

Colorado Space Grant Consortium

University of Colorado at Boulder (CU), Lead Institution

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<http://spacegrant.colorado.edu>

Affiliate Members:

CSU - Colorado State University

UNC - University of Northern Colorado

MSC – Mesa State College

CSM - Colorado School of Mines

WSC - Western State College

ASC - Adams State College

FLC - Fort Lewis College

CSU-Pueblo - Colorado State University – Pueblo

UCCS - University of Colorado, Colorado Springs

PPCC - Pikes Peak Community College

MSCD - Metropolitan State College of Denver

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 Colorado Consortium is a Designated Consortium funded at a level of \$590,000 for fiscal year 2007.

Program Relevance to NASA:

Space Grant consortia build human capital and research expertise to support NASA programs and missions, expand NASA's expertise and educational networks, and bring knowledge and awareness of space to a broad range of constituents in every state. COSGC's student space hardware opportunities directly meet NASA's Higher Education Objective #1 which is to "contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals (Employ & Educate)". Education/Public Outreach (E/PO) programs at COSGC institutions span NASA Education Outcomes 2 & 3 and support the university/college student by providing pre- and in-service teachers with professional development opportunities in order to encourage the use space science as a tool for teaching. COSGC provides well trained students to NASA and companies that support NASA each year. Numerous students are working at many of NASA centers and facilities as a direct result of their experiences

working at COSGC. The student hands-on programs, like DemoSat and our Industry Internships, are providing valuable and meaningful results to NASA engineers and scientists.

Program Benefits to the State:

The Colorado Space Grant Consortium (COSGC) works to enhance the educational experience of students throughout the state based on cooperative relationships among universities, colleges, industry, research organizations, NASA, and other Space Grant programs – and to cultivate this rich cooperative environment to provide incentives, interdisciplinary educational opportunities, and educational excellence in space science and engineering. The Consortium was rated by the Colorado Commission of Higher Education as one of the top educational programs in Colorado for 10 years. The COSGC program features hands-on opportunities for undergraduate and graduate student research in multi-disciplinary space missions, space-related courses and seminars, and cooperative service learning projects to provide opportunities for students to gain leadership skills while engaging with the wider community.

Program Goals:

The Colorado Space Grant Consortium had four primary goals for the year as part of a five year strategic plan developed to enhance the overall student experience and better equip the student for the workforce.

These four primary goals were:

1. Increase diverse student participation
2. Implementation of staged hands-on programs
3. Student intern EduSourcing with Industry partners
4. Mutually beneficial research faculty partnerships

Program Accomplishments:

- DemoSat V was completed with **10** student payloads launched in April and August. **19** students traveled to KSC in August 2007 and presented their projects and findings at a two-day NASA educational conference. Participating schools were Metro, CSU, CSM, WSC, UNC, CU, ASC, and FLC. **57** students participated in DemoSat V.
- CSU-Pueblo & UNC submitted proposals to support a new and expanded workforce development projects.
- Undergraduate students at CU Boulder successfully designed, built, tested, and integrated the RocketSats II & III payloads. Launches took place on April 28, 2007 & June 20, 2007.
- The Colorado CubeSat (CO³Sat) mission progressed throughout 2007, working toward a 2008 launch.
- Development of the first annual Colorado Robot Challenge was completed and the first Challenge took place April 7, 2007. Students at ASC were integral at development of the program and students from CSU-Pueblo and ASC participated in the challenge.

The COSGC affiliate director at Adams State, Randy Emmons, led this effort. The Second Annual Colorado Robot Challenge is scheduled for April 5, 2008.

- A short workshop was hosted at ASC (Alamosa, CO) in preparation for the Challenge. Students and professors from COSGC institutions participated in a successful workshop.
- UCCS started a new student research project to demonstrate the basics of a “space sling”.
- UNC students designed and built a semi-autonomous rover, housed in a protective box. The payload was flown on the August 2007 DemoSat V launch. The demonstration would have been successful, had the rover not become tangled in the balloon tether.
- Students at FLC participated in astronomical research with faculty, attended the New Mexico Symposium (a professional astrophysics conference), launched a balloon-borne cosmic ray detection device for DemoSat V, attended a Robotics Workshop, and helped with an upgrade on the community observatory.
- Students at CSU – Pueblo participated in the Colorado Robot Challenge, with student teams designing and building two distinct rovers. The teams then participated in the Undergraduate Research Symposium where they discussed their work and outcomes. Students have begun evaluation and redesign in preparation for the Challenge in 2008.
- At WSC the first semester of a new Gateway to Space course was offered in the spring 2007 semester. Students were supported for work on robotics, including attendance at workshops and competitions.
- CU students and staff completed the development of the RockOn! workshop in conjunction with NASA Wallops Flight Facility and Virginia Space Grant Consortium. The 1st RockOn! workshop is scheduled for June 23-27, 2008. Development will continue through spring 2008.
- CSU funded students in summer intern projects – DemoSatV, AutonoRam UAV, and research in laser measurements or erosion of electric propulsion devices. A CSU student team became the first DemoSat team to successfully launch and deploy an autonomous rover, that deployed after landing and drove around the landing site.
- MSC students participated in the development of a full scale autonomous vehicle – specifically on software development and vehicle design.
- The LEO DANDE mission student team completed their Preliminary Design Review. The DANDE mission now includes students from both CU and UNC. The combined team proposed for and won a flight on the KC-135 that will take place March 2008.
- The Annual Undergraduate Research Symposium was held April 2008.
- MSCD developed a course based on the BalloonSat curriculum, CSMARTS, as a Gateway course. The course will be offered in Spring 2008 for the first time. Students at MSCD participated in DemoSat V and traveled to KSC with the COSGC group.
- CSM students worked on a research project with faculty exploring construction and operation of an outpost on the Moon. The team entered the PICES lunar outpost student design competition.
- CSM students continued research on sample acquisition. A student design team developed a drilling rover for sample and resource recovery on the Martian surface. As a result of its work, the team was invited to participate in the RASC-AL Forum in May at the Kennedy Space Center.

- EduSourcing was discussed at the 2007 Fall Colorado Space Grant Director's Meeting and at the 2007 summer COSGC Advisory Board meeting.
- A total of **20** students were placed in EduSourcing industry internships.
- Two new companies partnered with the EduSourcing program: Exoterra and Advanced Solutions, Inc.
- Negotiations are currently taking place to partner with other local companies.
- The EduSourcing program was discussed at two events hosted by the Colorado Space Business Roundtable. Numerous representatives from Colorado Aerospace industry were available at both events and connections with possible future partners have been made.
- The EduSourcing program has expanded to include students from 2 COSGC institutions (CU and CSM).
- Three students were hired as a direct result of their participation in EduSourcing. Michitaka Onizuka and Ponphet Homchanh were hired at MicroSat Systems, and James Hilverding was hired at Lockheed Martin.
- The LEO mission, DANDE, includes collaboration with faculty from Aerospace Engineering. Collaboration has been in the form of faculty time as advisors and student mentors. In addition, Aero faculty have provided much needed funding through their own grants.
- CU Space Grant students flew an Aerospace professor's GPS experiment on the RocketSat II flight.
- CSU funded 2 faculty seed grants to bolster space-related research: 1) Non-Contact Magnetic Sensing of Azimuthal Current in Hall Thruster; and 2) Rapid, Field-Based Biological Analysis System.
- CU has partnered with Aerospace and Electrical and Computer Engineering faculty on several Senior Design projects.

Student Accomplishments:

In addition to awarding **128** fellowships and scholarships to Colorado students at institutions of higher education, COSGC student programs engaged over **1,350** students in hands-on, space hardware programs.

David Gooding was an Electronics Engineering Technology (EET) major at CSU – Pueblo. David participated in DemoSat III & IV as a CSU – Pueblo student. Following the successful launch of the payload he worked on for DemoSat III, David traveled to the Jet Propulsion Laboratory to present his work along with 20 fellow COSGC students in August 2005. As a result of his hands-on, space hardware experiences, his visit with JPL engineers and scientists, and his success in the EET program, David was offered a position at JPL in June 2006 and he continues to work at JPL at the present time.

In September of 2000, Stephan Esterhuizen was a student in the first CU Gateway to Space class that used BalloonSats as a learning tool. Stephan showed talent and initiative in the class and was recruited to work on two LEO satellite missions. After three highly productive years with the CU Space Grant program (working on the Citizen Explorer and

Three Corner Satellite missions), Stephan was recruited by the Aerospace Engineering program to attend Graduate School and work with faculty on UAV and GPS research. Stephan returned to COSGC in 2006 as a graduate researcher when he needed a platform to demonstrate technologies and gather data needed to complete his thesis. A BalloonSat provided the perfect opportunity. Freshman students in the Gateway to Space class worked with Stephan to provide two Balloon payloads to carry his science instrument. His final year at university, Stephan came full circle in the COSGC program, receiving support for his research, while providing mentorship to the next round of students. Stephan is currently employed at JPL.

Brian Lionberger, former MSC student, was a part of the DemoSat III project was hired at Sun Microsystems. His experience with COSGC and the DemoSat project, strengthened his real-world experience and resume.

David Fifield, a Computer Science graduate of MSCD, was instrumental in developing visualization software for translating linear and angular accelerations that was used on DemoSat IV and V payloads. David was selected as Metro State's "Outstanding Graduate" in 2007, by the President's Office after a very competitive process. In his acceptance speech, David repeatedly referred to his experience with Space Grant and his hands-on work with the DemoSat projects.

Michitaka Onizuka, Ponphet Homchanh, and James Hilverding all received positions at local Aerospace Industry following graduation, as a direct result of their participation in the COSGC EduSourcing Student Internship program. Onizuka and Homchanh were hired at MicroSat Systems and Hilverding was hired at Lockheed Martin.

Sarah Nowak, UNC Physics Junior, was one of a team of four students that designed, built, tested, and flew a semi-autonomous rover with the DemoSat V program. As a sophomore student, this was Sarah's first foray into hands-on, space hardware projects. Inspired by her experience with DemoSat V, Sarah submitted a dossier to compete for the Colorado Elaine Hansen NASA Internship Competition. Sarah won an all expenses paid internship to Goddard for her effort. Sarah was chosen to attend the NASA Academy.