Indiana Space Grant Consortium
Purdue University, West Lafayette
Barrett S. Caldwell, Ph.D.
765-494-5873
insgc.org

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 Program Grant funded at a level of **$730,000** for fiscal year 2008.

PROGRAM GOALS

NASA Education Outcome: *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

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.

Research Infrastructure

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

INSGC Goals:

1. INSGC will be a preferred source of information, materials, and opportunities for inspiring, preparing, and supporting individuals for NASA-related STEM education and careers.
2. INSGC will be an effective and preferred vehicle for enhancing the engagement of K-20 educators and students in the full range of NASA-related STEM activities and opportunities.
3. 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.

PROGRAM/PROJECT BENEFIT TO OUTCOME

Highlights and Anecdotes

NASA ED. Outcome 1

Scholarship / Fellowships: My goal is to work for NASA Marshall Space Flight Center as a civil servant after graduation. I would like to spend several years doing engineering work but one day get a master's in aero/astro engineering or get an MBA and possibly work as a project manager or systems engineer. *-INSGC summer intern*

Research Infrastructure: *Undergraduate Research in Observational Astronomy Using Telescopes in Arizona and Chile* uses the remotely controlled Southeast Association for Research in Astronomy (SARA) telescopes (36-in in Arizona and 24-in in Chile) to augment undergraduate astronomy and research classes. This is part of continuing support (initiated in 2006) by INSGC of undergraduate research in observational astronomy at both Ball State and Valparaiso University.

Higher Education: A team of 10 engineering students from the University of Evansville topped the competition at this year's NASA Moon Buggy competition in Huntsville, Alabama, marking the first time a UE team has won the competition. The UE team was in first place after the race's first heat with a time of 4 minutes, 18 seconds.

Purdue Space Day took place on the West Lafayette campus of Purdue University on November 8. 455 students in grades 3-8 filled the event to capacity with a record number of 175 Purdue students from 38 majors volunteering to run the event. The students had the opportunity to try out various space and science related activities.

INSGC affiliate Orbit Frontiers LLC is a founding member of Team LunaTrex, an official team vying for the Google Lunar X PRIZE. Orbit Frontiers sponsored a Moon Mission Competition in conjunction with Purdue Space Day, in which students explored the unique challenges faced by Team LunaTrex in the Google Lunar X PRIZE.

PROGRAM ACCOMPLISHMENTS

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.

Scholarship / Fellowships: The number of applicants for scholarship and fellowship awards, and the growing demand for INSGC support of NASA summer interns, has demonstrated an increased level of competitive pressure on these funds. Nonetheless, INSGC maintains a commitment to support of internships, undergraduate scholarships at regional comprehensive campuses, and targeted requests for candidates from underrepresented groups. The following objectives have been met: FY 2008 INSGC achieved 121 applicants for 47 available awards; FY 2008 10 students received continuing support; FY 2008 achieved 11.1% matching of scholarship and fellowship award funds; and Partnerships were developed with Women in Engineering @Purdue and IUPUI Minority Engineers Group.

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

Research Infrastructure: It has long been the policy of INSGC to support favorably reviewed faculty research projects that include the use of undergraduate students as members of the research team. This practice will be included as a requirement for faculty research projects proposed for future competitions. The 2009-10 Guidelines have specifically included this new requirement and its justification, and feedback has been provided to all 2008-09 Research Infrastructure applicants regarding INSGC goals in this area, including: Analysis of the Light Curves of Carbon-rich Proto-Planetary Nebulae; Matching Funds for the Undergraduate Research Grant Program; and Undergraduate Research in Observational Astronomy Using Telescopes in Arizona and Chile.

Additional objectives met: In FY 2008 INSGC received proposal submissions of 202% of Discovery Grant award funds available; and INSGC received submissions that included Astronomy, Biology, and Physics.

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.

Higher Education: One of our Higher Education goals for FY 2008 was to create a web page of resource links was catastrophically affected by the Year 17 Challenges and Constraints. We have conducted a focus group with undergraduate students to help identify priorities for updating the website. Although the resource links was seen as an important priority, an even higher priority was indicated for identifying and updating student internship opportunities as they become available. As of February 6, 2009, this update is in process, using resources from the Purdue Engineering Computing Network. After website design has been changed, we plan to migrate the INSGC site from its current server to a larger, more secure Purdue College of Engineering server cluster.

Workforce development projects are proposed by faculty and have the stated a goal of increasing the employability skills of the student. INSGC, with the goal of involving students in research, offers a variety of funding opportunities, including: 3D Computer Graphics Student Project; 2008 Taylor HARP Program; 400,000 People Landed Apollo 11 on the Moon: A Living Library of Engineer's Stories; A Collaborative Program of Student Research in Observational Astronomy; A Novel Way for Teaching Global Environmental Changes at IUPUI and ISU; Autonomous Airplane Development; Electronic Powered Ducted Fan Wing-In-Ground Effects Vehicle; Enhancing Science Education with Multimedia Curriculum Based on NASA Resources; Geospatial Watershed Assessment and Stream Monitoring in East-Central Indiana; High-Altitude

Launch Opportunity Program II (HALO II);Metabolism of Anaerobic Archaea; NanoScience and Technologies in Future Space Exploration; Promoting Conceptual Change of Undergraduates Declarative and Configurational; Understanding of Biomes Using Animation and Digital Images from Space; Purdue Reduced Gravity Student Flight Programs (Two projects);Purdue Space Day; Station Keeping Capability for Unmanned Systems; Taylor Small Satellite Program; The Great Moonbuggy Race; The Moon Buggy On-Board Data Acquisition and Evaluation; Urban Sprawl and Fire Danger in the Urban/Wildland Interface: A Skills Building; Research Experience; Using the SARA Telescope in the Introductory Astronomy Laboratory; Very Low Frequency (VLF) Remote Sensing of the Lower Ionosphere and Electron; Precipitation from the Radiation Belts; VOSS@PACE: Visiting Our Solar System @ Purdue—Accessible Campus Education; and Zero Gravity Projects.

Pre College: INSGC completed agreements with the INSPIRE program at Purdue, which provides both short term and long-term educator professional development experiences for K-12 STEM teachers, including a year-long professional fellowship. Delays in full INSGC funding, combined with a transition in INSPIRE program leadership, however, led to a gap in coordination preventing the full use of these funds. A project at Purdue-Calumet links a general public telescope to curriculum development, and was successful in submitting an NSF CCLI proposal; this effort continues a tradition set by Taylor University to apply INSGC project experience toward CCLI project continuation. INSGC signature programs continue to focus support for K-12 student involvement projects such as FIRST and Space Day. Several ongoing projects continue to be funded by INSGC, due to their long-standing success in providing opportunities for middle school and high school students to understand NASA STEM-related career interests, including: Digital Star Lab; INSPIRE; Incorporating Remote Sensing Technologies into the High School Science Classroom; OPTIONS for Middle School Girls; OPTIONS for High School Girls; Space Camp; Space Explorers; and Space Resources for Pre-Service Teachers.

General Public: Several landmark INSGC activities supported NASA Education Outcome 3 during Program Year 18. An IMAX theater partnership with INSGC highlighted the release of "Fly Me to the Moon," with INSGC as a local co-sponsor (with appropriate advertising credit) for this animated feature film. Based on discussions with the Indiana State Museum, and a return of INSGC to the Indiana State Fair, a major exhibit is planned for the 2009 State Fair focusing on links between Indiana and the nation's aerospace and STEM history. This exhibit, entitled "Indiana Space Travels," is also tied to our series of International Year of Astronomy programs. All three Challenger Learning Centers conducted programs based on NASA 50th Anniversary theme materials. These relationships help reinforce the role of INSGC as a coordinating and integrating agent for informal and general public, as well as precollege, higher education, and research infrastructure programs for the State of Indiana. INSGC supported a wide range of projects that we class as informal education projects, such as: 3-D Science Visualization Room (VizRoom) at the Terre Haute Children's Museum; IMAX Fly Me to the Moon K-12 Movie Attendance; IMAX Fly Me to the Moon Premier/Affiliate Event; Moon Mission Competition; Purdue FIRST Programs; SEDS Spring Space Forum; University of Evansville Spring Space Day; and Wind Tunnel Exhibit.

External Relations: Our interactions with the Indiana State Museum and Indiana State Fair represent a new level of potential external relations and partnerships to increase the visibility and recognition of the INSGC to a wide variety of Indiana residents previously unaware of the range of STEM relevance in their lives.

At the 2008 Affiliates meeting a committee (Benefactor Committee) was formed to explore ways to support Indiana Aerospace companies' need for high-quality employees while providing an advisory/funding resource for INSGC. The committee concluded that the best course of action was to develop internship programs within Indiana by working with the 92 member Indiana Advanced Aerospace Manufacturer's Alliance (IAAMA) membership. INSGC would recruit prospective student interns from affiliates that could be matched effectively with Indiana internship opportunities through INSGC. A pilot program based on this model is currently being explored with Raytheon Corporation in Fort Wayne.

PROGRAM CONTRIBUTIONS TO PART MEASURES

Longitudinal Tracking: External and internal factors have impeded the development of a successful longitudinal tracking system. This has been a weakness for demonstrating the consortium impact in the state. The internal assessment and evaluation team is taking the lead on completion of this critical task; in addition to quantitative longitudinal tracking, case studies and qualitative data will continue to be collected. INSGC is piloting three concurrent strategies to create an acceptable longitudinal tracking process to document students' progress through their academic programs until the second year of employment and continued career development. First, INSGC is performing systematic searches to gather current contact information. Second, INSGC has established a relationship with the Purdue Alumni association and will establish similar relationships with the alumni associations of our affiliate institutions. Third we are enlisting social networking technology (Facebook) to identify and contact current and former students.

Course Development: The National Science Foundation awarded a three-year Course, Curriculum and Laboratory Improvement (CCLI) grant to Taylor University. The grant objective was to integrate Taylor's high altitude research platform (HARP) program into the Science, Technology, Engineering and Math (STEM) curricula of over 20 institutions with an ultimate goal of reaching 40 institutions, predominately in the Midwest, over the three-year grant period. This novel use of weather balloon technology has been pioneered in Indiana by Taylor University using seed money from the Indiana Space Grant Consortium. Additional course development efforts have been supported on multiple campuses associated with INSGC awards, including the development of a new engineering program minor at Taylor University.

Matching Funds: Matching funds for Administrative Segment activity come from several sources. Salary support for the Director and Program Coordinator comes from the host institution through the office of the Purdue College of Engineering Associate Dean for Undergraduate Education. Partial match for the Evaluation and Assessment Team come from the Assessment Research Center and the Discovery Learning Center of the host institution. INSGC support for Outreach Coordination (Ann Broughton) is partially matched by funding from the School of Aeronautics and Astronautics. INSGC collects dues from its academic affiliates to support travel and expenses that are not allowed in the NASA portion of the budget.

Scholarship and Fellowship programs—Matching funds on this portion of the funding is not required. However, we encouraged all institutions to match or otherwise support the funds the students received—particularly in the form of tuition remissions. Some scholarship matching was available to augment scholarships awarded to underrepresented students targeted for awards by both INSGC and local program offices. INSGC indicated support for NASA and other internships as scholarship / fellowship support, because of the primary focus of these funds for undergraduate student experiences, including NASA internships, without opportunities for matching. (On some INSGC campuses, internship stipends are processed in the same way as scholarship funds.)

Grant Program—Minimum one-to-one matching is required for all proposals submitted to the INSGC grant program competitions; overmatching is encouraged. Several ongoing INSGC programs, such as FIRST and Purdue Space Day, obtain substantial matching funds from corporate donations. Match generally comes from a variety of sources identified in the grant proposals. Award decisions for Program Year 18 were made with a consideration to ensure adequate matching and cost-share support from a variety of non-federal sources.

Minority Serving Institutions: INSGC does not have a designated Minority Serving Institution among its academic affiliates; 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. Some projects are especially devoted to increasing support, engagement, and retention of underrepresented minority students. Among these are the Minority Engineering Bootcamp (for incoming first-year students), and the Purdue Research Opportunities Program (for students at historically black colleges and universities), which provide on-campus experiences and support groups for underrepresented students. Purdue's College of Engineering has a longstanding partnership with North Carolina A&T State University. Ongoing pipelines to NCA&T and other Historically Black Institutions are supported through an HBI Visitation program held each year on the Purdue campus. Several alumni from HBI Visitation partners are now graduate students at Purdue, including two graduate students who participated in NASA Center Internships during summer and fall 2006. This continuing pipeline helps demonstrate to other underrepresented minority students that NASA related STEM projects and careers are available for their participation.

Recently, Indiana University and IUPUI (both affiliates) partnered with nine Historically Black Colleges and Universities (HBCU) as part of the STEM Initiative program. The STEM Initiative is an academic and research partnership that promotes and develops the science, technology, engineering and math (STEM) disciplines. INSGC will explore how this partnership might broaden the pool of underrepresented applicants to the consortium.

IMPROVEMENTS MADE IN THE PAST YEAR

Management: As of 2008, a new full time program coordinator and full- time program secretary/clerical staff are in place providing renewed energy and effort for the consortium. INSGC's continued its commitment to communication with affiliate members via web-based surveys capturing their perceptions of consortium management and direction. Additionally increased access to the program coordinator has resulted in positive collaborations.

Project Design: Visiting our Solar System @ Purdue--Accessible Campus Education (VOSS@PACE) is a uniquely designed Engineering Projects in Community Service (EPICS) class where the undergraduate team designing a "modern" scale solar system is in constant contact with the "customers" in order to maximize the students' experience of working on a project team. In this case, the customers are Discovery Park @ Purdue University (where the project will be placed) and

INSGC (funding). Other aspects of the project are promotion of the project to test market the design and effective documentation of the project in order to hand it off to the fall 2009 team that is expected to begin construction.

Project Evaluation: The evaluation team and the program coordinator are developing templates to streamline reporting of research projects from affiliate directors and identify appropriate procedures to track students supported by INSGC. The development of the evaluation plan for INSGC projects/activities for the 2009 Indiana State Fair began in FY2008; Student intern programs and Space Day programs were also evaluated.

Collaborations and Partnerships: A program sponsored by the INSGC, Purdue Space Day is an initiative designed to give young people in grades three through eight, the opportunity to learn about astronautical engineering and space exploration through hands-on experiences with the intention of sparking their interest in science, technology, engineering and mathematics (STEM). The existence of PSD programs at several sites has opened the possibility of addressing community and educational needs that extend beyond those of a university and its local community. Under the funding of the Indiana Space Grant Consortium, PSD will now be expanded to serve other educational establishments within both the state of Indiana and on a national scale. Indiana Space Day has also been held at The University of Evansville.
The Coordinator of the event held at Purdue will provide downloadable information for other institutions to hold the event and provide help as and when needed.

Consortium Synergy: IYA Initiatives: During FY 2008 plans and projects were developed to showcase at the 2009 is the International Year of Astronomy celebration and there are events planned at INSGC affiliates Ball State University, Indiana University, Purdue University, and Valparaiso University. There will be a Hubble display (NASA model) at the 2009 Indiana State Fair with related programming highlighting Indiana's contribution to Hubble, Indiana users of the telescope, as well as presentations related to the servicing mission (planned for May, 2009).

Several 2008 initiatives have shown considerable promise, but the INSGC/IMAX 2008 State Fair Exhibit has succeeded beyond any expectation. Based largely on last year's success, INSGC has been offered the Grand Hall (6,000 sq. ft) for the 3-week 2009 Indiana State Fair. INSGC plans on using this occasion to promote Indiana educational and employment opportunities to the widest possible audience.

Workforce Development: Feedback from our primary workforce development customers (undergraduate engineering students) indicated that, while some students were very pleased with their internship experiences, INSGC could do better in supporting the internship matching process. INSGC has created its own "in-state" internship application, modeled on NASA internship applications, to gather applicants for in-state internships.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic Affiliates: Ball State University / Dr. Ronald H. Kaitchuck (Affiliate Director); Indiana State University / Dawn Underwood (Affiliate Contact); Indiana University – Bloomington / Dr. Richard H. Durisen (Affiliate Director); Indiana University – Purdue University Fort Wayne / Dr. Jihad Albayyari (Affiliate Director); Indiana University – Purdue University Indianapolis / Dr. Sivakumar Santhanakrishnan (Affiliate Director); Purdue University – Calumet / Dr. Adam W. Rengstorf (Affiliate Director); Taylor University / Dr. Will Holmes (Affiliate Director); University of Evansville / Dr. Philip Gerhart (Affiliate Director); University of Southern Indiana / Dr. Glen Kissel (Affiliate Director); and Valparaiso University / Dr. Bruce J. Hrivnak (Affiliate Director)

Outreach Affiliates: Brownsburg Challenger Learning Center / Mary Patterson (Affiliate Director); Challenger Learning Center of Northwest Indiana / Amanda Maynard (Affiliate Director); Imagination Station ; IMAX Theater / Dave Brown (Affiliate Director); Indiana State Museum / Barry Dressel (Affiliate Director); Indianapolis Challenger Learning Center of Decatur Township / Cyndy Moriarty, NBCT-Flight Director; Science Central / Shane Pickett & Lou Pepai (Co-directors); and Terre Haute Children's Museum / Linda Edwards (Affiliate Director)

Corporate Affiliates: StratoStar Systems / Jason Krueger; TMGLabs / Brian Tanner, Chief Technology Officer; and Orbit Frontiers, LLC / Joseph Gangestad, President
Two additional affiliate requests pending on February 9 have since been approved: Purdue College of Technology, Columbus / Jack Head, Affiliate Director (ACADEMIC); ETHOS, Inc., Elkhart / Patsy Boehler, Affiliate Director (OUTREACH).

Submitted on behalf of the Indiana Space Grant Consortium

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Barrett S. Caldwell, PhD, Director, Indiana Space Grant Consortium, February 9, 2009