

Sean Lange
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February 27, 2024

Monterey Bay Aquarium Research Institute
7700 Sandholdt Rd
Moss Landing, CA 95039

Dear Dr. Matsumoto,

From an early age I've always had an interest in engineering. I joined my local 4H robotics group in elementary school, where I was first introduced to all the facets of engineering. I continued on to be a Teen leader of the group and then president of the entire 4H club. In my sophomore year of High School, a First Robotics Club started up, and I immediately joined. At that point I had a number of years using CAD software, so I was put in as design lead. My previous robotics experience had been salvaging, repurposing, and modifying existing things, but now I was creating things from scratch, and I encountered a now, very familiar problem: How do you make what you designed? This led me to take a CNC machining course at my local community college, concurrently with high school. I quickly developed a deeper interest and talent in the manufacturing domain. After the pandemic prevented our robotics team from competing for the next two years, I'd go on to lead the Team as president, and we got to our first ever competition. All the while I continued taking courses at the community college, completing all the CNC courses by the time I graduated High School. I developed a great rapport with the instructor, and I became the teacher's assistant in the department. I have worked there for the last two years while I completed my CNC programming certificate while pursuing a mechanical engineering degree.

I dedicate the bulk of my free time to hobby projects. I designed a spectrum analyzer which performs a FFT on audio waveforms like music and uses a laser galvanometer to project the transformed bins on a wall. At first, I used an Arduino, but I found the clock speed and ADC to be lacking, prompting me to switch to an STM32 Nucleo Development board. I used the hardware configurator to set up an ADC, and DMA streams, and the cubeIDE to program the desired behavior.

I grew up going to every aquarium I could and watching countless Deep Ocean documentaries, instilling a lifelong fascination with the ocean and its inhabitants. Also, from an engineering perspective, I find the challenges and constraints of marine engineering uniquely fascinating.

Recently, I decided to dive straight for the deep end, and make an ROV. The primary antagonist of hydrostatic pressure led me to hours of poring over the Parker O-rings manual. I

recently finalized my design for the pressure cannister and verified it with FEA to 1000m with a greater than 1.5 safety factor and have been machining parts for it. So far, I've made a flanged acrylic dome, aluminum endcap and O-ring flange. Designing parts that I make myself has given me an intimate knowledge of Design for Manufacturing, and a degree of practicality, which I previously lacked. The secondary challenge of getting adequate lighting onboard the ROV led me to learn PCB design, layout, and assembly. I designed and had boards manufactured, which I assembled and reflowed. The result was a fully functional 1500 lumen LED light, capable of PWM dimming.

I included this recount of my past few months' struggles because I think it reflects the best of my character as a student and an engineer. I treasure an interesting challenge, and I love to chase it into new and novel areas. I believe my focus on the mechanical domain coupled with my prior experience with the STM32, the coast profiling float project would be the best match for me. I'd deeply value the opportunity to exercise and develop my interests in subsea mechanical and electromechanical engineering under the mentorship of MBARI engineers.

Thank you,
Sean Lange

CERTIFICATES AWARDS AND HONORS

- **Chabot College Certificate of Achievement: Computer Numerical Control Programmer**
- **Autodesk Inventor Certified User**
- **Chabot Honors list**
- **Gene Haas Foundation Scholarship**
- **Society Of Manufacturing Engineers Education Foundation Scholarship**

PERSONAL PROJECTS

- Designed an ROV pressure vessel with an acrylic dome, in Autodesk inventor, and used FEA to verify a >1.5 Safety factor at 1000m. Made a Mastercam program and machined the aluminum O-ring flange, endcap, and acrylic dome.
- Developed a high power ROV LED light PCB, creating a schematic and board, and had the board manufactured. Then assembled and reflowed the board. It features a 1500 lumen max brightness and PWM dimming.
- Used a STM32 Nucleo development board to perform spectrum analysis of an audio signal from a 3.5mm jack and project the binned FFT waveform using a laser galvanometer.
- Modified the School's post processor to add peck tapping capabilities and change axis configurations. Additionally created a simulation model for the school's 5 axis and 3 axis CNC mill to attempt to catch and prevent any crashes.

POSITIONS

Machine Tool Technology Department Teacher's Assistant

Chabot College — July 2022 - Current

I lecture, perform demonstrations, and assist Students for the advanced and introductory CNC courses. I grade and verify student's submitted G-Code and Mastercam Programs, guide them through the setup, operation, and running of their programs.

POSITIONS — *continued*

First Robotics Club President

Castro Valley High School — August 2021 - May 2022

Oversaw getting our robotics team to competition for the first time ever and coordinated between teams: electrical, programmers, mechanical, and non-technical members, like grant writers and merchandise artists. I also retaining my role as lead designer, designing a complex and heavy linkage arm driven by linear actuators, which due to its weight, had to be perfectly dynamically balanced with a gas spring. I utilized dynamic simulations to get the optimal spring constant and placement so the linkage arm would be mobile. Additionally, I created a required elevator system to lift the entire 90lb robot, using lead screws I machined on a manual lathe.

PLTW Intro to Engineering Teacher's Assistant

Castro Valley High School — August 2021 - May 2022

Introduced students to foundational engineering concepts, especially CAD. Created sample projects, and lecture videos showing how to model and create prints of those sample parts.

EDUCATION AND SELECTED COURSEWORK

Chabot College – 4.0 GPA

January 2020 – Current

MATLAB — In progress:

Created a program to generate face gear 3D surface flank geometry.

SolidWorks:

Gained a high level of competence with the program, created complex assemblies, and technical prints utilizing GD&T.

PLC and Process Control:

Became highly proficient at creating ladder logic programs and industrial electronic schematics. Developed a familiarity with wiring and configuring industrial sensors. For the final project designed, programmed, and wired a Micro820 PLC based furnace heating control system with a human machine interface (HMI). (Portfolio [link](#))

Mastercam:

Created complex 5 axis mill and mill-turn programs, successfully modified post processors and control 2definitions.

EDUCATION AND SELECTED COURSEWORK — *continued*

Advanced CNC Mill:

Hand wrote GCode programs for a Haas VF3 and trunnion with 3+2 and simultaneous 4 axis operations. Further developed an understanding of manufacturing, especially automation strategies.

Advanced CNC Lathe:

Hand wrote GCode programs for a ST-10Y lathe including 4 axis live-Y operations.

Intro to CNC Mill:

Hand wrote 3 axis drilling, boring, tapping, and milling programs utilizing a broad range of techniques, and gaining an intimate understanding of manufacturing processes and limitations.

Las Positas College – 4.0 GPA

August 2022 – Current

Physics 2:

Gained an understanding of optics, and basic fluid dynamics. Successfully assembled and performed interferometry with a Michelson interferometer.

Chemistry:

Gained a broad level of chemistry knowledge, relevant subjects include electronegativity and its role in galvanic corrosion.

Castro Valley High School

September 2017 – June 2022

Engineering Design & Development:

Gained extensive experience running CO2 Laser Cutters and 3D Printers. Developed a low cost, low backlash cycloidal gearbox.

Sean Lange

Mechanical Engineering Student
and Teacher's Assistant

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[LinkedIn](#)

sean-lange.com

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EDUCATION

Chabot College – 4.0 GPA

January 2020 – Current

Las Positas College – 4.0 GPA

August 2022 – Current

Castro Valley High School

September 2017 – June 2022

CERTIFICATES AND AWARDS

- Chabot College CNC Programmer Certificate
- SMEEF Scholarship recipient
- Chabot Honors List
- Gene Haas Foundation Scholarship

WORK AND ACTIVITIES

Machine Tool Technology

Teacher's Assistant

Chabot College

July 2022 – Current

Robotics Club President

Castro Valley High School

August 2021 – May 2022

PLTW Engineering Teacher's Assistant

Castro Valley High School

August 2021 – May 2022

Robotics Club Design Lead

Castro Valley High School

August 2019 – May 2021

4-H Club President

Palomares 4-H Club, Castro Valley

August 2016 – June 2019

SKILLS

- CAD/CAM
- 5, 3+2, and 3 axis mill setup, programming, and operation
- 2 Axis and Live-Y Lathe setup, programming, and operation
- STEM teaching
- DFM analysis
- Technical drawings and GD&T
- Programming: Java, C, C++, MATLAB, GCode, LaTeX
- PCB layout and design
- FEA and CFD analysis
- PLC and HMI programming, operation, and debugging
- Generative design
- Basic interferometry
- CMM inspection
- Dynamic simulation

SOFTWARE

- Autodesk Inventor Certified
- Mastercam
- SolidWorks
- Autodesk Fusion 360, HSM, CFD, and Revit
- MATLAB and Octave
- Kicad
- LogixPro500
- Connected Components Workbench
- STM32CubeIDE and STM32CubeMX
- CIMCO Edit
- HAAS Control
- Microsoft and Google Office Suite

Feb. 26, 2024

Dear MBARI,

I am writing to offer my strongest support to Sean Lange as a candidate for the MBARI internship. Sean has been a student of mine for 6 semesters, taking both introductory and advanced CNC programming courses at Chabot College. Sean impressed me right away with both his initial depth of knowledge about modern manufacturing (Sean was already programming his high school's CNC router, and was well versed in 3D printing technology) as well as his passion for the field. Sean could always be relied on to ask challenging questions that displayed his forethought and ability to apply today's lessons to tomorrow's projects. Sean is also very tall, and both my lab technician and I were taken aback when he told us he was still in high school.

I teach a broad population at Chabot College. Most of my students already have some contact in the machining or manufacturing industry. Many of my students are currently working as machinists, CNC operators, or CNC programmers. I have found that there is a certain rhythm to the submission of their programs. Sean quickly identified himself as an outlier to that rhythm by regularly submitting programs faster than other student in any of my classes. The result was that I found myself looking for extra work for Sean to complete, and he found himself in my advanced class at the end of his first semester simply to try to satisfy his appetite for new material. Once Sean entered my advanced courses, he spent half of the course completing regular assignments and the other half of the course working on novel projects that moved past the regular curriculum. I'm not embarrassed to say that Sean is currently more my colleague than my student. I have more to teach him, but I'm quickly running out of tricks. Sean has already put his stamp on Chabot Machine Tool Technology classes by blazing new trails in Mastercam programming and generating projects that I will use to occupy any similarly inspired students of the future.

In addition to Sean's stellar academic performance here at Chabot (he completed an additional course at Chabot in PLCs and process control systems) he has also taken 4 years of PLTW and biotechnology while also running his high school's first robotics club. Frankly, I don't know where he finds the time.

Sean is an exceedingly bright and inspired student. I hope this letter does some good in advancing him along toward his educational and professional goals. Exceptional talent deserves exceptional support.

Sincerely,
Adam Hathaway
MTT Instructor
Chabot College
(256) 679-9712