Final Project: Overview

Your Strobe Lab Project

A major component of your activity this semester your Strobe Lab Project. This is your opportunity to select a real world problem to work on, to figure out how to solve that problem, to conceive and implement experiments that will yield the data necessary to formulate a rational solution, and—through the project report—to communicate what the problem was, what you did, how you did it, and what your results were. You will demonstrate that your group knows how to select a project, devise a set up, trouble-shoot and debug, and execute a substantive lab project with minimal guidance from the course staff.

What are the ground rules?

The final project must be a *substantive* project that usually involves some form of *imaging*. Notice that the imaging need not be of high-speed phenomena. Time-lapse, for example, is quite acceptable, as are many standard photographic techniques.

By *substantive,* we are looking for a *quantitative* effort, one that requires laboratory measurements to gather data. The focus can be on the data gathered, or developing the process that allows data to be gathered.

Your project topic must be cleared through the course staff to insure that we agree that it is substantive. Topics tend to be complex—try to distill yours down to the minimum components that satisfy the above criteria. Then, time permitting, you can add back complexity.

What is the time-line and deliverables?

The *Mark I* work is a proof-of-concept, or feasibility study. The goal is to take two weeks to show that you can carry out the key piece of the experiment. For example, suppose your project is to study the flow of people through Lobby 7 as classes change. Then, for Mark I, you would like to capturing a small set of images (perhaps a short video sequence) and demonstrate that you can track how people moved across the Lobby, including where they entered the space and where they leaved the space.

Mark I

- Lab work over two weeks (the two weeks after break, Mar. 31—Apr. 4, Apr. 7—11)
- Mark I report has written and oral component, both are group efforts. Oral component is due Apr. 14 (Strobe 1-3) & Apr. 16 (Strobe 4-6), written component is due Fri. Apr. 18

Final Project

- Lab work begins week of April 14
- Written component of final report (group effort) is due the last day of classes (May. 15), but there is no penalty if it is up to 24 hours late.
- Oral component of final report (group effort) presented during last 2 lectures
  Strobe 1-3 present on Apr. 12 & Strobe 4-6 on Apr. 14.

What do we expect from you?

At the end of the term you will turn in your project report. The report will usually contain two or more significant *graphs* of information you collected as well as sketches of your experimental set-ups, and an indication of the equipment used. This information will make it possible for any competent engineer to reproduce your work and achieve exactly the same results you did. There will be a class presentation of your results, including graphs and photographs as appropriate. Grades are based upon demonstration of having done good work, not upon pounds of paper.

Let's examine a couple of examples.

A. You decide that you wish to build a system that automatically performs the fine adjustment of circuit boards to produce a given spectral output from an electronic flash. This might consist of a system, possibly computer-driven, that fires the flash unit, measures the spectral output, recommends changes in circuit components that will adjust the current density appropriately, and then iterates the procedure.

   Would a great difference between the desired and actual spectral output guarantee that you flunk the project? **Not at all!** We are far more concerned with the quality of approach and technique employed in your practical work than whether it works or fails in the first breadboard version. Think, experiment, observe, think, experiment, observe, ... is the typical iteration for most good product ideas. And remember that most good products bear little resemblance to the initial model produced by an inventor.

B. How about the problem which at first appears to be entirely qualitative in nature and therefore is not a suitable selection by the above rules? An example might be "Photography of Bullets Penetrating Cardboard." Bang, Bang - just another batch of pretty pictures! But, rethink the topic slightly. However, our synchronizer is not very precise in setting the position of the bullet when the photo is taken. How about working up a "precision synchronizer" to take the picture. A series of tests experimentally determines, say the (graphable) "precision as a function of bullet velocity." The goal of the experiment is now slightly be altered to determine the velocity of cardboard particles as a function of bullet position during penetration. Note that this requires additionally an accurate determination of DISTANCES as well! Most qualitative projects have the necessary quantitative supporting elements, and the "pretty pictures" still will results, but as the final application.

Here are a variety of topic titles from past years which may serve to stimulate your thinking. Do not feel in any way LIMITED -- they are intended only to be starting points. Discuss with me and/or the TA what you want to do, so that we agree that your work will be substantive and mutually acceptable.

Some Past Projects

- Stereo Time-Lapse Imaging
- HSV studies of gymnastics
- Methods for Imaging Flying Insects
- Precision timing for bullet photography.
- Creating *Matrix*-Like Special Effects
- Properties of Non-Newtonian Fluids
- Dynamics of an Eye-Blink
- Shooting Pencils through Plywood
- Crashing Corks at Mach 0.5
- Photographing the Satellites
- Rock Fracture Videography
- Animating Stroboscopy wheels
- Three-D Multiflash photography
- Precision timing for Bullet Photographs
- The Laser Velocimeter
- Optical Triggering and Compression Studies
- Momentum and Friction of a Pool Table
- Measuring the Velocity of a Bullet using a Ballistic Pendulum
- Using Silhouette Photography to Measure the Speed of Water Waves
- Electronic Panoramic View
- Measuring the Velocity of Cracks in Glass
- Muzzle Velocity and Impact Force of a Paintball Charge
- Turn-On Characteristics of a Light Bulb
- The Curve Ball from a Batter's Perspective
- How a BB Breaks a Window
- Effect of Shape on Energy Transfer for an Object Dropped into a Fluid
- Effect of Viscosity on Splash Characteristics
- Heat Flow Analysis Using Schlieren

Some project ideas:

1) Capture hard throws, catches, or blocks of a frisbee as in ultimate frisbee. Prof. Seth Teller writes, "In ordinary photos I have seen significant deformation of the frisbee itself, and of the thrower's hand, wrist and forearm during throwing, and of the hand during catching. High-speed might capture provide some measurable quantities about release speed, impulse force imparted to the hand, etc.

2) Aerial photography from kites

3) High-speed studies of athletic events (e.g., archery, golf, football, baseball)

4) Use high-speed video to create instructional videos for 8.01T

5) Water drops can be made to flow up hill on an inclined ratcheted surface.
http://www.uoregon.edu/~linke/dropletmovies/

Does the drop move at a reproducible rate? Does it vary with the liquid's density, viscosity, or specific heat?