

Alternate-Light Photography on a Budget

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Photography is not always a "point and shoot" endeavor and at times can frustrate even the most competent of investigators. When photographers must capture crime scenes or subjects in low-light conditions, the program-mode method of photography will not always work. Now, add in some ultraviolet or other alternate-light source into the equation and some investigators may be willing to give up on trying to photograph a subject. I want to encourage all investigators to remember that if you can see a subject, you can photograph it. You can even photograph some things that are unseen. Creativity is the key to capturing these images, not the size of your expense account.

Alternate-light sources are used to create contrast between a subject and its background by exciting electrons to a higher level of energy. This excitation of electrons is what allows "fluorescence" to appear. The ability to photograph this fluorescence can be the difference in a guilty or not-guilty verdict. Photographing fluorescence may require some unique photography techniques, including painting with light, intentionally under or over-exposing subjects, and using different types of filters.

There is an endless supply of ultraviolet illumination sources available to crime scene investigators. They are available from any one of a hundred crime scene supply companies, but cheaper and just as effective ones are available at your neighborhood department store. These ultraviolet illumination sources are often sold as "black lights" and operate at near-ultraviolet range or around 405 nanometers. These "black lights" work just as well as the multi-thousand dollar variety, but at a fraction of the cost. The more expensive light sources have a lot more power and a broader selection of wavelengths, but the lack of illuminating power does not prevent the ability to visualize or photograph fluorescing subjects. In addition, investigators can find fluorescent-tube black lights in a number of lengths, ranging from 4-inch battery powered units to 4-foot a/c powered ones. The choice between light sources is up to the individual investigator and his or her wallet.

Once a light source has been selected, then it is time to

put it to use. Ultraviolet illumination can be used in a number of different applications, including sexual assault scenes, skeletal bone recovery scenes, and any situation where fluorescent fingerprint powder is used to develop prints. The fluorescent properties of semen, bone matter, and different types of powders can be found, identified, and photographed in ultraviolet illumination. In addition to an ultraviolet illumination source, photographers will need a single-lens reflex (SLR) camera. An SLR camera is preferred over a "point and shoot" style camera because of its ability to take bulb exposures and meter light up to and including 30 seconds. Whether the camera is a digital or film camera is up to the individual photographer. Digital cameras do provide that instant knowledge of a well-photographed subject, but film offers much more latitude with exposure. With a little bracketing of the exposure values, there is no reason why a photographer should doubt his or her ability to capture a subject on film. Film also offers other advantages, such as choices between color and black & white. Black & white film offers a little better contrast for latent print work, but color film is better for documenting actual crime scenes. In addition, both film cameras and digital cameras offer a variety of ISO film-speed settings. The choice between an ISO of 100, 800, or higher is simply a matter of patience. You can capture fluorescence with any speed film, but the exposure will take longer with slower-speed film. The color and sharpness of slower-speed film is often times worth the extra couple of minutes it may take to capture an image.

Photographing fluorescence is really not that difficult. Since the fluorescing properties of powders, semen, and other items are in the visible range (400 nm to 700 nm), the camera should be able to meter the fluorescing light effectively. Problems with exposure occur most often because of the sharp contrast between a completely dark background and the bright fluorescing matter. When using a digital camera, corrections can be made to the photograph by increasing or decreasing the exposure as needed. When using a film camera, bracketing the exposures is the best way to ensure a quality image. Since film has a latitude of approximately two f/stops, this is the amount of exposure that should be added and subtracted from an image's zero-balanced exposure reading in the camera.

Photographers can fine tune their bracketing efforts by increasing and decreasing exposure in one-f/stop increments, but it is still a good idea to expand the exposures by a total of two f/stops in both directions.

Sometimes the use of filtration will be needed to increase the contrast between the object being photographed and its background. Typically, three filter colors are used for crime scene related photography: red, orange, and yellow. Each filter color can be broken down into varying degrees of intensity, but no matter what filter is placed in front of the camera lens, the camera will still be able to meter the light passing through it. The exposure times will be slightly longer because of the added filter barrier, but the increased contrast will be worth the extra effort.

Filters with more density can create a need to paint your subject with the ultraviolet illumination in order to get a more even exposure over the entire image (see *Painting With Light*. C Duncan. *Chesapeake Examiner*. Fall 2004. 42(2):5). Ultraviolet illumination sources can operate much like a flashlight, with a hot spot in the middle of the illumination and a rapid drop off of brightness as the light radiates outward. Filter effects can drastically increase this effect. Painting the subject with an ultraviolet source, much like painting a dark crime scene with a flashlight, is an excellent way to obtain a well-illuminated and balanced image. Metering this type of scene or subject is a little more difficult because the light will be added throughout the exposure. Photographers should begin by placing the light source in the middle of the viewfinder and use the light meter to obtain the shutter speed and aperture settings. This image will most likely be underexposed because you will be moving the illumination around the framed image throughout the exposure. Additional images should be taken with increased exposure in order to guarantee a quality image. As a rule, longer exposure times allow the photographer to move the illumination across the image completely without leaving hot spots on any one place in the photograph. Remember if the shutter speeds are too short to paint the subject effectively, close down the aperture and force a longer exposure time. When painting with ultraviolet illumination, remember to continue and move the source across the subject or scene. While painting, do not stall the source in any one location or you risk developing hot spots in the image. You do not have to worry so much about overexposing a painted image, since reciprocity failure takes effect during longer exposures. Reciprocity failure occurs in exposures longer than one second and, in effect, negates the standard aper-

ture-shutter speed relationship. Reciprocity failure will work to the photographer's benefit by making it difficult to overexpose the image.

With a little practice with your regular light source, you should be able to develop just the right technique that works best for you. The power of your particular light source will dictate what technique will work best. A powerful 500-watt Polilight® or CrimeScope® will throw plenty of ultraviolet radiation onto a fingerprint. Simply balancing the shutter speed and aperture can capture that small image. However, if you are using a 15-watt black light and photographing a semen stain on a living room couch, then painting that scene will be necessary and it may take minutes instead of seconds. A little practice will go a long way in the field.

Photographs can also be captured using infrared illumination or that illumination above 700 nanometers. One good use of infrared illumination is to photograph gunpowder particles on clothing. Gunpowder particles that may not be visible in natural light will contrast strongly when examined in infrared illumination. Once again, the use of an expensive alternate light source may be of some use. However, the purchase of a #87 (Tiffen) infrared filter is all that is needed to photograph gunpowder particles. An 87 filter costs approximately \$90 and is extremely effective in this endeavor.

The use of an infrared filter can result in a photograph of something you cannot see. The #87 filter is completely opaque because it blocks out all visible light only allowing illumination above 700 nanometers pass through the filter. The subject must be photographed while the camera is on a tripod or copy stand, because the exposures can be quite long. This is where a digital camera is a great convenience, but the image can still be captured on film. Film photographers simply have to practice with exposures before trying it on an actual scene. Select a light source, such as a flashlight or the lights on your copy stand. Select a favorite aperture, such as f/8. Now photograph your choice of subject using the set aperture and light source. The copy stand lights are the easiest to work with, but if you might try this activity in the field someday, you may want to practice painting your subject with a flashlight. Painting with a flashlight is much like painting a subject with an ultraviolet source. Using the same aperture and light source for every exposure, simply change and record the length of time for each exposure. When the film is developed, you can examine the negatives for the

best combination of shutter speed, aperture, and light source. This now becomes your base exposure, because it is still a good idea to bracket your exposures in order to ensure capture. Surprisingly, most cameras can meter a proper exposure through the opaque filter when a strong light source like the sun is used.

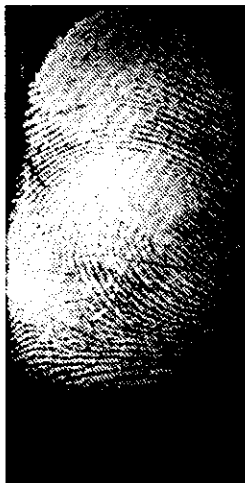
The first step in examining clothing in infrared illumination is to set up the subject and camera and take a natural-light photograph. Once the focus is set, you will need to shift it slightly to a longer focal length and attach the infrared filter. The focus shift is needed because the camera's lens is meant to focus between 400 to 700 nanometers, not with radiation above 700. Some older manual focus cameras will actually have a red "IR" index mark that will tell you exactly how far to adjust the focus. Once again, practice and experience with your equipment will make this easier in time. This shift in focus can also be accomplished by raising the camera up on the tripod and away from the subject a short distance. The distance will differ depending upon the focal length of each individual lens, but at most it will be a few inches. Another way to increase the zone of sharp focus is to use a small aperture. This will dictate a longer exposure, but if the image is important, then the extra effort is necessary. Because black & white film simply records light intensity and not color, it is a better choice than color film. However, there is no need to purchase infrared film for this type of work.

Another opaque filter that can be used to take some interesting photographs is the Tiffen #18A ultraviolet filter. The 18A filter will block all light above 400 nanometers and is useful in photographing bruising, bite marks, and injuries to human skin. Using this 18A filter requires the same sort of practice and techniques as the infrared filter, except that, instead of lengthening the focal distance after taking a natural-light photograph, the focal length must be shortened. The Tiffen 18A filter will cost approximately \$100, but with a little practice, the photography of bruises will never be the same.

In conclusion, photographing in illumination outside the visible range can be challenging, but rewarding. Although expensive alternate-light systems are effective and easy to use, many investigators must purchase equipment on tight budgets or out of their own pockets. With a little practice and creative thinking, the images captured using less expensive equipment can result in the same powerful photographic images. Remember that light is additive on film. If you have a lot of light dumped on a subject during a one second exposure, the same image can be captured by a less powerful light placed on a subject over the course of a 30-second exposure. It is all a matter of time, patience, and practice.

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The graphics below represent a single print take with 3 different light sources, the point being that just because a light source is expensive doesn't mean that you will end up with better images.



Polilight® Alternate
Light Source



4 inch UV Fluorescent
Tube Light from WalMart
\$7



INNOVA "Cobalt
Blue"® LED flashlight
\$40