**Meet with Roland Harvey senior GNC engineer:**

1/17/2025

4th GNC engineer, team of four developing the GNC software stack from scratch. Everything running. Satelliute is in orbit. The pacing is very fast. You are expected to be assigned a task and be asble to complete withing 2-3days. Company is made up of people knows how to do their jobs. Experts! No middle management. Team leads are also doing technical work. There could be pressures.

How do you deal with problems. Decompose subproblems step by step. Divide and conquer

Started GNC in grad school. Involved in defense project aersopsace project, Orlando FL. Lockheed Martin. Worked with 6 DOF. Pulled into grad school. Specifically nonlinear and cooperative control. Worked on power system grid.

**Espace**

**BUILDING highly leo satellites comms for remote areas. Have connectivity everywhere. Services for that.** Different products. Have experience in satellite communication and navigation.

Process to hitring manager, team and panel interview and the CEO. Based in Saratoga for GNC team. Arlington team is an option. 200 employees. 3 yrs old. Looking to build and move at high speed. Competitive environment. Visions 1000 satellites and develop software to accommodate all of it. Partner to provide their solution to help farming solutions. Low level on water. Location in Uganda. Works in India and UK France and Germany.

**Startup environment: 40 ppl in Saratogam,CA**

**Collaborative. Former SpaceX ppl. Work with Brilliant people. Free lunch.** No matching contribution for 401K unlimited PTO. First 60 days, Onboarding lot of people at the same time. Everyone is new. Close knit people. Soul cycle.

**Why Espace?**

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. One way to do so is by contributing to the LEO space systems. Today, we see evermore usage of satellites in LEO especially the small ones in variety of sectors and industries. For earth observations, telecommunications, military applications and etc. So, contributing to LEO satellites is the greater work that I am looking for and benefits a greater society. I believe I can do so at E-space system. You guys aim to overcome the limits of LEO systems and improve the design, manufacturing and everything about LEO space. E-space also has a long vision to make the whole ecosystem at LEO more sustainable for generation. It shares the idea of harnessing the power of space to advance humanity and protect our planet. This aligns with my professional goal, so I would love to contribute to E-space’s mission and goal.

1. Fail-safe
2. 100% Demise
3. Small cross section
4. Low mass
5. No component Release
6. Entrain and de-orbit

**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 modeling Systems and Control.

Specifically, this position will be responsible for building and simulating MATLAB models, and 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 have strong communication skills.

In Academics, I have taken courses to consolidate my knowledge in classical control concepts and orbital mechanics. 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. Last semester I also took a GPS course where I got a chance to acquire and track a GPS signal using MATLAB.

Lastly, I could talk later about my internship at Samsung Austin Semiconductor, where I demonstrated my ability to quickly contribute to projects that are new to me. wait

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, I was a leader in it too.

So, I tried to match my experiences with the qualifications of a candidate that you guys are looking for, and I think I could be great fit for this position, I would love to be part of E-space and contribute to its effort to make spacecraft affordable and reliable.

**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 on the classified network compared to working in a regular network. My mentor and I saw an opportunity to improve this process.

I began developing a simulation in the unclassified network because not all the GNC work had to be done in the classified network, and 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 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 model and the vehicle itself. My previous experiences in MATLAB and Simulink helped me to understand the exact issues with the simulation and come up with solutions for them. Most of the issues arose from conditional statements implmeneted in the Simulink models that were used for other testing purposes. This exitsting model was originally developed for another program and purpose, so the majority of the work came from looking at the simulation results and observe the vehicle’s behavior. These results indicated the cause for the unexpected behavior , then I could go find that specific model and fix it.

By the end of the summer, I was able to 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 automating 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 sim very often, say if a sim takes 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 to run 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. We discussed two options to achieve this. Considering compatibility with the current development setup Powershell 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 sim and automated sim 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.

Also, the team has moved on to using GITLAB, and I am currently helping the team implement CICD work for the SIL in development.

**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 model, 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. I was introduced to SIL, HIL, and process-in-the-loop (PIL) for flight software development. This gave me an idea of what behavior the team expects during its flight. I could look at the sim results and distinguish some strange behaviors. So, 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. 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.

**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 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. 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 members to have your teammates follow you and lead them. I had to genuinely listen to them 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 for new ideas and consensus

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 was basically a competition where student teams competed to see whose algorithm could go pop ballons with a drone the fastest. our team developed an algorithm that would enable a drone navigate through an obstacle field. In the process, I created a 6DOF drone simulation in MATLAB, developed a path-finding algorithm in C++ .

I started the work by modeling the drone's dynamics in MATLAB. I would anaylze the forces acting on the drone, how should attitude of the drone be represented, so I could come up with ordinary differential equations to simulate Drone’s motion. They were accurately modeld that the drone moved as I intended at least in the simulation. I also implemented a PD controller to control its attitude and trajectory, and emulated GNSS and IMU measurements. One of the most difficult part was tuning the pd controller. There were 8 terms that needed to be tuned, and I was almost blindly tuning them. And at one point I got stuck on an steady state error for not using the correct gains. Some people could have asked why not used PID controller. But I was sure PD controller will work since I had a feedward terms to compensate for them. In addition, sometimes I wasn’t sure what exactly the issue was. It could have been my dynamics model or gnss model that could have been the issue. This is where modularizing the models came in handy, so that I was able to test each models individually and validate their correctnesss. Then I was able to pinpoint that it was the gains that caused the issue. In the end, I was able to find the right gain and implement the adequate contorller. With this course in addition to Sandia and Blue experience, I got an extensive experience in MATLAB and this really helped me become proficient in it which is one of the qualifications for this position. Also, this provided some Control experience that could be helpful.

After I built a complete 6DOF simulation, I then moved ovis

n 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 utilized a game engine that was used to check the performance of our path finding algorithm. 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. Through this course, 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 a quality you guys are looking for and I couldn’t have succeeed without communication in this team project.

SO I wanted to point out these qualities to show that I am a fit for this position. 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.

**GPS Course**

S: Last Semester, I took a GPS course that learned to process GPS signals through MATLAB.

T: I was given a raw signal that has all the incoming GPS signals. My task for the entire semester through this course, was to distinguish existing GPS signal embedded within the raw signal.

A: To do so, I learned how to generate the GOLD codes that corresponds to individual GPSs. I use that to correlate it with the raw signal, and the GPS, say GPS 1 or 30, with the high correlations with the raw signal meant that signals from those GPS exist. This process also determines the Doppler frequency and code start times those GPS signals that are necessary for GPS signal tracking. This process can be referred to as acquiring signals. Then, to continue to track those acquired signals. I learned to implement Phase lock loops which are essentially a typical control system loops that aims to produce the correct Doppler frequency that are important in determining position of the receiver.

All this process was studied on MATLAB. Lots of debugging was necessary. It was essential that I understood what was happening at each steps of the acquiring and tracking process. Especially at first, I really had trouble understanding the concept of correlating signals and using ffts. To get a better undersntading of them, I read lecture notes over and over again, saw lots of yourtube videos, went to almost every office hour by my professor. Again, I did unit testings since many of the signal processing tools I was devleopeing was modularized. I was able to debug many issuses by checking to see if the functions were producing the expected results, and this is how I could pinpoint the issues. and what helped me the most was discussing with classmates. We cross checked our understanding, asked questions to each other on concepts. And there were a few students who had experience with signal processing and so our discussion were very productive. This concept of signal processing was very very new to me, so it was daunting at first, but I wasn’t afraid to ask questions and then..

R: Finally by the end of the semester,I was able to complete the signal processing tool in MATLAB that acquires and tracks GPS signals for more than a minute. This really gave me insights into how specific GPS signals are distinguished amongst many other signals in the air and what entails in the processing side of acquiring the GPS signals.

**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 interpret the standard. I also met with manyh technicians to receive their feedbackand reflect them on the methods for testing the component.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,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**

This project was heavily customer focused and time driven project. The team I led was tasked with designing an impact test machine for equipments on naval ships. It was important that we met our customer’s need and deliver a product in a timely fashion, since we were designing such a big system from the ground up in three months.

To understand our customer’s needs and also deliver the results on time, communication was key. Projects like these, I think it is important to have every member and our customer be on the same page without much confusion. Do each members know exactly what tasks to do. Do we understand why they are build this product, where are they going to place this? What are other specifications? Does the customer understand what we are going to do? If the team is confused, it delays the time for it to do actual work on the project, and rather have to do the work again, or be stagnant in confusion. In order to reduce such misunderstandings and miscommunications, we held meetings regualraly with the customer and amongst our team to give each other chances to communicate as often as possible, and at the end of every meeting, I clarified action items and each members 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. This was very helpful when we were brainstorming ideas on how to raise the hammer for the system and bolt down the system and etc. Having multiple ideas, allowed us to consider different options we were able to compare each of them and be confident on our choices of our design. We can say this was a better idea because of this reason. Another way I stayed open minded or tried to be communicative was 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. Presented them to an audience.

So, With this senior design project, I helped my team deliver the deliverable on time, stayed open minded to run the project efficiently, and focused on our customer to meet their needs.

**Military-** In Korean military, there is quarterly, squad team qualificaition test that measures the team and the individuals’ abiltiy to operate missions. So physical tactical, and other miltiary basics a solider should know. On the team missions, for the first two quarters I took, we could not get that above 90 points that we needed for our company’s goal. those two first times, it jsut seemed like coordinating the entire squad was hard, the directors for the tests seemed just harsh for no reason. I wanted do something for us change our squad’s performance. So When I rose to the rank when I can start commanding other fellow soliders, I started discussion sessions within the squad before we took a test. we came up with the plans together, rehearse them. talking about each other’s movements, strategeis, tips they have heard over the months. This really solidfied our operation during the test and we did recieve that high performance grade that we needed. IT was really an accomplishment for us. From that I learned that it’s just a discussion and the planning together is what makes a huge differenece and gave us the result we wanted. All we needed to do was communicate among us. and I think Engineering is not much different from that. Communication is the key and discussions are wehre we find solutions in any engineering roles and projects. I have been working since to communciate and at the same time lead my team members through verbal communication in any engineering projects

**Samsung**

This was my internship two summers ago. 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. At the time, I had 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 if I join York space systems, so I want to show here that I have an open mind set to learn and will learn and apply my learnings for this position.

**How do you resolve conflicts?f**

One time in the Korean miliatry in 2019, I heard about an opporutnity to volunteer as a translator for FINA international swimming event. I thought at the time it was a good opproutnity for me to experience new cultures through people around the world, get some sort of revelation or insights like I had when I first came to the United States from Korea, also I thought at the time it could be a good resume builder. So They were looking for people who could speak english amongst the soliders who can volunteer. So I volunteered and asked my captain if I could get a permission to go. My captain was okay with it, but I also had to get a permission from the higher up battalion commander. He initially said no. I couldn’t directly get a chance to directly ask him due to rank in order, I was able to infer it and ask my captain why he refused to let me go. The primary reasons were that me going to big events will have uncessary risks by going out in the public. Say I could get involved in accidents and if anyhting bad happens it’s battalion’s responsibility for my accidents. He didn’t want to complicate things.

Although it was battalion commander’s command which is almost like a law in the base, I didn’t want to lose my one and only opportunity t obe a translator. I thought I will never have this chance again. I didn’t give up and I thought I should be given this oppruntiy to do it. There weren’t any big trainings coming up too, so I thought since now I understand why he said no, I should persuade him with my reasoning. So I decied to write an essay for him, listing reasons why I should be sent out to volunteer. I expalined the benefits of this chance, such as an oporutnity to expeirnece the people around the world that can expand my insights and views for the world , which is what happened to me when I moved to US from Korea. I also said I wanted to make my draft service meaningful and this opportunity will be one of the reasons why I had a great time despite it being a draft. I also emphasize the importance of enhancing my ability to communciate with people. Like now I need to be able to talk to anyone about my stories and listen to other people and this event is the perfect opprutnity for it.

With this letter, I asked my captain if I could go into his office directly and hand in this essay myself. I was granted the access and handed it over to him. I was nervouse but I was glad that I tried my best and still belived that I was doing the right thing for the right reasons. The next day I was granted the permission to volunteer from him. Which was great! In the end unfortunately, the volunteering positions were already all filled and couldn’t do it. But I was glad I could solve this conflict through communicating my reaosning to him. I learned that some disagreements could sometimes be solved by simple communications.