Flash Photography with Canon EOS Cameras - Part III.

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Common EOS flash features.

Here are some features found on various Canon EOS Speedlite flash units. Note that not every flash has every feature, and some features only work in conjunction with certain camera bodies.

Bounce flash - swivel and tilt.

Many of Canon's external flash units have the ability either to tilt or both tilt and swivel the flash head independently of the flash body. The 430EZ, for example, lets you tilt the head from 0° (straight on) to 90°. Left swivel goes from 0° to 180° - facing backwards! Right swivel only goes from 0° to 90°. There are click stops at various detent positions, and a spring-loaded bounce latch keeps the flash head pointed head-on.

Tilt and swivel let you bounce (reflect) the flash unit's light off walls, ceilings, reflectors, etc, in order to soften the light. Non-bounced flash light tends to be fairly harsh, since it originates from a relatively small area. This harsh light tends to result in unflattering photos of people, for reasons outlined in the quality of light section.

Bounce flash softens light nicely, but does have some disadvantages. For one, you obviously can't bounce flash outdoors unless you carry a reflector or something with you - it's most immediately useful in interior spaces. Some interiors, in fact, aren't much good either if they have really dark surfaces or high ceilings. Another drawback is that coloured surfaces (such as painted ceilings or walls) can end up tinting the light from the flash, resulting in unwanted colour shifts. Relying on ceiling bounce flash can sometimes result in unattractive shadows appearing under the eyes and nose - some photographers elastic-band an index card around the back of vertically-pointing flash heads in order to bounce a little bit of light forward to minimize this problem. And finally, bouncing the light obviously reduces the amount of light hitting the subject and this costs about half your range. For this reason you may want to use faster film or larger lens apertures when using bounce flash.

Low-end flash units which lack tilt and swivel heads can also be used for bounce flash - you simply attach an Off-Camera Shoe Cord 2 and then you can point the flash unit in any direction you like. Note, however, that this technique doesn't work well with flash units that rely on external sensors such as A-TTL devices since the sensors will be recording the light bouncing back from the reflective surface and not the subject.

You probably won't want to use bounce flash in manual flash mode. You can do it, but you have to perform the flash calculations manually, as described in the section on manual flash.

Flash units which neither tilt nor swivel:

Speedlites 160E, 200E, 220EX, 300EZ, ML-3, MR-14EX, MT-24EX*.

Flash unit which tilt only:
Speedlite 380EX.

Flash units which both tilt and swivel:
Speedlites 300TL, 420EZ, 430EZ, 540EZ, 420EX, 550EX, 480EG.

Flash units with an additional downward tilt for macro shots:
Speedlites 540EZ, 550EX.

* The MT-24EX macro flash unit has independently movable swivelling arms with detachable heads. So it's not fixed, but it doesn't tilt or swivel in the way that shoe-mount Speedlites do. As a macro flash it's not meant for illuminating rooms with bounced light, though it can be used for lighting small spaces.

Zooming flash heads.

Canon's mid to high-end external flash units contain small motors which move the flash bulb closer to or further away from the clear plastic screen at the front. This allows the flash to alter the coverage area of the light emitted from the unit - the closer the bulb is to the screen, the wider the coverage angle and vice versa. It also means that the flash's light output can be concentrated for greater distances and used more efficiently. (ie: you aren't wasting light by illuminating areas not covered by longer focal-length lenses)

Typically the zooming motor covers the range used by 24 to 80mm lenses or 24 to 105mm, and does so in several fixed steps matching popular prime lens focal lengths, such as 24-28-35-50-70-80mm. (continuous zooming control to arbitrary focal lengths is not supported) Remember that a flash unit's upper zoom limit doesn't *prevent* you from using the flash with longer lenses. All it means is that the zoom can't concentrate its light beyond a certain point for more efficient coverage of a narrower area. At least, not without a flash extender accessory. The reverse is not true for the wider end, however. If you use, for example, a flash unit with 24mm coverage at the wide end with a 17mm lens you'll get a kind of vignetting effect (darkening of the edges) since the flash will not be able to illuminate the entire coverage area of the wide angle lens.

Some zooming flashes have manual controls that allow you to override the automatic zoom setting by pressing a button. Others are only automatic - they zoom to a setting near to the current lens focal length when you press the shutter halfway. Canon flash units usually default to a 50mm zoom setting when in bounce mode and to 35mm when no EF-compatible lens is attached.

For some strange reason camera bodies with image areas less than that of 35mm film (APS cameras and most EOS digital cameras) do not compensate for the cropping factor of their image areas. So you are, in effect, wasting light when taking a photo using such a camera body and a zooming flash unit, since areas outside the edges of the picture will be illuminated. This isn't a huge issue, but it does seem a bit odd that no compensation was built in. Perhaps Canon were concerned that this could lead to confusion, since turning a zoom lens on such a body would result in the flash head zooming to a different focal length on its LCD screen.

Remember that the flash head will zoom to the nearest zoom setting that is *less or equal to* that of the focal length of your attached lens. So if you have a 100mm lens attached, say,

and the flash unit can zoom to either 80mm or 105mm, then it will automatically go to 80mm only. It will not narrow the light cone down any further by zooming to 105mm, as you would risk getting darkening around the edges of the picture if it did.

Wireless-capable units with zooming heads (420EX and 550EX) will zoom to 24mm when in wireless slave mode. The 420EX has no manual zoom controls and so always shoots at 24mm. However, the 550EX's manual zoom controls are very useful in wireless mode since they let you set up your slave units around the scene, override the default zoom setting and adjust the coverage angles for each unit independently. They aren't so commonly used outside a wireless context but they allow you, for example, to create a sort of spotlight/vignetting effect by narrowing the flash coverage down to a tighter circle than that required by the focal length of the lens. (an intentional use of the problem outlined above) You can also use manual controls to adjust the zoom setting so that you can work with manual lenses which don't transmit focal length information to the camera.

All Canon flash units which have names ending in Z, such as the 540EZ, contain zooming flash motors. However, some later E-TTL flashes such as the 420EX and 550EX also have zooming heads, so Z Speedlites aren't the only ones with the feature.

Two EOS cameras, the Elan/100 and the A2/5, have three-position zoom motors built into their internal flash units. It's this zoom capability that explains why the Elan/100's built-in flash has a maximum guide number of 17 at 80mm. When the flash isn't zoomed out it has a guide number of 12; typical for a camera's built-in flash. Canon have not carried this feature through to any later bodies, however. Presumably the expense and bulk of the zooming mechanism were deemed to outweigh the benefit of improved guide numbers.

The primary disadvantages of a zooming flash unit are that the zoom motor makes a loud buzzing noise when adjusting coverage angles and that the flash head has to be larger to accommodate the motor.

Flash units with motorized zooming heads:
300EZ, 420EZ, 430EZ, 540EZ, 380EX, 420EX, 550EX.

Flash head coverage:

Flash units.

Flash unit with 28mm fixed coverage (no zoom motor):
Speedlite 220EX.

Flash units with 35mm fixed coverage (no zoom motor):
Speedlites 160E, 200E*, 480EG**.

Macro flash units (no zoom motor):
Speedlites ML-3, MR-14EX, MT-24EX.

Flash unit with hand-operated four-position 24-85mm (24-35-50-85mm) zoom head (no zoom motor):
Speedlite 300TL.

Flash unit with automatic-only four-position 28-70mm (28-35-50-70mm) zoom coverage:
Speedlite 300EZ.

Flash units with automatic six-position 24-80mm (24-28-35-50-70-80mm) zoom coverage with manual override:
Speedlites 420EZ, 430EZ.

Flash units with automatic-only six-position 24-105mm (24-28-35-50-70-105mm) zoom coverage; no manual override:
Speedlites 380EX, 420EX.

Flash units with automatic seven-position 24-105mm (24-28-35-50-70-80-105mm) zoom coverage with manual override:
Speedlites 540EZ, 550EX.

* The 200E can be augmented by an optional accessory clip-on adapter (Wide Adapter 200E) which extends its 35mm flash coverage to 28mm.

** The 480EG ships with two accessory clip-on lenses which can be used to alter its default 35mm coverage. The Wide Panel 480EG-20 takes you to 20mm and the Tele Panel 480EG-135 takes you to 135mm.

Cameras.

Cameras with fixed 35mm internal flash coverage, GN 12:
EOS 750 (first EOS camera to sport a built-in flash), 700, 10/10s, Rebel S/1000F, EOS 5000/888.

Cameras with fixed 35mm internal flash coverage, GN 14:
EOS Rebel II S/1000FN*.

Cameras with fixed 28mm internal flash coverage, GN 12:
Rebel X/EOS 500/Kiss, Rebel 2000/EOS 300/Kiss III, EOS Kiss III L, EOS 300V/Rebel Ti/Kiss 5 (high profile), Rebel G/EOS 500N/New Kiss, EOS 3000/88, 3000N/66.

Cameras with fixed 28mm internal flash coverage, GN 13:
EOS Elan II(E)/50/55, Elan 7(E)/30/33, Elan 7N(EN)/30V/7S.

Cameras with automatic-only three-position 28-80mm (28-50-80mm) internal flash zoom coverage, GN 12 or 13 to 17:
EOS Elan/100 (GN 12-17), A2(E)/5 (GN 13-17).

Cameras with fixed 22mm** internal flash coverage, GN 11 or GN 10:
EOS IX/IX E (GN 11), IX Lite/50/7 (GN 10).

Cameras with fixed 18mm** internal flash coverage, GN 12:
EOS D30, D60.

Camera with fixed 18mm** internal flash coverage, GN 13:
EOS 10D.

Camera with fixed 18mm** internal flash coverage, GN 13, high profile:
300D/Digital Rebel/Kiss Digital.

Cameras with no internal flash:
EOS 650, 620, 850, 600/630, 1, RT, Rebel/1000, Rebel II/1000N, Rebel X, 1N, 1NRS, 3, 1V,

1D, 1Ds, 1D mark II.

* Seems odd that this particular low-end camera should have a higher guide number than all other EOS cameras with built-in flash, but that's what the Canon camera museum claims.

** Note that these coverage areas are related to the dimensions of the image area - APS film for the IX cameras and the sensor chip for the D30, D60 and 10D digital cameras. All have smaller image areas than 35mm film. The digital cameras would have a 28mm coverage area if they were 35mm cameras, for example.

AF assist light.

It's very hard for cameras based on passive autofocus mechanisms (this includes all EOS cameras except the manual-focus EF-M) to focus when it's dark, since they rely on contrast between light and dark areas. For this reason many EOS cameras have a built-in light that automatically illuminates in low light situations to help the autofocus system to work. On some cameras this is a relatively discreet patterned red light from a bright red LED (light emitting diode), on some it's an irritating bright white incandescent light and on others it's an even more irritating pulse of the built-in flash. (for a list of these cameras please see the next section)

All of Canon's Speedlite flash units for EOS cameras have patterned red AF assist lights - sometimes called AF auxiliary lights in older Canon manuals - built in. These are clear red panels on the front which use one or two high-brightness LEDs to project red circles of light striped with dark lines, in order to give the camera a high-contrast pattern to focus on. Red is chosen in part because high-output red LEDs are readily available, but also because red light does not cause the pupils of the eye to dilate as much as does white light. The red light is sometimes described as being "near infrared," though it is in fact visible.

An important thing to remember is that the AF assist light works only if your camera is in One-shot mode - it *will not illuminate* in AI Servo or in any icon AE mode which employs AI Servo, such as the Sports mode. This is because the camera is constantly focussing and refocussing when in AI Servo mode, in order to track subject motion.

Also, if you have a camera body with multiple focussing points and your flash unit's AF assist light isn't lighting up in low light it's probably because the AF light on the flash you happen to be using cannot cover your currently selected (ie: non-centre) focussing point. Many flash units have AF assist lights which can only illuminate the area around the central point. Switch to the central focussing point and the flash unit's AF assist light should start working. Two exceptions are noted in the next section - the A2(E)/5 and the 10/10s.

As for the coverage area of these AF lights and multiple focus points, the coverage varies but depends in part on when the flash was introduced. For example, the 430EZ flash was introduced when Canon's cameras all had one focussing point only, and so the 430EZ's AF assist light cannot cover all the focussing points built into, say, the Elan 7/EOS 30. The 420EX, however, has an AF assist light which covers all 7 points used by the newer camera. There is a full list below.

The maximum range of the AF assist light varies from unit to unit, but is typically a distance of around 5-10 metres from flash unit to subject. Flash units which cover more than one focus point have lower AF assist ranges for outer points. The MR-14EX and MT-24EX macro ring light flashes have small white incandescent bulbs for modelling and focussing rather than red AF assist LEDs. The Macro Twin Lite MT-24EX can be configured so that pressing

the shutter release halfway turns these lamps on. The MR-14EX requires a press of the controller-mounted "lamp" button to enable the lamps.

Flash units with 1 (central) point AF assist light coverage:
Speedlites 160E, 200E, 220EX, 300EZ, 380EX, 420EZ, 430EZ.

Flash unit with 5 point AF assist light coverage:
Speedlite 540EZ.

Flash unit with 7 point AF assist light coverage:
Speedlite 420EX.

Flash units with 45 point (area) AF assist light coverage:
Speedlites 550EX, ST-E2. (see the note below concerning the EOS Elan 7/30/33/7)

Flash units with white incandescent focus assist bulbs:
Macro Speedlites MR-14EX and MT-24EX.

Flash units with no AF assist lights:
Speedlites 480EG, 300TL.

Camera-specific notes on AF assist lights.

The EOS 5/A2/A2E and 10/10s: these older cameras never activate the AF assist lights on external flash units - they will only illuminate the camera body's built-in AF assist light. The reason for this limitation is because the camera bodies have multiple selection points and the flash units sold at the time could not cover all of the points. The 10/10s is also unusual in that its external two focussing sensors look for horizontal lines and not vertical lines, whereas many flash units project only vertical striped lines.

Sadly, this restriction was pretty short-sighted, since later Speedlite flash units handily cover all the focus points of multiple focus point cameras, but these older camera bodies still doggedly rely on the body AF light only - even if the central focus point is the only one selected. And the body's AF assist light can be blocked by larger lenses or lens hoods. Luckily, the body's AF assist light has a reasonable range - only slightly shorter than most external flash units.

The EOS 300/Rebel 2000, EOS 30/Elan 7 and other EOS cameras which lack a red AF assist light on the body: you can always use the AF assist light on a flash unit if you want to avoid the irritating main flash pulses used by your camera as an AF assist light. Some of the smaller Speedlite flashes are quite compact and can easily be packed in a camera bag, though the tiniest don't cover multiple focussing points, limiting you to the central point. The ST-E2 transmitter covers all 45 of the EOS 3's focussing points, all of the D30/D60 points, and 5 of the 7 points of the Elan 7/EOS 30/33/, so it's a better bet for most newer cameras if all you want is AF assist. A rather unfortunate and inconvenient (and expensive, in the case of the ST-E2) way to deal with the camera's shortcomings, but there you go. The EOS 30/33/Elan 7/EOS 7 is most suitable for use with an external flash unit's AF assist light, since this camera has a custom function which disables the external flash while maintaining the operation of the AF assist.

The EOS D30/60: the primary weakness of these otherwise excellent digital cameras is their weak autofocus performance, particularly in dim light. Many D30/60 users advocate carrying an ST-E2 wireless flash transmitter and using its AF assist light to help the camera focus in

low-light situations. Other users carry a 550EX set to TTL mode. In TTL mode the 550EX will not fire but the AF assist light will still work. These are somewhat expensive options. You could always use one of the tiny and inexpensive Canon flash units like the 160E or 200E for this, but their AF assist lights cover only the central focussing point of the D30/60.

The Elan 7/EOS 30/33/7: this camera has 7 focussing points - five in a row and one point above and one point below the row. However, the Speedlite 550EX flash unit and ST-E2 unit predate the Elan 7/EOS 30/33/7. So, although they cover all 45 points of pro cameras they do not adequately cover the upper and lower AF points on the Elan 7/EOS 30/33/7. This is because they project horizontal patterns across the area read by the upper and lower AF points of the Elan 7/30/33/7, but these points want vertical patterns. At time of writing the 420EX is the only flash unit which adequately illuminates these upper and lower AF sensors.

Cameras with red patterned (LED) body-integral AF assist lights:
EOS 10/10s, A2/A2E/5, Elan/100, Elan II/IIE/50/50E/55.

Cameras with bright white incandescent body-integral AF assist lights:
EOS Rebel XS/500/Kiss, EOS 3000/88, EOS 3000N/66/Rebel XS N, D30, D60.

Cameras which fake AF assist by pulsing the internal flash unit:
EOS Rebel 2000/EOS 300/Kiss III, Kiss IIIL, EOS Elan 7/30/33/7, EOS Rebel Ti/300V/Kiss 5, EOS 10D, EOS 300D/Digital Rebel/Kiss Digital.

Cameras with no body-integral AF assist lights:
EOS 650, 620, 700, 750, 850, RT, 1, Rebel/EOS 1000, Rebel S II/1000FN/1000S, Rebel X, EOS 5000/888, Rebel G/500N/New Kiss, IX, IX Lite, 1N, 1N HS, 3, 1V, 1D, 1Ds, 1D mark II.

Flash exposure compensation (FEC).

There are times when you may want to adjust the total flash output from a flash unit above or below what the assumed mid-tones that the camera thinks you probably want. For example, a scene that's mainly white or mainly dark will fool automated sensors, so you may want to override the flash unit. This is flash exposure compensation; referred to as "fill-in ratio control" or "flash level control" in older Canon material.

As noted in the section on fill flash, a common application for flash is lightening shadows and toning down the high-contrast nature of full sunlight. Adding a subtle catchlight in someone's eyes is another. For cases like this you might want to dial in an additional minus stop or two of flash compensation over the camera's built-in flash program since you don't want to blast out a ton of fill flash that will wash out the subject's face or cast flash shadows. Or perhaps you want to take a harshly lit flash photo, like old paparazzi photos from the days of non-electronic bulb flash. You could then dial in additional flash compensation. Yet another common situation is overriding the default flash controls in situations that are hard for the flash system to meter. Wedding photos of a man in a black tuxedo in a large room or a woman in a white dress next to a white cake are typical examples.

FEC is adjustable in half or one-third stop intervals, depending on the camera and flash. You can apply both positive (more light from the flash) or negative (less) compensation, usually by up to three stops. Remember that, on cameras which have it, FEC is completely independent from regular exposure compensation on your camera. (cameras which lack FEC simply adjust flash and ambient compensation simultaneously) It's quite possible to, for instance, apply plus 1 stop FEC and dial in minus two stops exposure compensation at the

same time. Just like regular light metering, one stop represents a doubling or halving of light output. Altering FEC means altering power output, not distance. (see the section on guide numbers for more information)

As noted earlier, EOS bodies automatically apply by default auto fill reduction under brighter ambient lighting conditions. So it may not be necessary to dial in any FEC if you just need fill flash - particularly if you're using E-TTL rather than TTL. E-TTL is generally agreed to have improved and more subtle fill flash when ambient light levels are bright. You'll probably want to run some tests to see how your camera and flash combination works for you. Remember that any FEC you apply manually will be in addition to any auto fill reduction that the camera may apply.

However, most pro and semi-pro EOS cameras have a custom function that can disable automatic fill flash reduction if you desire. This is useful when shooting backlit objects, where you don't want fill flash reduction.

Cameras which disable auto fill flash reduction with custom function 10:
EOS D30, D60.

Cameras which disable auto fill flash reduction with custom function 14:
EOS 1N, 1NRS, 3, 1V, 1D, 1Ds, 10D, 1D mark II.

Camera which disables auto fill flash reduction with custom function 16:
EOS 5/A2(E).

Which bodies/flashes have FEC.

Flash exposure compensation may or may not be available to you, depending on which camera body and flash you have. Most midrange EOS cameras support FEC for internal flashes, but most low-end EOS cameras do not. Also, remember that FEC will not work in the basic (PIC) metering modes - just P, Tv, Av and M modes.

For FEC to work with an external flash you need one of the following two cases:

- either both a camera capable of supporting FEC on external flash units and a flash unit capable of receiving FEC commands, or
- any EOS camera except the 620, 650, 750 or 850 and an external flash unit with FEC switches built in - the Speedlites 430EZ, 540EZ, 550EX, MR-14EX or MT-24EX.

The next section has a comprehensive list of which cameras and flash units have which features.

For instance, let's say you have an Elan 7/EOS 30 with a Speedlite 420EX external flash. In this case you can use the FEC controls built into the camera to control the flash exposure levels on the external flash.

Or let's say you have an original Elan/EOS 100 with a Speedlite 540EZ external flash. In this case you can't use the camera's on-board FEC controls, because the Elan/100 is the only EOS camera with FEC controls that can't send FEC signals to external flashes. But the 540EZ happens to have controls that let you set the FEC levels directly on the flash itself, so you're fine.

However, if you have, say, a Canon Rebel G and a Speedlite 380EX then you're out of luck. The Rebel G can't send out FEC commands to a flash, and the 380EX lacks external FEC controls. You can't directly adjust the flash exposure settings independently of the exposure metering. You can only fake FEC by altering the ISO value.

Some bodies display the FEC setting in the viewfinder and others only display it in the top-deck LCD. If your flash unit has its own FEC controls you can look at the flash unit's rear panel LCD for the current FEC setting. Also, remember that if your flash unit has FEC controls then its settings will override those of the camera's custom function setting, if it has one.

List of which bodies/flashes have FEC.

- Camera bodies which do not support any kind of FEC even with flash units with external FEC controls:
  EOS EF-M, 650, 620, 750 or 850.

- Camera bodies which only support FEC when used with an external Speedlite flash unit which has FEC controls:
  EOS 600/630, RT, 700, 1, 10/10s, all EOS 1000 series cameras, all EOS Rebel series cameras, all EOS Kiss series cameras, 300, 300V, 500, 500N, 5000/888, 3000/88, 3000N, IX Lite/IX 50/IX 7, EOS 300D/Digital Rebel/Kiss Digital.

- Camera body which supports FEC on the internal flash but not on external flash units unless they have external FEC controls:
  EOS Elan/100.

- Camera bodies which support FEC on internal flash units and can also control FEC on any external Speedlite flash unit:
  EOS 5/A2(E), Elan II(E), 50(E)/55, IX, Elan 7(E), 30/33/7, D30, D60, 10D.

- Camera bodies which lack internal flash units but which can control FEC on any external Speedlite flash unit:
  EOS 1N, 1NRS, DCS 1/3/5, D2000, D6000, 3, 1V, 1D, 1Ds, 1D mark II.

- Camera bodies with a flash exposure level scale on the right side of the viewfinder:
  EOS 1N, 1V, 1D, 1Ds, 1D mark II.

- Flash units with external FEC controls:
  Speedlites 430EZ, 540EZ, 550EX, MR-14EX, MT-24EX.

Faking flash exposure compensation.

It's possible to fake FEC if your camera and flash combination lacks the ability. It basically involves fiddling with your camera's manual ISO (film speed) override. You can't simply adjust exposure compensation because doing so affects both ambient exposure settings and flash exposure settings simultaneously.

The workaround is thus to do the ambient metering first and locking it into place by going into manual metering mode. This puts both the shutter speed and aperture under your direct control. Once that's done you can manually alter the ISO setting of the camera (if your camera supports this, as the vast majority of EOS cameras do).

If you lower the film speed rating you're essentially tricking the camera into producing more flash output - halving the ISO results in one stop more flash output. If you raise the film speed rating then the camera will produce less flash output -doubling the ISO results in one stop less flash output.

The drawbacks to this technique are obvious and threefold. First, it's rather fiddly since altering ISO isn't a commonly changed thing and thus the interface isn't the easiest to use. Second, you have to be certain to set the ISO value back to its correct setting when you're done or else you risk messing up the exposure settings for the rest of the roll. And third, you can't really use it if your camera lacks manual ISO controls altogether.

Flash exposure lock (FEL).

EOS cameras (type A) which support E-TTL also support flash exposure lock when used with EX flash units. This feature lets you lock flash settings in, then optionally recompose the image before taking the final photo. This allows you to adjust the flash settings in certain difficult to meter cases. Canon first introduced FEL in 1986 with their T90 camera and 300TL flash, but dropped the feature with the first EOS cameras. It wasn't until 1995, with the introduction of the Elan II(E)/50/55 and E-TTL, that FEL made its return.

FEL works by issuing a preflash when the AE lock button or, if the camera has one, when the FEL button is pressed. (on most EOS cameras the AE lock and flash exposure features are tied together, but top of the line EOS cameras have separate FEL buttons which allow you to set AE lock and FEL independently) The camera then stores flash exposure data, biased towards either the current focus point or the central focus point, for a 16 second period or for as long as you keep the shutter release pressed halfway. During this time you can recompose the photo or you can adjust the aperture and shutter speed (overriding AE lock, which is set when you press the AE lock button, if you like).

FEL is thus useful for taking photos in which the subject is not covered by one of the focus points or photos containing reflective surfaces which can fool flash metering or certain cases in which the subject is moving. It's also useful for scenes in which you want to bias the flash exposure to something other than the current focus point. A major drawback with FEL is that the E-TTL preflash occurs when the AE lock or FEL button is pressed, which can confuse your photographic subjects who may think that the photograph is already taken.

If you lock focus on a scene and recompose you will likely have poor flash metering, since E-TTL biases flash metering to the current focus point. Use FEL instead to avoid this problem.

Some cameras have a custom function (CF 8 on the Elan II(E)/EOS 50/55 and Elan 7(E)/EOS 30/33/7) which lets you specify whether you want partial metering and FEL tied to the central focus point - the default - or to the active focus point instead.

Cameras that support FEL:
All type A bodies.

Cameras with separate FEL buttons:
EOS 3, 1V, 1D, 1Ds, 1d mark II.

Flash units which support FEL with type A bodies:
All EX series flash units.

The T90 and the 300TL flash unit support FEL, but only with each other. Their FEL protocols are not compatible with E-TTL, and so putting an EX series flash unit on a T90 will not give you FEL.

Flash exposure bracketing (FEB).

Recent high-end EOS flashes - the 550EX, MR-14EX and MT-24EX - support flash exposure bracketing. It's a function of the flash unit - the Canon "Flash Work" brochure says that these recent high-end flash units can do FEB on any EOS camera except the 650, 620, 750, 850 - and EF-M.

This is a similar concept to auto-exposure bracketing (AEB), only instead of changing ambient exposure settings you shoot a series of three photographs with normal, positive flash compensation and negative flash compensation. You can apply the bracketing value in half, third or full stop values.

Enabling second curtain sync.

This depends very much on the camera and flash unit that you're using. Early on, Canon put control for this feature on the flash unit. Later they switched to putting control for this feature on the camera body. So whether you have second-curtain sync available to you depends on a complicated set of permutations.

Many mid to high end Canon flash units, listed below, have a button or switch which lets you enable second curtain sync. It's usually marked with a triple triangle (>>>) symbol or the word SYNC. For instance, on the 430EZ and 540EZ you press the + and - buttons together simultaneously to turn on second-curtain sync. When you do so a triple triangle symbol appears in the LCD. On the 300EZ and 300TL there's a small slide switch - left is first-curtain sync and right is second-curtain.

Most midrange and professional EOS bodies from the A2(E)/5 onwards have a custom function that lets you specify whether you want first or second curtain flash. The exception is the original Elan/100, which had a custom function that can only control the internal flash and not external flash units. In the case of a camera with a custom function and an external flash unit which has a second curtain switch it appears the physical switch on the flash takes priority, though this may vary from model to model.

Low-end EOS cameras, such as the 1000 series or Rebel series, do not have any custom functions and so cannot control second curtain sync options directly. So to take advantage of second curtain sync on such cameras you must have an external flash which has externally-available controls to operate it.

Second-curtain sync cannot be used with any EOS camera in a PIC (icon) mode - you have to be set in P, Av, Tv or M modes. And you can't set second-curtain sync in stroboscopic mode or FP mode, since that wouldn't make any sense. Finally, second-curtain sync requires a dedicated Speedlite flash unit - it isn't supported on flash units connected via a PC socket.

List of which flash units and camera bodies have second-curtain sync.

Note: verifying this information is difficult, since it's not listed on all product specs, and I don't have access to every camera and flash unit that Canon have ever built. I believe this list is accurate, but please let me know if there are any errors.

Flash units which do not support second-curtain sync:
Speedlites 160E, 200E, 480EG, ML-3.

Flash units with external second-curtain sync controls:
Speedlites 300EZ, 420EZ, 430EZ, 540EZ, 540EZ, 550EX, MR-14EX, MT-24EX.

Flash units which can use second-curtain sync when used with any EOS body that has a second-curtain sync custom function other than the Elan/100:
Speedlites 220EX, 380EX, 420EX, 550EX, MR-14EX, MT-24EX.

Camera bodies which cannot support second-curtain sync in any form:
EOS EF-M, 750, 850.

Camera bodies which lack custom functions altogether and so support second-curtain sync only when used with flash units with external controls:
EOS 650, 620, 700, all EOS 1000 series cameras, all EOS Rebel series cameras, all EOS Kiss series cameras, 300, 300V, 500, 500N, 5000/888, 3000/88, 3000N, the IX Lite/IX 50/IX 7*, IX**, EOS 300D/Digital Rebel/Kiss Digital.

Camera bodies with custom functions but which lack a custom function to enable second-curtain sync:
EOS 600, 630, 1, 1N, 1NRS, RT, 10/10S.

Camera body which has a second-curtain sync custom function that works on the internal flash but not on external units:
EOS Elan/100.

Camera bodies with custom functions that enable second-curtain sync on both internal flash and on compatible external flash units:
EOS A2(E)/5, Elan II(E)/50(E)/55, Elan 7(E)/30/33/7, D30, D60, 10D.

Camera bodies with custom functions that enable second-curtain sync on compatible external flash units but which lack internal flash:
EOS 3, 1V, 1D, 1Ds, 1D mark II.

The T90 camera and the 300TL flash unit support second-curtain sync, but only with each other.

* I haven't been able to find out if the IX Lite/50/7 camera supports second-curtain sync with flash units that have external controls, but since it's based around Rebel-style technology it seems unlikely that such support would have been removed.

** The Westfall/Overton FAQ states that the IX can use second-curtain sync with 380EX flash units, which lack external second-curtain sync controls. The Canon "Flash Work" brochure, however, isn't clear on this.

Range warning.

The first type of range warning applies only to the 630, 1 and RT cameras. All other EOS cameras lack this kind of range warning for patent reasons. If the foreground subject is too close to or too far from the flash to be illuminated by it, it's said to be "out of coupling range." If the subject is too far away then both the shutter speed and aperture values will blink in the viewfinder display. If it's too near then the distance display will blink.

The second type of range warning is built into the FEL feature with type A bodies. If the lightning bolt icon in the viewfinder blinks when you set FEL then you know that you don't have enough flash output to illuminate the subject correctly.

Manual flash.

High-end Canon flash units can also work in full manual mode, which lets you set the flash output by hand rather than relying on an automated system like TTL or E-TTL. Note that manual flash metering is *not* the same thing as the camera's manual exposure (M) mode, which is used for ambient (non flash) light metering. Though having said that, you usually put the camera into manual exposure mode when using manual flash metering, so it can be very confusing.

Traditionally, manual flash units required the user to perform calculations by hand in order to use them. However, Speedlites with manual controls and rear LCD panels can perform these calculations for you. This is how you do it.

- Set the *camera* to either Av (aperture priority) or M (manual exposure) mode. You can set the camera to other "creative" zone modes if you want, but the aperture symbol will flash to indicate a problem and the picture's flash metering will probably be out.

- Set the *flash* to manual mode. On the 430EZ and 550EX, for example, you press the mode button on the flash. The flash mode (TTL or A-TTL) will switch to M.

- Press the plus or minus button to set the correct flash intensity. 1/1 means full power, 1/2 means half power and so on. Different flash models support different numbers of flash intensity - the full list is below.

- Press the shutter button halfway. The flash will display the current aperture and a distance setting. On the 430EZ this distance setting will be a number of metres or feet, depending on whether you bought the flash anywhere in the world but the US or the US. On the 540EZ and 550EX the distance information is shown on a little scale, and the unit type can be changed by a small switch in the battery compartment.

- If you're in Av mode the shutter speed will be the camera's X-sync speed and you can manually set the aperture. In M mode you can set the shutter speed to any value from 30 seconds to the camera's X-sync and the aperture to anything within the lens range.

- Adjust the settings so that the distance information on the flash matches the number on the distance scale on the lens you're using. If the lens lacks a distance scale then you'll have to estimate or measure the distance.

- Once everything's set correctly you can press the shutter release all the way to take the photo, assuming the "flash ready" lightning bolt is displayed in the viewfinder.

  The flash can't help you in bounce mode - you have to perform the calculations manually by measuring the flash to subject distance. Remember that in bounce mode it's not the distance from the flash to the subject that's important - it's the distance that the light actually has to travel from the flash to the reflecting surface and then to the subject. You also have to factor in the light loss from the reflecting surface, which can only really be done by experience or judicious use of a flash meter. Also don't forget that the flash unit's

guide number is measured in metres and for ISO 100 film. If you want to use feet and/or film of a different speed you will need to do some additional arithmetic.

Flash units with manual controls:
Speedlites 420EZ, 430EZ, 540EZ, 550EX, 480EG, MR-14EX, MT-24EX, 300TL.

Two levels of manual power - MHi (full power) and MLo (1/16):
Speedlite 300TL.

Five levels of manual power - full power to 1/16:
Speedlite 480EG.

Six levels of manual power - full power to 1/32:
Speedlites 420EZ, 430EZ.

Seven levels of manual power - full power to 1/64:
Speedlites MR-14EX, MT-24EX.

Eight levels of manual power - full power to 1/128:
Speedlites 540EZ, 550EX.

Flash exposure level.

The most recent high-end Canon cameras have the ability to display the flash exposure level in the viewfinder. When you press the FEL button near the shutter release a sliding scale will appear in the viewfinder on the right side. Typically this is done with a grey card filling the spot metering circle.

The flash exposure level will be displayed on the far right bar of this scale. You can then adjust the output on the flash unit manually to match the standard exposure level.

Cameras with viewfinder flash exposure level scale:
EOS 3, 1V, 1D, 1Ds.

Rapid-fire mode.

Electronic flashes work by charging up a capacitor with electricity, then releasing the stored-up power in a split-second burst of light. This charging process, the "recycle time," takes up to a few seconds on larger units - which can be a problem if you need to take several flash photos in fairly rapid succession, such as at a wedding.

Many EOS flashes have the ability to be triggered even if not fully recharged, on the theory that there are times when you're better off being able to take a photo without a full flash charge available (ie: at a lower guide number than maximum) than having the flash not fire at all. Flash units capable of this feature have a two-colour flash ready ("pilot") light. If the light is red then the flash is fully charged. If it's green then the flash is only partially charged but will still fire anyway if you take a photo.

It can be quite frustrating using a flash unit without rapid-fire, in fact. It's all too easy to take two photos in succession only to find that the second one didn't trigger the flash and so is totally underexposed.

Rapid-fire mode will not work if the camera is in continuous film winding mode, if the flash

is in manual mode at full or half power or if the camera is in stroboscopic flash mode at a fairly fast setting. The 430EZ does not work in rapid-fire mode if an external battery pack is used.

Flash units with rapid-fire capabilities:
Speedlites 160E, 300EZ, 420EZ, 430EZ, 540EZ, 550EX, 480EG.

Flash units with no rapid-fire capabilities:
Speedlites 200E, 220EX, 380EX, 420EX, ML-3, MR-14EX, MT-24EX, 300TL.

Stroboscopic flash.

In flash photography the term "stroboscopic" refers to a photographic technique whereby a number of brief pulses of light are emitted during the course of a photographic exposure. The result can capture, for instance, half a dozen steps of a dancer in motion. Each step would be recorded on the same frame of film, like a multiple exposure. Here's a less than thrilling example that I took as a test - a bit poorly done, since the foreground was underexposed because of insufficient flash output, but you get the idea.

To take a stroboscopic photo you need to have a very dark background that doesn't reflect much light. If you have a bright background you'll find that the multiple pops of light from the flash will build up cumulatively to overwhelm the foreground subject. You'll probably also need to experiment a fair bit to determine the ideal number of light pulses to cover your action appropriately and the output settings required to expose the subject correctly. You'll probably want to use negative (print) film and not slide film for such a photo, since the former has much wider exposure latitude.

Setting stroboscopic flash.

High-end Canon hotshoe flash units have a stroboscopic mode, activated by pressing the mode button until MULTI is displayed on the rear LCD panel.

You can then enter the firing frequency in hertz (ie: the number of flashes per second) and the power output setting. The 5xx flashes also let you specify the actual number of stroboscopic light flashes as well. The 4xx flashes don't, so you have to calculate that number from the time period the shutter is kept open and the number of flashes per second you've set. The maximum firing frequency of the flash varies from flash model to model, but it ranges from 5 to 199 Hz. Power settings also vary - the 430EZ and 540EZ, for example, cannot use stroboscopic flash at full or half power - only 1/4 power and down.

Naturally there's a relationship between these settings - you can't fire many times at higher power settings if the firing frequency is high, for example, since the flash needs time to recharge. The flash manual includes a table showing the maximum number of flashes you can expect at different power settings and firing frequencies. There is a risk of overheating and damaging the flash bulb if you pulse the bulb too much, but the flash units have cutoff mechanisms that prevent this from occurring.

Once you've set the flash settings you can put the camera into M (manual exposure) mode and determine how long the shutter should be kept open in order to cover the full field of action for your photo. You can also set the proper aperture. As you do this the flash will display the coupling range on its rear-panel LCD. (press the shutter release halfway if the coupling range information is not displayed) Adjust the power output and aperture so that the coupling range matches the focus distance.

Stroboscopic flash won't work with the EOS EF-M, 750 and 850 cameras.

Flash units with stroboscopic capabilities:
Speedlites 420EZ, 430EZ, 540EZ and 550EX.

Stroboscopic ranges:
Speedlite 420EZ: 1-5 Hz.
Speedlite 430EZ: 1-10 Hz.
Speedlite 540EZ: 1-100 Hz.
Speedlite 550EX: 1-199 Hz.

Flash exposure confirmation.

Not to be confused with flash exposure compensation. Some Nikons have a very handy feature - a small LED which illuminates in the viewfinder to indicate that the flash believes you had enough light to exposure your subject correctly. Unfortunately, for patent reasons no Canon camera bodies have such a feature.

The closest thing in the Canon world can be found on many flash units, not camera bodies. Most Speedlite flash units have a small LED which lights up for two or three seconds, post-exposure, to confirm that there was sufficient light from the flash to illuminate your subject correctly. This is a nuisance since you have to lift your head and peer at the flash back in order to see this light, but I guess at least it's there.

Keep in mind one important limitations of this feature - the LED will glow even if the image was overexposed. It only checks to see that the photo was not underexposed owing to being out of range. So having this LED light up is no guarantee of a perfectly exposed flash photograph.

Flash units with flash exposure confirmation:
Speedlites 480EG, 540EZ, ST-E2 remote transmitter, ML-3 ring flash and all EX flash units.

Wireless remote control.

There are a number of third-party (ie: non-Canon) systems for controlling flash units from a distance such as products from Wein and PocketWizard. However, the newest E-TTL Canon flash units are also capable of being triggered remotely without wires, much like Minolta's pioneering wireless flash system. These wireless E-TTL units work as master or slave units.

And yes, it's kind of unfortunate that the terms "master" and "slave" are used in this context. Unfortunately the terminology is pretty common in the world of hardware engineering to mean a system with a controlling device and a responding device, the grim political and social overtones of the words notwithstanding. However, to minimize confusion I'll use the terms since Canon use them.

How wireless E-TTL works.

Canon's wireless E-TTL system employs brief digitally-encoded pulses of light (either visible or infrared, depending on the master unit used) to transmit commands from a master flash unit to a slave unit or multiple slaves. Since the system relies on digital messages in the light pulses it's immune to the problem that regular optical slave flash units have - that of being triggered accidentally in response to other flash units firing. (unless you're near other photographers who are also using Canon wireless flash units, of course)

Wireless E-TTL doesn't use radio signals like most third party systems, so you can't trigger flashes remotely from great distances, such as the other side of a sports arena. But it's ideal for quick, portable and flexible flash setups in smaller spaces. Canon chose light-controlled wireless rather than radio partly because it's cheaper to implement and partly to avoid the regulatory nightmare of getting licensing approval for radio transmitters from every country in which Canon sell photographic gear.

Canon's wireless system requires at least two wireless-capable flash units in order to work. A master flash unit is attached to the camera's hot shoe (either directly or using the Off-Camera Shoe Cord) and the slave flash unit or units are set up to illuminate the scene as desired. Unfortunately no current EOS camera can use its internal flash unit as a wireless E-TTL master; convenient as that would be. Hopefully future EOS camera bodies will have this ability - it shouldn't require additional hardware to implement, and it'd be very handy. You would then, for example, be able to walk around with a camera in one hand and a flash in the other without any bulky transmitter units or cumbersome cords.

As noted above, the master unit sends command signals to the slave units by using pulses of visible light or infrared, so each slave must be positioned such that the wireless sensor on its front can see these pulses. When shooting indoors with many light-reflecting surfaces (walls, ceilings, etc) the slave should be able to detect the master's control signals even if the two units aren't set up to point at one another, but outdoors or in an un-reflective indoor setting the slave unit's front-mounted sensor must be able to see the front of the master unit, which can be a little inconvenient. It may help to remember that many Canon flash units, such as the 420EX and 550EX, have rotating heads, so it's possible to have the flash head pointing in a very different direction from the body of the unit. You can also put the master unit on an off-camera shoe cord rather than mounting it directly to the camera body if you need to point it in a certain direction.

Command transmission distance depends partly on the angle at which the master is transmitting relative to the slave and whether you're using the units indoors or outdoors. In addition the 550EX, which uses visible white light from the large main flash tube to send data, has greater range than the ST-E2, which uses a smaller flash tube covered by a plastic filter so it emits only invisible infrared energy.

The 550EX has an official transmission range of 8-10 metres (25-30 feet) when used outdoors, with horizontal coverage of roughly 80° and vertical of about 60°, assuming that the flash head is set to its 24mm setting. Naturally you can adjust the flash head zoom setting manually to a tighter coverage than that if you want - or wider if you use the flip-down 17mm panel, though at the cost of dramatically decreased range. There's conflicting data about the ST-E2. Canon USA's spec sheet claims that the ST-E2 has the same range as the 550EX, which appears to be incorrect. Canon USA's Chuck Westfall has said that the ST-E2 actually has a range of about 3.5-5 metres (12-15 feet) when used outdoors, with coverage of about 40° horizontal and 30° vertical.

The control pulses from the master unit to the slave or slaves are sent at varying points in the period between the camera's shutter release being fully pressed down and the shutter opening. The wireless E-TTL control sequence works as follows:

- Photographer presses the shutter release button halfway.
- Ambient light metering of the scene is conducted.

- Photographer presses the shutter release all the way.
- The master flash unit sends a wireless signal to all slave units in group A, instructing them to issue a low-power preflash.
- Any slave units in group A fire a preflash and the camera records this light output using its evaluative meter.
- The master flash instructs group B slaves to issue a preflash.
- Any slave units in group B fire a preflash and the camera records this light output.
- The master flash instructs group C slaves to issue a preflash.
- Any slave units in group C fire a preflash and the camera records this light output.
- The camera calculates what the final flash output for the scene should be, based on both the preflash data from each slave group (if any) and the user-defined group ratios/flash exposure compensation settings.
- The camera flips up the mirror and opens the shutter.
- The master flash instructs all slave units to fire simultaneously.
- All slave units fire at whatever level the master unit has told them to. Naturally if the master flash unit is flash-capable (ie: not an ST-E2) and is configured to fire then it too will do so.
- The camera flips down the mirror and closes the shutter.

  There are of course differences in the timing of some of these events if AE lock, flash exposure lock (FEL) and/or second-curtain sync are used, but that is the basic flowchart. Naturally these command pulses and prefires occur at an extremely rapid rate. They'll register with the human observer but occur far too quickly to mean anything to a human.

  Using wireless E-TTL.

  You can specify one of four different data channels for flash control, and each flash unit can be put into one of three groups. The four channels are there so that up to four cameras can use wireless E-TTL in the same physical location without conflicting with each other, and the three groups are there so that independent flash output ratios can be specified (though only with certain cameras; see below). When wireless mode is used with any type A body you have full E-TTL metering, FP mode, FEL and other E-TTL features.

  There is no coded limit to the number of slave flash units which can be in each group. This is because there is no two-way communication between master and slave units - each slave simply sits there and awaits commands, and the master only knows what slave units exist in terms of whatever light they produce during the prefire stage. So you can set up as many slave units as your space and budget can accommodate. The only issue here is the SE (save energy) feature, which will cause slave units to switch to an energy-saver mode after a certain period of time. (see the SE section for details)

  You can check whether your slave flashes are within transmission distance or not by

pressing the test ("pilot") button on the master flash unit. The camera will instruct all the slave units to emit a flash of light. First the A group units will flash, then the B and then the C. If your camera has modelling flash capabilities (see list in next section) you can use that feature as well, giving you a quick preview of the final scene.

The 550EX, when used as a master unit, can have its main tube disabled, so it can control the slaves without contributing any camera-mounted light to the scene. In addition, flash units with zooming flash heads (the 550EX and 420EX) automatically zoom out to 24mm coverage when in wireless flash slave mode, though it's possible to override the zoom setting manually in the case of the 550EX.

You *can* use Canon's wireless flash units with older type B bodies, but only if you set the flash output settings manually, (where possible - the 420EX has no flash exposure compensation pushbuttons and so can fire only at full power) which isn't particularly convenient. In other words, Canon's wireless system works only with E-TTL and does not work with either TTL or A-TTL flash metering.

Ratios.

A number of recent mid to high-end type A camera bodies - see full list in next section - are capable of supporting varying light ratios between flash groups. (ie: this is unrelated to fill flash ratios with single flash units) Each slave flash can be in one of three groups - A, B or C. If your camera is ratio-capable you can then specify the ratio of light produced by flash units in groups A and B. This A:B ratio can be set from 1:8 to 1:1 to 8:1 in half-stop increments, which yields a total of 13 stops. The 550EX is also capable of specifying flash compensation for a third and completely independent group - group C. Compensation of group C is adjusted from -3 to +3 stops relative to the A:B ratio, in 1/3 increments.

Note that if you're using a 550EX as a wireless master unit (either on-camera or connected to it using the off-shoe camera cord) then it defaults to group A. If you want to control the ratio of slave unit output to master unit output be sure to put the slave units into group B.

The two Canon EX macro units - the MR-14EX and the MT-24EX - also support wireless flash capabilities. The flash units can both serve as master units in wireless E-TTL setups, though not in the way one might expect. One of the two flash tubes on the macro unit is assigned to the A group and the other to the B group (the tubes are marked on the flash unit) and you can use the macro unit controller to specify the output ratio between the two tubes if you have a ratio-capable camera. You can then assign other slave flash units to group C and adjust flash exposure compensation of these units relative to the two macro unit tubes. You can also use a custom function on the flash to control slaves in groups A and B, but they are linked to the internal tubes.

Unfortunately, the first generation of type A (E-TTL capable) bodies support wireless E-TTL but do not support wireless E-TTL ratio control - all flash units on the same channel will fire at the same power when used with such cameras. However, if you're using a 550EX as a slave there is a partial workaround for this - you can specify flash exposure compensation manually using the flash unit's push buttons.

One interesting side benefit of wireless E-TTL's ability to control multiple flash units is simplifying high-speed photography. If you want to use flash to freeze rapid motion (water droplets, insects, hummingbirds, etc) you often have real range problems, since short duration flash pulses are also effectively low output pulses. If you've only got one flash unit at your disposal this limits the range the camera can be from the light source. However,

with E-TTL you can set up a battery of slave units, each at the same distance from the subject, and fire them simultaneously at low power. An expensive solution, to be sure, but one which affords a fair bit of versatility.

ST-E2 wireless transmitter.

Another interesting component of Canon's wireless flash system is the ST-E2 transmitter. This compact unit fits onto a camera's hotshoe and can control external wireless Speedlite flash units, but can't produce any scene-illuminating white light. The ST-E2 contains a small flash bulb, which it uses to send the control signals to other flash units, but the bulb is covered by a filter so that most of its light output is invisible infrared (IR) energy. Since the human eye can't detect IR, the ST-E2 is more discreet in operation than the 550EX when controlling slave units.

Although fairly small and portable, the ST-E2 can't transmit its control signals as far as, and its coverage angle is more narrow than, the 550EX. The ST-E2 is capable of about half the range of the 550EX, in fact, at about 3-5 metres (see coverage details above). This basically limits its usefulness to indoor photography in small rooms or studios. Unlike the 550EX the ST-E2 supports only groups A and B and A:B ratio control - it unfortunately cannot control group C. The ST-E2 also does not support flash exposure bracketing (FEB).

On a more positive front, the ST-E2 also contains a red AF assist light, which makes it a popular accessory for owners of EOS cameras which lack true AF assist lamps - notably the Elan 7/EOS 30/33/EOS 7 and D30 and D60 cameras.

Drawbacks of wireless E-TTL.

On the whole, wireless E-TTL is a powerful and flexible system with a few drawbacks. First, the wireless control pulses can inadvertently trigger analogue optical slave units and flash meters; a problem suffered by E-TTL in general. Both the white light pulses from the flash units (wireless signals are sent as preflashes from the main flash tube) and the infrared pulses from the ST-E2 control unit are sufficiently bright to cause problems with such equipment. Second, another side effect of the light pulses is you must ensure that the various units are correctly positioned so they can see each other, and that the receiving sensors on the front of each slave flash unit are not covered by anything. This also limits the working range compared to radio-controlled wireless units. Third, portable battery-powered flash units are still fairly low-powered compared to studio units and thus not suitable for a lot of complex flash arrangements or larger areas. Fourth, the ST-E2 unit cannot control group C slaves. And finally and most inconveniently, buying a bunch of Canon flash units is a fairly expensive proposition.

List of wireless-capable Canon flash units and cameras.

Master-capable flash units:
The Speedlite 550EX and the ST-E2 transmitter both have the ability to act as a master (control) unit. The MR-14EX and MT-24EX macro flashes can also serve as masters, but only with slave units in group C or with slave groups A and B linked to the internal tubes and other slave units in group C (see above).

Slave-capable flash units:
Speedlites 420EX and 550EX can both act as a slave flash when using wireless E-TTL. The MR-14EX and MT-24EX can also act as slave flashes, with the two flash bulbs on each unit assigned to slave groups A and B.

Flash units with no support for wireless E-TTL:
The earlier EX flash units - 220EX and 380EX - cannot operate in Canon's wireless mode. No TTL-only or A-TTL flash units (all E and EZ units) can operate in Canon's wireless mode.

Non-Canon wireless-capable flash units:
Metz also build a wireless flash system, but it's not compatible with Canon's implementation. Sigma, however, make at least one flash unit (the EF 500 Super) that's designed to be compatible with Canon's wireless protocol.

Camera bodies with support for basic wireless E-TTL:
All type A cameras.

Camera bodies with additional support for flash ratios and wireless modelling light:
EOS 3, 1V, Elan 7/7E/EOS 30/33/EOS 7, D30, D60, 1D, 1Ds, 10D, 1D mark II.

Modelling flash.

Large studio flash units frequently have incandescent tungsten bulbs built in alongside the main flash tube or tubes. These constant-light bulbs cast light on the subject in much the same way as the actual flash bulb would, only much more dimly. This constant light is known as a modelling light, as it allows you to preview the flash effect in a rough fashion - or at least see where the flash shadows and reflections are likely to fall.

The Canon modelling flash feature lets you simulate the effect of the flash going off before you take the picture - particularly useful for previewing wireless E-TTL flash ratios. It works by pulsing the flash rapidly (at 70 Hz) for a second, much like in FP mode. This obviously drains the batteries and can overheat the flash unit if triggered repeatedly, so it's best used sparingly. Pressing the depth of field preview button fires the modelling light, but you can turn this off with a custom function if you find it annoying. The 420EX must be in slave mode for the modelling light to work.

You need both a camera and a flash unit which can support modelling flash to use the feature. The camera must be in a creative zone mode for this feature to operate - modelling flash will not work in the PIC modes. Note also that Canon's ring flashes also contain small white incandescent bulbs for focus assist and modelling purposes.

Camera bodies which support modelling flash:
EOS 3, Elan 7/EOS 30/EOS 7, 1V, 1D, 1Ds, D30 and D60, EOS 300V/Rebel Ti/Kiss 5, 10D.

Flash units which support modelling flash:
Speedlites 420EX, 550EX, MR-14EX and MT-24EX.

Save Energy (SE) mode.

Most EOS flashes go into low-power or SE mode (called "Energy Conservation Control" in some Canon material) after a predetermined period of time - usually 90 seconds or 5 minutes - in order to minimize battery drain. Some flash units are always in SE mode when powered on. However, since it can be annoying to have your flash unit turn itself off in the middle of setting up a shot some flash units have a three-position switch - off, on and SE. The ability to override SE mode is very important for wireless flash applications.

Pressing the shutter release button down halfway will wake up the flash and recharge it. If you're using the intervalometer on an EOS 10/10s, a 600-series camera with the Technical

Back E, an EOS 1 or 1N with the Command Back E1 or an EOS 1v, 3, D2000, D30 or D60 with the TC-80N3 timer/remote controller, the camera will wake up the flash unit a minute or so prior to taking a photo in order to give it time to recharge.

Note that there is still battery drain associated with the SE mode. If you're going to leave the flash off for more than an hour or so you're probably best off turning it off altogether. Some more advanced flash units like the 550EX have custom functions which allow you to adjust various power-down time intervals.

No power switch at all:
Speedlite 160E. (unit charges up when you press the shutter halfway)

No SE function:
Speedlites 480EG, 200E.

90 second SE timeout:
Speedlites 380EX, 420EX*, 430EZ, 540EZ, 550EX*, MR-14EX, MT-24EX.

5 minute SE timeout:
Speedlites ML-3, 300EZ, 420EZ, 300TL.

SE override capabilities (3 position power switch):
Speedlites 540EZ, 550EX*, MR-14EX, MT-24EX, 300TL.

* These flash units behave differently when they're used off-camera in wireless slave mode. Here the SE timeout is extended to 10 minutes for the 420EX and 60 minutes for the 550EX (unless custom function 4 is set on the 550EX, in which case it's 10 minutes). Pressing the master unit's test button or activating FEL on the camera will wake up a slumbering flash.

High voltage connector.

Speedlites 430EZ, 540EZ, 550EX, MR-14EX, MT-24EX and 480EG have high voltage connectors which allow you to connect large-capacity external battery packs. See the battery pack section for details.

PC terminals/sockets.

Many older flash units and most studio flash units support PC connectors, which are simply electrical connectors and wires used to connect cameras and flash units. They just carry a trigger current and do not carry digital data communications of any kind such as metering information.

All semi-pro and high-end EOS cameras have a built-in PC socket. Lower and midrange EOS cameras generally don't have PC sockets. However you can cheaply buy small adapters which plug into the camera's hotshoe mount which convert to PC cables, so this normally isn't a huge limitation. None of Canon's standard flash units can be triggered via a PC cable without a hotshoe adapter for the flash unit. Only the 480EG can connect to a PC connector via the optional Synchro Cord 480.

The PC here stands for "Prontor/Compur," two manufacturers of leaf shutters used in older and large format cameras. It does not stand for "personal computer" in this context, and so a camera with a PC socket cannot be hooked up to a computer through it. Some of Canon's material refer to it as a "German" socket.

Finally, be aware that many studio flash units use very high trigger voltages, which can damage your camera. Canon recommends that trigger voltages of 6 volts or less only be used with the camera's hotshoe. The PC socket has better high-voltage protection on at least some models, however. The EOS 1D, for example, should not be used with flash units which have a trigger voltage of greater than 250 volts. I don't have information on every PC-equipped EOS camera model, so please consult the manual which came with your camera. (assuming the manual says anything - the D30 manual does not list a safe voltage, so you may need to ask Canon)

EOS cameras with PC sockets:
EOS 1, 1N, 1NRS, 5/A2/A2E, 3, 1V, 1D, 1Ds, D30, D60, 10D, 1D mark II.

Custom functions on flash unit.

The most recent high-end E-TTL Canon flash units - standard hotshoe flash unit 550EX and ring lights MR-14EX and MT-24EX - have custom functions, much like mid and high end Canon camera bodies. These "functions" (settings or parameters, really) allow you to alter the default behaviour of the flash units in certain ways.

For example, custom function 3 on the 550EX and MR-14EX lets you switch from E-TTL to TTL flash metering.

Test flash (manual firing).

If you want to fire the flash manually simply press the illuminated pilot light on the back of the unit. The flash unit will fire a test burst, whether on-camera or not.

Flash units which lack a manual fire button:
Speedlites 160, 200, possibly others.

Manual flash triggering for light painting.

A fun way of taking interesting photos in the dark is to trigger a flash unit manually whilst leaving the shutter open - sometimes called "open flash." For example, you could set your camera on a tripod, open the shutter by putting the camera into "bulb" mode, and then walk around the scene with a flash unit, painting the scene with light. Coloured gels can be taped over the flash head as well, to illuminate the photo with different colours of light.

Canon Speedlites with manual controls or old flash units with manual metering are ideal for this - you can take the device off the camera shoe, dial in the appropriate manual flash setting (full power, say, or 1/2 power or 1/16 or whatever) and then trigger the flash by hand. You do this on most Speedlite flash units by pressing the illuminated pilot light on the back of the device - other flash units should have similar manual trigger buttons. If you wear dark clothing and point the flash away from you you shouldn't even appear in the photo. You can't rely on your camera's light meter to help you meter the scene, so this sort of thing is largely a trial and error process. It's helpful to keep the flash the same rough distance from the area to be illuminated for each flash burst.

If you have an E-TTL (type A) camera with an EX series flash unit you can even take advantage of FEL to meter

Naturally you don't have to use flash unit to do this. People often take outdoor night scenes using high-powered floodlamps or indoor photos with small flashlights (electric torches) or

blinky light toys. And it doesn't have to be used purely for fun or unusual photographs. Here's a photo, for example, that was primarily illuminated by the full moon and small kerosene lamps. However I had a portable incandescent flashlight with me which I used to brighten up shadow areas. Sort of a really slow fill flash.

Finally, on a somewhat related topic, it's possible to do high-speed photography - such as photos of a balloon being burst with a pin - using ordinary flash gear. You build or purchase a sound trigger, set up your subject in a pitch-black room, open the camera shutter and let the sound trigger fire the flash. Flash units are capable of extremely brief light bursts, particular at low power settings - remember that power output on portable flash units is determined by the duration of the pulse. There's a lot of useful information on how to do this at http://www.hiviz.com/.

Noise.

This is sort of a feature; albeit an undesirable one. But flash units always make various kinds of noise. There's usually a high-pitched whistling whine which increases in frequency as the unit is charged up. This is caused by an oscillator circuit, used to convert DC to AC so that the device can generate the high voltages needed to charge the capacitor. Some flash units, like the 540EZ and the 550EX, have multiplex circuits which make particularly noticeable humming/clicking sounds when powered on. All flash units also make a soft popping sound when fired.

The other thing you can hear on zooming flash units is the hollow rattling buzz of the small electric motor used to move the flash bulb inside the flash head. This is also totally normal.

Flash safety.

Finally, and this isn't really a flash unit feature as such but just something that doesn't really fit in anywhere else, I'd like to remind you about the need to keep flash safety in mind.

Electronic flash technology involves extremely high voltages - literally thousands of volts. The amperage is fairly low, but nonetheless some of the internal components of any flash unit still have quite a high-voltage kick to them if they've been charged up recently. And it takes a bit of time for this high voltage energy to drain out of the flash unit's capacitors. Even cheap disposable cameras with built-in flash units can shock you if they're disassembled.

So. Don't expose your flash unit to rain or liquids if you can avoid it. And don't open up the device and monkey around with the innards unless you know what you're doing and have drained the capacitors by grounding them. You could literally get a nasty shock - which could be deadly if you have a heart condition.

However, as long as you don't dismantle your flash unit or pour lemonade into it you shouldn't have any problems.

Accessories.

As with any photographic endeavour there are all kinds of add-on accessories you can buy for use with your flash unit.

Extension cords.

There are two extension cord systems which allow you to move the flash away from the camera for more complex flash setups.

The Off Camera Shoe Cord 2.

The OCSC 2 is a simple coiled cord with sockets on either end that lets you attach a flash unit to your camera's hotshoe and move the flash independently of the camera, up to a distance of about 60 cm (2 feet). This cord, though expensive, preserves all flash functions including E-TTL if it's available, and is useful for mounting a Speedlite flash to a flash bracket.

It's pretty short, however. You can connect two of them together if you need more distance, but Canon do not recommend this practice since the electrical impedance (internal resistance) changes. I've heard from other users that worked just fine for them, so you might want to experiment to see if it works reliably for you. Note also that there was the original Off Camera Shoe Cord (no numeric designation) which lacked a locking hotshoe pin. Despite reports to the contrary online, it appears that the two cords are both fully compatible with EOS cameras except for the note below.

The OCSC 2 has problems with some earlier EOS models. For one thing, it's not fully compatible with the EOS 600, 630 and RT and may behave unpredictably on those cameras. More excitingly, when used on the 10/10s camera the cord can generate more radio-frequency interference than is permitted by US, Canadian and German regulatory agencies. Using a 10/10s camera with an OCSC 2 in those countries makes you an RF outlaw!

Multiple TTL flash.

There's also the camera-mounted TTL Hot Shoe Adapter 3, which runs off a small lithium CR-2025 battery. This adapter connects with various dramatically costly accessories - 60cm and 3 metre connecting cords, the tripod-mount-equipped Off-Camera Shoe Adapter OA-2 for connecting Speedlites to cords and a TTL distributor that lets you hook one camera up to 3 flash units.

The cords must be used in conjunction with the Hot Shoe Adapter 3 and the Camera Shoe Adapter and connect together using mini-DIN style connectors - they don't use, say, PC connectors or anything like that. Note: there was also the original Hot Shoe Adapter (no numeric designation), which worked only with the T90 and does *not* work with EOS cameras, and the Hot Shoe Adapter 2, which does work with EOS cameras.

This system works with TTL only - A-TTL and E-TTL are not supported. In fact, a whole slew of flash features are not supported if you use the TTL Hot Shoe Adapter 3 cable system. You can't use A-TTL or E-TTL, there is no preflash, second-curtain sync does not work, the DEP mode will not work, program shift won't work, automatic flash head zooming is disabled (though manual zooming works if the flash supports it), the aperture and coupling range data is not displayed on flashes with LCD panels and the AF assist light does not work. These features are all disabled because their control signals a) are all sent down one line and b) would result in contradictory instructions from multiple flash units. (though as a side note this device can be used for disabling E-TTL features if you like)

You can't automatically adjust lighting ratios between the individual flash units in TTL multiflash mode - all flashes will fire at the same time and shut off at the same time. There are four awkward workarounds for this problem. First, you could move individual flash units closer to and further from your subject. Second, you could stick neutral density filters or

diffusers on the flash heads. Third, you could use manual zoom controls, if available, to zoom the flash head since that reduces the light output on wider lens settings. And fourth, you can use manual controls, if available, to adjust light output of each unit individually. However any flash set to manual will disable TTL flash for all of the flash units. You can't shoot a multiple flash photo with a mixture of manual flash and TTL autoflash.

The TTL Hot Shoe Adapter 3 cord system is really only useful for older (type B) bodies and compatible flashes. In fact, the cord system doesn't work at all on E-TTL only cameras like the digital 1D, 1Ds, D30 and D60. The new wireless system supported by the latest E-TTL flash units is considerably more flexible (it supports ratios on certain cameras, for example) and convenient (no wires to trip over or limit your placement of slave units).

Flash diffusers.

A number of manufacturers, such as StoFen and Lumiquest, sell various attachments you can clip or tape onto the head of your flash unit. These diffusers usually cost a couple stops of light, easily halving your flash range, but can soften and tame the harsh light of a flash considerably under certain circumstances - see the quality of light section for more information on how they work. There are two basic types - small light redistributors and large panels.

Small diffusers are of the StoFen Omnibounce variety - milky white (or green or yellow) plastic open-ended boxes which fit snugly over the head of the flash unit. These small diffusers redistribute the flash unit's light output so there's more light scattering around and bouncing off walls and ceilings and so on. This type of diffuser is, therefore, good for bouncing light around small interior spaces or for doing macro (closeup) photography without a macro flash. It's not so good if you're shooting outdoors or in dark interior spaces, where there's nothing off which to bounce the light. In such situations you're simply cutting down your usable range, wasting power (and thus batteries and thus money) and increasing flash cycle time by using a small diffuser. It's also not recommended for use in spaces where the walls or ceilings are painted bright colours, as the light bouncing off those surfaces will have a colour cast to it.

The other type of diffuser, such as the Lumiquest ProMax, is a big white stick-on panel. These diffusers essentially enlarge the light output area of the flash, softening the edges of shadows. Unlike small diffusers these larger accessories aren't so reliant on white surfaces off which to bounce light and thus are of more value outdoors or in large banquet halls and so on. However, they're really meant for relatively close-range shooting - they won't help much when taking pictures at a distance and indeed will hinder, as they cut the range of your flash unit by at least half and again, wasting batteries and increasing flash cycle times.

Note that Speedlites 540EZ and 550EX also include flip-down panels that serve as wide-angle flash diffusers and which increase flash coverage to 18 or 17 mm, respectively. Such panels are important for wide-angle photography since flash units aren't typically designed to cover huge areas. Fisheye lenses in particular represent a bit of a problem, since they have such wide coverage (nearly 180° diagonal for 15/16mm fisheyes and nearly 180° vertical for 8mm fisheyes) and so some experimenting with diffusers would be required for successful flash-illuminated fisheye photography.

Be careful if you're using A-TTL flash. A-TTL relies on an external sensor on the front of the flash unit, behind a recessed transparent lens. Certain types of flash diffusers can either block this sensor or reflect light down from the flash head to the sensor. Either way the sensor will get confused, which can lead to problems with your flash metering. Make sure

the diffuser doesn't block the sensor. In the case of StoFen's Omnibounce accessory, for example, follow the instructions and tilt the flash head upwards by 45 degrees or so.

Another important thing to remember is that you do not have to adjust flash compensation when using a diffuser in any automatic flash metering mode that works through the lens (TTL, A-TTL or E-TTL) - just put the diffuser on the flash unit and shoot away. The camera will adjust automatically for the stop or two that the diffuser costs you, up to the limits of the flash unit's light output. Of course, if you plan on shooting in manual flash metering mode you'll need to factor in the reduced light output yourself through testing.

Finally, don't think you have to spend the money on these accessories. You can always just slap together a homemade flash diffuser out of a white translucent milk jug or tracing paper or thin fabric or whatever else you have lying around. A common trick is to angle the flash unit vertically, then use an elastic band to wrap an index card around the back of the flash head. This provides some forward light in addition to the light bouncing off the ceiling. The expensive accessories are mainly just more convenient and professional-looking.

Flash brackets.

As noted above, the large metal brackets from companies such as Stroboframe and Newton, and designed for mounting external flash units to a camera, are commonly used by wedding photographers and the press for reducing the risk of the redeye effect. However they also serve other purposes as well.

By raising the flash up above the lens you also reduce ugly flash shadows cast onto walls behind a subject. The shadows still occur; they're simply lowered down below the subject and thus may not appear in the final picture. Many flash brackets also have rotating attachments which allows you to keep the flash centred above the lens at all times rather than having it on the side when you take photos in portrait orientation rather than landscape.

The primary drawbacks of flash brackets are that they're very large and cumbersome and that they make you look like you've got a huge gigantic camera rig - which can frighten your human subjects or make them feel much more self-conscious than they would normally.

Another drawback involves AF assist lights. If you raise the flash off the camera you may find that the assist light on the flash unit no longer lines up correctly with the camera's focus points, thanks to simple geometry. Ironically this isn't a problem for A2/5 and 10/10s users, because those cameras never activate the AF assist light on external flash units.

External battery packs.

Most of Canon's high-end flash units have sockets on the side which can accommodate external high-voltage (270 volts) battery packs. These packs have two basic functions - they speed up the flash's recycle time between shots to a second or two (critical for news or wedding photography) and extend the time you can go between changing batteries. They're also useful in cold weather (battery performance always drops precipitately at freezing temperatures) since you can stuff the pack inside your jacket to keep the cells warm if necessary.

The Compact Battery Pack E requires 6 regular AA alkaline, NiCad or NIMH cells, but the newer Compact Battery Pack CP-E2 can also accept lithium AA cells. Either compact pack

can be attached to the bottom of a camera using the tripod mounting screw. The much larger Transistor Pack E can use either 6 regular C cells (with Battery Magazine - lithium cells are not compatible) or nickel-cadmium rechargeable cells (with Ni-Cd Pack) and obviously has much greater capacity than the smaller Compact pack.

A number of other companies also sell high-power battery packs compatible with the Canon Speedlite high-voltage connector. These products include Quantum Instruments' Turbo (lead-acid) and Turbo Z (NiCad), Lumedyne's Cycler and Dynalite's Jackrabbit.

Unfortunately, the packs are all fairly heavy, bulky and inconvenient, (especially the huge Transistor Pack E and third party products) and require that the flash unit be tethered to the battery pack via a coiled cord. Note also that the flash unit will not work with an external pack if the flash unit's internal AA batteries are dead or missing - the high-voltage power is used solely for recharging the unit's capacitors, not for powering its control circuitry.

A number of manufacturers also sell generic battery packs (such as the Quantum Bantam) which can be connected to most AA-powered EOS flash units - even those which don't have special power sockets. They work by replacing the AA batteries with a plastic shell and running a cord to the power pack. However, as they aren't high-power they can't speed up the recycle time as dramatically - they're more useful for extending the number of shots you can accomplish between battery changes.

Keep in mind that portable flash units were not designed for continuous high-power use. You can damage your flash if you fire too many high-power bursts in a short period of time; something an external battery pack may let you do. So try not to fire flash bursts for longer than a few seconds, especially at full power manual or small aperture TTL firing. Remember that smoke emerging from your flash unit is shorthand for "stop immediately."

Flash units with high-voltage sockets:
Speedlites 430EZ, 540EZ, 550EX, 480EG*, MR-14EX and MT-24EX.

* The Compact Battery Packs are not recommended for use with the 480EG.

Flash extenders.

If you're doing nature photography of wild animals or are stalking wild celebrities for a tabloid and need to use flash photography across great distances, you might consider a flash extender, such as the Better Beamer. These accessories are simply plastic Fresnel lenses you can attach to your flash unit's head with tape or velcro. They concentrate the light much like a zooming head and give you an extra couple stops of light, at the cost of coverage area. They're only really useful, therefore, when using very long telephoto lenses - say, 300mm or so or longer. Michael Reichmann's "Luminous Landscape" Web site has some example photos of how this works, and Arthur Morris' "Birds as Art" site sells them.

I've also seen the term "flash extender" refer to devices which let you mount your external flash unit higher up off the camera hotshoe, but that's something different altogether.

Power source options for external flash units.

Most Canon external flash units run off four standard AA (LR6) alkaline cells, though one - the tiny and discontinued Canon 160E - used instead a small 2CR5 lithium battery of the type used by many EOS cameras. Here are some power source options for the AA type of

flash.

Remember that all batteries can leak. If they do you'll find your beloved flash unit full of a corrosive liquid that will damage or even destroy it. It's wise to remove any cells from your flash if you aren't planning on using it for some length of time - a few weeks or whatever.

Note also that some flash units can behave erratically when battery power is low. Normally weak batteries just result in long recycle times, but on the 430EZ at least low batteries can result in strange behaviour - the flash triggering randomly, the zoom motor buzzing at odd intervals, etc. So if your flash unit suddenly starts acting strangely try changing the batteries. This can also happen if the flash unit isn't firmly seated in the hotshoe or if the contacts are dirty or corroded.

Standard AA non-alkaline (zinc carbon) cells.

Pros: Available for next to nothing.

Cons: Don't last very long at all and can't be recharged. They also have fairly high internal resistance and so it takes a few extra seconds for the flash unit to recharge between shots.

Standard AA alkaline cells.

Pros: Alkalines are cheaply and readily available anywhere. They store a fair bit of power and let you go a reasonably long time between replacements.

Cons: Last much longer than carbon zinc cells but otherwise have the same disadvantages. Recycle time to full power can range from 6-20 seconds, depending on how new the cells are.

Rechargeable nickel-cadmium (NiCad) cells.

Pros: Relatively inexpensive, rechargeable hundreds of times. They have a fairly low internal resistance and so decrease the recycle time the flash unit will take to recharge to full power to 4-6 seconds. NiCads also have better cold-weather performance than alkalines - their performance suffers when the temperature drops below freezing, but not as badly.

Cons: Don't store as much juice as alkalines, so you have to switch batteries much more often. NiCad cells are also hazardous household waste (heavy metals) and should not be thrown into the regular garbage system. NiCad cells drain flat ("self-discharge") within a few weeks after charging.

Lithium AA (FR6) cells.

Pros: A fairly new development, these are lithium cells built to an AA shape. They store a lot of power, have long shelf lives, and recharge the flash at roughly the same rate as alkalines.

Cons: Really expensive and not rechargeable. Steep death curves - they'll work fine and then suddenly run out of power unexpectedly. Most importantly, only the latest Canon Speedlites can use them. Older models are not compatible with lithium AA cells owing to power issues, and might be damaged by them. The

540EZ and all EX series flash units can safely use lithium cells; all other flash units cannot.

Rechargeable nickel metal hydride (NiMH) cells.

Pros: Affordable and rechargeable hundreds of times. Higher capacity (1600 mAH) cells have similar capacities to alkaline cells. Not as hazardous to the environment as NiCads. Have a similar recycle time to full charge as NiCads - around 4-6 seconds.

Cons: Require different chargers from commonly available NiCad chargers. Can self-discharge in a couple of weeks.

External battery pack.

Pros: High-power packs can decrease recycle time to a second or two, letting you shoot flash photos more rapidly. Store a lot of power and so mean you don't have to change batteries as often.

Cons: Large, bulky packs linked to the flash via coiled cords. High-power battery packs work only with a handful of high-end flash units with the necessary power socket. Third-party battery packs are required for use with other Canon flash units, but don't have as rapid recycle times.

Flash tips.

Here is a handful of tips and potential pitfall areas. To begin with, however, a brief discussion about the quality of light (the kind; not a value judgement) involved in flash photography.

Quality of light.

I'm sure we've all had the dispiriting experience of getting a roll of film back from the lab, only to find that the photos that you hoped would look terrific are all harshly lit and disappointing. How is that the professionals get such wonderful looking photos? Well, there are many reasons for this, but since this is an article about flash photography I'm going to discuss just one very common reason why amateur photographs can look terrible - flash.

The problem typically comes down to the quality of light. For a professional-looking photo of a person you generally want very soft light (light which lacks distinct shadows) or light which originates off the lens axis or both.

Hard and soft light.

The difference between hard and soft lighting essentially comes down to the relative size of the light source compared to the subject. Soft lighting is light which originates from a large area. Think of an overcast day, when the sun's light is filtered through clouds covering the entire sky - shadows are very soft. By contrast, a stage spotlight will cast a perfectly sharp circle. Hard light tends to produce sharp-edged shadows, emphasizes facial blemishes and generally looks very unflattering, except in certain special-effect cases or when photographing people with marble-smooth skin (or heavily coated with makeup, as in the case of Hollywood movie stars from the 1940s).

Portable camera flashes are essentially designed to work like spotlights and have pretty small light-emitting areas - just a few square centimetres. This is partly for portability reasons and partly because flash units are designed to achieve the maximum distance range possible, by concentrating their light output with a reflector and lens. Any softening of the light necessarily involves a reduction in efficiency and range. So the light from a flash unit is, therefore, very hard-edged and harsh. Sometimes you want light like that - for illuminating glittery objects and emphasizing specular highlights. But for many things you don't.

The easiest way to soften the lighting in your flash photos is to bounce the light from the flash unit off a large white surface. White walls and ceilings work very well for this, as do large portable folding reflectors. You can also buy diffusers that attach to your flash that can help as well, either by distributing the light in more directions so the light can bounce off walls and ceilings, or by increasing the light-producing area somewhat. Remember that coloured surfaces will add a colour cast to the light - something you should always be aware of when bouncing light in interior spaces. A blood-red wall is going to reflect red light onto your subject.

Studio flash units (the big kind that plug in the wall) are frequently used with photographic umbrellas or softboxes to give the light source a larger surface area. Umbrellas are large folding umbrellas lined with white or silver, off which the light from the flash unit is bounced. (ie: the flash unit is mounted in the middle of the umbrella facing away from the subject, and the light bounces outwards) Softboxes are large boxes with reflective interiors and diffused white fabric front panels.

Portable battery-operated flash units don't really have the power required to illuminate large studios when used with umbrellas and large panel diffusers. But if you're on a budget and working in a smaller space, a photo umbrella - or even a regular umbrella painted silver on the inside and taped to a stand - can be a handy tool. So can directing the light from your flash unit through a simple frame with thin white fabric stretched over it. Experiment to find out what works for you. Here again, incidentally, digital cameras have a huge advantage - you can move things around and experiment constantly and get immediate feedback on the screen as to whether the new configuration works or not.

Remember that it's the relative size of the light source compared to the subject that's important. A huge softbox a long way away from a subject has the same kind of hard light as does a small diffused flash close up. So placing the diffused lightsource close to the subject is important as well. In studio situations softboxes are often positioned just outside the frame of the image area.

Of course, having said all that, hard flash lighting isn't necessarily a malevolent evil forever to be eschewed. It often has its uses, particularly in the hands of an experienced expert. Have a look at some of the fascinating examples at FilmlessPhotos. Many of them use direct flash lighting, albeit often altered using a flash modifier or with multiple-flash setups, to great effect.

Off-axis lighting.

The other issue here is that light from a camera-mounted flash unit originates pretty close to the lens axis. And, as noted elsewhere in this article, this is a pretty unnatural place for us to see light emerging. We're used to looking at subjects illuminated by light sources (the sun, ceiling lights, table lamps, etc) which are not directly positioned next to our heads. So another important trick is to get that flash away from the camera or use multiple flash units

illuminating different parts of the scene.

There are two common ways to do this. You can use an extension cord to move the flash unit away from the camera or you can use a wireless triggering system to control the flash units remotely. Wireless is definitely the best for flexible multiple-flash configurations. And in both cases you're physically moving the flash somewhere else so that its light shines on the subject from the top, bottom or sides and provides some interesting shadowing of the subject. On-axis lighting (also known as axial lighting) tends to be very flat which, unless exploited deliberately for a particular effect, looks rather unreal.

Even bounce flash is essentially moving the light source off-axis by having the light bounce off onto the subject from a larger surface area. And walls and ceilings by definition provide natural directions from which light can shine.

As always, digital is particularly useful for experimenting with lighting setups, since you can preview the results immediately.

General flash photography tips:

- Remove any lens hoods when using an internal flash. If you don't you'll probably notice a dark crescent-shaped flash shadow at the bottom of your photos.

- Don't stand closer than a metre or so (3 feet) to your subject unless you have a macro flash. You'll get similar shadowing at the bottom of the photo. An external unit with a small diffuser can help, though.

- If the tilt/swivel head is not set straight on, double-check its position if you switch from landscape to portrait orientation or vice-versa. If the head is pointing the wrong way for the current orientation you might end up with ugly flash shadows, or half your photo might be properly exposed for flash and the other half not at all.

- If you're shooting in vertical (portrait) orientation and you have a shoe-mounted flash, be absolutely certain that your left hand is not holding the lens or in a position that could block light from the flash unit.

- If your camera has more than one focussing point do *not* use the old "focus, lock AE and recompose image" trick when taking flash photos. Instead, select the focus point nearest to your subject in order to bias flash exposure to that area. The exception to this rule is type A bodies which support FEL. You can use FEL in such situations to lock flash exposure to a given area of your photo before recomposing.

- If you need to shoot a number of flash photos in rapid succession consider using NiMH (nickel metal hydride), NiCad (nickel cadmium) or lithium (if your flash can handle them - many models cannot) batteries instead of regular alkalines. The internal resistance of these batteries is lower and thus the recharge time is faster. Note, however, that NiCad batteries can't store as much power as alkaline batteries so you'll have to replace them more often. Another alternative is an external battery pack, though they tend to be large and cumbersome.

Tips on shooting indoors in a small space:

- Use bounce flash off a low ceiling or a wall to soften the light. Unless the walls or ceiling are painted in strong colours, in which case you'll probably want to avoid bounce flash unless you

want to tint the light.

- If you don't bounce the flash try using a small flash diffuser to break up the directionality of the light.

- Be sure you aren't shooting towards something reflective, like a glass window or mirror. Flash glare will bounce off the glass and look like an ugly mess. It will also throw off the flash metering, underexposing the photo.

Tips on shooting outdoors or indoors in a large space:

- Don't use bounce flash if outdoors or if the ceilings are too high or too dark or are painted in colours that will tint the light of the flash. Keep the flash straight on. If you tilt the flash, for example, you'll find the upper half of the image to be brightly lit and the lower half dark. This looks awful. The one exception is if you have a large flash diffuser installed.

- You probably won't want to use a small flash diffuser as it'll just cut the useful range of the flash. Small diffusers are light redistributors and thus most useful when there are nearby white surfaces off which the flash will bounce, softening the light. Large flash diffusers are mildly useful in that they spread the source of the flash unit's light over a larger area, softening shadows, though the cost in range may not be worth it.

- When photographing people at great distances in low-light conditions remember that the risk of redeye in the photos goes up. This is particularly apparent when taking closeups of people using a telephoto lens from a long way away. (typical example - you're zooming in with a long lens to get a child's face during a school concert in a dimly lit gymnasium and the photo ends up looking like a choir of young Satans) Try to separate the flash as far as possible from the camera - even a large flash on a shoe mount won't be adequate distance.

Links to other useful documents.

Chuck Westfall/Mark Overton "EOS Flash FAQ".

Dave Herzstein's "EOS Speedlites Comparison Table".

Canon EOS FAQ Version 2.4. Section 3: Flash. (very useful, but no longer updated)

PhotoZone flash technology FAQ.

Discharge Graphs of Electronic Flash.

Toomas Tamm's "Electronic Flash Information".

Kevin Bjorke's "PowerShot flash photography". (discussion of flash photography with Canon digital cameras but more generally applicable)

Moose Peterson's "the TTL Flash System". (Nikon oriented, but has some general info)

Kodak Flash Photography. (a series of pages with helpful beginner material)

Cybaea "Colour Temperature and Colour Correction Defined and Explained".

Kelvin scale. (includes a list of colour temperatures)

Photodo's "Take the lights (sic) temperature and avoid colour casts". (interesting description of colour meters and colour temperature)

Photo.net: A-TTL and E-TTL. What is the difference?

Photo.net: Elan IIe and 380 ex fill flash.

Canon "Flash Work" brochure. (online edition from Canon Malaysia)

Vincent Laforet - "Show me the Light." (brief writeup on Canon E-TTL wireless flash. Scroll down 2/3 of the page to find the article)

Photography Tips - guide numbers.

Sam's Strobe FAQ. (total geek information - extremely detailed notes on the electronics found in flash units)

Back to **Part II**.

- NK Guy, tela design.

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Back to Photo notes.