The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) 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.

Indiana Space Grant Consortium
Lead Institution: Purdue University
Director: Dr. Barrett Caldwell
Telephone Number: (765) 494-5873
Consortium URL: www.insgc.org
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 2014.

PROGRAM GOALS

INSGC Goals are as follows:

- *be a preferred source of information, materials, and opportunities for inspiring, preparing, and supporting individuals for NASA-related STEM education / careers.*
- *be an effective and preferred vehicle for enhancing the engagement of K-20 educators and students in NASA-related STEM activities and opportunities.*
- *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, Higher Education Projects, Research Infrastructure

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 funds to support student participation in authentic hands-on experiences at NASA centers or industry partners, and team-based project activities that may occur on academic campuses.

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

INSGC Scholarship and Fellowship applicants are managed through an open competitive application process. Each campus with two applicants is guaranteed one undergraduate scholarship, ensuring awards for all academic affiliates.

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

RI funds are prioritized toward supporting young faculty and student involvement in STEM research activities at our smaller undergraduate and regional campus academic affiliates. This year the Unmanned Aerial System Interdisciplinary Knowledge Group formed at Ball State University to conduct research and educational activities.

INSGC Objective 1-A: Faculty/researchers/doctoral fellows receiving INSGC funding report increased research capacity/competency as a result of awards. (Objective 1.1)

INSGC strongly supports publication from faculty, researchers and doctoral fellows.

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)

Achievement of INSGC Objectives 1-A and 1-B has been achieved according to received progress reports and other contacts with higher education program students.

INSGC Objective 1-C: At least 60% of higher ed program participants seek employment with NASA, aerospace, universities, or educational institutions. (Objective 1.2)

INSGC Objective 1-D: At least 40% of undergraduates participating in higher education programs will move on to advanced education in NASA-related fields. (Objective 1.2)

INSGC Objective 1-E: At least 25 underrepresented/underserved students (minimum 30% of total) will participate in NASA-funded higher education programs.

59% of scholarships, fellowships, and internships are to URM, and 53% are female.

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

Current projects resulted in 2 new or revised courses: 1.) Valparaiso University Autonomous Control Table (VU-ACT) ME - 444 laboratory, and 2.) Development of Electromagnetics Visualization Laboratory Course for High School Students.

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

2.1 Educator Professional Development –short duration development/training to educators, equipping them with skills and knowledge to attract and retain students in STEM disciplines.

2.3 Curricular Support Resources – Provide resources using NASA themes and content to enhance student skills and proficiency in STEM disciplines, inform students about STEM careers, and communicate information about NASA's mission activities.

2.4 Student Involvement K–12 - Provide K–12 students with first hand opportunities to participate in NASA mission activities, inspiring interest in STEM disciplines and careers; Provide opportunities for family involvement for K–12 students learning in STEM areas.

INSGC has emphasized in-service and pre-service teacher training experiences and K-12 activities. Two projects for 2014: Increasing Capacity in STEM Fields through Authentic Research Activities in Small Scale Sustainable Agriculture including a workshop for in-service teachers on field research in classrooms, and Nanotech Summer Fellows Program at IUPUI, for high school math/science teachers to attend IUPUI Nanotechnology Discovery Academy (www.crl.iupui.edu/nanotech.asp).

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 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)

Ball State University developed The New Charles W. Brown Planetarium portable, hands-on activity stations designed to facilitate STEM learning for underrepresented and underserved students and educators. Also, The Purdue Fall Space Day hosted 650 K12 students in 2014 with 230 undergraduate volunteers.

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)

3.1 Resources – Provide informal education 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 –improve competency and qualifications of STEM informal educators, enabling them to effectively communicate information about NASA activities and data for programs and exhibits.

Observational Astronomy for Research and STEM Engagement by Undergraduate Students at Valparaiso University allowed ~500 participants from the general public to become more familiar with the cosmos and more supportive of NASA's mission.

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)

Evansville Museum of Art History and Science secured the movie *To Space & Back*. Science Central participated in the Kid Zone at the Brickyard 400 NASCAR event including NASA-related activities utilized by hundreds of school-age children. The IMAX Theater held a special screening of *Interstellar*, with presentations by Affiliate Director John Millis (Anderson University) and Director Barrett Caldwell.

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

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

For 2014-15, INSGC has awarded funding to projects within the targeted outcomes in alignment with our proposed allocation percentages (Outcome 1: Current 75%, Proposed 75%; Outcome 2: Current 24%, Proposed 24%; Outcome 3: Current ~1%, Proposed 1%)

NASA Outcome 1
Scholarship/Fellowships/Internships: The competitive award mechanism for scholarship/fellowship support includes students at institutions across the State. Awardees were 53% female and 59% underrepresented minority (URM). NASA internships are placed and supported based on selections by NASA Centers.
Higher Education Anecdote: *Get Technical (Purdue University Calumet)* - The Get Technical project is a continuation of an outreach and community involvement program that the College of Technology and the Department of Engineering Technology of that school offered last summer at the Purdue University Calumet (PUC) Campus in Hammond, Indiana. More than a dozen faculty and staff and several graduate students from the department together with more than 100 high school and junior high school students from Northwest Indiana explored the science, technology, engineering and math (STEM) fields of Engineering and Technology using the facilities, equipment, and laboratories of the College of Technology. Staffs from the non-profit Challenger Center and Planetarium were also included to expand into astronomy or planetary science.

NASA Outcome 2: **Pre-College Anecdote:** *8th Annual Indiana Bat Festival (Indiana State University)* - The ISU Center for Bat Research, Outreach, and Conservation invited members of a 3rd grade class that had completed a 5 month long expeditionary study of bats and their teachers from Inspire Academy in Muncie, Indiana, to attend the 8th Annual Indiana Bat Festival in Indianapolis, Indiana. Their final project was developing a song about bats to deliver facts about bats in general and the Indiana bat in particular. The music video was posted to You Tube and quickly became an internet sensation (http://youtu.be/VUHQh0fm9Dw). For the students, largely from underprivileged backgrounds, this was a day to be immensely proud of their hard work and further develop their professional and intellectual skills. Over 550 people attended the festival.

NASA Outcome 3: **Informal Education Anecdote:** *To Space and Back (Evansville Museum)* –From the Franklin Institute in Philadelphia, film describes how technology that transports us through space is paving the way for the devices and apps we use every day. The film is strong in science, technology and engineering.

PROGRAM ACCOMPLISHMENTS

Outcome 1: Higher Education
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. *MURI Discovery* (IUPUI) - undergraduate research in multidisciplinary areas; *Computational Materials Chemistry and Physics Research and Instruction* (Valparaiso University)- collaboration between the Depts of Chemistry and Physics.

1.2 Student Support

Scholarships / Fellowships – INSGC received 86 scholarship/fellowship applications in in 2014-2015 including 4 Virgil "Gus" Grissom Memorial Scholarships. In 2014 we received 42 research/outreach proposals. INSGC also supports a number of summer interns at NASA Centers (7 in 2014).

Projects – VOSS Dedication Student Support –The VOSS Model is a scaled model of the solar system aiding education, research, and outreach in STEM and dedicated to former astronaut Janice Voss; Matching funds for URGP (Purdue Calumet) - Funds to help reduce the cost associated with undergraduate research projects; RGEFP (Purdue) - to propose, design, build, fly, and publish data from an experiment in reduced gravity. The team has also held several outreach events; The NASA Human Exploration Rover Challenge (Purdue Calumet) - team participation in a NASA sponsored race.

1.3 Student Involvement in Higher Education

INSGC provided many opportunities for groups of post-secondary students engaged in authentic mission-based activities. *SARA (Valparaiso and Ball State)*- Membership provides access to two research-quality telescopes for faculty and student research and used in general education, outreach, and research programs; *Observational Astronomy for Research and STEM Engagement (Valparaiso*)- research experience for undergraduate STEM majors and engagement experience for non-STEM majors; *Improving STEM Student Retention via Early Research Engagement (Valparaiso University)*- brings freshmen into the lab during the academic year, giving them a taste of research early in order to improve retention; *Orion Launch Event and Convos Events (Purdue University)*- A live viewing of the Orion launch, String theorist and author Brian Greene, one of the world's leading theoretical physicists presentation, and the tale of deep-sea explorer Alvin Sputnik was part of the Lafayette Three Stories High Film Festival.

1.4 Course Development (Educate)

INSGC is able to provide course resources for integration into STEM disciplines. *Valparaiso University Autonomous Control Table* to design, manufacture, and test control platforms utilized in Valparaiso University's ME - 444 laboratory and in CoE tours; *Development of Electromagnetics Visualization Laboratory Course for High School Students (IPFW)* demonstrating the principles of physics and electromagnetics.

Research Infrastructure

1.5 Targeted Institution Research and Academic Infrastructure

Unmanned Aerial System (UAS) Interdisciplinary Knowledge Group (Ball State University)- members from disciplines including computer science, environmental management, telecommunications, criminal justice, geo-science, and agriculture.

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

2.2 Educator Professional Development – Long Duration

*Nanotechnology Space Consortium Summer Teachers Fellow Program (*IUPUI)- provide professional development opportunities for K-12 teachers linking the multidisciplinary field of nanotechnology to grade-level math and science standards.

2.3 Curricular Support Resources

Charles W. Brown Planetarium STEM Activity Stations (Ball State)- to facilitate STEM learning for underrepresented and underserved students/educators;

The Valparaiso University Autonomous Control Table (VU-ACT) - utilized in Valparaiso University's ME - 444 laboratory.

2.4 Student Involvement K-12

Foundations in Science and Mathematics (Indiana University) - summer program in science and math for high school students; *Nanotechnology Summer Schools Program*(IUPUI)- spark interest in STEM through nanotechnology; *Purdue Space Day* (Purdue University) - undergraduate participation in leading general public / K12 events; Four Indiana FIRST robotics teams were supported to attend the National Championship in Saint Louis; *Get Technical* (Purdue Calumet) - faculty, staff and graduate students worked with students from Northwest Indiana; *Increasing Capacity in STEM Fields through Authentic Research and Hands-On Activities in Small Scale Sustainable Agriculture* (Saint Joseph's College*)* - a composting workshop was directed by students for Rensselaer Middle School; *8th Annual Indiana Bat Festival* (ISU)*;* The ISU Center for Bat Research, Outreach, and Conservation invited students and teachers from Inspire Academy in Muncie, Indiana, to attend the 8th Annual Indiana Bat Festival; *Kids Zone (*Science Central)- NASA activities in Kids Zone at Indianapolis Motor Speedway.

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

Informal Education

Informal education efforts build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

Objective 3.1 Resources

To Space & Back (Evansville Museum of Art History and Science)- the museum screened the film about the far reaches of our known universe down to our own planet.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity**: INSGC continues to exceed targets for ethic and gender diversity of student participants; over 53% of scholarship, fellowship, and internships awardees are female, and over 59% are members of underrepresented minorities, exceeding INSGC goals in support of NASA's performance measures.

- **Minority-Serving Institution Collaborations:** No Historically Black or Hispanic Serving Institutions with a focus on STEM degrees exist in the state. However, both Purdue and Indiana University have strong relationships with minority serving

institutions in other states and there has been significant partnering with the Minority Engineering Program at Purdue University.

- **NASA Education Priorities:**

  - Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

The vast majority of INSGC funded project involve hands-on activities in science and engineering including real-life activities and problems. All those involved in higher education, pre-college, or informal education programs experience these activities.

  - Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or careers.

Nanotechnology Summer Schools Program at IUPUI to spark interest in STEM subjects through interdisciplinary field of nanotechnology, mainly sophomores, juniors, and seniors in high school with significant ethnic and minority diversity. Get Technical - Purdue Calumet; Over a dozen faculty and staff and several grad students from the department with more than 100 high school and junior high school students from Northwest Indiana explored STEM fields of Engineering and Technology using the facilities, equipment, and laboratories of the College of Technology.

  - Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

As part of the 2014 award for Community College Partnerships (INCCP), INSGC has developed stronger relationships with several community colleges across Indiana.

  - Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

Autonomous Unmanned Aerial System (UAS) for Environmental Management – Ball State University; Interdisciplinary Knowledge Group formed to conduct collaborative research and educational activities. Members are from various disciplines including computer science, natural resources and environmental management, telecommunications, criminal justice, geo-science, and agriculture. Alvin Sputnik, Deep Sea Explorer – Purdue University; this theater production theme involved a post-apocalyptic world brought on by climate change.

  - Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.

Several INSGC projects targeted early career faculty. The aforementioned UAS project at Ball State University, Valparaiso University's Computational Materials Chemistry and Physics Research and Instruction, the Get Technical program at

Purdue Calumet, and IPFW's Development of an Electromagnetics Visualization Laboratory Course for High School Students all involved early career faculty.

IMPROVEMENTS MADE IN THE PAST YEAR

This year INSGC managed a number of transitions of affiliate directors at INSGC affiliates due to retirements, and even active participants moving from affiliate director positions at one affiliate to request involvement at another affiliate! The INSGC Central Office (particularly Program Manager, Dr. Dawn Whitaker) has been more proactively involved in "onboarding" and sharing expectations with new affiliate directors
INSGC was awarded a Community College Partnership grant in September 2014. The proposal and goals of the INCCP were discussed among INSGC Affiliates during the Spring Affiliates Meeting. Once awarded, a number of academic affiliates volunteered to collaborate with our community college partner institutions. This reflects one of the first statewide activities to coordinate Indiana 2-year and 4-year higher education institutions. Increases in numbers of affiliates, visibility of programs, and success of past efforts have resulted in increased competition for INSGC funds. Additional requirements to provide NASA reporting data have increased the requirements for competitive, responsive, and SMART-verified proposal and reporting activity by awardees. As a result, INSGC has taken a more proactive stance in advising and guiding prospective awardees in adhering to guidelines, improving the timeliness, accuracy, and completeness of reporting.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The INSGC office engages the Affiliates to discuss and contribute to the strategies of the consortium. All Affiliates have voting rights and responsibilities approving strategic directions and Consortium program decisions discussed at Affiliate Meetings.

Academic Affiliates

Purdue University – *Lead Institution*
Purdue University College of Tech at Columbus
Ball State University
Indiana State University
Indiana University – Bloomington
Indiana University Purdue University Ft, Wayne
Indiana University Purdue University Indianapolis
Valparaiso University
Purdue University Calumet
Anderson University
Saint Joseph's College
Taylor University
Trine University
University of Evansville
University of Southern Indiana

Outreach Affiliates

Children's Museum of Indianapolis
Challenger Learning Center of Northwest Indiana
Ethos, Incorporated
Science Central
Indiana Challenger learning Center of Decatur Township
IMAX Theater
Indiana State Museum
Evansville Museum
Terre Haute Children's Museum

Corporate Affiliates and Partners

StratoStar Systems
Indiana Afterschool Network
Wisdom Tools
ISTEM-Purdue University