December 2008

Colorado Space Grant Consortium

Student News

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

Inside Stories:

Director's Corner	2
RockOn! Workshop	3
New Cosmology Book	4
COSGC Students on Microgravity Flight	4
Metro Teaches some SMART students	5
Staying in Touch with Alumni	5
A Robot Called DOG	5
DANDE Update	6
High Altitude Student Platform Project	6
RockteSat	7
A CubeSat named HERMES	7
Student Focus	11
Funding Space Grant	14
COSGC Alumni Spotlight	15

Robots at UNC

Using funds from COSGC a student team at the University of Northern Colorado (UNC) has been developing an introductory robotics course along with Dr. Matthew Semak, UNC Physics. One of the goals of the team is to design and build a rover larger than the one designed and launched on a balloon with the DemoSat program. The new rover will also have more capabilities than the DemoSat version and include the capacity to take robotics to schools around the country and the world. The UNC robotics program engages people of all ages and skill levels.



UNC students working on robot for the new robotics program

The first stage of the program is to understand how a robot thinks. This is accomplished with the use of smaller "Teaching Tanks." These are modified remote control radio controlled tanks that have been retrofitted with a series of sensors, a microcontroller, and a wireless transceiver. Students can remotely control the Teaching Tanks. Each sensor is used as a variable, when the students test different algorithms on the Teaching Tanks built-in functions report data in units tangible to the students. By simplifying the programming structure the students can focus more on writing algorithms and understanding how robots "think."

Once students gain confidence in their abilities on the Teaching Tanks they then have the opportunity to work on a larger robot called Odin. UNC students are building Odin to model the behavior of an actual rover on another planet. Students have a number of ways to interface and work with the robot. The robot

Robot continued on page 9

COSGC Spring 2008 Symposium

COSGC's Annual Undergraduate Student Space Research Symposium was held on April 19, 2008. COSGC students from around 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 winners were Grant Rhoads, Christopher Lawhorn, and Allison Porter (Colorado State University) with their paper on "AutonoRam: Development of a Cost-Effective

Symposium continued on page 8



Brian Sanders standing with the Grand Prize winners from left to right Grant Rhoads, Allison Porter, and Christopher Lawhorn

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

Fort Lewis College
Craig Tyler

Mesa Sate College
Phil Kavanagh

Metro State College of Denver
Keith Norwood

Pikes Peak Community College
George Tessmer

Space Foundation
Iain Probert

University of Colorado at Boulder
Brian Sanders

University of Colorado at Colorado Springs
Steve Tragesser

University of Northern Colorado
Robert Walch

Western State College
Theodore Violett

Director's Corner



I had just arrived at work. It was September 15, 2008 and within seconds of opening my office, my cell phone was ringing. On the other end, some 463 miles away, an excited student was telling me that their payload just launched from NASA's Columbia Scientific Ballooning Facility. The student (Kyle Kemble) and three others (Ahna Isaak, Viliam Klein, and Grant Fritz) along with Colorado Space Grant Consortium's (COSGC) Research Coordinator Brian Sanders had been embedded in the very small town of Fort Sumner, New Mexico for over a week preparing for this launch. Later that day, I watched (along with many other COSGC students) as the projector displayed live video of the student's DIEHARD project from ~120,000 feet; the curvature of the Earth and the jet black vastness of deep space provided the backdrop. A critical moment in the project had arrived; the opening of the solar shade on top of the telescope. The camera zoomed in. Everyone was thinking, "Why hasn't it opened." My cell phone rang again. Kyle was wondering if we were watching and at that moment the shade opened and the room exploded with cheers and Kyle had his answer. Those calls and the events surrounding them made my day because the excitement in all the students voice's affirmed that what we're doing is making a difference in the lives of these students.

This year has been full of events like the one above, too numerous in fact to document here. COSGC students have been involved in all the events and their outlook on their future has been renewed. They continue to see that they can be a part of something greater and bigger than themselves. Whether it was watching students launch their RocketSat IV experiment on a sounding rocket as it thundered into space, or seeing students floating with their experiment in NASA's C-9 microgravity aircraft, or hearing students present their status of their small satellite Hermes (CubeSat) to group of NASA reviewers, or mentoring students with their BalloonSats at a state college in Denver, students eye's were opened to the possibilities that lay before them.

Students today need to see that what they are doing can lead to great achievements in exploration and discovery. It is vital to their future and this Nation's future. Students involved in COSGC today are able to be creative with their minds and productive with their hands. I believe the COSGC is providing students across Colorado with unique opportunities to gain valuable hands-on experiences with real-world, space payloads and satellites.

COSGC continues to be a leader outside Colorado. This year, with a tremendous team of COSGC staff and students and help from the Virginia Space Grant Consortium, the RockOn Workshop was completed. 19 teams of faculty and students from 19 states including Puerto Rico attended the six day workshop at NASA's Wallops Flight Facility. Not only did all 19 payloads successful launch into space on a Wallops sounding rocket, they all were recovered and they all worked. This workshop provided participants with the tools to build their own sounding rocket payloads and allowed COSGC to lead the way to develop a new standardized way for students to access space. This program is called RockSat and it has 12 universities involved including four from Colorado and will launch in June 2009. Additionally, I was elected as Chair of the National Council of Space Grant Directors by my fellow Space Grant Directors at the National meeting in March. My duties include chairing all national meetings including the Executive Committee of the Council and be the point of contact with NASA Headquarters. I'm honored to serve the National Space Grant program in this capacity for the next two years.

I believe the COSGC is stronger and more engaging than ever before because of the students involved. Our statewide DemoSat program, now in its seventh year, continues to be a great way for students to begin and then expand their experiences at COSGC. With the success of our RocketSat and RockOn programs, which provides students the next step after BalloonSats, we have started our statewide RocketSat program with four of our COSGC affiliates. Our 50 kg DANDE satellite, designed and proposed by COSGC students in 2006, is in final integration and testing. DANDE is also providing students coming up from RocketSat and CubeSat programs with more challenging and demanding experiences to take part in. Our partnerships with Colorado aerospace industries continues to bring new programs to COSGC students. Redefine Technologies and COSGC are near completion on a STTR phase II effort. We continue to get tremendous mentor and test support from companies like Analytical Graphics, Ball Aerospace, Composite Technology Development, Design_Net, Edge of Space Sciences, First RF, Infinite Links, ITT, L3 Communications, Lockheed Martin, MicroSat Systems, Raytheon, Redefine Technologies, Southwest Research Institute, SpaceDev, and Special Aerospace Services. Without our industry friends, COSGC student programs would not be what they are today.

The passage of time has a way of bringing certain events into sharp focus. As 2008 draws to a close, many events (like the those above) stand out in my mind, signifying the impact that Colorado Space Grant Consortium is having on students from all over Colorado and ultimately on this Nation's future. I am proud of what the students of the Colorado Space Grant Consortium have accomplished this year and delighted to share them with you in this edition of the Colorado Space Grant Student News.



RockOn! Workshop

From June 22 – 27, 2008 Colorado Space Grant along with the Virginia Space Grant held the first RockOn! workshop at Wallops Island, Virginia. The RockOn! workshop was designed to be the next step beyond the Boulder BalloonSat and Ballooning workshops held each year during the summer. The RockOn! workshop was similar in concept to the Boulder workshops in that teams learn through hands-on activities. The main objective was for participants to learn how to build a sounding rocket payload or RocketSat. This summer at the RockOn! workshop there over 57 participants working in teams of 3 to build their RocketSat from a kit in only three days. The hardware in the kits can be used on future RocketSats and possibly on CubeSats. On the

RockOn! continued on page 8



RockOn! workshop participants the morning of launch in Wallops Island, Virginia



NASA Wallops Flight Facility where the RockOn! Workshop took place



RockOn! kits

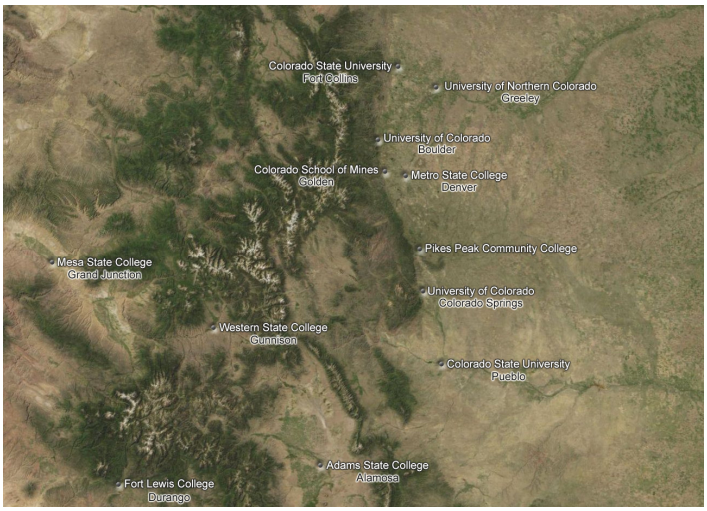


RockOn participants Paul Johnson (WYSGC) Oscar Resto, and Gladys Munoz



A NASA's Wallops engineering works on integrating several RockOn payloads

COSGC Affiliates



<u>Colorado Space Grant Consortium</u> (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 12 universities and 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 tracking stations as well as numerous partnerships with industry.

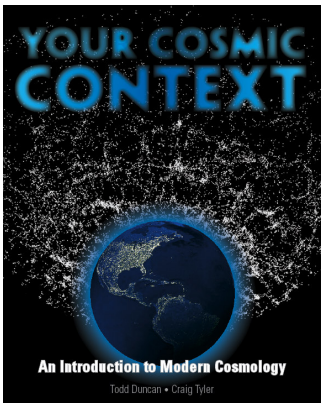
Students will make progressive steps throughout their time with COSGC. As a student progresses, projects become more complex and relevant to current space projects. Students at COSGC gain valuable job skills that place them ahead of other individuals in the workforce.

Cosmology Book

COSGC Affiliate Director, Craig Tyler (Fort Lewis College) recently co-authored a textbook called *Your Cosmic Context: An Introduction to Modern Cosmology*, the first published textbook to incorporate the latest major discoveries about the universe at a conceptual level.

The authors explain, "We've written a new cosmology textbook designed for general education classes, for instructors teaching (or considering starting) a general education course in cosmology or a similar "big picture" course about our origins from a scientific perspective. Many faculty have told us that they need a more appropriate, up-to-date book for their classes. Others want a textbook that provides a template for developing a new course to capture the increasing popularity of cosmology among students. With *Your Cosmic Context*, we've tried to construct a self-contained story for the evolution of the universe, including the latest hot topics, in a sequence designed to encourage students to appreciate the concordance of evidence for the big bang theory."

The text explores how surprising things we now know about the distant reaches of space and time were discovered, and thereby serves as one of the best available illustrations of the scientific method in action. Chapters include: Starting Points, The Sky We See, The Universe We Discover Through Heat and Light, The Universe We Discover Through Motion and Gravity, Clues About the Cosmos, The Fabric of Spacetime, An Expanding Universe, Photons and Electrons, The Nuclear Realm, The Big Bang Theory, History, Density, and Destiny, The Story of Structure, The Emergence of Complex Life, What Does It Mean to You? You can search inside the book at Amazon.com, or request a free copy from the publisher if you are considering the text for your classes (contact COSGC for more information).





From left to right:Marcus Rhimpour, Matthew Capron, Andrew Tomchek, Wes Roos, Casey Kuhns, and Bruce Davis standing in front of NASA's C-9



Taking a peak inside the C-9 cockpit

C-9 Flight (Microgravity project – DANDE)

April 2008 COSGC students take a flight they'll never forget.

The team consisted of 5 members, four students from the University of Colorado at Boulder and one from the University of Northern Colorado in Greeley. All students were undergraduates on the DANDE (Drag and Atmospheric Neutral Density Explorer see page 6) team. The mission was to provide video and numerical proof of a successful separation between the Lightband Adaptor Bracket (LAB) and the kinematic mounting system which will be used on the DANDE spacecraft. The Low Shock Release Mechanisms (LSRMs) for the DANDE spacecraft are unique because they absorb a majority of the energy that is stored when the spacecraft is bolted to the rocket during launch. The mechanisms are new and have not flown on any type of spacecraft before; the team tested the LSRMs reliability in a microgravity environment to increase their confidence level in the LSRMs performance.



Space Grant students from left to right Casey Kuhns, Marcus Rahimpour, Andrew Tomchek, Wes Roos, and Matthew Capron on board NASA's C-9 aircraft

The team hoped to see several clean separations between the spacecraft portion and the LAB. They were hoping for very little rotation from the LAB as it separated from the spacecraft. Though the team had some difficulty working in the zero gravity environment they were able to get good results with multiple clean separations for the LAB from the

Microgravity continued on page 9

Metro C-SMARTS Students

In collaboration with Lockheed Martin, the Colorado Association of Black Professional Engineers and Scientists, North High School, and Ball Aerospace, COSGC Affiliate Metropolitan State College of Denver (Metro) and the Community College of Denver (CCD) have been in the process of implementing the Access to Collaborative Education in the Sciences (ACES) project. ACES has two main objectives: 1) to introduce project management principles into the science, technology, engineering, and math (STEM) classes at CCD; and 2) to create an Associate of Science degree in Pre-Aerospace Systems Engineering Technology that will lead into a Bachelor of Science degree in Aerospace Engineering Technology or Aerospace Operations Technology at Metro. Facilitated by NASA and the United Negro College Special Funds Program, ACES is designed mainly to increase minority student enrollment in the science field. Under the ACES project, Metro and CCD have implemented the C-SMARTS course (Colorado Students and Mentors Applying Research and Technology in Space) now a required course for the Pre-Aerospace Systems Engineering Technology degree. C-SMARTS was developed by Chris Koehler, Director, Colorado Space Grant Consortium. Space systems, space exploration, and team dynamics, are core topics taught in the class. Students also build BalloonSat payloads that carry lightweight experiments to 100,000 ft. The Metro/CCD class flew joint missions with CU students on April 12 and November 15, 2008. "Students are very enthusiastic and excited about their BalloonSat payloads," said instructor Stephen Hevert. This is the second time the C-SMARTS class is being taught at Metro, which is the fifth COSGC institution to implement the C-SMARTS curriculum.



C-SMARTS students filling up a high altitude balloon at launch



C-SMARTS students at the April 2008 launch

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 listserve. To join the list go to the following link

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

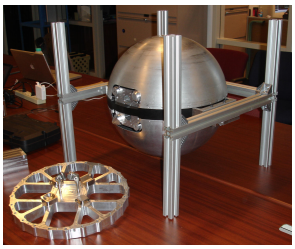
Then enter your email address in the **"Subscribe to COSGC - Alumni"** field and simply click subscribe. Now you'll continue to be updated on all the Space Grant News throughout the year!

A Robot Called DOG

At the COSGC Affiliate Colorado School of Mines, students Adam Kelson and Nathan Weinstein are currently working on a multi-phased robotics project called DOG. DOG's purpose is to film astronauts while they work on the lunar surface. The hope is to take the camera out of an astronauts hand and put it onto a robotic tripod making it into a robotic camera or dog. DOG will allow astronauts to work without having to worry about holding a camera or keeping in view of the camera. DOG will also be able to continue to film and explore after the astronauts have left. "We are expecting this project to be able to keep up with a person as they do routine tasks, and transmit the footage back to a ground station" explains Nathan Weinstein. The video feeds will be available to people on Earth through the internet.

Currently the project is in Phase I where students are working with a rolling chassis. The frame is being built and the code to control the project is being developed. In Phase II the wireless video transmission from the rover to a ground station will be implemented. The final phase is to provide the rover with a sustainable power source.

DOG was originally started in an EPICS II (Engineering Practices Introductory Course Sequence) course at the Colorado School of Mines. After the course Mr. Kelson and Mr. Weinstein continued the project, furthering the build and design. Mr. Kelson is a senior in Electrical Engineering with a minor in Computer Science. Mr. Weinstein is a senior in Mechanical Engineering. They hope to bring on a couple more students to the project.



DANDE sphere with ground support equipment



Student Andrew Tomchek inspects the first completed side of the Proto-Qual DANDE Equatorial Plate



HASP just before being launched in Ft. Sumner, NM



HASP in flight

DANDE

Neutral density, composition, and wind measurements are increasingly needed to further scientific understanding of the Earth's upper atmosphere. To address this need, the Drag and Atmospheric Neutral Density Explorer (DANDE), a low cost system which makes in-situ measurements of the neutral atmosphere at altitudes of 200 - 350 km is being developed at CU COSGC as a part of the Air Force Office of Scientific Research (AFOSR) sponsored University Nanosat Program. This is the first spacecraft to be specifically designed to measure winds, drag, and number 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 student-led project includes faculty, government and industry advisors. This has been a two year effort which includes undergraduate and graduate students from electrical, computer, mechanical, aerospace engineering and computer science designing and building the DANDE hardware.

The project has passed Critical Design Review and will be competing for down select in January 2009. Presently, forty students at the University of Colorado are integrating the structure and electronic components in preparations 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. DANDE students have 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, and investigated the effectiveness of antennas at First RF Corporation. A test scheduled for late 2008 will evaluate the DANDE wind sensor at NASA Goddard Space Flight Center.

During the two year project, DANDE research has been presented in poster and presentation formats at the CEDAR, COSPAR, and Small Satellite Conferences. Four graduate students

DANDE continued on page 9

HASP

The University of Colorado at Boulder Space Grant team of 10 students proposed a High Altitude Student Platform (HASP) project in December 2007 and were awarded a flight opportunity to be launched September 2008.

The HASP flight program is supported by the NASA Balloon Program Office (BPO) and the Louisiana Space Grant Consortium. HASP flies once a year from Columbia Scientific Balloon Facility (CSBF) in Fort Sumner, New Mexico. The platform is designed to carry student payloads to an altitude of 36 kilometers with a flight duration of 15-20 hours using a small volume, zero pressure balloon.

The CU team flew preliminary versions of their science experiments on balloon flights in Colorado during fall 2007 and spring 2008. The payload, titled Demonstrating Intensity of Electromagnetic High Altitude Radiation Determination (DIEHARD), mission was to determine the viability of high altitude observatories by diurnal imaging of celestial bodies, measuring and recording light intensity in the stratosphere as a function of altitude, and by nocturnal imaging of celestial bodies to determine atmospheric turbulence and light intensity due to residuals in the atmosphere. The DIEHARD team was comprised of freshmen and sophomores in the studying aerospace engineering, mechanical engineering, and physics.

DIEHARD was launched on Monday, September 15, 2008 in the early hours of the morning. Onboard were four photometers mounted at a 45° angle from the horizon. [During ascent and descent data was recorded for broadband viewing at night.] An astronomical filter wheel recorded data for four different wavelengths of light. Two CCD cameras recorded video during the flight. One large angle field of view (FOV) CCD found points of reference in the night sky while the other smaller FOV CCD made more detailed observations. The payload reached a height of 37 km while on its 20 hour flight. The student led team worked with scientific advisers from Dartmouth College and the Southwest Research Insti-

HASP continued on page 10

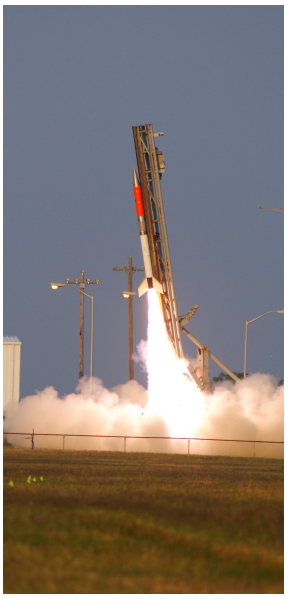
RocketSat IV

COSGC students at the University of Colorado at Boulder have built and launched four RocketSat payloads and are about to begin a fifth.

On June 27, 2008 RocketSat IV was successfully launched onboard an improved Orion rocket and recovered from Wallops Island, VA. RocketSat IV's purpose was to provide undergraduate students the opportunity to get hands on experience working as an engineering team and taking qualitative data of the flight environment. The RocketSat IV team worked in conjunction with NOAA (National Oceanic and Atmospheric Administration) scientists with the goal of expanding the knowledge of the composition of the upper atmosphere by measuring the concentrations of carbon dioxide and methane above 30 km. In order to do this the team collected air samples in a long section of tubing as the rocket fell back down to earth. This method, called AirCore, was initially pioneered by NOAA on balloon flights. A balloon flight is limited to an altitude of approximately 30 km (100,000 ft) while using a sounding rocket can more than double that altitude. RocketSat IV reached an altitude of 67 km and the first time an AirCore has ever been flown on a sounding rocket.

The AirCore was designed to collect atmosphere from 67 km to just before the parachute deployment at 6 km. The data collected was then compared to current theoretical and actual models of

RocketSat IV continued on page 10



RocketSat IV launch out of Wallops Island, VA

CubeSat—Hermes

The Hermes CubeSat, named after the Greek messenger of the gods, is a small orbital satellite project that began in the summer of 2006. Hermes is the first CubeSat under construction at the COSGC headquarters at the University of Colorado in Boulder. Hermes is being built in accordance with the specifications set forth by the California Polytechnic State University CubeSat Foundation. The primary mission of Hermes is to test a satellite bus developed at the University of Colorado. Additionally, Hermes will serve as a test bed for a high speed communications system that operates in the s-band frequencies, and will determine the feasibility of implementing such a system in a small satellite in low Earth orbit. One overwhelming deficiency with CubeSats launched to date is the low data-rate of their communication systems. Hermes plans to improve the 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 easily-feasible.



The CubeSat team: from left to right first row: Greg Stahl, Lee Jasper, Riley Pack, Ahna Isaak, Alicia Harris, Stephanie Pitts, Philip Holtzman, and Harout Hedeshian. Top row: Jared Russell, Mariam Moghaddam-Zadeh Jack Oakes, Andrew Bath, Tyler Murphy, Anthony McDougle, Mason Hauck, Kyle Kemble, Dustin Martin, William St. Charles, Brian Roth, and Grant Fritz

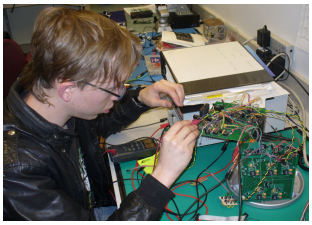
"Although our satellite is relatively small, it has taken great care, concentration, and hard work to put this project together. We have come to greatly value advise from professors, members of other [COSGC] projects, and members of industry in designing and assembling the satellite," explains Hermes project lead Alicia Harris, Sophomore CU Aerospace student.

The Hermes CubeSat team is comprised of undergraduate students in various studies including Aerospace Engineering, Electrical Engineering, Electrical and Computer Engineering, and Computer Science. Currently Hermes is in the integration process. The team recently met an important deadline with the completion of the flight boards layout, connection, and testing at the beginning of November. The team plans to complete all environmental testing in November and have the satellite ready for flight by December. Currently launch is scheduled for sometime in 2009.





Space Grant antenna built by CubeSat team



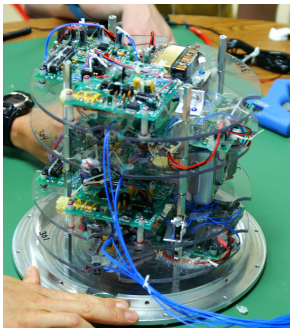
CubeSat team member Jared Russell



Session Winners "Laser Based Erosion Sensor for Electric Propulsion Applications"



Session winner Robert Jones, "Free Flier Technology Demonstration Satellite"



5 RockOn! kits assembled for flight



RockOn! participants working hard

Symposium

continued from page 1

Unmanned Aerial Vehicle." Session winners were Robert Jones (University of Colorado at Boulder), "Free Flier Technology Demonstration Satellite" and Scott Domingue, Stan Nielsen, Kevin Troyer, and Ellen Zwickl (Colorado State University), "Laser Based Erosion Sensor for Electric Propulsion Applications." Awards were also given to student teams for the winners of a hardware demonstration session – "Laser Based Erosion Sensor for Electric Propulsion Applications" (Colorado State University) and "Fully Automated Parachute Design" (Colorado State University - Pueblo).



CSU-Pueblo Hardware demonstration session winners "Fully Automated Parachute Design"

Special thanks to our Symposium sponsors!

Colorado Space Business Roundtable

ITT

Raytheon

Redefine Technologies

SAS – Who Dreams Wins

Webster University

Special Aerospace Services



Colorado RockOn! workshop staff from left to right; Top row: Eric Pahlke, Brian Sanders, Ana Ilic, Aaron Russert, Josh Tucker, Jessica Brown, and Chris Koehler. Bottom row: Shawn Carroll, David Ferguson, and Riley Pack

RockOn!

continued from page 3

sixth day the payloads were launched on a sounding rocket to an altitude of 67 km. NASA's Wallops Flight Facility (WFF) provided the rocket and launch operations of the workshop. WFF also gave workshop participants tours and briefings on sounding rocket environments for future flights. RockOn! was funded by a grant from NASA Education while the remaining costs were shared by WFF and the Colorado and Virginia Space Grant programs. The next RockOn! workshop is currently scheduled for June 21 – 26, 2009. For more information please visit the RockOn! program website at spacegrant.colorado.edu/rockon

Virginia Space Grant Consortium

COSGC

NASA

Wallops Flight Facility
Goddard Space Flight Center

Microgravity

continued from page 4

spacecraft.

The team wrote a proposal to a NASA program, Microgravity University, in order to test their hardware on the C-9 aircraft. Microgravity University accepts college teams who have experiments that they would like to test in microgravity environments. The experiments range from separation tests to looking at convection currents to structural deployment tests.

The C-9 produces weightlessness by flying in a parabolic flight path. Each flight consists of 30 parabolas; each parabola has a microgravity portion but also has a pullout phase where the passengers on the aircraft experience 2g's. This is actually the portion of the flight were most passengers experience motion sickness.

So what does weightlessness fell like? COSGC student Matthew Capron remarked, "When the transition started from the 2 g portion to the zero gravity portion it was similar to feeling at the top of a roller coaster when you feel the "butterflies" in your stomach. Then, when I adjusted to the zero gravity environment I was just floating. You could touch the wall and just start floating to the other side of the aircraft! It was an incredible experience and I've never felt any other sensation like it."

In order to share the team's experience of flying on the C-9 microgravity airplane the DANDE team has participated in multiple outreach opportunities. The team visited schools along the Front Range to share their experiences working on an engineering project and also providing some guidance about how others can take part in similar projects.



COSGC student Matthew Capron watches the separation of DANDE from the LAB in microgravity

Robots

continued from page 1

has the ability to be driven manually over the internet via a web browser that can be configured to allow students to drive in real time. The website can also be setup to simulate a Mars mission where commands are uploaded manually and the rover executes these commands in a similar fashion to the rovers currently on Mars. The second function of the robot is the ability to have the hardware re-programmed via the internet. By uploading a folder with the desired code to be executed the robot's infrastructure is designed in such a way that it can process the desired code to operate the system. To prevent catastrophic failures the robot is fitted with hardware fail safes that override the system if imminent danger is detected.

The UNC program combines all aspects of robotics and provides them to undergraduate students at an affordable cost. Not only does this benefit the home school but all affiliated schools that have access to this technology.

Currently four undergraduate students from UNC are working on the project. All four students are majoring in Physics. The students have built and tested all of the Teaching Tanks and are currently testing Odin. Odin will continue to be developed throughout the 2008 school year.

DANDE

continued from page 6

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 Mentorship on Student-Led Satellite Projects" which underlines the importance of industry and government advisors to the DANDE program.

Building a spacecraft which performs cutting edge research on a small budget is no easy task. "I wouldn't be doing this if it wasn't challenging," remarks Bruce Davis, DANDE's integration and test engineer when asked to comment on the difficulty of designing and integrating a spherical spacecraft. His words underline the sentiment which draws many excellent students to the project. Every day presents new problems which are solved in a fast paced and tightly knit group environment. Ultimately, the team has embarked on a mission to make unique measurements of the upper atmosphere because it has never been done before and because it is uniquely challenging.



Grant Fritz, Brandon Gilles, Kyle Kemble, Lee Jasper, and James Gorman admiring DANDE



DANDE Critical Design Review

HASP

continued from page 6



The DIEHARD team inspecting their payload one last time

tute to build upon flight experiences from Fall 2007. Currently the DIEHARD project is going through analysis of the data recovered from flight.

Student Science Team Lead Kyle Kemble was excited to be on the project because, "DIEHARD is a unique project that brings students through the entire life cycle of a project. Beginning with the proposal stage through design, build, and testing, and finally the analysis of the data collected."

After analysis a new student team will decide whether to build-on and improve the original DIEHARD concept or to move it in an entirely new direction.



HASP team members from left to right: Grant Fritz, Viliam Klein, Ahna Isaak, and Kyle Kemble with the entire HASP payload in the background

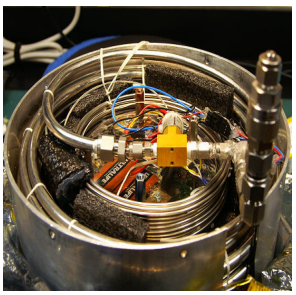


RocketSat IV team members Josh Tucker, Jessica Brown, and Aaron Russert work on integrating the payload before launch

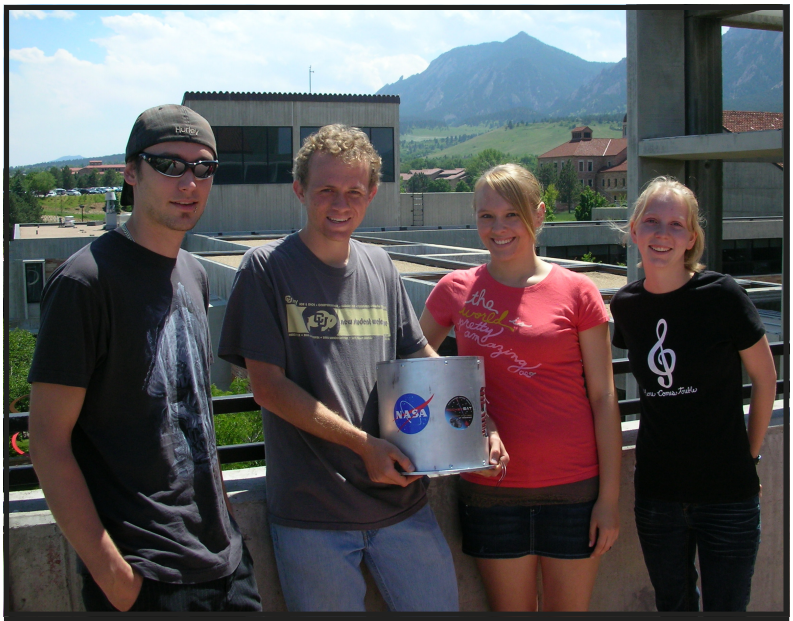
RocketSat

continued from page 7

carbon dioxide and methane in the upper atmosphere. Both gasses are considered greenhouse gasses and 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 a leak between the collection device (300 feet of stainless steel tubing) and the static port in the rocket, the payload collected a contaminated sample of air from the pressurized rocket and did not collect any scientifically useful data. When asked about the lessons learned CU student Jessica Brown said, " [we needed to] establish a design early on, leave nothing up to assumptions, test in the same type of environment as the flight environment, and most importantly leave more time for thorough testing."



Interior look of the RocketSat IV payload



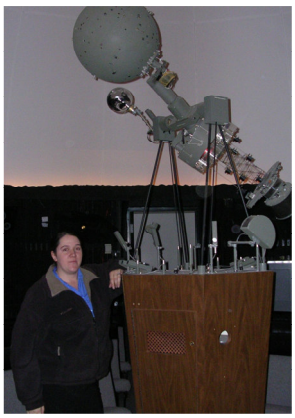
RocketSat IV team members from left to right: Josh Tucker, Aaron Russert, Kristin Brenner and Jessica Brown

RocketSat V will further develop the ideas established by RocketSat IV. It will fly using the same technology and ideas with the same mission objectives. Improvements will be made to ensure the tubing is leak free and clean to prevent contamination. The structure will also be updated so that is can be easily accessible for integration and disintegration.

COSGC Student Focus

Adams State College—Shelly Grandell:

Shelly Grandell obtained her Bachelor of Sciences in Geology from Adams State College and will be finishing her Masters in Secondary Science Education this December 2008. During her freshman year at Adams State College Shelly first became involved with Space Grant through a class called Planetarium Operations. Shelly enjoyed the class so much that she was soon hired onto the Planetarium's four person staff. She specifically worked on the rural science outreach programs through COSGC, bringing science front and center to the local community. Shelly worked to align the outreach programs to the Colorado State Standards and has worked to make information accessible to the large Spanish speaking population by working on program translations. "I truly think that learning requires hands-on experiences. Not just in school but in life," Shelly explains. During her time at the Adams State College Planetarium Shelly worked alongside Dr. Randy Emmons who has inspired her to not only become an educator but a lifelong learner.



Shelly Grandell inside the ASC Planetarium

Colorado School of Mines—Nathan Weinstein:

Nathan Weinstein is a senior in Mechanical Engineering at the Colorado School of Mines (CSM) in Golden, Colorado. Nathan became involved with Space Grant through a first-year design course called EPICS II (Engineering Practices Introductory Course Sequence). In this course Nathan helped design and build a small satellite payload for the DemoSat balloon program. Nathan's team built a payload that took high altitude panoramic pictures. Impressed by Nathan's hard work, his EPICS II professor and CSM Space Grant Affiliate Director, Dr. Robert Knecht invited him to join a team beginning design on a new project called DOG. DOG is a lunar robotic camera platform that is designed to follow astronauts around on the moon, see page 5 for more information on DOG. Nathan also had the opportunity to fly to Orlando, Florida with other COSGC students who participated in the DemoSat program. While in Florida he was able to tour NASA's Kennedy Space Center facilities and see a shuttle launch. Nathan explains, "That had to be one of the most amazing opportunities I've had in college – to be able to travel to Florida and see a shuttle launch. Meeting other science and engineering students from around the state was also a wonderful experience."



Christina Watanuki with her team's balloon payload

Colorado State University—Christina Watanuki:

Christina Watanuki is a fifth year senior in Engineering Science with a concentration in Aerospace at Colorado State University in Fort Collins, Colorado. Christina first got a glimpse of what Space Grant had to offer while taking the Gateway to Space class at CU Boulder. While in her junior year Christina transferred to CSU and quickly found a place at the CSU Space Grant. Christina participated in the CSU summer internship program, DemoSat, where she worked with a team of students that designed, constructed, tested and launched a payload on a high altitude balloon. Recently, Christina worked on team with three other CSU students to design HabiSAT, another high altitude balloon payload that tested low-cost methods that could be used to geographically and environmentally map Martian environments. Christina attended the RockOn workshop at the Wallops Flight Facility in Virginia. Currently Christina is working with a team of students to develop RamRack for the 2009 RocketSat launch. "There are many students and faculty members who make this program [COSGC] possible," Christina remarks. "None of the benefits or experiences I have had would have been possible without the talented students I worked with in my teams. I hope that Space Grant at CSU is recognized for the many amazing people interested in developing a stronger space program." After graduation Christina hopes to begin working for an aerospace or aeronautics company. She would love to work in aerodynamics and material research and analysis or in space propulsion and mission analysis. Eventually Christina would like to pursue a graduate degree.



Mike Dismuke working hard at CSU-Pueblo

Colorado State University-Pueblo—Mike Dismuke:

Mike Dismuke has his Associate of Applied Science in Electronic Technology from Pueblo Community College and is currently working on a Bachelors degree in Mechatronic Engineering and a minor in Electronic Engineering at Colorado State University-Pueblo. In Mike's sophomore Introduction to Engineering class it was announced the COSGC needed students to deign and build autonomous rovers and he immediately signed up. For three years now Mike has been the project manager at CSU-Pueblo for the COSGC – Robot Challenge project held at the Great Sand Dunes. "I've always had an interest in robotics. I thought the rover design would be a great opportunity to be creative and get hands-on experience. It also gave me a chance to put my electronic and programming skills to use," says Mike. Mike has also received an IEEE award for his work and the team received a best paper award from the American Society of Mechanical Engineers. After Mike finishes school he hopes to continue working with robotics and software applications.

COSGC Student Focus



Pictures taken by Shane at the Fort Lewis College Planetarium

Fort Lewis College—Shane Mayer-Gawlik:

Shane Mayer-Gawlik is a senior majoring in physics at Fort Lewis College in Durango, Colorado. Shane initially engaged with Space Grant when he took the C-Smarts class. In that class he built a small payload with a camera and a simple science experiment that was launched on a high-altitude balloon. Since then Shane has worked on several other balloon payloads and also attended the first RockOn! workshop in Wallops, Virginia. Some of Shane's payloads include: a cosmic ray detection payload; a payload that measured acceleration, pressure, and temperature as it ascended; and a payload that would align itself in different directions after the balloon reached an altitude of 60,000 feet. Currently Shane is involved in designing a RocketSat program at Fort Lewis College. Not only has Space Grant given Shane a lot of hands-on experience he has also been able to visit the Jet Propulsion Laboratory (JPL) in California, tour facilities at the Kennedy Space Center, and meet industry professionals. Shane acknowledges Space Grant opportunities, but insists that students must have their own initiative to take advantage of all Space Grant has to offer. Shane explains, "my best advice to Space Grant students is not to sit back and watch. Now is the time to get your foot in the door and use this opportunity to get involved in new exploration." After graduation Shane is considering pursuing a career in teaching but would like to keep the door open for other possibilities.



Matthew holding his team's RockOn Payload

Metro State College of Denver—Matt Hanley:

Matt Hanley is a senior at Metro State College of Denver (MSCD) and will be graduating with a bachelor's degree in Mechanical Engineering Technology in May of 2009. In 2005 Matt became involved in Space Grant through friends who told him how much fun they had had working on a balloon payload and how it was such a great opportunity. Since joining Space Grant Matt has worked on the MSCD DemoSats IV and V teams, presented a research paper at the Colorado Space Grant Undergraduate Space Research Symposium, and attended the RockOn! workshop in Wallops, Virginia as the MSCD representative. Matt is now the student program manager for COSGC projects at MSCD and is currently working on promoting and expanding the program. "My favorite part of my entire COSGC experience so far has been applying my school work to an actual real project that worked!" exclaims Matt. After graduation Matt plans on pursuing an advanced degree in engineering and then hopefully teaching part time in addition to working.



Jamie Smith from Pikes Peak Community College

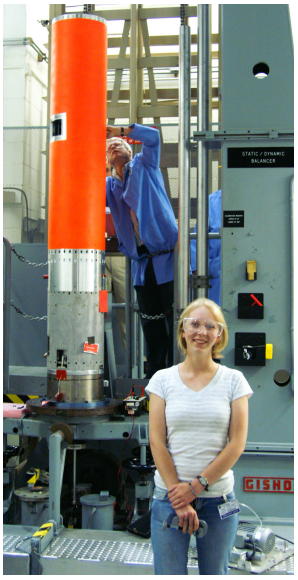
Pikes Peak Community College—Jamie Smith:

Jaime Smith is currently a student at the University of Colorado at Colorado Springs pursuing a double major in Anthropology and Biology. Before attending UCCS Jaime was a student at Pikes Peak Community College (PPCC). It was at PPCC where Jaime became involved with COSGC. Jaime started working in the Science Prep area in laboratories at PPCC with professor George Tessmer, COSGC Affiliate Director for PPCC, among other professors. Jaime worked with Professor Tessmer on several laboratory projects and ultimately with the construction of the observatory at PPCC. "I am honored to have been able to work with the COSGC while at PPCC," Jaime states. "My time spent with Professor Tessmer and growing a relationship with COSGC aided my future academic career." Jaime plans to continue to work on her degree in Anthropology and Biology and subsequently begin my graduate program, preferably at the University of Hawaii. Her goal is to gain an expertise in both Forensic anthropology and Paleonanthropology. Currently she is hoping to obtain an internship with the JPAC at Hickam Air Force Base in Hawaii.

COSGC Student Focus

University of Colorado at Boulder—Jessica Brown:

Jessica Brown, or JB as she is known in Space Grant circles, is a sophomore in Aerospace Engineering. She started working at the CU Boulder Space Grant the first semester of her freshman year. As a freshman JB began working on the Science team on the RocketSat IV project. Half way through the project she became the project manager. Currently, JB is the project manager for the RocketSat V team. While a Space Grant student, JB has participated in the Small Satellite Conference in Logan, Utah, made presentations to the Colorado Space Business Round table, attended a National Space Grant Conference in Washington, D.C., and attended the RockOn! Workshop at Wallops Island, Virginia. Working at Space Grant has allowed JB to combine two of her passions: space science and hands-on experience. "I feel that being passionate about what I am doing makes all the hard work worthwhile. In the end, there is nothing more rewarding than seeing something I worked on launch into space." JB plans on getting a masters degree and possibly a doctorate as well. Her ultimate goal is to become a Mission Specialist Astronaut working for NASA.



JB standing in front of the sounding rocket that launched her team's RocketSat IV payload

University of Colorado at Boulder—Shawn Carroll:

Shawn Carroll is a junior in Aerospace Engineering at the University of Colorado at Boulder. Shawn took the Gateway to Space class where he launched a high altitude balloon payload. After the class Shawn attended the Boulder COSGC open house and soon after joined Space Grant working on the DemoSat V team, where he was ultimately elected as the project manager. Shawn served as the initial project manager for the RocketSat IV team and was the student project manager for the RockOn! 2008 workshop. Currently Shawn is managing the statewide DemoSat-B (BalloonSat) and DemoSat-R (RocketSat) programs in addition to the nationwide RocketSat Payload Canister program and RockOn! 2009. While at Space Grant Shawn has also had the opportunity to visit the Kennedy Space Center along with many students from the Colorado DemoSat program, he has attended the SmallSat conference in Logan, Utah and has visited the Wallops Flight Facility in Wallops, Virginia twice. Shawn explains, "I got involved with Space Grant to broaden my horizons. The college experience isn't solely about sitting in classrooms and taking exams. I saw Space Grant as the opportunity I was looking for that would give me hands on training that none of my peers would get from the classroom." After graduation Shawn would like to possibly work for NASA, ULA (United Launch Alliance), or Boeing specializing in aerodynamics.



Shawn watches a RockOn payload being tested

University of Colorado at Colorado Springs—Leif Sandager:

Leif Sandager is a Senior in mechanical engineering (with minors in aerospace and statistics) at the University of Colorado at Colorado Springs. Leif became involved with COSGC after receiving an email from a professor recruiting interested students to work on a research project. Leif was eager to participate because he was looking for a way to get involved with NASA and to find a way to use what he was learning in his classes in a hands-on project. Leif has been engaged with Dr. Steve Tragesser (UCCS Affiliate Director) and other student peers on the design and test of a Space Sling model.

University of Northern Colorado—Casey Kuhns:

Casey Kuhns is a Senior in Physics at the University of Northern Colorado. Casey first became involved with Space Grant when his professor, Dr. Robert Walch, asked him if he would like to participate in DemoSat. At first Casey wasn't interested but once he learned that the team would be designing and building a RoverSat he was hooked. Since then Casey has been a part of four DemoSat teams three for which he was the Project Manager. He has also attended the COSGC SHOT I & II workshops in Boulder, Colorado. Casey was part of a team of UNC faculty and students who were awarded a supplemental grant to design a class in robotics. During the summer and fall semesters of 2007 Casey had the opportunity to work on the DANDE team as a structures team member. While on the DANDE team Casey flew on NASA's C-9 microgravity flight where they tested the separation mechanism for the DANDE spacecraft, see page 4. Currently Casey is working with Dr. Matt Semak at UNC to further develop the robotics class (check out the article for this on page 1). In addition to the robotics course Casey is working on a microgravity project at UNC, which he also hopes to fly on a RocketSat this summer 2009. Casey plans on attending graduate school studying robotics or aerospace then pursuing a career related to aircraft or aviation.



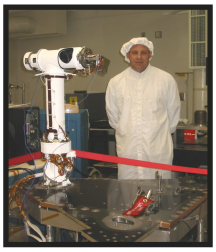
Casey playing with a gyroscope while onboard a NASA microgravity flight

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 every 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/

The Colorado Space Grant Consortium is moving forward into a new phase of development and growth. You can see our strategic plan at http://spacegrant.colorado.edu/strategic_plan.htm. We believe we are making a significant difference to students from all backgrounds and areas of study. With additional support, we can do much more for current and future higher education students in Colorado. We would be pleased to explore ways to collaborate with you.

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.



"Space Grant provided me an opportunity to work on exciting projects that the traditional education path didn't offer. I was on the ESCAPE II shuttle payload team and found the experience unrivaled by anything I did in class. Building and testing a real payload gave me insight into what the aerospace industry was going to be like. On programs I have worked since college I can see similarities between tasks I have now and work that I did with Space Grant. I want to see this program continue to be available for other students who want to enter this field so that is why I financially support Space Grant each year."

Jason Baugher, 1995 COSGC Graduate (Stellar Solutions Inc.)

We have different levels of support:

Balloon	$1–$99	includes newsletter and Space Grant tour
Rocket	$100–$299	includes items above plus a T-shirt
CubeSat	$300–$499	includes items above plus a coffee mug
Satellite	$500–$749	includes items above plus a COSGC Space Pen
Moon	$750–$999	includes items above plus the donors name and year on the Student Support Plaque
Mars	$1,000 & up	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

Space Grant College Fund 0121379:

Please send your support by making your tax-deductible gift today.

☐$100 ☐$300 ☐$500 ☐$700 ☐$1,000 ☐ _____

Please make your check payable to: CU Foundation

Or charge: ☐Visa ☐Discover ☐MasterCard ☐AMEX

Account Number _____ Exp. Date _____

Name on Card _____ Signature _____

☐ My company will match this gift ☐ Enclosed is a matching gift form
☐ My spouse's company will match this gift

To support online please visit the following address:

http://www.cufund.org/giveonline/

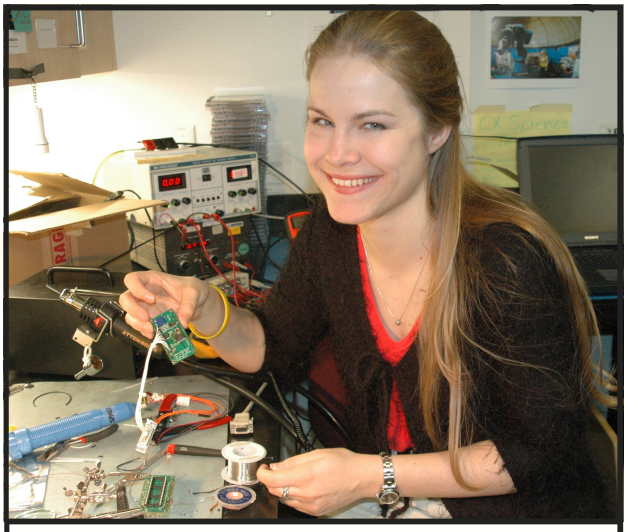
Under **Getting Started** click on the University of Colorado–Boulder link. Scroll to the bottom of the page and click **Give Online** in the **Other** box. **When entering a *Description of Gift* make sure to note that it is for "Space Grant College Fund" and include description number 0121379.**

To support by check please mail the form on the left:

Colorado Space Grant Consortium
Space Grant College Fund
520 UCB
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



Christy as a student at Space Grant

Christy Predaina is a Program Manager for Northrop Grumman. She graduated from CU in 2005 with a B.S. in Computer Science and a B.A. in Astrophysical and Planetary Science. Christy was hired before she graduated by Northrop Grumman after meeting a recruiter at the Society of Women Engineers national conference in 2004. The recruiter was impressed with Christy's work experience as an undergraduate, in particular her work with the Colorado Space Grant Consortium.

Christy spent two years working for the Colorado Space Grant Consortium as the Citizen Explorer I Science team lead. She was brought on board with COSGC for her unique background of engineering and science and her coursework, which included spectrophotometers, the basis of the CX-I science mission. Christy brought a unique perspective to the CX-I science mission since she joined the COSGC late in her academic career at CU. During her time spent at Space Grant she compiled a diverse team of undergraduate, graduate, and even faculty engineers and scientists to work on the CX-I science payload. She and her team worked on testing and integrating the photometer and spectrophotometer payloads for CX-I. Much of that work spanned multiple disciplines and was executed in many facilities across campus including the CASA facility in the CU research park and the CU Optics Lab. Christy and her team also authored a research paper that won the 2004 Colorado Undergraduate Space Research Symposium's technical paper competition about the optical calibration of the CX-I science instruments.

After graduating from CU in 2005 Christy moved to Northern Virginia to work for Northrop Grumman TASC as a project manager. She has since been promoted and is now working as a program manager for multiple programs within the SIGINT Technology Center. The center is the largest hardware development lab within TASC providing hardware, software, and services to the intelligence community. Her teams comprise in total of roughly 40 electrical, software, mechanical engineers, and support staff and her programs include hardware development, systems engineering, system integration and testing, and operations and maintenance of deployed systems. In her role Christy is responsible for directing all phases of these programs from inception to completion while ensuring technical performance and adherence to schedule and cost constraints. She finds her job very rewarding as it is a chance for her to do her part in the service of her country and in the process exercise her talents as an engineer and a manager.

Since moving to the Washington, D.C. metro area Christy has earned a M.S. in Engineering Management from George Washington University while working full time. She has also earned a certification as a Project Management Professional (PMP) from the Project Management Institute. In addition to her job responsibilities she has been instrumental in forming and managing a group called the Society of Young Professionals at TASC. The organization serves early career professionals through social and professional networking, outreach, and enrichment opportunities. She is also still involved with the Society of Women Engineers, regularly volunteers for CU in the D.C. area, and volunteers for the Colorado Space Grant Consortium whenever possible.

Christy believes her experience at Space Grant was one of the most valuable aspects of her time as an undergraduate. She feels that she learned more about applied engineering as an undergraduate during her time at Space Grant than she did at her other internships or in the classroom. "Space Grant is a wonderful way for an undergraduate to get real hands on experience by applying theory learned in their curriculum to an actual engineering problem. The Space Grant experience generates lessons that cannot be learned in a classroom alone." Christy also feels her experience at Space Grant was a discriminator that made her resume stand out to employers and more specifically to Northrop Grumman for her present position. "How many undergraduates looking for an internship or their first job can tell a recruiter that they have experience designing or building real space hardware? Or that they have managed an interdisciplinary team of Engineers and Scientists working on a space mission? Space Grant students can say that and as a result they have a head start on their career. I'm grateful for that experience and the only thing I regret is not joining Space Grant sooner."

NORTHROP GRUMMAN

"How many undergraduates looking for an internship or their first job can tell a recruiter that they have experience designing or building real space hardware?"



Christy (middle) visiting with current Space Grant students in Washington D.C. earlier this year

COLORADO SPACE GRANT CONSORTIUM
520 UCB
BOULDER, CO 80309

spacegrant.colorado.edu

Phone: (303) 492-3141

COSpaceGrant@gmail.com

Address

Newsletter of the Colorado Space Grant Consortium

To be removed from our mailing list, please email COSpaceGrant@gmail.com

Special Thanks to our newsletter sponsors! It was their generous support that made the publication and mailing of this newsletter possible.

Special Aerospace Services