institutions through the UCAR Community Programs, which provide the resources, tools, and services needed by NCAR and its members to fulfill their research and education goals. Headquartered in Boulder, Colorado, with locations in Cheyenne, Wyoming, and Washington, D.C., UCAR also manages NCAR, which is sponsored by NSF. UCAR also acts as an advocate for Federal funding in support of atmospheric research.

Contributions to NASA

NASA actively sponsors three UCAR Community Programs: Global Learning and Observations to Benefit the Environment (GLOBE) Program, UCAR Center for Science Education (SCIED), and Visiting Scientist Program (VSP). GLOBE engages K-12 students by encouraging them to learn about their local environments and the Earth system through inquiry-based investigations. SCIED provides education to adults and children through online tools, videos, and interactive games that share the results of scientific work performed by UCAR scientists. Finally, VSP supports the recruitment of early-career scientists by connecting them with experienced scientists through summer schools, workshops, expert peer-review working groups, and steering committees.

VSP also supports NASA's "Living with a Star" Program, which promotes interactions between members of the research and engineering communities from academia and industry across various subdisciplines within heliophysics in order to understand systems created by the Sun-Earth connection, or how the Sun's magnetic activity interacts with the Earth's environment and atmosphere, and aspects of space weather and climate.

In 1995, UCAR used Global Navigation Satellite System (GNSS) Radio Occultation through radio signals from Global Positioning System satellites sent to a satellite in low Earth orbit to study the Earth's atmosphere. GNSS measures occultation – the way in which radio signals are impacted by molecules as the signals travel through the atmosphere – to observe atmospheric temperature, pressure, and water vapor. These early experiments led to the launch of subsequent missions including UCAR's Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) and the establishment of COSMIC Data Analysis and Archival Center, a radio occultation processing and analysis center. This Center, a joint effort with JPL, provides high-quality radio occultation profiles to operational and research communities for use in radio occultation missions.

University of Maryland
Center for Environmental Science

The University of Maryland Center for Environmental Science (UMCES) is a research, education, and service institution that advances knowledge by scientific discovery, integration, application, and teaching that results in an improved understanding of the environment and natural resources.

Program Essentials

NASA Affiliation: Goddard

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: $247,895

Funding Mechanism

Type of Award: Grants

Nature of Award: Competitive

Period of Performance: Through May 2016

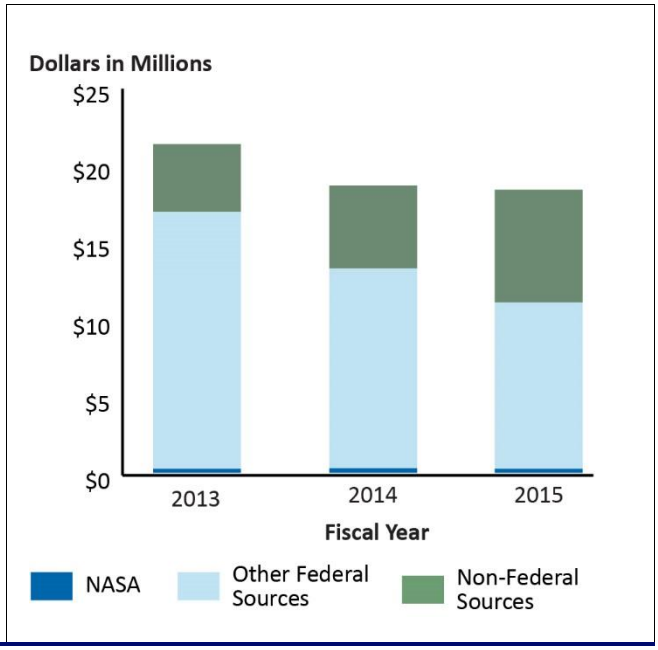
Category: Contractor-led, physical presence

Funding Profile

UMCES receives the majority of its Federal funding from NOAA (40 percent), National Science Foundation (29 percent), the Environmental Protection Agency (16 percent), with the remaining portion (15 percent) contributed by numerous other Federal agencies, including NASA. The Agency contributed 1.4 percent of UMCES' total funding for FYs 2013 through 2015.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$255,000
	Other Federal Sources	$16,597,000
	Non-Federal Sources	$4,387,000
	Total	**$21,239,000**
2014	NASA	$285,000
	Other Federal Sources	$12,917,000
	Non-Federal Sources	$5,352,000
	Total	**$18,554,000**
2015	NASA	$247,895
	Other Federal Sources	$10,756,000
	Non-Federal Sources	$7,291,000
	Total	**$18,294,895**



Historical Perspective

Founded in 1925 as the Chesapeake Biological Laboratory, UMCES currently conducts programs through four laboratories in Maryland: Appalachian Laboratory, located in Frostburg; Chesapeake Biological Laboratory, located in Solomons Island; Horn Point Laboratory, located in Cambridge; and, the Institute of Marine and Environmental Technology, located in Baltimore.

Part of the University System of Maryland, UMCES operates under a specific natural resources statutory mandate to "conduct a comprehensive program to develop and apply a predictive ecology for Maryland to the improvement and preservation of the physical environment, through a program of research, public service, and education." Also, through its role as lead institution for the administration of the Maryland Sea Grant Program, the Center provides leadership in environmental research and graduate education.

UMCES currently focuses on understanding genetic regulation of key ecological processes and applying this knowledge; supporting resilient ecosystems and human health across the land-ocean continuum; evaluating and communicating the environmental opportunities and consequences of energy production alternatives; understanding, evaluating, and reducing the environmental consequences of the demand for water for agricultural, industrial, and human use; and enhancing the capacity for international collaboration and training to develop expertise in environmental research, application, and management.

UMCES' research aims to improve understanding of the environment and the societal consequences of environmental change. The Center's resources include four research laboratories designed with advanced instrumentation for chemical and biological experiments and analysis, seawater systems for maintenance of and experimentation with marine and aquatic organisms, shellfish and finfish aquaculture facilities, greenhouses, computational and geographic information systems, a research vessel, and automated environmental observing systems.

Contributions to NASA

In June 2012, two researchers from UMCES's Appalachian Laboratory were awarded a research grant from NASA's Earth Science Division to conduct a 3-year project to determine how the growth rate of trees in a longer growing season impacts the environment. The study utilizes satellite pictures of forests on the East Coast and the Mid-Atlantic, as well as data collected from airplanes and tree samples to determine how trees are responding to the longer growing season. Previous studies have shown that the growing season has lengthened; however, it is not clear whether this results in trees growing faster and thereby cleaning more carbon dioxide from the atmosphere, which would be a mitigating effect on global climate change. UMCES has also provided research in sea decline, whale monitoring, and ecological studies to NASA.

UNIVERSITY OF TENNESSEE SPACE INSTITUTE

Established in 1964, the University of Tennessee Space Institute (UTSI) is a graduate education and research institution located adjacent to the U.S. Air Force Arnold Engineering Development Center (AEDC), in Tullahoma, Tennessee.

Program Essentials

NASA Affiliation: Glenn, Langley, Marshall

NASA Strategic Alignment: 2.1, 2.4

FY 2015 NASA Funding: $108,033

Funding Mechanism

Type of Award: Cooperative agreement

Nature of Award: Non-competitive (sole source)

Period of Performance: Through March 2015

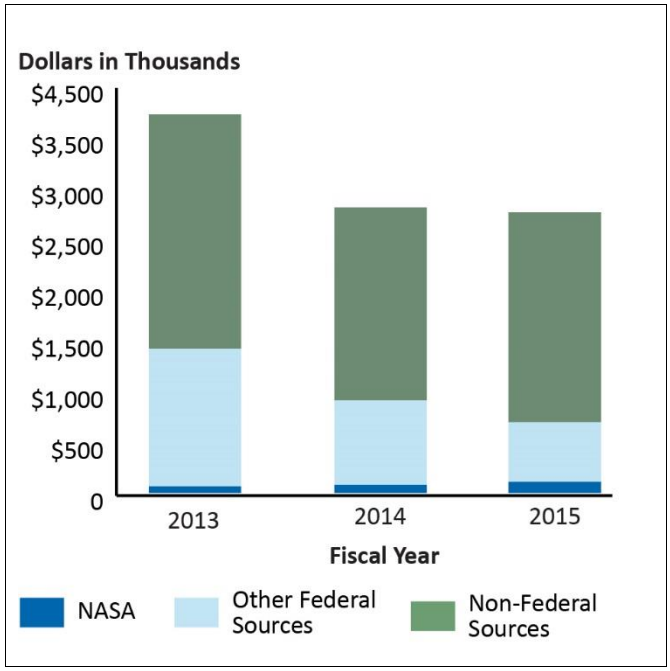
Category: Contractor-led, physical presence

Funding Profile

UTSI had one cooperative agreement with NASA that provided about 3 percent of UTSI's total funding for FYs 2013 through 2015. Other Federal funding was provided by the Department of Defense's Office of Naval Research, several Department of Energy laboratories, the National Institutes of Health, and NSF.

Program Funding

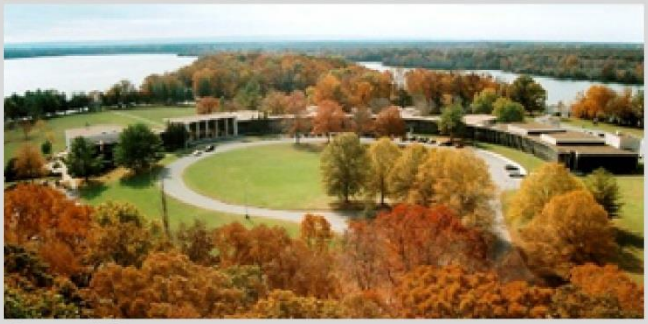
Fiscal Year	Funding Source	Funding
2013	NASA	$63,468
	Other Federal Sources	$1,349,170
	Non-Federal Sources	$2,300,131
	Total	**$3,712,769**
2014	NASA	$76,529
	Other Federal Sources	$828,999
	Non-Federal Sources	$1,892,194
	Total	**$2,797,722**
2015[a]	NASA	$108,033
	Other Federal Sources	$584,700
	Non-Federal Sources	$2,059,273
	Total	**$2,752,006**



[a] FY 2015 funding is estimated through June 20, 2015.

Historical Perspective

In 1950, the U.S. Air Force began construction of a laboratory in Tullahoma, Tennessee, subsequently named AEDC, which focused on airplane and missile airframes, propulsion systems, and wind tunnels.



Source: UTSI

In 1956, the Air Force entered into an agreement with the University of Tennessee to establish a graduate program for AEDC employees. In 1964, the University of Tennessee established UTSI in order to address the need for education related to space technology and support graduate study and research in engineering, physics, mathematics, and aviation systems.

Contributions to NASA

In February 2011, UTSI's Aviation Systems Program was awarded a NASA Aircraft Catalog Blanket Purchase Agreement (BPA), which funds aircraft to accommodate light and heavy-lift instrumentation payloads provided by both Government and non-Government customers on fixed-wing platforms for airborne science missions. Additional services for engineering, fabrication, and installation may be requested by NASA, depending on the particular payload and science mission. The catalog BPA of airborne platforms is managed by Wallops, and airborne science missions are conducted at various locations within and, occasionally, outside the United States.

UTSI is also working on the Icing Contamination Envelope Protection system, which identifies degradations in aircraft flight performance resulting from airframe ice accumulation and provides warnings to the pilot. A part of NASA's Integrated Vehicle Health Management Program, this 4-year research project being conducted by UTSI and Bihrle Applied Research, Inc., in collaboration with Glenn and Langley, focuses on developing real-time assessment methods and their use in defining flight and control limits related to aircraft icing.

UTSI flew the Marshall Airborne Polarimetric Imaging Radiometer (MAPIR) on the Institute's Piper Navajo aircraft to collect surface temperature data of nuclear power plant cooling water for improved computational modeling. Developed as part of the Observing Microwave Emissions for Geophysical Applications project managed by Marshall, MAPIR is a dual beam, dual angle polarimetric, scanning L-band passive microwave radiometer system. UTSI Aviation Systems Program staff designed, fabricated, and flight tested a unique "belly pod" that could carry the MAPIR and other airborne science sensors underneath the Institute's aircraft.

West Virginia High Technology Consortium Foundation

The West Virginia High Technology Consortium Foundation (WVHTC) is a nonprofit organization providing technology-based business development, commercialization of products and services, research and development, infrastructure support, and educational resources and training programs.

Program Essentials

NASA Affiliation: Armstrong, Goddard, Langley

NASA Strategic Alignment: 2.1, 2.4

FY 2015 NASA Funding: $1,359,505

Funding Mechanism

Type of Award: Contracts

Nature of Award: Non-competitive (sole source)

Period of Performance: Through May 2017

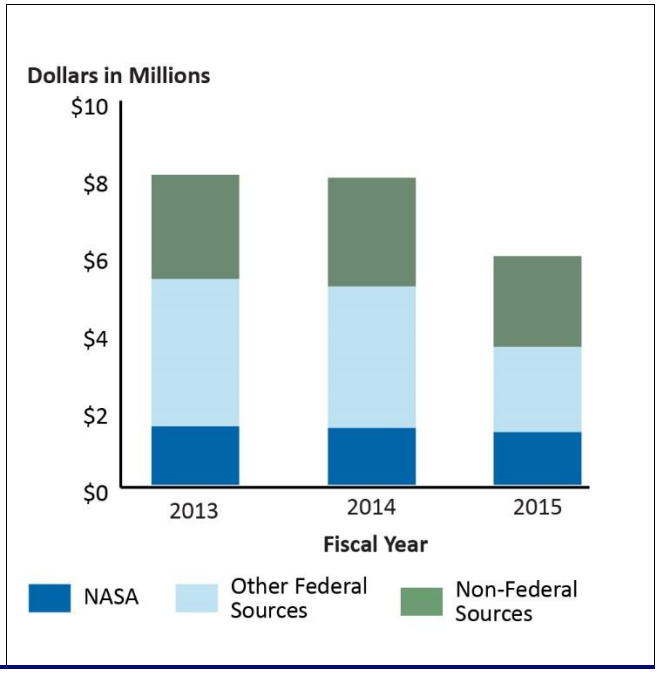
Category: Contractor-led, physical presence

Funding Profile

NASA accounted for approximately 20 percent of WVHTC's total funding through three contract awards between FYs 2013 through 2015 for management of NASA's Independent Verification and Validation (IV&V) Facility, development of software platforms, and the procurement and configuration of flight control computer (FCC) modules. WVHTC also receives funding from other entities within West Virginia and from other Federal agencies, including the Federal Bureau of Investigation and NOAA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,507,832
	Other Federal Sources	$3,811,225
	Non-Federal Sources	$2,964,173
	Total	**$8,283,230**
2014	NASA	$1,463,853
	Other Federal Sources	$3,664,359
	Non-Federal Sources	$2,810,158
	Total	**$7,938,370**
2015	NASA	$1,359,505
	Other Federal Sources	$2,205,062
	Non-Federal Sources	$2,345,050
	Total	**$5,909,617**



Historical Perspective

Located in Fairmount, West Virginia, WVHTC was established in 1993. The Foundation operates a 375-acre technology park in which NASA's IV&V Facility is located and has leased space since 2010. The Facility is sponsored by NASA's Office of Safety and Mission Assurance, operated by Goddard, and managed by NASA's IV&V Program. A part of the Agency's quality control process, the IV&V Program assesses whether software associated with Agency science and space flight activities will meet program, cost, schedule, and safety requirements. Approximately 270 employees work on the Program.

Contributions to NASA

Between FYs 2010 and 2013, WVHTC engineered, built, tested, and delivered the Assessment Environment for Complex Systems (AECS) to Armstrong. AECS is a software platform that tests verification and validation methods of flight critical systems to ensure their safety. This effort supports development of the Next Generation Air Transportation System, which was created by the Federal Aviation Administration's Interagency Planning Office.

Between March 2012 and March 2014, Langley procured three FCC modules from WVHTC to support development of the Quad FCC Testbed, an avionics research tool to improve the performance and reliability of flight critical systems. Langley configured the tool so that it could be integrated into the System and Airframe Failure Emulation Testing and Integration Laboratory used to perform high-fidelity flight simulations.

WOODS HOLE OCEANOGRAPHIC INSTITUTION

The Woods Hole Oceanographic Institution (WHOI) is dedicated to researching and educating society about the ocean and its interaction with the Earth's ecosystems.

Program Essentials

NASA Affiliation: Goddard, Marshall

NASA Strategic Alignment: 2.2, 2.4

FY 2015 NASA Funding: $3,816,300

Funding Mechanism

Type of Award: Grants, cooperative agreement

Nature of Award: Competitive, non-competitive (sole source and unsolicited proposal)

Period of Performance: Through 2018

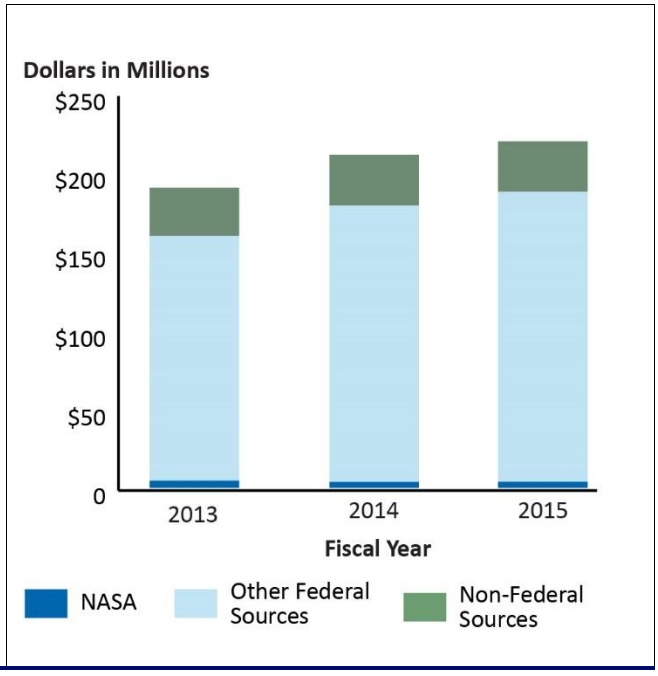
Category: Contractor-led, physical presence

Funding Profile

NASA provides less than 2 percent of WHOI's overall funding, with the majority of funding coming from NSF and the U.S. Navy. As of November 2014, WHOI has 30 active grants, 1 cooperative agreement, and 2 subawards with NASA.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$4,475,522
	Other Federal Sources	$155,044,895
	Non-Federal Sources	$30,490,376
	Total	**$190,010,793**
2014	NASA	$3,667,673
	Other Federal Sources	$175,087,410
	Non-Federal Sources	$32,162,401
	Total	**$210,917,484**
2015	NASA	$3,816,300
	Other Federal Sources	$183,627,815
	Non-Federal Sources	$31,985,900
	Total	**$219,430,015**



Historical Perspective

WHOI was founded in 1930 for the study of oceanography in all its branches and to maintain laboratories, including boats and equipment, and a school for instruction in oceanography and allied subjects. The Institution's first research vessel, *Atlantis*, arrived in Woods Hole, Massachusetts, in August 1931.

Alantis

Source: WHOI website.

WHOI's early oceanographic efforts included collecting mud cores for bacteriological studies, taking measurements at anchor stations and water samples from the Gulf Stream, and making hydrographic measurements. During World War II, WHOI personnel consulted with the U.S. Navy on matters of national defense. For example, WHOI worked on projects involving the effects of salinity and temperature on the transmission of underwater sound and its application to anti-submarine warfare and investigation of underwater explosives.

While the Navy continues to support WHOI and sea-going ocean science through the funding and construction of oceanographic research vessels, NSF provides the majority of funding for the Institution and funded research time onboard the vessels. WHOI has over 100 partners and sponsors including NASA, other Federal agencies, foreign governments, academic, industry, and non-government organizations. The Institution employs more than 1,000 staff, including scientific and technical staff, ships' crew and officers, a variety of support staff, and about 130 students.

Contributions to NASA

WHOI contributes to NASA's planetary and Earth science oceanographic research. For example, in October 2009 researchers from WHOI and JPL discovered the deepest known hydrothermal vent on Earth, 16,400 feet below the surface of the western Caribbean Sea. Related research will contribute to understanding the limits to which life can exist on Earth and help prepare for the search for life on other planets. A similar research expedition in November 2014, conducted by NASA, WHOI, and Duke University, discovered that shrimp living near the Earth's deepest undersea hydrothermal vents harbor bacteria inside their mouths that produce organic matter on which the shrimp feed. Scientists believe that studying this ecosystem will lead to better understanding of what life could be like on other planetary bodies such as Jupiter's icy moon, Europa.

In March 2015, a NASA Physical Oceanography Program scientist and senior scientists from WHOI's Department of Physical Oceanography conducted research to better understand the patterns and variations of salinity at the ocean's surface. These patterns reflect the overlying patterns of evaporation and precipitation that force the freshwater balance in the upper ocean. The research, entitled Salinity Processes in the Upper-Ocean Regional Study (SPURS), was first conducted between August 2012 and October 2013 in the subtropical North Atlantic. A second experiment, SPURS-2, is planned for 2016 – 2017 in the tropical eastern Pacific Ocean. SPURS is funded by NASA for understanding the physical processes related to sea surface salinity, and was a result of the new global measurements of surface salinity from the Aquarius/SAC-D satellite mission, which provided weekly estimates of surface salinity over the entire ice-free ocean.

WOODS HOLE RESEARCH CENTER

The Woods Hole Research Center (WHRC) is a private, nonprofit research organization whose mission is to advance scientific discovery and seek science-based solutions for the world's environmental and economic challenges through research of the Earth's forests, soils, air, and water.

Program Essentials

NASA Affiliation: Headquarters

NASA Strategic Alignment: 2.2

FY 2015 NASA Funding: Projected $2,108,896

Funding Mechanism

Type of Award: Grants, cooperative agreements

Nature of Award: Competitive

Period of Performance: Through 2019

Category: Contractor-led, physical presence

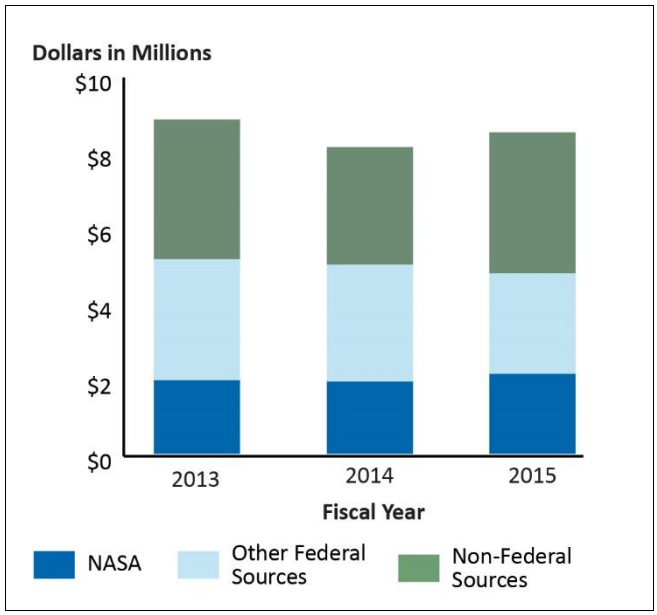
Funding Profile

NASA contributed approximately 23 percent of WHRC's total funding for FYs 2013 through 2015. Other Federal contributors include NSF and the U.S. Geological Survey. Non-Federal sources include private foundations and individual contributors.

Program Funding

Fiscal Year	Funding Source	Funding
2013	NASA	$1,933,551
	Other Federal Sources	$3,197,516
	Non-Federal Sources	$3,691,333
	Total	**$8,822,400**
2014	NASA	$1,903,788
	Other Federal Sources	$3,080,585
	Non-Federal Sources	$3,106,241
	Total	**$8,090,614**
2015[a]	NASA	$2,108,896
	Other Federal Sources	$2,650,408
	Non-Federal Sources	$3,719,741
	Total	**$8,479,045**

[a] FY 2015 funding is through June 30, 2015.



Historical Perspective

WHRC was founded by ecologist George M. Woodwell in 1985 as an institute for environmental research. The Center's headquarters are at the Gilman Ordway Campus in Falmouth, Massachusetts. In FY 2015, WHRC had 55 full- and part-time staff, including approximately 35 researchers (biologists, chemists, hydrologists, geologists, soil scientists, economists, social scientists) and 20 administrative staff.

WHRC assesses threats to the climate and identifies and implements opportunities to stabilize global and regional climates. Their scientists use fieldwork, satellite data, and computer simulations to understand how land processes contribute and respond to climate change. WHRC's scientists work around the globe, including in places where vast pools of carbon stored on land are at risk, such as thawing permafrost in the Arctic, threatening to cause climatic and societal disruption, to tropical deforestation propelled by expanding industrial agriculture in Brazil and Indonesia.

Contributions to NASA

WHRC's contributions focus on understanding the effects of climate change. For example, a WHRC scientist received a NASA grant to research the effects of land use change on climate in the Amazon, which is designed to reveal the effects of deforestation in the region.

In January 2008, a senior scientist at WHRC was named the project scientist for the NASA Large-scale Biosphere-Atmosphere Experiment in the Amazon, the largest international cooperative scientific project studying the interaction between the Amazon rainforest and regional and global atmospheres.

WHRC researchers within the Global Ecosystem Dynamics Investigation team received NASA support to place a Light Detection and Ranging System sensor on the International Space Station in 2018 to monitor global forests, including tree height, biomass, canopy architecture, and tree cover. The team will use collected data to assess the implications of climate change on forests, as well as the feedback of forest change resulting from both natural and human-induced causes.

APPENDIX A: SCOPE AND METHODOLOGY

We performed this review from November 2014 through May 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the review to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our objectives.

In September 2014, we began work to identify a universe of institutes used by NASA for conducting research, analysis, and the development of equipment and technologies. We met with representatives of the former Program Analysis and Evaluation (PA&E) Office concerning their internal review of institutes and determine how they defined an institute for inclusion in their review. Their review included 16 "umbrella institutes" consisting of approximately 55 "sub-institutes" that had a period of performance of 5 years or longer with NASA awards of at least $5 million. The review identified that NASA did not have a definition of an institute and no policy guidance for their establishment or use.

Using PA&E's definition and universe of 71 institutes as an initial guide, we set out to identify a universe for the OIG review. For purposes of our review, we defined an institute as an establishment, foundation, society, or similar organization that receives funding from NASA for the purpose of conducting research or development. We established that an institute could be composed of multi-disciplinary teams or organizations, serve as an independent source of information, research, or development, and was created for a particular purpose, focused on specific research activities. We included all institutes that received NASA funding in FYs 2013 through 2015, regardless of the amount. Various NASA offices were unable to duplicate the data used in the PA&E study; therefore, we conducted extensive internet research to identify a universe. We did not limit our universe by a dollar value or term of performance. However, we eliminated international institutes and required that the institute received funding in FYs 2013 to 2015. We began contacting institutes to provide historical, background, and financial data and identified that the review was feasible.

In November 2014, we began the review and continued to work with the Agency to identify and verify institutes for the universe. We requested Agency Directorates, Offices, and Centers to identify any NASA-funded institutes they utilize. The Agency provided a list 30 institutes. We compared these 30 to the list of 89 institutes we initially identified in our research. We then provided a second request to the Agency that included institutes they did not include in their response, and they were able to confirm 16 of them as NASA-funded. We did not ask the Agency to confirm any other OIG-identified institutes until the two-page briefs were complete.

Overall, we identified 105 institutes for review and eliminated 45 for a variety of reasons – lack of recent funding, educational in nature, no longer exist, absorbed by another institute, or had the incorrect name. See Appendix C for the complete list of eliminated institutes and the reason for their elimination. Ultimately our universe was comprised of 60 institutes. An additional 23 institutes were identified but not included in our review due to time constraints. From our limited review, it appears that these 23 institutes are associated to NASA, but we did not determine whether they met our review criteria. See Appendix E for the 23 additional institutes. Ultimately, we could not confirm the complete universe of institutes funded and used by NASA and any conclusions in this report are based solely on the assessment and review of the 60 institutes.

After completion of the written product for each institute, the individual briefs were shared with the institutes to review the factual content. We then provided the briefs to the Agency for a similar factual review. In both cases, changes were made to the briefs as appropriate.

Use of Computer-Processed Data

We did not rely on computer-processed data for identification of a universe. However, individual institutes provided and extensive internet research was conducted to obtain universe, historical, background, and financial data. Financial data as provided by the institutes was not validated, but accepted as provided. The institutes and NASA management were provided an opportunity to review the factual content for accuracy, and changes were made to the briefs as appropriate.

Review of Internal Controls

We did not perform an assessment of the internal controls of any of the institutes included in this review, but reserved that work for future audits. However in this report, we did cite past NASA OIG audits with internal control weaknesses that would be pertinent in future audits. Additionally, early in the review we met with representatives of the former PA&E Office that conducted an internal review of institutes as well. They identified that NASA did not have a definition of an institute or any plans to implement one and no actions were taken as a result of the internal review.

Prior Coverage

During the last 5 years, no reports of significant relevance to the subject of this report have been issued. Grant audits may have been conducted of individual institutes, but they had no bearing on this review.

APPENDIX B: INSTITUTES INCLUDED IN OIG REVIEW

Table 2: Universe of Institutes

	Institute	Acronym
1	America Makes – National Additive Manufacturing Innovation Institute	NAMII
2	American Institute of Aeronautics and Astronautics	AIAA
3	Center for Computational Relativity and Gravitation	CCRG
4	Center for Gravitational Wave Astronomy	CGWA
5	Center for Research and Exploration in Space Science and Technology	CRESST
6	Desert Research Institute	DRI
7	Earth and Space Research	ESR
8	Earth Institute	EI
9	Earth Research Institute	ERI
10	Florida Space Institute	FSI
11	GeneSys Research Institute	GRI
12	Goddard Earth Sciences Technology and Research	GESTAR
13	Goddard Planetary Heliophysics Institute	GPHI
14	Harvard-Smithsonian Center for Astrophysics	CfA
15	Imaging Research Center	IRC
16	Information Sciences Institute	ISI
17	Infrared Processing and Analysis Center	IPAC
18	Institute for Astrophysics and Computational Sciences	IACS
19	Institute for Global Environmental Strategies	IGES
20	Institute for Medical Research	IMR
21	Institute of Geophysics and Planetary Physics	IGPP
22	Institute of Global Environment and Society	IGES-2
23	Joint Center for Earth Systems Technology	JCET
24	Logistics Management Institute	LMI

	Institute	Acronym
25	Lunar and Planetary Institute	LPI
26	Massachusetts Institute of Technology Kavli Institute for Astrophysics and Space Research	MKI
27	Medical University of South Carolina Foundation for Research Development	MUSC
28	NASA Aeronautics Research Institute	NARI
29	NASA Astrobiology Institute	NAI
30	NASA Exoplanet Science Institute	NExScI
31	National Academy of Sciences	NAS
32	National Center for Advanced Manufacturing	NCAM
33	National Center for Atmospheric Research	NCAR
34	National Institute for Rocket Propulsion Systems	NIRPS
35	National Institute of Aerospace	NIA
36	National Snow and Ice Data Center	NSIDC
37	National Space Biomedical Research Institute	NSBRI
38	Ohio Aerospace Institute	OAI
39	Planetary Science Institute	PSI
40	Research Institute for Advanced Computer Science	RIACS
41	Resources for the Future	RFF
42	Scripps Institution of Oceanography	SIO
43	SETI Institute	SETI
44	Solar System Exploration Research Virtual Institute	SSERVI
45	Southwest Research Institute	SwRI
46	Space Policy Institute	SPI
47	Space Science and Engineering Center	SSEC
48	Space Science Institute	SSI
49	Space Telescope Science Institute	STScI
50	Texas Engineering Experiment Station	TEES
51	The Samuel Roberts Noble Foundation	SRNF
52	The Scripps Research Institute	TSRI
53	Universities Space Research Association	USRA

	Institute	Acronym
54	University Affiliated Research Center	UARC
55	University Corporation for Atmospheric Research	UCAR
56	University of Maryland Center for Environmental Science	UMCES
57	University of Tennessee Space Institute	UTSI
58	West Virginia High Technology Consortium Foundation	WVHTC
59	Woods Hole Oceanographic Institution	WHOI
60	Woods Hole Research Center	WHRC

Source: NASA OIG.

APPENDIX C: INSTITUTES EXCLUDED BY OIG

Table 3: Excluded Institutes

	Institute	Reason for Elimination
1	Aeronautics Research Institute	Duplicate of NASA Aeronautics Research Institute
2	Aerospace Education Research and Operations Institute	Education program
3	American Institute of Aerospace	Does not exist, incorrect name
4	California Institute of Technology	Eliminated by OIG – not an institute
5	Center for Advanced Sensor Technology	No NASA funding
6	Center for Advanced Studies in Photonics Research	No NASA funding
7	Center for Hybrid Multicore Productivity	No NASA funding
8	Center for Space Sciences and Technology	No NASA funding
9	Chandra X-ray Center	Included as part of Harvard-Smithsonian Center for Astrophysics
10	Florida Space Research Institute	No longer exists
11	Goddard Earth Sciences and Technology Center	Expired in 2011
12	Harvard Radio Meteor Project	No longer exists
13	Institute for Broadening Participation	Education program
14	Institute for Theory and Computation	No direct NASA funding
15	Institute of Earth Science Research and Education	Education program, no open funding
16	Institute of Medicine	Included as part of the National Academy of Sciences
17	International Space Science Institute	International institute – out of scope
18	Jet Propulsion Laboratory	Eliminated by OIG – not an institute
19	Joint Center for Astrophysics	No longer exists
20	Joint Institute for Nuclear Astrophysics	No recent NASA funding
21	Joint Space-Science Institute	No direct NASA funding
22	JPL Space Science Institute	Does not exist, incorrect name
23	Living With a Star Institute	Included in UCAR write-up
24	Marshall Space Institute	Does not exist
25	Mason Game and Technology Institute	No NASA funding
26	NASA/Columbia University Institutes	Education program
27	NASA Institute for Advance Concepts	No longer exists

	Institute	Reason for Elimination
28	NASA Lunar Science Institute	Eliminated by Ames
29	NASA Science and Technology Institute	Education program
30	National Center for Defense Manufacturing and Machining	Absorbed by America Makes-NAMII
31	National Center for Space Exploration Research	Contract ended in 2008
32	National Institute of Aeronautics	Does not exist, incorrect name
33	National Space Grant College and Fellowship Program	Education program
34	National Space Institute	Absorbed by National Space Society
35	National Space Science and Technology Center	Eliminated by OIG – not an institute
36	National Space Science and Technology Institute	No NASA funding
37	National Space Society	No NASA funding
38	Pre-Service Teacher Institutes	Education program
39	Rice Space Institute	No NASA funding
40	Schmidt Ocean Institute	No NASA funding
41	Space Operations Institute	No recent NASA funding
42	Space Studies Institute	No recent NASA funding
43	St. Louis Science Center Foundation	Education program
44	University of California, Davis Academy	Education program
45	University Research, Engineering, and Technology Institutes	No recent NASA funding

Source: NASA OIG.

APPENDIX D: NASA'S STRATEGIC GOALS AND OBJECTIVES

Table 4: Strategic Goal 1 – Expand the Frontiers of Knowledge, Capability, and Opportunity in Space

Objective		Lead Office	Figure 4 Label
1.1	Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and international collaboration.	Human Exploration Operations Mission Directorate	Human Exploration
1.2	Conduct research on the International Space Station to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.	Human Exploration Operations Mission Directorate	ISS
1.3	Facilitate and utilize U.S. commercial capabilities to deliver cargo and crew to space.	Human Exploration Operations Mission Directorate	Commercial
1.4	Understand the Sun and its interactions with Earth and the solar system, including space weather.	Science Mission Directorate	Heliophysics
1.5	Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.	Science Mission Directorate	Astrobiology
1.6	Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars.	Science Mission Directorate	Astrophysics
1.7	Transform NASA missions and advance the Nation's capabilities by maturing crosscutting and innovative space technologies.	Space Technology Mission Directorate	Space Technology

Source: NASA.

Table 5: Strategic Goal 2 – Advance Understanding of Earth and Develop Technologies to Improve the Quality of Life on Our Home Planet

Objective		Lead Office	Figure 4 Label
2.1	Enable a revolutionary transformation for safe and sustainable U.S. and global aviation by advancing aeronautics research.	Aeronautics Research Mission Directorate	Aeronautics
2.2	Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet.	Science Mission Directorate	Earth Science
2.3	Optimize Agency technology investments, foster open innovation, and facilitate technology infusion, ensuring the greatest national benefit.	Office of the Chief Technologist	Technology Transfer
2.4	Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers, and faculty in NASA's missions and unique assets.	Office of Education	STEM

Source: NASA.

Table 6: Strategic Goal 3 – Serve the American Public and Accomplish Our Mission by Effectively Managing Our People, Technical Capabilities, and Infrastructure

Objective		Lead Office	Figure 4 Label
3.1	Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.	Mission Support Directorate	Mission Support
3.2	Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's mission.	Human Exploration Operations Mission Directorate	Mission Sustainment
3.3	Provide secure, effective, and affordable information technologies and services that enable NASA's mission.	Office of the Chief Information Officer	Information Technology
3.4	Ensure effective management of NASA programs and operations to complete the mission safely and successfully.	Office of Safety and Mission Assurance, Office of the Chief Engineer, and Office of the Chief Health and Medical Officer	Safety

Source: NASA.

APPENDIX E: ADDITIONAL NASA-FUNDED INSTITUTES

We identified the following 23 organizations that receive some level of NASA funding. Because of time constraints, we did not determine whether these organizations constituted institutes as we defined the term for this review.

Aerospace Ventures

Founded in 2013 and located at the University of Colorado at Boulder, Aerospace Ventures is focused on creating a collaborative environment in which aerospace engineering, Earth, and space science faculty, students, and industrial researchers collaborate to solve complex problems. Activities are conducted at five research Centers: BioServe Space Technologies (BioServe); Center for Aerospace Structures; Center for Environmental Technology; Center for Astrodynamics Research; and Research and Engineering Center for Unmanned Vehicles. The BioServe Center has worked with NASA to design and fly more than over 50 different payloads on more than 40 space missions including the Space Shuttle, International Space Station, and the Space Exploration Technologies' Dragon. In addition, the Center works to build partnerships between industry, academia, and government to develop products that support NASA missions.

Association of Universities for Research in Astronomy

Founded in 1957 in Washington, D.C., the Association of Universities for Research in Astronomy (AURA) is a consortium of 40 U.S. institutions and 4 international affiliates operating astronomical observatories devoted to research, engineering, and other activities benefiting astronomy and the astronomical community. AURA centers include the AURA Observatory, Gemini Observatory, Large Synoptic Survey Telescope, National Optical Astronomy Observatory, National Solar Observatory, and the Space Telescope Science Institute (STScI). AURA manages STScI under contract for NASA. A major initiative for AURA is the James Webb Space Telescope, a space-based telescope for planetary science and astrophysics.

Battelle Memorial Institute

Founded in 1929 in Columbus, Ohio, Battelle Memorial Institute is a charitable trust founded on the vision that science and business interests can combine as forces for positive change. Battelle has over 60 locations globally, manages national laboratories, and has a research portfolio spanning industry, energy and environment, health and pharmaceutical, and national security. For example, Battelle and a partner recently completed their evaluation and submitted a final report as part of a Glenn Research Center contract assessing smart grid technology which could help NASA accomplish deep space exploration missions.

Bigelow Laboratory for Ocean Sciences

Established in 1974, the Bigelow Laboratory for Ocean Sciences (BLOS) is a private, nonprofit corporation dedicated to research, education, and enterprise in ocean sciences. BLOS' mission is to understand the key processes driving ocean ecosystems, their evolution, and their fundamental relationship to life on Earth through interrelated programs in research, education, and technology transfer. BLOS is participating in a NASA project to advance space-based capabilities for monitoring microscopic plants that form the base of the marine food chain.

Carnegie Institution for Science

Founded in 1902 as the Carnegie Institute of Washington and known since 2007 as the Carnegie Institution for Science, this organization is an endowed, independent, and nonprofit organization that supports scientific research in the fields of plant biology, developmental biology, Earth and planetary sciences, astronomy, and global ecology. Research is conducted by scientists at the Department of Embryology, Baltimore, Maryland; Geophysical Laboratory, Washington, D.C.; Department of Global Ecology, Stanford, California; The Observatories, Pasadena, California; Department of Plant Biology, Stanford, California; and the Department of Terrestrial Magnetism, Washington, D.C. In October 2008, NASA awarded a 5-year grant of about $7 million to study the origins, evolution, distribution, and future of life in our universe.

Center for Radiological Research

Established in 1916, the Columbia University Medical Center's Center for Radiological Research conducts research on the effects of radiation on the human condition. The Center's primary research mission is threefold: to advance human knowledge about the effects of radiation exposure in living tissue; to provide the scientific basis and principles underlying the clinical use of radiation in diagnosis and treatment of human disease; and to enhance national security by developing innovative rapid screening methods for assessing radiation exposure in large numbers of individuals in the event of an accidental or terrorist radiological emergency. NASA research grants have funded studies on the effects of space radiation on astronauts. For example, a NASA-funded study presented a new biological based mathematical model which in principle can estimate a second cancer risk for cancer survivors.

Conservation Biology Institute

The Conservation Biology Institute (CBI) is a nonprofit institute founded in 1997 in Corvallis, Oregon to provide scientific knowledge to support the conservation and recovery of biological diversity in its natural state through applied research, education, planning, and community service. The Institute conducts research and works in collaboration with other research organizations to find ways to address a wide range of ecological problems and develop tools, techniques, and analysis to support other organizations, agencies, and companies. For example, a CBI modeling team is involved in the Multi-scale Synthesis and Terrestrial Model Intercomparison with the goal to improve global carbon budget estimations. The Institute is receiving indirect financial support on the project through funds provided by a NASA grant to the U.S. Forest Service.

Emory University's Winship Cancer Institute

Emory University's Winship Cancer Institute, in Atlanta, Georgia, was selected in 2009 as a NASA Specialized Center of Research (NSCOR) and awarded $7.6 million over a 5-year period to study how a component of space radiation may induce lung cancer. An NSCOR award differs from an individual grant award in that it incorporates a number of complementary research projects that focus on a single research area. As defined by the NASA Space Radiation Program, "a NSCOR consists of a team of investigators who have complementary skills and who work together to solve a closely focused set of research questions. The team also includes strong undergraduate, graduate, or post-graduate training components." Under the 2009 award, the Institute conducted a study to determine the health risks to astronauts exposed to space radiation including cognitive deficits and possibly accelerated aging. The study was designed to provide insight into cellular and molecular mechanisms underlying central nervous system risks from space radiation and to predict countermeasures to mitigate health risks from space radiation.

Environmental Defense Fund

Founded in 1967 in New York City, the Environmental Defense Fund's (EDF) mission is to preserve the systems upon which life on Earth depends. EDF is focused on solving critical environmental problems facing planet Earth. For example, under a 2012 NASA research grant, EDF proposed developing and leading a workshop in collaboration with NASA and the California Water Foundation on the use of remote sensing and other satellite technologies for data acquisition and water management. Participants would access the needs of regulators and managers, and the potential of technologies to meet their needs and the steps needed for implementation. These types of projects address a NASA goal of studying Earth from space for societal benefit.

Hauptman-Woodward Medical Research Institute

Founded in 1956 as the Medical Foundation of Buffalo and renamed the Hauptman-Woodward Medical Research Institute (HWI) in 1994, the Institute is an independent, nonprofit, biomedical research facility and a consortium of research, clinical, and educational institutions located on the Buffalo-Niagara Medical Campus. Researchers are focused on finding the fundamental causes of many diseases with the goal to develop and understand how living cells function, how diseases originate, and how to cure or alleviate their symptoms. For example, working under a 2014 NASA 5-year $750,000 research grant HWI researchers will send several experiments to the International Space Station aimed at identifying protein samples that benefit crystallization in microgravity.

Interdisciplinary STEM Cell Institute

Founded in 2008, the Interdisciplinary Stem Cell Institute (ISCI) at Florida's University of Miami Miller School of Medicine spearheads cell-based therapies for a host of currently untreatable diseases. The Institute's focus includes research in basic cell biology, hematology, oncology, cardiology, dermatology, diabetes and endocrinology, neurology, orthopedics, pediatrics, and ethics and science policy. ISCI's vision is to find new treatments for heart disease, neurological disease, bone disease diabetes, cancer, and other debilitating or incurable diseases. The founding director of the ISCI was among seven stem cell researchers awarded a NASA research grant to use the International Space Station's unique environment to explore the impact of microgravity on fundamental stem cell properties.

Laboratory for Atmospheric and Space Physics

Established in 1948, the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado, Boulder aims to identify and address key questions in solar influences, atmospheric, planetary, and space sciences. LASP has sent instruments to all eight solar system planets and Pluto including the Aeronomy of Ice in the Mesosphere; Cassini UltraViolet Imaging Spectrograph; Kepler; Magnestospheric MultiScale; Mars Atmosphere and Volatile Evolution MissioN; Miniature X-ray Solar Spectrometer; New Horizons Student Dust Counter; Quick Scatterometer; Solar Dynamics Observatory/EUV Variability Experiment; Solar Radiation and Climate Experiment; Time History of Events and Macroscale Interactions During Substorms; Total Solar Irradiance Calibration Transfer Experiment; Van Allen Probes; and Voyager 1 and 2.

Lerner Research Institute

Founded in 1945, the Lerner Research Institute's Center of Space Medicine is focused on finding solutions to medical problems experienced by humans during prolonged space flights. The Center is supported by a cooperative agreement with NASA's Glenn Research Center (Glenn). Funding grants are also received from Glenn, NASA Headquarters, Johnson Space Center, and the National Space Biomedical Research Institute. For example, Glenn funded a 2008 lecture series to address key information related to motion sickness, bone loss, cardiovascular alterations, and risk of injury due to radiation exposure in space and its relevance to the earth-gravity environment.

Los Alamos National Laboratory

The Los Alamos National Laboratory in New Mexico was established in 1943 to enhance national security by ensuring the safety and reliability of the U.S. nuclear stockpile, developing technologies to reduce threats from weapons of mass destruction, and solving problems related to energy, environment, infrastructure, health, and global security concerns. The Laboratory is building the body for the SuperCam component of NASA's Mars 2020 rover.

Marine Biological Laboratory

Founded in 1888 in Woods Hole, Massachusetts, the Marine Biological Laboratory is a private, nonprofit institution affiliated with the University of Chicago. The Laboratory's focus is to improve the quality of human life through research and education in biology, biomedicine, and environmental sciences. The Laboratory has conducted NASA-sponsored research to measure changes in key soil processes and the fluxes of carbon dioxide, methane, and nitrous oxide associated with the conversion of tropical rainforest to pasture in Rondonia, a state in the southwest Amazon region that has experienced rapid deforestation since the late 1970s.

Marine Station at Fort Pierce

The Smithsonian Marine Station (SMS) located at Fort Pierce, Florida and founded in May 1999, is a research center specializing in marine biodiversity and the ecosystems of Florida. SMS research is focused on the Indian River Lagoon and the offshore waters of Florida's east central coast and comparative studies throughout coastal Florida. Research conducted at SMS is published in scientific journals and forms the basis for environmental policy, conservation efforts, and resource management. SMS received a 4-year NASA-funded grant to study the mangrove invasion of salt marshes as the climate changes and the resulting impacts on coastal ecosystems.

Michigan Tech Research Institute

Prior to 2006, Michigan Tech Research Institute (MTRI) had its heritage in the Environmental Research Institute of Michigan that was subsequently developed as a research center of the Michigan Technological University located in Ann Arbor, Michigan. MTRI focuses on education, research, and development of technology to sense and understand natural and manmade environments. The Institute's mission in research, development, and use of information technology is to support solutions to critical problems in bioinformatics, Earth sciences, and environmental processes. MTRI received a NASA research grant in 2012 to develop regional fire emissions information products for NASA's Carbon Monitoring System.

NASA Space Radiation Laboratory

Established in 2003, the NASA Space Radiation Laboratory (NSRL) is funded by NASA and located at and managed by the Brookhaven Laboratory for the Department of Energy (DOE). As NASA prepares for future missions in deep space, many of the health risks of cosmic radiation are still uncertain. Before humans can travel for extended periods outside of the Earth's atmosphere, scientists must learn more about the risks posed by cosmic radiation. As more is understood regarding the risk of space radiation and its effects on living organisms, research at NSRL will shift from risk assessment toward countermeasure development. For example, over the years, a large number of animal experiments have been conducted at NSRL and at other facilities under the funding support of the NASA Space Radiation Program Element. Studies using rodents and other animal species to address the space radiation risks will remain a significant portion of NASA's space radiation research.

Research Triangle Institute

Founded in 1958 in Piedmont, North Carolina, the Research Triangle Institute (RTI) is an independent, nonprofit research and development organizations with staff in 75 countries. The institute's mission is to improve the quality of human life by turning knowledge into practice through innovative study and analysis in health care, pharmaceuticals, education, training, surveys and statistics, advanced technology, international development, economic and social policy, energy and the environment, laboratory, and chemistry services. RTI's focus is to conduct multidisciplinary research and to develop new technologies for its clients. In 2006, RTI led the effort to identify markets for the emulsified zero-valent iron developed at Kennedy Space Center to remediate groundwater pollution. The technology has the potential to assist in the clean-up hundreds of contaminated Superfund sites across the country.

Smithsonian Environmental Research Center

Established in 1965 in Edgewater, Maryland, the Smithsonian Environmental Research Center (SERC) seeks to understand environmental threats and changes facing the Earth. SERC leads research efforts on the coastal ecosystems and provides scientific knowledge to inform decisions for environmental policies, best business practices, and a sustainable planet. SERC operates 18 research laboratories to collaborate on scientific studies centered on linkages between ecosystems at the land-sea margin. SERC has joined NASA and several other Federal agencies to initiate research to integrate NASA's global satellite data of the physical environment with ground-based data on specific species and ecosystems and computer modelling to detect and understand biological responses from climate change.

Space Research Institute International

Established in 1946 as the Stanford Research Institute, the Space Research Institute (SRI) International is located in Menlo Park, California. SRI's capabilities range from basic research to applied research, technology development, system deployment, custom products, and technologies for license. In collaboration with the NASA Extreme Environment Mission Operations, in 2006 SRI presented the first demonstration of an image-guided remote tele-robotic surgery. SRI's robotic surgical system is small enough for compact storage and easy assembly should an astronaut require emergency surgery. The technology could also be applied in situations on Earth where there is limited access to medical care.

Stanford Woods Institute for the Environment

Founded in 2004, the Stanford Woods Institute for the Environment concentrates on interdisciplinary environmental and sustainability research at Stanford University. The institute's mission is to help produce solutions to major global resource sustainability challenges while protecting the environment for future generations. The Institute serves as an independent "umbrella" that connects and brings together expertise in a collaborative environment from across Stanford's seven schools to produce research and development on environmental and sustainability issues. With funding from NASA, Institute researchers used Inteferometric Synthetic Aperture Radar to make measurements of numerous locations in Colorado's San Luis Valley – an important agricultural region and flyway for migrating birds – to compile water-level measurements for several confined aquifers and match the data to monitoring wells.

Von Braun Center for Science and Innovation, Inc.

Established in 2006 in Huntsville, Alabama, the Von Braun Center for Science and Innovation, Inc. (VCSI) is a nonprofit research and development center that focuses on finding work already underway in industry, government, or academia and applying its capabilities to meet new requirements. VCSI is a product-focused entity that engages in collaborative efforts with multiple partners in the projects and activities it conducts. VCSI is involved in a cooperative effort with the Marshall Space Flight Center and the John Hopkins Applied Physics Laboratory to develop a robotic lunar lander.

APPENDIX F: MANAGEMENT'S COMMENTS

National Aeronautics and Space Administration
Office of the Administrator
Washington, DC 20546-0001

May 27, 2016

TO: Assistant Inspector General for Audits

FROM: Associate Administrator

SUBJECT: Agency Response to OIG Draft Report, "Review of NASA-funded Institutes" (A-15-001-00)

Thank you for the opportunity to review and comment on the Office of Inspector General (OIG) draft report entitled, "Review of NASA-funded Institutes" (A-15-001-00), dated April 28, 2016.

NASA appreciates and values the effort expended by the OIG during the course of this review and for the comprehensive and detailed reporting on NASA-funded institutes.

While the draft report contains no specific recommendations to NASA, we will review the "other matters for consideration" to confirm our current guidance is appropriate and adjust, if necessary.

We have reviewed the draft report for information that should not be publicly released. As a result of this review, we have not identified any information that should not be publicly released.

Once again, thank you for the opportunity to review and comment on the subject draft report. If you have any questions or require additional information regarding this response, please contact Paul Roberts on (202) 358-2260.

Robert M. Lightfoot, Jr.

APPENDIX G: REPORT DISTRIBUTION

National Aeronautics and Space Administration

Administrator
Deputy Administrator
Associate Administrator
Chief of Staff
Associate Administrator for Aeronautics Research
Associate Administrator for Human Exploration and Operations
Associate Administrator for Science
Associate Administrator for Space Technology
Assistant Administrator for Procurement
Director, Ames Research Center
Director, Armstrong Flight Research Center
Director, Glenn Research Center
Director, Goddard Space Flight Center
Director, Jet Propulsion Laboratory
Director, Johnson Space Center
Director, Kennedy Space Center
Director, Langley Research Center
Director, Marshall Space Flight Center
Director, Stennis Space Center

Non-NASA Organizations and Individuals

Office of Management and Budget
    Chief, Science and Space Branch

Government Accountability Office
    Director, Office of Acquisition and Sourcing Management

Congressional Committees and Subcommittees, Chairman and Ranking Member

Senate Committee on Appropriations
    Subcommittee on Commerce, Justice, Science, and Related Agencies

Senate Committee on Commerce, Science, and Transportation
    Subcommittee on Space, Science, and Competitiveness

Senate Committee on Homeland Security and Governmental Affairs

House Committee on Appropriations
    Subcommittee on Commerce, Justice, Science, and Related Agencies

House Committee on Oversight and Government Reform
Subcommittee on Government Operations

House Committee on Science, Space, and Technology
Subcommittee on Oversight
Subcommittee on Space