**Why APL**

I look for companies that can benefit our society the most because that is my professional goal. From my previous internship, I had a chance to lead a project to help HVAC technicians, and the magnitude of impact that I realized that I could have as an engineer as well as the appreciation that I received for helping them was so rewarding that I wanted to seek greater work that can benefit greater society. And I believe I have the opportunity to do so at APL. APL aims to provide the solutions to the most difficult problems for our nation and to benefit our society and improve the lives of people, and it has been doing that with its innovation in the first Satellite Navigation System, recent DART mission, and more. I hope to be part of those innovative projects by contributing to APL and also achieve my professional goal with APL.

**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, which I see as one of the technical areas this position is hiring for.

Specifically, this position is looking for a candidate with impactful experience through an internship. 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.

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 a great opportunity for me to demonstrate one of the qualification for this job, which is to thrive in a collaborative team environment that requires 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 internship at Samsung Austin Semiconductor, again as one of the qualification for this position, I demonstrated my ability to quickly contribute to projects that are new to me. I have leadership experience in Gudaloop, which is a student Hyperloop team and I took initiatives as a leader, and also my senior design project.

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 Discovery program, I would love to explore multiple technical areas and be a contribution to APL and to our nation with my passion to be a benefit to our nation.

**Discovery Program**

Technical Area they are hiring:

Dynamics and Controls

Qualification:

* demonstrated impact in at least one internship or project outside of classroom (Sandia and Trane)
* Demonstrated initiative that has enabled excellence in projects (Gudaloop)
* Thrive in collaborative team-strong comm and interpersonal skills ( Blue and Trane and Military)
* Engaged in multiple internships
* Have leadership experience (Gudadaloop and Senior Design Project)
* Ability to quickly contribute to projects in tech areas that are new to you (Samsung)

About APL

* Vacuum and thermal Chamber for Equipment testing
* Meteorite lab
* APL values:
  + Unquestionable integrity
  + Trusted service to the nation
  + World-class expertise
  + Game-changing impact
  + Collaborative and fulfilling environment
* Core purpose
  + Critical contributions to ciritical challenges
  + Goal: create ddefinin g innovations that ensure our nation’s preeminence in the 21st century
* Vision
  + Become a Treasured national resource
  + Be recognized for technical leadership
  + Provide decisive advanctage to the nation
  + Sharing knolwedge and technology that benefit our society and improve the lives of people throughout the world
* 4 sectors
  + Air and Missile defense
  + Force projection
  + Asymmetric operations
  + Space exploration
* Discovery Program
  + Ability to reach back to different teams sh worked on for their expertise
  + Put you into network of people
  + Patrick Cox (Discovery Program Group supervisor)
    - Allowed members “to permeate and cotnribute to diverse scientific and engineering domains”
  + APL puts emphasis on this program and how important it is to find new talents and have thosetalents develop wellrounded understanding of different disciplines. Allows them to communicate with different people technical disciplines
  + Three rotations 8 month each

**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

All in all, 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 making an impact in my team at Sandia by providing an option to improve the GNC software development process.

**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 gain an experience with simulations in MATLAB and Simulink. I became proficient in Gitlab. Lastly, I demonstrated communication and interpersonal skills that are required by this position, and why I think I could be a fit for GNC engineer here at Mach industries

**Guadaloop**

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 is designed this way. So, I took the initiative to scrap the entire design and begin from scratch. Of course, I discussed it with my teammates and explained to everyone why I thought we needed to start from scratch, and I was able to convince everyone to do so. Just like I had done in other design courses, I led the suspension team to take methodical approach 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. 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. They involved lots of communications. 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 take an initiative as a leader in the team to produce a better product, which I also see as another qualification for this position.