Projects:

<u>Lab transition project:</u>

Break-up groups during the semester so that bad group dynamics are not formed. Write names on folders and place 3, randomly, on each table to select groups.

Labs could have less and less scaffolding per lab as the semester goes on.

Could the last lab be more like a guided project lab. IE. Shoot for your grade: Have them do more error analysis on the outcome. Then add some additional questions to pursue over the next week. The next week they pursue these questions (create an experiment, analyze results)

For the final projects:

Lab 3: Presented with the projects "menu"
Lab 4: Pick your project

Week 0: A chance to play with some initial equipment for the project. Provide them with some things to measure. They create an outline of their experimental procedure. Avoid taking tons of blind data taking. Take a little data and check results. Look for quick initial trends. Students often waste time taking data when they should be thinki9ng about the theory

Week 1: Students turn in their outline for approval and graded. Modify or assemble your equipment to meet your needs.

Week 2: Continue with outline or make tweeks.

Week 3: Check-in point. (make appointments for conference) Show results. Show at least one plot! Is the group working well? Have a model/Matlab code. Graded???

Week 4,5: Groups are on their own.

- Inertial Navigation: The app was flaky. Be careful about using a good app. Maybe use only an accelerometer. Use a fourier bandpass filter, Large accelerations work best. Try using physical constraints like start and stop from zero speed to make average acceleration zero.
- Solar System Model: Binary star system, provide simple code (Euler's method) to start with, rocket to Mars,
- Wilber-Force pendulum.

- Modeling a surface: experimental data – ball on incline?
- Waterslide – NEVER AGAIN!
- Ball in channel: good, but needs to go further.
- Coupled Oscillators: pendulums, vertical springs worked well. Should include FFT in the project and force analysis.
- Coffee Filters: riddled with experimental problems. Difficult experimentally.
- Parametric oscillator: challenging problem. Shouldn't be a problem for good students.
- Sphere on a turntable: Do not show derivations in presentations!!!!
- Ski Jump: not our favorite.
- Basketball: interesting. Basketball modeled as a spring and rotating object..
- Physics of the Frisbee: good, but difficult to model. Rotation, lift, drag, etc…
- Pick your own: needs to be picked well in advance and be well thought out.
- Chain pulse: good, but needs more.
- Driven harmonic oscillator: amount of damping and resonance curves, torque of motor to get forces.
- Damped harmonic oscillator: amount of damping and type of damping.
- Physical pendulum: take quick data and improve pendulum. Could be a different shape.

Provided Materials: