Indiana Space Grant Consortium
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Consortium URL: https://engineering.purdue.edu/INSGC
Grant Number: NNX10AK66H

PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Indiana Space Grant Consortium is a Designated Consortium funded at a level of $575,000 for fiscal year 2012.

PROGRAM GOALS

INSGC Goals are as follows:

- *INSGC will be a preferred source of information, materials, and opportunities for inspiring, preparing, and supporting individuals for NASA-related STEM education and careers.*
- *INSGC will be an effective and preferred vehicle for enhancing the engagement of K-20 educators and students in full range of NASA-related STEM activities and opportunities.*
- *INSGC will raise awareness of and access to NASA-related activities, events, and opportunities for the government, institutions, and residents of the State of Indiana.*

NASA Education Outcome 1**:** *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals. (Employ and Educate)*

Scholarship / Fellowship

1.3 Student Involvement Higher Education - Provide opportunities for groups of post–secondary students to engage in authentic NASA–related mission based R & D activities.

INSGC Scholarship and Fellowship applicants are managed through an open competitive application process to the INSGC–controlled website. For any campus with at least two valid applicants, at least one undergraduate scholarship is guaranteed, ensuring that INSGC awards are provided to all academic affiliates.

Higher Education

1.1 Faculty and Research Support – Provide NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows.
1.2 Student Support – Provide NASA competency–building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education.

INSGC intends competitively awarded Higher Education award funds to support student participation in authentic hands-on experiences at NASA centers or industry partners, as well as team-based project activities that may occur on academic campuses. In addition, INSGC provides support for undergraduate research experience programs at multiple campuses. Competition guidelines provide strict limits on funding support for faculty, thus emphasizing student involvement and financial support.

Research Infrastructure

1.5 Targeted Institution Research and Academic Infrastructure – Improve the ability for targeted institutions to complete for NASA research and development work.

INSGC does not favor Research Infrastructure awards at our research intensive campuses (Purdue-West Lafayette and Indiana University-Bloomington). Instead, RI funds are prioritized toward supporting young faculty and student involvement in STEM research activities at our smaller undergraduate and regional campus academic affiliates.

INSGC Objective 1-A: Faculty, researchers, and doctoral fellows who receive INSGC funding will report increased research capacity and competency as a result of their awards. (Objective 1.1)

INSGC strongly supports the publications of papers from faculty, researchers and doctoral fellows. For the 2012-13 year, faculty Bruce Hrivnak; affiliate Valparaiso University has provided his publication from the Astrophysical Journal, 766:116 (21pp), 2013 April 1. Titled Studies of Variability in Proto-Planetary Nebulae, II, Light and Velocity Curve Analyses of Iras 22272+54235and 22223+4327.

INSGC Objective 1-B: Students who participate in INSGC higher education programs will report an increased: a) interest in STEM study and careers, b) understanding of NASA programs, and c) perception of leadership skills. (Objectives 1.2 and 1.3)

As of APD (Apr 16), most academic year higher education awards are still operating; not all project reports have been received. Highlights and anecdotes

received to date do indicate unsolicited qualitative responses that demonstrate achievement of INSGC Objectives 1-A and 1-B.

INSGC Objective 1-C: At least 60% of NASA higher education program student participants will seek employment with NASA, aerospace contractors, universities, and other educational institutions. (Objective 1.2)

INSGC Objective 1-D: At least 40% of undergraduate students who participate in NASA higher education programs will move on to advance education in NASA-related fields. (Objective 1.2)
INSGC Objective 1-E: At least 25 underrepresented and underserved students (minimum 30% of total) will participate in NASA-funded higher education programs.

As indicated below, 56% of scholarship, fellowship, and internship students funded to date are underrepresented minorities (76 total). This figure does not include all students funded in undergraduate research programs or other faculty-led program awards. Preliminary data indicates that INSGC will achieve 2012-13 targets for INSGC Objectives 1-C, 1-D, and 1-E.

INSGC Objective 1-F: At least 2 new or revised course targeting STEM skills needed by NASA will be created through INSGC support. (Objective 1.4)

The Northern Indiana Groundwater Modeling Consortium, which is a collaboration between Valparaiso University and Ball State University, is an interdisciplinary effort of the Department of Mathematics and Computer Science on the subject of groundwater flow. As part of this effort, a curriculum for STEM students and faculty devoted to computational and mathematical groundwater flow modeling has been developed for utilization at both campuses.

NASA Education Outcome 2: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty (Educate and Engage)

Pre-college/Higher Education/General Public
2.1 Educator Professional Development – Provide short duration professional development and training opportunities to educators, equipping them with the skills and knowledge to attract and retain students in STEM disciplines.
2.3 Curricular Support Resources – Provide curricular support resources that use NASA themes and content to a) enhance student skills and proficiency in STEM 3 disciplines; b) inform students about STEM career opportunities; and c) communicate information about NASA‟s mission activities.
2.4 Student Involvement K – 12 - Provide K – 12 students with authentic first hand opportunities to participate in NASA mission activities, thus inspiring interest in STEM disciplines and careers; Provide opportunities for family involvement for K – 12 students learning in STEM areas.

Beginning in 2010 and continuing into 2012, INSGC has more strongly emphasized a focused portfolio of in-service and pre-service teacher training experiences and K-12 activities. INSGC partnered with informal education providers at Outreach Affiliates, as well as College of Education contacts at Academic Affiliates, to submit a proposal for pre-service teacher training to the Innovative Pilot in STEM Education CAN.

INSGC Objective 2-A: At least 75% of elementary and secondary educators who participate in two or more NASA training programs will use NASA resources in their classrooms. (Objective2.2)

INSGC Objective 2-B: At least 60% of elementary and secondary educators who obtain NASA content-based education resources or participate in short-duration NASA education activities will use NASA resources in their classroom instruction. (Objective 2.1)

INSGC Objective 2-C: At least 50% of students will express interest in science, technology, engineering, and math (STEM) careers following their involvement in elementary and secondary education programs. (Objective 2.3)

INSGC Objective 2-D: At least 500 elementary and secondary students will participate in INSGC instructional and enrichment activities. (Objective 2.4)

The FIRST Robotics Boilermaker Regional Competition was held in March 2013 and hosted 1500+ K-12 students (not including parents and other visitors) to Purdue Armory; Purdue Fall Space Day hosted over 650 K-12 students in October 2012. These two events more than demonstrate achievement of INSGC Objective 2-D. Annual assessments of Space Day participants provide ongoing evidence of the positive effects of that program on K-12 participants. Additional questions were asked on the affiliate final reporting templates for Objectives 2-A through 2-C and will be included in INSGC's final report. Projects were encouraged to include specific assessments on these objectives; for example the *Foundations in Science and Mathematics* project at Indiana University developed a survey for participants to track Objective 2-C. Initial feedback from affiliates (especially Outreach Affiliates) suggests that Objectives 2-A and 2-B might be better evaluated on a multi-year longitudinal basis, due to the issues of implementing new curriculum elements within a specific academic year.

NASA Education Outcome 3: Build strategic partnerships and linkages between STEM formal education providers that promise STEM literacy and awareness of NASA's mission (Engage and Inspire)

General Public/External Relations

3.1 Resources – Provide informal education support resources that use NASA themes and content to 1) enhance participant skills and proficiency in STEM disciplines; 2) inform participants about STEM career opportunities; and 3) communicate information about NASA's mission activities.

3.2 Professional Development for Informal Education Providers – Provide opportunities to improve the competency and qualifications of STEM informal educators, enabling informal educators to effectively and accurately communicate information about NASA activities and access NASA data for programs and exhibits.

INSGC has supported the Brownsburg Challenger Learning Center during its period of transition out of the Brownsburg School Corporation., Partnerships with INSGC Outreach Affiliates include a new opportunity for a space-themed exhibit and NASA content for the Children's Museum of Indianapolis. INSGC support of the "Rockets 2 Racecars" NASA exhibit at the Celebrate Science program in Indianapolis adds to a developing new focus on STEM and motorsports including efforts unique to Indiana.

INSGC Objective 3-A: At least 4 museums and science centers in Indiana will actively engage the public in major NASA events, with exposure of at least 1000 persons to STEM content and educational opportunities available through INSGC. Objective 3.2)

INSGC Objective 3-B: At least 25 informal educators will report increased efficacy as a result of INSGC supported professional development. (Objective 3.2)

The Outreach to Space exhibit at Science Central has hosted approximately 15,000 (through Jan 13) visitors; IMAX Theater in Indianapolis hosted the viewing of Space Junk the movie to over 4,000 people in which 75% of the total were K-12 students. By the end of our funding year, IMAX expects to have over 5,000 visitors to view Space Junk.; HASTI which will take place in March 13 in Indianapolis is expected to draw several thousand teachers/pre-service teachers; and NASA Learning Environments & Research Networks (LE&RN) "Rockets 2 Racecars" STEM education program participated in the Celebrate Science Indiana event held on October 7, 2012. The event was attended by over 3,000 families, children, and teachers. Rockets to Race Cars provided a teacher workshop where local teachers had the opportunity to work through the new revised Curiosity Rover Engineering Design Challenge. Thus INSGC Objective 3-A has already been documented. To date (April 16, 2013) INSGC is still connecting with our Outreach Affiliates in capturing and documenting at least 25 informal educators with increased efficacy as a result of INSGC supported professional development. (Objective 3-B).

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, & 3)

One of the major goals for INSGC is to increase our benefit and impact to engage STEM Education across the State of Indiana. Particularly due to the fact that Indiana does not have a NASA center within the state, INSGC can be the voice of NASA and a connector of NASA activity to STEM education priorities within the State, giving Indiana residents the opportunity to learn about NASA's mission and goals, and increasing the appreciation for NASA and it's many accomplishments and resources. In taking a more active and visible role within the state, INSGC will increase its exposure and value. This has led to development of key relationships with individuals and programs that have similar goals and interests, whereby we can leverage the financial strength of the programs, attain synergy and improve results while minimizing the budgetary impacts.

For the 2012-2013 year, INSGC has awarded funding to projects within the targeted outcomes in alignment with our proposed allocation percentages. The outcomes and current and proposed funding percentages are as follows:

- Outcome 1 (scholarship/fellowship/internships, plus other projects): Current 77%, Proposed 75%
- Outcome 2: Current 23% Proposed 24%
- Outcome 3: Current ~0% Proposed 1% (Note: This year's reduction of funding for Outcome 3 was designed to compensate for the high funding of Outcome 3 in Year 2. This allows our overall 5 year grant percentage to fall to the proposed level.)

Highlights and Anecdotes
The following information is not an exhaustive list, but is representative of the significance and benefits of the INSGC programs arranged by outcome.

NASA Outcome 1

Scholarship/Fellowships/Internships
The competitive awarding mechanism for INSGC scholarship and fellowship support includes students at affiliate's institutions across the state of Indiana. The overall demographics for the 63 scholarship, internship, and fellowship awardees show 48% female participants and 55% underrepresented minority (URM) participants. NASA internships are placed and supported based on selections by NASA Centers; corporate internships within Indiana were not placed in 2012-2013.

Higher Education
Analysis of Gamma-ray Emission from Supernova Remnants, and Next generation Detector Development: Anderson University along with Purdue University has been working together on two aspects of the VERITAS program. The first task had the students analyze new data accumulated by the collaboration on Pulsar Wind Nebulae and Millisecond Pulsar systems in the Very High Energy Gamma-ray band. The second task was to develop a testing procedure, including two implementation of new hardware and

software, to test photo-multiplier tubes; both as an assessment of now obsolete tubes from VERITAS experiment, as well as testing of newer iterations of the technology for deployment in future experiments. Student teams from both institutions have accumulated the necessary VERITAS data and have conducted initial analyses of the sources of interest. Deeper, more advanced, analyses are ongoing. Plans for publication of the results obtained are in process, and will likely be combined with analyses of other related sources.

Research Infrastructure

Student Research Program on Energy for Aerospace Applications: Indiana University Purdue University Indianapolis (IUPUI); The Purdue School of Engineering and Technology in partnership with the Lugar Center for Renewable Energy (LCRE) at IUPUI educated students in the growing importance of energy, focusing on aerospace applications; and providing cutting edge research opportunities in emerging energy fields. Five multidisciplinary student researcher teams were formed and are working on lithium-ion battery, fuel cell, thermal barrier coating, hydrogen transport membrane, and electron-beam physical vapor deposition. The research results are expected to be posted to the internet as well as publication of conference papers and journal articles along with having conference papers and/or journal papers published.

NASA Outcome 2

Pre-College

Balloon Launches: Valparaiso University (VU) have developed and implemented a research project led by undergraduates from VU that will involve innovative balloon payloads and integrate with local middle and high school students. Two events have taken place on the University of Valparaiso campus; The Northwestern Indiana Science Fair (February 23, 2013) and the Met Field day (April 2, 2013) with hundreds of students in attendance. These events consisted of 2 balloon launches with radiosondes and ozonesondes. A background information session, tutorial on science relevant to the data collection, and assessment materials were also provided.

FIRST Lego League and FIRST Robotic Competition: Purdue University hosted the FIRST Lego League Competition on November 17, 2012. Approximately 65 college students participated along with 40 teams consisting of ten 10-13 year old K-12 students. The undergraduate students mentored and partnered with the student participants, dedicated teachers, and parents in an effort to promote further STEM education, community service and leadership opportunities. Purdue University hosted the FIRST Robotic Competition on March 14-16, 2013. Approximately 1000 high school students, teachers, parents, and siblings attended. The top four winning teams from Indiana FIRST Robotics were comprised of 153 team members, including 40 females, and 41 URM. These team members will be representing the State of Indiana and STEM education at the World Series Competition being held in St. Louis, MO April 13.

Foundations in Science and Mathematics: Indiana University summer program consisted of preparatory courses in science and mathematics for high school students. Courses were held during two separate two-week sessions in June and July 2012. The program included introductory and advanced courses in chemistry, biology, physics, pre-calculus and calculus. There were 103 high school students in attendance that participated in more than one course. Pre- and post-test and surveys were completed by all in attendance providing positive feedback with participants indicating that the summer program better prepared them to succeed in high school math and science. IU attained the goal of increasing student interest in STEM education, STEM careers, and stronger self confidence in students. An article was published in "The Physics Teacher" May 2012, for the 2011 Foundation in Science and Mathematics program. IU is currently working on a scientific article for the 2012-2013 program which they expect to publish in a similar journal.

Nanotechnology Space Consortium Summer Scholars Program; Indiana University Purdue University Indianapolis (IUPUI) provided educational opportunities for K-12 students to inspire them to pursue STEM disciplines through the interdisciplinary field of nanotechnology. Five students from Indianapolis-area underserved high schools attended a week-long IUPUI Nanotechnology Discovery Academy (NDA) summer day camp. IUPUI partnered with the Center for Research and Learning and the Integrated Nanosystems Development Institute to provide activities such as fabrication and testing of fuel cell and solar cell devices, lectures, and field trips to campus labs. The participants presented their work to family members and the IUPUI community in a culminating NDA poster presentation and project demonstration event. Each student earned one fully-transferrable college credit in either science or engineering upon successful completion of the program.

Nanotechnology Space Consortium Summer Teachers Fellow Program: Indiana University Purdue University Indianapolis (IUPUI) provided professional development opportunities for K-12 teachers that will equip them to inspire students to pursue STEM disciplines. During the summer of 2012, 16 local high school math and science teachers participated in the Integrated Nanosystems Development Institute (INDA) to discover innovative technologies and learn about new frontiers in the STEM disciplines. This included fabricating and testing fuel cells and solar cells, attend researcher presentations, and field trips to campus labs. The participants along with campus faculty mentors, compiled a virtual "resource library" of popular and scholarly books, articles, websites, movies and other resources on nanotechnology topics.

Hoosier Association of Science Teachers: HASTI: is a state chapter of the National Science Teachers Association (NSTA). The HASTI event was held February 6-8, 2013 in Indianapolis. INSGC supported Bonnie Murray, NASA's Rockets to Racecars program to speak and run a four hour short course for formal and informal educators. At the time of this writing we do not have all detailed reporting from this event, but HASTI attendance was estimated at 2,000.

The Great Moonbuggy Race 2013: Purdue University Calumet (PUC) is a continuation of the participation in the NASA sponsored race held annually in Huntsville, AL. The Great Moonbuggy Race is used as a design project for students in various fields of engineering and engineering technology in designing a Moonbuggy for the annual competition. The 2013 race will take place from April 25–27, 2013. Results and outcome student participation numbers will be reflected in the final reporting.

NASA Outcome 3

General Public / Informal Education

Purdue Space Day (PSD): Purdue University presented its 17th annual outreach event on October 20, 2012. A total of 576 grade school children from 3rd through 8th grade attended the event. Three hands-on STEM activities were provided throughout the day. PSD also presented three guest astronauts; Andrew J. Feustel, Ph.D., Scott Tingle (Commander, USN), and David Wolf (BESS, M.D.) provided educational talks and interacted with participants. There were 180 college, high school and faculty volunteers in attendance for 2012. Over the past 17 years, PSD has touched 6,570 grade school students and 2,116 Purdue students, local high school and faculty volunteers. These volunteers present creative ways to excite the grade school students to think about future careers in NASA-related research areas.

Outreach to Space; (OTS) Science Central has taken interactive exhibits, designed and built by San Francisco's famed Exploratorium with original project support from the National Science Foundation to eight different fairs, festivals and school events impacting over 15,000 people in both urban and rural settings. Two new kiosks were purchased in 2012 to create two new exhibits: a Meteorite Exhibit and a Robotics Exhibit. Their hands on exhibits allow people to make connections to real world concepts, and to initiate the "fun factor" where visitors discover science is fun. Science Central expects to have reached over 18,000 visitors with these exhibits by INSGC year-end of May 16, 2013.

Personal Statements

INSGC takes great pride in the positive influence on the lives of the people served. A few of the many outstanding comments regarding the role of INSGC funding in supporting their education are shown below.

Seth Frey (Fellowship, Indiana University) The project titled "Preventing Vicious Cycles in Sophisticated Groups and Swarms" will analyze data from two current experiments; statistically document sustained non-convergence to equilibrium and compare three competing models of reasoning. Seth will also simulate data from the three models to compare their attractor structures, synthesize the results of the research conducted for the first two objectives in a review that addresses the relevance to NASA activities, and communicate the ties between game theory and NASA to a general audience by writing a

monthly blog and Facebook posts. A manuscript demonstrating Empirical demonstration of non-equilibrium dynamics in human game learning is currently in press (PLoS One).

Kristina Hammond (Fellowship, Indiana State University) Since May 2012, I have presented preliminary result findings on my project titled "Summer Indiana Bat Ecology in the Southern Appalachians; An Investigation of Thermoregulation Strategies and Landscape Scale Roost Selection" at three conferences. I also helped with the Indiana bat roost workshop with the US Forest Service. This was all because of the funding by INSGC.

Nathalie Haurberg (Fellowship, Indiana University) I have been working on "Understanding the Stellar Populations in the Lowest Mass Galaxies." With the support of INSGC, I will complete my work on time and defend my dissertation in August 2013. During the time working on this project, I have finalized a related project and completed a paper that will soon be published in the Astrophysical Journal (paper has been accepted, awaiting publication),

PROGRAM ACCOMPLISHMENTS

To date, (April 16, 2013) and for the grant year May 17, 2012 through May 16, 2012, this grant has enabled INSGC to fund over $389,000 in program awards with $236,000 in projects, $143,500 in scholarships/fellowship awards and $9,500 in internships.

NASA Outcome 1:

Higher Education
The funding from INSGC has enabled many of our affiliates to participate in Higher Education Projects. These projects focused on Affiliate strengths in engineering, environmental studies, mathematical studies, electrical and chemistry focuses, and lunabotics.

1.1 Faculty and Research Support
INSGC has provided the following NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows.

- Characterization of Catalytic Activity-Purdue University; develop a better understanding of the muscle-specific deubiquitinase (DUB) Usp25m.
- Space Exploration Vehicle Structures-Indiana University Purdue University Indianapolis; provide space exploration vehicle (SEV) designers with computational tools to generate high-performance, non-intuitive shapes and configurations.
- MURI Discovery-Indiana University Purdue University Indianapolis; undergraduate research in multidisciplinary areas

- Observational Astronomy Research by Undergraduate Students-Ball State University; undergraduate research opportunity in science and technical careers.
- Analysis of gamma-ray Emission from Supernova-Anderson University; students will have the opportunity to investigate the connection between very high-energy gamma-ray emission and cosmic ray measurements using VERITAS.

1.2 Student Support

Scholarships / Fellowships – INSGC ran its open competition for the 2012-13 award year from December 1, 2012 through February 24, 2013. As noted in last year's report, we have been working closely with our affiliates to improve the quality of the proposals and to foster communication at the affiliate institutions to broaden the scope of projects and include more fields within STEM. As part of this effort, the guidelines and qualifications documentation provided to applicants was significantly revised for this year's competition. As a result, we received slightly fewer applications and proposals for scholarships, fellowships, and research/outreach proposal funding, but the applicants were much more highly qualified with stronger applications and the proposal quality was notably higher this year. Diversity was also significantly improved in both scholarship/fellowship applicants (in terms of gender, URM, and STEM majors represented) as well as in research and outreach proposals. We received 36 scholarship/fellowship applications in 2009-2010, 64 in 2011-2012, 103 in 2012-2013, and 83 for 2013-2014. In 2011-2012 we received 33 research/outreach proposals, 43 in 2012-2013, and 36 for the 2013-2014 funding cycle. INSGC supports the summer interns, Virgil "Gus" Grissom Memorial Scholarships and Diversity Enhancement scholarships.

Projects – INSGC provided NASA competency-building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education.

- Purdue Space Day – Purdue University, undergraduate participation in leading general public / K12 event with a space and aerospace engineering theme.
- Discovery Park Undergraduate Research Initiative (DURI) – Purdue University; Undergraduate research in multidisciplinary areas.
- Matching funds for Undergraduate research Grant Program – Purdue Calumet; Funds to help reduce the cost associated with undergraduate research projects.
- Diversity Equity and Minority Affairs STEM Initiative (DEMA) – Indiana University; Summer research program for students of Historically Black Colleges and Universities (HBCUs) and IU

1.3 Student Involvement in Higher Education

INSGC has been able to provide many opportunities for groups of post-secondary students engaged in authentic NASA related mission-based activities.

- Undergraduate Research in Observational Astronomy-Ball State University and Valparaiso University; Undergraduate research in binary star systems
- NASA Lunabotics Mining Competition-Purdue University; engaging STEM students to design and build a lunar excavation device which can do specific tasks in a competition.
- MATE ROV Competition- Purdue University; Design and build a ROV that can do specified competition tasks
- Able Flights-Purdue University; allowing students with disabilities a unique way to challenge themselves through flight training.
- Indiana Geographic Information Council (IGIC) College Space Grant Competition-Indiana University Purdue University Indianapolis; Competitive award focused on geospatial activities, while furthering STEM educational objectives and integrating business objectives of state and local communities.
- Multidisciplinary Instrumentation Student Projects-Trine University; Electrical and Computer Engineering (ECE) students along with chemistry students build instrumentation systems including a data acquisition (DAQ) software and learn experimental techniques.

1.4 Course Development (Educate)

INSGC is able to provide course-resources for integration into STEM disciplines.

- Initiation of Northern Indiana Groundwater Modeling Consortium-Valparaiso University and Ball State University; To initiate inter-institutional cooperation between students and faculty in the Department of Mathematics and Computer Science on the subject of groundwater flow; creating a curriculum for STEM students and faculty devoted to computational and mathematical groundwater flow modeling.

Research Infrastructure

1.5 Targeted Institution Research and Academic Infrastructure

- Undergraduate Research in Observational Astronomy Using the SARA Telescopes in AZ and Chile-Valparaiso University

NASA Outcome 2

Pre-College

Pre-College programs emphasized the support of activities for K-12 students to participate in STEM related activities and increase enthusiasm to pursue STEM majors at the university level. These programs include:

2.1 Educator Professional Development-Short Duration

- Electromagnetic Waves-Indiana Purdue Fort Wayne; 3-day teacher training workshop in the field of physics to develop classroom programs.
- Rockets to Race Cars-NASA; Teacher workshop providing STEM education activities through Rockets to Racecars program and Curiosity Rover Engineering Design Challenge.

2.3 Curricular Support Resources

- Hoosier Association of Science Teachers, INC (HASTI) - Curriculum distribution and training for K-12 science teachers.
- Space Junk-IMAX; film on orbiting debris threatening the safety of earth's orbit.

2.4 Student Involvement K-12

- FIRST activities- Purdue University; FIRST Lego League and FIRST Robotics Competition to engage, inspire and mentor K-12 students.
- Summer Prep Classes in Physics and Mathematics- Indiana University Purdue University Indianapolis; summer prep camp for high school students as an introduction to physics and advanced math.
- Electromagnetic Waves-Indiana Purdue University Ft. Wayne; High school students attended workshops providing hands on experience with RFID development kits.
- Balloon Launches-Valparaiso University; Provided balloon launches for local middle and high school students to help instill excitement about STEM.
- Foundations in Science and Mathematics-Indiana University; summer program of preparatory courses in science and mathematics for high school students.
- Nanotechnology Space Consortium Summer teacher Fellows Program- Indiana University Purdue University Indianapolis; Underserved high school teacher training in nanotechnology.

General Public-Informal Education

2.4 Student Involvement K-12

- Outreach to Space-Science Central; Funds for 10-13 interactive astronomy exhibits geared for the general public.
- Rockets to Race Car-NASA; Display booth and interactive computer allowing K-12 students to experience the R2R website, a video comparing the kinetic energy of Mars and provide live viewing of a shuttle tire and a NASCAR tire.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

Student Data and Longitudinal Tracking: INSGC continues to update and follow current and previous significant awardees with our longitudinal tracking surveys and Facebook connections. We have been successful in tracking >82% of the significant awardees since 2005 and>75% of the significant awardees since 1995.

Diversity: INSGC continues to exceed targets for ethic and gender diversity of student participants; over 48% of scholarship and fellowship awardees are female, and over 55% are members of underrepresented minorities.

Matching funds: Complete accounting of matching funds was not available at the time of this report (April 16, 2013). However, projected match for base program funds awarded was $457,828, or a ratio of 1.9:1 for NASA funds.

Minority Serving Institutions: INSGC does not have a designated Minority Serving Institution among its academic affiliates; no Historically Black or Hispanic Serving Institution with a focus on STEM degrees exist in the state. However, both Purdue and Indiana University (where the overwhelming majority of underrepresented STEM minorities are enrolled) have strong relationships with minority serving institutions in other states. INSGC does partner with Diversity, Equity and Minority Affairs (DEMA) where we are able to reach several underrepresented students from eight different campuses throughout the US who come to IU for the opportunity to conduct research and receive mentorship from faculty in diverse areas of study. This provides an opportunity for undergraduate underrepresented minority students in STEM fields to experience what it would be like to pursue a graduate degree in their field of research.

NASA Education Priorities: The projects funded by INSGC are in strong correlation with NASA Education Priorities and NASA mission efforts and program competitions; examples are provided below.

- The Purdue IEEE ROVE team built an underwater ROV for a themed competition where each of the 16 members must contribute from design to a final assembled vehicle.

IMPROVEMENTS MADE IN THE PAST YEAR

Since May 2012, INSGC has become more active in partnering with other Indiana networks and organizations to integrate and promote STEM K-12 education initiatives around the State. In several cases (e.g., STEM Action Coalition for Today; Techpoint Foundation), INSGC responded to requests from these organizations to play a critical role based on prior INSGC history of program awards, involvement, and affiliate network coordination. In other cases (e.g., Indiana Motorsports STEM (M-STEM); Innovative STEM Pilot proposals), INSGC proactively approached other groups to help improve the

leveraged execution of INSGC mission activities. Existing partnerships and collaborations allowed INSGC to submit two Innovative STEM Pilot proposals, each involving over eight INSGC Affiliates and multiple INSGC Partners. The Indiana M-STEM initiative was already ongoing; INSGC will be integrating NASA content regarding spinoff technologies applied to motorsports to help advance this initiative and curriculum development with a relatively modest additional INSGC / NASA funding requirement.

As previously noted, INSGC began using analytics on our website in 2010 to track and compare usage. Website traffic has increased each year since tracking began, with this year's increase doubling the increase for last year. This year's comparison of the sources of traffic within the State of Indiana shows that the coverage is expanding to more areas. This demonstrates the increase of awareness, relevance, and utilization throughout the state. We attribute some of our additional involvement in statewide partnerships to this increased awareness and utilization through the INSGC website and other social media (including blog entries and Facebook page updates).

At the April 12, 2013 Affiliates Meeting, INSGC staff distributed a staff evaluation survey to all affiliates in attendance. This evaluation survey is intended to serve as a determination of improvements achieved, and additional priorities for improvement, in management functioning during the current program year. As of April 16, 2013, INSGC is processing the results of 13 surveys returned to the evaluation liaison (Dr. Anna Douglas).

Also at the April 12 Affiliates Meeting, there was a discussion of the nature of affiliate membership, and requirements for affiliates to remain in good standing. A committee was formed to update guidelines and procedures for affiliate membership; their results should be available for review, discussion and approval by the fall 2013 teleconference meetings. Affiliates voted to remove one affiliate for non-participation and non-payment of dues for at least three years. In addition, affiliates emphasized that INSGC should not restrict or discourage potential affiliates from application just because of the number of current affiliates. (In other words, there is no strict determination of "full capacity".)

After a period of transition in College of Engineering business operations, the Lead Institution (Purdue University) has provided a dedicated business staff to assist INSGC in project financial analysis, account management, and transaction processing. This staff member, Jami Butler, is provided to INSGC at no additional cost to the Consortium, and represents improvements in access, transparency, and timely processing of INSGC account activity. Ms. Butler works extensively with INSGC Director Caldwell and INSGC Operations Coordinator Verissimo to maintain updated accounts and transaction histories. Ms. Butler began working with INSGC in this role in summer 2012, and will continue indefinitely.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

INSGC office engages the Affiliates to work with our office to discuss and contribute to the strategies of the consortium.

All Affiliates (Academic, Outreach, Corporate) have voting rights and responsibilities approving strategic directions and Consortium program decision discussed at Affiliate Meetings. INSGC generally holds two affiliates meetings per year. In the fall, the annual Fall Teleconference is conducted in two phases: one teleconference is focused on Academic Affiliates, while the second is focused on Outreach Affiliates. The Spring Affiliate meeting is generally held on the campus of one of the Affiliates. The 2013 Annual Affiliate meeting was held at Ball State University in Muncie, Indiana on April 12, 2013. Multiple offers have been made for the 2014 meeting; a tentative plan is to hold the 2015 meeting at the University of Southern Indiana in Evansville.

INSGC now has both Consortium Affiliates and Consortium Partners, reflecting the greater variety of relationships and program integration activities across Indiana. New partnerships over the past year have been developed to support a statewide "STEM Action Coalition for Today" (STEM-ACT). Our major partners with this effort include the Indiana Afterschool Network and Wisdom Tools, as well as the ISTEM Program housed at Purdue. The list of INSGC Affiliates, as of April 16, 2013, is provided below. A list of current Affiliates by type follows:

Academic Affiliates
Purdue University – *Lead Institution*
Anderson University (John Millis)
Ball State University (Ronald Kaitchuck)
Indiana State University (Susan Berta)
Indiana University – Bloomington (Paul Edwards)
Indiana University Purdue University Fort Wayne (Jihad Albayyari)
Indiana University Purdue University Indianapolis (David Coats)
Purdue University Calumet (Adam Rengstorf)
Purdue University College of Technology at Columbus (Jack Head)
Saint Joseph's College (Jennifer Coy)
Taylor University (Jeff Dailey)
Trine University (Jamie Canino)
University of Evansville (Phil Gerhart)
University of Southern Indiana (Glenn Kissel)
Valparaiso University (Bruce Hrivnak)

Outreach Affiliates
Brownsburg Challenger Learning Center (Mary Patterson)
Children's Museum of Indianapolis (Michele Schilten)
Challenger Learning Center of Northwest Indiana (Rebecca Manis)
Ethos, Incorporated (Patsy Boehler)
Evansville Museum (Mitch Luman)
IMAX Theater (Craig Mince)
Indiana State Museum (Peggy Fisherkeller

Indiana Challenger learning Center of Decatur Township (Cyndy Meier)
Science Central (Martin Fisher)
Terre Haute Children's Museum (Lynn Hughes)

Corporate Affiliates
StratoStar Systems (Jason Kruegger)

Partners
Indiana Afterschool Network (Debbie Zipes)
ISTEM-Purdue University (William Walker)
Wisdom Tools (Sony Kirkley)

Below is a valid signature from Barrett S. Caldwell indicating submission of this progress report.

Submitted on behalf of Indiana Space Grant Consortium

Barrett S. Caldwell, PhD, Director
Indiana Space Grant Consortium

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.