Colorado Space Grant Students

WHAT THEY WERE UP TO DURING 2019 - 2020 ACADEMIC YEAR

NASA ALIGNED EARTH-BASED, SUB-ORBITAL, & ORBITAL PROJECTS/Missions

STEM COMPETITIONS AND RESEARCH

GLEE AND MUCH MORE

COLORADO COMMUNICATOR

Celebrating the collaborations that make student projects possible!

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.
Hi everyone and thank you for stopping by to catch up on all the goings on highlighted in COSGC’s annual newsletter.

I hope that as you begin to read this edition of the Colorado Communicator you are well. I truly mean that. The world has changed in so many ways since the beginning of this year that there is a good chance your wellness, safety, and/or health have been affected. In this moment then, I hope you are well.

This edition of the Colorado Communicator highlights projects that took place during our most recent “period of performance” - the majority of which took place prior to COVID (May 1, 2019 - April 30, 2020). Don’t let the group photos cause any “lack-of-physical-distancing” panic. At the latter end of spring 2020 semester, as campuses closed, projects that were at stages that could continue remotely took full advantage of technologies available to continue to work collaboratively, while others came to abrupt halts. COSGC students, faculty, and staff quickly adapted to changes in location, courses, projects, and life in general.

I know that many of our readers are not current students but likely were at one time - and maybe even a COSGC student. I try to imagine what the world must feel like to students today. Just being a college student provides many challenges, but the continual shift in how students today must learn has to be overwhelming. Even the views of their potential future must be constantly going in and out focus.

COSGC staff, along with our incredible Affiliate Directors at institutions across the state, are keeping that future in focus. We are adapting, innovating, and creating ways for our students to continue to have the unique, challenging, and life changing experiences typically found within our programs and projects. We will continue to equip each of our students with the skills they need to be successful and better humans as the world begins to open to a new normal. If you wish to help us in this mission, no matter how small your offer, we will gladly accept it.

I am in awe at what Colorado Space Grant students are accomplishing in this moment of great uncertainty. As you read the following pages of this Communicator, I hope you too will appreciate the work of our students and those who come together to support them in their endeavors, and find some comfort that our future will be better with students like these, supported by the community that has grown into the COSGC family, all working toward a better future.
Through this period of performance, over 600 Colorado students at 20 COSGC institutions across the state participated in 116 projects ranging from Earth based astronomical observatory and physics explorations to wearable tech, balloon payloads, sounding rocket experiments, orbiting spacecraft and even lunar-focused missions. All COSGC students are encouraged to participate in the annual Undergraduate Space Research Symposium by creating a research document to be reviewed by industry engineers and scientists - whether it be a paper or a poster or both. While students are completing their research and writing, industry and alumni partners join the event to read and score works, participate as a day-of judges to score presentations, ask lots of questions, interact with students live, and/or to support the event financially so that as many cash prizes as possible may be awarded to diligent COSGC students. As preparations were underway, the COVID shutdown happened. The response to changes to the Symposium was more alumni stepping up than ever before - until it was necessary to start turning folks away. For students overwhelmed with the abrupt ending of projects, focused on switching to remote learning for their classes, and dealing with suddenly finding themselves without child care or having to move out of campus/local housing, COSGC created an open video category, challenging students to present their research in video format of their choosing. COSGC staff focused on learning the Zoom platform and ensuring it could be used safely and securely. The end result was ~160 students, academic mentors, alumni & other industry partners, family members and peers logging in from around the country to watch students present their work in 8 concurrent sessions morning and afternoon, and to participate in an interview-style keynote with Anthony Colaprete - COSGC alumnus - now Planetary Scientist at NASA Ames Research Center. 2020 sponsors were Space Dynamics Laboratory, Red Canyon Engineering & Software, Amergint Technologies, Ball Aerospace, the CU Space Minor, CU’s College of Engineering and Applied Sciences, Urban Sky, and COSGC Alumni Christy Predaina, Bill Ireland, and Jason Baugher.

Pandemic + Symposium = Community Gathers

**Paper Winners:**

- **Grand Prize:** Constructing an Accessible Low-Budget Detection Biosensor, B. Loftness - CMU
- **Top in Paper Sessions:**
  - Joining Antarctica’s Next Generation of Explorers, S. Edwards - CU
  - Solar Balloon Payload, E. Hix, C. Street, K. Gerhard - TSJC
  - Muon Detector Onboard an Experimental Sounding Rocket - D. Lazcano, S. Ossareh, N. Kindred, C. Robinson - CSU

**Poster Winners:**

- **Grand Prize:** You Can’t Hit What You Can’t See: De-orbiting Small Scale Space Debris using Non-contact Methods, K. Cuyler - CSM
- **Top in Poster Sessions:**
  - Viability Testing for Serratia marcescens in Near Space, T. Lovett - RRCC
  - Double-Sided Linear Induction Propulsion and Passive Magnetic Suspension Optimization Using Finite Element Analysis, G. LaFlower, A. Hauser, A. Westbrook - UCCS
  - Affordable Application of Rocker-Bogie Suspension - M. Collard, I. Brooks, S. Rencher, M. Guerrero - CSU

**People’s Choice Videos:**

- High Score: Depth Perception Buddy, D. Bilbao, V. Montoya, M. Blake - CSU
- Franklin Robot, M. Marshall, A. Kiattanaphon - ACC
- Upside Down, B. White, C. Gonzalez, G. Running Wolf, W. el Halabi - CCA
- Non-invasive Cortisol Sensor, N. Alvarado, Z. Bloomfield, H. Blanchsky - CU
As the excitement of the 50th anniversary of Apollo began to spread in 2018, COSGC Director, Chris Koehler began to consider the possibility of going beyond talking about reminiscing about Apollo - focusing on what it would take to get students involved in a mission to the Moon, using the heritage of Apollo to activate students around the world. Chris began to think out-loud whenever possible - including voicing the challenge at national Space Grant meetings. New York Space Grant Director, Mason Peck, reached out to Chris to talk about a possible solution based on a technology called ChipSat. ChipSat is an idea developed by a team at Cornell, headed by then grad student Hunter Adams - a tiny spacecraft designed to drastically cut down the costs of spaceflight and exploration in Low Earth Orbit. Through these initial conversations the technology for the GLEE mission was born. In order to round-out the mission, Chris began recruiting partners within the National Space Grant College and Fellowship program. Conversations explored the possibilities for a worldwide mission that would engage thousands of students. Representatives from many Space Grant programs joined the discussion with Colorado and New York, including Georgia, Kentucky, Louisiana, Maryland, Minnesota, Nebraska, Nevada, North Carolina, North Dakota, and South Carolina.

Chris recruited a team of students at the University of Colorado Boulder to begin developing the ChipSat approach for a Moon mission - the result of which is called LunaSat. Similar to ChipSats, LunaSats are designed to include solar cells for power and will include a microcontroller, radio, and a standard suite of sensors. GLEE is a mission to the surface of the Moon that will conduct science and test technology with hundreds of LunaSats built by students from UN countries around the world.

As the ideas began to take shape the CU GLEE team was selected for funding through NASA Office of STEM Engagement’s Artemis Student Challenge Opportunity. This funding supports the final stages of LunaSat development and the creation of curriculum modules that will teach the skills necessary participate in GLEE. In addition to the LunaSat team, students are working on on a goal of 2023 to deliver 500 LunaSats, built by students, to the surface of the Moon to conduct multiple distributed science and technology missions, while engaging the world’s next generation of space explorers. GLEE began with significant
collaborations. Strong connections have been made with NASA Mission Directorates, Industry and Alumni partners and more are needed to see the mission through. The team continues to raise funds and connect with partners - understanding that only through continuing to build partnerships will the GLEE mission reach the Moon. More information about GLEE may be found at GLEE2023.org. If you’re interested in collaborating, contact bgarcia@colorado.edu.

The statewide nature of COSGC enables partnerships on affiliate campuses and between Colorado institutions of higher education. COSGC student projects would not be possible without talented and committed faculty at every institution fulfilling the roles of affiliate directors, mentors, & advisors.

When COSGC began to explore a new wearable technology statewide design challenge program, faculty and staff at Colorado Mesa University, Pueblo Community College, and University of Colorado Boulder worked together to design a how-to workshop and develop standard challenge details. As biological experiments became more popular for DemoSat flights, Red Rocks Community College (RRCC) microbiology faculty designed a how-to workshop about developing robust biological experiments and how to safely fly samples in a high altitude balloon payload. Each year faculty, staff, and students from all COSGC institutions come together for an annual meeting where we share successes and lessons learned and discuss ways to improve student engagement and outcomes and new strategies for inclusive student recruitment to create a population that reflects our society - both in demographics and discipline in order to continue to facilitate innovative projects.

The statewide nature of COSGC also enables students to stay connected with hands-on projects as they transfer from 2-year to 4-year degree programs at Colorado institutions of higher education. This year, Brianne Treffner (Bri), was able to continue to explore her interest in orbital debris mitigation - an interest that began as a student at RRCC when she participated in the CC of CO sounding rocket mission. As she began the task of transferring to Colorado School of Mines, Bri connected with affiliate director, Angel Abbud-Madrid and proposed a sounding rocket payload that would engage CSM students - thus CSM’s first student sounding rocket payload mission was born. COSGC’s Statewide Design Challenge programs - high altitude balloon payloads, autonomous robotics, wearable technology - continue to be vibrant programs because of the participation of students teams across the state, supported by faculty and campus resources. Affiliate directors recruit and mentor students teams who then participate in required project reviews and ultimately launches (DemoSat) and/or demonstration events (Colorado Robotics Challenge/Wearables Quest).
COSGC’s unique member, the Space Foundation, engages with pre- and in-service teachers, providing professional development to develop educators able to integrate space into all aspects of teaching at the K-12 level. The Space Foundation also supports COSGC student projects by providing access to the Mars Yard at the Discovery Center, which has been used by COSGC teams developing autonomous robots, as a practice yard where teams troubleshoot their systems and prepare their creations to participate in the annual Colorado Robotics Challenge.

**Part of a National Network**

The COSGC program continues to benefit from connections to Space Grant programs across the country. From creating the foundation for a Lunar mission with NYSGC (page 3), to collaborating with SG programs to build high altitude balloon launch capabilities and programs, to the Nationwide Eclipse program facilitated by Montana Space Grant program - COSGC benefits from being part of the national Space Grant network in many ways. Several COSGC institutions (CCA, FLC, UNC, & CU) have taken part in Louisiana Space Grant’s HASP (High Altitude Space Platform) program. The HASP program provides a free flight on a zero pressure balloon that stays afloat for 8 - 20 hours at ~120,000ft. Students must successfully be selected through a proposal process. Once selected, they then have regular interaction with HASP engineers and even participate in payload integration and testing at the NASA Columbia Scientific Balloon Facility in Palestine, TX. Many COSGC teams have traveled to Ft. Sumner New Mexico to take part in launch and operations.

A similar program that has engaged COSGC students is the First Nations Launch (FNL) Competition facilitated by Wisconsin Space Grant. FNL offers Tribal Colleges and Universities, in addition to American Indian Science and Engineering Society (AISES) chapter students, the opportunity to demonstrate engineering and design skills through direct application in high-powered rocketry. The AISES programs at Fort Lewis College and Colorado School of Mines have been able to connect with FNL and students have completed in the competition since 2015.

This year, COSGC faculty and students participated in the National Space Grant College and Fellowship Program’s (NSGCFP) 30th anniversary celebration held in the Washington, D.C. RRCC and ACC students from the CC of CO sounding rocket payload traveled with COSGC Director, Chris Koehler, and RRCC Affiliate Director, Barbra Sobhani. They presented their project, traveled to NASA HQ, and met the NASA Administrator. As an organization within NASA’s Office of STEM Engagement (OSTEM), Space Grant is in great company with the Minority University Research and Education Program (MUREP) & NextGen STEM. This year COSGC benefitted from the opportunity to engage with people representing programs throughout OSTEM at the MEGA PI Meeting attended by COSGC Deputy Director Bernadette Garcia Galvez in August 2019 - engaging in important conversations and a tour of Glen Research Center.
Many who come through the COSGC program as they are earning degrees continue to be active in the COSGC community as Alumni in various significant ways. As the PolarCube CubeSat mission moves ever closer to launch, the team continues to communicate with past PolarCube students who have continued as advisors and former students continue to support testing efforts. Over the past year Alumni have provided mentorship to student projects at many affiliate institutions - participating in project/mission reviews and suggesting project experiments. An incredible number of alumni came forward to support this year’s Symposium - several of who do so each year, as they commit to read and scoring papers and posters, donating funds to support session prizes, and/or even spending a whole day at the event (See the article on page 3 for full details). Alumni also serve on the COSGC advisory board. COSGC Alumna, Christy Predaina, has done all of the aforementioned activities, in addition to joining the COSGC contingent in Washington D.C. each year to talk about her COSGC experience with Colorado representatives on The Hill. In many cases, COSGC alumni are important connections to industry partnerships.

**Industry Partners**

COSGC continues to benefit from a robust aerospace economy in the state. Industry partners enable COSGC to facilitate authentic hands-on projects by providing project suggestions, hardware donations, and financial support. Collaborations are mutually beneficial as industry partners engage students in research and development efforts and are able to recruit students after graduation. Highlights from the past year include: mentors for student projects from TransAstra Corp, Lockheed Martin, Roccor, Ball Aerospace; hardware donations from Urban Sky, Advanced Electronics, uAvionix, and Tacuna Systems.

**Alumni, Industry, and Government Labs**

- **Jared Leidich** (Urban Sky) suggested a project experiment, served as mentor and donated hardware and funds to support student effort exploring reusable high altitude balloons.
- **Alex St. Clair** (LASP) suggested a project experiment and serves as team mentor/advisor for said project.
- **Jessica (JB) Young** (Lockheed Martin) was guest lecturer in the Gateway to Space and Pathway to Space classes.
- **Chris Baugher** sponsored Symposium Sessions.
- Many alumni at Ball Aerospace have set up monthly donations through the company that support COSGC student projects.
- **Lee Jasper** (SDL), **Glenda Alvarenga** (Ball), **Christy Predaina** (Northrup Grumman), & **Leina Hutchinson** (JPL) serve on the COSGC Advisory Board.
- **Anthony Colaprete** (NASA Ames) provided the Keynote speech at the 2020 COSGC Symposium and serves on the GLEE Science Advisory Board.
- **David Ferguson** (SpaceX) gave a talk to COSGC students and was a special guest in the Pathway to Space class.
- **John Mark Reade** connected with NASA JSC to develop a student project based on his internship.
- **Kamron Medina** (Roccor), provided an experiment idea for a sounding rocket payload, and recruited mentors and advisors for the project, including **Bruce Davis**, and funds to support students and launch fees.
- **Wesley Perkins**, continues to provide IT support at the Lead Institution and helps with hands-on workshops.

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Chris Koehler and Christy Predaina visiting sharing COSGC accomplishments in D.C.
MAXAR/Digital Globe continues to place student interns that support their satellite calibration efforts in northern Colorado. One of COSGC’s newest orbital missions resulted from a collaboration with Southwest Research Institute (SwRI). CU Space Grant signed on as the student “outreach” payload on the major PUNCH (Polarimeter to Unify the Corona and Heliosphere) mission, funded through NASA’s Science Mission Directorate. The PUNCH mission focuses directly on the Sun’s outer atmosphere and how it generates solar wind. COSGC’s student payload, STEAM (Student Thermal Energetic Activity Module), will fly on one of the four PUNCH spacecraft and will search for nano flare signatures and solar wind using x-ray spectrometers. The PUNCH/STEAM team is currently in Phase B of the mission. Students have participated in system requirement and

A Beautiful Friendship

In 2009 a newly minted robotics program at Trinidad State Junior College (TSJC) led by Cindy Clements (TSJC Affiliate Director, MS CalPoly & OSU) contacted Parallax for tech support. Cindy had provided Parallax hardware to the student team for their inaugural robot. What began as questions about using BASIC Stamp led to questions about Parallax educational materials and the SPIN programming language. Cindy’s questions were forwarded to Andy Lindsay, Parallax author and teacher educator. Andy informed her that Parallax was introducing a new language called PropC and inquired about whether Cindy and her students would be open to beta testing educational materials and hardware. Recognizing a perfect opportunity to challenge her students and build upon the collaboration with Parallax, Cindy agreed. Since the initial connection, Cindy and her students have had the opportunity to work with other Parallax professionals and various hardware and software tools. Parallax has provided quad rovers to use in STEM community activities and advises on teaching materials for a TSJC PropC course - paying close attention to State of Colorado requirements. TSJC students beta test materials and software; including, Hayden Alworth (TSJC alumnus) who submitted issues he discovered in some of the math libraries. Andy has signed on to be an electrical engineering advisor as TSJC Space Grant develops a wearable technology program. Cindy has reciprocated by providing feedback on education materials and participating in conversations about how to effectively use Parallax products in the college classroom. As Parallax is headquartered in California, the collaboration continues to grow through phone & video chats and Google hangouts.
preliminary design reviews with the PUNCH team including engineers from SwRI, NASA, U.S. Naval Research Laboratory and RAL Space.

**Government Lab & Federal Partnerships**

Perhaps the longest lasting partnership with a federal agency (aside from NASA - see page 11) is COSGC’s continuing collaboration with the Great Sand Dunes National Park. Since 2007, the Sand Dunes has been the location for the annual Colorado Robotics Challenge. Working closely with Park rangers, COSGC is able to facilitate this popular event every year.

Student projects have been further enabled by partnerships with various government labs. Adams State University connected with an Army Research office program and to facilitate an AI summer student internship. The National Snow and Ice Data Center has provided mentors and project ideas for both orbiting satellites and Earth-bound projects. This year, students completed the JANE (Joining Antarctic’s Next generations of Engineers) project with mentor, Ted Scambos. The team worked to design various hardware and software applications as part of the AMIGOS research effort. Their designs were incorporated into the stations now currently functioning in the Antarctic.

**In the Local Community & On Campus**

COSGC projects and programs directly engage with community surrounding COSGC campuses in ways that benefit students and the communities in which they live. In Gunnison and Durango, faculty and students are able to use community observatories and learn about the inner workings of telescopes and observatory upkeep by providing “hands on the ground” to help keep observatories running. Students and faculty then have access to telescopes for astronomical observing projects. When raising funds to support student travel for the CC of CO sounding rocket mission, students at CC of Aurora, Red Rocks CC, and Arapahoe CC were able to count on the local Mercury Cafe to host a fund raiser. Colorado Mesa University students continue to create content for the Eureka! Math/Science Center and engage with younger students at the campus Math Extravaganza.

Maker spaces have proven to be ideal venues for creating mutually beneficial connections between students and community resources. Front Range Community College has benefitted from connections with the Longmont Maker Space, Colorado Mesa University with the CMU Maverick Innovation Center and GJ Makerspace, and Adams State University Space Grant oversees the San Luis Valley (SLV) STEAMshop - giving students access to machining equipment and lab space and avid tinkers in the community who can be valuable advisors/
mentors. Students give back to the community by being volunteers or paid employees in the maker spaces - using the skills built in COSGC projects to mentor teams of younger students and community members themselves engaged in STEM projects.

Often, COSGC projects connect with community resources in that area able to provide ideas for projects, hardware, experts, or even funding to support student endeavors. Several COSGC institutions have found connections with local companies that provide project ideas, hardware, and advisors. Aims Community College & Pueblo Community College have both recently made such connections (with Blue Bird Botanicals and DiTomaso Farms respectively) that have enabled Earth-bound Mars agriculture project & a high altitude balloon payload projects.

Engaging with the community has proven to be a good way to connect with younger students and persuade them to consider smaller, local schools as option for either concurrent enrollment as junior and senior high school students and/or as the place to earn a bachelor’s degree. Trinidad State Junior College has found a unique opportunity for students to demonstrate their robotic abilities and past robots during the town’s Artocade (parade) and seasonal Farmer’s Markets. Programs at all COSGC campuses host tours and various hands-on activities as a way to continue to recruit students.

EOSS - An Integral Part of the Family

COSGC's high altitude balloon payload program is made possible by a collaboration with 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 and has been providing high altitudes balloon launches carrying COSGC student payloads for almost 20 years.

COSGC Director, Chris Koehler, began his collaboration with EOSS in 1996, while an engineer at Lockheed Martin. Chris facilitated a high school outreach program and asked EOSS if they could provide regular launches to carry student payloads. Four years later, as Chris returned to COSGC as Deputy Director, he brought the collaboration and a standardized educational payload approach to Space Grant. Since then, the EOSS/COSGC partnership has flown 163 balloons carrying 1,104 payloads designed and built by nearly 5,000 students representing ALL COSGC institutions of higher education. In addition to payloads built as part of the statewide DemoSat program, the collaboration has enabled COSGC to facilitate a 6-year national balloon payload workshop, Gateway to Space and other COSGC classes, summer high school programs through Upward Bound and the Precollegiate Development Program, expand the COSGC membership by providing standardized student projects easily integrated on new post-secondary campuses, a sub-orbital platform to test systems for orbiting spacecraft and other sub-orbital opportunities, senior design projects, collaboration with the Air Force Research Lab’s University Nanosat Program and participation in the 2017 National Total Solar Eclipse efforts led by Montana Space Grant. The partnership even results in student projects. A team has been working with EOSS to integrate ADS-B technology into all EOSS flights. EOSS had provided mentors and flight opportunities to the effort.

(left) Chris and EOSS members checking out the antenna on the DLC roof; (center) COSGC student works with EOSS mentor; (right) CCD student payload captured VR footage during flight
into their programs. Participants include community members and prospective and current students on campuses.

COSGC’s presence at institutions of higher education provide ideal foundation for building real-world projects, as every COSGC institution has a talented and committed faculty members fulfilling the role of Associate Director - managing the NASA award and facilitating students projects. Projects would not be possible without supporting faculty members stepping up as mentors or advisors. COSGC students also have access to lab resources on their campuses. Space Grant programs are able to connect with on-campus resources to recruit students and to help support and retain students at they complete classes, while engaging in projects that provide opportunities to apply their coursework in NASA-aligned applications - such as TRIO, Veterans Services, Tutoring Services. Connections with STEM Centers and various student clubs and societies including: Robotics Clubs, Science Clubs, Students for the Exploration and Development of Space (SEDS), American Indian Science and Engineering Society (AISE), Society of Women Engineers (SWE), National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers/Latinos in Engineering and Science (SHPE/MAES), enables COSGC programs to recruit talented students, while providing content for students in the form of workshops and projects.

In addition to facilitating student-led projects, faculty also engage students in projects courses and theoretical physics, graduate level and/or faculty led research projects. Various courses including intro engineering projects (CU, CSM), experimental design (CCA, CCD, TSJC), advanced manufacturing (Aims, CMU), robotics (CCA, TSJC, CCD, UNC), and first-year experience seminars (CMU, WCU) - that focus on balloon payloads, wearables technology or robotics. Pathway to Space is a new class as part of a collaboration with the Space Minor, that explores space applications in a wide range of disciplines. Other student-led projects are like those at the University of Northern Colorado encouraging students to explore “problems” through theoretical physics projects. COSGC students also engage in faculty-led projects like this years Aegis Space Suit Simulator project partnering with Dr. Allie Anderson at CU and various research projects at University of Colorado Colorado Springs.

**NASA Connections, Opportunities, and Competitions**

Collaborations with people at NASA Centers continue to enable unique, real-world student projects in Colorado and across the country. COSGC’s partnership with NASA’s Wallops Flight Facility is entering its 14th year. What began as a national “How-to” workshop to teach basic skills and resources to establish sounding rocket payload programs has grown to an annual workshop and two annual launch opportunity programs - RockSat-C and RockSat-X. In 2018, the RockSat approach was used for a collaboration with Andøya Space Center that engaged student teams from the U.S., Japan, and Norway. This period of performance, in addition to the launch of the 2nd CC of CO (Community Colleges of Colorado) payloads, the collaboration resulted in a new project for the CC of CO combined sounding 2019-2020 rocket payload team (Arapahoe CC and Red Rocks CC). The 360 VR project is a direct response to a “problem” suggested by Goddard Space Flight Center (GSFC) in 2018. Engineers indicated that they wanted a virtual reality experience focus on the sounding rocket experience. At the time GSFC representatives approached WFF engineers, who explored the request. It was determined that such a small-scale project provided challenges to a professional engineering team supporting WFF missions and activities. WFF engineers approached RockSat-X program leaders - including WFF

*The RockOn Workshop support team heading to NASA Wallops*
engineers and COSGC Director, Chris Koehler. It was determined that the suggested “problem” was ideal for a student sounding rocket project - as the flexibility of student schedules makes it possible to complete the design process quicker and at a lower cost, while providing the opportunity for students to participate in an authentic suborbital mission. Two additional COSGC teams facilitated RockSat-X sounding rocket payload projects at Colorado School of Mines (CSM) and University of Colorado Boulder (CU).

Student, Christina Bariga, at University of Colorado at Colorado Springs, completed a research project based on a NASA Marshall mission concept with tethered Cubesats in orbit around the moon. NASA sponsored competitions continue to be an ideal way for COSGC students to engage in authentic hands-on projects and engage with NASA programs and people.

This period of performance, students at Colorado State University - Pueblo competed in Micro-G NEXT. Colorado School of Mines students participated in several NASA Competitions including two RASC-AL (Revolutionary AeroSpace Concepts-Academic Linage) in two sections: Low Lunar Orbit Reusable Transportation and Lunar and Martian Water Excavation; the NASA Robotic Mining Competition; and the NASA BIG Idea Challenge. For the NASA BIG Idea Challenge, the CSM team was one of 8 teams selected for the 2020 Challenge which focused on NASA Artemis priorities. Students were given challenges to develop a sample lunar payload that can demonstrate systems for exploration, reconnaissance, and science; resource prospecting and extraction; or enabling human safety, productivity, and navigation in the Permanently Shadowed Regions in or near a lunar polar region. The CSM team received funds to complete Phase I work and was selected to continue into Phase II which included an additional award.

Other industry and academic competitions provide opportunities for students to engaged in real-world, innovative design projects. University of Colorado at Colorado Springs sponsored a students team to participate in the SpaceX Hyperloop competition and at Colorado State University, students compete in the Intercollegiate Rocket Engineering Competition.

NASA Community College Aerospace Scholars (NCAS)

Students from all 10 COSGC community college affiliate institutions have participated in the NCAS program. During the program, students compete to become a NASA Community College Aerospace Scholar by completing STEM-based activities online to become eligible to visit a NASA Center for a four-day onsite experience. COSGC students have traveled to various NASA Centers and in some cases connected with summer internships. The program has been incredible for COSGC students. More information is available at the NCAS website: nasaostem.okstate.edu
May 2019 - April 2020, COSGC engaged over 600 Colorado students in space hardware missions, classes, and research projects. Introducing them all to our readers would take a newsletter all its own. Instead, we present a sample of the high caliber of students who are a part of the Colorado Space Grant family, the projects they are working on, and their plans for the future.

**Crystal Gonzalez** is studying general science at Community College of Aurora (CCA) through the pre-engineering program. At CCA, Crystal is part of a wearable technology team designing a glove that could be used in both space and Earth-based emergency management applications. She is a first-generation student, the president of the Latinx Student Alliance, a member of the Student Government Association, and a member of the State of Colorado Student Advisory Council. Crystal is an LSAMP Scholar, S-STEM Scholar and a member of the CCA TRIO program. She has received Outstanding Student recognition by the Colorado Community College System. After finishing her degree at CCA, Crystal plans to transfer to a 4-year institution to pursue a bachelor's degree in engineering.

**Mathew Martinez** is a student at Arapahoe Community College (ACC) focusing on general computer networking. For two years, Matthew was on the ACC Wearable Technology team - this year focusing on a touch sensitive communication glove. After completing his degree at ACC, Matthew plans to transfer to University of Colorado at Boulder (CU) to student Climate Modeling in addition to completing a Technology Certificate at ACC.

**Heather Monteson** is working toward an Associate of Science degree at Front Range Community College (FRCC). She is working on the Front Range Robotics Team and hopes to continue working on Space Grant projects while finishing her degree. Heather plans to transfer to CU to pursue a bachelor's degree in electrical engineering. Ultimately, she is considering graduate school and is interested in exploring sustainable power sources.

**Aidan Westbrook** is a second-year business student at University of Colorado at Colorado Springs (UCCS) focusing on accounting and economics. He is the president of the UCCS Hyperloop Pod Competition team, participating in the annual SpaceX competition - handling operations and logistics and working closely with the team's technical director. Upon graduation, Aidan plans to focus on the creation of STEM focused ventures. He has already co-founded a tech startup.

**Brynn Loftness** is a junior computer science student at Colorado Mesa University (CMU). She is working on developing a low-cost stress-detection biosensor. Her research paper on the project won Grand Prize honors at the annual COSGC Undergraduate Space Research Symposium (see page 3). Brynn has been working on the project during her three years at CMU and is continuing to modify and improve the design each semester. After she finishes her undergraduate degree, she plans to apply to a doctoral program to continue her research within the biomedical/computer science/artificial intelligence fields.

**Kaleb Vierra** is a senior at Western Colorado University majoring in math and computer science with a minor in physics. He has been part of an autonomous rover project for three year - most recently serving as the project manager. Upon finishing his undergraduate degree, Kaleb plans to work in the computer science field.
Kaitlyn Raub is a senior at University of Northern Colorado (UNC) completing a bachelor’s of science in physics with an astronomy concentration. As a Space Grant student, she has been working on modeling images obtained from the Hubble Space Telescope of 22 nearby quasars and galaxies in their immediate neighborhood using GALFIT software. Upon graduation, Kaitlyn hopes to enter the workforce at either a large observatory or in the aerospace industry.

Wassim Halaby graduated from CCA in May 2020 with an associates of science degree with a physics concentration. While at CCA, Wassim was on a team that developed, and built an autonomous robot as part of the Robotics Design course at CCA which was demonstrated at the Colorado Robotics Challenge. Most recently, he was part of a wearable technology team and focused on hardware build, test, and integration. Wassim plans to transfer to a 4-year institutions to earn a bachelor’s degree in electrical engineering, ultimately either moving on to a graduate degree or into the aerospace or aviation industry.

Gina Stainer is a second-year aerospace engineering student at CU. Gina began her tenure with CU Space Grant as a first-year student in the Gateway to Space projects course where she was on a team that built and flew a high altitude balloon payload. Gina joined the team of helpers that assist with the facilitation of the national RockOn! workshop at Wallops Flight Facility. Gina was recruited as the project manager for a team creating an ADS-B payload to demonstrate the technology as an integrated part of COSGC (and statewide) high altitude balloon flights. Around the same time, she accepted a position to shadow the project manager of the RockSat-C program. Gina is now the RockSat-C project manager. She plans to participating in the CU BS/MS program and graduate with a masters degree in astrodynamics. Gina ultimately wants to work in a fighter jet program like Lockheed Martin’s Skunk Works.

Daedalus Muse is a mechanical engineering junior at the University of Colorado at Boulder (CU) minoring in business. Daedalus started working at CU Space Grant as part of the Aegis Planetary Spacesuit as both systems engineer and a member of the helmet sub-team, helping design and manufacture the helmet, ventilation, and communications systems of the suit. He is currently a working on the Spacecraft team of the Great Lunar Expedition for Everyone (GLEE) mission. After completing his degree, Daedalus plans to work in the aerospace industry.

Brianne Treffner is a senior in engineering physics at Colorado School of Mines (CSM). She became part of the COSGC program initially participating in multiple balloon payload projects at Arapahoe Community College and then as a student at Red Rocks Community College on the combined CC of CO sounding rocket mission. Upon transferring to CSM, Brianne established a sounding rocket project to continue the research she started on CCoFCO by connecting to the CSM Space Grant program. She is the president of the AIAA CSM chapter and helped establish a chapter of the Women of Aeronautics and Astronautics (WoAA) on the CSM campus. Brianne is a peer educator at CSM, received the Astronaut Scholarship, and studied heliophysics at an REU that was a collaboration between NASA Marshall and the University of Alabama Huntsville. Brianne plans to earn a masters in mechanical engineering at CSM. She then plans to pursue an internship prior to entering a doctoral program in aerospace engineering.

Nathaniel Todd is an engineering senior at Fort Lewis College. He has participated in the FLC Space Grant program on several projects including both short- and long-duration high altitude balloon payloads. Most recently, Todd is working on the autonomous rover team. Todd plans to serve in the military before pursuing a degree in aeronautical engineering.
Natalie Alvarado is a sophomore studying environmental engineering at CU. Natalie’s first Space Grant team project was a wearable technology project developing a low-cost non-invasive cortisol sensor. She took on the role of project manager and led the team to a top prize in both paper and video categories at the annual COSGC Symposium (page 3). Natalie accepted a position on the GLEE mission, where she works on the communication and outreach team. After finishing her degree, Natalie would like to be an environmental engineer working on space applications.

Affiliate Director Highlight

Angel Abbud-Madrid is a professor at Colorado School of Mines. He earned a BSE in mechanical and electrical engineering from the Instituto Tecnológico y de Estudios Superiores de Monterrey, Monterrey, Mexico; an MSE in mechanical and aerospace engineering from Princeton University, & a PhD in mechanical engineering from CU. He is currently the Director of the Center for Space Resources at the Colorado School of Mines, where he leads a research program focused on the human and robotic exploration of space and the utilization of its resources. He also serves as the Director of the Space Resources Graduate Program, aimed at educating scientists, engineers, economists, entrepreneurs, and policy makers in the field of extraterrestrial resources. He has more than 30 years of experience conducting experiences in NASA’s low-gravity facilities such as drop-towers, parabolic-flight aircraft, the Space Shuttle, and the International Space Station. Angel has received the NASA Astronauts’ Personal Achievement Award for his contributions to the success of human space flight. He is currently the President of the Space Resources Roundtable and Observer and Technical Panel member of The Hague International Space Resources Governance Working Group. At the undergraduate level, Angel is the Director of the Space and Planetary Science and Engineering Area of Special Interests and faculty advisor of the CSM AIAA student chapter, Astronomy Club, and Rocket Club. When not dreaming about space, Angel enjoys music, photography, and getting lost in history books.

COSGC Alumni - Where Are They Now?!

Tanya Hardon is a Systems Engineer at Northrop Grumman and an alumna of the COSGC program at the University of Colorado at Boulder (CU) where she earned a BS in aerospace engineering.

Tanya learned about the Space Grant program as a first-year student during an open-house event. She applied for a position and became a member of the DANDE satellite mission team. She began as a volunteer, supporting mission operations prep and worked her way into a paid position as Co-Project Manager during operations. As she completed her degree, Tanya went on to work on the PolarCube mission - working on Attitude and Control System and supporting other project tasks.

She is now working on the James Webb Space Telescope. Tanya focuses on requirement verification for the spacecraft. “My path to Northrop Grumman (NG) was heavily influenced by Space Grant. I learned about
NG and had my first interview with them while attending a Small Satellite Conference as part of the Space Grant participating team. Tanya has since also earned an MS in Astronautical Engineering from University of Southern California. “Space Grant was a large contributor to my education experience. I learned so much about the challenges of turning ideas into practical solutions and how important it is to document EVERYTHING. The hands-on experience was unlike anything I was able to do as an undergrad. I still work with peers who have not touched flight hardware or seen a launch after being in the industry for years! Aside from learning technical skills, Space Grant helped me hone my “soft-skills” by having providing opportunities to present and speak to folks in industry.”

You know how Space Grant projects benefitted your education and early career experiences. You can help make today’s Space Grant opportunities a reality. Every monetary gift, no matter the amount, directly effect students by supporting student stipends, hardware, travel, or project supplies. Most gift are tax deductable and you can leverage your gift through matching donations from your employer.

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