



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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Colorado Space Grant Consortium

Consortium Happenings

COSGC is Healthy and Growing!

The Colorado Space Grant Consortium is excited to welcome four new community colleges into the consortium membership. The addition of new affiliate institutions was made possible by a grant from NASA Education through the National Space Grant College and Fellowship Program's Minority Serving Institution Partnership Development Competition. Community College of Aurora, Community College of Denver, Pueblo Community College and Trinidad State Junior College join the COSGC team through the ACCESS (Active Community College Experiences for Students in Space) initiative. The new members officially became affiliate institutions of COSGC by an unanimous vote at the Annual COSGC Affiliate Member Meeting in Boulder, CO on September 12, 2009. These new affiliate institutions help to expand and diversify the Colorado student population engaged in Space Grant's hands-on, space hardware programs.



Colorado Space Grant Director, National Program Assistant, Affiliate Directors, and students at the Consortium Meeting in Boulder, CO



Colorado Space Grant ACCESS participants retrieving their Balloon Payloads.

16, 2010. The ACCESS Program will culminate with a trip to JPL for participating students. Students will present their projects and final data to JPL engineers and scientists on January 29, 2010. More details about the program and schedule may be found at <http://spacegrant.colorado.edu/access>

Students at all four new affiliate institutions are already engaged in balloon payload projects at their local campuses. The ACCESS program is patterned after the successful DemoSat program which continues to engage students in both balloon and rocket payloads at affiliate institutions state-wide. The ACCESS program began in April 2009. A hands-on workshop was hosted in July to train new affiliate directors, faculty, and students. ACCESS partners have assembled student teams, begun the design process, and participated in a Preliminary Design Review. Working with input from mentors from JPL, student teams will follow a strict schedule for design, build and test that will take them to launch of their payloads on January

Colorado Space Grant Affiliates

Adams State College
Randall Emmons

Colorado School of Mines
Robert Knecht

Colorado State University
Azer Yalin

**Colorado State
University—Pueblo**
Huseyin Sarper

**Community College of
Aurora**
Victor Andersen

**Community College of
Denver**
Gudryn Doherty

Fort Lewis College
Craig Tyler

Mesa State College
Phil Kavanagh

**Metro State College of
Denver**
Keith Norwood

**Pikes Peak Community
College**
Bud Murch

Pueblo Community College
Vernon Stringer

Space Foundation
Iain Probert

**Trinidad State Junior
College**
Robert Philbin

**University of Colorado at
Boulder**
Brian Sanders

**University of Colorado at
Colorado Springs**
Steve Tragesser

**University of Northern
Colorado**
Robert Walch

Western State College
Dustin Hite

Director's Corner

Looking back at this past year, I cannot think of one event to talk about in this year's edition of the Director's Corner; I can think of many. 2009 has been an incredible year for the COSGC. So many events this year stand out in my mind that I will remember them for many years to come.

My heart skipped a beat when Abbie Stewart from the Air Force Research Laboratory announced, to a room of about two hundred people from approximately 19 Universities, that our DANDE project was the winner of the University Nanosat V program. This is the equivalent of winning the national championship. The win provides two more years of funding, plus guarantees that DANDE will eventually fly in space.

At our statewide affiliate meeting in September, I was so impressed by all the great projects and programs going on around the state. One particular moment stands out in my mind. Affiliate director, Craig Tyler, was giving his update for Fort Lewis College when in a rather nonchalant way, he showed the famous gas pillars in the Eagle Nebula taken by Hubble and then showed an image that his Space Grant students took from their observatory outside Durango, Colorado. My jaw dropped. I was absolutely amazed by what I was seeing.

I will always remember the cheering of our students when they watched the live downlink video from this year's HASP flight as the sunshade was successfully commanded opened by students on the ground. We were privileged to have another great HASP team this year who built upon the very successful flight last year and reached new heights with their own version of the 40 pound balloon payload.

I will never forget the day when Brady Young stopped by my office to tell me a story. Brady, a former COSGC student now working at Lockheed Martin, said he recently finished his taxes and realized how much his experiences at COSGC had a role in his current career. He wanted to thank us for that. He also realized how much he was paid for this experience. He told me, "Chris, I want to give it all back." Well of course I fell right out of my chair. At that moment, Brady became COSGC's single biggest individual donor ever. Brady's only request was that all the funds be used to support current students. That is an easy request to fulfill, as we always have more students wanting to work at COSGC than we have funding to support. Brady continues to meet his commitment to COSGC and students continue to benefit by his choice to give back.

Another one of my favorite moments this year was when the RockOn/RockSat rocket jumped off the pad at NASA's Wallops flight facility just as the sun was rising over the horizon. I simply could not breathe when the second stage ignited. When I turned my gaze back to the ground and looked around I saw over a hundred people celebrating the launch of their payloads.

I will never forget the day I opened my email and read that COSGC had been awarded additional funds from NASA headquarters to add four additional affiliates to our consortium. This was great news for COSGC and the students we are trying to serve. When we held our orientation and training workshop with our new affiliate directors and their students, I was overwhelmed by their excitement and eagerness to be a part of this program. It reinvigorated me and my staff.

I will always remember the day Brian Sanders and I first heard our current advisory board chair Brett Tobey tell us that that Lockheed Martin was going to provide the funds to support COSGC's next CubeSat program. The \$400,000 gift will be used to support the students who will be working on the ALL-STAR program over the next two years.

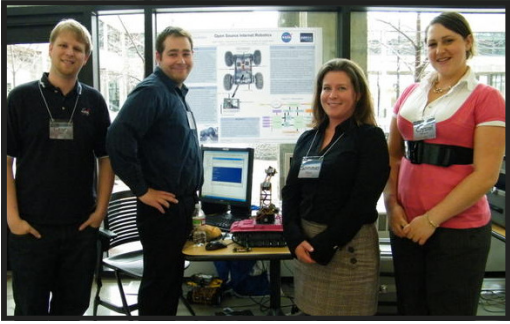
Other highlights include my visit with the Obama Transition Team at NASA headquarters to present the national space grant program, the hiring of our new academic coordinator Kendra Kilbride (who is also a former COSGC student), another very successful statewide symposium, and numerous balloon launches.

There are so many more amazing achievements to reminisce about but I must let you get to the rest of this newsletter. I must say one more thing; none of these great achievements could have occurred without the amazing team that makes up the COSGC: The staff at the lead institution, the affiliate directors at all of our 16 affiliate institutions around the state, our advisory board, our friends from industry, our numerous faculty mentors, our 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 all the possibilities and opportunities that lay before us in 2010 and can't wait to tell you what has happened in our next newsletter.



Chris Kolb

COSGC Spring 2009 Symposium



Demonstration and Poster Session winners
University of Northern Colorado Robotics team.

Prize winner was Jonathon Cox (Colorado State University) with his paper on "Dynamically Adaptive Inverted Pendulum Platform." Session winners were John Lucas, Christopher Reed, Christina Watanuki, and Zachary Wiggins (Colorado State) with "HabiSAT: Geographical and Environmental Mapping BalloonSat"; Emily Logan, Steven Ramm, and Mackenzie Miller (University of Colorado at Boulder) with "RocketSat V: AirCore"; and Farheen Rizvi, Jaime Catchen, Robert Witoff, (Univeristy of Colorado at Boulder) with "Guidance and Navigation for a Re-deployable Multi-rover System." Awards were also given to student teams for the winners of the hardware demonstration and poster sessions - "University of Northern Colorado Robotics team" (University of Northern Colorado) and "Drag and Atmospheric Neutral Density Explorer (DANDE) Spherical Spacecraft Design Challenges" (University of Colorado at Boulder).



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 universities, colleges, and community colleges and 1 foundation in Colorado. COSGC students have access to faculty and lab resources, including access to a clean room, assembly labs, mission operations and control centers and ground satellite tracking stations as well as numerous partnerships with NASA Centers and industry.

Students will make progressive steps throughout their time with COSGC. As a student progresses, projects become more complex and relevant to current space projects. Students at COSGC gain valuable job skills that place them ahead of other individuals in the workforce.



COSGC Symposium Demo
Session Winners





AFFILIATE DIRECTOR FOCUS: Dr. Ted Violet's Service Honored

Dr. Ted Violet (Professor Emeritus, Physics, Western State College) passed the baton to a new Affiliate Director in 2009 following 18 years of service as Affiliate Director for the Western State

Space Grant program. During his time as AD, Ted engaged college, K-12 students, and the general public in many different ways. In addition to his full load of classes and other academic

responsibilities, Ted organized the Space Grant program at Western State. His contributions to COSGC include mentoring students building balloon payloads, providing technology upgrades for physics classes and labs, writing a science column for a local paper, providing teacher

workshops with a space science focus for in-service teachers, hosting astronomy observing sessions, helping with Girl Scout College Days, administering scholarships for Western State students, providing public lectures about planetary science, mentoring students in the science olympiad, supporting local middle school science students, helping to direct the COSGC state-wide programs, & contributing to the COSGC strategic planning process. Ted retired from Western State College after teaching there for 50 years. He affected the lives and education of hundreds of students and fellow faculty members. As part of Space Grant, Ted provided a much needed NASA presence on the rural, western slope of Colorado.



Ted Violet working with a COSGC student



Mines Moonbuggy

Enjoying the thrill of celebrating the landing of the first lunar rover, Steven Wilbur and Katelyn Sandoval represented the Colorado School of Mines (CSM) at the 16th Annual NASA Great Moonbuggy Competition, April 3 - 4, 2009. The event held at the Marshall Space Center in Huntsville, Alabama attracted 75 teams from high schools and colleges in the United States and several international locations.

Steven and Katelyn finished 11th and won the Rookie of the Year award for their performance. They took 4 minutes off their race time by modifying the articulated joint in their buggy. The redesign and modification resulted in Frank Joe Sexton Memorial Pit Crew Award. CSM President, Dr. W. Scoggins personally congratulated Steven and Katelyn for these awards and for their Participation and Spirit awards.



**CSM 2009 Rookie of the Year Award
NASA Great Moon Buggy Race**

Steven Wilbur and Katelyn Sandoval at NASA's Annual Great Moonbuggy Competition

Space Foundation Discovery Institute to Provide Local and National Aerospace-Themed Education

The Space Foundation is solidifying its position as one of the nation's premier space-focused education providers with the establishment of the new Space Foundation Discovery Institute on the campus of Jack Swigert Aerospace Academy in Colorado Springs, Colo. The **Jack Swigert Aerospace Academy**, is an aerospace-focused public middle school created in conjunction with Colorado Springs School District 11 that drives STEAM (science, technology, engineering, art, and mathematics) proficiency through a space-related curriculum, enhanced onsite laboratories and learning opportunities, and involvement with Space Foundation programs. The Academy has expanded the application of space-related curriculum to include the arts in addition to the traditional STEM subjects, creating a new focus on improving students' proficiency in science, technology, engineering, arts, and mathematics. The Academy is named in honor of Colorado native and Apollo astronaut John L. "Jack" Swigert.

The Space Foundation Discovery Institute will provide space- and aerospace-themed professional development, training and support for teachers and students from around the world and will serve as the base location for the Space Foundation's popular education programs. It will house classrooms, a NASA Educator

Resource Center, and eventually include three major laboratories: a simulated space mission operations center to open in early 2010; a simulated Martian terrain laboratory to open in early 2011; and, as funding becomes available, a Science on a Sphere facility in early 2012.

The Space Foundation has already received commitments from a number of organizations for financial and volunteer services to help build the Institute and the onsite laboratories. Significant contributors include: Analytical Graphics, Inc.; Ball Aerospace & Technologies, Inc.; The Broadmoor; CEAVCO Audio Visual; El Pomar Foundation; Freeman Company; The Larson Group Architects; and United Launch Alliance/Lockheed Martin Corp.

The Space Foundation's nationally recognized standards-based education programs use space themes and principles to build proficiency in and enthusiasm for STEM subjects among teachers, students, parents and communities. The goal is to strengthen STEM skills so that today's students can go on to become scientists, engineers, mathematicians, teachers, and supporters of space exploration. "Education is fundamental to the Space Foundation's mission to advance space-related endeavors to inspire, enable, and propel humanity," said Space Foundation Chief Executive Officer Elliot Pulham. "Creating the Space Foundation Discovery Institute underscores how strongly we believe that teaching and learning are the keys to the future."



Apollo astronaut John L.
"Jack" Swigert



Instructions for Alumni about how to join the 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 listserv. To join the list go to the following link

<http://spacegrant.colorado.edu/Alumni/>

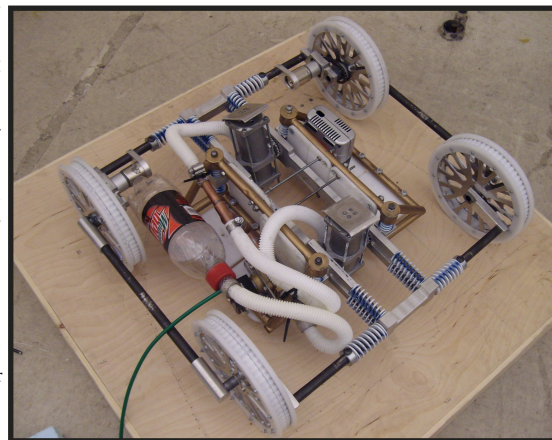
Then enter your email address in the "Subscribe to COSGC - Alumni" field and simply click subscribe. Now you'll continue to be updated on all the Space Grant News throughout the year!



CSU's Rover Hops to the Challenge



Students at Colorado State University in Fort Collins, Stacy Jonett, Joseph Kennedy, Tim Schneider, and Ian Smith, designed and built a Mars Exploration Rover Pneumatic Prototype, informally known as Frogger. This MER prototype was designed and fabricated to test the applicability of pneumatic actuators for use on smaller rovers, as a possible option for dislodging a rover from an unfavorable situation. The students generated the idea in summer 2009 when current rover, Spirit, became trapped in soft sand. The results from the first Frogger design were favorable, and showed that the use of such a system was practical and plausible. During the fall 2009 semester, the students dismantled the prototype and began upgrades and redesigns to address issues of reliability and weight.



CSU's Mars Exploration Rover Pneumatic Prototype



RockOn! Workshop Participants

RockOn!: Take Two

June 21st through 26th Colorado and Virginia Space Grants facilitated the second RockOn! Workshop at Wallops Island, Virginia. This year participants started the workshop on Sunday instead of Monday, which allowed for a slightly more relaxed pace. It still was a sprint for participants, building and integrating a rocket payload in 4 days, but it alleviated some of the exhaustion noted at the last workshop.

This year the workshop also carried out the first iteration of the RockSat program which engaged students from 10 universities from around the nation including Boston University, Colorado State University, Metro State College of Denver, Penn State, Universities of Colorado (Boulder), Minnesota, North Dakota, Puerto Rico, Wyoming, and Virginia Tech. A total of nine canisters flew this year, up from the five canisters that flew in 2008. Three of the canisters from this year contained workshop payloads, one contained support logistics for the participants, and the remaining five contained RockOn student experiments. The addition of four new canis-

ters was enabled by switching to a two-stage Terrier Improved Orion. In 2008, payloads flew on a single-stage Improved Orion. The maximum height of the sub-orbital flight was approximately 72 miles.

A great deal was learned from the first RockOn workshop about how canister integration should be completed to minimize the risk of damage to payloads. This year's canister integration took a slower, systematic approach which helped mitigate the risk of damaged payloads. After the first year it was also discovered that over 90% of all bugs were due to cold solder joints, so this year an effort was made to ensure that the workshop helpers were constantly inspecting workmanship. Additionally, in 2009 a new Remove Before Flight (RBF) system using Winchester connectors to easily connect payloads to the shorting plug was implemented. Using the connectors allowed Wallops technicians to pre-fabricate the RBF system to save time.

All of the 2009 RockOn! Workshop team data showed expected trends, particularly in the axial acceleration of the rocket. It was

also discovered that there is a potential for up to a 40g acceleration spike at stage separation! This quick impulse was clearly present in several teams' data as a single point at the approximate time of the expected stage separation.

It is important to note that the model that seeks to have RockOn participants return the following year as RockSat customers appears to be working well. Schools that participated in both 2008 and 2009 are returning for 2010 to fly payloads. At this point in time, there is more interest than space available, which will make RockSat competitive and lead to higher quality payloads. "We [the staff] all love what we do, and we hope that the participants enjoy the experience as much as we enjoy providing it to them. This is definitely the highlight of my year," RockOn! Staff Shawn Carroll explains. On the RockOn post survey participants noted that this was one of the best workshops they had ever attended. Not only is it fun, but participants walk away with a special knowledge set that is not easily acquired elsewhere. We hope to see a large number of participants in 2010!



Terrier Improved Orion launching with RockOn payloads.

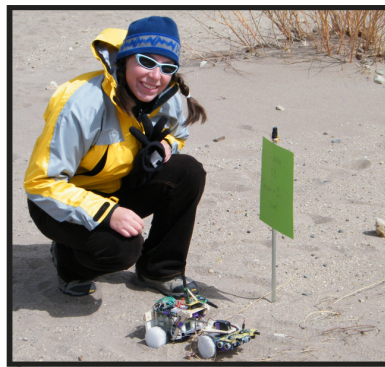


Wallops Flight Facility
Goddard Space Flight Center

Student Robots Take On the Sand Dunes

The Colorado Space Grant program at Adams State College hosted the third annual Colorado Robot Challenge on April 4, 2009 at the Great Sand Dunes National Park. The event challenges student teams to design and build an autonomous robot capable of surviving the harsh environment of the Dunes while autonomously navigating to a base station. In addition, robots are challenged to weigh less than 1.5 kg in order to enable flight on a balloon launch for robots that are able to successfully complete all three courses. This year, students were allowed to provide their own beacons. Some teams utilized radio beacons that transmitted a signal which the robot had to locate and then traverse the obstacles laid in the path. In addition to freezing temperatures

and blowing sand, challenges included various size rocks, water traps, and hills. One team designed a robot that used visual targeting system to locate its ultimate destination. Dr. Randy Emmons, Affiliate Director of the Adams State Space Grant program explains, "This year's event included some extremely talented students. We hope to engage a greater number of students from more Colorado institutions of higher education". The Robot Challenge is part of the COSGC's state-wide Workforce Development Initiative. More information about the Robot Challenge (including how to participate) may be found by visiting the main COSGC website and clicking on "Robotics Challenge" in the menu.



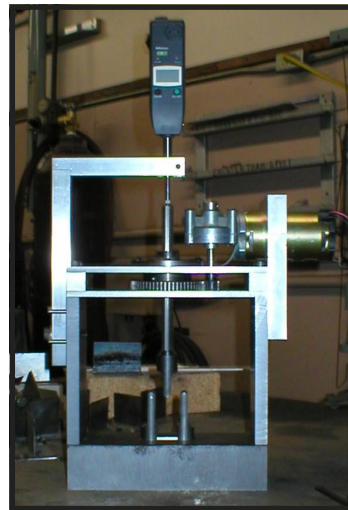
2010
Colorado
Robot Challenge
Saturday April 10
Great Sand
Dunes National
Park



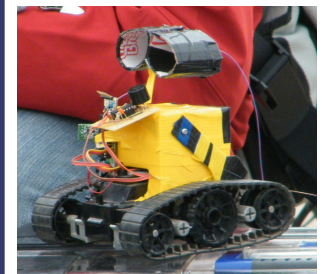
Exploring the Effects of Weightlessness on Bones

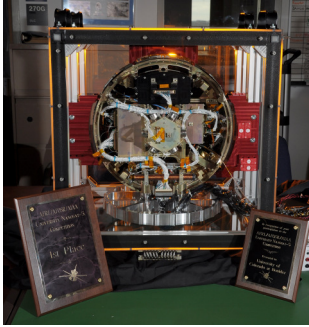
Engineering and Biology students at Colorado State University - Pueblo have been engaged in a new research project along with faculty biology lead Dr. Annette Gabaldon and engineering mentor, Dr. Huseyin Sarper. They are examining "The Effect of Dietary Symbiotic on Bone Mass and Mechanical Strength During Simulated Weightlessness". The purpose of the research is to study the effects of microgravity on long-duration astronaut stays in space. Utilizing hind limb bones (femur, tibia) harvested from rats kept at Idaho State University, students are com-

pleting the following tests: mechanical strength testing with a 3-point bending test, bone volume and density determination, bone composition and mineral density, and bone specific mineral profiles using ICP mass spectrophotometry. Engineering students completed the construction of a 3-point bending machine and have begun work on instrumenting the machine with a force and strain sensor for output to a computer for data collection. The project provides an opportunity for students to participate in innovative biology research that hopefully will result in an opportunity to publish results.



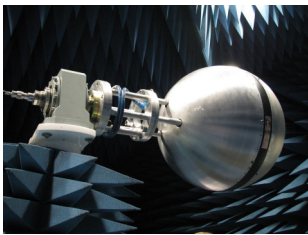
The 3-point bending machine designed by CSU-Pueblo engineering students and mentors.



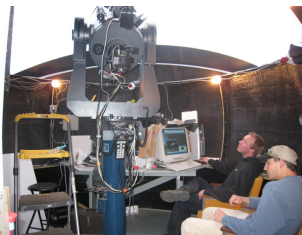


DANDE takes first place!

(Photo courtesy of University of Colorado at Boulder)



RF Testing DANDE



Fort Lewis Students working on their senior project at the school's

DANDE Takes Home the Gold!

In January 2009 Colorado Space Grant students from the University of Colorado at Boulder (CU) traveled to Albuquerque, NM to participate in the final step of the University Nanosatellite Program: the Flight Competition Review along with 10 other Universities from schools across the nation (sponsored by the United States Air Force Research Laboratories (AFRL)). Students teams were competing for a guaranteed launch of their satellite and two years of follow-on funding to support continued development up to launch. Students gave a 15-minute presentation about their satellite project and then participated in four judging rounds with a total of 25 judges. Teams were judged on design, mission relevance, testing, documentation, workmanship, and other support materials. At the end of the day, the DANDE team finished by earning first place honors!

Drag and Atmospheric Neutral Density Explorer (DANDE), is a low-cost satellite which makes in-situ measurements of the neutral atmosphere at altitudes of 200 - 350 km and is the first spacecraft to be specifically designed to measure winds, drag, and densities simultaneously. DANDE is a spherical spacecraft, 18 inches in diameter, which will carry a novel drag measuring system as well as a Wind and Temperature Spectrometer which characterizes the horizontal wind vector. The project is a joint venture between Colorado Space Grant Consortium and the CU Aerospace Engineering Sciences department wherein students design and build the hardware under the mentorship of faculty, government and industry advisors. DANDE has been a three year effort including undergraduate and graduate students from electrical, computer, mechanical, and aerospace engineering as well as engineering physics and computer science.

Presently, a team of twenty five students at the University of Colorado are integrating the structure and electronic components in preparation for a systems level, or day in the life test. During this test, the electronics will be activated and operated as if they were "living" in the space environment.



COSGC students at Lockheed Martin performing a Spin Test on DANDE

The DANDE student team collaborates with many government and industry advisors and sponsors. As part of this interaction, DANDE students tested the rigidity of the DANDE structure at Ball Aerospace, machined parts with the help of machinists at the Laboratory for Atmospheric and Space Physics (LASP), investigated the effectiveness of antennas at FirstRF Corporation and conducted a mass properties test at Lockheed Martin to name just a few. During this process students have learned much about testing, modeling and design practices for manufacture. In October, students traveled to NASA's Goddard Space Flight Center to complete a test evaluating the DANDE wind sensor. (Continued on page 10)

Fort Lewis College Observatory

Students at Fort Lewis College continue to utilize the FLC Observatory for coursework and senior projects. In 2009, one student completed research on the binary star system Algol via color photometry. He was able to disentangle the spectrum of each star, and calculate stellar radii and eclipse coverage. Four more students worked with a faculty mentor to improve observatory systems like autoguiding, tracking, and balance. Students are also working to develop a standard image processing technique as a resource to help make the observatory even more accessibly to future students. To complete this goal, students were challenged to "reproduce" a few well known images taken by the Hubble Space Telescope. The students succeeded with stellar results (see images below).



Whirlpool galaxy NASA Hubble Space Telescope



Whirlpool galaxy FLC Observatory

RocketSat Update

COSGC students at the University of Colorado at Boulder have designed, built, tested and launched five RocketSat (sounding rocket) payloads and planning their sixth.

On June 26, 2009 RocketSat V was successfully launched on-board a Terrier Orion rocket and recovered from Wallops Island, VA. RocketSat V's mission was to provide undergraduate students the opportunity to get hands on experience working as an engineering team while launching a scientifically reliable payload on a sounding rocket. The RocketSat team worked in conjunction with NOAA (National Oceanic and Atmospheric Administration) scientists with the goal of creating an atmospheric profile of carbon dioxide and methane above 22 km. In order to do this, the payload was designed to collect a continu-

ous sample of air in a long section of tubing as the rocket fell back toward earth. This sample was then analyzed on the ground. This method, called AirCore, was pioneered by NOAA on balloon flights. However both last year's RocketSat IV and this year's RocketSat V have developed the science of the AirCore mission for sounding rocket payloads. RocketSat V reached an altitude of 117 km, marking the highest AirCore has ever been and only the second time it has ever flown on a sounding rocket.

The AirCore was designed to collect atmosphere from 40 km to just before the parachute deployment at 6 km. The data collected could then be analyzed on the ground and compared to current theoretical and actual models of carbon dioxide and methane in the upper atmosphere. Both

gasses are considered greenhouse gasses meaning the AirCore project could potentially contribute towards research on global warming. The team expected to see the concentrations of carbon dioxide and methane decrease with altitude; however due to an unexpected acceleration at the ignition of the second stage, the power momentarily failed. This caused the payload to stop taking data 14 seconds into flight, meaning the tubing never opened and no air sample was collected. After recovery the payload was returned to a flight ready state and the software was updated in order to accommodate temporary power losses due to violent vibrations in preparation for a possible new launch.

Work on RocketSat VI has already begun. There are 11 undergraduate students from aerospace, electrical, and mechanical

RocketSat IV continued on page 10

HASP

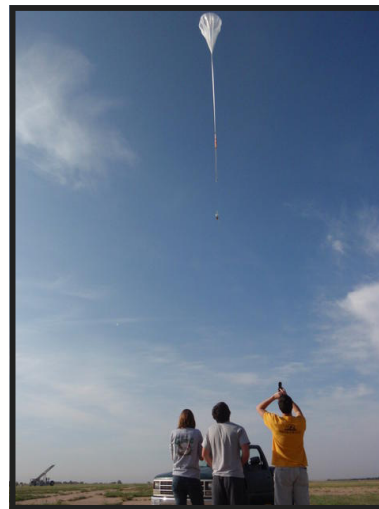
The High Altitude Student Platform, stationed out of Louisiana State University, provides students with the opportunity to launch payloads to the edge of space on a high altitude zero-pressure NASA balloon. The HASP team from the Colorado Space Grant Consortium at CU, comprised of mostly sophomore and freshman engineering and astrophysics students, is currently working alongside Dr. Eliot Young of the South West Research Institute in an effort to investigate the possibility of balloon stationed optical observatories. The prospect of affordable cosmic imaging above earth's distorting atmosphere seems like an invaluable asset to fields such as astronomy and astrophysics. The HASP 2009 payload, coined BOWSER (Balloon Observatory for Wavelength and Spectral Emission Readings) was a follow-

on to CU Boulder's HASP I flight and flew to 120,000 feet on the 11th of September. BOWSER's mission was to investigate how an optical stabilizing system might be implemented on a balloon platform in order to eliminate attitude disturbances. Eliot Young suggested that the best way to achieve this might be the use of high precision star trackers. To investigate this prospect, BOWSER was equipped with two imagers, one placed in the focus of a telescope, the other providing a broad field of view. The payload's roof had an extensive light sensing array in an effort to characterize the sky background as a function of wavelength, altitude, and angle from the sun. In order to sense the stability of the platform, BOWSER also included many accelerometers and gyro-

scopic sensors. So far, preliminary results from the data look very promising. BOWSER caught many stars during sunset and twilight and was able to sense the brightness of the sky behind the stars. Hopefully, if positive results continue to be extracted from the



HASP team member Nick Truesdale working on the computer, the rest of the team is in the background.



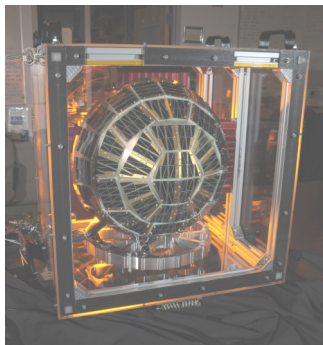
The HASP team spotting the HASP payload just after launch.



The HASP platform balloon being filled.



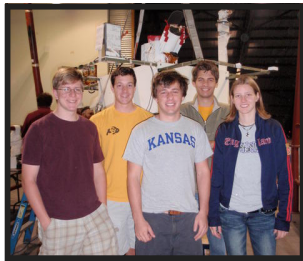
HASP continued on page 10



The DANDE spacecraft



The BOSWER payload viewed by the HASP platform camera

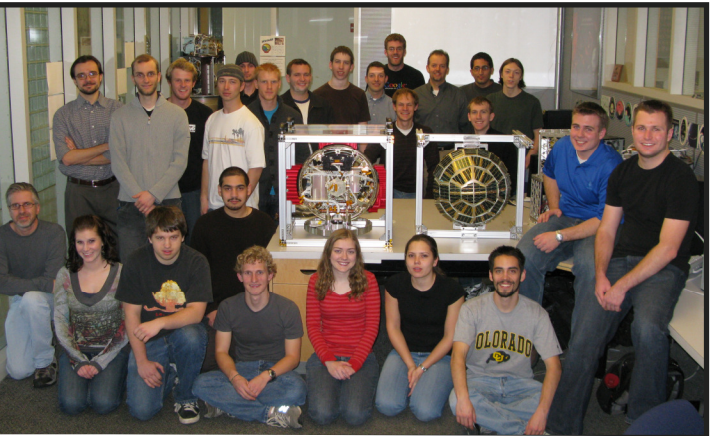


The 2009 HASP team

DANDE

continued from page 8

Over the last three years DANDE research has been presented in poster and presentation formats at the CEDAR, COSPAR, and Small Satellite Conferences. At the 2009 AIAA/USU Conference on Small Satellites two graduate students, former Project Manager Marcin Pilinski and former Integration and Test Engineer Bruce Davis, took first and second place in the student scholarship competition. Four graduate students have successfully defended their master's theses on subjects covering DANDE attitude control, communications, operations, and science. Students and their mentors have also published an AIAA conference paper titled "The Creation and Impact of Corporate Men-



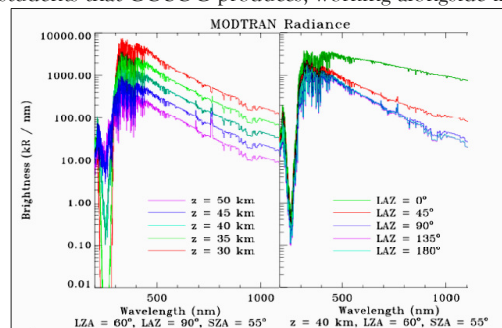
DANDE team before FCR

torship on Student-Led Satellite Projects" which underlines the importance of industry and government advisors to the DANDE program. The student team is currently working toward a delivery in April/May 2010 at which time the spacecraft will be delivered to AFRL where it will undergo environmental testing.

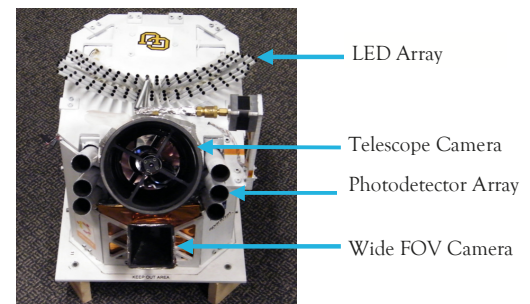
Ultimately, the team hopes to launch the DANDE spacecraft in late 2011/early 2012 because the sun will be at its solar maximum which is ideal for DANDE's data gathering mission - during which students will lead mission operations efforts from CU Boulder.

HASP *continued from page 9*

data sets, publications for the support of high altitude observatories will soon be written. Students are currently working on analyzing the collected data to complete the HASP mission. The HASP platform provided by LSU is optimal for any science heavy experiment due to its enormous power supply, simple telemetry and command interface, and the high altitudes it reaches. As HASP at CU looks to the future, we hope to continue to produce payloads that can utilize these resources for science intensive missions, led by the talented students that COSGC produces; working alongside industry and academic mentors.



The brightness of the sky background is vital to orienting a balloon platform by use of a star tracker. Models such as MODTRAN have characterized sky background in the stratosphere. This model predicts adequate reduction of sky brightness in the stratosphere for star tracker orientation. BOWSER's flight has provided empirical evidence to compare with the MODTRAN model (see graph above).



RocketSat *Continued from page 9*

engineering working on the team. The objective of RocketSat VI is to measure large aerosol particle density and charge from 75 to 95 kilometers to determine if the presence of these particles is related to mesospheric charge balance and phenomena and increased levels of carbon dioxide methane in the atmosphere. The team is trying to study the effect of meteoritic smoke particles in the mesosphere. Meteoritic smoke particles are caused by small meteors disintegrating as they pass through the atmosphere, as they float towards Earth, the cold temperature causes water to freeze onto these particles, making them larger. The presence of these particles could support theories on global warming and noctilucent clouds. Overall, the team is studying these particles in an area that has not actually been studied before, and they will add their data to only six other measurements so far which makes for very unique mission data!



RocketSat V team prepares to do testing during an early morning balloon launch.

Colorado School of Mines—

Katelyn Sandoval is a junior at the Colorado School of Mines. She is currently pursuing a bachelor's degree in mechanical engineering. Katelyn became involved with Space Grant through her EPICS (Engineering Practices Introductory Course Sequence) design class project with Affiliate Director Dr. Robert Knecht. Katelyn worked on the Annual Great Lunar Buggy Race along with Mines student Steven Wilbur. The team traveled to Huntsville, Alabama to compete and left with several awards including Rookie of The Year Award. Katelyn asserts that, "Space Grant has allowed me to be able to apply techniques and methods taught in my classes and apply them to a real world project. I would definitely recommend joining COSGC. My experience has been one of the most exciting things I've done during college." Currently Katelyn is looking for internships or more professional job opportunities that could potentially lead to a career. After Katelyn finishes her undergraduate program she is considering graduate school.



Katelyn Sandoval



Colorado State University—

As a senior mechanical engineering student at Colorado State University, Space Grant was the first major capstone of Joseph Kennedy's college experience. Joseph first heard of Space Grant when two of his aerospace engineering peers, Stacy Jonett and Kenny Vogel, invited him to attend an American Institute of Aeronautics and Astronautics (AIAA) meeting at school. He became extremely excited and applied for a position to work with Space Grant, after hearing Dr. Azar Yalin (Affiliate Director) and several of his peers speak of their positive experiences while participating in the program. After Joseph's acceptance into the program, he began work on the Mars exploration rover pneumatic prototype, informally known as Frogger. Space Grant allowed Joseph the opportunity to work not only with his peers, both at his university and other colleges in the surrounding area, he met working professionals one-on-one and got their thoughts and advice on his project which helped him grow as an engineer. "Personally, working on this project allowed me to practically apply all of the knowledge that I had gained in classes over my five years at college — such as fluid mechanics, dynamics, and mechatronics. I also grew as a design engineer by learning to design for manufacturing," explains Kennedy. Upon graduation Joseph is applying to work either at the Jet Propulsion Laboratory in California as a machinist, or in the renewable energy industry as either a design, manufacture or an applications engineer.

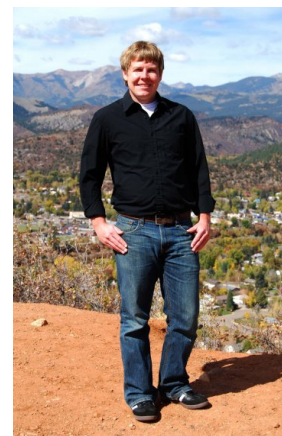


Joseph Kennedy



Fort Lewis College—

Daniel J. Lowry is a senior at Fort Lewis College majoring in both Chemistry and Physics with Minors in Mathematics and Philosophy. He became involved with Space Grant through Dr. Craig Tyler (Affiliate Director) after taking his senior level astrophysics course. Daniel, through a recommendation from Dr. Tyler, began work on a project at JPL in Pasadena, CA. The Space Grant project he was a part of at JPL was a remote sensing project that produced gapless sea surface temperature maps by blending data from microwave and infrared satellite instrumentation. These maps were then validated by comparing their map temperature measurement to buoy temperature measurements at the buoy's exact location. The group that he worked for is the GHRSSST (Group for High Resolution Sea Surface Temperatures), however they were working in close collaboration with the SPORT (Short-Term Prediction Research and Transition Center) group at the Marshall Space Flight Center. Real world applications for this research include hurricane prediction, global warming evidence, advanced weather prediction, and long term climate modeling. For Daniel the benefits of being a Space Grant student have been receiving letters of recommendation for graduate schools, real world work experience, incredibly interesting projects, and the networking associated with working for some of the most renowned experts in their fields. After graduation Daniel plans to attend graduate school and will most likely study nuclear chemistry and alternative energy.



Daniel J. Lowry





Sabrina Eggleston at the ACCESS balloon launch



Jeremy Begley with his team's balloonsat payload



Paul Philbin working on the TSJC payload.

Pueblo Community College—

Sabrina Eggleston is a junior completing her final lower division classes at Pueblo Community College (PCC). Sabrina graduated from PCC in May 2009 and in January 2010 will be attending the University of Colorado at Colorado Springs. She is majoring in Mathematics and is planning to concentrate in System Science. In April Sabrina's instructor, Vernon Stringer, mentioned a satellite project for NASA which caught her attention. Mr. Stringer had few details concerning the project at that point but Sabrina expressed her interest and lifelong goal of someday working for NASA. As more information became available Sabrina became more adamant about being involved. In July, Mr. Stringer took five students, including Sabrina, to the ACCESS DemoSat workshop in Boulder, CO where she and her team of fellow students participated in building a DemoSat and learned a great deal about Space Grant; what it was and all the opportunities available. The more Sabrina learned about Space Grant the more she wanted to become a part of it. Sabrina explains, "I have wanted to work for NASA since I was in the second grade and I saw Space Grant as a huge leap forward towards my dream. I believed it could give me insight, experience, and an abundance of opportunities that were not readily available to me before as a community college student, a wife and a mother of two children." Currently Sabrina is part of the team at PCC working on designing and building their own balloon payload. It is scheduled to launch mid-January along with payloads from student teams from three other Colorado community colleges. After graduating with her BS in Mathematics, Sabrina would like to pursue a Masters of Engineering in Space Operations. Directly after that she plans on beginning her career at NASA.

Trinidad State Junior College—

Jeremy Begley is a sophomore in engineering at Trinidad State Junior College. He first heard about Space Grant through his professor Mr. Robert Philbin in the spring of 2009. Mr. Philbin mentioned the possibility of building a balloon satellite, and it really sparked Jeremy's interest, "Space has always intrigued me, so having the opportunity to participate in a project like this, I felt that it was something I couldn't pass up." Jeremy became involved with Space Grant this past summer when he and a few other students attended the ACCESS balloonsat workshop. Currently Jeremy and the rest of the team are working on a balloon satellite that will collect gas samples throughout various layers of the lower atmosphere via flexible tubing as it descends after burst. The samples obtained shall then be analyzed to quantify the amounts of greenhouse gases (methane and carbon dioxide) at varying sections of the atmosphere. The quantitative analysis will be performed using a Fourier Transform Infrared Spectrometer (FT-IR). Upon graduation from Trinidad State Junior College Jeremy plans to transfer to Colorado State University in Fort Collins, Colorado and attain a degree in civil engineering. After graduating from CSU, Jeremy would then like to find a job in the field of civil engineering.

Trinidad State Junior College—

Paul Philbin is a 19 year old student at Trinidad State Junior College (TSJC). Having been home schooled his entire life Paul decided to take classes at TSJC instead of going to a large state school for his first formal educational experience. While working on his Associates degree, Paul has decided that he wants to major in computer science or possibly engineering. Paul joined Space Grant because he thought that joining would be a perfect opportunity since it involved the two different fields he was considering. His main duty as part of the group is helping engineer the TSJC payload that we will be sent up in January. Paul is working on the same team as Jeremy Begley on the AIRSat (Atmospheric Inferred Research Satellite). Their plan is to collect air samples using a length of tubing that is sealed at one end. On the way up into the upper atmosphere the tube will vacate and when it descends the tube will fill up with atmospheric gasses. They will take these air samples and analyze them using an inferred spectrometer. The data will tell them how much greenhouse gases are in a certain part of the atmosphere. Paul has enjoyed working for Space Grant because of the real world experiences "This experience has made me realize that I really love engineering and computers and I would like to pursue this as a career choice. I also have enjoyed working and collaborating with the other students on the project. Space Grant has been an amazing opportunity for me. I think I have gained confidence in my ability to solve problems. I was able to solve a pump problem we were having. Space Grant has given me opportunities to use my math and science skills but also my ability to work with others, meet deadlines and accept and give constructive criticism to other members of a team."

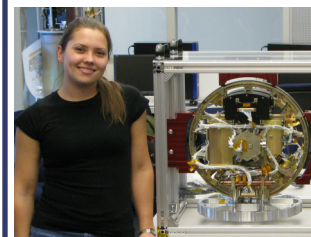
COSGC Student Focus

University of Colorado at Boulder—

Shannon Dickson is in her fifth year at the University of Colorado at Boulder participating in the Bachelors of Science and simultaneous Masters of Science (BSMS) program pursuing degrees for Engineering Physics while minoring in Astronomy. Shannon does research in a plasma physics lab with Professor Scott Roberston studying space plasmas and works for Colorado Space Grant as the DANDE thermal team lead. Shannon became involved with Space Grant through an open house at CU in January 2008 and has been a part of the program ever since. As Thermal team lead Shannon uses an AutoCAD software package to model the spacecraft and its thermal environment in order to predict likely thermal conditions on flight. These model predictions help the team choose a thermal design for the spacecraft that will insure all of DANDE's components will remain within safe temperatures during the mission. Shannon has also done some work for the DANDE Science team on the Neutral Mass Spectrometer (NMS), examining its functionality in the presence of additional magnetic fields and also modeling a new feature meant to reduce noise in the data from stray particle detection. While working on the DANDE project Shannon has traveled to New Mexico for the Final Competition Review for the NanoSat V competition and participated in the DANDE spin test at Lockheed Martin's Waterton facilities. "Space Grant has been a great experience for me. It's given me a strong fundamental understanding of the design process," explains Shannon. She will be studying abroad spring semester 2010, but plans to return to Space Grant upon her return. After she graduates, Shannon hopes to work for a couple of years and then return to school to pursue her Doctorate and one day to apply to the astronaut core. In her free time Shannon also likes to rock-climb, bike-ride, and hike!

University of Colorado at Boulder—

Riley Pack is a senior in Electrical and Computer Engineering and Applied Mathematics at the University of Colorado at Boulder. Riley first became involved with Space Grant during his freshman year while taking the Gateway to Space class. Riley worked as a volunteer on the Bell Jar project, where a team of students had the task of designing a system that integrated a bell jar and motor system that would allow other projects to do vacuum testing. The following spring and summer, Riley worked on RocketSats 2, 3, and the conceptual stages of RocketSat 4 and the RockOn! Workshop. During that time, he was thrown into embedded C programming and embedded system hardware design, which was both terrifying and extremely challenging. In addition to some late nights at Space Grant, he was also able to travel to New Mexico twice to witness the launches of RocketSats 2 and 3. The following fall, Riley transitioned to the CubeSat software team while also working on software for RockOn!. He has been working on CubeSat for two years and has helped design, implement, and test the software system for the satellite, which will hopefully be wrapped up by January. Meanwhile, Riley has continued to work with RockOn!, which has resulted in two successful workshops in Wallops, Virginia, where over 30 teams have launched and recovered payloads during weeklong workshops. "Because of Space Grant, I have a very good understanding of both the theory and hands-on implementation behind embedded systems design, which is priceless," said Riley Pack. Recently Riley was awarded one of the coveted Astronaut Scholarship Foundation awards for 2009-2010. The scholarship award is given to top engineering and science student who exhibit motivation, imagination, and exceptional performance in their field of study. It is the highest monetary award given in the US to science and engineering students at the undergraduate level based solely on merit. Riley plans to continue his education by pursuing an MS in electrical engineering. He is then considering furthering his education with a PhD or going into industry.



Shannon Dickson standing next to DANDE



Riley Pack standing in front of the Terrion Orion Rocket used for launch at the 2009 RockOn! Workshop

In Memoriam



The Colorado Space Grant Consortium family (Director, Associate Director, Affiliate Directors, staff and students) extend our heartfelt condolences to the family of George Tessmer (Pikes Peak Community College, Affiliate Director 2006-2009). George passed away on October 11, 2009 just one month after we had the pleasure of experiencing his typical enthusiasm at the annual Colorado Space Grant Member Meeting. George was an integral part of the COSGC family. He assumed Affiliate Directorship at Pikes Peak Community College when the PPCC program was struggling to find the best way to engage with PPCC students and programs. George led the effort to establish the Space Grant program at PPCC by engaging students in special projects, directly reaching students in science labs by providing student access to state-of-the art laboratory tools, and establishing the PPCC Observatory as an important resource for all PPCC students engaged in the study of astronomy—contributing a much needed hands-on approach to classroom learning. His ever-present smile and boundless energy was beneficial not only to the program and students at PPCC, but to the consortium as a whole.

Support Tomorrow's Workforce Through a Gift to Space Grant

Support from our former students who are now successful engineers and scientists is increasing every year. 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 contribution, no matter the amount, contributes toward this goal and is tax deductible in most cases. If you would like to support the students at the Colorado Space Grant Consortium, please complete the card below and send it in today! You can also call the CU Foundation at 1-800-405-9488 or donate online at: <http://www.cufund.org/giveonline/> (see instructions below)

Our nation needs good engineers and scientists 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.



The new donor plaque prominently displays the names and dates of donors in cumulative support categories.

In 2009, Space Grant experienced a unique and exciting donation from former student, Brady Young. As explained by Chris in the Director's Corner, Brady was determined to enable future student to have a similar opportunity to his student experiences at Space Grant. Brady vowed to donate all the money he had received in his final year at Space Grant back to the program. He began making monthly donations and specified that he wanted the funds to directly support student salaries working on a technical project. Brady also secured a matching donation from Lockheed to extend his contribution. Thus far, Brady's generous support has enabled two students to work in paid positions on the DANDE satellite – 2 student positions that would not have been available without Brady's astounding contribution. Read more about Brady's current work on page 17 in the "Life After Space Grant".

Levels of support:

| | | |
|-----------------|---------------------|--|
| Balloon/Rocket: | \$1–\$250 | includes newsletter and name on Student Support Plaque |
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Boulder, CO 80309-0520

You will be mailed a receipt, so please include a return address.

Life After Space Grant—What They're Doing Now



Brady Young

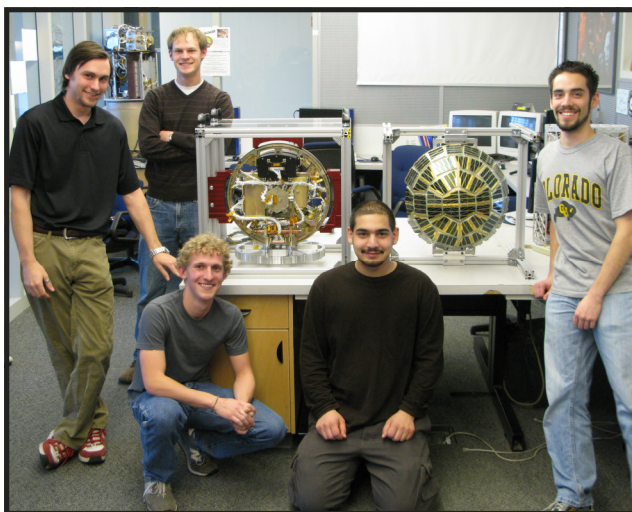
Brady Young, University of Colorado (CU) graduate, is currently working for Lockheed Martin Space Systems Company in Littleton, CO. Brady attended CU from Fall 2006 to Spring 2008 where he worked on a Masters of Science in Aerospace Engineering, specializing in Systems and Control under the guidance of Dr. Hanspeter Schaub, his thesis advisor.

As a graduate student Brady began work at Colorado Space Grant in January 2007 as the Attitude Determination and Control lead on the Drag and Atmospheric Neutral Density Explorer (DANDE) project. The design of DANDE's attitude control system became the basis for Brady's Master's thesis. Until working at Space Grant Brady had very little experience with control systems and now Brady works professionally in this field. "Space Grant gave me the opportunity to exercise my classroom knowledge beyond pure academics.

I much preferred to work on a real product instead of pure research, and the experience has given me a huge leg up going into industry," explains Brady. Brady worked on the project until graduating in May 2008 and now continues to stay involved with DANDE as an advisor.

Brady works as in an Entry-Level Rotation Program within the Military Support Programs (MSP) at Lockheed Martin. He first began working for Lockheed Martin as a summer intern mechanical engineer on MSP. During the school year Brady was able to work part time with Lockheed Martin through the Colorado Space Grant EduSourcing program, and it was through this program that Brady found the full-time position he has today. Since going full-time Brady has held three different jobs, every job being a different experience that provides unique learning opportunities. Brady spends most of his day working with other engineers on collaborative projects. "Whether it's preparing an analysis for an upcoming CDR or testing a software upgrade for bugs, it's rare that an hour will go by where I am not asking another engineer for advice, or discussing the best approach to a problem."

Space Grant gave Brady a rare opportunity to be involved with a spacecraft project from start to finish. This is a unique experience for undergraduate and graduate college students because in industry that process can take years and it is difficult even for an entry level engineer to be aware of all aspects of the program. "It's really incredible to have the opportunity to start with an idea, develop a mission, design a spacecraft, build, test, launch and operate it, all in a few semesters," Brady asserts. He has found that learning from those around you is an invaluable tool. "Space Grant is a great program for students of all years and backgrounds to begin collaborating together. A freshman working on a balloon payload can ask a junior working on a CubeSat for help with her thermal analysis. The best thing you can do is ask questions of the experts, then take a moment to teach someone else one of your talents."



Brady Young as a student with the DANDE spacecraft and other DANDE team members



Brady Young as a COSGC student working with Brandon Gilles and Marcin Pilinski on the DANDE poster

*"The best thing you
can do is ask
questions of the
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someone else one of
your talents"*

Brady Young

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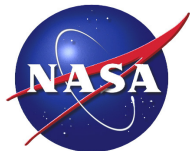
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