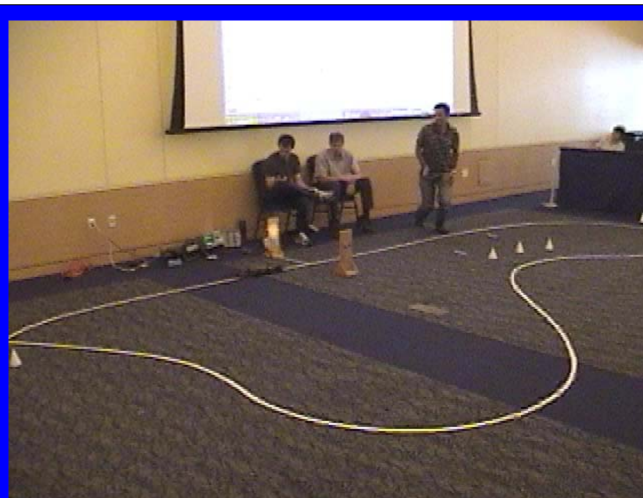
## Natcar Project Introduction

- Instructor: Prof. Spencer
- TAs: Mark Simonian & Vladimir Glavtchev
- Project description
- EEC195 Course overview
- Requirements
- Grading
- Laboratory and Course Rules
- Teamwork
- Documentation
- Debugging & problem solving guidelines

## Project Description

- The objective:
  - Design, build and race an autonomous race car
- The course
  - Defined by white tape with a wire underneath
  - The wire has a 100 $mA_{RMS}$ 75 kHz sinusoidal current
  - Course has crossings and 6” steps - see web for details www.ece.ucdavis.edu/natcar/
- The car
  - You are given a car with motor, servo and chassis
  - You add the sensing, steering and motor control
  - Everything must run from one 7.2 V NiCd battery
  - See web for details

## What Does the Race Look Like?



More videos are available on the course website!

## Project Description

- A MAJOR difference between this class and others is that you are expected to do the work on your own (like a real engineer). The TAs and instructor will ask and answer questions to help you along, but we won't show you how to do it.
  - You are expected to go research any topic that you need to know more about
  - You are expected to keep careful notes in your lab notebooks
  - You are expected to figure out for yourself how to do most of the design (we will help, but we won't do it for you)

## EEC195 Course Overview

- Two-quarter long class; you must commit!
- The project is done, and partially graded, as a team.
- Schedule:
  - fall; lectures, labs, homework, build basic car, exam
  - winter; work on car, bi-weekly demonstrations, race, written reports
- The final internal race will be held during the scheduled winter final exam time (your performance at that time is what is used in grading the project). Attendance at that race is mandatory.
- There is an optional competition with other schools on Friday, May 22. We may not be able to have everyone race. If not, the internal race results will decide who goes.

## Class Schedule

- See the course website and the syllabus for a detailed schedule
- You will have a key to the lab (get a form from Destiny and have me sign it) and may use it anytime the building is open, but be careful. You should NOT work alone if you are using any dangerous tools.
- You *must* check the course website and your email regularly for important announcements

## Requirements

- You will need to be responsible to your team and to the instructor: check website and reply as necessary, set and keep schedules. Communicate!
- You will probably want to buy some tools if you don't have them. If this is a hardship, there are tools available to use.
- You will need to be at the internal race at the end of winter. There will also be special practice sessions prior to the race (on evenings and Saturdays) that you will probably want to attend.

## Requirements continued:

- You will have to spend some money on miscellaneous parts and supplies; the total spent is typically less than $100 per team, but can be much more - it depends on you.
- We provide the most common parts and components. Many companies will provide you with free "samples" if you tell them you are students working on a project (talk to an applications engineer if at all possible).
- You need to go to the ECE office for a form to get a key to the room and I need to sign the form.

## Requirements continued:

- We need to define the teams early in the fall quarter. Let me know today if you have any preference.
- We much prefer three-person teams, but will allow four if:
  - We have to given the number of people in the class
  - Your team wants to pursue a more complex design
- You may NOT do the project alone.
- We try to balance the teams in terms of the experience and backgrounds of the individuals.

## Grading

- Your grade will be based on:
  - 10% Homework & laboratory projects
  - 20% Written examination
  - 10% Meeting deadlines
  - 15% Written report
  - 45% Performance of your car (weighted by your contribution to the team - determined at the in-house final race, although we may *raise* a grade if you do much better in the final competition in May, but you have to tell Prof. Spencer you plan on running)

## Laboratory and Course Rules

- Keep the lab and parts cabinets neat and clean! (you don’t have a bench that is “yours”).
- Keep the lab and parts cabinet LOCKED! Report unauthorized access. Micromouse students may use the room for overflow, but NOT the cabinets.
- No food in the lab.
- Don’t work in the lab alone if you use any dangerous tools.
- Report problems (e.g., low on parts) to TA.
- Check the course website often (lock combinations may change and you will be notified there)
- Be responsible to your teammates.

## Laboratory Safety

- Soldering irons:
  - put them away cold
  - avoid breathing the fumes
  - don’t hold items by hand unless they are thermally insulated
- Drill press (and hand drill):
  - wear safety goggles or glasses at all times
  - securely clamp items being drilled
  - make sure the bits are sharp and secure
  - avoid loose clothing and jewelry
- Hacksaw, knives, etc.:
  - wear safety goggles or glasses at all times
  - securely clamp items being cut

## Teamwork

- Working in a team can be very hard, but it is often necessary
  - many engineering jobs are simply too complex for one person to do
  - the job can be accomplished faster with more than one person helping
  - working with another person can be more enjoyable and can help you avoid many mistakes
- Working successfully on a team requires that you
  - be honest about what you can do and have done
  - be responsible; do <u>what</u> you promise, <u>when</u> you promise
  - work hard to understand the other point of view; it may be *better* than yours! Or it may lead to a better solution
  - encourage and help your teammates

## Documentation

- Documentation *is* important!
  - you will *not* remember the details in a few weeks (or days), so without good documentation, you *will* repeat yourself
  - others can't evaluate, use or add to what you have done if it isn't documented well
  - securing patents and protecting yourself from lawsuits requires good documentation
- It all starts with your lab notebook. USE IT
  - never skip pages
  - don't worry too much about neatness, but *be complete*
  - get in the habit of writing down everything!
  - we will grade your labs by looking in your notebook

## Problem Solving Guidelines

- When stuck on a problem, Don’t just sit there, do *something*!
  - Check your algebra and arithmetic
  - Check your assumptions (it *can’t* be the … )
  - Check your data - are they reliable? reasonable? can you get them another way?
  - Check your models - are they good enough?
  - Rephrase the question
  - Try a different approach
  - Explain the problem to someone else
  - Try a simpler, but similar, example

## Debugging

- Some simple rules:
  - NEVER debug a circuit without a schematic
  - ALWAYS know what each node voltage should be
  - check DC levels first (use a scope to be sure DC *is* DC)
  - check the scope voltage range and time scale to avoid being fooled
  - NEVER change more than one thing at a time
  - keep a careful record of your measurements & changes
- If your sure the problem "can't possibly be that…", it most likely is! Watch your assumptions.

## Ultimate Goal for the UCD Team

# WIN THE RACE!

Beat Berkeley

Beat UCLA

Beat Stanford

Beat Sac State

Beat San Jose State

Win money!

Get a job