

Activity C-2. Photographing Bursting Balloons

Goal: To photograph a balloon in various stages of ripping open

Prelab:

1. Read “Fundamentals of photography: Controlling exposure when using electronic flash.”
2. Read Appendix G on “High-Speed Photography with Digital Cameras.”
3. Read this activity in order to familiarize yourself with what you’ll be doing.
4. Do the online questions on the reading.

Equipment:

- Vivitar 283 or 285 flash unit
- 4 AA batteries or SB-4 AC adapter for flash power
- Modified PC cord
- Flash clamp
- Piezoelectric sound trigger (requires 9-V battery)
- Digital camera and related equipment (batteries and/or AC adapter, memory card, A/V cable to connect to TV monitor, card reader)
- Tripod
- Balloons, pin
- Background cloth or paper

Photography Setup

In this activity, you’ll learn the basics of taking photographs of high-speed events using a single flash unit, triggered by sound. Before you take a photograph, there are several decisions to be made.

1. How far from the subject (the balloon) will the camera be placed?

Usually, one tries to place the camera as close as possible so that the image of the event to be photographed will fill the frame of film. If the subject is small, the minimum focusing distance of the camera may limit the size of the image.

2. What background will be used and how far behind the subject will it be?

It is desirable to have a featureless background that will not distract attention from the main subject. A sheet of cloth or paper can be placed behind the subject. The surface should be rough to minimize glare. The further behind the subject the background can be the better. This will reduce glare and any visible surface texture.

3. Where will the flash unit be placed?

The flash unit is usually placed as close to the subject as possible, while still giving uniform coverage. This increases the concentration of light on the subject, as needed for achieving short flash duration. One should also consider the angle at which the light strikes the subject. By choosing the angle correctly, shadows can be produced that help to show structure and texture in the subject. If the flash unit is placed on the hot shoe of the camera, care must be taken that opening the shutter of the camera does not discharge the unit. Putting a piece of electrician's tape over the center contact on the flash foot can do this.

4. How far from the source of sound will the sound trigger be placed?

The greater the distance of the sound trigger from the source of sound, the longer the delay will be before the flash discharges. If one is not sure how much delay is needed, the trigger can initially be placed very close to the source and then moved further away if necessary.

5. What lens aperture will be used?

When the flash unit is used on an automatic setting, the selection of the lens aperture is easy. Set the calculator dial located on the side of the flash unit to the speed of the film being used. Then read the aperture opposite the color of the automatic setting. This assumes that the flash unit and camera are the same distance from the subject. If this is not the case, the auto-thyristor module can be moved to the location of the camera using an auto-thyristor extension cord, if one is available. Otherwise, follow this guideline: If the flash unit is closer to the subject than the camera (the usual situation), open the camera aperture wider. If, for example the camera is twice as far from the subject as the flash, open the aperture by one stop. An explanation is provided as a footnote.¹

6. What shutter speed will be used?

High-speed flash photographs are usually taken in a dark room. The shutter of the camera is held open, and then the high-speed event is initiated. One could therefore use the B setting of the camera as long as one was careful not to leave the shutter open too long. That could create thermal noise problems as described in Appendix H. Another approach is to set the shutter speed to, say, 1 and then make sure to initiate the high-speed event during the second that the shutter is open.

7. What film speed will be used?

As a general rule, use ISO 400 as this will allow you to use small enough apertures to get good depth-of-field while at the same time producing an image that isn't too grainy. In the

¹ The camera aperture determined from the flash unit's calculator dial is only valid when the camera and flash are at the same distance from the subject. As the flash unit is moved closer, the light intensity reflected to the flash unit's photocell increases. This causes the flash discharge to be quenched sooner. Thus, the light reaching the film is less than the amount needed for correct exposure. Opening the camera aperture corrects for this. The guideline of opening the aperture by one stop when the camera is twice as far from the subject as the flash is only an approximation. Bracketing exposures is always a good idea.

event that you don't need large depth-of-field or you have great enough intensity, use a smaller film speed.

8. What image quality and size should be used?

You'll probably want to make enlargements of your best images, and some of them may be published at some point in the future. Therefore, you should generally choose a high size and quality. Avoid the use of raw image format, though, as this complicates the file conversion process.

9. What flash duration is needed?

The flash duration must be short in order to freeze high-speed events. In Activity A-2, you learned how to achieve this. There are times, however, when a longer flash duration is desired so that there will be blur in the photograph. This can provide a sense of movement that a sharp, frozen image cannot. The choice is a matter of personal preference. In order to create blur, the flash duration may be increased by placing the auto-thyristor module in a mode other than yellow. Your tests in Activity C-3 should help you in making a decision here.

As examples of photographs that use blur to good effect, consider those in Figures 1 and 2. Both were taken with the flash unit in manual mode to give maximum flash duration. For the hammer smashing a light bulb, note the streaks of particles on either side of the head of the hammer. These provide effective contrast to the sharply defined cracks in the bulb. Likewise, the water spray emerging from the mass of water once held in place by the balloon provides the clue that something dramatic is about to happen to the seemingly static mass of water. (A needle sticking out from the bottom of a cork was dropped on the balloon to pop it.)



Figure 1. Hammer breaking a light bulb



Figure 2. Burst of a water balloon

About recording your data: Information will be provided during the lab about how to record data on the photographs that you take.

Method:

1. Set up to take a photograph of a balloon burst. Prepare your camera and mount it on a tripod. Slide the flash unit onto a flash clamp, which you then clip to a table or chair. Be careful to place the flash so that you are not prone to bump into it as you move around. It's better to use batteries in the flash and camera rather than using power cords, because you may trip over cords in the dark.
2. When the equipment is arranged, check to make sure that the camera is set for complete manual operation, that the aperture, shutter speed, film speed, and image quality size/resolution are set appropriately. Double-check the composition of the photograph and the focus. Then turn out the room lights, press the shutter, pop the balloon, close the shutter, and turn on the lights. If you miss the burst, it's possible that the shutter closed too soon. Another possibility is that you popped the balloon during the shutter lag time before the shutter opened. If you think the latter may be the case, try delaying popping the balloon a bit longer after the shutter is pressed.
3. Open the aperture by one stop and take another photo under otherwise identical conditions. One reason for this is that the flash unit's calculator dial frequently underestimates the size of the aperture needed for correct exposure. The dial is calibrated for small rooms where there is significant reflectivity from the walls. The latter situation is generally avoided in taking high-speed photographs. Another reason for opening the aperture is that the imaging element may be less sensitive than normal at the short exposure times typical of high-speed photography.
4. Take a series of photos like the ones above, moving the sound trigger to different positions to capture the burst in a different stage.
5. Take some photos with long flash duration in order to test the effect of blur. When you increase duration, remember that brightness increases also. That means you need to make the lens aperture smaller. You can use the calculator scale on the side of the flash unit to determine what aperture to use.