

1. In 350 words or less, please describe the type of company and internship work assignment you would prefer and why?

Commercial space exploration is different from any other industry in the world. It combines the engineering challenges engrained in propelling spacecraft throughout the universe with the profit-driven entrepreneurial focus that naturally seek real, sustainable business models. I realized my passion for space exploration during the start of my college career. My studies changed from memorizing equations to understanding the fundamental concepts. As I am in class, I learn the material, but through the eyes and mindset of a rocket engineer. As I venture into the real world I am on the continuum of where I will be the most challenged, inspired, and happy to work. I have gained experience scientific research during the summers of 2017 and 2018 at the University of New Hampshire Institute for Earth, Oceans and Space studying gamma ray polarization in solar flares and the National Institute of Standards and Technology studying Inconel 625 in tension and compression. I have also taken on a part-time job at TURBOCAM International allowing me to gain knowledge in the inner-workings of a private aerospace engineering company. Additionally, I started an aerospace engineering organization called The University of New Hampshire's Students for the Exploration and Development of Space, which has supported my drive to gain experience comparable to an aerospace startup company. From these experiences in engineering and project management, I have concluded that private industries promote the most efficient, fast paced environments that I thrive in. The host institutions in the Matthew Isakowitz Fellowship Program that primarily focus on rocket propulsion and spacecraft design would directly align with my professional and personal interests.

If I am awarded this highly selective internship and mentorship program, I would be able to bring my natural drive and curiosity for commercial space and engineering into my host company. It would enable me to contribute to their engineering projects and propel their mission forward. Humans have an innate desire to explore, and space beyond low earth orbit is the next frontier to discover. What possibly is more exciting than the thought of starting off your day among the stars? I can't think of one...

- 2. In 350 words or less: You have just stepped into an elevator with an investor and lucky you, you have an idea for a commercial space start-up! What is your start-up idea, and what 'elevator pitch' would you give them to convince them to invest in your business?**

Mr. Silverstein? Hi sir, my name is Charlie Nitschelm and I am mechanical engineering student at the University of New Hampshire with experience in spacecraft design and hybrid rocket propulsion. I recently started a company directly related to your work at NASA. As you know, a fundamental challenge for long-term human spaceflight is the absence of gravity. Astronauts have experienced bone, endurance and sight loss during long duration missions. They also spend nearly 3 hours every day exercising, trying to slow down the negative effects of constant zero gravity. With these inevitable consequences it has been my companies mission, Artificial Gravity, to advance the standard of living among any space vehicle's occupants. All spacecrafts will continue to have standard pressurized mating adapters to catch incoming spacecrafts for cargo or crew. Our company is working towards designing and manufacturing a spacecraft module that would lock with space vehicles or stations to be able to produce artificial gravity of any magnitude. It would do this by having two major components: the stability module and the artificial gravity module. The artificial gravity module would obtain an angular velocity to produce a centrifugal force on its occupants. Its design is very similar to a ferris wheel, so occupants could walk around the module, experiencing forces similar to what their body would feel on Earth or Mars. One challenge, of course, is to counteract the inherent rotational momentum this would add to the entire spacecraft system. The stability modules purpose is to counteract the rotational momentum added to the system from the artificial gravity module that also serves as the connection tube from the artificial gravity module to the spacecraft. The stability module would rotate in the direction opposite of that with the artificial gravity module, allowing the entire spacecraft to remain unaffected.

Now Mr. Silverstein, I know you are deeply engrained in space exploration, and our company is just beginning to create traction in the aerospace industry. If you are interested, I would be honored to talk more in detail on our company and product and the potential partnership we could create.

In 800 words or less, please answer the following: Why are you excited about commercial space and your current or future role in it, and why are you a strong candidate for this Fellowship?

When I started the University of New Hampshire as a mechanical engineering major, I had no clue what I wanted to apply my studies to. I then witnessed the live event of SpaceX's booster engine land on a drone ship from a sub-orbital flight. I instantly had the realization that I wanted to be a part of a team that is pushing the bounds of space exploration. There are very few topics that funnel my thoughts into only the current moment. I was told growing up that there would be a time in my life that my passion would find me. Some must wait more than half a life-time, but I only had to wait 18 years. Space exploration, and specifically rocket technology, is one of those topics.

Commercial space opens up the opportunity to more people to be innovative and creative. Government and political organizations cannot compete with entrepreneurial models and commercial drive. Private companies seek real, sustainable business models that will allow the industry to lower costs and grow over time. With any scientific development, no matter the topic, all areas of human knowledge expand. Jumping higher into rocket and space technology will have unimaginable benefits to society on Earth, and beyond. I take pride in going about my day knowing that we are capable of greatness; to positively change the life of generations of people. There is nothing more exciting than letting our natural curiosity of the unknown unfold secrets of what else is out there in the universe. I cannot say it better than Elon Musk, who said "You want to be inspired by things? You want to wake up in the morning and think the future is going to be great. That's what being a spacefaring civilization is all about. It's about believing in the future and believing the future will be better than the past."

After I knew I wanted to contribute to the focus on commercial space, I needed to become a part of it during my university studies. I came across Students for the Exploration and Development of Space (SEDS) that empowers young students to participate and make an impact in space exploration near the end of my freshman year at the University of New Hampshire. I am proud to note that I founded UNH SEDS during the Spring of 2017 with the goal of pushing its members to explore the inner workings of rocket mechanics and the engine that drives it. During the 2017-2018 school year, we developed simulation and optimization functions using MATLAB to design, manufacture and assemble that most optimized rocket given its constraints. After countless flights, including burning a hole through our first launch pad, a G engine coming out of the engine tube, 2 tree landings, countless rocket lawn darts and one very unfortunate lake landing, I think I can finally say to the entire SEDS team that we now know how to build a rocket. After the end of our school year, we were able to optimize a multi-stage carbon fiber rocket and fly it to 2,200 meters, crushing previous record from other universities with a limited total impulse that can be applied through its flight. When the 2018-2019 school year began, we decided to pursue the design and manufacturing of a hybrid engine using HTPB

and nitrous oxide to propel a rocket to compete in the Spaceport America Cup Competition in May 2019. To date, we are currently finalizing our first design and moving to manufacturing over the next week. We have also recently returned from San Diego, California where our group attended SpaceVision, a SEDS sponsored conference, enabling us to network and connect with other space-enthusiastic students across the country. Developing this team has been the hardest, most rewarding thing I have done. I owe everything to SEDS. Rocketry is a noble pursuit. It is the truest profession in which failure directly leads to success. It can become discouraging that failure has been experienced over and over again, but it has only pushed us more to prove that we are capable of achieving greatness. SEDS USA has guided us to finally become rocketeers.

Matthew Isakowitz was a passionate young man who was motivated by the opening of the commercial space frontier. He was also known for his kindness, respect and generosity to anyone he encountered. I believe I am an excellent fit for this program because my drive everyday stems from the same principals that Matthew had. I have created a community at the University of New Hampshire that embodies the incredible universe we live in. The future is all around us, directly above every single person on Earth.