

# Project Description and Technical Deliverables

**Project:** Instrumented glute ham developer

**Sponsor:** San Francisco 49ers

**Technical focus:** Mechanical design

**Class:** 2.98 / 2.980: Sports Technology: Engineering & Innovation

**Semester:** Spring 2020

## PROJECT DESCRIPTION

The most common injury in football is a hamstring strain. To mitigate the risk of these strains, glute ham exercises play a pivotal role in athlete training. The San Francisco 49ers currently have two machines that they use for these exercises. The first is the UCS Glute-Ham Machine:

<https://www.ucsspirit.com/strength-speed/product-detail.cfm/category/Ucs-Signature-Equipment/product/Gluteham-Machine>

This machine has a number of advantages including adjustability of angle and position of the footpad. However the UCS machine does not measure the forces produced by the athlete. The second machine is the Nordbord testing system.

<https://www.valdperformance.com/nordbord-hamstring-testing-system/>

This machine does not have the adjustability of the UCS apparatus, but it is able to measure hamstring strength and imbalance.

Your challenge this semester is to combine the best of both systems into a single apparatus.

## DELIVERABLES

**Team deliverable 1 (due 2/20):**

**NOTE: FIRST TEAM AND INDIVIDUAL DELIVERABLE ARE SWAPPED FOR THIS PROJECT, AND**

Articulate the requirements of the desired apparatus. Include functional requirements, geometric requirements, and cost constraints. Include quantitative constraints (e.g. range of forces and precision required in your force measurements). For this deliverable, you will need to work closely with your sponsor to understand their needs. Prioritize your list of requirements (e.g. identify which are non-negotiable, which are “would be nice to have,” and which are in between).

For this and all other **team** technical deliverables, you should turn in only **one** assignment for the whole team.

**Individual deliverable (due 3/12):** Given the list of requirements in your previous deliverable:

- Brainstorm and sketch at least three design concepts.
- Choose your best design and estimate the magnitude of the maximum stress your machine will need to withstand and where it will occur.
- Make a list of components required for your design (including prices, manufacturer, and part model number). This will not be your final list of parts but it will give you some idea of which components are readily available and which you will need to design yourself.

For **this deliverable only**, each member of the team should hand in their own analysis and visualizations (although we encourage you to work closely with your teammates to share ideas and discuss the project).

**Team deliverable 2 (due 4/16):** As a team, down-select and identify the design you will use moving forward. Produce a small-scale model of the most critical module that you will need to incorporate into your apparatus. Demonstrate the feasibility of your design using your scaled model along with relevant quantitative estimates (e.g. if your machine breaks while in use, you run the risk of injuring the athlete; perform the relevant tests and calculations to ensure that your design can be used safely).

**Team deliverable 3 (due 5/12):** Demonstrate a functional prototype of your apparatus.

## RESOURCES

**Sponsor Contact:** Ben Peterson (Ben.Peterson@49ers.com)

**Primary Mentor:** TBD

**IDC Shop Manager:** Chris Haynes (haynesc@mit.edu)

**Google Tools Advisor:** Ramzi BenSaid (rsbensaid@gmail.com)