



*Dream Chaser prior to shipment in the Sierra Space manufacturing facility in Louisville, CO; Photo Credit: Dustin Koehler/Sierra Space*

## From LEGO® Bricks to the Dream Chaser: An Early Career Engineer's NewSpace Journey

*Grace Robertson, ECLS Flight Control, Sierra Space*

The first research paper I ever wrote was on the solar system in the fifth grade. We were given free rein to choose whatever topic we were pleased to write about, and my curiosities led me to our planetary system. This example of my ten-year-old self is one of the earliest I can think of that specifically highlights my interest in space, though my scientific curiosities were prevalent long before then. For as long as I can remember, I loved tinkering with LEGO® bricks more than any other toy, indicating a strong engineering aptitude from a young age. Ironically enough, I have a collection of space-themed LEGO® models on my desk even today.

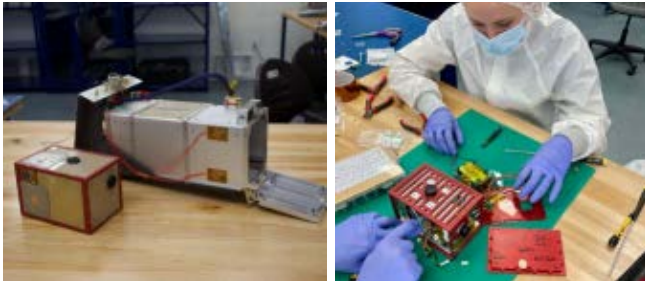
These curiosities and aptitudes would not have manifested into much if it were not for key people in my life who molded my interests into passions and later skills. From the second grade on, I was pulled into advanced science and math courses, which challenged me enough to keep me intrigued and always asking more questions. Outside of school, my father took the brunt of those curiosity-based questions as I constantly asked, "How does that work?" about nearly everything around us. Once I got to high school, my tenth-grade chemistry teacher assigned our class a one-page report on a university that offered a degree program potentially leading to a career of interest to me. I have that teacher, Mr. Holmes, to thank for setting

me up for one of the most important decisions of my life. It was due to that one-page assignment that I found my undergraduate program at Embry-Riddle Aeronautical University (ERAU) in Daytona Beach, Florida. From that point on, I knew that my future lay within ERAU, and I was set on doing anything in my power to make sure I ended up there.

For the rest of high school, I spent every day working to make sure I would go to Embry-Riddle, and working even harder to earn the academic scholarship I knew I needed to be able to attend. Most days I found myself falling asleep on textbooks in the late hours of the night, even after sports practices and music rehearsals. A visit to the ERAU campus my junior year further solidified that I had found not only my academic future at Embry-Riddle, but also my home. I was the first in my family to go away to college, and I knew I was taking a leap of faith in doing so. This is a key point in which trusting my gut instinct led me deeply in the right direction.

That leap of faith led me to the best, and toughest, four years in academia that I could have ever imagined. It took me a while to recalibrate my compass to know where I was headed next. As a freshman, I started investigating solutions to remove microplastic from beach sand. Living at the beach at the time and still having that scientific

curiosity I had since childhood, I saw a problem very close to home and naturally wanted to do something to solve it. We worked on that project through the end of its prototype phase, at which time I pivoted to work in the Space Technologies Laboratory with Dr. Troy Henderson. For two years, and more hours and sleepless nights than I can count, I worked with my team on the development, assembly, and test of the EagleCam CubeSat that will be flying on Intuitive Machine's first lunar lander mission, IM-1.



*EagleCam complete in the Space Technologies Laboratory prior to mission integration with Intuitive Machines; Photo Credit: Daniel Posada/ERAU, right photo - EagleCam electrodynamic dust shield camera integration; Photo Credit: Daniel Posada/ERAU*

Working on EagleCam was one of the first opportunities I had to really hone my engineering skills with spaceflight hardware. What you learn in a classroom is valuable as a foundation, but no beautiful architecture is ever complete just at the foundation. Working on EagleCam as a test engineer and interning on aircraft flight test programs provided me with the deep hands-on experience I needed to not only keep that childhood curiosity alive but also drive me to the next steps in my career. Climbing those next steps came through both engineering experience and philanthropic efforts.

My main volunteer effort grew out of the pandemic era, when I knew I wanted to do something that had a direct impact on the community around me. Together with Dr. Geoffrey Kain, I formed a relationship between ERAU and a local community center, Derbyshire Place. It was at this community center that we spent hundreds of hours volunteering with a group of ERAU Honors Program students to grow and distribute food to the local community. This community was in dire need, living in mostly subsidized housing and lacking affordable fresh food. The Derbyshire Place Community Garden has become an oasis in the desert, distributing thousands of pounds of food since the volunteer partnership was formed. Leading this effort as the volunteer director taught me not only the true value of community but sparked my graduate thesis idea and my wonder for what plants could provide for us as part of a spacecraft life support system.

The combined output of my work on EagleCam, internships in flight test engineering, and volunteer work at Derbyshire allowed me to earn the Astronaut Scholarship. I had no idea how much my life would change as a result of that one-page paper in my sophomore year of high school and

a scholarship from the Astronaut Scholarship Foundation (ASF). When I was awarded the 2021 ASF scholarship, it was the first time any ERAU student had received the award. The selection process is rigorous and dives into who a student is holistically, especially with their community contributions. Becoming an Astronaut Scholar opened a world of opportunities for me that I didn't even know existed.

In my award year, I was handed my certificate by former NASA astronaut Curt Brown while surrounded by some of the greatest names in spaceflight history. The award was presented in front of my university community months later, and I shared the three things I wish I knew most going into my undergraduate program: learn fast, love hard, and laugh often. Learning fast is key to picking up the concepts you need to succeed and superimposing them to develop unique solutions. Many folks say you need to love what you do because if you aren't happy doing it, then you won't be able to do your best. Laughing often keeps your perspective in check. We're all just doing our best with what we're given, and sometimes a real laugh is all you need to reset at a hard time. At the end of it all, the hard thing you're going through right now only seems hard because it's new, until you reach the next hardest thing.

Chasing hard problems seems to be the way of the engineer, especially in the space industry. Chasing that next hard problem can sometimes be the problem itself, because deciding the next steps in your path means embracing uncertainty. This can seem so counterintuitive, yet it is vital for making goal-oriented moves. Finishing my undergraduate program and wrapping up work on EagleCam presented me with another array of opportunities. My dream had long been to become a flight controller, to be in mission control as a spacecraft operator. I was further nudged towards this field by the ASF community, which included many historic greats from NASA Mission Control. I had the opportunity to go through NASA flight controller training directly after my undergraduate program. This was something I had never expected to be within reach at a young age, yet a gut feeling told me it was not the right time to pursue controller certification. At the time, I had a few job opportunities on my plate to juggle. Weighing the importance of those in light of my values, passions, and future dreams was the most difficult part.

In another moment of trusting my gut, I walked away from the NASA flight controller opportunity, knowing there was something else out there for me that would still lead to that dream. I took a job with Sierra Space as an instrumentation systems engineer, working primarily on the assembly, integration, and testing of the first Dream Chaser flight vehicle, named "Tenacity." Sierra Space is the entity responsible for the world's only commercial spaceplane, Dream Chaser, capable of orbital cargo transit.



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This vehicle will fly a minimum of six cargo missions to the International Space Station and is the planned transportation to Sierra Space's future commercial space station, Orbital Reef. I had thought working on EagleCam was a lot of long days, but it pales in comparison to my role on Dream Chaser. Working on the development of the first flight vehicle has come with its own intricate difficulties, each novel in its own way. My first two years at Sierra Space have been dominated by mastering those intricacies and interlacing them with each vehicle subsystem to ensure maximum expected functionality.

The Dream Chaser program has allowed me to step up as a leader far sooner than I expected in my professional career. My peers have taught me invaluable lessons in having hard conversations, both technical and in leadership strategies. Leadership happens at all levels, in all decisions, and certainly in every presentation you make to a large group. The instrumentation technical knowledge I gained while working in this role now supports not only my current flight controller training but also my graduate thesis work at the University of Colorado, Boulder.



Placing lens covers on the video cameras on the Shooting Star Cargo Module  
Photo Credit: Dustin Koehler/Sierra Space

The calculated risk I took walking away from the NASA flight controller job offer was well worth the reward, as I have now fully transitioned within Sierra Space to train as a spacecraft subsystems controller. In a roundabout yet still more efficient way, I have ended up in mission control having collected skills along my journey to help me become an effective controller. My console is the Environmental Control, Life Support, and Thermal Control systems under the call sign ECLS. This is the dream. This is the job that I have always wanted, and I always wondered if I would have one day. I have been training in mission simulations for over a year now, and every time I step into the control room, the chills never go away. I truly never thought I would achieve this dream so early in my career, yet I will always remain grateful for the chance to wake up every day and do it all over again. I will be supporting Dream Chaser's first mission from inside the control room and celebrating all the little wins along the journey of the mission.

Finding those little bits of joy and those little wins is what keeps me going in my professional, academic, and athletic ventures. Keeping up with my pursuits outside of work

keeps me well-rounded, focused, and, most importantly, happy. Later in my career, I plan to re-enter the academic sphere to become a professor. So many teachers and professors have changed my life for the better, and I can only hope to have that same positive influence on young students. With the aspiration to become a professor, I will continue my academic pursuits toward a Ph.D. in bioastronautics while supporting flight control operations at Sierra Space. The juxtaposition of these two unique experiences creates the perfect middle-ground for me to instruct at the collegiate level in the future and pay it forward as so many have done before me.

At some point outside of all of this, I feel it is incredibly important to be more than just your career. Life is deeper than solving engineering problems or getting to your next technical accomplishment. Training for Spartan races and making small improvements to my race performance take up the majority of my time outside of work. Most importantly, training and racing are fun and remind me to get outside and get moving. In my peak race season, I'm training twice a day, anywhere from 8-10 times a week. This is my chance to quiet my mind and experience the world around me in incredible ways. None of this would be possible without my coaches or loved ones who constantly stand in my corner through it all.

I have discussed several key people that have made lasting impressions in my life, and to them I will never be more grateful. Sometimes the impact of someone's influence may not sink in for years to come. My mother, from the time I was probably an infant, always told me to go to college. I just don't think she expected me to move a thousand miles away at the age of 18 to do so, or that I would keep going to pursue a Ph.D. I trusted my gut instinct that something better for me was out there in the world, starting at Embry-Riddle, and there is likely so much more yet to come.


My father, an engineer himself, helped to mold my curiosities and was always patient when I would barrage him with questions about how the mechanisms of the world worked. My college roommate and I strategically took all our classes together so we could collaborate while studying. The keys to the doors of the engineering realm come through collaboration, even if that's first learned in all-day homework sessions in a college apartment. Some of the brute force problem-solving methods we developed while using our windows as a whiteboard still hold for how I solve problems at work today. Solving those problems can get mundane when they stack up, so it is important to remind myself how remarkable it is to be living my childhood dream while fostering the next one.

Dreams are a funny thing when you achieve them. You've worked so hard to get there, so what now? Enjoy it, figure out what worked to get there, and figure out where



Model of the Nova-C lunar lander; Photo Credit: ERAU

you're going next. After I started my undergraduate program, I needed to recalibrate. I'm sure I will have to do that for the rest of my career in the space industry. I have already adjusted my goals to include earning my Ph.D., contributing to industry using my dissertation work, supporting Dream Chaser flights from mission control, and eventually sharing that wealth of knowledge with university students in the future. I know that my future decisions will not always be driven by knowing every single factor going into them.

Trusting my decisions, calling a friend across the country, and having loved ones believe in you when you forget to do it yourself – this is how I've made it in my marathon-length journey. By sharing my story, maybe someone else will have the courage to trust their instincts about the next big decision or to move across the country unsure of what's to come next. No path is linear. None of the information is ever apparent at the start, but it all works as a compilation of hard decisions, little moments of joy, and a vision for the future. 



**Grace Robertson** is a dedicated graduate student in the bioastronautics department at the University of Colorado, channeling her passion for aerospace into her work in flight operations at Sierra Space. Beyond her professional pursuits, Grace is committed to making a positive impact by actively engaging in volunteering, public speaking, and mentorship circles to pay the good forward in the world.

*Guest Editor's Note:* The EagleCam, carried aboard the Nova-C lunar lander was successfully launched on a SpaceX Falcon 9 rocket February 15, 2024 at 1:05 am EST. It is targeted to land on the Moon on February 22.

**For more information:**

- [Astronaut Scholarship Foundation](#)
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