COLORADO COMMUNICATOR

Providing a diverse group of Colorado students with experiences in space to prepare them for our nation's future space programs.

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Rockets, Rockets, Rockets

Colorado's first foray into sounding rocket payloads took place in the early 1990s with the CSOAR and CSHARP missions. In 1996 the HOMER rocket mission engaged students at the University of Colorado Boulder (CU) and the University of Southern Colorado (Pueblo). Following the HOMER mission, the focus of student space hardware missions advanced to low earth orbiting satellites. Since 2004, COSGC has been developing a new generation of Colorado sounding rocket payloads that began as part of the Staged Hands-On Programing (SHOP) approach to student space hardware experiences. SHOP engages post secondary students in rover/robot projects, telescope observing, high altitude balloon payloads, laboratory research, High Altitude Student Platform payloads and low earth orbiting CubeSats and nanosatellites. Students work on projects of growing complexity as they continue to be a part of Colorado Space Grant program as post-secondary students.

The first generation of the new COSGC sounding rocket payload effort was RocketSat I. The payload was designed to be easily reproducible in order to accommodate follow-on student missions, as well as to provide a platform that could be used to extend rocket payload opportunities outside of Colorado. With the successes of RocketSats I, II, and III, COSGC completed the design of a "how-to workshop", in partnership with NASA's Wallops Flight Facility and the Virginia Space Grant Consortium. This workshop, called RockOn! was designed to provide educators from across the state with experience and resources to implement student rocket payload projects at their home institutions.

The success of the first RockOn! workshop in 2008 led directly to the formation of the RockSat initiative, coordinated by COSGC staff and students. RockSat provides competitive launch opportunities to student teams from across the country. Teams apply for a sounding rocket launch opportunity. The idea was to provide the tools for developing sounding rocket payload projects via RockOn! and to followup the "how-to" with a launch opportunity the following summer. Thus far 123 of participants have engaged in the RockOn! workshop and ~23 student teams have launched payloads as part of RockSat. More information about the RockSat program can be found on page 8 of this newsletter.

Within COSGC, the RockOn! and RockSat initiatives have enabled COSGC affiliate institutions to add sounding rocket missions to their student space hardware opportunities. In addition to CU, Colorado students are engaged in sounding rocket missions through RockSat at Colorado State University (Ft. Collins) and the University of Northern Colorado (Greeley). For details on CU, CSU, and UNC missions see page 4.

Launch of the RockOn! and RockSat payloads at Wallops Flight Facility, June 2010.

Colorado Space Grant Affiliates

Adams State College
Randy Emmons

Colorado School of Mines
Bob Knecht

Colorado State University
Azer Yalin

Colorado State University - Pueblo
Huseyin Sarper

Community College of Aurora
Victor Andersen

Community College of Denver
Seth Stepelton

Fort Lewis College
Charlie Hakes

Mesa State College
Phil Kavanagh
Warren MacEvoy

Metropolitan State College of Denver
Aaron Brown

Pikes Peak Community College
Bud Murch

Pueblo Community College
Bill Hardwick

Space Foundation
Iain Probert

Trinidad State Junior College
Bob Philbin

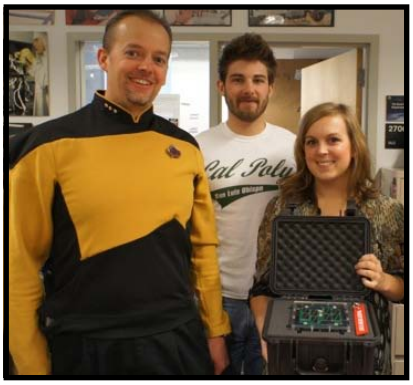
University of Colorado Boulder
Brian Sanders

University of Colorado Colorado Springs
Steve Tragesser

University of Northern Colorado
Bob Walch

Western State College
Suzanne Taylor

Director's Corner



COSGC Director, Chris Koehler, poses with students Nicole Doyle and Mike Opland at the Hermes Bon Voyage celebration.

2010 was a remarkable year for the Colorado Space Grant Consortium. It was the final year of our 2006 – 2010 Strategic Plan. While preparing the first draft of the 2011 – 2015 Strategic Plan, I was struck by how much we have accomplished over the last 5 years and how these accomplishments have propelled COSGC into a new landscape. COSGC in 2010, like the COSGC of 2005, is still focused on providing students the best possible experiences on real-world and hands-on space projects. However, the range of projects has expanded. Students across the state are engaged in laboratory research, advanced balloon payloads, autonomous robots and rovers, sounding rocket payloads, moon buggies, astronomical observations, and small and large LEO satellites. Students are collaborating with engineers and scientists from NASA centers and facilities as well as aerospace companies. Students leverage their experiences into the touchstones of their careers, securing employment at NASA centers and supporting aerospace and STEM related companies while others are pursuing advanced STEM degrees. COSGC is truly making a impact in the lives and futures of Colorado students.

The year kicked off in January with our ACCESS program realizing its goals with a successful balloon launch of payloads built by students at our new affiliate community college campuses. Launch was followed by a trip for 16 students to NASA's Jet Propulsion Laboratory to present their results. There were 16 JPL engineers and scientists involved with the review and tour of the JPL facilities. It was amazing to experience a life-changing trip with the students and to officially welcome four new affiliates into the COSGC family

Over 100 students from all over Colorado participated in the annual COSGC Undergraduate Student Space Research Symposium. I was so happy for all those who participated and were awarded session prizes. My heart soared when the grand prize was awarded to one of our ACCESS participants. I am thrilled that the Colorado Robot Challenge at the Great Sands Dunes is growing each year. April's event, was the biggest Challenge yet. It was also in April that I was invited to attend an event at Kennedy Space Center where I met President Obama - a moment I will never forget.

This year I had the pleasure of traveling to all of our affiliate campuses. This annual road-trip is near and dear to my heart. The time visiting our affiliates in their labs and offices is eye opening. It helps me remember that we are truly a statewide program that is making a difference throughout Colorado.

June was marked with another successful SHOT (Student Hands-On Training) workshop with the University Nanosat program, which is funded by the Air Force Office of Scientific Research. COSGC is proud to continue to support this workshop and collaboration since 2003. June was also the month of our RockOn and RockSat launch at NASA's Wallops Flight Facility. This year's launch was a blast.

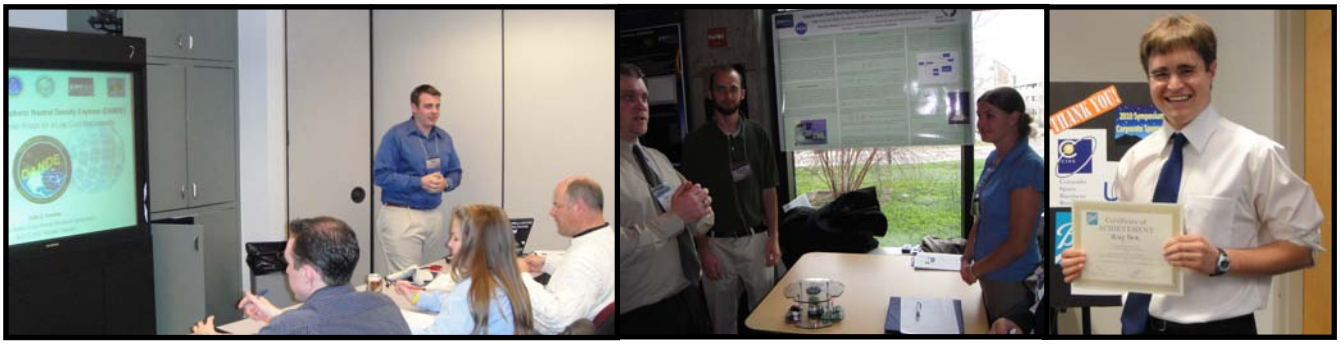
Jumping ahead (because I am running out of room on this page), my fondest moment of 2010 was when COSGC's first student-built CubeSat (Hermes) was delivered to NASA for launch in February 2011. Hermes will be the first COSGC student satellite to orbit the Earth since the days of our Get-Away-Special payloads. Getting Hermes ready and delivered is a testament to the type of students who are engaged at COSGC. Without the leadership of Nicole Doyle, Hermes would not have made it. Mike Opland, Tyler Murphy, Brian Roth, and Anthony McDougle also made the delivery of Hermes a reality with the countless hours of effort they poured into that little 1 kg satellite. I will be forever grateful for their dedication.

There are many more events of 2010 to reminisce about, but I will share one final thought. None of these achievements could have occurred without the amazing team that forms the COSGC family. The staff at the lead intuition, the affiliate directors and supporting faculty and staff at our 17 affiliate institutions around the state, our advisory board, friends from industry, faculty mentors, alumni who give back to current students, and most importantly our students, whom we serve and who in the end make COSGC all that it is today. I look forward to the possibilities and opportunities that lay before us in 2011.

2010 Undergraduate Space Research Symposium

COSGC's annual Undergraduate Space Research Symposium was held April 17, 2010. Students from consortium institutions across the state presented research papers to panels of industry engineers and scientists. Industry partners also volunteered their time to read and judge student papers prior to the presentations. Students competed for cash prizes sponsored by local aerospace companies. The Grand Prize winner was "Effects of Near-Space Conditions on the Genome of *E. coli*" by Katherine Cullis, Susanna Jacobs, Puja Kapoor, Kim Richard & Shellene Wright (Community College of Aurora). Session winners were Lee Jasper (University of Colorado) with "Testing Methodologies for Student Built Projects"; Riley Pack (University of Colorado) with "Phoenix Architecture"; and Kyle Kemble (University of Colorado) with "A Novel Approach to Body Mounted Solar Arrays for a Low-Cost Nanosatellite". The winners of the hardware demonstration were University of Northern Colorado students, Sage Andorka, Zach Sears, Dan Welsh, Maurice Woods III, and Motoaki Honda for "Liquid Fuel Slosh during the Flight of a Sounding Rocket: SloshSAT".

Shellene Wright (left) accepts Grand Prize honors from COSGC Academic Coordinator, Kendra Kilbride, on behalf of her team from Community College of Aurora.



Left to right: Kyle Kemble (University of Colorado) presents with the front row of industry judges looking on; Zach Sears, Dan Welsh, and Sage Andorka (University of Northern Colorado) answer questions about their SloshSat Demonstration; Riley Pack (University of Colorado) displays his session prize

The **Colorado Space Grant Consortium** (COSGC) uses the excitement of our Nation's aeronautics and space programs to inspire, educate, and develop America's future technological workforce by enabling a diverse community of college and university students.

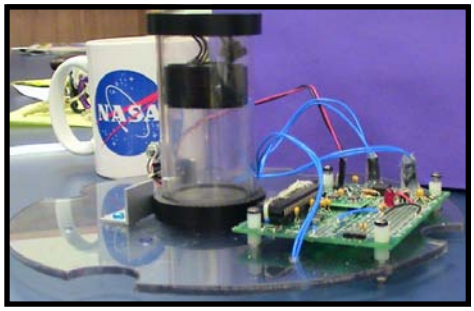
COSGC consists of 16 institutions of higher education and 1 non-profit foundation in Colorado. COSGC students have access to resources including faculty and industry mentors, a clean room, assembly and integration labs, faculty research labs, a mission operations and control center, ground satellite tracking stations, observatories, as well as numerous partnerships with NASA Centers and Industry.

Colorado Student Rocket Payloads

Student teams from three COSGC institutions designed, built, tested, and launched sounding rocket payloads as part of the RockSat initiative in collaboration with NASA's Wallops Flight Facility (see RockSat article on page 8). Sounding rocket payloads were built at Colorado State University (CSU), University of Northern Colorado (UNC) and University of Colorado at Boulder (CU) in the 2009/2010 academic year.

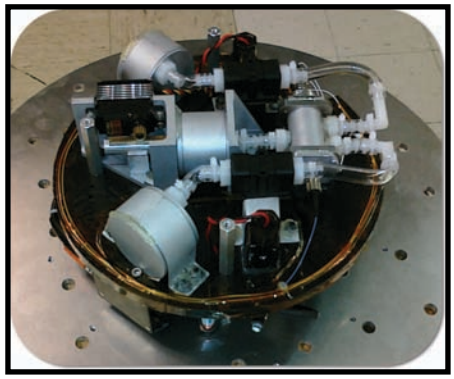
UNC SloshSAT team celebrates a victory at the 2010 Colorado Undergraduate Space Research Symposium, where they won first place in the hardware demo session.

The SloshSAT payload was designed by the UNC RocketSAT team. Headed by Sage Andorka (UNC physics education major), the team included Maurice Woods III, Mototaki Honda, Zach Sears, and Dan Welsh. The UNC team explored the effects that liquid fuel can have on a rocket vehicle. As the rocket ascends, its vibrations could cause the fuel to oscillate in a manner that induces a sloshing motion, which, if unmitigated, could cause the rocket to tumble out of control, compromising its mission. The payload was designed to restrict the movement of a canister, filled with fluid, to the vertical axis of motion. Students were challenged to find a liquid that would not endanger the rocket's electronics nor those of other payloads. They used Galden 110 (donated by Solvey Solexis, the company that developed the liquid). The liquid is designed to cool large servers, and is nonreactive and safe for electrical devices. The students tested the liquid by submerging a cell phone in Galden 100 and then calling the phone to ensure it was operational. Following thermal tests, the team was convinced of the liquid's safety, as were Wallops engineers.



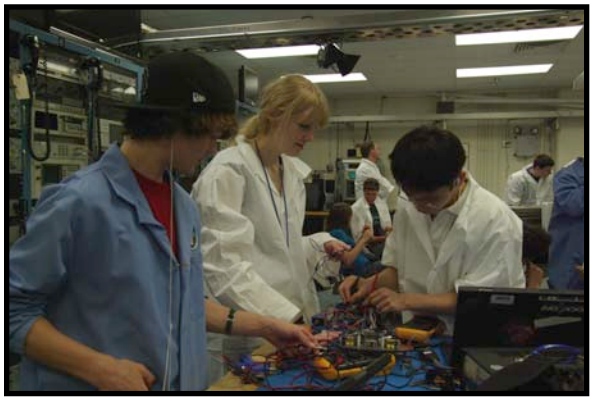
The SloshSAT payload.

The CSU sounding rocket payload program was developed as part of the senior projects course offered in the engineering department. CSU students, Ryan Sullenberger, Wesley Munoz, Kenny Vogel, and Matt Lyon decided to explore an innovative way to determine liquid volume in a tank in microgravity without liquid settling, tank stirring, or spacecraft acceleration. As current mass gauging sensors add significant weight to propellant tanks, the team's goal was to design a lightweight gauge. Their answer was an optical mass gauge which would allow accurate, real-time liquid measurements in any gravitational environment. The experiment garnered interest from NASA's Marshall Space Flight Center (MSFC), which also provided mentors to the CSU team. A new student group is working with MSFC advisors to re-fly the payload in summer 2011.



The CSU optical mass gauge payload.

At CU, students were intrigued by meteoric smoke particles that are deposited from meteoroids burning up upon entry into Earth's atmosphere. These particles collect and eventually sink to lower altitudes, but remain in the mesosphere for months. CU students determined that a sounding rocket payload would be ideal for such a mission and developed the RocketSat VI (RSVI) mission. RSVI was designed to detect the amount of large aerosol particles and the charge of the particles in the atmosphere during ascent. While there are models that predict the distribution of the particles, there are few in-situ measurements to fully support the predictions. The CU RSVI team hoped to find conclusive data as to whether or not there is a significant amount of large aerosol particles in the atmosphere above Virginia, and to use their data to further validate models predicting the shift of the particles. Ultimately, the students' goal was to have a better understanding of the effect the aerosols have on the atmosphere and their relation to mesospheric phenomena.



The CU RocketSat VI team does final checks prior to integration at Wallops Flight Facility.

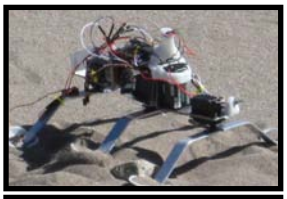
Colorado students from all three missions participated in final check-out and integration and attended the launch of their payloads at Wallops Flight Facility in June 2010. All three programs have continued their rocket payload programs into the 2010/2011 academic year and are scheduled to launch as part of either RockSat-C in June 2011, or the new RockSat-X (see page 8) initiative in July 2011.

Colorado Robot Challenge Has Biggest Year Yet!

The 4th annual Colorado Robot Challenge took place on April 3, 2010. This year's event had the most student teams participating, as well as the largest overall attendance since the Challenge began in 2006. More than 100 students, faculty, advisors, and visitors watched student teams demonstrate how their autonomous robots faced the extreme environmental conditions at the Great Sand Dunes National Park in Alamosa, Colorado - including the fine sand, which is ever blowing on the dunes and gums up moving parts in seconds. The Robot Challenge is the brain child of COSGC Affiliate Director, Randy Emmons (Adams State College). Dr. Emmons has taken his enthusiasm for robotics all over Colorado and northern New Mexico, as he proves anyone can make an autonomous rover with an hour's worth of instruction and resources. One proven fact is if you show up with a robot built out of Legos, it will quickly succumb to the fine, blowing sand. The location also has freezing temperatures that has rendered batteries inoperable.

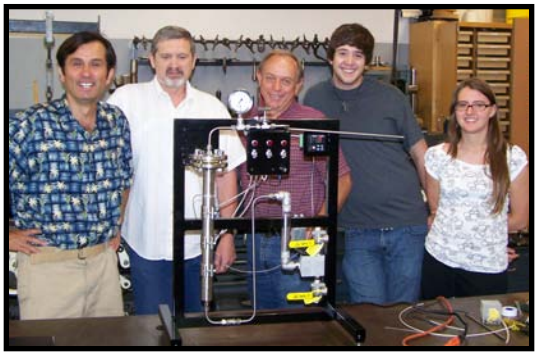
In order to build on the "Mars Tradition" of the Great Sand Dunes National Park (test site for systems of the Viking Landers), Dr. Emmons chose the site for the annual event. "I believe our efforts will not only improve our understanding of autonomous robots, but will encourage students to study key science and technology disciplines needed by our country," Dr. Emmons explains. "Not only for students in Colorado, but those across the nation."

The 2011 Challenge is scheduled for April 2, 2011. COSGC is hoping to reach a wider audience in 2011 and has extended the offer of how-to workshops to high school students and Space Grant Consortia in neighboring states. The coordinating team, including Dr. Emmons and COSGC Research Coordinator Brian Sanders, are working toward standardizing communications. Standardization will enable student teams to focus on developing more sophisticated mechanical and electrical systems that can overcome challenges naturally provided by extreme environmental conditions of the Sand Dunes. As well as those designed by Dr. Emmons.



CSU-Pueblo Working on Real-World Mars Exploration Challenge

Along with faculty and staff mentors, engineering and chemistry students at Colorado State University - Pueblo are focusing on the challenge of creating fuel for the return home from Mars. The engineering team designed and built a Sabatier reactor, designed to combine hydrogen gas with the carbon dioxide (present in Mars' atmosphere) to create methane and water. The methane is used as fuel while the water is used through a solar electrolysis process to provide more hydrogen gas along with oxygen gas. The team has completed a successful initial test run, resulting in condensed water creation in the a cooled cryogenic flask. The next step will be to optimize gas flow rates, temperatures, and ultimately to quantify any methane along with residual carbon dioxide or hydrogen.



CSU-Pueblo students, staff, and faculty take a break to pose with the Sabatier reactor.

The reactor in action.

Hermes Team Delivers Their CubeSat Payload

The student team working on the Hermes CubeSat Payload at the University of Colorado (CU) is preparing for Mission Operations. The Hermes payload is part if NASA's ElaNa (Educational Launch of Nanosatellites) program, scheduled for launch February 2011. Students delivered Hermes on November 14, 2010 for acceptance testing and integration into the P-POD (the integrated flight unit) along with cubesats from Kentucky and Montana. The P-POD will now be turned over to NASA KSC for installation of the thermal blanket.

In reflection of its primary science mission, which demonstrates a high speed communication system, the project is named for Hermes, the Greek messenger god. One challenge with CubeSats that have been launched to date, is the low data-rate of their communication systems. While current systems work fine for the uplink of commands to satellite and the downlink of basic health and status information, it is exceedingly difficult to downlink large quantities of data, such as that associated with imaging or high-data science experiments. Hermes plans to improve CubeSat communications through the on-orbit testing of a high data-rate communication system that will allow the downlink of large quantities of data, making CubeSat imaging or high-data quantity science feasible. Another objective of the project is to create a reproducible and extensible spacecraft bus in the support of future missions. This will allow future COSGC CubeSat teams to focus more on the science aspects of low-earth orbit spaceflight, rather than the logistics of designing a spacecraft.

Left to right: CU students Nicole Doyle, Tyler Murphy, and Mike Mozingo observe vibe testing at a Lockheed Martin facility; Mike Opland and Tyler Murphy prepare for the integration of Hermes at CalPoly; Hermes project manager, Nicole Doyle, in the clean room during P-POD integration; Student's rendering of Hermes in orbit.

Students Design and Build a Ground Station

Over the past two years, as the Hermes team designed, built, and tested their CubeSat, a separate student team has been busy designing and building the ground station that will make S-band communication between students and the Hermes CubeSat possible. Their first challenge was to pinpoint the perfect location - one that had a clear view of the sky and could still be equipped with the required internet and electrical connections. The answer came from former Colorado Space Grant director, Elaine Hansen. Elaine volunteered space on the horse ranch she co-owns, Blue Cloud Farms, in Longmont, Colorado. The student team, led by aerospace engineering students, Lauren Persons (sophomore), and Aaron Russert (graduate student), have transformed a small corner of the horse ranch into COSGC's S-band communication center (including a strong fence to protect the dish and the horses).

In addition to physical space donated by Elaine Hansen and Blue Cloud Farms, the effort has been enabled by funding from the University of Colorado's Engineering Excellence Fund and advisors from Edge of Space Sciences. Many undergraduate students have contributed physical labor and communications and electrical engineering talent into the design, build, and testing of the ground station in preparations of Hermes mission operations.

BLUE CLOUD FARMS, INC.

EOSS

Engineering Excellence Fund

New Space Hardware Mission

Students from the University of Colorado at Boulder are working to develop a miniature satellite, known as ALL-STAR (Agile Low-cost Laboratory for Space Technology Acceleration and Research). The ALL-STAR mission began in January 2010 and is being developed in collaboration with Lockheed Martin. Lockheed Martin has provided funding for the ALL-STAR mission in addition to advisors from Sunnyvale, CA, Palo Alto, CA, Newtown, PA, Albuquerque, NM, and Denver, CO. Mentors supply their system engineering, program management, and systems integration expertise to students as they design, develop, and build the 3-unit CubeSat.

ALL-STAR will be designed to support one year on-orbit operations for a variety of space-based research payloads. The project is the first in a new series of COSGC CubeSats developed by students, as the spacecraft bus will be reproduced and evolved to support future student missions.

The ALL-STAR project was the catalyst for a newly developed senior project mission for students completing their final year in CU's aerospace engineering program. Senior design students are developing a science payload, called THEIA, that will fly as the ALL-STAR inaugural flight. The the THEIA payload is designed to demonstrate ALL-STAR's advanced CubeSat capabilities. To do this, the THEIA payload will include a student-designed telescope that will demonstrate the high-power and extensive data transfer capabilities, along with the pointing accuracy of ALL-STAR.

ALL STAR students and mentors pose for a group picture following the mission preliminary design review.

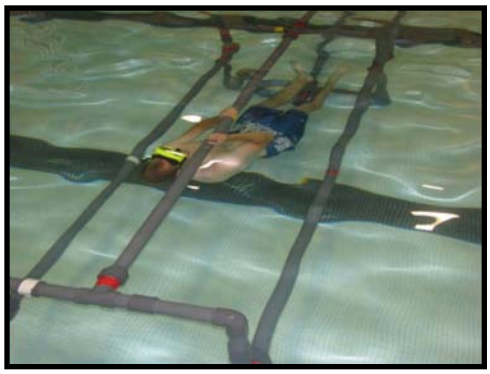
LOCKHEED MARTIN

Teacher Education Programs at the Space Foundation

The teacher education programs at the Space Foundation have officially moved into their new home at the Discovery Institute on the campus of the Jack Swigert Aerospace Academy (a District-11, space-focused public middle school in Colorado Springs, CO). From this new location, the Space Foundation continues to offer programs to support teachers and PreK-20 students that meet standards-based education and are designed to integrate science, technology, engineering and mathematics into daily curriculum. The Space Foundation's approach is to leverage its resources by investing in teachers, who then can impact their students.

One of the major efforts implemented by the Space Foundation's education team are the Space Across the Curriculum Courses. Courses are taught not only in Colorado, but also Charles County, Maryland and Chicago. Two of the most popular classes are Biological & Physical Research and Earth Systems Science. Biological and Physical Research provides teachers with underwater microgravity simulations and examination of long-duration space missions comparison taking teachers up one of Colorado's best known mountains - Pikes Peak. The Space Foundation's newest education endeavors are their PreK-2 Early Childhood Space Exploration courses. More information about these and all of the Space Foundation's Teacher Education programs may be found at:

www.spacefoundation.org/education



Colorado-Run, Nationwide Rocket Payload Programs

The RockSat-C (RockSat-Canister) program began in 2008, as a planned follow-on to the initial RockOn! workshop (a five-day intensive hands-on, how-to workshop developed by Colorado Space Grant Consortium). RockSat-C was developed in collaboration with NASA's Wallops Flight Facility (WFF), to provide launch opportunities to student teams from institutions that had previously participated in the RockOn! workshop and established sounding rocket payload programs at their home campuses. The premise of the program is the payload canister (the same one used in the RockOn! workshop) that provides a standard payload volume and weight for launch on a sounding rocket for a relatively low cost. The canister is a modular system of cans designed for suborbital flights with WFF Sub-SEM ring assembly. The objective of the RockSat payload canister is to give customers a design envelope to build around that will allow easy integration to any WFF rocket using the ring assembly. In order to be considered for a RockSat launch, payloads must be student developed, but are expected to include engineers from academia and/or industry as mentors. The second RockSat-C launch took place on June 24, 2010 and included student payloads from 10 universities. The third RockSat-C launch is scheduled for June 23, 2011 with 7 universities participating.

Left to Right: CSU and UNC students pose near the stack of canisters following successful integration of their payload; Wallops engineers carefully put the skin on the fully integrated payload canisters; RockSat students, faculty members, and Wallops engineers pose in front of the fully integrated rocket.

The RockSat-C program has been a successful way to offer low-cost, student access to suborbital space. Based on the popularity of the RockSat-C program and a desire to launch student payloads to a higher altitude and provide resources for more complex experiments, the RockSat-C team developed RockSat-X (RockSat-eXtreme), once again in collaboration with WFF engineers. The RockSat-X payload deck is a modular system, based around decks designed for suborbital flights with WFF's sub-SEM ring assembly. However, student teams have access to a rocket with an ejectable skin and nose cone that will expose experiments to the space environment fully at apogee. Additionally, the rocket will be de-spun to a reduced rate of ~0.5Hz to allow for greater range of experiments. Currently, three universities are participating in the RockSat-X program which is scheduled for launch in July 2011.

The RockSat-C program is managed by University of Colorado (CU) junior aerospace engineering student, Emily Logan and RockSat-X by CU aerospace engineering graduate student, Shawn Carroll. Emily and Shawn mentor student teams from across the country to teach them the engineering process and what it takes to build a payload to launch on a sounding rocket. They facilitate reviews and tackle issues that come up as student teams develop their payloads. Emily and Shawn also act as liaisons between students and Wallops engineers. One of their duties includes working with students to ensure payloads meet Wallops requirements in order to streamline integration. During integration Shawn and Emily step aside and encourage the teams to directly work with Wallops engineers to integrate their payloads to the launch vehicle.

More information about RockSat-C, RockSat-X, and the 2011 RockOn! workshop may be found at spacegrant.colorado.edu/rockon

COSGC's Newest Members Hit the Ground Running

The Colorado Space Grant Consortium (COSGC) grew by four affiliate institutions at the end of 2009. Community College of Aurora (CCA), Community College of Denver (CCD), Pueblo Community College (PCC), and Trinidad State Junior College (TSJC) joined the consortium through the ACCESS (Active Community College Experiences for Students in Space) program. ACCESS was funded through the National Space Grant College and Fellowship Program's Minority Serving Institution Partnership Development Competition. Student teams at each institution developed, built, and launched balloonsat payloads as their initiation into the COSGC program. As part of their first-year of engagement with COSGC, students and faculty from the participating community colleges travelled to JPL and presented the results of their ballonsat experiments to NASA engineers and scientists. Each of the institutions have continued their programs as fully-funded COSGC affiliates. As such, they have established student hands-on hardware programs designed to meet the needs of their unique student populations.

Top to Bottom: TSJC student team working with sensors during balloonsat design and build; TSJC students pose with their robot at Great Sand Dune National Park; close-up of the TSJC "Zil Screw Drive" robot.

CCA accepted the challenge of facilitating two separate balloon payloads their first year out: one testing the effectiveness of Mars-like regolith as a shield against radiation; and the other examining genetic mutations of E.coli exposed to various near-space extremes. The biology experiment exceeded student and mentor expectations. The team's research was presented at the 2010 Undergraduate Space Research Symposium, where they won grand prize. Following this success, the team leader was invited to present at the National Space Grant Director's meeting in Washington D.C. Their project caught the attention of representatives of LSU's HASP (High Altitude Student Platform) program and they won space on the 2010 launch where they will fly their experiment for a longer duration and a slightly higher altitude.

TSJC students developed a balloon payload designed to take "air core" samples of the atmosphere. The team connected with scientists at NOAA where similar air core experiments are underway. Inspired by the experience with their balloon payload and eager to do more, students and faculty decided to design a robot to participate in the 2010 Colorado Robot Challenge. The result was one of the most creative robots to-date.

CCD and PCC successfully flew balloon payloads and have since both experienced a change in leadership on their campuses. Their programs are being redeveloped for the 2010/2011 academic year. The majority of students engaged in the first year of the new COSGC affiliates have moved on to four-year institutions to continue their coursework toward 4-year degrees. Many are attending colleges and universities that are also affiliates of COSGC. Sabrina Eggleston (PCC) and Puja Kapoor (CCA) were accepted as summer interns at JPL as a direct result of their balloon payload experiences. In addition, David Ceniceros (CCD) worked at a summer internship on the Hermes CubeSat mission at the University of Colorado.

Left to Right: Community College students and faculty pose with JPL engineers and a prototype of a Mars rover following final report presentations; PCC students during their final presentation at JPL; CCD students and faculty pose with their balloon payloads after launch and recovery; CCA students and faculty try to keep warm as they get ready to track their payloads following an early morning (and freezing) launch in Deer Trail, CO.

Colorado Balloon Payloads Extend Their Reach

HASP (High Altitude Student Platform) is a flight opportunity for student payloads organized by Louisiana State University (LSU) and supported by the NASA Balloon Program Office and the Louisiana Space Consortium. The platform provides students the opportunity to build and launch a payload that reaches 120,000 feet on a zero-pressure NASA balloon at the Columbia Scientific Balloon Facility in Ft. Sumner, New Mexico. The first two HASP payloads at University of Colorado at Boulder (CU) Space Grant helped quantify many variables in order to perform future astronomical observations including sky brightness, number density, optical and mechanical disturbances, and viability of using a start tracker in the upper stratosphere. The 2010 payload, SPARTAN-V, seeks to determine the feasibility of detecting transiting exoplanets from a balloon platform. The student team began working on SPARTAN-V in November 2009 and completed build and test in time for the 2010 delivery and integration schedule.

CU was not the only COSGC institution to represent Colorado as a 2010 HASP payload. Community College of Aurora (CCA) students developed a balloon payload for a short balloon flight. Their results were intriguing enough to win the team a spot on the 2010 HASP flight. CCA's team hopes to further investigate genetic mutations of *E.coli* exposed to various near-space extremes for a longer period of time and at a higher altitude than the initial balloon flight.

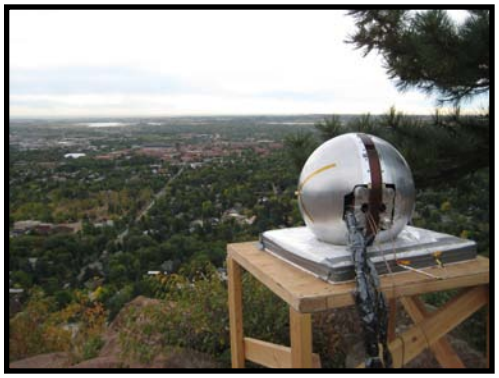
CCA and CU students participated in integration and pre-launch testing of their payloads at the Columbia Scientific Balloon Facility in Palestine, Texas for a week in August 2010 in preparation for an early September launch. However, following an accident during the launch of a similar platform in Australia, the 2010 launch was put on hold pending an internal NASA investigation. The slip of the 2010 launch has provided student teams with extra time to continue testing and debugging of the payloads. The teams hope to launch May 2011.

Top to bottom: CU students, Yiwen Chen, Josh Tiras, and Sreyas Krishnan during payload integration; CCA student, Shellene Wright, doing final tests awaiting her turn for integration of the CCA payload; the CU team quickly debugging the SPARTAN-V payload during final test and integration efforts.

DANDE Satellite Update

2010 was a busy year for the student team working on the DANDE (Drag and Atmospheric Neutral Density Explorer) satellite. Students are in the final development stage of the mission, focusing on requirement verification and implementation - proving that all sub-systems work together. One of the big pushes in 2010 was getting the Neutral Mass Spectrometer (NMS) functional in order to enable end to end testing. The NMS is DANDE's main science instrument that measures wind speed, direction, and composition. It works in conjunction with the accelerometers to complete DANDE's mission. Students continue to test the NMS at CASA (the Center for Astrophysics and Space Astronomy), a research center at the University of Colorado thanks largely to Dr. Matt Beasley (CASA faculty). Students have also completed, and continue to engage in, a significant amount of communications system testing.

Students are preparing for a launch readiness review in January 2011 with Air Force Research Laboratory (AFRL) representatives. The DANDE team, along with the leadership at CU Space Grant, is working closely with AFRL to review launch opportunities. At the time of publication, the team had just completed their secondary experimental payload review board at the AFRL, U.S. Air Force and the Department of Defense levels and were awaiting notification of their ranking.



The DANDE satellite undergoing communications testing while overlooking Boulder from atop the foothills.

Pikes Peak Community College Students Prepare to Jump on a Balloon

PCC students and their mentors pose during a PTerP team meeting.

Bud Murch stepped in as the affiliate director at Pikes Peak Community College (PPCC) late in 2009. He immediately honed in on the possibility of engaging PPCC students in a balloon payload. In order to gauge the interest of PPCC students in the possibilities of flying an experiment to 100,000 feet, Bud offered a cosmic radiation seminar. Four students participated in the seminar which included lectures by PPCC faculty and industry representatives. Hands-on investigations supplemented the lectures and familiarized students with radiation sources and detectors. Students explored radiation versus distance and shielding and even did an experiment to determine amounts of natural radiation in their lab. Two students emerged as leaders and will be managing the team of students who will design and build the PPCC balloon payload working toward a spring 2011 launch. As of the publication of the newsletter, the team had completed their conceptual design review with industry and academic mentors. The PCC balloonsat mission has been dubbed Terra Proxima (PTerP). The PTerP payload will characterize the near Earth environment in terms of meteorological and ionizing radiation. Additionally, PTerP will examine the effects of this environment on various bio-samples.

CU Undergraduates Take Science and Engineering into K-12 classrooms.

In order to provide opportunities to give back to the community and encourage well-rounded students, CU Space Grant provides service-learning opportunities, for undergraduate students who are working on space hardware missions, to engage with K-12 students. In addition to ad hoc visits by various schools and the general public, CU students facilitate activities in conjunction with Colorado MESA (Mathematics, Engineering, and Science Achievement). Colorado MESA is a statewide program designed to encourage minority and female students to prepare themselves for a college education and to major in STEM disciplines. The MESA mission is to increase the numbers of economically disadvantaged and at risk students who graduate from high school fully prepared for post secondary education. Over the last decade, more than 90% of MESA high school graduates have enrolled in college. Over 80% of the 2008 MESA high school graduates indicated that they enrolled in a math/science related major. Approximately 85% of MESA students are from families in the low-to-moderate income bracket and over half are from ethnic groups underrepresented in math based careers.

CU Space Grant provides NASA content and subject matter experts for the 6-week, space-focused, science intensive program. Each semester, CU Space Grant adopts a school in the St. Vrain Valley School District and undergraduate students facilitate science and engineering activities for 3rd, 4th and 5th graders in an afterschool setting. The final activity is a field trip for the young students to the CU campus where they engage in engineering competitions and have lunch with engineering students.

Student Focus

Community College of Aurora/Metropolitan State College of Denver

Shellene Wright is currently a senior at Metropolitan State College of Denver working toward a BS in cellular and molecular biology with a minor in chemistry. Shellene became involved with Space Grant while attending the Community College of Aurora where she was earning an associate's degree and certificate in biotechnology. Her professor and mentor told her about the opportunity to participate in a balloon payload project. The first project Shellene worked on was designed to look at the effects of radiation, cold, and reduced oxygen on a non-pathogenic species of *E.coli*. The genetic mutations Shellene's team found after a brief flight were very unique and exciting. The team was invited to participate in the Colorado Undergraduate Research Symposium, where they won grand prize. Shellene has noted that Space Grant has opened many doors for her. Recently she was invited to speak at the National Space Grant Director's meeting in Washington D.C.. She recently won a position on the 2010 HASP flight to further study the mutations found during the initial balloon flight. Shellene and her research partner have been invited to speak at the Colorado Space Business Roundtable in December as well. Shellene has become a leader at Metro State Space Grant. She asserts that, "working at Space Grant has allowed me to think about my future in a way that only attending classes does not. The chance to research, design, and test an experiment independently is an experience I have not found in the classroom." Shellene says that working on a team can be challenging and this project has improved her skills in time management and working with people with varied skills. Shellene would like to continue doing biological research in the aerospace field for NASA or other related industries.

University of Northern Colorado

Maurice Woods III is currently a junior majoring in physics with an emphasis in astronomy at the University of Northern Colorado (UNC). Maurice's first experience with Colorado Space Grant was during his freshman year at UNC, where he participated in a project that involved a balloon payload that generated energy using solar panels, peltier coolers, and a magnetic pendulum. During Maurice's sophomore year, he was involved in a rocket payload project named Slosh SAT, which measured the effects of vibration and liquid slosh during a sounding rocket flight. Currently, he is the project manager for the UNC ReX (ReEntry Experiment) SAT payload, which will launch in July 2011. The payload will jettison a capsule that will reenter the Earth's atmosphere while gathering video of its flight. "Space Grant has presented numerous opportunities for me to explore new fields of applied physics that I would have otherwise thought were beyond my abilities," Maurice explains. Upon graduation, Maurice is planning to attend graduate school to earn an advanced degree in physics and astronomy.

Community College of Denver/Colorado School of Mines

David Ceniceros is a sophomore at the Colorado School of Mines working toward a BS in electrical engineering. David became involved with Colorado Space Grant while attending the Community College of Denver. His physics instructor invited him to be a part of the first CCD balloonsat project. His involvement with the Space Grant program at CCD led to an internship at the University of Colorado at Boulder working on the Hermes CubeSat. David worked on the mission operations team, where he helped develop protocols and plans in preparation of the Hermes launch. David also participated in the build and test of the new COSGC ground station that will be used for both the Hermes and DANDE satellite missions. David explains, "The projects I've worked on at Space Grant have given me the opportunity to put what I'm learning at school to practical use. I've noticed how students from different engineering backgrounds work together to make a project successful." After earning his BS, David plans to work in industry for several years, but eventually plans to earn an advanced degree. Ultimately, David would like to be an astronaut - at NASA or in a supporting industry.

Student Focus

University of Colorado at Boulder

Tyler Murphy is an aerospace engineering junior. He first became involved with Space Grant at CU through the DemoSat (balloon payload) program and the Gateway to Space class. He has since worked on many projects during the past three years. He began as a Command and Data Handling team lead on the MarkerSat balloon payload mission. He returned to Space Grant during the summer to volunteer his time on the Hermes CubeSat mission, helping in any way he could. He joined the Hermes structures team and became the team lead. While continuing to work on Hermes, he also worked on the DANDE low-earth orbiting satellite mission on the structures team. Tyler took on more responsibilities with the Hermes mission, accepting the position of integration and testing team lead. As the ALL-STAR team developed, Tyler was asked to fulfill the role of structures team lead. He completed some of the preliminary design for ALL-STAR and then moved into the mechanical systems team lead position. While helping these missions move forward, Tyler mentored student teams in a revamp of a Bell Jar for payload vacuum tests and the CU Space Grant clean room pass-through. When he graduates, Tyler would like to work on satellite structural design at a company like Lockheed Martin. As he continues work on the ALL-STAR mission, he is also becoming more interested in mechanical systems engineering.

University of Colorado at Boulder

Nicole Doyle is an aerospace engineering senior. She first became involved with Space Grant in 2008 on the team developing the COSGC ground station. She soon became the liaison between the ground station team and the Hermes cubesat mission operations (MOPS) team. She was recruited to be a full time member of the MOPS team and eventually became the MOPS team lead. Nicole stepped up as the Hermes project manager in 2009. Nicole has led the team through final testing and debugging, preparing the payload for launch and mission operations while at the same time completing her undergraduate degree and her senior projects course. After graduation, Nicole plans to attend graduate school and would like to do research in the orbital mechanics field.

Colorado State University - Pueblo

Michael Bender is a junior working on a double bachelors degree in chemistry and industrial engineering Mike became involved in Space Grant when he was getting help on organic chemistry homework. His professor asked him what his goals were. When he discovered Mike's education plan, he suggested that Mike join the team that was exploring the problem of rocket fuel and the return from Mars with a Sabatier reactor. Mike is involved in the chemistry portion of the experiment, working with another student on the hydrogen and oxygen gas aspects of the reaction. The chemistry team is working with three engineering students who are tackling the solar electrolysis challenge. The cohesive team is writing a research paper about the experiment with plans to present it at research symposia. His experience with the Sabatier reactor team has provided him an opportunity to develop leadership skills and understand the collaboration of science and engineering teams within a scientific endeavor. His experience has helped to hone his ideas of what he wants in the future and to understand how what he is studying in the classroom can benefit a position that he would obtain in industry. Mike encourages students to "go see your professors not only for homework help, but to discuss independent study opportunities. You never know what might pop up just at the right time!" Eventually, Mike would like to complete an advanced degree in organic chemistry and in chemical engineering and then either teach at a university or work in a NASA supporting industry.

Where are they now?

Scott Harder graduated from the University of Colorado at Colorado Springs in December 2009 with a BS in mechanical engineering and minors in aerospace engineering and mathematics. Scott currently works at Entegris, which is a provider to products and materials used in advanced, high-technology manufacturing. At Entegris, Scott does testing and assists with new product development with the micro-environments product development engineering group. While at UCCS, Scott participated in the Space Grant program. After looking for an opportunity to do something real-world and hands-on to supplement his education, Scott was disappointed when he was not able to find anything that peaked his interest. It was at that time he saw an advertisement for the UCCS Space Grant program - specifically recruiting students to work on the Space Sling project. Scott attended an informational meeting and was intrigued at the idea of designing and building a miniature land-based space sling (in a lab). The purpose of the project was to demonstrate controllability and repeatability in launching a payload along a desired trajectory. It was exactly the type of project Scott was looking for. He joined the team and quickly became a leading contributor to the project, particularly in design, manufacture and implementation. He designed the spooling systems, the drive system, feedback motor control algorithms and lead the effort to design a sensor that measured displacement angles of the tether in the horizontal and vertical planes. The project went through two generations of teams and Scott was able to work with younger students, helping connect their course work with real-world applications in the lab. Scott explains, "it was the perfect activity to help students understand the limitations and the practicality of theoretical analysis as well as the fundamentals of applied mechanical design."

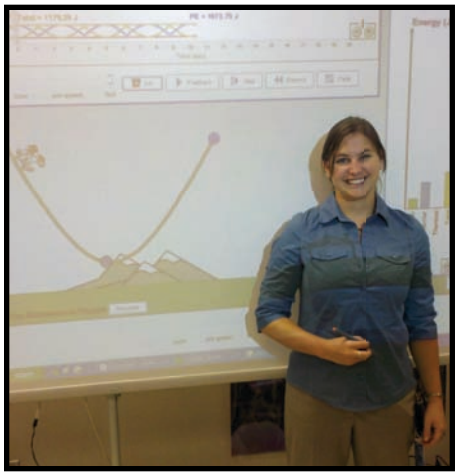
> "I was surprised to find that people were very interested in my work with Space Grant. Particularly during interviews."
>
> Scott Harder,
> former UCCS Space Grant student

"I was surprised to find that people were very interested in my work with Space Grant. Particularly during interviews. I have had two professional experiences since I engaged with Space Grant. At each of these jobs I've drawn from my experience at Space Grant. Space Grant exposed me to real engineering: solving real problems in an efficient and practical manner. Engineering is about turning ideas into reality and my participation in Space Grant helped me do that."

Sage Andorka graduated from University of Northern Colorado May 2010 with a B.S. in physics and her secondary education license. She is currently the Honors and Advanced Placement Physics Teacher at Air Academy High School in Colorado Springs, Colorado.

> "Space Grant challenged me to learn new skills and opened doors to other opportunities that I never knew existed."
>
> Sage Andorka,
> former UNC Space Grant student

Sage learned about the Space Grant program at UNC her sophomore year through conversations with peers. She started working on a balloon payload and was instantly hooked. Sage's first assignment was to study the aerodynamics of differently shaped payloads on the structural design team. She then became the project manager on the next balloon payload where the team studied high atmospheric radiation.



Sage was a participant in the inaugural RockOn! Workshop that took place at Wallops Flight Facility in June 2008. She returned to UNC to help develop a sounding rocket program within UNC's Space Grant. She was project manager for UNC's first RockSat payload, which tested a new analytical method for modeling liquid slosh forces on board space bound vehicles.

"Doing research with Space Grant has allowed me to apply my passion for physics to real life problems. Space Grant allowed me to take the learning from the textbooks and classroom lectures into new areas and practical places. It challenged me to learn new skills and opened doors to other opportunities that I never knew existed. I highly encourage students to get involved." Ultimately, Sage plans to go back to school to earn a Ph.D. in Physics. She asserts, "I look forward to accessing Space Grant's many opportunities again when I continue my education."

Instructions for Alumni about how to join the COSGC Alumni Listserve

Attention Space Grant Alumni: Do you like what you are reading and want to know how you can continue to stay updated with current happenings at Space Grant? If so, you can join our COSGC Alumni listserve. To join go to the following link:

http://spacegrant.colorado.edu/Alumni

Then enter your email address in the "Subscribe to COSGC - Alumni" field and simply click subscribe. Now you'll continue to be updated on all the Space Grant News throughout the year!

Support Tomorrow's Workforce Through a Gift to Space Grant

Support from our former students who are now successful engineers and scientist is integral to the COSGC's success. So is the support from our industry partners. We would like to support an additional 10 students each year through this fund-raising effort. A typical student working the entire year at Space Grant receives about $13,000 in paid wages. Every monetary gift, no matter the amount, contributes toward this goal and is tax deductible in most cases. To leverage your contribution even further, consider matching donations from your employer.

Our nation needs good engineers and scientist with degrees from great colleges and universities to fill the vacancies being created by the "graying of the workforce." Through our student hands-on programs and partnerships with Colorado colleges and universities, NASA, and aerospace companies, COSGC can help give our nation the best. Please join us in making this happen.

Levels of Support

Balloon/Rocket	$1 - $250	includes newsletter and name on Student Support Plaque
CubeSat:	$251 - $500	includes items above plus a COSGC coffee mug
Satellite:	$501 - $1000	includes items above plus a COSGC t-shirt
Moon:	$1001 - $2500	includes items above plus a Space Pen
Beyond:	> $2500	includes items above plus a special lunch with students in your honor.

To sponsor COSGC students you can send a check, donate online, or make a gift by phone at: 1-800-405-9488

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2011 UPCOMING EVENTS

APRIL
- 2 BalloonSat Payloads Launch
- 2 Colorado Robot Challenge
- 9 Colorado Undergraduate Space Research Symposium

JUNE
- 9-11 AFOSR SHOT Workshop
- 18-23 RockOn! Workshop
- 23 RockSat C Launch

JULY
- 19 RockSat X Launch
- 30 BalloonSat Payloads Launch

SEPTEMBER
- 9-10 COSGC Annual Meeting

NOVEMBER
- 5 BalloonSat Payloads Launch

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