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

The host companies are as interdisciplinary as the commercial space industry itself, from additive manufacturing in a microgravity environment to satellite imagery with a 3-5 meter per pixel resolution. I see my experience and passion oriented most with the host companies in rocket propulsion, vehicle integration, and spacecraft design. Each company serves a purpose of progressing human development in space, but host companies such as Virgin Orbit, Rocket Lab, and The Spaceship Company will always climb to the top of my list. As an intern, my focus would be to learn and assist those around me, to be there and acquire hands on experience with engineers and technicians alike. Opening space is not a one-man venture, the whole is greater than the sum of its parts, and I want to be there for the team.

Over the summer of 2019, I had the opportunity to visit fellow Charlie Nitschelm during his internship at Rocket Lab USA. What he initially told me was going to be a relaxing weekend in California, turned out to be a whirlwind trip visiting and touring different host companies. We visited The Spaceship Company in Mojave and Virgin Orbit, Spin launch, and Rocket Lab in Los Angeles, it was without a doubt the most inspiring day. Since then it has been my ambition to return to those facilities, walk through Virgin Orbit and Rocket Lab again to see Launcher Ones and Electrons on the shop floor. In what other profession can your office be next to a rocket? None, and that's why there's nothing more fascinating to me than these companies.

In conclusion, commercial spaceflight is my vocation, and whether it takes me 6 months, or 10 years, I will always pursue a career within this industry. If I am granted a spot in the Matthew Isakowitz Fellowship Program, I will bring the love for space that I have carried and will carry for the rest of my life. NASA and the Space Race encouraged me to take my first steps, I want to be a part of the team that encourages others to take theirs.

2. Please answer **ONE** of the following essay questions in **350 words or less**:
    - What will be the next giant leap in space technology from the private sector and why?
    - **You are testifying before Congress for a hearing focused on the biggest barriers for the commercial space industry. What would be your opening remarks?**
    - Elon Musk, in a discussion with our 2019 Fellows, stated that starting a company is like "eating glass and staring into the abyss." Thankfully, you have the stomach for this kind of business. What start-up idea would drive you into starting a business and why?

Thank you chairwomen Kendra Horn and ranking member Brian Babin, thank you for the opportunity to testify today. As we sit here today, there are more than 21,000 objects larger than 10 cm orbiting the Earth, not to mention the 500,000 bits of space debris that fall between 1 and 10 cm. On the bright side, small debris burns up once it re-enters through the atmosphere, and larger objects can be tracked, simulated and ground impacts predicted. The key term was

predicted, we cannot control or modify impacts, simply predict them. As you can see, space debris poses a threat for the space industry on both fronts, in the sky and on land. Competitive entrepreneurship within the commercial space industry has dramatically lowered launching costs, from $54,500 per kilo on the Space Shuttle to $2,720 on the Falcon 9. With this decrease in price, we will see an increase in the number of items launched into orbit. Thus, it is crucial that we recognize commercial space's responsibility for these items.

In a recent industry study, I asked 15 commercial space professionals what the biggest barriers in the industry were currently, and in the foreseeable future. Of the responses, 8 mentioned space debris and orbital debris disposal as one of their top issues. These professionals are ingrained in our industry, from a Manager of Business Development at one of the largest defense contractors, to a CEO & System Engineer at a Korean based small orbital launch company. Their input is invaluable and as one professional commented on space debris, "It's like driving across a vast desert with your eyes closed, maximum car speed, with a lot of other cars driving there too… only seeing a very small fraction of things you can run into." These dangers exist in every facet of space, from life support systems on the ISS, to precision equipment on space satellites. Space debris poses as one of the most formidable dangers for future space missions and will be a significant barrier for the future commercial space industry. Thank you, and I look forward to answering your questions.

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

I started my undergraduate engineering degree at the University of Maine (UMaine). I knew the next four years would dictate the start of my career and my introduction to the commercial space industry, I couldn't afford to waste time. After three semesters, I did not see myself succeeding in the ways required to get into this industry. I needed a change and transferring to the University of New Hampshire (UNH) was my solution. Once at UNH, I lost no time joining extracurricular organizations and activities. I found my home with UNH Students for the Exploration and Development of Space (SEDS) just a few weeks after its foundation and connected with Charlie Nitschelm, future 2019 fellow.

UNH SEDS stems from SEDS USA, a nationwide organization whose mission is to empower young people to participate and make an impact in space exploration. As the vice president for the past three years, UNH SEDS has allowed me to pursue the commercial space industry all while reinforcing the concepts covered in my engineering courses. One instance of this occurred while sitting in classical mechanics. My professor began class with "today we'll be reviewing Tsiolkovsky's rocket equation." The following lecture remains to this day to be the best class I have ever attended, and since then many SEDS freshmen have received a premature dose of classical mechanics and the famous rocket equation. Instances like these are what I try to foster at UNH SEDS; an environment where regardless of your grade or major, there is always something exciting to learn about the world above.

UNH SEDS' development was critical to UNH. UNH previously lacked an engineering competition team that incorporated all degrees and years. UNH SEDS allowed for knowledge transfer between years to be seamless, and to build a relationship between undergraduates and alumni. During the 2017-2018 school year, mastery of rocketry was a far-fetched reality, from lawn darts to lake landings, we failed in some glorious ways. I'll always remember when Charlie and I stayed in the workshop until 3 AM, finalizing our second rocket, only for it to undergo a rapid unscheduled disassembly during flight. It never felt like work. Time and time again, we marched out to our home-made launchpad and flew 9 rockets. This year captured the spirit of the club at its finest, a few college kids from New Hampshire trying to build rockets. Lessons learned and modifications made, we felt strong in our understanding and looked forward. The 2018-2019 school year brought in the development of Runaway, our hybrid engine utilizing HTPB rubber and nitrous oxide. Stepping outside of our comfort zone, we challenged ourselves by attempting four hot-fire tests, gaining insight on our engine's performance and the capabilities it would be able to achieve the following year. 2019-2020 marks my senior year. As the vice president and frame lead, I manage the student body of the organization and work with every engineering team to design the best rocket frame possible. SEDS and space are my passion, so having the ability to integrate each team while simultaneously work with undergraduates and new members is a huge honor. With less than 10 months until the 2020 Spaceport America Cup, it's now or never for New Hampshire's first undergraduate hybrid rocket.

My professional growth over the past three years have been solely guided by SEDS. Traveling to the past two SpaceVisions and spending a week at the 2019 IAC, SEDS has fueled my development and I am grateful for every person I have met along the way. Six months from now I'll hopefully be joining a new team within the commercial space industry, where the same mission exists as before: to inspire the next generation of space loving enthusiasts while improving life on and off earth. I can only hope that I have opened space for one of the undergraduates who will carry UNH SEDS forward.

Commercial space capitalizes on man's innate desire to explore. It captures the minds of the youngest generation and the greatest engineering minds alike, inspiring entrepreneurs to drive the market faster and further than the government's capability. When considering its sphere of influence, look no further than your phone or the exercise equipment at the gym because space is interwoven into so many facets of our lives. Personally, nothing could generate a more fulfilling life's work than to be with a team of people who are driven by the challenges space presents. In conclusion, I am a strong candidate for this program because I believe I share the same passion and enthusiasm for exploration that Matthew Isakowitz was guided by. From others who knew him, Matthew Isakowitz was an inspirational figure within the commercial space industry and his curiosity was only matched by his kindness. It would be an honor to be part of his legacy.