**Fulbright Program Information**

Abstract/Summary of Proposal

Prepare an executive summary detailing the what, where, and why of your proposed project․ If you are proposing the pursuit of a graduate degree program, summarize the program and relevance to your career/education plans․  
*200 word limit.*

The University of Nottingham, known for its world-leading research, hosts the most prestigious masters in additive manufacturing and 3D printing. I am interested in pursuing the graduate degree program at the University because I am interested in being a part of the development of this technology. Not only will the program teach me advanced skills and knowledge in 3D printing, but it will allow me to play a role in the future of the technology. My first-hand experience in additive manufacturing has taught me that companies prosper by choosing to manufacture parts with additive manufacturing that would otherwise be impossible or very difficult to make through other methods. The aerospace industry, which is well known for complex parts and mind-bending challenges, has been using this technology to improve performance and the manufacturability of some of the most complex parts in the world, including rocket engine nozzles and injectors. The course in Nottingham is unique as it is a taught rather than a research-based masters. By focusing on the “big picture” while simultaneously exploring a few topics of interest more thoroughly, I can transition into the industry as a well-rounded manufacturing and additive engineer to make components reliably, cheaply, and fast.

Host Country Engagement

A key purpose of the Fulbright program is to be a cultural ambassador while living abroad. How will you engage outside of the workplace to fulfill this mission?  In what ways do you plan to share your culture and values in your host community?  Provide specific ideas.  
*200 word limit.*

I started a local *Students for the Exploration and Development of Space* (SEDS) chapter at my university that is dedicated to bringing together students passionate about the aerospace industry to support learning, outreach initiatives and professional networking. The community that I have built at the University of New Hampshire has enabled the team to pursue their passions in the space industry, finding work that they enjoy and find rewarding. I plan to start a chapter at the University of Nottingham for the same reasons. Space isn’t for one country, but for all. I also plan to participate in Code Club, an outreach program committed to educating young students on the power and future of coding and computers. Introducing young students to the language early will expose them to this current blossoming field in the tech industry. Finally, I would like to actively participate in and assist local makerspaces. Makerspaces, local independent businesses that provide individuals and organizations with the means to imagine, design and build their own work locally, provide opportunities for all people to participate in the future of imaginative and independent creation.

Plans Upon Return to the U.S.

Describe your career and/or educational plans after completing a Fulbright grant.  
*100 word limit.*

I am passionate about commercial space travel and making life multi-planetary. Manufacturing processes are the most critical component of the quest to achieve these goals. After I receive my Fulbright grant and complete my master’s program at the University of Nottingham in additive manufacturing and 3D printing, I will be equipped technically to handle any obstacles to the advancement of modern rocketry. By the late 2020’s or early 2030’s, SpaceX’s Starship will be the vessel that transports humans to the surface of Mars. I plan to work on that project, carrying humans closer to the stars.

STATEMENT OF GRANT PURPOSE  
Charlie Nitschelm, United Kingdom, Engineering  
Additive Manufacturing and 3D Printing

The aerospace industry, and more specifically rockets, are known for their precise and complex parts. To the common space enthusiast these rockets magically appear to make their journey to the stars, but their real beginning is during their design, on the production floor, and in a complex, refined, and developed manufacturing process. Computer aided design has enabled engineers around the world to create precision systems, like the rocket engines that can power the modern rockets and spaceships we see today. But these systems are not just computer files that can stand alone; they need fabrication in real life to make a difference. Design engineers have been constrained by the limitations of available manufacturing techniques. In the case of critical temperature rocket nozzles, challenges like internal features and part fixturing requirements make it extremely difficult for flight acceptance. However, additive manufacturing (AM), which is the process of building up designed parts from the computer layer by layer, offers the ability to manufacture parts otherwise impossible or extremely difficult to create outside of a computer screen. A good way to conceptualize this relatively new field is picturing yourself assembling your favorite burger. You start with the bottom bun “layer,” then the patty, the cheese, the lettuce and so on. AM is much the same. You build a part--one layer at a time. With this new process, design and manufacturing engineers can now create systems that were previously only an engineer’s dream. I am applying for a Fulbright-funded MSc in AM and 3D printing from the University of Nottingham to gain insight into the future of additive technologies in order to apply those principles in my work in commercial space.   
          The University of Nottingham and its Institute for Advanced Manufacturing are a leading research powerhouse in AM and 3D printing, with its research in computational methods, printing materials, and overall process control. I plan to apply the knowledge and skills I learn from this program to the aerospace industry, the current leader in utilizing AM for many flight parts. Much of my experience so far in additive processes has been working with and around a direct metal laser sintering (DMLS) printer on an internship at Rocket Lab. I helped in the production of all the Electron engine’s thrust chambers, Rocket Lab’s small satellite rocket. This thrust chamber’s nozzle, currently in nearly every modern rocket, has been redesigned to improve its performance. This improvement is made directly possible by the introduction of metal AM. Aerospace was the first industry that could bring a propulsion engineers’ complex dreams to life with the implementation of wacky internal features that could actively cool the nozzle’s wall, greatly reducing the overall mass of the engine and increasing its overall performance. The impact this process can have on industries around the world cannot be understated. A tremendous number of engineering problems that I have encountered still need to be solved. The solutions to these problems will reduce cost, increase print speed, and improve the quality of each part coming out of a 3D printing machine. I am thrilled that inquiry into the improvement in all of these processes is currently part of the active research at the University of Nottingham. I have had preliminary contact with Professor Martin Baumers, assistant professor of AM management and Director of the AM and 3D printing master’s program at the University of Nottingham. From him I learned about the unique courses offered by the University and the specific classes within the program. Earning this Fulbright and allowing me to take part in this master’s program will hone my skills and afford me the opportunity to improve the quality and usability of additive processes. Many universities around the world who offer additive

Charlie Nitschelm, Grant Purpose, Page 2

manufacturing programs are research based, diving deep into fundamental research. Nottingham, with its post-graduate taught course, provides an opportunity for students to become more well-rounded in AM while diving deeply into a few topics that are of special interest to each student. This deeper analysis and focused study is more valuable to me than other less focused programs as I pursue my career as a future manufacturing engineer within commercial space.  
          The post-graduate taught course with small research projects that the University of Nottingham offers directly aligns with my interests. This program researches technology levels 1-3, the very new technologies that are so new that industry standards have yet to be developed. The program consists of block modules, normal lecture courses, and a large summer individual project that culminates our learning into a specific focus area in AM. After talking to Professor Baumers, the advanced manufacturing course that reviews the current practices in post-printing conditioning and processing seems the most intriguing to me. This is also an area in the aerospace industry that needs significant work, as I have learned from personal experience at Rocket Lab. The program also hosts smaller AM conferences and students travel to a few large conferences throughout the year to connect, learn and share knowledge I am most excited about the Germany AM conference, FormNext, which the professors and graduate students at the university attend, as I have used several German-based additive machines and enjoy the build quality and user interface.  
          The community outreach that is currently active at the University is plentiful and interesting, especially Code Club. Code Club is an outreach program committed to educating young students on the power and future of coding and computers. I was fortunate to go to an afterschool program during my elementary and middle school days that introduced me to STEM topics and provided me with the freedom to be creative and build what was on my mind. To this day, I still code on multiple platforms to analyze data and control machines. Providing my young mind with the resources and professional assistance I needed to be creative and to create led me to my career as an engineer. I know that there are children around the world, just like me, that just need a little inspiration to find their passion in any STEM field.   
          A well-rounded educational background in mechanical engineering (ME) from my undergraduate university, research in Inconel (a common 3D printed nickel-based super alloy) and hands-on additive and advanced manufacturing work as an intern at Rocket Lab and working closely with engineers from New Zealand, have equipped me to be successful in my pursuit of this specific advanced engineering degree and studying in another country. Once I discovered the commercial space industry and its connection with additive manufacturing, I was driven to enter this exciting and groundbreaking field. My passion drove me to start a rocket club, UNH Students for the Exploration and Development of Space. We are currently working on the design and manufacturing of a hybrid rocket engine and we are creating a space community that shares my excitement for the space industry and the thrilling advancements that will come in our lifetimes. The learning and experiences I will haves at the University of Nottingham in this specific additive program directly align with my long-term professional goal: to have an impact on manufacturing which resonates around the world. After receiving such an excellent education through this program, I will be prepared to continue my work in the fast-paced commercial space industry, contributing to the goal of sending humans deeper into space. Acceptance into the Fulbright program will pave the way to become a more globally minded, well-rounded leader and engineer.

PERSONAL STATEMENT  
Charlie Nitschelm, United Kingdom, Engineering

July 25th, 2019 was the best day of my life so far: I met Elon Musk and was asked to talk to him privately about the future of space and manufacturing at SpaceX; I shook hands with Buzz Aldrin, the second human to walk on the moon; and I spent the day and night with fellow space students and current space leaders. I wasn’t always a space nerd though. It was during the middle of my freshman year at the University of New Hampshire that I witnessed the first sub-orbital flight booster reenter and land on a floating drone ship by SpaceX. I have always followed Elon Musk and his adventures into the space and automotive industry with Tesla, but seeing live what commercial space is capable of completely defined my dreams. My uncle Allen, who started his own newspaper company and genuinely enjoys his work, told me there is *sometimes* a moment in people’s lives that make them realize what they are passionate about, what they are inspired to work on. For me, it was that moment. I wanted to work on making humans explore deeper into space and become multi-planetary.

Space is a unique industry and one that is inherently cosmopolitan. It is the only physical location that is the same distance away from everyone, just 100 kilometers above your head. The one challenge for me was to become a member in the commercial space community, as it is the hardest industry to get into as an engineer. I didn’t want to wait for my university days to be done to begin my venture into commercial space, so I started a local Students for the Exploration and Development of Space (SEDS) chapter where we specialize in the design and manufacturing of rockets and hybrid engines, and community outreach. SEDS has given me the opportunity to work with like-minded engineers on aerospace projects that are exciting and difficult. It was my first experience in difficult manufacturing challenges, and my initial work with plastic 3D printing.

My work with SEDS and my passion for rockets and commercial space led me to be accepted into the Matthew Isakowitz Fellowship Program. The fellowship is a selective internship and mentorship program for students passionate about commercial spaceflight. It led me to work at Rocket Lab, a rocket company based in New Zealand. I worked in their Huntington Beach factory manufacturing the rocket engines for their Electron rocket launched in Mahia, New Zealand. The Fulbright program also pairs perfectly with my belief in the strength of cultural connections. Working at a New Zealand based company let me interact with the engineers there that not only think differently but offer creative ideas and concepts that could not have come from any of the engineers here at the US factory. Just recently, I was working on designing a tool for machining a nozzle extension for our engines. I was able to reach out to the lead engineer in New Zealand to work directly with him on coming up with the most optimal design for our needs. The difference in experience and engineering education allowed the team to bounce new ideas around, coming up with a design that was perfect for its design criteria.

Space is grand, and it will take minds from around the world in every industry to make humans a multi-planetary species. Being a team player and working with people regardless of cultural upbringing or religious beliefs is imperative to the future of everyone on Earth.