ANNUAL NEWSLETTER OF THE COLORADO SPACE GRANT CONSORTIUM FEBRUARY 2017

COLORADO COMMUNICATOR

COSGC
COLORADO SPACE GRANT CONSORTIUM

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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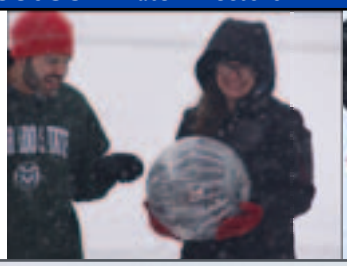
Robotics Challenge Turns 10!

Typically, snow melt runoff from the nearby Sangre de Cristo mountain range provides interesting obstacles for course set-up at the annual COSGC Colorado Robotics Challenge at the Great Sand Dunes National Park. This year, Mother Nature contributed to our 10th anniversary celebration with blowing snow (lots of it) and freezing temperatures. Nevertheless, students, faculty, and robots made a great showing at the event. Students went the extra mile - designing covers for their robots at the last minute to protect electronics from the added extreme temperature, wind, and precipitation challenges. Teams that could not make it as a result of the weather, were able to participate by submitting videos of their robots tackling sandy terrain. Here's to another 10 years and beyond!



COLORADO SPACE GRANT AFFILIATES

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Aims Community College (AiCC)
Lee McMains

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Brian Sanders

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University of Northern Colorado (UNC)
Matt Semak

Western State Colorado University (WSCU)
Suzanne Taylor

Director's Corner

Greetings from Boulder, Colorado. I am standing at my desk, yes I have a stand up desk, writing this potentially award winning Director's Corner. I just finished reading the latest Colorado Communicator – COSGC's most awesome newsletter – and was blown away.

I know I am bit biased but I think we have the best Space Grant program in the Solar System. I know there are 51 other Space Grant programs around the country that are also very good but I am going to be bold and claim the title and if anyone wants to dispute my claim, I ask them to kindly read the following 22 pages first. If that is not convincing enough, I will send you our 489 page expanded edition for further consideration.

Our students, and the affiliate directors, faculty, and community partners who mentor them are incredible. This newsletter provides a selected set of the stories from 2016 to highlight the impact COSGC has on the universe. Their stories and accomplishments inspire me.

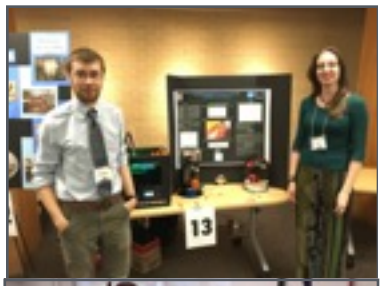
I want to take a moment to introduce our newest staff member – Liz Coelho. Many of you may have heard of Liz because she was our affiliate director at Pikes Peak Community College for the past 8 years. She is now COSGC's Academic Coordinator and we are all looking forward to her perspective and contributions. And while I'm at it, I want to give a shout out to Brian Sanders, COSGC's Deputy Director and Bernadette Garcia Galvez, our Associate Director (and creator of this newsletter). Without them none of what you read here would be possible and I am honored to work with them each day to make the world spaceier.

Well it's time to close this edition of the Director's Corner. You are likely too excited about reading the coming pages that you are struggling to maintain focus as you continue to read my excellent prose. Before you go, please know that I also appreciate you because if you are reading this, you are likely connected to our Colorado Space Grant family somehow. Whether as a former student or mentor or past/current contributor; you are either an outcome of and/or a believer in the program, or perhaps you're one of many professionals within the state, or around the country, who collaborate with us and/or take care of the administrative processes that keep our program strong…for all of you, I am grateful.

Onward…

The COSGC family at the 2016 Annual Meeting on the WSCU campus in Gunnison, CO

COSGC's annual Undergraduate Space Research Symposium was held April 23, 2016. 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 and Space Grant alumni.



Paper/Presentation Winners:

Grand Prize: High Elevation Light Intensity Observation System V (HELIOS V) - D.Beatty, H.Flaherty, R.Kloetzel, V.Nystrom

Session Winners:

R-Log: A Low-Cost Low-Power Solution for Data Logging on Payload Missions - R.Belter

Performing Material Science Research in Microgravity - K.Kates, T.Joy, A.Olson, A.Zimmerer

Design of an Extensible Telemetry and Command Architecture for Small Satellites - D.Beatty, B.Hogan, C.Maywood

Poster Winners:

3D Printed Polymers in Near Space Conditions - Melissa Breathwaite, Shelby Ryan

Mars Explorer (MrX) - Kelli Demny, Jiaxin Zhao, Nicholas Pepping, Igor Ryzhkov, Kevin Bennett

Robotics Challenge: Design and Fabrication - Cody Helms

Chris Koehler Receives NASA Achievement Medal

Colorado Space Grant Consortium Director, Chris Koehler, was awarded a NASA Exceptional Public Achievement Medal during the 2016 Agency Honor Awards in Washington, DC on September 14, 2016. At the ceremony, NASA presented the highest honors it bestows on its workforce with the intention of highlighting the distinguished contributions of the honorees. In addition to being honored personally for his efforts, Chris was also a member of the team that was honored with the Group Achievement Award for development of the RockOn and RockSat-X programs. In addition to Chris, the team included engineers at NASA's Wallops Flight Facility, Virginia Space Grant Director, Mary Sandy, and University of Colorado and COSGC alumni Riley Pack (LGS Innovations), Shawn Carroll (Digital Globe), David Ferguson (SpaceX), Eric Pahlke (First RF), and Lee Jasper (Jet Propulsion Laboratory). Featured right is Chris at the award ceremony pictured with Joyce Winterton, Senior Advisor for Education and Leadership Development at Wallops Flight Facility.

Sometimes all the necessary components come together just at the right time to enable something truly spectacular. Such is the story of the Community College of Colorado (CC of CO) sounding rocket project.

COSGC has been fortunate to connect with remarkable educators at Colorado community college institutions. Three such individuals lead the programs at Community College of Aurora (CCA - Victor Andersen), Arapahoe Community College (ACC - Jennifer Jones) , and Red Rocks Community College (RRCC - Barbra Sobhani) as Space Grant affiliate directors on their campuses. All three were facilitating multiple, robust student hands-on Space Grant projects on their campuses, when, in 2015, the opportunity to apply for additional Space Grant funds to establish new and/or expanded programs came about through the Community College and Technical College grant opportunity. In addition to providing supplemental funds for exceptional COSGC campuses, the award sponsored 13 COSGC community college students to attend the RockOn Workshop.

CC of CO students deliver the completed payload.

Students from each institution participated in the RockOn Workshop at NASA's Wallops Flight Facility, where they built, integrated, and launched simple payloads. At the workshop, they also attended the Launch Readiness Review of the RockSat-C payloads that were launching on the same rocket at their RockOn payloads. They were able to hear the experiences of students from around the country.

Once back in Colorado, the work began. A combined project between multiple COSGC campuses had not previously been attempted, so there was no foundation to help implement the project. Affiliate directors and supporting faculty at the institutions would be building the framework as the project progressed.

With many students from multiple institutions involved, it was challenging to choose just one experiment. The team decided to allow one experiment per institution, and so developed three separate experiments that flew in a single payload. The CC of CO payload explored: the viability of carbon fiber as radiation shielding, the structural integrity of multiple types of DNA

RockSat-C 2016 payloads integrated and ready for launch!

CC of CO students at the launch site at NASA's Wallops Flight Facility.

subjected to the extreme stresses of the rocket launch, and the viability of an inexpensive, custom-built RICH detector for use in particle astrophysics research observing. Students and faculty experienced the challenges of keeping up with the strict schedule of the RockSat-C program, while managing multiple subsystem teams comprised of students from three different campuses. Design, build, testing, and regular reviews with the RockSat-C manager challenged the students in ways they had not previously experienced. A team of students from each campus delivered the payload on-time and participated in final integration, testing and launch on June 23, 2016. Experiments worked as they had hoped, and the team submitted their final report outlining the results.

Launch of the 2016 RockOn! Workshop and RockSat-C Payloads.

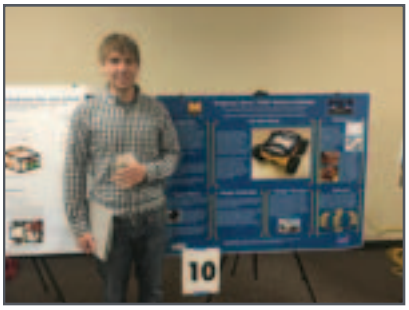
Jamie & Thomas at the APS Conference.

There were times during the project when both students and faculty alike wondered if their expectations had been unreasonable - if they had attempted too much. Many were convinced that there would definitely not be a repeat of the endeavor. However, after a serious debrief and review of outcomes of the project, affiliate directors on each campus have secured another round of supplemental grant funds to do CC of CO's 2nd payload - planning for launch in June 2018. The effort has created a framework and lessons learned for the entire COSGC program that will inform future, innovative collaborations between campuses. In addition, the experience has been shared at conferences by both faculty and students. Students, Jamie Principato (ACC) and Thomas Horning (CCA), were invited to present their work at the Joint Meeting of the Four Corners and Texas Sections of the American Physical Society in Las Cruces, NM. Their paper and presentation "Prototyping of a Durable and Inexpensive RICH Detector" was honored with "Best Student Talk" at the conference.

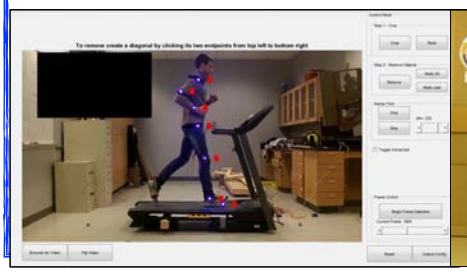
Western State Colorado University (WSCU) Space Grant continues to engage in astronomical observations - specifically focusing on light curves of exoplanets. This effort includes students working with faculty to troubleshoot and repair telescope issues. This was the first year, WSCU Space Grant facilitated a freshman orientation class focused on building high altitude balloon payloads. The result was 2 payloads that launched on the November DemoSat flight. WSCU Space Grant continues to facilitate a team for the Colorado Robotics Challenge. Their team braved the weather and made a great showing at the 10th annual Challenge.

Space Grant at University of Northern Colorado facilitates various student projects including autonomous robot projects, high altitude balloon payloads, and theoretical physics research. UNC DemoSat teams explored high altitude radiation effects on carbon nanotubes, DNA, and quantum dots; exploring radiation flux as a function of altitude; and testing of a communication system for a possible sounding rocket payload. The UNC robotics teams built a robot for the COSGC Robotics Challenge in addition to completing the development of various sensors for robotics applications and designing a quadcopter. Physics research included an examination of balance.

UNIVERSITY of NORTHERN COLORADO



University of Colorado at Colorado Springs (UCCS) Space Grant helped connect seven COSGC transfer students with faculty working on hands-on projects including development of a testbed for lithium ion battery controls research; development of a system to track joint locations for biomedical studies; data collection for a human movement study; research in the UCCS physics department; and effect of sunlight on human cells. UCCS Space Grant students made significant improvements to the motion capture system and completed work on a wheelchair stabilization system for a U.S. Paralympic athlete.



Trinidad State Junior College (TSJC) Space Grant continued to provide multiple STEM opportunities for both post-secondary, and concurrently enrolled high school students in the local community. The TSJC robotics team designed advanced autonomy capabilities in their Robotics Challenge submission called SABLE in order to satisfy an extended challenge at the 10-year anniversary event. Their success at this challenge encouraged the team to take on a more sophisticated robot design which they hope to eventually summit to NASA's RoboOps Challenge. TSJC Space Grant students participated in the RockOn Workshop at NASA's Wallops Space Flight Facility and launched a high altitude scientific payload with the summer 2016 COSGC DemoSat program. TSJC faculty and supporting staff and community members facilitated additional courses including 3D Printing and Design and Intro to Electronics. TSJC continues to enrich the partnership with Parallax Inc., which has provided software, electronics, and mentorship to student project teams. As a recruitment tool, TSJC Space Grant students developed a robotics float for a local community parade which brings visibility to TSJC, the Space Grant program, and the robotics projects.