**Fulbright Program Information**

**Award Type**: Study/Research Award

**Country**: United Kingdom

**Award**: University of Nottingham Award

**Program:** Additive Manufacturing and 3D Printing MSc

Field of Study

**Engineering**

Project Title

Enter a descriptive Project Title. If awarded a grant, this Project Title will appear in the Grantee Directory.  
90 character limit.

**Additive Manufacturing and 3D Printing**

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.*

It is rare to play a role in the disruption to the biggest, and even oldest industry in the world, manufacturing. The University of Nottingham, notorious for its world-leading research, hosts the most prestigious masters in additive manufacturing and 3D printing. Not only will the program teach me advanced skills and knowledge in 3D printing, but it will allow me to look forward and play a role in the future of the technology. From learning first-hand, additive manufacturing, which is the process of building up designed computer parts layer by layer, offers a company the ability to manufacture parts otherwise impossible to create outside of a computer screen. The aerospace industry, which is well known for complex parts and mind-bending challenges, has been able to use this tech, although still infantile to its potential, to improve performance and manufacturability of some of the most complex parts in the world including rocket engine nozzles and injectors. The connections between accelerating the path to make humans a multi-planetary species and the opportunity for advanced additive manufacturing to play a role is not only tantalizing but drives me to develop the skills to make a significant difference.

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 had the privilege of starting a local Students for the Exploration and Development of Space (SEDS) chapter at my university, dedicated to allowing students passionate about the aerospace industry work together to support learning, outreach and professional networking. The community that can be built and the cultural exchange and appreciation that a SEDS chapter can foster is a fundamental reason I would like to see the start of a chapter at the University of Nottingham, continuing the naturally supportive and accepting culture that has been the aerospace industry. I also plan to participate in current initiatives at the University, including Code Club, an outreach program instilling the power and future of code and computers to young students in the area. Although I am an engineer, coding is the neckbone to make modern machines function correctly. To get introduced to the language of computers and systems early will let young students be exposed to a blossoming field in the tech industry. The final thing I would like to actively participate and assist in is local makerspaces, as that is what can help so many people in a community imagine, design and build their own work locally.

Plans Upon Return to the U.S.

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

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

Computer aided design has enabled engineers around the world with the ability to create precision systems that can quite literally increase the standard of living of billions. The problem is that these systems are just computer files, and they need to be made in real life to make a difference. Since the beginning of 20th century manufacturing, engineers have been tied down with its limitations, like no internal features and part fixturing requirements. But additive manufacturing (AM), which is the process of building up designed computer parts layer by layer, offers the ability to manufacture parts otherwise impossible 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, then the patty, the cheese, lettuce and so on. Additive is much the same. You build a part one layer at a time. But, if you forget the essential patty and try to place the cheese, it will fall on top of the bottom bun, and the whole meal is ruined! In terms of additive, a build, which can be a superalloy rocket nozzle, or a plastic ring for a toddler, was designed to be placed on a plate one layer at a time in a very specific order and process, so if one setting or sequence is off, the entire burger, I mean part, is ruined. The entire compromise that engineers and machinists have shared for nearly 100 years has fizzled into the ability to create systems that were otherwise an engineer’s dream. I am applying for a Fulbright-funded masters in AM and 3D printing from the University of Nottingham to gain insights in the future of additive technologies to make an engineer’s dream leave his screen and help the world, one layer at a time.

The University of Nottingham is a leading research powerhouse in AM and 3D printing, with its research in computational methods, printing materials, and overall process management. 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 a direct metal laser sintering (DMLS) printer that produces all the Electron’s engine’s thrust chambers, Rocket Lab’s small satellite rocket. The thrust chamber’s nozzle in every modern rocket has been redesigned to improve its performance made directly possible by the introduction of metal AM. It was the first industry that could literally bring a propulsion engineers wet dream to life with the implementation of complex internal features that could actively cool the nozzle’s wall, greatly reducing the overall mass of the engine and increasing its overall performance. It can not be understated the impact this process can have in industries around the world, but an immense amount of engineering problems is still out there to be solved to reduce cost, increase print speed, and improve quality of every part coming out of a 3D printing machine. The process of quick prototyping, plastics or metals, has been improved everywhere, specifically the plastics printers that can now be bought as a reasonable birthday present to a very lucky child. I am not only excited to live during a time of such innovation in additive but am tantalized by the opportunity to take part in the world-wide movement.

I had the opportunity to connect 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 where I was able to get a more in-depth look at the program and its main objectives. The post-graduate taught course that they offer directly aligned with my interests, as they research and prod technology levels 1-3, meaning very new technologies that have not had the time to even develop standards for. These new processes and features on AM machines are fascinating and can make a huge difference on how the world creates, well, everything. The university is very well known in the AM industry, and this master’s program is also one-of-a-kind. There is no program like it that has the resources and focus that the University of Nottingham has. It consists of block modules, normal lecture courses, and a large summer individual project that culminates our learning into a specific focus area in AM. They also host and attend large AM conferences throughout the year to connect, learn and share knowledge to keep up to date with the industry. I am most excited about the Germany AM conference (which the professors and grad students attend) as I have used several of their additive machines and enjoy the build quality and user interface.

I have also had the honor to work with Paul Parkin, the current Director of Production at Rocket Lab and UK native. He could not speak more highly about his childhood in the midlands, and his excitement for me to experience UK culture and community as he has. Just browsing the community outreach that is currently active at the University was inspiring, especially Code Club, an outreach program committed to educating young students on the power and future of coding and computers which I plan to volunteer at. I was fortunate to go to an afterschool program during my elementary and middle school days that introduced me to not only coding but having the freedom to be creative and build what was on my mind. I still remember the time I was eating M&M’s and felt the need to sort them into their respective colors, so I build a small structure that took in a bag of them, grabbed one, identified the color and dropped in its respective bin. Enabling me with the resources and professional assistance to make that kind of stuff growing up led me to my career as an engineer, and I know that there are children around the world that just need a little inspiration to find their passion in any STEM field.

A well-rounded educational background in mechanical engineering (ME), research in Inconel (a common 3D printed superalloy) and hands-on additive and advanced manufacturing work as an intern at Rocket Lab USA in Los Angeles has equipped me with the ability to be successful in pursuit of this specific advanced engineering degree. When I started at the University of New Hampshire (UNH) as a ME major, I didn’t have a clear idea in what I wanted to apply my skills to. Once I found the drive of the rising commercial space industry, I could not take my mind off it. It allowed me to have the passion to start a rocket club, UNH Students for the Exploration and Development of Space, and design and manufacture a working hybrid rocket engine, and create a space community that shares my passion for the excitement that is coming to space over our lifetime. The most rewarding thing I have accomplished thus far was SEDS, and it drove me to be a part of the larger community that runs all the chapters throughout the USA. The power of natural curiosity trumps pure intelligence, as a group of people will always be stronger than a lone genius, and empowering people from fundamentally different background to work together towards a common goal is something I find very rewarding and empowering. The experiences and advances topics I would learn at the University of Nottingham in this specific additive program will push me to continue my work in the fast-paced aerospace industry, and the acceptance into the Fulbright program will pave the way to become a more cosmopolitan, well-rounded leader and engineer.

PERSONAL STATEMENT  
Charlie Nitschelm, United Kingdom, Engineering

I recently was able to have a one-on-one meeting with Alan Manara, the Director of Engineering at Rocket Lab USA (a rocket company based in New Zealand) that focused on what my professional goals are. He asked me “Charlie, what do you want to do? Say 10 years from now, where are you? Not just physically, but mentally.” I have never been asked such a grand question, and it was hard to put into words my answer. After jumping around from working on exciting projects in engineering and the skills I want to obtain, I landed on the true essence of what I have been chasing: I want to want to work. I want to start my day excited to go to work and look forward to going back when I leave. I was raised by my mum in Portsmouth, New Hampshire, just an hour above Boston. My mum had always jumped from job to job, never finding something she truly enjoyed. I guess I have been subconsciously chasing the idea of finding a topic and industry that fascinates me where the work isn’t really ‘work.’

When I entered the University of New Hampshire as a mechanical engineering major, I chose it because it was the broadest of all the engineering majors, giving me the fundamental courses to choose from a variety of industries as I just didn’t know what I enjoyed doing yet. It was during the middle of my freshman year that I witnessed the first booster reentry and landing on a drone ship from sub-orbital flight by SpaceX. My uncle Allen, who started his own newspaper company and genuinely enjoys his work, told me there is sometimes a time in peoples lives that make them realize what they are passionate about, what they are inspired to learn more about. For me, it was that moment. I wanted to work on the development of space. Space is also 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 one of the hardest industries to get into as an engineer. I didn’t want to wait for my university days to be done to begin my venture into aerospace, so I started a local Students for the Exploration and Development of Space (SEDS) chapter, where we specialize in rockets, hybrid engine design and community outreach. The family I have formed over the past two years with 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 integration with plastic 3D printing.

Working with printers at the local makerspace and my passion for rocket engines led me to work at Rocket Lab USA to assist in manufacturing the Rutherford engine for the Electron rocket in New Zealand. There I was able to learn the importance of additive in metals and led me to finally find an industry centered in aerospace that fascinates me. This experience in additive manufacturing has led me to want to pursue it formally through the top researchers and facilities in the world, which the University of Nottingham completely supports. 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 Kiwi people that not only think differently but offer creative ideas and concepts that would not have come from any of the engineers here at the US factory. 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.