

## **Laboratory 5: Bullet Photography**

To: R&D Team  
From: James W. Bales  
Date: 14 October 2009  
Re: Comparison of Nikon D200 and Film Images  
IM5-JWB

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I'm considering the purchase of a Nikon D200 Digital Still Camera to expand our electronic imaging capability. I've arranged to have a camera on loan so that we can evaluate it. I need a head-to-head comparison of the D200 against our standard 35-mm B/W film.

Also, I'd like to take this opportunity to revive the "bullet" pictures that this lab made famous. So, use images of a bullet in flight as your subject.

### **Assignment**

Take pictures of bullets splitting playing cards with both the D200 and 35 mm film. Next, take similar images of an object of your choosing as it is being shot. You *must* discuss your proposal beforehand with the Lab Manager or myself. Write up your results in a memo. Your memo should:

1. Present D200 and B/W print images of playing cards being shot by bullets.
2. Present any additional images you obtained that you feel are relevant.
3. Describe your procedures in sufficient detail that we can reproduce your results.
4. What *additional* items of equipment and software must we purchase for the D200 to be useful, and what is their expected lifetime? What consumable materials and supplies will we have to buy? Estimate the annual cost of using the digital camera over four years, assuming we produce approximately 4,500 prints per year.

Compare this annual expense to the approximately \$1,000 per year we spend on film, paper, and chemicals for the wet darkroom, including equipment upkeep. As the lifetime of darkroom equipment is very long (of order 15-25 years), and as the technology is quite mature, do not consider the cost of the darkroom equipment in your comparison.

What factors *other* than the costs of equipment, materials, and supplies might go into this business decision? Take them into account in making your recommendation.

5. When is the D200 preferred? When is film preferred?
6. Make a recommendation for our decision to purchase the D200 system.

## Laboratory 5 - BULLET PHOTOGRAPHY

**History:** Edgerton may be best known for his bullet photographs. The .22 caliber, single-shot rifle he used to make most of his photos was used in this lab until 1996, when it was stolen without its bolt (and thus is inoperable by the thieves). We suspect that the rifle is somewhere around campus. We would like to have this historic artifact returned. Information concerning its location is appreciated, and if it reappears, we will ask no questions.

**Preparation:** In this lab you will use bullet photography to compare the performance of the D200 electronic still camera to that of 35-mm film. *Read the safety section below.* Your group may select a target to be shot, but must follow the guidelines of Item 8, below. **Your group must email 6.163-staff@mit.edu with your choice of targets at least 48 hours before your lab session.**

**Read and print out the handout “D200 Guide.pdf” found on the “Resources” page at the course website.** (Bring it to lab.) Note that the D200 imager is 24 mm by 16 mm, that is,  $2/3^{\text{rds}}$  the size of a 35-mm-film negative.

**Have your equipment list written in your notebook when you arrive for lab. Your work plan can summarize steps 1-7, below as “Take photos of bullet through playing card as per handout”. Write down your estimate of the time it will take to complete each step. Note that your work plan needs to expand on Step 8. In particular, plan out how your subject will be secured in place, the lens you will use for both the playing cards and the subject of your choice, and the camera & strobe locations you want.**

### Safety

*Only authorized Strobe Lab/Edgerton Center personnel may discharge firearms in the Edgerton Center under any circumstances. All observers and experiments must wear appropriate ear and eye protection. Never stand in or near the trajectory of the bullet when the bolt is in the rifle.*

#### Procedure:

##### 1. Learn the equipment:

**Prism Science Works “Spot” Microflash unit.** Set up the vacuum tube photocell and oscilloscope. Measure the Guide Number and flash duration ( $\Delta t_{1/3}$ ) for Spot. The peak BCP is quite high, so you will need to place the photocell several feet from Spot. Set the delay controls to 0.

Note - Spot should not be triggered at high repetition rates. Wait 5 seconds or so between successive flashes of the unit.

**D200 Digital Still Camera.** At least one member of your team needs to become proficient with the D200 still camera. Set up the camera as per the instructions under the "Resources" heading on the course web page.

2. **Set up the target:** Place a chalkboard eraser on top of the stand. Move the eraser until it is flush with the up-range edge of the stand, and position a card between two felts at the up-range edge of the eraser.

Set up a halogen lamp to illuminate the edge of the eraser. Bore sight through the rifle, and have a team member adjust the position of the eraser until the image of the edge of the card bisects the bore, and the card is not twisted with respect to the line of flight. Mark the location of the stand and eraser.

3. **Frame the Image:** Set up the D200 and a 35-mm camera roughly perpendicular to the face of playing card. Frame the image you want, including where you want the bullet to be when the strobe goes off. You may want to hang a colored backdrop behind the subject. Carefully focus both cameras.
4. **Position Spot:** Aim the hot-spot of Spot at the desired location. Turn out the lights, and (using the manual trigger button on Spot) fire the strobe a couple of times, adjusting the position and aim of the strobe until the image is illuminated correctly.

Select your aperture - consider the location of the hot spot when doing so. Capture trial images on the D200. These will help you decide if you have the strobe where you want it. Also, with the “film speed” of the D200 set to ASA 400, you can use its aperture settings to help you select the aperture for the film camera.

5. **Set up the Sound Trigger:** Position the trigger slightly downrange from the card. Connect it to the input of Spot.. Test the system by clapping your hands. If Spot does not fire, slightly increase the sensitivity setting on the trigger unit and try again.
6. **IF SPOT STARTS TO FLASH WITH NO TRIGGER, TURN IT OFF!**
7. **Take Photos of Bullet striking a playing card:** Use both cameras, bracketing apertures with the film camera. Print your best results from each. Compare and discuss them in your memo.
8. **Take a Photo of a Special Subject you Bring to Lab:** It should be small and relatively soft, so as to not deflect the bullet. Bars of soap, candles, playing cards are all good subjects. No Jello® or other sticky, gooey stuff.

The limitations include:

- No animal products
- No hard objects
- No liquids

9. **Clean Up the Lab.**

***\*You must have your target approved in advance!\****