Owen May

Portfolio

BS Mechanical Engineering
California Polytechnic State University

Table of Contents

Profile

About Me

Basics

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Academic

California Polytechnic State University

- BS Mechanical Engineering - Expected 2027
- CEA CAPA Education Abroad - Barcelona

Introduction

Hi, I'm Owen, an incoming third-year Mechanical Engineering student at Cal Poly, San Luis Obispo. I'm originally from Denver, Colorado, and came to Cal Poly as a Biomedical Engineering major before transitioning to Mechanical Engineering to explore broader design and technical opportunities.

My current focus lies in the aerospace field, where I'm especially interested in systems design, simulation, and advanced manufacturing. At the same time, I continue to explore applications in medicine and biomechanics, particularly where the two fields intersect.

This portfolio includes a range of hands-on projects, from clinical device prototypes to research in regenerative orthopedics and manufacturing simulation, each reflecting my drive to engineer solutions that are both precise and purposeful.

NICU CPAP Mask Redesign

EMPOWER Engineering Club / Edwards Lifesciences

Project Overview

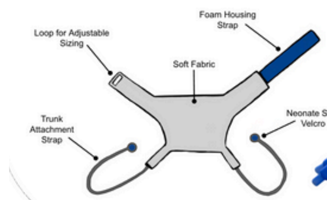
Redesigned a neonatal CPAP mask to improve airflow, comfort, and attachment reliability for preterm infants in the NICU. Collaborated with clinicians to develop a sleek, modular interface promoting consistent pressure delivery.

Problem Statement

The current NICU CPAP mask is bulky, unstable, and prone to turbulent flow, which reduces respiratory efficiency and causes skin breakdown in premature infants. Its poor fit and limited facial access hinder both patient comfort and clinical usability.

Design Goals

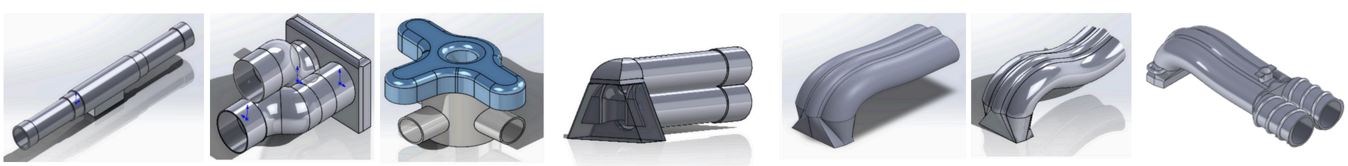
- Decrease flow disruption
- Increase access to patients head and face
- Decrease movement restriction in patients
- Ensure compatability with current devices



My Role

As Design Lead, I led all CAD modeling and design iterations of the CPAP interface, incorporating clinical feedback and engineering constraints to improve flow dynamics and patient usability.

Attachment Piece Iterations

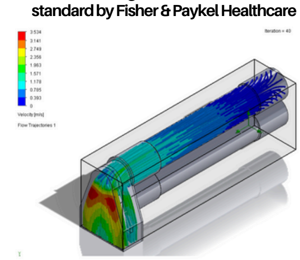


Initial Redesign **Final Redesign**

Outcome / Where We Are

- Reduced turbulent flow by 36.05% (FEA), promoting more consistent pressure delivery
- Enhanced stability, with over 60% reduction in rotational inertia across all axes
- Passed leakage testing, ensuring clinical reliability under NICU conditions
- Improved aerosol delivery with less particle buildup at the proximal end
- **Project extended** by the EMPOWER board, with increased funding for bench top validation, manufacturing and sterilization costs, as well as patent filing and IP protection

CFD of the original FlexiTrunk™, market standard by Fisher & Paykel Healthcare



Skills Used

- <u>CAD Modeling</u> – Multi-component assemblies designed in SolidWorks
- <u>CFD</u> – Airflow and pressure modeling SolidWorks Flow Simulation
- <u>Material Selection</u> – Selected biocompatible, FDA-cleared polymers for 3D printing in addition to sterilization compliance recognition
- <u>Physical Testing</u> – Designed and performed Mass Moment of Inertia, Range of Motion, Pulling Force, and Pressure Drop tests
- <u>Human Factors</u> – Improved usability and procedural access for NICU staff
- <u>IP-Conscious Documentation</u> – Created NDA-compliant visuals and patent-ready files
- <u>Technical Communication</u> – Presented at PDR and CDR reviews to multidisciplinary teams

Tendon PRP Stretch Assay Development

UC Health / CU Anschutz Medical Campus

Project Overview

Supported wet lab development of a mechanical stretch assay to study platlet-rich-plasma (PRP) effects on tendon progenitor cells (TPCs) from chronic tendinopathy patients. The assay modeled tendon loading in vitro and contributed to a larger effort to standardize PRP and develop IRB-ready clinical protocols.

Problem Statement

Chronic tendinopathy remains difficult to treat due to poor healing and limited regenerative options. While PRP is a promising biologic therapy, clinical outcomes are inconsistent due to variability in preparation and a lack of standardized testing platforms.

The Stretch Assay

A lab method used to mimic tendon strain and study how cells respond to PRP treatment.

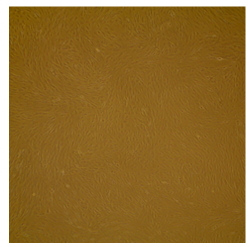
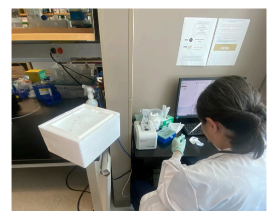


Image captured using the Zeiss LSM microscope. Tendon Progenitor Cells (TPCs) are visible across the field. Thousands of similar images were collected to analyze cell alignment and viability across varying PRP levels—providing foundational data for the abstract report and contributing to the published study.

Pub Med - https://pmc.ncbi.nlm.nih.gov/articles/PMC9596906/

Aims of the Study

- Create a stretch assay to model physiologic tendon loading in vitro
- Evaluate the effects of PRP on chronic TPC morphology and alignment
- Support validation of TPC viability under repeated strain
- Assist in standardizing chamber prep, seeding, and stretching protocols
- Contribute to IRB-ready workflow and future clinical application of PRP



Senior Scientist, Quianbin He, demonstrating the careful addition of PRP to a well

My Role

Supported all stages of the project, beginning with the organization and digitization of the human tendon tissue biobank to enable consistent sourcing of chronic tendinopathy samples. Contributed to the writing of the project proposal, which was submitted for IRB approval and used as the foundation for experimental planning. Participated in biweekly research meetings, where I presented updates and collaborated with the team to refine study design. Aided in the development of cell testing methods, including PRP preparation tracking, stretch exposure protocol, and cell viability assessment. Performed tendon progenitor cell (TPC) plating, microscopy-based morphology analysis, and data logging to evaluate regenerative effects of PRP formulations. Helped draft and finalize the research abstract, which was presented at the 6th Annual Orthopedic Research Symposium.

Outcome / Where We Are

Established a working in vitro platform to evaluate PRP effects on chronic tendon cells under mechanical load. Findings supported an IRB submission and were presented at the 6th Annual Orthopedic Research Symposium. Ongoing work includes extended PRP testing and gene expression analysis.

Skills Used

- Proposal & Abstract Writing – Contributed to IRB submission materials and symposium abstract
- Scientific Communication – Presented findings in biweekly meetings and research symposium
- Microscopy & Imaging – Captured and analyzed cell morphology using phase-contrast microscopy
- Cell Culture Techniques – Assisted with TPC isolation, plating, and maintenance under sterile conditions
- Biobank Management – Organized and digitized tendon tissue inventory for research use
- Assay Development – Helped create protocols to assess PRP effects under mechanical strain
- Data Documentation – Logged and tracked cell responses, PRP characteristics, and timepoints

Topographic Modeling & Earthwork Analysis

J&T Consulting

Project Overview

Performed detailed land analysis for Mangess Land Holdings, beginning with survey point data collection of surface elevations. Then drilling for clay, and bedrock layers. Using the data, developed 3D terrain models using AutoCAD, with alignments, profiles, and grading plans to guide site planning. Completed volume calculations, stage-storage modeling, and reservoir capacity estimates.

Problem Statement

Existing site models relied on outdated data, limiting accuracy for resource planning. The client needed a full redesign to maximize profitability while meeting regulatory compliance.

Outcome

Discovered over 4 million square yards of additional minable surface beyond initial estimates. All tracts are now scheduled to become long term water reservoir sites after completion.

Process Step-by-Step

1 - Survey Points & Data Collection

Gathered hundreds of survey points across multiple tracts, capturing elevation and location data needed for surface modeling. These points provided the raw dataset used in all subsequent analysis.

2 - Borings & Depth Logs

Analyzed boring logs and depth charts to distinguish surface, clay, and bedrock layers at each point. This testing was essential for mapping subsurface conditions and separating material types for accurate modeling.

3 - Surface Creation

Built digital terrain models from survey and boring data, generating separate surfaces for each material layer. These models established the foundation for grading and resource calculations.

4- Profiles & Alignments

Created profiles and alignments across the project site to evaluate elevation changes, identify constraints, and plan development pathways. This step allowed for clear visualization of terrain transitions.

5 - Grading & Volume Calculations

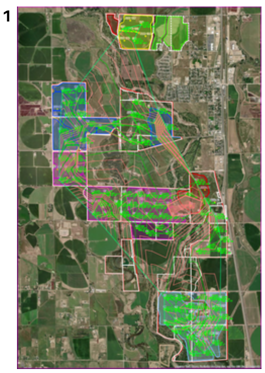
Performed grading analysis to simulate cut-and-fill operations, ensuring efficient land use. Calculated material volumes across tracts to quantify earthwork requirements and resource potential.

6 - Stage-Storage & Reservoir Estimates

Developed stage-storage curves and water capacity models to assess potential reservoir sites. These results provided critical insight into long-term water resource management and project feasibility.

BASEMAP (1) is comprehensive overview of the 13 different tracts of land. Zoomed in view (2) shows ground points from survey data that aid surface creation (3)

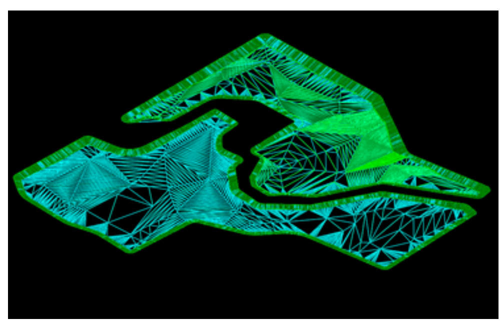
1



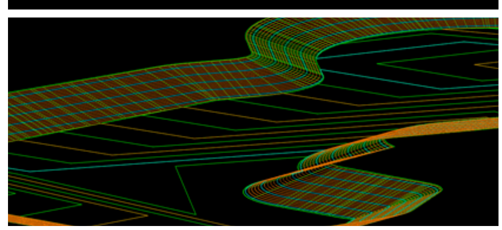
2

An example of a gradation to the bedrock surface. From LIDAR data (3), and a zoomed in view of the Northern tract (4)

3



4



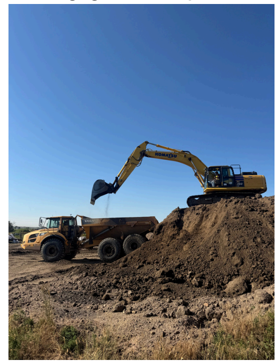
Skills Used

- AutoCAD Civil 3D – Learned over the course of 5 weeks, modeled terrain surfaces, profiles, and alignments for large-scale land development
- Geospatial Data Analysis – Processed survey points, boring logs, and depth charts to build accurate subsurface models
- Earthwork & Hydrology Calculations – Performed grading, volume analysis, and stage-storage modeling to estimate reservoir capacity
- Technical Communication – Delivered findings through clear visualizations, maps, and design reports for client decision-making

On-Site Structural Testing

J&T Consulting

Obtaining a gradation sample



Unit weight test

Project Overview

Conducted on-site material testing for active construction projects, coordinating with crews to obtain representative samples. Monitored field testing procedures and documented conditions, times, and results. Prepared formal reports with test data to support geotechnical evaluation, quality control, and verification of soil suitability for construction.

The Tests

- Porosity (Lab Collaboration) – Analyzed void ratio and permeability characteristics of soil and concrete
- Filtrate – Measured fluid loss with sealed pressure chamber and an attached air compressor
- Viscosity – Assessed flow characteristics of fluids, ensuring the same starting head pressure and volume
- Sand Content – Determined percentage of solids in slurry
- Unit Weight – Recorded density of fluids and backfill to ensure compliance with design specs
- Gradations - Determined particle size distribution of soil to identify proportions of gravel, sand, silt, and clay
- Slump Test – Evaluated workability and consistency of fresh concrete

Skills Used

- Quality Control - Ensured accuracy and reliability of field and lab soil test results
- Technical Reporting - Generated clear, detailed reports to support engineering evaluation and decision-making

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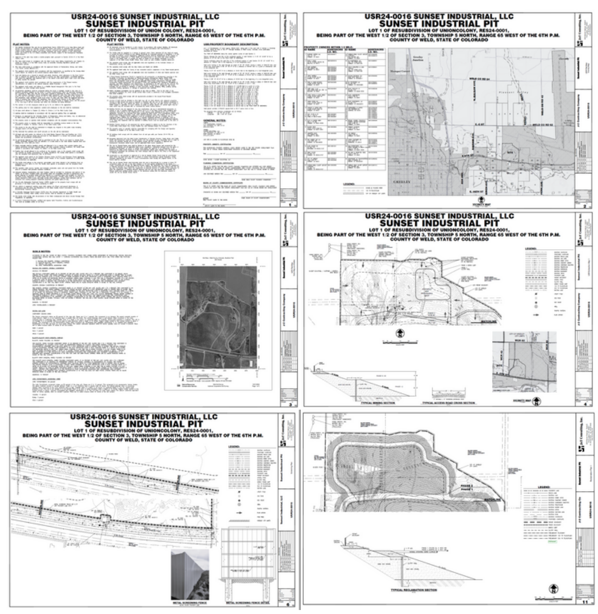
Drawings for the State Engineer

J&T Consulting

A few example pages, showing compliance standards, drawings, etc.



Project Overview

Completed three different drawing groups for the state engineering organization, each 12 pages long.

Problem Statement

All construction drawings and CAD plans required formal approval before implementation.

To achieve approval, each drawing had to be properly formatted, revised through multiple redline review cycles, and updated in response to engineer and client comments.

In addition, the drawings needed to comply with applicable codes, standards, and project specifications to ensure accuracy, constructibility, and regulatory approval.

Skills Used

- Guidelines Compliance - Reviewed and applied engineering codes, standards, and requirements to ensure drawings met approval criteria.

Adaptive Golf Glove

Empower Engineering Club / Callaway Golf

Project Overview

Designed an adaptive golf glove for individuals with limited grip strength, in collaboration with Callaway. The glove improves swing control through ergonomic support, assistive strapping, and targeted reinforcement—enabling more accessible and consistent play. The final design earned second place in a campus-wide engineering competition.

Problem Statement

Traditional golf gloves offer minimal support for players with hand weakness or impaired grip. Without a secure connection to the club, adaptive athletes struggle to maintain control, resulting in inconsistent shots and increased injury risk. A redesigned glove was needed to restore grip function without interfering with swing mechanics.

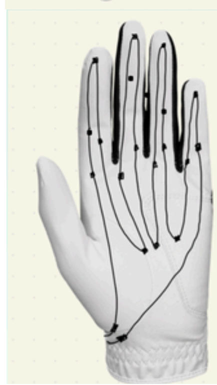
Market Analysis + Cost Breakdown

With over 25 million golfers in the US, many over age 50, grip strength issues are common, especially among those with arthritis. Current solutions like athletic tape, oversized grips, and personal training are often costly, temporary, or inaccessible.

The adaptive glove offers a targeted, lower-cost alternative. After sourcing components and prototyping, we found the total manufacturing cost to fall between \$30–40 per unit, including:

- Callaway Glove Base – \$15.99–21.99
- BOA Dial (IP1/Li2) – \$12.99–17.00
- Routing Materials – \$0.15 per part
- 3D-Printed Attachment – \$1.05 per part

This positions the glove as a scalable and affordable option in the adaptive golf equipment market.



BOA System Integration

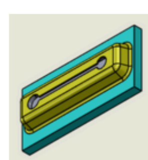
To create a glove that could support one-handed operation and adaptive grip assistance, we embedded a BOA cable system. A BOA is a mechanical dial-and-cable closure used in performance footwear and medical braces. Drawing inspiration from snowboard boots, hiking shoes, and wrist supports, we conducted market research on multiple BOA dial models. We selected the Li2 and IP1 dials for their compact form, smooth adjustability, and proven reliability in high-stress applications.

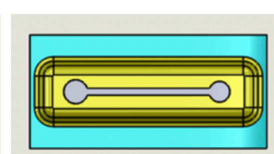
The Prototype - Initial Designs

- <u>BOA Cable System</u> – Guided lining along fingers to assist grip formation
- <u>Bag Attachment Module</u> – Custom-designed track and twist-lock mechanism for securing glove post-use
- <u>Reversible Dial Mount</u> – Symmetrical locking design for use by both left- and right-handed golfers

Attachment Unit

To accommodate users with limited or no hand function on one side, a custom bag-mounted attachment was designed unit that allows the BOA dial to be tightened using only one hand. The dial inserts into a 3D-printed locking track, where it can be secured and rotated using a twisting mechanism—similar to buckling a seatbelt. This feature ensures the glove remains fully operable for golfers with unilateral limb difference or weakness, expanding its usability across a wider range of adaptive athletes.





Skills Used

- <u>Human-Centered Engineering</u> – Designed for one-handed use and accessibility across varying grip strengths
- <u>Product Design</u> – Created adaptive grip system integrating BOA hardware with commercial glove base
- <u>Rapid Prototyping</u> – Developed glove modifications and 3D-printed attachment unit for functional testing
- <u>Team Collaboration</u> – Delivered a refined final product that placed 2nd overall in Cal Poly's campus-wide design competition

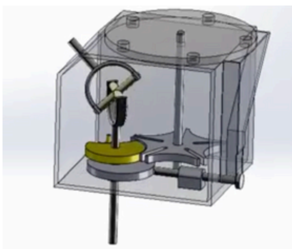
Class Projects

Cal Poly, San Luis Obispo

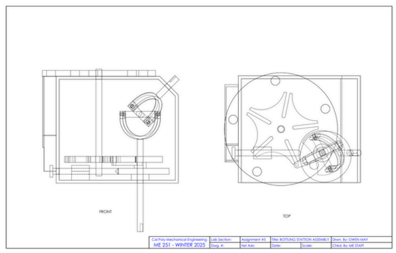
Bottle Wheel Assembly, Geneva Wheel Mechanism - ME 251: Intro to Detailed Design

SolidWorks

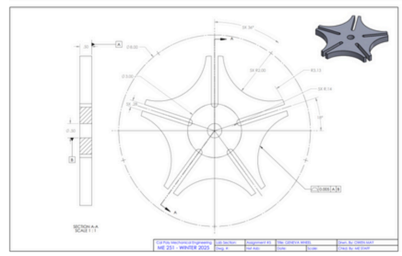
Constrained components using advanced SolidWorks mates, and applied a Motion Study to simulate intermittent indexing. Utilized advanced modeling features and a motion analysis tools to verify smooth operation and timing of the mechanism.



Motion study freeze frame



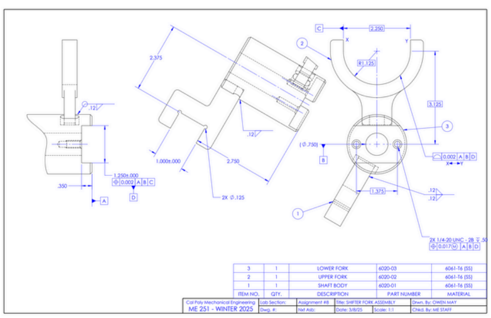
Assembly drawing



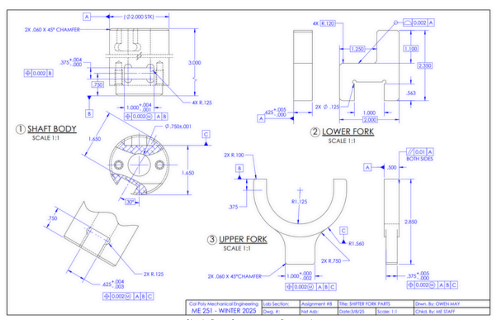
Geneva wheel drawing

Shifter Fork - ME 251: Intro to Detailed Design

SolidWorks



Bill of materials and assembly drawing



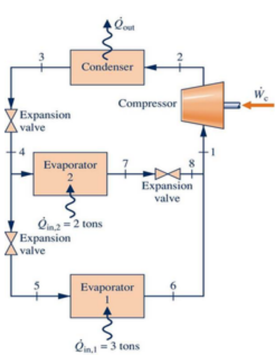
Individual parts drawing

Incorporated full dimensioning and geometric tolerancing, bill of materials, and callouts to industry standards. Ensured clarity and manufacturability by applying proper drawing conventions, annotations, and revision control.

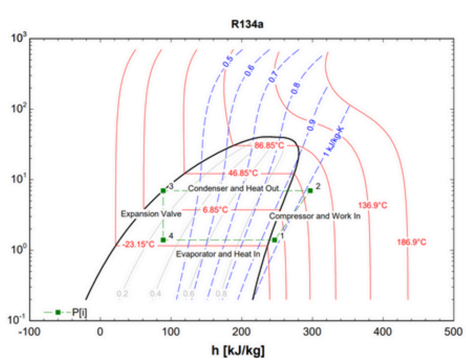
Refrigeration System Analysis - ME 303: Thermodynamics II

Engineering Equation Solver (EES)

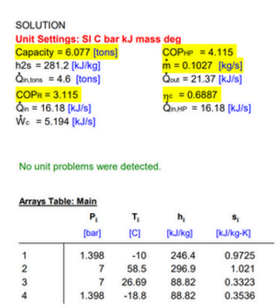
- Cycle Modeling - Programmed refrigeration cycles in EES to analyze thermodynamic performance.
- Refrigerant Selection - Chose working fluids and calculated state properties, heat transfer rates, and efficiencies.
- Performance Evaluation - Determined coefficient of performance (COP) under varying operating conditions.
- Visualization - Generated P–h and T–s diagrams to illustrate cycle behavior and system performance.



An example system



A labeled p-h diagram from a refrigerant selection case study



SOLUTION

Unit Settings: SI C bar kJ mass deg

Capacity = 6.077 [tons]

$h2s$ = 281.2 [kJ/kg]

$\dot{Q}_{in,tons}$ = 4.6 [tons]

COP_R = 3.115

$\dot{Q}_{in}$ = 16.18 [kJ/s]

$\dot{W}_c$ = 5.194 [kJ/s]

COP_{HP} = 4.115

$\dot{m}$ = 0.1027 [kg/s]

$\dot{Q}_{out}$ = 21.37 [kJ/s]

η_c = 0.6887

$\dot{Q}_{in,HP}$ = 16.18 [kJ/s]

No unit problems were detected.

Arrays Table: Main

	P_i [bar]	T_i [C]	h_i [kJ/kg]	s_i [kJ/kg-K]
1	1.398	-10	246.4	0.9725
2	7	58.5	296.9	1.021
3	7	26.69	88.82	0.3323
4	1.398	-18.8	88.82	0.3536

A solution window from the same case study