Project Planning in Strobe Lab

State your *Objective*

The Objective is broad statement that describe what you intend to accomplish. The verbs may refer to internal, non-observable states or processes (e.g., to learn, to understand, to develop). Thus, the Objective is not necessarily measurable, and we may need to translate it into Deliverables. You may have more than one Objective.

Define the *Deliverables* that show you have achieved your *Objective*

Unlike Objectives, Deliverables are necessarily measurable. The verbs are observables (to measure, to obtain, to identify). You are saying that if, at the end of the project, you can present your Deliverables , you have achieved your Objective to your satisfaction.

Describe a *Method* that will let you obtain the *Deliverables*

The statement of the method is specific enough to give a reader a clear understanding of how you intend to process. It is not a careful step-by-step description of the procedure you will follow in the lab. It is, however, specific enough to allow you to identify the equipment, materials, and supplies you will need to obtain. Block diagrams of the process you are considering can help here.

Propose a *Setup* that will let you implement the *Method*

The setup takes the process to the next level of detail. At this level, sketches are often quite helpful. You may need to make calculations to determine some parameters (e.g., focal length of lens to use). You may need to estimate (or make an educated guess) other parameters. From the setup you can list the materials, equipment, and supplies need for the experiment.

Flag the items on your list that are not standard in the laboratory, you will need to identify who is to buy/build/borrow these items, and their due dates.

Agree on a *Timeline* and *Task List* for creating the *Set-up* and doing the work to achieve the *Objectives*

The Timeline lists the milestones that must be accomplished to complete the project, and when each will be completed. The Task List is a listing of what each person is responsible for doing, and when it must be done by. The two can be combined, or separate.

To be effective everyone must be committed to meeting the milestones as set down. Any slipping of milestones is a cause for concern--particularly early milestones! It is easy to let an early milestone slip because of “more pressing” deadlines, but this is a recipe for disaster.

Example of Project Planning in Strobe Lab

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Example Objectives

1. To understand the processes that occurs when a drop of milk splashes on a plate
2. To learn if the composition of the milk plays a significant role to this process

Define the *Deliverables* that show you have achieved your *Objective*

Unlike Objectives, Deliverables are necessarily measurable. The verbs are observables (to measure, to obtain, to identify). You are saying that if, at the end of the project, you can present your Deliverables , you have achieved your Objective to your satisfaction.

Example Deliverables:
A paper report that

1) Itemizes the distinct phases that we identify as occurring in the process of the splash of whole milk. These stages might be
   a) Drop impacting the plate
   b) Crown rising
   c) Crown falling
   d) Puddle of milk rippling
2) States the typical time it takes each phase to occur
3) Presents clear, well-exposed and well-composed images characterizing each stage of the process of the milk-splash.
4) Repeats 1) through 3) for skim milk and heavy cream.

Describe a *Method* that will let you obtain the *Deliverables*

The statement of the method is specific enough to give a reader a clear understanding of how you intend to process. It is not a careful step-by-step description of the procedure you will follow in the lab. It is, however, specific enough to allow you to identify the equipment, materials, and supplies you will need to obtain.

Example Method
Set up a milk-dropping apparatus so that the drops strike a plate within the field of view of a camera. Turn out the room lights and open the camera shutter. Let the falling drops of milk interrupt a beam-break system, which in turns starts a delay timer. When the preset delay has elapsed, the timer triggers a strobe to flash. Once the strobe has fired, close the camera shutter. Repeat with varying delays until all stages of the process have been observed and imaged, and the duration of each stage measured.

Propose a *Setup* that will let you implement the *Method*

The setup takes the process to the next level of detail. At this level, sketches are often quite helpful. You may need to make calculations to determine some parameters (e.g., focal length of lens to use). You may need to estimate (or make an educated guess) other parameters. From the setup you can list the materials, equipment, and supplies need for the experiment.

Flag the items on your list that are not standard in the laboratory, you will need to identify who is to buy/build/borrow these items, and their due dates.

Example Setup

Figure 1 shows most items required and their schematic arrangement. The actual geometry follows. The funnel will be 300 mm above the plate, with the beam-break about 100 mm above the plate. The camera will be 210 mm away from the splash [1], and the strobe 2 feet from the splash [2]. The strobe will be about 30 degrees to one side of the camera to cast a shadow back on to one side of the splash.

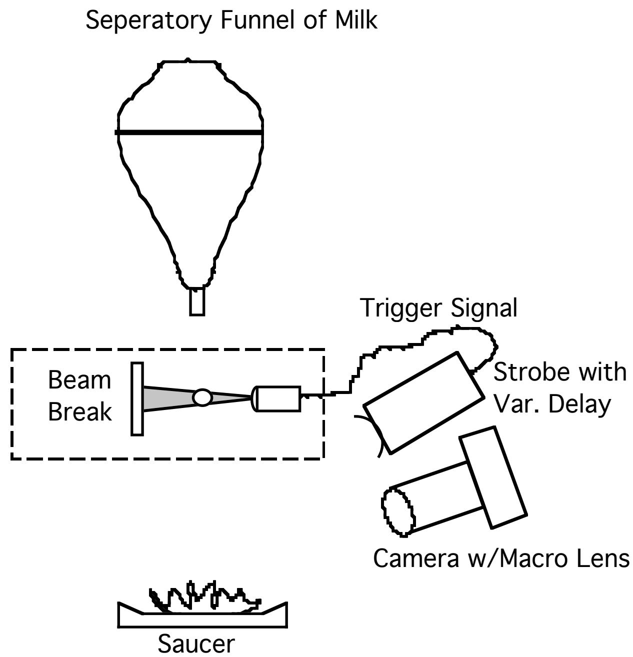

Figure 1. Proposed setup for imaging milkdrop

<u>Equipment, Materials, and Supplies needed (Bulleted items need attention)</u>

Funnel (with valve) to generate milk drops
Plate for drops to hit - color must give good contrast against milk!
Bowl or dish to catch spilt milk
Beam-break apparatus
Delay timer
Photocell and oscilloscope (to determine delay between beam-break and flash)
Cables to connect
- Beam-break to delay timer (specify connectors)
- Beam-break to oscilloscope specify connectors)
- Delay timer to strobe (Need to specify connectors))
- Photocell to o'scope (BNC Female to BNC Female

Lab stands and clamps to hold the funnel, plate, and beam-break apparatus
35-mm camera
- 105-mm Macro lens [1] (can it focus close enough?)

Tripods for camera and strobe
Strobe - at least 7 BCPS [2] and flash duration of order 20 microseconds [3]
B/W film (ASA 400), at least **two** 36-exposure rolls [4]
Paper towels
Milk (whole and skim) and heavy cream

Calculations and assumptions made:

[1] We assume that we want to image a 48 mm by 72 mm area of the impact, so our magnification m = 0.5. We know we have a 105-mm macro lens in the lab so we choose that. Applying the equations from the first lecture, we find that the camera-to-subject distance is 210 mm - but can the lens focus this close?

[2] We assume the strobe will be 2 feet away from the subject. Given the small subject, any reasonable strobe will be able to illuminate the image area from a distance of 2 foot (600 mm). If we use an aperture f/4.0 (to preserve depth of field), we find we need at least 7 BCPS.

[3] We are guessing that 20 microseconds will suffice for the flash duration, in part because we discussed this problem with Dr. Bales, who has observed this phenomenon using high-speed video. He claims that there is still some blur (but not much) at an exposure of 1 ms (1,000 μs).

[4] If we have 4 stages of the event, and need to bracket each image +/- 1 stop, and do this for whole milk, skim milk, and heavy cream, we then need:
3 fluids x 4 stages x 3 separate exposures/image = 48 images. A single 36-exposure roll will not suffice.

Agree on a *Timeline* and *Task List* for creating the *Set-up* and doing the work to achieve the *Objectives*

The Timeline lists the milestones that must be accomplished to complete the project, and when each will be completed. The Task List is a listing of what each person is responsible for doing, and when it must be done by. The two can be combined, or separate.

To be effective everyone must be committed to meeting the milestones as set down. Any slipping of milestones is a cause for concern--particularly early milestones! It is easy to let an early milestone slip because of "more pressing" deadlines, but this is a recipe for disaster.

Example Timeline

19 - 21 Sept.	ID Strobe, confirm that lens will work, obtain cables, lab stands and clamps
21 Sept.	Test all cables and connectors
22 Sept.	Conduct Lab
23 Sept	Begin writing report (individual effort)
29 Sept	Lab report due at start of lab session.

Example Task List

Moe's Tasks:

18 Sept	Confirm with The TA that Lens will work, else find alternative lens.
19 Sept	Go into lab and layout equipment to ID what lab stands and clamps we need. Obtain required parts from Lab supplies
22 Sept	On way to lab, stop by LaVerde's & buy both skim and whole milk, and cream.

Larry's Tasks:

18 Sept	Get list of possible strobes from The TA, email team with Larry's recommendation. Ensure that we reach a consensus on strobe choice.
20 Sept	Email The TA with our strobe choice
22 Sept	Stay at Edgerton Center after lab, develop negatives that afternoon. Have them hanging to dry no later than 6:30 PM.

Curly's Tasks:

18 Sept.	Get from The TA a listing of the connectors required for the cables above, and a listing of which ones are available.
19 Sept.	Borrow, buy, or build any cables required
20 Sept	Test all cables, replace or repair any that don't work.
22 Sept	Copy lab notes before 9 PM. Go to darkroom after 9 PM, cut negatives, put in film holder, and store negatives and copies of notes in lab group drawer.

Project Planning Exercise

Meet in your groups. In class work out a project plan for your topic. Include all six sections (*Objectives, Deliverables, Method, Setup, Timeline* and *Task List*). Each person must bring a neat copy of the project plan to class on Monday. It is OK if one group member writes it for all of you, but there must be one copy for every one of you!

Leap of an Ice Skater (Monday and Tuesday Groups)

You are to take high-speed video footage of figure skaters as they perform a triple spin as they jump in the air. It will be used on-air to help explain the mechanics of the jump during an Olympic broadcast. Note, you will create this footage a month or two *before* the event. You will work at a skating rink. Your camera cannot be on the ice, so it must be at least six feet from the skater.

Plan a project to use a high-speed video camera to collect the desired footage. The skaters and their coach request that your method should also them estimate the speed of each skater as they leave the ice, their rotation rate, and the maximum distance between their skate and the ice.

Sonic Toothbrush (Wednesday and Friday Groups)

A company is making what they call a "sonic toothbrush," where the bristles move back-and-forth at 30,000 strokes per minute (500 Hz). They want to obtain close-up high-speed video footage suitable for analysis, and (if possible) for use in a TV commercial. You will need to work in their facility.

Plan a project to use a high-speed video camera to collect the desired footage. The engineering staff wants to determine how each bristle moves during one stroke of the toothbrush. They also want to see if the frequency of vibration is what they expect.

NOTES FOR BOTH ASSIGNMENTS:

You are not given enough information above to specify all parameters of your equipment. List the questions you need to have answered so that you can fully specify the equipment you will use. How much lead time is needed from when you have that information until you can actually do the work?

Lenses available:

- Lens 1: 28 mm focal length; f/stops of f/22, to f/2.8, min. working distance of 0.85 meters.
- Lens 2: 50 mm focal length; f/stops of f/22 to f/1.8, min. working distance of 0.45 m.
- Lens 3: 90 mm focal length; f/stops from f/32 to f/4, min. working distance of 0.71 m.
- Lens 4: 200 mm focal length; f/stops from f/32 to f/4, min. working distance of 0.71 m.

Cameras Available:

- Phantom v5.0 HSV
- Others that you can find