

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.

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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 Louisiana Space Grant Consortium (LaSPACE) is a Designated Consortium funded at a level of \$575,000 for federal fiscal year 2014.

PROGRAM GOALS

LaSPACE Strategic Goal 1: *Foster aerospace related, interdisciplinary, science, technology, and engineering research and education at Louisiana colleges and universities (NASA Outcome 1).* This goal involves (1) enhancing student and faculty research, (2) training graduate and undergraduate students, (3) providing hands-on flight opportunities, and (4) supporting student internships, competitions, and design projects.

LaSPACE Strategic Goal 2: *Encourage aerospace related industries in Louisiana for economic development and diversification (NASA Outcome 1).* Implementation includes working with the Michoud Assembly Facility, developing interactions between industry, students, and faculty, and making information available to students.

LaSPACE Strategic Goal 3: *Promote and contribute to science, technology, engineering, and mathematics pre-college education excellence (NASA Outcome 2).* Targeted programs for middle and high school educator training and school district programs are the main tools to achieve this goal.

LaSPACE Strategic Goal 4: *Engage and educate the general public in NASA's space exploration projects, benefits and opportunities as well as Louisiana's role in the NASA program (NASA Outcome 3).* Informal education projects and public outreach campaigns and events contribute to this goal.

LaSPACE Strategic Goal 5: *Maintain a cooperative, effective and inclusive consortium of Louisiana institutions to promote aerospace related research, education, and economic development (NASA Outcomes 1, 2, and 3).* This requires effective program management and communication plus increasing stakeholder involvement, e.g. through Consortium Sustaining Grants.

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

LaSPACE financially supported 4 summer interns from 3 universities for internships at 3 different NASA centers. Alphabetically, our 2014 LaSPACE NASA Interns were: Clay Blanchard, LSU Mechanical Engineering (*Marshall*), Brandon Oubre, LSU Computer Science and Applied Mathematics (*Johnson*), De'Shon Swafford, Grambling Technology and Electronics (*Marshall*), and John Timaeus, Tulane Engineering Physics (*LARSS*). In addition to the hands-on research experience these students received at their host-center, they were taken to additional NASA and space industry partner sites around the country. The combined impact of their educational and professional development and networking strengthens the likelihood that they will continue to pursue a career in NASA-related STEM fields. Three of the four students were newly supported by Space Grant, and two of those three were from institutions with relatively inactive participation in LaSPACE programming, Tulane and Grambling. The latter is one of our HBCU's. One intern, Clay Blanchard, is a veteran of the LaSPACE program and was profiled in our previous APD for his participation in the LURA program and poster presentation at one of our national meetings. After this summer's internship, Clay served as the student lead on a Senior Design proposal for a reusable launch vehicle by creating a small-scale rocket glider. This project is currently funded by LaSPACE. (*Aligned with NASA Outcomes 1 & 2*)

LaSPACE supports K-12 and informal education development through targeted support for teacher training and outreach. The LaSPACE-funded Sci-Botics Teacher Education Program administered by our affiliate Sci-Port, offers annual professional development for in-service teachers, helps to advance middle-school STEM curricula, stimulates student participation in science competitions, and creates partnerships among formal and informal education communities. In partnership with Barksdale Airforce Base, Sci-Port trains middle school teachers from Bossier Parish in robotics technology and in the development of a science pedagogy that uses robotics. Teachers incorporate robotics into their curriculum, students compete in the regional LEGO NXT competition, and Sci-Port offers interactive exhibits of the types of robotic instruments produced by the students. (*Aligned with NASA Outcomes 2 & 3*)

PROGRAM ACCOMPLISHMENTS

LaSPACE Strategic Goal 1 (*Foster aerospace related, interdisciplinary, science, technology, and engineering research and education at Louisiana colleges and universities.*) **is aligned with NASA Education Outcome 1**

Objective 1 – Enhancing student and faculty research

Research Enhancement Awards (REA): The primary goal of the REA program is to provide seed funding to affiliate faculty to develop new research projects and/or directions, obtain special training, and foster new collaborations among the campuses as well as with NASA centers, other federal labs, and the aerospace industry. During FY2014 six new awards were issued; 3 at ULL, 2 at LaTech, and 1 at LSU. Five of these awards included budget lines to hire graduate student workers for the project, and 3 also budgeted money to support undergraduate student researchers. These projects will investigate a variety of NASA relevant areas including fault tolerant aircraft control systems, sensors for health monitoring, manufacturing polymer nanocomposites, high thermal conductivity ceramic composites, novel space radiation detectors, and remote sensing ground truth studies.

Objective 2 – Training graduate and undergraduate students

Note that the programs discussed here involve students in research projects and so are also applicable to Objective 1 above.

Undergraduate Students: We engage undergraduate students in research training activities through the LaSPACE Undergraduate Research Assistantship (LURA), Space Grant Scholars – Timbuktu Academy (SGS-TA) and Minority Research Scholars (MRS) programs. During FY2014 four new LURA awards were issued at two universities (LSU & LaTech) supporting student research in biomedical engineering, nanosystem engineering, astrophysics, and mechanical engineering with projects related to space exploration, including light-weight vehicle composite design and bone-density repair. Further, continued support for SGS-TA engaged 22 students at Southern University in Baton Rouge in research projects and other STEM career training activities. Finally, MRS awards were made to support the research projects of two female students at Louisiana Tech University.

Graduate Students: Four new GSRA (Graduate Student Research Assistantship) awards were issued at two universities (LSU & LaTech) supporting graduate student research in the development of 1) a hybrid laser scattering method to be used in fused deposition modeling to create metal prints in a zero gravity environment, 2) a fully three-dimensional gesture recognition and classification system, 3) a methodology to measure a critical nuclear reaction rate to provide unparalleled insight into the chaotic stellar burning of LMXB's, and 4) development and analysis of simulations of the CALorimetric Electron Telescope, a cosmic-ray instrument currently in development. No new fellowships were issued this fiscal year, but three fellowships for PhD students were renewed and remain active.

Student Research Presentations: We have continued to successfully recruit student participation in the annual council meeting's student poster session. This year's session included undergraduate and graduate student participants from Dillard, Loyola, LSU, McNeese, SUBR, SUNO, and ULL. For the second year running, we also invited one undergraduate student and one graduate student to give a talk to the council. ULL engineering undergraduate student Alex Lanclos presented on the successful on-going student satellite program at ULL. LSU Physics PhD candidate Nick Cannady spoke about his participation in a multi-national collaboration to develop an International Space Station cosmic ray instrument.

Objective 3 – Providing hands-on flight opportunities

LaSPACE has developed a comprehensive student ballooning program with LaACES, which introduces basic technical and project management skills to entry level students at Louisiana institutions and HASP, for advanced student teams across the nation. Both efforts are supported by the NASA Balloon Program Office (BPO) at Wallops Flight Facility and the Columbia Scientific Ballooning Facility (CSBF) in Palestine, TX. The LaACES program completed its tenth year of continuous operation with the launch of ACES-43 on May 20, 2014. This flight involved 37 students from UNO, Loyola, LSU, McNeese and Xavier who developed seven flight payloads over the previous academic year. The LaACES program for the 2014-2015 academic year currently involves students at LSU, McNeese, Loyola, UNO, Xavier, Baton Rouge Community College, Delgado Community College, and River Parishes Community College. In addition, the 9th successful flight of the High Altitude Student Platform (HASP) was conducted on August 9, 2014 carrying 7 student payloads involving 103 students (86 undergrad; 17 grad students; 83 male; 20 female; 44 Hispanic or minority) from 9 jurisdictions (AZ, MN, IL, MA, NC, ND, FL, CO, & P.R.).

Objective 4 – Supporting student internships, competitions, and design projects

LaSPACE supported 4 summer interns from 3 universities for internships at Marshall, Johnson, and Langley NASA centers. Students worked on the design and manufacture of a thrust test stand for a 1-Newton thruster, design of a proof-of-concept prototype that will send solar energy to the South Pole of the moon, development of data management middleware for the WEAR Lab's Modular Wearable Architecture, and the development of the software and hardware control loop for a digital twin of a specimen of fiber reinforced polymer. During FY2014 two senior design projects were completed. One of these at LaTech involved development of automated processes for fabrication of superconducting filaments planned for use in advanced space propulsion systems. The second one at LSU involved support a team at the SAE Aero Design competition. In addition, LaSPACE is also currently supporting three teams at LSU: two on aeronautics projects, designing and developing a micro-air-vehicle for the SAE Aero Design Competition (one team competed in the 'Regular' class competition and the other in the 'Micro' class), and one on a rocketry project.

LaSPACE Strategic Goal 2 (*Encourage aerospace related industries in Louisiana for economic development and diversification.*) **aligned with NASA Education Outcome 1**

During FY2014 LaSPACE personnel participated in two meetings focused on NASA technology needs, technology transfer and commercialization. One such meeting featured Dr. Michael Gazarik, NASA Associate Administrator for the Space Technology Mission Directorate and a second meeting was with Dr. Kumar Krishen, Lead Technologist for the Technology Transfer Office at NASA JSC. The information and contacts gained during these meetings will enable LaSPACE to provide a better interface between NASA's needs and Louisiana industry capability. Further, LaSPACE partnered with a local company, Carver Scientific, Inc., to submit a SBIR proposal to NASA. The effort involves improving the TRL of a high density energy storage device that could potentially reduce energy storage weight on balloon and space craft payloads by an order of magnitude. LaSPACE's contribution to the SBIR is its expertise in balloon flight systems, high altitude environment test chamber and access to the HASP platform.

Further, LaSPACE and Carver Scientific discussed a summer internship program which could be established as early as summer 2016.

LaSPACE Strategic Goal 3 (*Promote and contribute to science, technology, engineering, and mathematics pre-college education excellence.*) **is aligned with NASA Education Outcome 2.**

LaSPACE has a small but ‘targeted’ program for enhancing pre-college education focusing on the training of K-12 teaching professionals. We annually support teacher workshops at Sci-Port: Louisiana’s Science Center, and our Manager sits on the Advisory Council for the Scotlandville Magnet High School (SMHS) Academy of Engineering (AoE). This year we also funded one SMHS teacher’s Project Lead the Way (PLTW) certifications and one Middle School teacher’s attendance at the annual Texas Liftoff workshop at JSC. This year we also supported Iberville Parish Mathematics, Science, and Arts Academy-West’s participation in the Student Spaceflight Experiments (SSEP) Mission 6 to the International Space Station (ISS).

LaSPACE Strategic Goal 4: (*Engage and educate the general public in NASA’s space exploration projects, benefits and opportunities as well as Louisiana’s role in the NASA program.*) **is aligned with NASA Education Outcome 3.**

LaSPACE affiliates include regional Louisiana science centers such as Sci-Port (Shreveport), the Idea Place (Ruston), the Louisiana Art and Science Museum Pennington Planetarium (Baton Rouge), along with institutions such as the Gordon A. Cain Center for Scientific, Technological, Engineering, and Mathematical Literacy (Baton Rouge). We regularly help develop and promote events sponsored by these centers. Additionally, we are partnering with the LSU chapter of the Society of Physics Students (SPS) to establish a schedule of public events for the newly refurbished Mobile Astronomy Resource System (MARS), a light commercial box truck containing computer controlled telescopes, a digital portable planetarium, and other equipment and materials to provide an astronomy / space science learning experience to audiences at remote sites who normally do not attend a fixed site science center. During FY2014 MARS was fully refurbished including a new external art wrap and interior modifications.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

Diversity LaSPACE has always been an open consortium, offering membership to any organization that shares the consortium's goals and objectives. The LaSPACE network includes 29 affiliates that represent the social and economic diversity across the state. Of the 21 universities and colleges that are part of LaSPACE, 16 (or over 75%) have been designated by the U.S. Department of Education as a Minority Institution or eligible for Title III and Title V programs at least once between 2010 and 2014 (marked by a ‘*’ in the list on page 8 of this report). Included in these numbers are five of the six Historically Black Colleges & Universities (HBCU) in Louisiana identified by the White House in 2014. Thus, the LaSPACE network of institutions is intended to be **inclusive**. NCES statistics show a statewide minority enrollment of ~36% in all disciplines. State statistics show that of students enrolled in STEM degree programs 28% are classed as minority and 22% are women. We exceeded these benchmarks the last two years and

anticipate achieving comparable participation rates this year. Our direct funding rates were: ~38% for underrepresented minorities and ~35% for female students (awards deemed “significant” tend to be distributed at even higher rates: over 50% for both underrepresented minorities and female students). The LaSPACE Council comprised of institutional representatives from each active affiliate and the 3-person management team at LSU includes 4 underrepresented minorities and 7 women.

Minority-Serving Institution Collaborations All five MSI/HBCU LaSPACE affiliates—Xavier, Grambling State, Dillard, Southern University in New Orleans (SUNO), and Southern University in Baton Rouge (SUBR)—are engaged in various collaborative efforts with Space Grant funded Programs. All five universities are active participants on the consortium council, and as such all had faculty and student representatives at our Fall 2014 meeting. LaSPACE continues to promote and encourage research partnerships via our Space Grant REA award program and the NASA EPSCoR RID funded RAP award program. Xavier is the lead institution for the New Orleans Regional Collaborative (NORC), a collective of LaSPACE affiliates in New Orleans creating an inter-university STEM retention program, successfully funded via a National Space Grant CAN and in year two of its two-year award. Of the 6 participating universities, 3 are HBCUs: Xavier (lead institution), Dillard, and SUNO. LaSPACE and SUBR typically support about 20 total students annually via the Space Grant-Timbuktu Academy Scholars. LaSPACE actively supports the predominantly minority student body of the Academy of Engineering program at Scotlandville Magnet High School in Baton Rouge by having the LaSPACE manager serve on the High School Engineering Advisory Board.

NASA Education Priorities

Authentic, Hands-on Student Experiences: The core focus of the LaSPACE program continues to be student involvement in genuine scientific research and engineering projects. Graduate students, seeking a Fellowship or GSRA support, by definition must be actively pursuing aerospace-related research. Our Minority Research Scholars (MRS) and LaSPACE Undergraduate Research Awards (LURA) Programs are year-long mentored research projects in which a faculty member and a student work on a pre-approved project. Additionally our seed-funding research programs (REA, RIG, & URP) highly encourage the inclusion of undergraduate and graduate student researchers, and, consequently, most of our funded proposals do include budget lines for student workers. Three of our programs focus highly on hands-on building experiences. Two are subsets of our student ballooning program, HASP and LaACES. The third is our Higher Education/Senior Design program, which tends to fund two senior design teams annually. The LaACES, HASP and senior design accomplishments are described earlier in this report.

Engage middle school teachers: Our in-state Sci-Botics program run by Sci-Port in partnership with Barksdale Air force Base provided 20 Bossier Parish middle school teachers with hands-on robotics training and robotics curriculum development tools. Subsequent classroom projects result in classes competing in regional robotics competitions in the Shreveport, LA area. We supported the attendance of one Middle school teacher at the Texas Lift-Off Workshop held in Houston this summer. Additionally, the Space Grant Director and staff typically participate in “Science Week” at LSU during the summer when we support a full day of “Physics” activities with 20 middle school students at both the LSU campus and the nearby LIGO facility.

Summer Opportunities: Summer Opportunities for enrolling freshmen are provided as part of our Scholars program at Southern University Baton Rouge. Generally, all of the Science and many of the Engineering departments at LSU and other institutions offer their own summer preparation programs to acquaint potential students with the rigors and expectations of the university experience. These are not Space Grant sponsored efforts, but LaSPACE personnel are often involved.

Community Colleges: In addition to the two community colleges (BRCC & DCC) recruited to our consortium for the execution of our Space Grant CAN-funded, “Launching Louisiana Community College Students into STEM” (LLCCSS), we have recruited a third campus, River Parishes Community College (RPCC). The institutional rep and 9 students from RPCC attended a NASA MSFC workshop on student ballooning in January with plans to participate in our LaACES program next academic year.

Aeronautics Research: Aeronautics Research was part of LaSPACE activity this past year again, even though it is normally covered by the EPSCoR program. An REA was awarded in the summer of 2014 to Dr. Afef Fekih of ULL for her project “Stability Guaranteed Fault Tolerant Flight Control Technology for Safer Aircraft Systems.” Success of the proposed project is expected to help build a new structure of controllers that guarantee increased survivability, safety, and security in aircraft systems.

Early Career Faculty: Early Career Faculty are called out as one of the target groups for LaSPACE research awards as well as for student support awards, with a goal to help young faculty establish their research programs. Our Research Enhancement Awards are specifically well-suited to a new researcher as they are intended as seed-grants which will ultimately lead to larger funding opportunities. Additionally, the LURA and MRS program are two ways to offer funding for an undergraduate researcher to work in an up-and-coming lab. For example, we issued MRS awards to support two female undergraduate students working in the labs of two female early career faculty members at LaTech, Jamie Newman, Visiting Assistant Professor of Biomedical Engineering and Mary Caldorera-Moore, Assistant Professor of Biomedical Engineering.

IMPROVEMENTS MADE IN THE PAST YEAR

Last semester we began implementing periodic “all-hands” teleconferences to supplement our annual LaSPACE Council meeting to discuss timely and complicated opportunities (such as the recent Community College CAN, our EPSCoR RID projects, and the current 3-yr bridge solicitation). We anticipate including one or more teleconferences each year. Over the last several months, LaSPACE has been refurbishing the recently-dormant MARS truck, including replacing mechanical parts, teaching tools, and a new wrap for the exterior. We have also established a relationship with the LSU chapter of the Society of Physics Students (SPS) to help staff the MARS vehicle at events across the state. A new part time LaSPACE Informal Education Curator has been hired to handle MARS maintenance, operations, and student training. In response to lagging female participation in our programs, LaSPACE opened up our Minority Research Scholars program to female students and are now funding two active projects with female faculty mentors and female student mentees at LaTech. LaSPACE recruited three new Community College affiliate members, and all three are already actively involved in Space Grant funded projects (two with our LLCCSS CAN award and one which participated in the NASA MSFC sponsored workshop in January).

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Consortium members (see list below) include colleges/universities [Research Intensive (RIU); Research Active (RAU); Four year institutions (4YI); Community Colleges (CC)], HBCU's, business/industry partners (B/I), state education boards (Ed), and nonprofit organizations (NPO), structured as Active Members (AM), Inactive Members (IM), and New Members (NM), the latter are members that signed on within the last 6 months. Affiliates designated by the U.S. Department of Education as a Minority Institution or eligible for Title III and Title V programs are marked with an asterisk (“*”). Each member has an institutional representative / coordinator. When that position becomes vacant, the institution becomes Inactive until a new representative is appointed. As an open consortium, joining LaSPACE is simple, requiring a letter of interest submitted to LaSPACE by an authorized institutional representative which designates an institutional coordinator. Overall, it is the Institutional Coordinators that have the responsibility for recruiting students on their campuses, publicizing LaSPACE opportunities, and building an aerospace component to the campus activities, utilizing methods that work locally.

List of Louisiana Space Grant Consortium Members (Alphabetical)

Baton Rouge Community College (BRCC): AM, NM, CC,*
Delgado Community College (DCC): AM, NM, CC,*
Dillard University (Dillard): AM, HBCU, 4YI,*
EBR Recreation & Park Commission: Highland Road Park Observatory: AM, NPO
Gordon A. Cain Center for STEM Literacy: AM, NPO
Grambling State University (GSU): AM, HBCU, 4YI,*
Jacobs Technology, Inc. at Michoud (Jacobs): AM, B/I
Louisiana Arts and Science Museum / Pennington Planetarium (LASM): AM, NPO
Louisiana Board of Elementary & Secondary Education (BESE): AM, Ed
Louisiana Board of Regents (BOR) (Co-founding Institution): AM, Ed
Louisiana Business and Technology Center (LBTC): AM, B/I
Louisiana State University and A&M College (LSU) (Co-founding & Lead Institution): AM, RIU
Louisiana State University of Shreveport (LSU-S): IM, 4YI,*
Louisiana State University Agricultural Center (LSU-Ag): AM, RIU
Louisiana Tech University (LaTech): AM, RAU
Loyola University (Loyola): AM, 4YI
McNeese State University (McNeese): AM, 4YI,*
Nicholls State University (Nicholls): AM, RAU,*
Northwestern State University of Louisiana (NWSU): AM, 4YI,*
River Parishes Community College (RPCC): AM, NM, CC,*
SciPort Louisiana's Science Center (SciPort): AM, NPO
Southeastern Louisiana University (SELU): AM, 4YI,*
Southern University and A & M College (SUBR) (Co-founding Institution): AM, HBCU, RAU,*
Southern University of New Orleans (SUNO): AM, HBCU, 4YI,*
Tulane University (Tulane): AM, RIU
University of Louisiana at Lafayette (ULL): AM, RAU,*
University of Louisiana at Monroe (ULM): AM, 4YI,*
University of New Orleans (UNO): AM, RAU,*
Xavier University of Louisiana (Xavier): AM, HBCU, RAU,*

The Council (comprised of all institutional reps and the central management team at LSU) is the primary oversight and advisory board for LaSPACE. The Council meets

annually for a formal two-day meeting during the fall semester at one of our affiliate's campuses, and communicates via teleconference and email between meetings. General administration and management is the responsibility of the LaSPACE Management Team at LSU.