**Discovery Program**

Technical Area they are hiring:

Dynamics and Controls

Qualification:

* Ability to work Independently and as a team on rapid devleopment programs ( Aerial Robotics)
* Relevant Internship and academic project experience that demonstrates technical and leadership qualities ( Blue Origin and Sandia)
* Self-driven with the ability to seek out requirements with minimal direction (Senior Design Project or Guadaloop)
* Strong Written, verbal and written communication and interpersonal skills ( Blue Origin)
* Passion for Blue’s Mission with a strong desire to continuously learn and improve
* Abiltiy to earn trust, maintain positive and prof. relationship, and strengthen our culture of inclusion
* Technical Assessment
* Projects including GNC, simulation

About Blue Origin

* Passion for our mission
* Customer Focus
* Deliver Results
* Embrace Team Blue ( Teamwork Leadership)
* Resourceful
* Bias for Action
* Ownership
* Opreational Excellence
* Earn the Trust of Others
* Hire and Develop the Best
* Insist on the Highest Standards
* Technical Ambition and Simplicity
* Practice Humility
* Have Backbone; disagree and commit

**What is PWM and what can it be used for?**

Pulse Width Modulation. Control Analog devices using digital signal. Control using DC motors, lights, actualtors. Using duty cycles or how long it stays on and off, you can control how fast DC runs.

Why use it? Power loss is very low. Easy to control as a linear response.

**# GPS**

31 Altitude: 20,200 km, 12 550 miles (MEO), XYZ t

**ISS**

90 minutes for an orbit around earth , 370 km~460 km,

**Why Blue**

I want to join Blue Origin because it shares my professional goal, which is to benefit our entire society. In my previous internship, the magnitude of impact that I realized an engineer could have and the appreciation i received for helping technicians was so rewarding that I wanted to seek bigger work that benefit society. The best way to do so is i believe by facilitating space travel. Because of global warming, I sincerely believe we have to reach out to space to find new resources and new habitat. That’s exactly the mission Blue Origin has. Blue distinguishes itself from all the other space companies in that aspect. It emphasizes benefit of earth rather than pure excitement of space exploration. And I can contribute to that effort with my experience in GNC engineering through internships. My courses in the past semesters were geared towards it. In addition, I have a perception that you guys have a very supportive environment, which I learned after working at Blue for a semester and interacting you guys the HR team. So, with my passion and background knowledge in GNC along with leadership and communication experiences, I believe I will be a good fit for this New grad rotation GNC engineering role and can contribute to Blue’s work.

**Tell Me About Yourself**

I am an integrated masters and bachelor’s student at the University of Texas at Austin. I am graduating this December, and my studies and experiences have been geared towards Dynamics Systems and Control.

First, this position is looking for a candidate with a relevant Internship and academic project experience that demonstrates technical and leadership qualities. I am currently a Navigation Guidance and Controls Engineering intern at Sandia National Laboratory since May of this year. I have been developing an unclassified simulation for one of its flight vehicles in MATLAB and Simulink. I debugged existing models to make a functional simulation and automate simulation runs and git operations that save time in the Software-in-the-loop process. This work demonstrates my technical abilities in developing simulations for GNC engineering.

I was also a Guidance Navigation and Controls Engineering Intern at Blue Origin. I did similar work there where I worked on MATLAB and Simulink Simulation for one of its rockets. Here I got a chance to collaborate a lot with other engineers through meetings and especially GIT for sharing works. It was another great opportunity for me embrace Blue’s culture to have passion for our mission and to demonstrate one of the qualification for this job, which is to have strong written, verbal communication and interpersonal skills.

In Academics, I have taken courses to consolidate my knowledge in classical control concepts and Kalman filters. I could specifically talk about aerial robotics course later, in which I implemented 6-DOF simulations and path finding algorithms in C++. I really loved that course.

Lastly, I could talk later about my leadership at Gudaloop, a student Hyperloop team, again as one of the qualification for this position, I demonstrated my ability to seek out requirements with minimal direction.

So, I matched my experiences with the qualifications of a candidate that you guys are looking for, and I think I could be great fit for this GNC rotation program, I would love to explore multiple technical areas and be a contribution to Blue to be a benefit to humanity. There were some other things that I skipped over, so Is there anything else that Icould specfically talk about or have I misssed anything that yo uwnat me to talk about?

**Sandia**

One of the issues that GNC engineers in my team had was the inconvenient work process in the classified network. There were extra steps and time that needed to be spent compared to working in a regular network. My mentor and I saw an opportunity to improve the process.

So I started working on developing a simulation in the unclassified network because not all the GNC work had to be done in the classified network, some work that can be done outside should have been done in the unclassified network to save time. Working in the unclassified side removes lots of inconveniences!

Fortunately, there was already a simulation in MATLAB and Simulink in the unclassified network, but it was broken and completely out of date. I studied the conops of the flight vehicle I was working on to understand what the simulation should be doing and debugged it to make it functional.

That process involved multiple meetings with my mentor to seek out for help to understand the simulation model and the vehicle itself. My previous experiences in MATLAB and Simulink helped to understand the exact issues with the simulation and come up with solutions for them. By the end of the summer, I was able make the sim functional and produce a result. I am currently still working on the sim to make it more reliable and produce more accurate results

In addition, I also worked to automate the simulations, Developers often took 10 mins~ 30mins a day or a week just waiting for a simulation to run. Since they had to run the simulations very often, say even if the sim took only 10 mins to run, but if he or she had to do it daily, that time adds up to almost an hour every week. This time could be saved.

So I used Powershell Script to schedule the sim at a designated time everyday by itself. Initially, my mentor and I were both unfamiliar with automating simulations, so we reached out to a software engineer to discuss different ways we could achieve that. One of the options we discussed was using Powershell Script. Considering compatibility with the current development setup it was most suitable.

I had never used PowerShell script before, but I was glad I got a chance to learn it and actually apply to a real work. So during the summer internship, I learned to use the script and wrote scripts that scheduled simulations to run at a designated time during the day daily, weekly or monthly, and also make the script to do GIT updates and produce the simulation results in a form of graphs( say a trajectory of the vehicle).

Currently, I have automated my unclassified simulation that I developed to run every morning at 1AM, do the git updates and save the results from the simulation in a designated folder, so that whenever I start working everyday I could just check the result folder without me actually running the simulation. This saves 30 mins a day for me which is how long my simulation takes to run

At the end of the summer, I was able to present my work on the unclassified simulation and automation of the simulation runs to my team. Engineers were looking to use the unclassified simulation in the future and showed a huge interest to use the automating script for their own development process that can save time!

Through this experience I have made and am demonstrating my technical abilities and utilizing communication skills to get ideas and help from other engineers, which I belive are the qualities that you guys are looking for.

**Blue Origin**

At Blue Origin, as a GNC engineering intern I worked on simulations in Simulink and MATLAB for the New Shepard rocket, specifically the ones that are used for verification and validation of flight software.

I was tasked with adding a new feature to the navigation system, which produced an incorrect satellite sky plot during a certain phase of the flight. This required me to work within an Object-Oriented MATLAB framework, which was completely new to me, and, to learn about flight systems and navigation concepts.

To tackle the problem, I started by studying the object-oriented programming (OOP) approach in MATLAB. I actively engaged with my mentor and other engineers. I asked for lot of 1on1s with them to teach me about the navigation system and best practices for improving the simulation. What is the purpose of this specific sim or variable. Why is this sim needed for navigation system. Initially, I didn’t even know what pseudoranges, L1, L2, Carrier phase ,etc. were about. I was introduced to SIL, HIL, and process-in-the-loop (PIL) for flight software development. With all these understandings, I realized in the sim that during a specific phase of the flight, a rocket parameter wasn’t appropriately assigned that it caused incorrect representation of the navigation variables. So, I introduce new variables to trigger the appropriate assignment, modified variables to accommodate the allocated data sizes, and fixed all the bugs to be compatible with any other simulations that were relevant.

Besides that Communication was critical, and I didn’t hesitate to ask for help when needed. I would come up with a few ideas on why the simulation is acting certain way, say the sequence definition is defined incorrectly, or a certain trigger switches rocket states, Then other engineers gave me a feedback or suggested alternative solutions to my problem. Having many technical discussions like this, helped me progress through my project, and also learn new things very efficient way compare to doing everything all by myself.

In the end, I successfully implemented the new feature that corrected the satellite detection issue, producing accurate skyplots. Additionally, I incorporated a navigation block that improved the simulation's fidelity, ensuring that it reflected real-world conditions more closely. Lastly, I want to put emphasis on how much of the GIT I learned here. It was my first time using it and my first exposure to git at Blue. The first month ,somedays I spent half the day working on the sim and the other half spent on Git. It was important for me to be comfortable, because I saw updates every single day. I needed to know how to constantly take those updates in and put my updates out. This experience really ramped me up to be proficient in using Git.

So, at blue, I was able to again gain an experience with simulations in MATLAB and Simulink that are technical abilities that are needed as a GNC engineer, and I became proficient in Gitlab. I demonstrated communication and interpersonal skills that are required by this position, and why I think I could be a fit for GNC engineer position.

Besides that, I also want to add I worked at Blue with passion for space. The fact that the work I’m doing is facilitating our access to space is what motivated me to do everything that I just described. I saw that amongst other engineers too. Which motivated me even more to do better there at Blue. It was nice to have the same passion as the company and with other co workers too. It wasn’t just words displayed on a website, it was a culture that I felt working there. That’s what excited me everyday at the time working there, made me wish I knew this, I learned more on certain topic, I should go back to school and take this course! IT will be fun. All that thought came from passion, and it still excites me whenever I imagine working there as a full time.

**Guadaloop**

My experience at Gudaloop demonstrates my leadership and my ability to seek out requirements with minimal direction as stated in the qualifation for this position.

I was the lead suspension engineer for the team in Spring 2023. The suspension design when I became the lead did not have any sufficient engineering justification. Meaning, We did not run a thorough stress, cost analysis, or reviews from any professionals. so we could not answer any questions when someone asked why our suspension was designed this way. So, I took the initiative to scrap the entire design and begin from scratch. Of course, this required discussions with my teammates. As one of Blue’s culture, Just like people at blue take owenership of their work, I explained that we should not sacrifice long-term value for short-term results. Although we already had some sort of design that could make the process faster and maybe even start manufacturing an actual system, it’s meaningless if we don’t have sufficient engineering background to this design. We won’t be able to convince the judges in the competitions, and even people within Gudaloop why our design was the best choice. Also, if the system failed, it will hard to identify the cause for the failure. I tried to communicate my opinion as much as I can to my teammates, and I was able to convince everyone to agree with me. So we started everything over.

I led the team to take a methodical approach. Because this was a self-led project, we had to seek out the requirements for this design ourselves. I gave instructions to clarify performance specifications, brainstorm, picking a design and analyzing our selection. We used Pugh charts, gantt charts, multiple sessions of 6-3-5 method, and ran stress analysis through FEA for different design options. While leading these processes, I felt the that it was important to earn the trust of others to have your teammates follow you and lead them, just like one of Blue’s core values. Because in order to make people listne, I had to genuinely listne first and create an environment where people can talk freely and show that your open to any novel ideas. I think keeping this in mind helped me propagate discussions in the processes that I just mentioned and we able to come up with new ideas, agreements, and have active discussions.

All these activities provided a solid justification for our team’s design, and if anyone had asked why certain things were designed in such a way, we were able to give them a sufficient engineering reason. So at the end of the summer of 2023, the team created a final CAD of suspension system along with documentation of the entire engineering process and its justification. The team just had to manufacture it at the time! With this experience I was able to lead the team by earning the trust of the teammates and also to self-identify the requirements for the design.

**Aerial Robotics**

This course required my ability to work Independently and as a team on rapid devleopment programs. This course was basically a competition course where student teams competed to see whose algorithm could go pop ballons with a drone in an obstacle field the fastest. our team developed an algorithm that would enable a drone to pop balloons in the fastest time, navigate through an obstacle field. In the process, I created a 6DOF drone simulation in MATLAB, developed a path-finding algorithm in C++ on Linux

I started the work by modeling the drone's dynamics in MATLAB. So we would see in a visualization tool in matlab that how the drone flies based on a trajectory that we give. The dynamics was accurately modled that it moved as we gave it an input trajectory. WE also implemented a PD controller to control its attitude and trajectory. We also emulated GNSS and IMU measurements. the state estiamtes, we didn't fully develop it ourselves, but our professor gave us the unscented kalamn filter modeled in MATLAB and we had figure out how to utilzie it and incorporate it into our simulation. With this course in addition to Sandia and Blue experience, I got a chance to be proficient at MATLAB and Simulink, again

After I built a complete 6DOF simulation, I then moved on to making a path finding algorithm in C++. I compared different methods, A\* Dijkstra’s and DFS and determined that A\* is the best. All this C++ developm,emnt was done on linux system and also utilized a game engine that was used to check the performance of our path finding algorithm. I got to use Ros visualization tool built into the game engine to check how well the algortih mfinds the optimal path to the ballons and the drone pops them. This a\* implementation helped me become more familiar with C++.

All this development was of course time limited in less than 3 month period. So teamwork was key to this competition and facilitating it was proficiency in git and communication. I did lots of work independently to accomplish my responsibilites for the team and studying the materials for this course. However, of course, teamwork still needed.

I led the team in using Git for collaboration, ensuring everyone understood version control, since no one in the team had the experience before Also my team communicated alot. I thought communciation will be key in solving technical issues i ndeveloping software and also for time managing, since all of us were busy with other works and job seeking and extracurrricular acitivities too, and again this devleopment had to be done in 3 months. so I suggessted we have designated times every week that we focus on working on this togetther. Being physically togehter helped us communicate much better than working remotely through zoom or email. WE would ask questions to each other right away or debug things together or discuss confusiong topics togther on the spot. I think this was essential in helping us develop a successful algorithm.

Our team successfully developed the algorithm and placed 2nd in the competition. I gained lots of relevant experiences and qualities for GNC position through this course. To mention those qualities, I gained an experience in developing and validating models and simulations through the complete 6DOF simulation for the drone. Gained an experience in C++ , MATLAB, Simulink ,.and Git. Communication is also a quality you guys are looking for and I couldn’t have succeeed without communication in this team project. Lastly, regards Kalman filter, I simply used a unscented Kalman filter that was made, I had to integrate into mysim for this project, but I have taken a stochastic estiamntion course, in which I got a chance to apply different klaman filters, unstntted and extended kalmana filters and also ran MC analysis to see how results come out and how well they estimate the states of asimple system.

SO I wanted to point out these qualities to show that I am a fit for this position, and I think the fact that we placed second aligns with Blue’s culture to deliver result. Despite our time constraints we were still able to work out the time and finished with a good result. so please let me know what you think, if there is anything else I need to talk about or need work on too.

**Samsung**

This was my internship last summer. The work I did there was not something I expected, but it was a chance for me to learn an entire new thing from the start and apply to work right away. In my life, I ve never coded before, I did not how to make websites. But during that internship I was tasked to learn Javascript, HTML, CSS SQL, VBA and all to create a website and excel tools that helps technicians report failures and record manufacturing data without error and quickly.So I learned all those and at the end I presented my work to engineers and especially the technicians. It was really rewarding again to see technicians appreciating my work and seeing my work at practice. I believe it is still functional in the semiconductor fab right now saving about 1 hour for each of the technicians every shift. I also gained confidence that I can learn new things and quickly adapt to it as well. I am sure there will be new knowledge that I need to learn working at Blue as well, so I want to show here that I have an open mind set to learn and will learn and apply my learnings in this GNC position. Also,while learning, I ran into numerous problems. It was daunting at first, but I struggled and produced a result that benefited the company at the end. So, this experience also shows my grit to overcome obstacles and make progress.

**Trane**

This was my first professional engineering experience. Among couple of things I was responsible for, most memorable was a component qualification project. I led the project, and the product had potential to save installation time for technicians, and I had to test its performance, check its standard compliance, and price to help the company decide whether to use this product or not. This type of product was not a typical component in HVAC, so I had many discussions with other professional engineers on how to test the performance and interpreting the standard. I also met with manyh technicians to receive their feedback reflect them on the methods of testing.I have also come up with a safety measure incase the component fails during tests. Experimented it and showed other engineers that it does perform properly as a safety mesure. I loved this project, it was really fun coming up with my own tests, interacting with actual users of the product, technicians, and learned alot from other engineers. It was great chance to show my written and verbal communication skills and was great leadership experience that I believe you guys are looking for this position.

**Senior Design Project**

The team I led was tasked with designing an impact test machine for equipments on naval ships. Because we were designing such a big system from the ground up in three months, the project was very timeline driven. Projects like these, I think it is important to have every member on the same page without much confusion. If the team is confused, it delays the time for it to do actual work on the project. In order to reduce such misunderstandings and miscommunications, at the end of every meeting, I clarified action items and their due dates for everyone, so everyone knew what to do and made progress on the project until the next meeting. Also, I stayed open minded as a team leader. I tried to embrace one of Blue’s culture”earn the trust of others” When a member thought that he could not finish his work in time, I discussed about it before the due date with the team and tried to see if we can distribute the work or reach out to our sponsor and the faculty to see if such extensive study was necessary given the time. At the end, we successfully met every single deadlines and produced a CAD model of the machine. So, With this senior design project, I helped my team deliver the deliverable on time and stayed open minded to run the project efficiently, which I believe are part