

# COLORADO COMMUNICATOR



Providing an inclusive community of Colorado students with research & hands-on experiences to prepare them for our nation's future space programs and supporting industry.

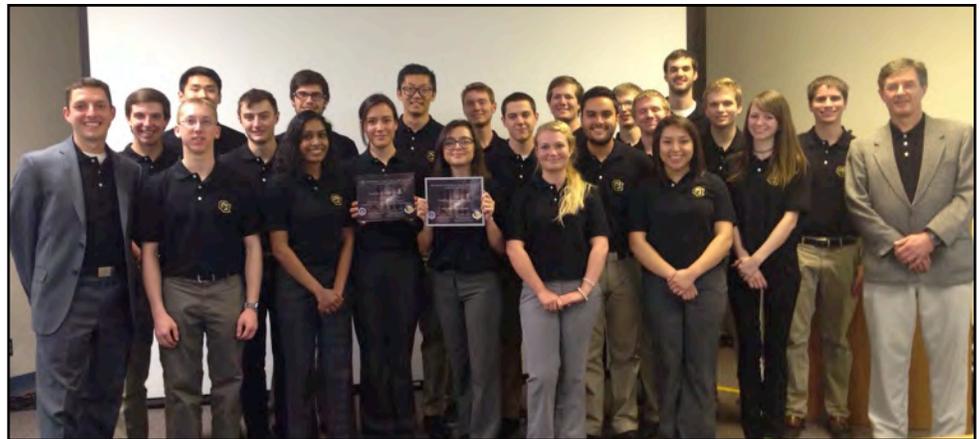
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## **Welcome Four New Community College Partners**

Four additional Colorado community college institutions (Red Rocks CC, Otero JC, Arapahoe CC, and Aims CC) have been integrated as COSGC affiliate institutions through the a new program called Colorado Community College Expansion (CCCE). The CCCE program is a result of grant funds won through the Community College and Technical School opportunity sponsored by NASA's National Space Grant College and Fellowship Program. Students, faculty, and affiliate directors for the newly implemented Space Grant programs on each campus participated in a 3-day how-to workshop to establish balloon payload programs (see pg 12). In addition to funding four more affiliate institutions, the grant has provided scholarships for students at all COSGC 2-year institutions, funding to support 9 students at summer internships at NASA centers, as well as funding to support 8 students and 4 faculty members at the RockOn! Workshop (sounding rockets) at NASA's Wallops Flight Facility. Students who participate in Space Grant programs at these institutions are now eligible to participate in COSGC sponsored programs, including the Undergraduate Space Research

*continued on page 12*



*The PolarCube team poses with their award plaques after winning 2nd place in the Flight Competition Review for the AFRL's University Nanosatellite 8 Program.*

## **PolarCube Team Earns 2nd Place at Flight Competition Review**

The University of Colorado (CU) student team took second place out of ten universities in the AFOSR/AFRL University Nanosat Program (UNP-8) competition, held at Kirtland Air Force Base in Albuquerque, New Mexico. The win secures one of five spots (along with a bit of funding) to continue development of the PolarCube spacecraft which will lead to an eventual launch of what could be the first passive microwave weather nanosatellite on a future Air Force launch. PolarCube is a collaboration between CU Space Grant, the Center for Environmental Technologies, and the National Snow and Ice Data Center. Industry judges were impressed with PolarCube's maturity following a two-year effort by the student team during which they assembled a mission and designed, built, and tested the majority of PolarCube's systems. Students are now working toward an early 2016 delivery of the finished satellite.

## COLORADO SPACE GRANT AFFILIATES

### Adams State University

*George Sellman*

### Aims Community College

*Lee McMains*

### Arapahoe Community College

*Jennifer Jones*

### Colorado Mesa University

*Phil Kavanagh*

*Warren MacEvoy*

### Colorado School of Mines

*Angel Abbud-Madrid*

### Colorado State University

*Azer Yalin*

### Colorado State University Pueblo

*Jude DePalma*

### Community College of Aurora

*Victor Andersen*

### Community College of Denver

*Steffanie Peterson*

### Fort Lewis College

*Charlie Hakes*

### Metropolitan State University

*Aaron Brown*

### Otero Junior College

*Mark Korbitz*

### Pikes Peak Community College

*Liz Coelho*

### Pueblo Community College

*Bill Hardwick*

### Red Rocks Community College

*Lynnette Hoerner*

*Barbra Maher*

### Space Foundation

*Iain Probert*

### Trinidad State Junior College

*Cindy Clements*

### University of Colorado Boulder

*Brian Sanders*

### University of Colorado Colorado Springs

*Steve Tragesser*

### University of Northern Colorado

*Bob Walch*

### Western State Colorado University

*Suzanne Taylor*

## (Associate) Director's Corner - by Bernadette Garcia Galvez

You can peek into any one of the Space Grant facilities around the state and witness students engaged in projects that are changing their lives in real-time. From faculty research projects to autonomous robots, to sounding rocket payloads and CubeSats, our students are “doing” science and engineering and gearing up to hit the ground running when they start their careers. Space Grant students are a hard working bunch - juggling classes, homework, projects, work, families, and life in general. These same students do exceptional things in projects, keep-up with classes, and then turn around and work with K-12 students, mentor younger students, or help facilitate activities in their local math and science centers.

The success of COSGC is a direct result of the committed educational professionals who facilitate Space Grant projects on 20 Colorado campuses and at the Space Foundation, thereby creating the opportunities for students and teachers. All of our affiliate directors have full time jobs. They are educators. They are researchers. They all have families and busy lives outside of their educator roles. Through an astounding cosmic happenstance, we have linked with some of the top educators in the state. The extra hours. The additional stress. The added administrative burden of reports, proposals, and meetings. Engaging with students outside the classroom in an entirely different and, one might say, even more challenging way. Our affiliate directors build relationships with Space Grant students and become mentors and friends. They listen to students’ struggles with classes and share the frustrations of life outside of school and worries about their families.

I’ll admit it. I think NASA is cool - as do all the students, faculty, and everyday citizens we work with. What isn’t amazing about exploring space and learning more about our world, our universe? NASA contributes to our society in so many ways and at Space Grant we work

with the young people who are NASA’s future. In this newsletter you’ll get a brief glimpse into what we’ve been up to the past year. Most importantly, you’ll learn a bit about some of the remarkable individuals who make it all happen.



*COSGC affiliate directors, student leaders, and leadership during the 2014 annual meeting hosted by the Space Foundation in Colorado Springs.*

### 2014 Undergraduate Space Research Symposium

COSGC’s annual Undergraduate Space Research Symposium was held April 19, 2014. Students from COSGC institutions across the state presented research papers to panels of industry engineers and scientists. Industry partners also volunteered their time to read and judge student papers prior to the presentations. Students competed for cash prizes sponsored by local aerospace companies. The Grand Prize winner was “An Investigation of Crystallization in Microgravity” by Kamron Medina, Rebecca Lidvall, Jannine Vela, Jon Quinn, and Peter Merrick (University of Colorado at Boulder - CU). Session winners were Camille Arnn, Eric Perry, Andrez Leyva, Mary Carpenter, and Hayden Alworth (Trinidad State Junior College - TSJC) with “Autonomous Logical Land-based Electronic Navigator - A.L.L.E.N.”; Jesse Ellison, Isaac Hayden, and Gabrielle Massone (CU) with “Compact Star Camera Design for CubeSat Attitude Determination Systems”; Paige Arthur, Cooper Benson, Chris Rouw, and Kristen Hanslik (CU) with “The Potential for Solar Tracking and Observation On-board a High Altitude Balloon Platform”; and Dwight Rider, Eric Benson, Viridiana Gonzalez, and Gabriel Walker (Community College of Aurora) with “Martian Mulch”. The winners of the hardware demonstration and poster session were the TSJC students mentioned above for “A.L.L.E.N.” and Metropolitan State University students, Ric Clark, Katrina Abramajtis, Jamie Adler, and Matthew Wicke with “MSUD Robotics.”



(L to R) The grand prize winning team from University of Colorado at Boulder following their presentation; Adams State University student presenting his design of an autonomous robot beacon system; and the dual-prize winning team (paper and poster) from Trinidad State Junior College.

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

COSGC consists of 20 institutions of higher education and 1 non-profit foundation. COSGC students have access to resources including faculty and industry mentors, assembly and integration labs, faculty research labs, a mission operations and control center, a clean room, ground satellite tracking stations, observatories, as well as numerous partnerships with NASA Centers and industry.



## AFFILIATE UPDATES

### Adams State University



*One of the robotics teams from Adams State University presenting their design at the Colorado Robotics Challenge.*

Adams State University (ASU) Space Grant continues to facilitate autonomous robotics projects for ASU undergrads. ASU Space Grant students are building upon work done by students over the past several years to expand the use of boards developed and customized by ASU students. Access to multiple 3D printers has provided the students the opportunity to machine parts of their own design. In preparation for the 2015 Colorado Robotics Challenge, students are exploring various mechanical systems including walking, bouncing, and wheeled designs, some of which incorporate a beacon system designed by a former ASU student. Students help advertise the robotics society and to recruit new undergraduate participants through STEM Saturday workshops and participation in an ASU lunch lecture series.

ASU Space Grant faculty and students contribute content to a summer high school STEM Academy. The Academy is a one-week resident program focused on hands-on STEM activities to further encourage students already leaning toward attending college in a STEM discipline, while attracting undecided students to both STEM and ASU as a post-high school option to continue their education. ASU Space Grant supports the Robotics classes during the Academy.



*Students in the STEM Academy at Adams State University learn programming working with NAO Robots.*

### Pikes Peak Community College

Utilizing funds awarded through COSGC's COURSE grant, the Space Grant program at PPCC

has been able to expand the student program by adding a second student team to the balloon payload program currently facilitated by affiliate director, Liz Coelho.



*PPCC students (top) celebrating the successful launch and recovery of their balloon payload and (bottom)*

In 2014, the PPCC balloon payload program supported 3 teams (2 in spring and 1 in summer). Recruitment of students takes place during the fall through a stringent and competitive process. Teams are assembled and begin work on their payloads, participating in the spring COSGC DemoSat program. One of the teams was accepted to and presented a paper at the 2014 Undergraduate Space Research Symposium. Their payload experiment explored melanin as a barrier against ionizing radiation. The team also presented their work at the AIAA Symposium. PPCC Space Grant students participated in the first annual Colorado Springs Maker Faire in fall 2014, sharing their work and information about PPCC Space Grant with the community and hoping to recruit younger students into the PPCC program. PPCC Space Grant student, Amanda Williams, was chosen as one of the National Community College Aerospace Scholars (see page 14).

### Community College of Aurora

Spring 2014 was the second iteration of CCA Space Grant's Introduction to Experimental

Design class. Class payloads flew with the April 2014 DemoSat launch and included 1 biology, 1 engineering, 1 chemistry and 1 instrumentation payload. All teams submitted and presented papers at the 2014 Undergraduate Space Research Symposium. The Martian Mulch team won a session prize at the event.



*Community College of Aurora "Martian Mulch" team accepts a session prize at the Symposium, along with industry sponsor.*

Utilizing funds through the Colorado Undergraduate Retention in Science and Engineering (COURSE) grant, CCA Space Grant is collaborating with CCA administrators to develop a program that targets students who express an interest in engineering at the beginning of their college careers. The program focuses on students who state their goal is engineering, but who do not yet have the mathematics required to be accepted into an engineering program at a 4-year institution. Students are eligible for scholarships and participate in introduction to engineering workshops. They are also assigned mentors who provide coaching and advising throughout their semesters at CCA.

### **Community College of Denver**

Throughout 2014 the Space Grant program at CCD went through many changes - including a growth spurt! CCD Space Grant welcomed a new



*CCD students at a COSGC workshop programming an Arduino with sensors for use on a balloon payload.*

Affiliate Director, Steffanie Peterson (Astronomy). After mentoring a balloon payload team through a DemoSat launch, Steffanie expanded student opportunities by recruiting additional faculty to support the effort and engaging the CCD program in both the COSGC autonomous robotics and national RockSat-C programs. These efforts were made possible through winning supplemental grant funds through COSGC's COLORADO Undergraduate Retention in Science and Engineering program.

After participating on a balloon payload mission, three CCD students accompanied Steffanie to the RockOn! workshop at NASA's Wallops Flight Facility. There, they learned the basics of building a sounding rocket payload, which they brought back with them. The CCD RockSat team is building a sounding rocket payload that will fly with the 2015 RockSat-C launch at Wallops in June.



*CCD students help integrate their payload during the 2014 RockOn! Workshop.*

CCD Space Grant continues to facilitate balloon payload missions for CCD students, mentoring a team each semester. CCD students are also developing an autonomous robot to demonstrate at the 2015 Colorado Robotics Challenge. Finally, CCD students and faculty provide content for a Rocket Day at a local elementary school where they facilitate hands-on projects with younger students, talk about their work at CCD and encourage students to think about STEM and CCD as they look toward the future.

### **Colorado State University**

CSU Space Grant provides autonomous robotics projects to engage first year students. Student teams built and demonstrated robots at the Colorado Robotics Challenge. Students built and launched a balloon payload with the summer 2014 DemoSat program that included a student-designed CO<sub>2</sub> sensor system. The intent of the system was to gather a vertical CO<sub>2</sub> profile. CSU Space Grant also facilitated an undergraduate research project in which

a team designed an open-path methane sensor for use on Unmanned Aerial Vehicles. CSU graduate students help mentor undergraduate Space Grant projects. In addition, these graduate students are engaged in their own research. One project this year was development of combustion emission sensors. Finally, several CSU student teams presented papers and posters at the Undergraduate Space Research Symposium.



CSU balloon payload team (top) posing with their payload post-flight, and (bottom) students preparing for a thermal-vac payload test pre-launch.



FLC summer DemoSat team poses with their payload at the recovery site.

College observatory. Students engaged in this research presented posters about supernovae classification by observation of light curves and application of the transit method of exoplanet detection.

**Colorado State University - Pueblo**

CSU - Pueblo students participated in two robotics-focused projects. The first was the design and demonstration of an autonomous robot at the Colorado Robotics Challenge. The robotics team has taken advantage of 3D printers on campus for rapid



CSU Pueblo student finalizing programming of his team's autonomous robot at the Colorado Robotics Challenge.

**Fort Lewis College**

FLC Space Grant students designed and built a balloon payload that flew with the summer 2014 DemoSat launch in August. Students also participated in the fall robotics workshop. Building on skills learned at the workshop students designed and demonstrated an autonomous robot at the Colorado Robotics Challenge in April. Finally, several FLC Space Grant students have been involved in astronomical observations using the Fort Lewis

prototyping of parts for their robots. The second team continued work on a lander that could successfully deploy the autonomous robot - designed to be used in a Mars-like environment. The lander team finished the construction of a parachute system and had a successful deployment test. Work on both projects continues.



FLC students programming their autonomous robot during the Colorado Robotics Challenge.

**Colorado School of Mines**

CSM Space Grant went through major changes in 2014. The Space Grant program moved from being part of the EPICS program (freshman projects) to being housed within CSM's Center for Space Resources. Along with this move came a change in affiliate director with Angel Abbud-Madrid stepping in as the new CSM Space Grant affiliate

director. The CSM Space Grant program joins a dynamic team that has facilitated NASA-related activities over the years including RASC-AL and the Great Moonbuggy Race. In addition, the center houses CSM's Rocket Club, Space Society, Society for the Exploration and Development of Space (SEDS), and Astronomy Club.

CMS students designed and built a high altitude balloon payload (short-duration) and launched with the Fall 2014 DemoSat program. Student teams are working on another balloon payload in addition to designing an autonomous robot to demonstrate at the 2015 Colorado Robotics Challenge.

The CSM Space Grant program was one of three COSGC campuses to integrate transfer students participating in the COLORADO Undergraduate Retention in Science and Engineering (COURSE) effort. Two students transferred from Community College of Aurora and are now part of the Space Grant family at CSM.

### **Trinidad State Junior College**

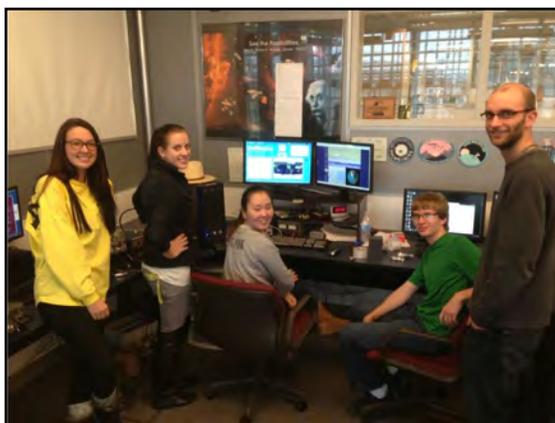
TSJC Space Grant continues a close collaboration with Parallax Inc to facilitate the robotics program on campus. The TSJC team designed the first ever autonomous robot to



*TSJC students (top) accepting recognition for the outstanding performance of their autonomous robot at the Colorado Robotics Challenge and (bottom) interfacing with their autonomous robot as it attempts to evade obstacles.*

successfully navigate all courses and obstacles at the annual Colorado Robotics Challenge. The TSJC robotics team submitted a paper and a poster to the Undergraduate Space Research Symposium and won sessions prizes in each category. The team is beta testing education materials for Parallax through their project in addition to writing libraries for sensors and other components in Propeller C. Parallax provides mentors and donates software and components to support the TSJC team.

### **University of Colorado - Boulder**



*CU students getting ready for a DANDE satellite pass in the Mission Operations Center on the CU Campus.*

CU Space Grant students were engaged in mission operations for the DANDE & ALL-STAR satellite mission throughout 2014. The DANDE team's paper was accepted and presented at the 2014 Conference on Small Satellites in Logan, Utah. The ALL-STAR CubeSat (carrying the THEIA science payload) launched from Cape Canaveral in April the same day that NASA Administrator, Charlie Bolden visited the COSGC facility on the CU campus. ALL-STAR was enabled through a partnership with Lockheed Martin. Work continued on the PolarCube mission (see cover page) which utilizes the ALL-STAR bus. The HELIOS III payload was designed, built, and tested from January through July and



*CU HELIOS students (left) helping integrate their payload on the platform and (right) complete final integration in preparation for environmental testing at NASA's Columbia Scientific Balloon Facility in Palestine, TX.*



*CU Space Grant students, alumni, and mentors gather with a picture of the rocket that will take the ALL-STAR payload to space at Cape Canaveral.*

launched on August 9, 2014 on the High Altitude Student Platform from NASA's Columbia Scientific Balloon Facility in Ft. Sumner, New Mexico. HELIOS III explores stratospheric observing of the Sun and was a collaboration with the Center for Astrophysics and Space Astronomy, partially funded through CU's Engineering Excellence Fund. The RocketSat-10 payload was completed in July 2014 and ready for launch from NASA's Wallops Flight Facility. Launch was postponed which gave the team time to continue testing of the system and samples. The team will demonstrate the combination of Aluminum and Indium and the alloy created in microgravity on a launch scheduled for March 27,



*Members of the RocketSat-10 team pose with their payload just before integration and environmental testing at Wallops flight Facility.*

2015. RocketSat-10 is a collaboration with the Air Force Research Labs.

CU Space Grant continues a collaboration with Digital Globe that engages students in sensor calibration alongside industry mentors and graduate researchers. Students are also working on re-designing the beacon system used for the statewide Colorado Robotics Challenge. Finally, CU Space Grant students continue to work on the development and implementation of ground stations (both stationary and mobile) to support mission operations for future CubeSat payloads.

### **Western State Colorado University**



*Western State Colorado University students making changes to their autonomous robot at the COSGC Makerspace.*

WSCU Space Grant hosted the fall COSGC 2014 Robotics Workshop. A WSCU student team participated in the Colorado Robotics Challenge in April 2014. The robotics team engaged the most WSCU students ever participating in a WSCU Space Grant project. WSCU Space Grant also facilitated a balloon payload project that explored the affect of near-space conditions on e-coli on the April 2014 DemoSat launch. Finally, WSCU Space Grant continues the observation of light curves of Exoplanets in collaboration with the Gunnison Valley Observatory. Following the installation of a new telescope and mount, one WSCU undergraduate has been working with affiliate director, Suzanne Taylor on the observations.



*WSCU students posing with their balloon payload as they prepare for launch in April 2014.*

### **University of Northern Colorado**

UNC Space Grant sponsored a student team for the summer DemoSat program. During the development and build of their balloon payload, the summer team of undergraduate students mentored a team of high school students who were building a payload as part of the Frontiers of Science Institute on



*UNC students present their autonomous robot at the Colorado Robotics Challenge.*

the UNC campus. The undergraduate team designed a cosmic radiation experiment. Both payloads flew with the August DemoSat launch.

In addition to balloon payloads, UNC Space Grant facilitated a robust robotics program during 2014. These included a team that participated in the Colorado Robotics Challenge in April. Other students investigated swarm behavior, designed and built a quadcopter, continued work on sensor integration and use with autonomous robots, and the use of rapid part fabrication with 3D printers. UNC Space Grant continues to support a Robotics Club and the use of BOE Bots to introduce new students to robotics. Finally, Zach Hafen, UNC physics undergraduate student, was mentored in his research to model human balance in a collaborative project with UNC's Sports & Exercise Science department. Zach presented his work on a poster at the Undergraduate Space Research Symposium.



*UNC students pose with their balloon payload alongside the Frontiers in Science Institute high school team.*

### **Colorado Mesa University**

CMU Space Grant was one of three COSGC programs to participate in the first year transfer program called COURSE (see page 10). Two students transferred to CMU from Trinidad State Junior College in fall 2014. CMU Space Grant students completed an entry for the 2014 DARPA Robotics Challenge. CMU Space Grant is collaborating with the new GJ Business Incubator which includes the Grand Junction Makerspace in

addition to continuing to collaborate with the local Math & Science Center for which students develop demonstrations and provide content.



*Transfer students, CMU affiliate director, and mentors at the GJ Makerspace during the COURSE summer campus visit.*

### **University of Colorado Colorado Springs**



*UCCS students and affiliate director pose with USA paralympic athlete.*

UCCS Space Grant students worked on two faculty mentored projects with space applications. The first project was the continuation of the development of an autonomous video capture system. Students have designed a more robust system through the year's effort. A student team also designed and fabricated a lift with a very stable platform that included a high level of adjustment for use with a wheel chair. The lift was eventually used to great affect by a USA Paralympic athlete.

### **Pueblo Community College**

PCC Space Grant students designed a balloon payload that tested gyroscopic stabilization to explore whether it would be usable to help stabilize balloon payloads during flight if there were ever a need for stabilization for science experiments. The payload was a robust structure that flew with the April 2014 DemoSat launch and is designed to be reusable for future PCC Space Grant teams. A team of PCC students participated in the COSGC robotics effort

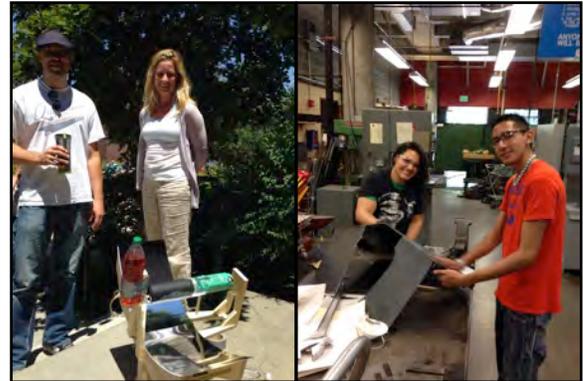
with an autonomous robot demonstrated at the Colorado Robotics Challenge.



*PCC students (top left) working on a PCB for the (top right) PCC autonomous robot; and (bottom) integrating systems onto their balloon payload structure.*

## **Metropolitan State University Denver**

MSUD Space Grant students worked on several projects with space applications. A student team developed an autonomous robot for the Colorado Robotics Challenge. A team continues work on the design of an electric vehicle. Finally, students developed a gimbaled solar concentrator to filter water.



*Metropolitan State University students (left) testing their solar concentrator water filter system and (right) machining parts for the electric car project.*

## **Cubes in Space**

One of the exciting collaborations that came to fruition in 2014 was the implementation of the Cubes in Space program. The Cubes in Space program was developed through a partnership between Rubik Learning Initiative, idoodlesoftware inc., and COSGC's RockSat-C program. The team initially approached Chris Koehler proposing to create a middle school program as part of a CubeSat mission. After listening to their idea, Chris suggested a sounding rocket flight might be more feasible to incorporate middle school payloads that could be designed and launched in a single academic year. The education team designed curriculum as the COSGC team designed the platform in which middle school experiments would fly. Mechanical engineering junior, Yohannese Gebremedhin, was hired to design the structure, working closely with COSGC Director Chris Koehler, Rubik Learning representatives and engineers from Wallops Flight Facility. Yohannese and fellow CU-Boulder aerospace engineering student, Gerardo Pulido, machined the final hardware. The COSGC team provided technical support to the Cubes in Space program throughout experiment design, integration, launch, and analysis. Yohannese's structures were used to secure 112 small containers filled by teams of 11- to 14-year-olds from around the world. The experiments launched June 26th. Cubes in Space has grown to include high altitude balloon payload platforms for middle school stratospheric experiments. More information about the program may be found at [www.cubesinspace.com](http://www.cubesinspace.com)



*(left to right) Yohannese Gebremedhin and Gerardo Pulido machining the Cubes in Space platform; Middle school experiments in the platform during final integration; and Yohannese and Chris Koehler pose with the Cubes in Space platform and mission patch following launch and recovery.*

## Meanwhile, Across the State...

The Colorado Space Grant program continues to support established, statewide efforts that provide launch opportunities and hardware demonstrations as resources with which COSGC affiliate directors may shape their programs.

The first of these is DemoSat. Three short-duration balloon payload launches took place as part of the DemoSat program. Students participated in mission reviews and launches. A total of 37 undergraduate payloads flew (representing 11 COSGC institutions) on five 2014 DemoSat balloon flights in April, August, and November. Students work in teams either enrolled in courses (at CU, CCA, MSUD) or as extracurricular projects (at PPCC, CU, WSCU, CCD, PCC, FLC, CCA, CSM, UNC). Launches are provided by Edge of Space Sciences (see back page for more details about EOSS)!

The 8th annual Colorado Robotics Challenge was held on April 5, 2014. Seventeen student teams representing 10 COSGC institutions (TSJC, WSCU, CSM, CSU-Pueblo, MSUD, FLC, UNC, CSU, ASU, PCC) gathered in the early morning to demonstrate their autonomous robots' capabilities and attempt to get through challenges including fine blowing sand, rocks of all sizes, dry vegetation, trenches, and human made obstacles. As a lead up to the Challenge, COSGC sponsored robotics workshops where students learned new tools, practiced skills, and established teams to participate in the event. COSGC's Colorado Robotics Challenge is held at the Great Sand Dunes National Park - testing site for the Viking Landers. Students participate in a MakerSpace in nearby Alamosa, the day before the Challenge. The 2015 Challenge is scheduled for April 4th. Visit <http://spacegrant.colorado.edu/statewideprograms/robotics-challenge> for more information.



*Students and mentors at the 2014 Colorado Robotics Challenge.*

## ...and the Country

COSGC facilitated the 7th annual RockOn! workshop in conjunction with Virginia Space Grant and coordinated two sounding rocket launch opportunities all in collaboration with NASA's Wallops Flight Facility. To date, over 300 faculty and students from across the country have participated in RockOn! and built over 100 payloads that were launched by the Wallops team.

RockSat-C provides student teams with a launch opportunity that includes regular reviews by COSGC faculty and students beginning in the fall semester and leading up to the summer launch. Payloads are student based and are supported through collaborations with faculty and industry involvement.

RockSat-X flights have an ejectable skin and a nose cone that will expose experiments to the space environment fully at apogee. Additionally, the rocket is de-spun to allow for a greater range of experiments. Participating teams are required to complete regular reviews with program facilitators.

Students participating in all programs participate in testing and integration of the payloads prior to launch. Teams are encouraged to attend launch and all payloads are recovered the same day. Both the C and X programs provide opportunities for students to work closely with faculty and industry mentors on a project that has low-cost access to the space environment. For more information about the RockOn! and the RockSat C and X programs, you may visit <http://spacegrant.colorado.edu/national-programs>



*RockOn! Workshop & RockSat C participants pose in front of the fully integrated rocket at Wallops Flight Facility.*

...continued from cover page

## **Four NEW COSGC Community Colleges**

Symposium and the COSGC community college transfer program. Talented faculty at each institution have been engaged as affiliate directors to lead the Space Grant program on their campuses. Faculty and student leaders from each of the new schools are engaged in COSGC projects at their home campuses. Otero has even branched out to participate in the Colorado Robotics Challenge!

Initial grant funding provides for 2-years of student engagement. COSGC leadership is working with affiliate directors to identify and raise funds in order to engage the four new affiliates as permanent COSGC affiliate institutions in order to maintain space hardware projects beyond the 2-year grant.



*(left to right) Students and faculty from Red Rocks CC, Otero JC, Aims CC, and Arapahoe CC participate in a balloon payload how-to workshop; students from Trinidad State JC and CC of Denver also participated in the workshop; participants celebrating the successful recovery of their payloads on the final day of the workshop.*

## **COSGC's Transfer Student Program Update**



*COURSE transfer students and COURSE student program manager, Gerardo Pulido, during campus visits.*

The Colorado Undergraduate Retention in Science and Engineering (COURSE) effort completed year 1 of a 2-year program funded through the Innovative Pilot opportunity by NASA's National Space Grant College and Fellowship Program. COURSE formalized the process of engaging students who graduate from COSGC community colleges and transfer to COSGC 4-year institutions. Eight students participated in the first year of the program - 2 from Trinidad State Junior College, 5 from Community College of Aurora, and 1 from Community College of Denver. The students transferred to Colorado Mesa University (2), Colorado School of Mines (2), and University of Colorado at Boulder (4). Students received a scholarship and participated in a campus visit at the institution to which they transferred. This "bridge" experience was a more in-depth tour of the campus and focused on connecting students with services and people on their new campuses. First among these services was the connection with campus TRiO programs that focus on helping first generation student succeed. In addition, students were offered placement in a hands-on COSGC project at their new institution. Many lessons have been learned after the first year of the COURSE program. Although it was assumed that the hands-on project would be the most beneficial aspect of the program - providing activities to aid in retention - the building of community and connection with faculty, peers, and services has proven to be the most important aspects of COURSE contributions to student retention. There are 13 spots available for the 2nd year of the COURSE program and students are applying as the deadline of March 1, 2015 approaches.

### Student Focus

In 2014, COSGC engaged 567 Colorado students in space hardware missions, classes, and research projects, about which you have read on the preceding pages. Introducing them all to our readers would take a newsletter all its own (an extremely thick one). Instead, we present a sample to give our readers an idea of the high caliber of students that are a part of the Colorado Space Grant family, the projects they are working on, and their plans for the future.



**Amanda Williams** is a sophomore in physics at Pikes Peak Community College. Her PPCC Space Grant project was a high altitude balloon payload that explored radiation in the stratosphere. Amanda applied for and was accepted into NASA's National Community College Aerospace Scholars Program. As an Aerospace Scholar, she was required to research the history and current status of NASA's missions to Mars. Amanda then had the opportunity to design a 3D model of a rover and outline a mission on Mars the rover could complete. She submitted her mission and rover design and

competed against 270 students from across the country. Amanda was selected as one of the winners. She won the opportunity to travel to Johnson Space Center in Houston where she presented her work to NASA engineers and scientists. While at JSC, Amanda worked with a team of students (*pictured right*) to complete another project with a NASA mentor, involving prototype rovers and real-world scenarios. Amanda plans to attend a university after finishing her degree and would like to do research in astrophysics while earning an advanced degree. Ultimately, she would like to work for NASA or the supporting industry and would like to be an astronaut.



**Hayden Alworth**: This is Hayden's second year taking classes at Trinidad State Junior College. He was on the TSJC Robotics team in 2014 and has continued work with the 2015 TSJC team preparing to demonstrate their new design at the 2015 Robotics Challenge. In addition to working with the Robotics team, Hayden assists TSJC's electronics professor with the electronics course. Hayden has been working closely with a mentor from Parallax Inc, and has created libraries for the Propeller C language and been part of the team beta testing Parallax software. Hayden plans to earn a bachelor's degree and eventually an advanced degree, but has not quite decided on a discipline. He knows it will be in science, engineering, or technology.



**Tanya Hardon** is a senior in aerospace engineering at the University of Colorado at Boulder. Tanya was a member of the DANDE satellite mission for three years and is currently the science team lead for the PolarCube mission. In addition to leading the science team, Tanya writes code for the Attitude Determination and Control team. After earning her degree Tanya plans to work in the space sector.

**Tyler Joy** is a mechanical engineering junior at the University of Colorado at Boulder. Tyler is currently the systems engineer on the RockSat-10 mission. He previously worked on the RockSat X-HED project, helping design and build a payload to take footage of the RockSat X flights. His CU Space Grant experience also includes a semester working on the PropSat mission as a member of the structures team. Tyler plans to get a masters degree after finishing his BS and is currently deciding what he would like to do with his post-university career.





**David Long** is a senior at Colorado School of Mines (CSM) double majoring in mechanical and electrical engineering. David currently serves as the CSM Robotics Club president. In this role, he mentors a team of students working to design and build an autonomous robot to demonstrate at the 2015 Colorado Robotics Challenge. David provides the team with prototype, design and manufacturing resources. After earning a bachelors degree, he plans to work in a robotics and automation-related field, hopefully with space applications.

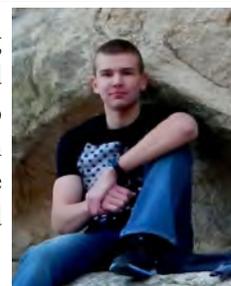
**Carroll Olson** is a sophomore at Pikes Peak Community College working toward her Associates of Science degree. Carroll participated in a PPCC Space Grant team that built a high altitude balloon payload exploring melanin as a barrier against ionizing radiation. She enjoyed the rigors of hard science the project required and so applied to be on another balloon payload team in order to take the experiment further. Carroll plans to transfer to the University of Colorado at Colorado Springs and work toward a bio-medical degree. She would ultimately like to be a researcher, but has not yet decided on a discipline.



**Becca Lidvall** is a junior in aerospace engineering at the University of Colorado at Boulder. Becca's first Space Grant project was a sounding rocket payload that explored crystallization in microgravity. She is currently the program manager of the national RockSat-C Program and to keep her skills sharp also works with the HELIOS IV (long-duration balloon payload) project on the EPS team, redesigning a printed circuit board following the HELIOS III flight in August 2014. Becca plans to work in the aerospace industry after earning her degree.



**Tanner Rotering** is a senior at the University of Colorado at Colorado Springs working toward a BS in mechanical engineering, with minors in aerospace engineering and mathematics. Tanner's Space Grant project is developing algorithms in MATLAB to synchronize video files and force plate data that contributes to a graduate/faculty research project exploring the human gait. After earning his degree, Tanner plans to work in the aerospace industry specifically interested in designing spacecraft and technology. He would eventually like to earn an advanced degree in mechanical or aerospace engineering.



**Jesse Austin** is an graduate student in electrical engineering working toward an MS at the University of Colorado at Boulder focusing on power electronics, embedded systems, engineering management and aerospace design. Jesse is currently the Program Manager for the RockSat-X National Program (see page 11). In this role, Jesses is the point of contact between participating college teams and NASA engineers and technicians at Wallops Flight Facility. Jesse mentors teams through the design process and ultimately ensure compliance with WFF regulations. He also regularly meets with WFF personnel to update them on status of payloads. In addition to his management experience, Jesse also worked as a team member on the PolarCube MiniRad payload, the RockSat-X video payload, and helps organize and facilitate the RockOn! Workshop. After he completes his degree, Jesse plans to work as a systems engineer at a top aerospace company ("JPL, I'm looking at you!!").



**Mary Carpenter** is a sophomore at Trinidad State Junior College (TSJC) working toward Associates of Science, Arts, and General Studies. Mary was the electronics team lead on the TSJC Space Grant 2014 autonomous robot team. She enjoyed the project so much, she joined the 2015 team and is Team Captain this time around. In this role, Mary has taken on the responsibility of mentoring students new to the project. Mary plans to continue her education at a university where she will study biomedical engineering (and hopefully continue playing basketball).

**Paige Arthur** is a sophomore in aerospace engineering at the University of Colorado at Boulder. Paige initially became involved with Space Grant by taking the Gateway to Space class. At the end of the class, she helped a team of students write a proposal to build a long-duration balloon payload. When the team won a spot on the HASP launch, Paige became the HELIOS III Project Manager. Paige led the team through design, build, testing, and launch and is now Project Manager for the HELIOS IV project. She is also a team member on the ADCS team. Paige plans to complete a BS/MS at CU and then would like to work in industry for a company involved in space exploration.



**Marshall Sweatt** could be in our “where are they now” section. He was nominated for the newsletter by his former professors at Colorado Mesa University. It was at CMU that Marshall was engaged in Space Grant projects for two years as he earned a computer science degree. At CMU Space Grant, Marshall worked on autonomous robotics projects including developing a system using sonar to triangulate position. He was able to take robots through several development phases, improving performance and capabilities. Marshall’s experiences introduced him to robotics and led him to recognize a passion for research and development. He decided to continue his education and was accepted at Colorado School of Mines where he is completing an MS in computer science. Marshall plans to work full-time as a software developer and to ultimately go back to school for a PhD once he’s been in industry for awhile.

**Kristian Kates** is a junior in aerospace engineering at the University of Colorado at Boulder minoring in atmospheric and oceanic studies. Kristian initially began working at CU Space Grant part of the mission operations team for the ALL-STAR CubeSat mission. He is currently the project manager for the RocketSat-10 mission, leading the team to delivery of their payload and preparing for launch. Kristian is still exploring the possibilities of a career. He is considering several options including working as an engineer in the aerospace industry, designing parachutes for skydiving, working for the FBI or possibly going back to school to explore biomedical engineering.



**Laurie McHale** is a mechanical engineering PhD student at Colorado State University where she earned an MS in atmospheric science. Azer Yalin, CSU Space Grant affiliate director, mentors Laurie’s doctoral research. She is developing open-path cavity ring down spectroscopy to decrease power/weight limitations of current sensors in order to make CRDS more applicable to UAV and remote deployment measurements of trace gases. Laurie supports the CSU Space Grant program by mentoring undergraduate teams. Summer 2014, she mentored a team that designed a complex air sample system that launched on a balloon payload. Laurie is currently mentoring a team building an autonomous robot for demonstration at the 2015 Colorado Robotics Challenge. Laurie is currently on track to graduate in 2017, after which she hopes to find a position in industry or in a government lab to continue her work developing commercial sensors.

## Where Are They Now?

Hundreds of COSGC alumni remain part of the Space Grant family. Alumni continue to contribute to student projects as they move on to their careers in STEM fields in industry or as STEM educators. Our alumni are project mentors, guest lecturers in classes, reviewers, judges for the Symposium, advisory board members, and even making financial contributions to the program.

**Jeremy Begley** joined the Colorado Space Grant family during his final year at Trinidad State Junior College. Jeremy was one of the students on the very first TSJC Space Grant project when TSJC first became a COSGC affiliate institution. While earning an AS at TSJC, Jeremy worked on a high altitude balloon payload and was also on the first autonomous robotics team at TSJC Space Grant. “The lessons I learned in the Space Grant projects helped me with my projects after I transferred to Colorado State University and even into my current employment.” Jeremy currently works for URS Corporation/AECOM. “In my job there is a lot of coordination



(left to right) Jeremy Begley during his TSJC Space Grant days helping his team demonstrate their autonomous robot and posing with fellow TSJC students and former affiliate director.

between the disciplines - electrical, mechanical, and instrumentation and controls,” Jeremy explains. “Participating in real-life engineering projects while at Trinidad State helped me build a universal skillset that has been significant in my career thus far. Jeremy is in the process of applying to an engineering masters degree program at the University of Denver.

**Shelly Grandell** was part of the Space Grant family for 7 years while she earned her degrees (BS in geology and MA in Science Education) at Adams State College (now Adams State University). During her years at ASC Space Grant, the program primarily focused on the Zacheis Planetarium and STEM education outreach to the rural communities surrounding Alamosa in southern Colorado. Shelly worked closely with the affiliate director as they engaged hundreds of children in thousands of kid hours every year at the planetarium and during school visits, workshops, and telescope viewing nights. “The work I did inspired me to become a teacher,” Shelly explains.



Shelly is currently the science department coordinator at Horizon Middle School in Aurora, CO where she teaches 6th grade science and facilitates a STEM club. Shelly is a Teacher Liaison with the Space Foundation. As a Liaison, Shelly has participated in many workshops, attends the Space Symposium every year and was accepted into the Honeywell Space Camp for Educators program. In this program, Shelly traveled to Huntsville, AL to the US Space and Rocket Center and participated in teacher workshops, met NASA professionals, participated in astronaut training modules, ran mock missions, and connected with teachers from around the country and the world. Through the Space Foundation Teacher Liaison program and



Space Camp, Shelly has brought back the experiences and resources into her classroom and school district. She uses curriculum she’s experienced as a Liaison with her students. Shelly describes one of her favorites: “Students work in teams to design a system to filter “urine” into drinkable fluid. I don’t tell them it’s fake urine right away. Students get an operating budget and limited supplies. It’s amazing to experience their problem solving and how they approach the challenge. It’s a great time. I am the ‘tester’ to see if it’s drinkable. The kids FREAK OUT when I drink the liquid...until I tell them it isn’t real.”



*Kristina (bottom right) posing with her team post-launch and recovery of their balloon payload.*

**Kristina Wang** first joined the CU Space Grant family as a member of the Outreach Team after taking the Gateway to Space class her first year as an aerospace engineering student. She worked in both on and off campus activities with K-12 students, eventually assisting with the summer high school 6-week Upward Bound class and was even a course assistant for Gateway to Space. Eventually, Kristina transferred to the ADCS team during the development of CU's first CubeSat, Hermes. She completed a BS/MS degree in 2010 and is now a Systems Engineer at Blue Origin. Kristina started at Blue Origin in 2012 and completed a one year rotation program before settling into her current position. "Space Grant and Gateway to Space were my first real exposures to flight hardware and understanding spacecraft subsystems," Kristina explains. "I believe that exposure gave me a foundation to understanding my engineering coursework and real-life applications of fundamentals." At Blue Origin Kristina's work varies and includes many different kinds of analysis - from developing thermal/fluid models, to conducting testing of flight components and making test predictions. She has also had the opportunity to learn about and work on diverse topics including acoustic work and software verification. "Working on a team at Space Grant with students of varying class levels and majors taught me about good teamwork, leadership, and communication. Working at Space Grant early in my academic career gave me an advantage when applying to other opportunities like internships and research projects."



*Kristina, Blue Origin employee (photo: Annie Laurie Malarkey, Geekwire)*

## Affiliate Director Snapshots

**Dr. M. Suzanne Taylor** is the affiliate director of the Space Grant program at Western State Colorado University (WSCU) in Gunnison. Suzanne joined the Colorado Space Grant family in 2010 when the former director retired and she was asked to take over. She was not unfamiliar with Space Grant, having participated in an Alaska Space Grant "space camp" and winning a scholarship from Oregon Space Grant while earning her bachelor's degree!

Suzanne earned a BS in physics from Linfield College. While an undergraduate, she completed an REU in computational astrophysics at North Carolina State University. Suzanne earned both an MS and PhD in physics from the University of New Mexico. As a graduate student, she worked on several projects including characterizing geosynchronous satellites using observations of their light curves; studying and compiling weather and atmospheric characteristics of an astronomical site; and for her dissertation investigated light sources of a periodic error in astronomical position measurements called anomalous refraction.

In her free time, Suzanne makes the most of the amazing environment in Gunnison. This includes hiking with her dog, mountain and road biking, cross-country and downhill skiing. During her tenure as WSCU Space Grant



*Suzanne working with students at the Gunnison Valley Observatory.*

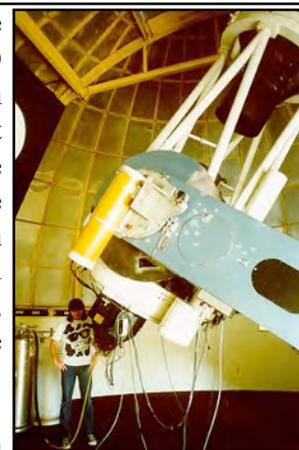


*Suzanne with WSCU students at the COSGC Makerspace working on their autonomous robot.*

affiliate director, Suzanne has grown the program and now engages more students and facilitates more programs than when she took the helm. These include autonomous robot projects, balloon payloads, and observatory research. She spends many summer evenings at Gunnison Valley Observatory and engages students in her observing efforts.

“Being involved in Space Grant is not only one of the funnest parts of my job, but it has also enhanced my job through funds and opportunities that have allowed me to do research and projects that would not otherwise have been feasible,” explains Suzanne. “It is incredibly satisfying to be able to provide students with a project and then step back and watch them take it from design to completion - developing skills, knowledge, and experience they would never had gained in the classroom.”

**Dr. Victor Andersen** is the affiliate director of the Space Grant program at the Community College of Aurora (CCA). Victor joined the Space Grant family in 2009 when CCA was initially integrated into COSGC through the Minority Serving Institution Partnership Development Competition. He earned his BS and MS degrees in physics at New Mexico Tech and his PhD in physics (with an astronomy specialization) at the University of Alabama. His research at both institutions focused on how the environment in galaxy clusters alters the interstellar medium and star formation in cluster galaxies. During his dissertation he collected optical data at the Lowell Observatory and Kitt Peak National Observatory. Prior to joining the CCA faculty, Victor was a professor at the University of Houston, where he was a member of the science team for the Martian Radiation Experiment (MARIE) aboard Mars Odyssey.



*Victor at the 42 inch telescope at Lowell during an observation run for his dissertation.*

In his spare time, Victor spends quality time with his wife and daughter. He is an amateur photographer and musician (plays the trumpet and even a couple chords on the ukulele). At CCA Victor has grown a Space Grant program that has included a long-duration balloon payload, a microgravity flight and numerous short-duration balloon payloads. He successfully developed and teaches an Introduction to Engineering course on the CCA campus that focuses on design, launch, and analysis of balloon payloads. Victor is working on a program to engage students who have expressed an interest in engineering since their first semester at CCA in order to mentor them through coursework and as they transfer to 4 year institutions. This new program includes scholarships and workshops. CCA Space Grant students also have the opportunity to work on autonomous robotics projects working toward demonstration at the Colorado Robotics Challenge. “My favorite thing about being a part of Space Grant is working

with students on the kinds of projects that develop skills that traditional course work does not,” Victor explains. “Not only technical skills, but leadership and communication. It’s exciting to watch students grow in confidence and realize they have what it takes to go beyond what they thought was possible for them when they started at CCA.”



*(left) Victor cosplaying Doctor Who with his daughter cosplaying Doctor Hooves at Denver ComicCon; and (Right) with CCA students at Johnson Space Center.*

**Colorado Hosts the Western Regional Space Grant Meeting**

COSGC hosted the biannual meeting of Space Grant programs in the western region of the country. Directors, affiliate directors, program coordinators, and students from Space Grant programs at 34 colleges and universities in 17 states along with representatives from Kennedy Space Center and NASA HQ participated in the 2 day meeting in Boulder. Participants had the opportunity to take part in a tour of the COSGC facility on the University of Colorado campus as well as a robotics workshop even before the official meeting began! Industry representatives from Lockheed Martin, SparkFun, and StratoStar presented programs at their companies focused on student projects. In addition to industry presentations, meeting presentations included students presenting their research; community college professors talking about facilitating student programs on their home campuses; and Space Grant faculty and staff presenting outcomes from collaborations on community college campuses, with planetaria, and with fellow academic institutions. Colorado congressperson Jared Polis even stopped by to share



*Western Regional participants pose following an engineering challenge during the meeting*

information about Colorado’s aerospace industry on the final day of the event. Most importantly, the event provided a venue for people involved in Space Grant’s western region to network - planning new collaborations, sharing lessons learned, and even strategizing about a major student project in development that will coincide with the total solar eclipse in 2017!

You know how significant participation in Space Grant was to your career. You can make the Space Grant experience possible for today’s students! Every monetary gift, no matter the amount, directly effects the life of a student by supporting student stipends or project supplies. Most gifts are tax deductible and you can leverage your gift through matching donations from your employer.

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

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**2015 EVENTS**

**JANUARY**

- 8-10 CCCE Balloon Workshop
- 31 Robotics Workshop

**MARCH**

- 27 RockSat X Launch

**APRIL**

- 4 Colorado Robotics Challenge
- 11 BalloonSat Payloads Launch
- 18 Colorado Undergraduate Space Research Symposium

**JUNE**

- 20-25 RockOn! Workshop
- 25 RockSat C Launch

**JULY**

- TBD COURSE Summer Bridge

**AUGUST**

- 1 BalloonSat Payloads Launch
- 11 RockSat-X Launch
- TBD HASP Launch

**SEPTEMBER**

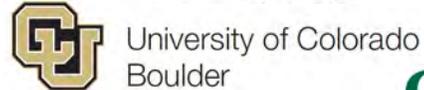
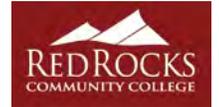
- 11-12 COSGC Annual Meeting

**OCTOBER**

- 21 Robotics Workshop

**NOVEMBER**

- 14 BalloonSat Payloads Launch



COSGC's short-duration, high-altitude balloon payload programs would not be possible without Edge of Space Sciences (EOSS). EOSS is a Denver based non-profit organization that promotes science and education by exploring frontiers in amateur radio and high altitude balloons. EOSS is comprised of volunteer members who utilize amateur radio and balloons to advance scientific study of the upper atmosphere. Their first flight took place in 1990. EOSS has been providing launches for COSGC for nearly 15 years! COSGC directly benefits from EOSS' commitment to Colorado students.

In November 2014 EOSS celebrated its 200th balloon launch with a special event that included past and current EOSS members, their families and people from academia and government labs for which they provide this important opportunity. The 200th launch happened to be a 2-balloon launch that carried COSGC DemoSat payloads and payloads from the Gateway to Space class. Congratulations and heartfelt thanks to all EOSS members, past and present. Looking forward to many, many more years of discovery! See [www.eoss.org](http://www.eoss.org) for more information about Edge of Space Sciences.

