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¹ Sequential shooting speed as of September 2016, when using Silent Sequential Shooting H Mode S-AF.

² With M.Zuiko Digital ED 12-100mm f4.0 IS PRO lens, as of September 2016.

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COVER PHOTO:
"ANTELOPE CANYON, ARIZONA"
BY JUSTIN JUNG

"I was on a week-and-a-half-long winter road trip, beginning in California, then heading out to Arizona, Nevada and Utah. I arrived at Antelope Canyon early in the morning and was lucky the crowd size was so small. I explored deeper into the canyon, and on my walk back, I loved how open this section of the cave was and felt it was perfect for a long-exposure portrait. The light was slowly building and bringing out the colors on the face of the rocks. I set up my camera and tripod, and captured this image just as the tours were beginning to funnel in. If you have a chance to plan a trip to Antelope Canyon, the conditions in wintertime are truly amazing, with a sense of calm and light crowds."



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The best camera is the one you have with you, but that's doubly true if it's a system that's right for the job at hand.

YOU CAN'T BE A PHOTOGRAPHER WITHOUT A CAMERA

It's often said that the best camera is the one you have with you. It's also said that a good photographer can make a photo with any camera. These things are both true, but to discount the importance of good photographic gear makes no more sense than saying that construction tools play no part in the creation of buildings. Certainly, the Pyramids were majestic feats of engineering, but that they were made out of stone and not steel and glass was due to the limitations in the tools to create building materials and the tools to assemble those materials.

Give a great photographer a terrible camera, and you'll likely end up with a good image; give a terrible photographer a great camera, and you'll likely end up with an occasional good shot and a lot of mediocre photographs. But give a terrible photographer a terrible camera, and not

only will you get the (expected) bad photos from them, but you'll have very little hope of having them improve their skills.

The tools we use become part of our artistic vision just as the brushes used by Renaissance painters created distinct colors and the vivid pigments they used helped bring a scene to life. So, too, do the cameras (and the medium the cameras use to capture an image) become part of our photographs.

Having the right tool for the job is more important than having the best tool available, though. Ansel Adams could have taken an SLR camera into the Yosemite Valley, but he wouldn't have ended up with the incredibly rich and detailed images that his large-format camera could capture.

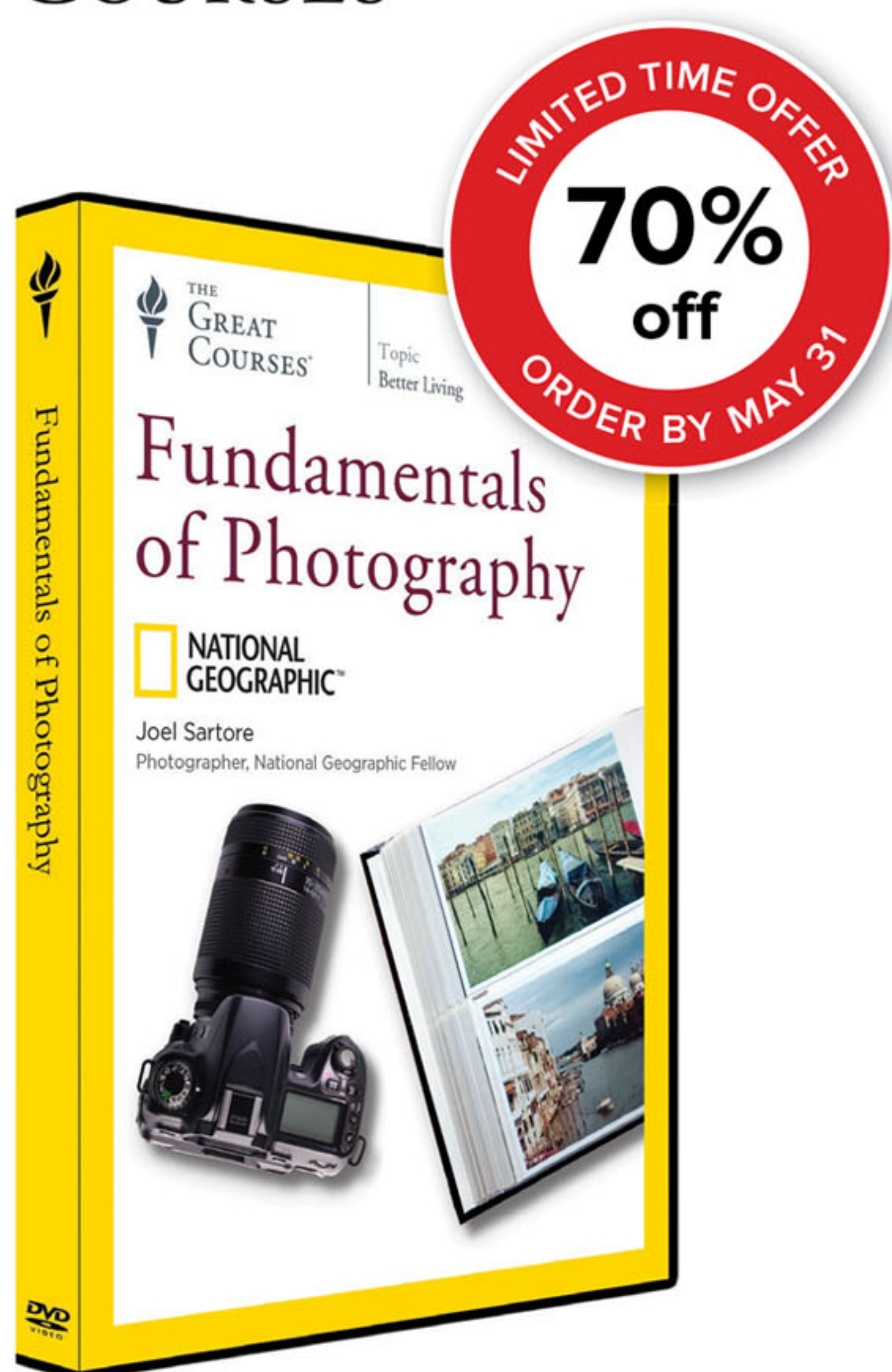
In this issue, our guide to cameras, we look at today's various camera types and models to help you decide what's the right tool for your art. From the humble

compact camera to the powerful DSLR, we bring you guides on what they're capable of capturing, what they're not capable of doing and what to consider when you make your next purchase. And because no man (nor woman) lives by camera alone, we also bring you a collection of must-have lenses.

Once you find the perfect camera, you'll need to be able to set it properly to get the best shot possible, so we bring you an excellent tutorial from Rick Sheremeta on camera settings for different types of photography.

Like any craft, mastering your tools and your technique are the fundamentals for creativity. We'd love to see the images you create with these resources. Share your photos with us on our Your Best Shot gallery at dpmag.com/your-best-shot/

—David Schloss, Editor
@davidjschloss, editors@dpmag.com



Learn the Inside Secrets of Professional Photographers

Photographs can preserve cherished memories, reveal the beauty of life, and even change the world. Yet most of us point and shoot without really being aware of what we're seeing or how we could take our photo from good to great.

Just imagine the images you could create if you trained yourself to "see" as the professionals do. With **Fundamentals of Photography**, you'll learn everything you need to know about the art of taking unforgettable pictures straight from photographer and National Geographic Fellow Joel Sartore—a professional with over 30 years of experience. Whatever your skill level, these 24 engaging lectures allow you to hone your photographer's eye, take full advantage of your camera's features, and capture magical moments in any situation or setting imaginable.

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KING OF THE HILL **THE DSLR**

FOR THE BEST PERFORMANCE AND MOST INNOVATIVE TECHNOLOGIES,
LOOK TO THE CAMERA THAT HAS BEEN ON TOP FOR DECADES: THE SINGLE LENS REFLEX

BY WILLIAM SAWALICH

The dependability, portability, image quality and versatility of DSLRs make them the perfect choice for the professional photographer. Sports photographer Brett Wilhelm hiked up Flagstaff Mountain overlooking Boulder, Colorado, on July 4th with his Nikon D810, knowing the full-frame 36-megapixel sensor and no optical low-pass filter would capture not only the color palette of the fireworks, but also the vibrant details of the town below, while still maintaining the deep black of his silhouette.



There have been tremendous innovations in mirrorless and compact cameras recently, yet while compact cameras of all kinds are getting better and better, there's still one type of camera that sets the standard for professional quality and versatility: the SLR.

The acronym SLR (or DSLR) stands for single-lens reflex (the D is for "digital"). The "single lens" refers to one lens that's used for viewing as well as taking the picture, as opposed to a rangefinder that uses separate lenses for these purposes. The "reflex" refers to a reflection of the image that's directed from a mirror through a prism and to the optical viewfinder. This brings us to one of the first and most obvious benefits of any SLR: The image you see in the viewfinder is exactly the image you'll capture on the sensor.

You see, with a rangefinder, because there are two separate lenses for composing and taking pictures, there's always a slight difference—and sometimes a big difference—between what you see and what you get. A DSLR eliminates that parallax.



GEAR

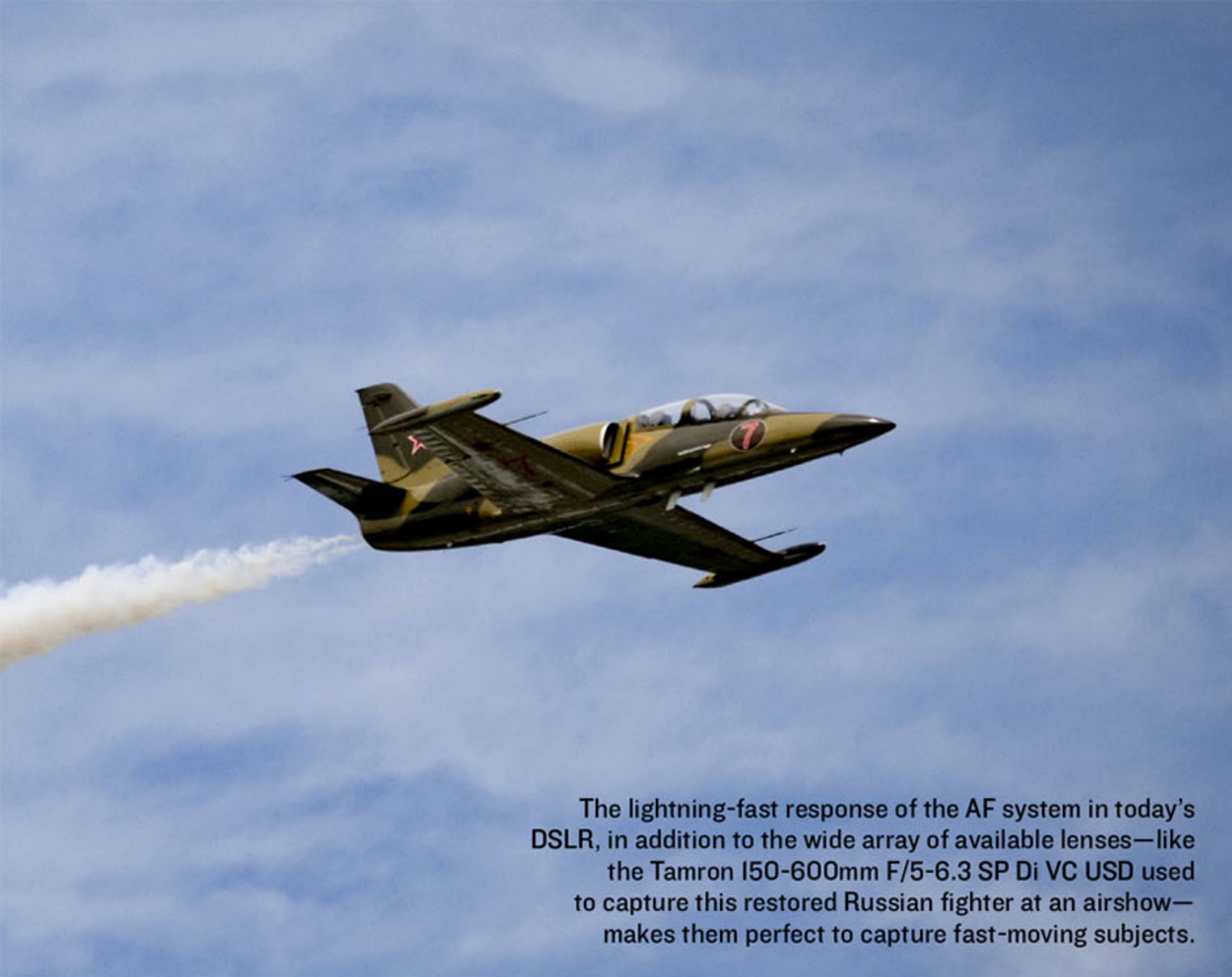
NIKON D5 AND CANON EOS-1D X MARK II

The Nikon D5 and Canon EOS-1D X Mark II represent the best SLRs these camera makers have to offer. In fact, they're the best DSLRs available anywhere, and the choice of professionals everywhere—from fashion photographers to photojournalists. The D5 sports a 20.8-megapixel full-frame CMOS sensor, native ISO up to 102,400 (expandable to an unprecedented 3,280,000 for shooting in impossibly low light) and a new 153-point autofocus system. Sports photographers love the

14-frame-per-second maximum speed, as well. Canon's flagship DSLR, the 1D X Mark II, also uses a full-frame CMOS sensor with a resolution of 20.2 megapixels and a fast 16-frame-per-second burst. It has a 61-point high-density reticular AF II system and an ISO range from 100 to 51,200, expandable to 409,600. Both cameras can capture 4K video, and both feature heavy-duty construction to withstand dust, moisture and the rigors of professional photography.

Price: Nikon—\$6,499; Canon—\$5,999. **Website:** nikonusa.com; usa.canon.com





The lightning-fast response of the AF system in today's DSLR, in addition to the wide array of available lenses—like the Tamron 150-600mm F/5-6.3 SP Di VC USD used to capture this restored Russian fighter at an airshow—makes them perfect to capture fast-moving subjects.

CANON EOS 5D MARK IV

If the \$6,000 price tag of Canon's professional EOS-1D X Mark II is too much for you, consider the brand's flagship enthusiast DSLR: the EOS 5D Mark IV. This full-frame, 30-megapixel DSLR features an improved autofocus system, 4K video recording capability and continuous shooting up to 7 frames per second. Known for its low-light capability, this newest iteration of the 5D offers an ISO expandable up to 102,400. The camera also features built-in WiFi for controlling the camera and transferring images from a smartphone or computer.

Price: \$3,499. **Website:** usa.canon.com



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But that's not really what SLRs are known for. They're known for control. These cameras provide photographers who want it complete control over focus and exposure settings—apertures, shutter speeds, ISOs—as well as more advanced settings such as frame rates, file sizes and much more. If you want to take manual control over any or every

aspect of picture taking, the SLR is a great choice

One of the biggest benefits of the DSLR is that the photographer is buying into a family of camera bodies, lenses and accessories that allow for complete customization of the camera system. The complement of lenses available for a Nikon DSLR, for instance, is in the hundreds when you include

GEAR



NIKON D500

The Nikon D500 was one of the most popular new cameras of 2016, and for good reason. The DSLR features a 21-megapixel APS-C sensor, and with continuous shooting up to 10 frames per second, sports and wildlife photographers are sure to appreciate the camera's speed, too, with the added magnification the smaller sensor provides. Features such as the 153-point autofocus system and RGB metering sensor of the company's top-of-the-line D5 have trickled down to the D500 as well. Bluetooth connectivity and 4K video capability round out the robust package.

Price: \$1,999. **Website:** nikonusa.com

CANON EOS 80D

Canon's EOS 80D is a great choice for a capable enthusiast-level DSLR. It uses a 24-megapixel APS-C sensor, making the camera slightly more compact than a typical full-frame DSLR. It features 45 cross-type autofocus points for better AF in still shooting and an upgraded Dual Pixel CMOS autofocus system for fast, smooth and quiet autofocus while recording 4K video. The 3-inch touch-screen LCD and WiFi connectivity make remote control and wireless downloading a snap, too.

Price: \$1,099. **Website:** usa.canon.com



NIKON D5600

The Nikon D5600 is an enthusiast DSLR with a 24-megapixel DX (APS-C) sensor. Introduced in January 2017, this compact, affordable camera also has wireless connectivity via Bluetooth and NFC for Android, as well as a 39-point autofocus system that can track subjects in three dimensions. The 3-inch articulating touch-screen display makes creative compositions easier; no more lying on the ground to make a low-level composition complete.

Price: \$699. **Website:** nikonusa.com



pre-autofocus and pre-digital lenses designed for the Nikon F mount—which, by the way, has been in use for nearly 60 years. The available lenses get even larger when you factor in aftermarket lens makers such as Sigma, Tamron, Tokina and Zeiss, who manufacture lenses for the Nikon F-mount system and several others. While Nikon is a particularly robust example, a similar array of lenses and accessories are also available for DSLRs from Canon, Pentax and Sony's A-mount cameras. All those lens options mean you can shoot from a wider focal length to a more telephoto focal length by choosing a DSLR. It also means there's a camera and lens combo for every photographic need, no matter how specific. And don't forget about accessories, from flashes and remotes to teleconverters and battery grips.

Because DSLR lenses are often larger than compact camera lenses, they can also be faster—meaning they sport a wider maximum aperture that lets photographers work at faster shutter speeds in lower light. This is yet another reason why DSLRs set the standards for sports photographers, wildlife photographers, commercial photographers and photo-journalists. That said, the gap between the lenses available for mirrorless systems and SLR systems is closing.

DSLRs tend to be feature-rich and the places where camera manufacturers tend to debut their newest and best technologies. For instance, when Canon makes its autofocus faster, quieter and more accurate, it debuts in the EOS DSLR ecosystem. Likewise, when sensor quality and image processing technologies are improved, they're first applied to DSLRs. For photographers looking for the best new technologies, the DSLR format is the sensible place to start.

Most DSLRs have full-frame sensors that approximate the size of a 35mm negative. These produce very high-quality, low-noise images while also allowing for higher resolutions and shallower depth of field. The latter is a benefit in many situations, from portraits to candid, because it facilitates separating subject from background. Full-frame sensors are rarer in mirrorless cameras,

so if you want a full-frame sensor, the DSLR is often the first place you look. If you want a smaller sensor—which leads to more compact cameras and lenses, as well as the “crop factor” that makes lenses perform more telephoto than their focal-length measurements would otherwise indicate—there's a DSLR for you, too. That's a benefit for photographers who want a longer reach with their lenses—wildlife photographers,

for instance, or sports shooters. The downside, however, is for photographers who like to work at ultrawide focal lengths, which are harder to achieve with the smaller APS-C and Four Thirds sensor sizes.

Finally, if you're hard on your cameras and you use them in extremes of temperature or dusty, dirty, sandy conditions, you may want to consider a DSLR. Many high-end DSLRs, in particular, are

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IAN GASTON CATCHES ZION'S SUBWAY WITH B+W

"The Subway in Zion National Park, Utah is a beautifully unique location that offers an abundance of photographic opportunities. Since this strenuous hike takes up most of the day, I had to shoot this scene in fairly harsh midday light. Luckily, I had my B + W MRC ND 3.0 which I paired with a Sony A7r and Canon 16-35mm. The 10 stops of exposure reduction allowed me to really slow down my shutter speed to achieve the desired effect I was after."

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made to withstand the rigors of professional use, so they're often constructed using more durable materials with weathertight seals to prevent dirt and moisture from infiltrating the sensitive electronics inside. This technology, too, has trickled down to consumer cameras, as well.

A VARIATION ON THE SLR: THE SLT

If you're shopping for an SLR, you may come across a modern variation known as the SLT. This single-lens translucent camera uses a pellicle mirror—a super-thin, semi-transparent, non-moving mirror that acts as a beam-splitter, sending some of the light to the sensor while diverting some of the light up through the pentaprism and to the viewfinder. This technology allows for a fixed mirror in place of the moving mirror that swings up and out of the way during exposure in a traditional SLR. By eliminating the swinging mirror, SLT cameras not only allow you to see the frame during exposure (traditional SLR viewfinders go dark at the moment of capture), but they also can employ full-time phase

detection autofocus during video recording or live viewing of the sensor from the rear LCD. Shoppers interested in SLT bodies these days look to the Sony Alpha a77 II and the Sony Alpha a99 II.

DOWNSIDES TO THE DSLR

The major gripe against DSLRs is that they're bigger and heavier than compact mirrorless cameras. The added weight of a larger camera—not to mention multiple lenses added to a camera bag—means that for photographers for whom low weight and small size are essential (travel photographers and those who carry their equipment on their backs for long periods of time, for example), compact mirrorless cameras are increasingly appealing. Technological advancements in compact cameras mean they now approach and in some cases surpass the quality and features of DSLRs. They finally present the first real challenge to the supremacy of interchangeable-lens SLRs in the digital era, but they're also getting bigger as a result of adding more features. DP

GEAR

RICOH PENTAX KP

The brand-new Pentax KP is a compact, yet rugged DSLR. It features a 24.3-megapixel APS-C sensor without an anti-aliasing filter, making for sharper pictures as well as the increased risk of moiré. Its ISO range extends to a whopping 819,200, and its electronic shutter can fire as fast as 1/24,000. It also incorporates a refined shake-reduction system that provides up to five full stops of stabilization—a boon for photographers who prefer handholding in many situations. The compact body is also weatherproof—sealed to keep out dirt and moisture—and it remains operational down to 14°F. An articulating 3-inch touch-screen LCD graces the rear of the body, which can be customized with three different battery grips.

Price: \$1,099. **Website:** us.ricoh-imaging.com



SONY a99 II

The new Sony Alpha a99 II is a 42.4-megapixel full-frame SLT: a single-lens translucent camera. Instead of a moving mirror, the a99 II uses a semi-transparent pellicle mirror to send some of the light to the sensor without having to swing the mirror out of the way. Phase-detection autofocus can this way be used during video capture and live viewing of the sensor. Video shooters will also appreciate the ability to record S-Log—kind of like RAW files for video. The compact camera can shoot 12 frames per second with continuous autofocus, making the kit appealing to action photographers, as well.

Price: \$3,199. **Website:** sony.com



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BY DAVID SCHLOSS / PHOTOGRAPHY BY JUSTIN JUNG



The high dynamic range and ISO range of the Sony a7S II make it one of the most versatile cameras on the market today.

When it comes down to it, there's nothing magical about the mirror in traditional SLR cameras. While it performs a very specific function, the mirror isn't *required* to take a photograph, and plenty of cameras in the pre- and post-digital eras already operate mirror-free. The rangefinder camera, for example, popularized by high-end manufacturer Leica, doesn't use a mirror, relying on a viewfinder that's separate from the lens. Compact digital cameras, the types you might stick in your pocket for vacation, also don't use a mirror (although we'll be talking about these types of cameras in a separate section).

While the design of the SLR camera is an elegant solution to some key issues with optics and physics, the fact that today's cameras are still using roughly the same mechanical design as they were using around the end of the Korean War is staggering when you consider how other technology has evolved.

THROUGH THE (SINGLE) LENS

In an SLR camera, the mirror's primary function is to bounce light up to an optical viewfinder (by way of a prism) so that the photographer can see the same image that will be captured

at the film (or sensor) plane. In a rangefinder or a twin-lens camera, the viewfinder doesn't accurately represent what will be captured, as the light hitting it is next to the imaging lens, and there's a bit of parallax. This system also allows photographers to change lenses and see precisely what the final image will look like from a focal length point of view.

When a photographer presses the shutter release, the mirror in an SLR flips up out of the way, allowing light to hit the film or digital imaging plane. After the image is captured, the mirror flips back down to allow light to pass to the optical viewfinder. The autofocus systems in SLRs also use the mirror to send light to a dedicated autofocus sensor, which means that there's a blackout in focus tracking every time the mirror flips out of the way and it regains focus when the mirror is down.

The mirror is a fundamental design component in modern cameras because the faster it moves, the faster the camera can begin focusing again, and the faster the next shot can be captured. The speed of the physical motion is then a limiting factor in both the focusing performance and the capture frame rate. A camera that captures images at 12 frames per second requires a more precise mirror mechanism and a more powerful motor

GEAR

FULL FRAME

The full-frame market is really heating up. Sony jumped into the mirrorless market first with APS-C cameras but then introduced the first full-frame mirrorless system with the a7. Since then, the company has refreshed the line several times and has added a wide array of pro-level and enthusiast-level lenses.

Leica jumped into the full-frame mirrorless market with the Leica SL, a weather-sealed and immaculately constructed camera. While there are lens adapters available to allow the SL to use other Leica lenses, there aren't many native SL lenses, though the company has promised more.



SONY a7R II

The Sony a7R II is the company's flagship mirrorless system, with a high-resolution, Sony-made 42-megapixel sensor that uses a technique called Backside Illumination to create low-light images with low noise and an ISO range to 102,400, which is impressive, especially considering the resolution of the sensor. The a7R II has built-in five-axis image stabilization that reduces camera shake with any attached lens, and it has built-in WiFi (and a decent mobile app) for image transfer. On-chip phase detection allows the a7R II to detect both faces and, more importantly, the eyes of a subject, for accurate focusing. Sony's pushing hard on the video front, and the a7R II also has 4K video recording either full-sensor width or at a "Super 35" crop. It can record 4K video to the SD card slot and can use its external HDMI connector to send even higher-quality video to an external recorder.

Price: \$2,900. **Website:** sony.com

than a camera that only captures at five frames per second.

At a certain point there's a *physical* limitation on how fast any mirror can operate, and that limits the performance of even the most expensive and powerful SLR. As a moving part, the mirror also contributes some vibration to the camera—this is usually a negligible amount of motion but is still enough to take into consideration.

The mirror in an SLR presents another issue as we move into the era where photographers do more video work, since the mirror must be out of the way for video capture. For most SLR cameras, having the mirror raised for video means that there's no way to perform autofocus—one of the roles of the mirror is to bounce light to the focus sensor, which is only possible when the mirror is down.

There are a number of benefits to a camera that eliminates a mirror yet uses a single lens for focusing and capture, which we'll talk about in a moment, but the trade-off of removing the mirror means that composition and focusing have to be done on an electronic viewfinder (EVF). Essentially a small LCD screen, the EVF has not had very good quality until recently, which limited the appeal of the systems. It wasn't until

mirrorless systems began to really improve their viewfinders that the various platforms really started to take off.

SHRINKING THE BOX

The first popular mirrorless cameras removed the mechanical component not for any performance gains but instead to create a smaller camera. The mirror in an SLR is positioned diagonally from the top of the camera downward toward the lens mount and runs far enough to cover the sensor. To accommodate this long piece of glass when flipped out of the way of the sensor, the body needs to have a depth that's slightly greater than the mirror held horizontally.

Without a mirror, the lens can be mounted much closer to the sensor, which results in a smaller camera and smaller lenses. Cameras like the early Micro Four Thirds systems used both a mirrorless design and a smaller sensor than the traditional full-frame or APS-C design to create an incredibly teeny camera that could still accept interchangeable lenses. These cameras were marketed as good alternative choices for those looking for a go-anywhere design but who didn't want fixed-lens compact cameras, and as a good step up for people getting into



SONY α7S II

The virtually identical α7S II has only 12.2 megapixels, but the smaller sensor allows it to have much greater dynamic range and ISO sensitivity up to ISO 409,600. The 169-point AF system also can track faces and eyes, even during video capture, and it can focus down to -4 EV. The camera has a 14-stop dynamic range, which means that it records the widest range of tones from white to black of any camera in its class.

Price: \$2,700. **Website:** sony.com

LEICA SL

While the \$7,500 price tag puts the Leica SL out of the range of most photographers, it's important in the mirrorless market for two reasons. First, it's the sole challenger to the full-frame mirrorless products from Sony, and second,

because it trumps the Sony cameras when it comes to some key features. It has a 4.4-million-pixel viewfinder and can capture 24-megapixel images at up to 11 fps. Most importantly for pros, though, the SL is the most waterproof and dust-proof full-frame mirrorless camera on the market.

Price: \$7,500. **Website:** us.leica-camera.com



MIRRORLESS

photography who didn't want the size and weight of an SLR system.

The issues with the EVF hampered the adoption of these systems among pros, as did the early solutions for focusing a camera without a mirror. Remember, one of the functions of the SLR's mirror is to send light to a dedicated AF sensor, so without this mirror, another focus method is required.

OUT OF PHASE

There are two different camera focusing systems: contrast detection and phase detection. Contrast detection is the least powerful of the two; it involves focusing and refocusing the lens to evaluate contrast between edges in the scene, and then moving the focus and retesting until

the optimum contrast is reached. It's the camera equivalent of the eye doctor "which is better, number one or number two" exam. Phase detection works by splitting the incoming light to two (or more) sensors. If the signals from the two sensors are identical, the image is in focus. If they're not, it's easy to tell how far to adjust the lens to make them meet up. Think of light as a waveform like on a histogram (or bell graph) hitting two sensors. If the waveforms match up, the image is in focus. If they're a little bit apart, the distance apart tells the camera how out of focus the image is and how much it needs to adjust focus to line the waveforms up.

Originally, mirrorless cameras only used contrast-detection systems, as contrast

detection can be performed with the signal coming from the sensor itself. Phase-detection systems in mirrorless cameras use a more complex method of using some of the imaging sensor points as focus points. This method wasn't widely used until mirrorless cameras began to be targeted to professionals.

Thanks to rapidly advancing sensor design, the phase-detection systems on mirrorless cameras are incredibly powerful and are starting to rival those on pro-level SLRs. Since there's no mirror to black out the AF system, phase detection in mirrorless cameras can be performed at a very high frame rate and can be used during video capture. This means that mirrorless cameras are capable of tracking subjects during

GEAR

APS-C

Fujifilm's first X100 lacked the interchangeable lens of many of today's mirrorless cameras, but it was the first system to have a large APS-C sensor (compared to the smaller Micro Four Thirds system Olympus and Panasonic used), and it validated the concept of mirrorless for advanced imaging needs. The new X100T can be found in the Compact Guide.

This is the most active category in the mirrorless market thanks to the competition of both Sony and Fujifilm products in this sensor size. Fujifilm has decided to go after today's photographer who has the design sensibilities of yesteryear, designing cameras that look and feel more like traditional film cameras than do those from Sony. For Sony's part, it has released a succession of cameras that seem to have the goal of packing the most features into the smallest body.



FUJIFILM X-T2

Fujifilm's X-T2 followed closely on the heels of the X-Pro2 last year and has garnered a lot of praise for its thoughtful design, image quality and compact size. Fujifilm's X-T2 uses a more classical SLR-style body while the X-Pro2 has a rangefinder design sensibility. It features a 24.3-megapixel sensor and a viewfinder that's twice the brightness of the previous X-T1 and that refreshes at a faster rate for better-looking images—in fact, a special mode for shooting action sets the refresh rate of the EVF from 60 fps to 100 fps.

The body is durable, too, thanks to the all-magnesium construction and dust and

weather seals, making the X-T2 a go-anywhere body that isn't likely to let you down.

Fujifilm used the same LCD screen as the X-T1, but a new jointed arm allows the screen to be used when the camera is held in the portrait orientation, making low-angle vertical shots much easier to compose and capture.

The X-T2 also edges out the X-Pro2 thanks to the 4K UHD video recording at up to 30 fps, and the optional battery grip not only extends the shooting times for stills but allows the X-T2 to record up to 30 minutes of 4K footage. We think the grip is an especially good addition since it also boosts the capture rate from 8 fps to 100 fps.

Price: \$1,600. **Website:** fujifilmusa.com

video recording, something that only a few SLR cameras can do. In fact, the main SLR rivals in the video capture arena come from Canon, who uses one traditional phase-detection system for still images but a proprietary on-chip phase-detect system during video capture. In other words, when these Canon systems are capturing video, they're acting like mirrorless cameras.

SIZABLE DIFFERENCE

While mirrorless cameras are smaller than SLR styles (all else being equal), that shouldn't be the main purchasing point, or more correctly, that differentiation will disappear with some of the brands. As mirrorless cameras get more powerful, their size will need to grow

to accommodate faster processors, bigger buffers and larger batteries. This will eliminate some of the size benefits of mirrorless systems over SLR cameras.

Much of the compactness of mirrorless systems has to do with the size of the lenses. For Micro Four Thirds systems, those lenses can be much smaller than similar focal-length lenses for a full-frame SLR, because the smaller sensor doesn't need as much glass to cover the frame. APS-C and full-frame lenses can only be slightly smaller than their SLR equivalents, and much of the current size difference has disappeared as pro-level lenses have become available.

If your main goal is to get the smallest camera possible, systems like Micro Four Thirds will be the best

choice, although you'll lose some image quality compared to an APS-C system, which will lose some image quality compared to full frame (again, all other things being equal).

LOSING MY REFLECTION

Since the mirror in an SLR performs so many important functions, what then, aside from the theoretical size benefits, are the reasons for purchasing a mirrorless camera? The answer comes down to technological advances and future performance gains.

Interestingly, one of the areas that was formerly a weakness for mirrorless cameras has turned into one of the strongest features, thanks to improvements in technology. While original EVF systems inaccurately displayed colors, would lag during motion work and were poor contrast, today's EVF systems are vastly superior. There's still a difference between working with an EVF and an optical viewfinder, but the gap is narrowing, and there's one trick the EVF can perform that an optical system never will—real-time display of settings.

With an SLR, you see what the world looks like through the lens, but not what it looks like with the selected settings. With a mirrorless camera, you can set the EVF to display what the image will look like with the current settings. Change the exposure compensation on an SLR, and nothing looks different in the viewfinder—you can't tell what the final image will look like. Dial in that same compensation setting on a mirrorless camera, and you can see in real time how it will look. It's possible to see the effect of different shooting settings, lens settings and picture styles before you press the shutter release.

Another key advantage of mirrorless shooting is only starting to be leveraged, and that's the capture speed. With an SLR, the capture rate is dependent on the shutter speed and the mirror speed. The mirror needs to return to the lowered position to focus, and it needs to raise to capture the image.

Because there's no mirror to move, it's possible to capture images at faster speeds on a mirrorless camera because the systems are able to focus without waiting for



FUJIFILM X-T20

Fujifilm's X-Pro2 and X-T2 cameras are pro-oriented, while the X-T20 gives enthusiasts the same features but at a lower price point. The X-T20 also has a 24.3-megapixel sensor, 4K video recording and a new processor for faster AF and performance. The LCD screen on the X-T20 has a touch screen, and the control layout allows for the camera to be used in completely auto shooting or with precise manual controls. The camera is available in a body by itself or as a kit with one of two lenses, the XF18-55mm or the XC16-50mm lens.

Price: \$900 (body only); \$2,000 (with XF18-55mm lens); \$1,000 (with XC16-50mm lens). **Website:** fujifilmusa.com

a mirror to return. Mirrorless cameras can also use the electronic shutter mode to capture images without using a physical shutter. In electronic shutter mode, cameras don't open and close a thin physical object, but instead they send power to the sensor to "open" the shutter and turn off

the current and process the data to "close" it. There are some image artifact issues here, but it can be used for some powerful capturing techniques.

We're already starting to see some cameras, like the Olympus OM-D E-M1 Mark II, capture at 15 fps using a mechanical

shutter and capturing at 60 fps using an electronic shutter. The OM-D E-M1 Mark II can also capture in a mode where it's continually buffering images, and when the shutter release is pressed, it records several frames both *before* and after the release is pressed.

GEAR

SONY a6500

Hot on the heels of the Sony a6300, Sony released an update to its top-end APS-C mirrorless system, and it's built for speed and accuracy. The a6500 has what Sony says is the world's highest number of phase-detection AF points, 425 of them, covering almost the entire sensor and using an AF system that Sony says is the fastest in its class.

The a6500 uses a touch-screen LCD that allows the display to act as a focus-selection trackpad. Simply swipe across the screen while the camera is up to your eye and the focus points follow your movement, or simply tap on the screen to focus.

Using a Sony-designed 24.2-megapixel sensor, the a6500 has an ISO range to 51,200, thanks to a sensor construction that moves the copper wiring out of the way so that light can hit the photodiode without getting blocked by the circuitry.

Like its full-frame counterparts, the a6500 is particularly adept at video, with 4K output oversampled from a 6K equivalent imaging area—which simply means that the camera captures way more data than 4K requires and uses this for high-res 4K video. The a6500 can record up to 5x slow motion or up to 60x "Quick Motion," and this speed-enhanced footage can be played back in-camera.

It also has the same five-axis image stabilization of the a7 series, the same WiFi connectivity, and can also send uncompressed 4K across the built-in HDMI port.

Price: \$1,400. **Website:** sony.com



CANON EOS M5

Canon has been a bit cautious in the mirrorless space, but the company's EOS M5 marks Canon's more aggressive strides into the market. Based around a 24-megapixel APS-C sensor, the camera uses the Dual Pixel AF system (that we mentioned in the comparison section above) and can capture images up to 9 fps with focus locked and 7 fps with continuous AF. Canon borrowed heavily from its SLR design sensibilities for the M5, which has a nice protruding grip that's easy to hold, with a familiar set of dials, including dedicated controls for camera modes.

A tilting 3.2" LCD screen is able to flip almost 180°, making it an excellent camera for selfies. The built-in EVF is bright and, with 2.36 million dots, is sharp and accurate. Video users can shoot at full 1080 60p, though there's no 4K video capability. The camera has both WiFi and Bluetooth connectivity, which work seamlessly with the company's mobile app.

Price: \$980. **Website:** usa.canon.com



With a high-sensitivity, 42-megapixel full-frame sensor, the Sony a7R II goes head-to-head with anything found in the DSLR world, and cameras like it are helping to quickly close the gap between DSLR and mirrorless systems.



MIRRORLESS

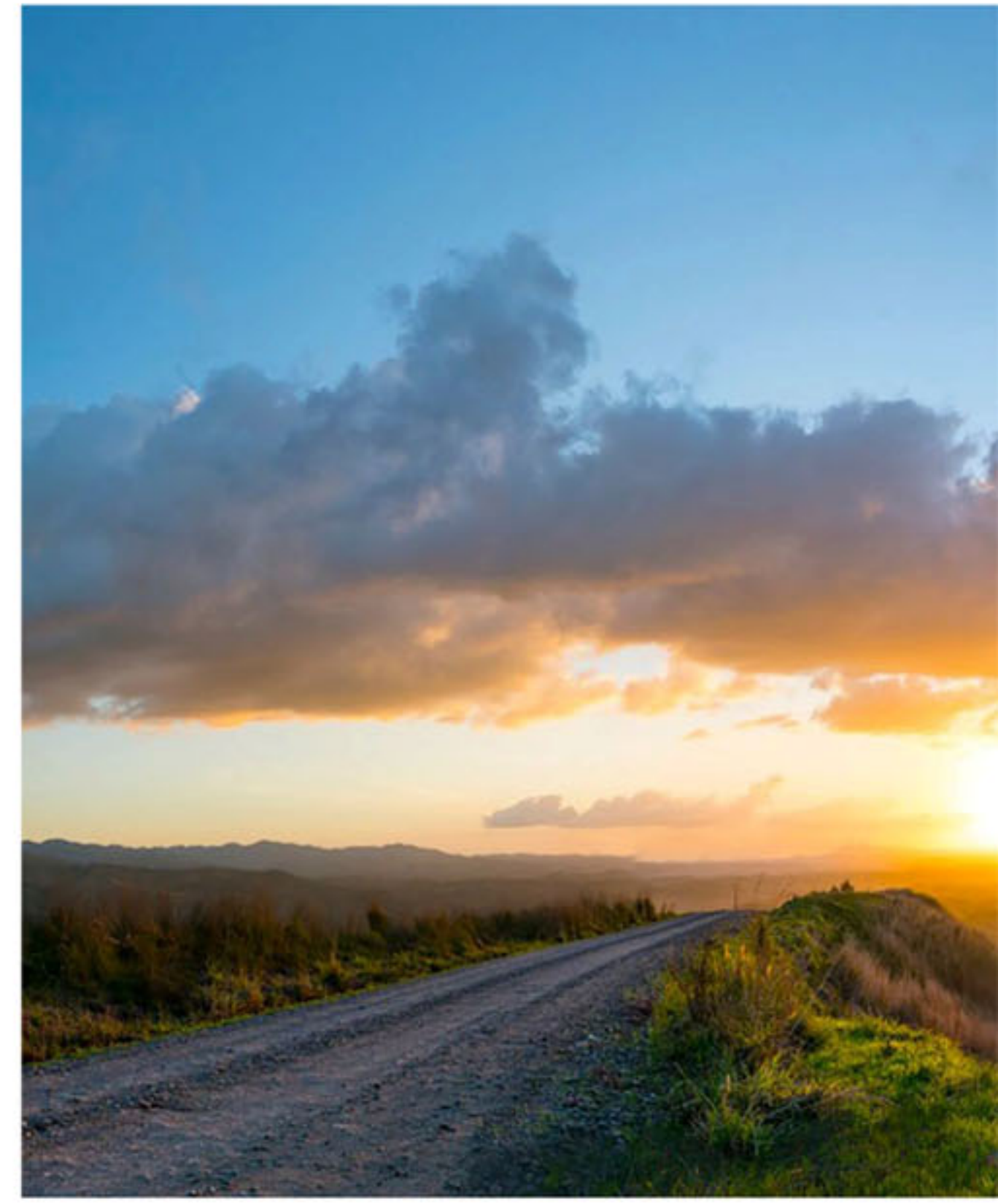
Not only can mirrorless cameras potentially capture photos better, but they're much more adept at shooting video as well. Cameras like the Canon EOS 5D Mark II helped usher in the era of still cameras capturing cinema-quality video footage, but mirrorless systems take that a step further. Companies like Sony and Panasonic are pushing heavily into the SLR digital video space, adding professional-level features at a much faster clip than either Canon or Nikon.

ECOSYSTEM

A few years ago, the number of lenses and accessories for SLR cameras vastly outnumbered what was available for mirrorless cameras; after all, SLR cameras have been in development since the 1960s. But the

mirrorless manufacturers have aggressively released lenses and the equipment needed to make complete environments for the consumer and for the professional alike.

Right now, the mirrorless market is still in flux. Each manufacturer is working to capture a piece of photographic market share, and for a slightly different demographic. This means that the various mirrorless systems have made some compromises—most notably at the pro level—compared to mature SLR systems. The Sony a7R II, for example, has one of the most technologically advanced sensors on the market, with higher resolution and better ISO performance than most SLR competitors, but it lacks the waterproofing design of cameras like the pro systems from Nikon or Canon.



GEAR

MICRO FOUR THIRDS

Olympus and Panasonic are the two big players in the Micro Four Thirds line of mirrorless cameras, which, thanks to the small sensor size, are known for their compact size. Recent product updates from Olympus kick up the image quality and system performance, while the new Panasonic camera sets the benchmark for video performance. Like the difference between Fujifilm and Sony, the two companies have a slightly different design ethos, with the Olympus cameras taking on some of the retro designs of film cameras from the 1970s and Panasonic systems looking more like miniaturized SLR cameras.



OLYMPUS OM-D E-M1 MARK II

Olympus has always boasted about the small size and the fast performance of its MFT cameras, but with the OM-D E-M1 Mark II, it's also boasting about the image quality, low-light performance and a range of innovative features.

The E-M1 Mark II (as it's often called) offers a shooting mode that captures up to 60 fps in single AF and 18 fps with full C-AF tracking when using the electronic shutter. When using the mechanical shutter, the camera can capture images

Price: \$2,000. **Website:** getolympus.com

from its 20-megapixel sensor at 15 fps, making all of the shooting modes on the E-M1 Mark II faster than even the fastest DSLRs. It can also capture RAW files.

Advanced shooting modes abound, including a 50-megapixel "High-Res Shot Mode" that captures eight consecutive shots and then makes an in-camera composite. The E-M1 Mark II also features Silent, Live Composite and Live Bulb modes for nighttime shooting, and a focus-stacking

mode for super-detailed macro work.

The E-M1 Mark II has built-in five-axis stabilization and 121 points of AF, and can record "cinema-quality" 4K video at 24P and 4K video to 30p, making the stabilization incredibly helpful for video shooters.

The OM-D E-M1 Mark II is super-sealed against the elements and is splash-proof, dust-proof and freeze-proof to 14°F—we've seen videos of these cameras surviving an actual shower.



But the mirrorless market is just getting started, and manufacturers have until now been playing a game of catch-up. Mirrorless used to lag behind SLRs in speed, image quality, lens selection and more. Now the playing field is starting to level, and in many areas the mirrorless systems are starting to pull ahead.

As technology improves, these cameras will introduce a new era of performance, and competition will result in a rush to add features and improve image quality as manufacturers work to make their lineups stand up against the competing systems.

We're already at a point where there are no *bad* cameras on the market, but these bodies are some of our favorites of the current crop of mirrorless cameras. DP



PANASONIC LUMIX DC-GH5

Like Sony, Panasonic's imaging roots are in professional-level video equipment, and the new GH5 offers some of the best video capabilities in the mirrorless market. The camera records stills and video using a 20.3-megapixel MFT sensor with no low-pass filter (for increased sharpness) and can capture 8-bit 4:2:0 4K video internally at 60p or 30p 4K at 10-bit 4:2:2, something no other

mirrorless camera can do. A 180 fps HD mode allows for slow-motion capture.

The 5-axis stabilization and Video Dual I.S. provide up to five stops of stabilization with several Lumix lenses. The 225-point AF system can capture at 9 fps, and the camera can capture 12 fps with focus locked. With this camera, Panasonic has introduced a 6K photo mode, which allows shooters to grab an

18-megapixel still image from a stream of 30 fps video shot at 6K resolution.

Like the Sony systems in the APS-C and full-frame categories, the 4K video in the GH5 is captured with no pixel binning (the process of skipping some pixels to save space, like a video JPEG), and there's no limit to the length of videos.

Price: \$2,000; **Website:** panasonic.com



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TIPS & TECHNIQUES

From the Pros

1 Turn Any Bag into a Camera Bag with Lens Wraps

The venerable lens wrap is found in many professionals' kits, due to its ability to transform an everyday bag or backpack quickly and easily into something safe for your delicate camera equipment. Wraps are also great for street photographers and other shooters looking for a compact kit who just need to carry one or two spare lenses in their bag or pocket.

2 Expedite Your Photoshop Workflow with Actions

When working in Adobe Photoshop, Actions can be used to automate some of the most often used, menial tasks with a single click. By recording your own Actions for resizing files for various applications, converting color spaces for print or Web, or for applying sharpening for different image types, you can save time finalizing the output of your files. Additionally, Actions can be assigned to a keyboard command for even faster, easier use.

3 Pre-Focus to Be In-Focus

Even the most creative minds get stuck once in a while. To get out of that rut and keep yourself motivated, taking a trip to the local gallery and looking at other people's work can help guide you into the direction you might want to go as a photographer. Books and magazines can prove to be great references, as well.

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COMPACT CAMERAS **PORTABLE WORKHORSE**

BIG THINGS ARE HAPPENING IN LITTLE CAMERAS

BY DAVID SCHLOSS



Today's compact cameras allow photographers to capture professional-level images in places where it would be impractical or impossible to bring a DSLR or even an interchangeable-lens mirrorless.

COMPACT CAMERAS

For a brief, shining moment, compact digital cameras were the superstars of the photo industry. Long before mobile phones—even before the iPhone arrived, when phones didn't have any cameras, the compact camera was the go-to device to capture those moments when you didn't have an SLR with you either because you didn't own one or didn't want to lug one around.

The astronomical price of the first digital SLR cameras made them only suited for pros and they were particularly prohibitive to the enthusiast. In 2000, when Canon launched

their first designed-in-house digital camera, the D30, for example, the body cost around \$3,500—for a camera with a 3MP sensor, three focus points, ISO of 100-1600 and a 3 fps max shooting speed.

At the same time Nikon, Olympus, Fujifilm—even Apple—and others had compact digital cameras that weren't really called compact; they were just digital cameras. Somewhere between the binocular-shaped Apple QuickTake 100 (which I used at my college newspaper) and the QuickTake 200 just a few years later, the cameras started to morph from a

GEAR

PROFESSIONAL GRADE

The most exciting compact cameras, by far, are the ones that are actually professional-grade cameras in disguise. When digital compact cameras started to arrive, this was the dream category. Every pro I knew wanted something that could fit in a bag or a pocket and could take images that rivaled their top-end DSLRs. But the poor quality of the original sensors in compact

cameras relegated them to snapping harsh and grainy images.

Today, this has changed, and the semipro cameras available produce a better-looking image, by far, than the highest-end camera at the dawn of the digital era. These professional compacts, though, somehow squeeze top-end features into a teeny body.



SONY CYBER-SHOT DSC-RX1R II

The Sony RX1R II is one of the most underappreciated cameras on the market today, with—quite literally—most of the same features found in Sony's flagship mirrorless, the a7R II. Perhaps this camera is overlooked because the price tag is also as high as a pro-level camera. Still, it could easily be someone's only camera.

The RX1R II features the same full-frame, 42.4-megapixel sensor in the a7R II, with 399 phase-detect AF points, a Zeiss 35mm *f*/2 lens, a pop-up viewfinder and a tiltable LCD screen. The sensitivity range on this camera is from ISO 50 up to 102,400—I've often used this camera to shoot in incredibly low light. The RX1R II can capture up to 5 fps and not only has face detection but eye-detection AF. The camera is the first in this class to use a variable "low-pass filter," which allows for more sharpness when turned off and more moiré reduction when turned on. There's also WiFi connectivity, additional apps available on the Sony app store and much more.

Price: \$3,900. **Website:** sony.com



FUJIFILM X100F

Fujifilm's original X100 was a pocket-sized marvel that set off the pro-level compact camera revolution and, in fact, launched the pro-level mirrorless revolution as well—the company used many of the design elements of the X100 in their later X-series mirrorless cameras.

The fourth-generation X100F uses a fixed lens that's the equivalent of 35mm on a full-frame camera—and is still one of the most compelling choices in the APS-C mirrorless market. The compactness of the body allows it to go just about anywhere, while full manual controls give it the ability to work in a pro environment. The camera has a 24.3-megapixel sensor using the company's X-Trans design for high-quality images, and the new X100F has an updated EVF, touch-screen LCD and faster processing times than the previous generations.

Price: \$1,300. **Website:** fujifilmusa.com

binocular-shaped device into digital versions of compact film cameras, complete with LCD screens, handgrips and other features still found today.

The popularity of these cameras was undeniable—suddenly anyone and everyone could eliminate their shoeboxes of photos and those trips to one-hour photo labs and replace them with an image that magically appeared on their computer. From around 1998 until the early 2000s, there was a constant barrage of small cameras released from around a dozen manufacturers. There was an arm's race to create

cameras that were small, cheap and ever more powerful.

All seemed to be going well for the camera companies as revenue projections and sales numbers both climbed. Then, in 2007, the digital camera world was turned on its head with the introduction of the iPhone. Sure, cell phones had sported cameras before the iPhone, but they were truly dreadful. Many people mocked Apple's early digital camera efforts with the failed QuickTake line, but failed to appreciate just how much the attention to a quality camera in the iPhone stemmed from the company's earlier forays in the camera market.

ENTHUSIAST

Not quite a replacement for your main camera, these compact cameras are powerful nonetheless. They slide into a pocket or bag with ease, and they can be counted on to produce a great-looking image.



SONY CYBER-SHOT DSC-RX10 III

Sony's third generation of the RX10 lineup adds new features to Sony's 1-inch-sensor (smaller than APS-C), super-versatile camera. Eschewing the pocketable design of some compact digital cameras, the RX10 III feels like a very squat DSLR. The lens has an amazing 24-600mm range (in 35mm equivalent) and somehow is only $f/4$ at the longest end (and $f/2.4$ at the widest). The camera has three rings on the lens barrel—one for zoom, one for focus and one for aperture—giving it a nearly-pro-level amount of control. The OLED viewfinder has 2.35 million dots (that's a lot for an electronic viewfinder) and it has a tilting LCD display.

Perhaps the most impressive features, though, are in the video realm. The RX10 III can capture 4K video with full pixel readout and no pixel binning (i.e., very high-quality 4K), and the camera has a mic in and headphone jack, making this one of the most capable portable video cameras around. There's an HFR (High Frame Rate) mode that captures up to 960 fps.

Price: \$1,600. **Website:** sony.com



NIKON COOLPIX A900

Nikon's Coolpix A900 is another choice for tiny cameras with a really wide-ranging zoom, and at 24-840mm (at 35mm equivalent), is longer than the DSC-RX10 III. The lens has a variable f -stop of $f/3.4-6.9$, so it's well suited to bright conditions and trying to reach faraway sports. The camera has a 20-megapixel 1-inch sensor and can capture 4K video at 30p. There's a built-in tilting LCD display, and the camera uses Sony's SnapBridge technology to keep a constant line of communications open between the camera and a smartphone.

Price: \$360. **Website:** nikonusa.com

COMPACT CAMERAS

While the iPhone and subsequent mobile devices attacked the camera market from below (who needs to spend \$600 on a camera when you've got a \$500 phone that takes good photos), the camera manufacturers attacked their own compact market from above (who needs a good \$600 compact camera when you've got a terrific SLR for \$800). The result was a collapse of the compact camera market that was nearly as significant as the collapse of the film market.

Out of the ashes of this once-vibrant market, though, the compact camera was reborn. Where the compact digital camera was once the only camera many consumers would own, it's now positioned as either a gateway for those who fall in love with photography or as a secondary camera for those looking to supplement their DSLR or mirrorless cameras but with the similar image quality and features.

POINT AND SUCCEED

In an era where cameras are built into our phones, what's the point of having another camera to lug around?

Despite billboard campaigns that promise pro-level images from smartphones, they're still based around teeny sensors, and there are inescapable physical limitations on those sensors. The larger a sensor, the more light it can gather (all else being equal), and that results in better low-light/high-ISO performance and lower overall noise. Larger sensors also generally higher dynamic range (the amount of shades between the lightest and darkest that can be captured) than smaller sensors. So while the phone in your pocket or bag is a technological miracle, it's a miracle of (literally and figuratively) smaller proportions than that in a compact camera.

A good-quality compact camera can capture images just not possible from a smartphone, and some of them—largely those with an APS-C or full-frame sensor—can produce images on par with top-end systems. Built-in zoom lenses, the ability to use accessories for lighting and audio, and the fact that the batteries can be swapped out (unlike those in most cell phones) make these cameras especially useful.

Many people say that "a good photographer can take a good

GEAR

ENTHUSIAST (CONTINUED)



CANON POWERSHOT G9 X MARK II

The G9 X Mark II updates one of Canon's most popular compact cameras, yet keeps an affordable price. It features a 1-inch sensor with a resolution of 20 megapixels. The camera has a 28-84mm lens (in 35mm equivalent) with a variable aperture of $f/2.0-4.9$. It's capable of capturing images at just over 8 fps and has a range of connectivity options, including NFC, WiFi and Bluetooth, and it connects easily to the company's mobile app.

Price: \$530. **Website:** usa.canon.com

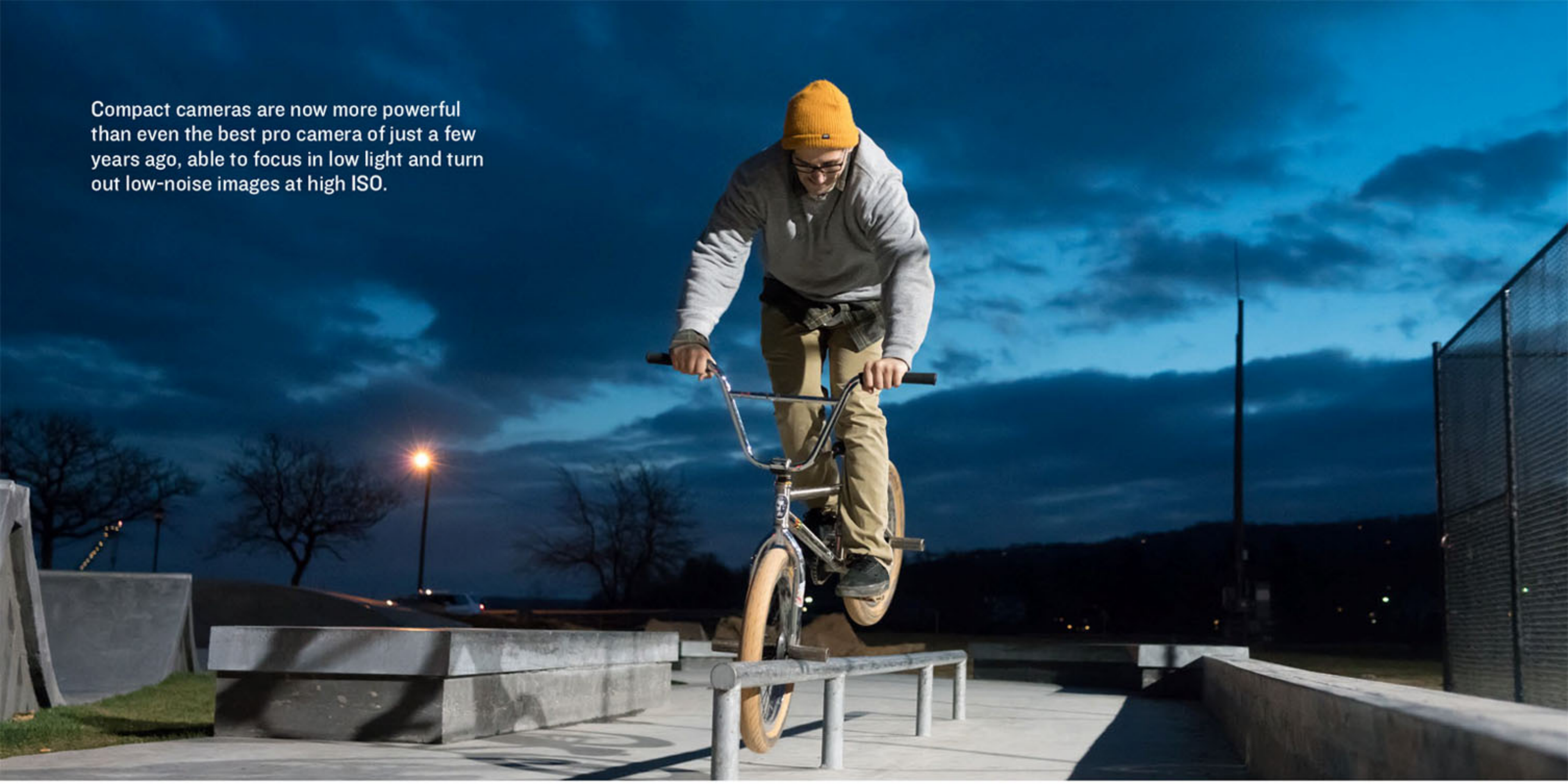


SONY CYBER-SHOT DSC-RX100 V

The DSC-RX100 V packs a ton into a camera that's not much bigger than a pack of playing cards. The 1-inch camera has a 35mm equivalent zoom range of 24-70mm and a variable aperture that's a super-wide $f/1.4$ at the 24mm length and only stops down to $f/2.8$ at 70mm. The 20-megapixel 1-inch sensor works with a 315-point AF system and can capture 4K video with no pixel binning. To keep the body compact, the RX100 V has a pop-up flash and a pop-up EVF.

Price: \$1,000. **Website:** sony.com

Compact cameras are now more powerful than even the best pro camera of just a few years ago, able to focus in low light and turn out low-noise images at high ISO.



CONNECTED

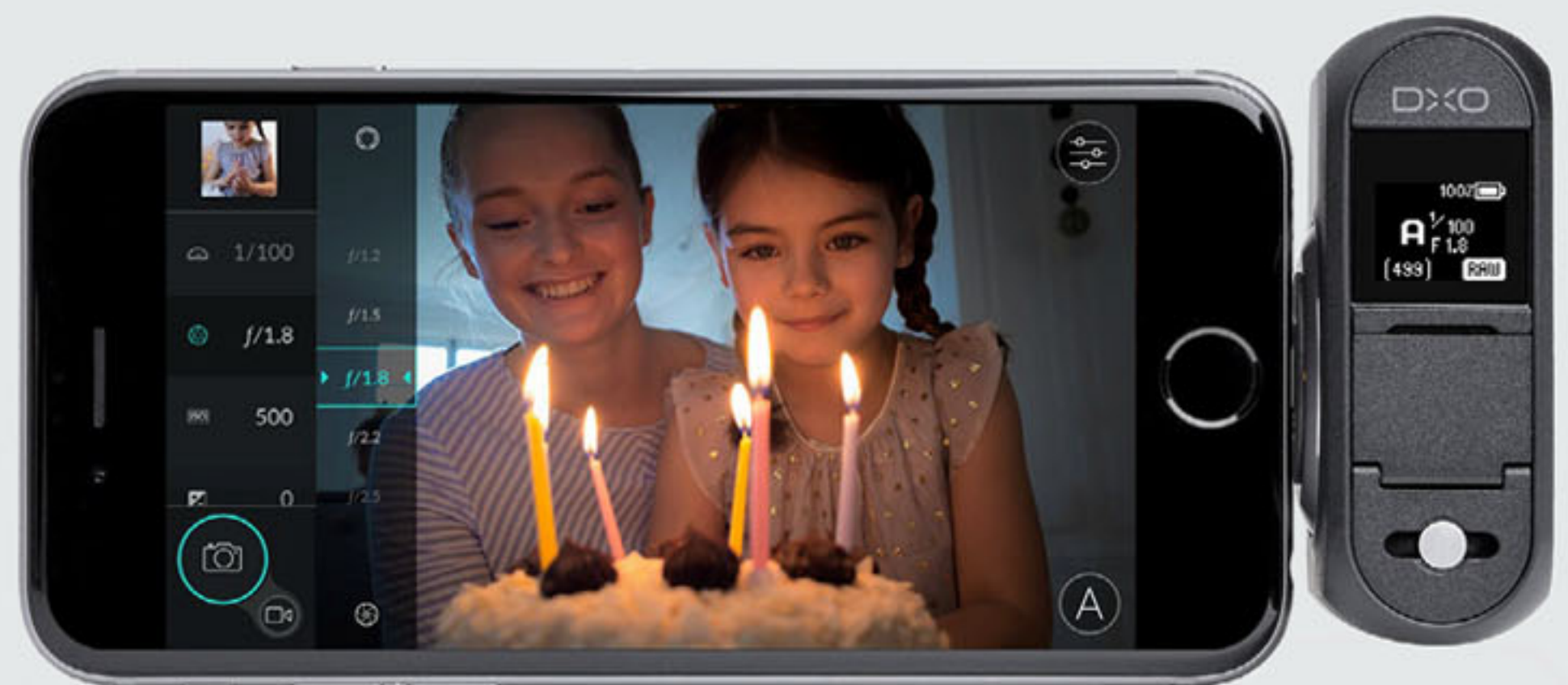
Connected cameras are a new phenomena—they attach to a device like an iPhone and include their own 1-inch sensor, yet use the processing and touch screen of the phone to help photographers capture images. They're an interesting choice for someone who wants to have more power than an iPhone can provide, but wants to leverage the phone's built-in sharing and OS features.



PANASONIC LUMIX DMC-LX10

Built around a 20-megapixel 1-inch sensor, the LX10 features a variable 24-72mm (35mm equivalent) lens with a nice wide-open aperture of $f/1.4-2.8$. The camera features a touch screen, which makes it easy to select menu items without a lot of button-pressing and dial-turning. The screen tilts for easy low-level shooting and the small shape makes this a good go-anywhere camera.

Price: \$700. **Website:** panasonic.com



DXO ONE

The DxO ONE is the most popular of the connected cameras. It connects to the Lightning port on the iPhone and has a 20MP 1-inch sensor that can capture up to 1/8000 of a second and up to ISO 51200. The DxO ONE works with a companion app on the phone for focus and configuration, though it can be used to capture photos independent of the camera, and can use built-in WiFi to capture images when not connected, yet still use the iPhone for the interface. The DxO ONE has a built-in 32mm $f/1.8$ lens (in 35mm equivalent). A coming update (by the time you read this) will allow the camera to be used for Facebook Live streaming. Full disclosure: I was a product tester on this product before launch.

Price: \$470. **Website:** dxo.com

COMPACT CAMERAS

photograph with any camera” and this is very true. But that photographer still can’t defy the physical limitations of the tool. Someone shooting with a disposable camera, for instance, might be able to snap one great shot of a skier on a jump, but not be able to shoot 12 fps of that same skier. That could be the difference between catching and missing a gold medal run.

A few years ago, I did a commercial job for a TV network where I documented the behind-the-scenes moments of a reality TV contest show. I wasn’t allowed to bring my DSLR gear—the bizarre union rules of the theater dictated that only the main house photographer could use “professional-level gear”—so I shot the job with a mix of mirrorless and compact cameras.

That’s when I noticed a funny thing. These amateur contestants, who would have been stilted and uncomfortable in front of a large pro-grade DSLR, were casual and accessible. By not bringing a large DSLR, I was able to shoot a range of images that would otherwise have been difficult or impossible to shoot with a pro DSLR.

Professional shooters run into this all the time when they

bring their work gear to a family event or a kid’s party. There’s an awkward set of looks that accompanies taking out a pro DSLR to photograph your child at a gathering of parents.

The advantages to photographing people with a compact camera don’t just end with the awkwardness factor; there are also strategic advantages to using a compact camera. One thing these cameras do very well now is focus on faces. While that naturally means you’ll get properly focused shots when composing a photo, it also means you can use the camera when it’s not being held to compose it. Hold a compact camera down at ground level and capture a baby crawling from their viewpoint without having to lay down on the grass yourself. Hold the camera casually in one hand down at waist level and snap away at your subjects without them knowing you’re taking a picture.

Now, I’m not suggesting you photograph people when they don’t want to be photographed—I’m really against street photography where photos of locals are captured without them knowing you’re photographing them. I’m suggesting, though,

GEAR

WEATHER-RESISTANT CAMERAS

These cameras can go (almost) anywhere and capture (almost) anything thanks to weather-sealed designs and toughened housings.



OLYMPUS TOUGH TG-870

This newest camera in the long-running Olympus Tough line can dive to 50 feet, can be frozen to 14°, can drop 7 feet and is crushproof under the weight of a very heavy human. The camera has a 16-megapixel sensor with a wide-angle 21mm (equivalent) lens, making it great for use underwater and in nature. There’s also a Super Macro mode, and a button on the front of the camera can be programmed for things ranging from shutter release to video recording—making it great for easy-to-start SCUBA selfies.

Price: \$279. **Website:** getolympus.com



RICOH WG-5 GPS

While it’s been out since 2015 (we’re hoping for a refresh), the Ricoh WG-5 GPS features something that other cameras don’t: a built-in GPS unit to geotag all of your photos, and that module even captures pressure, altitude and depth—as well as featuring a digital compass. The 16-megapixel sensor captures images from a 25-100mm (equivalent) zoom with a variable aperture of $f/2.0-4.9$. The camera can be taken to a depth of 45 feet, can be chilled to 10°F and survives crushes up to 200 pounds.

Price: \$360. **Website:** us.ricoh-imaging.com

An unassuming compact camera is a perfect tool for a street photographer, able to capture scenes like this rocker caught up in the Pokémon Go launch frenzy.



that you can use this technique when your subjects know you'll be taking their photos, but to do so without having to stop and raise the camera to your eye.

Thanks to the small size and light weight of compact cameras, they're also great for shooting things like sports where you can use them to get really low down or really high up without having to strain to hold a larger camera.

Many of today's compact digital cameras have wireless triggers that can be used either with an external device or with the WiFi on a mobile phone to capture images. I've successfully used this numerous times to capture photos from unexpected angles, putting my compact camera in harm's way, while my pro gear stays safely in a bag.

Finally, it's also possible to get compact digital cameras that are waterproof, or have small waterproof housings, which allows them to be used in places most DSLR and mirrorless cameras just won't survive. I've taken some great photos of my family in the surf using small waterproof cameras.

There's an additional non-creative benefit to shooting with

compact cameras. There's a certain amount of risk when traveling both home and abroad with what's obviously expensive camera gear. Stealing a camera or camera bag isn't difficult to do, and there's a direct correlation to the size of camera gear and its value in the DSLR world, so a compact camera—even a pro-level one—often goes unnoticed.

There are numerous low-end compact digital cameras—you can see them anytime you go into a big-box electronics store—but they're all very similar in features, and designed mostly to appeal to the customer who's uncomfortable using their phone as their camera. These are the types of cameras that many untech-savvy people end up buying, and if you're looking for a camera in that space, you should go to said electronics store and buy whichever is on sale at your price point. There aren't enough feature differences at the budget end of the compact market to really differentiate them.

Then there are cameras that have more features and create compelling images. You'll find a selection of our favorites in our Gear section.

DP

A macro lens is one of many specialty optics for cameras that can help photographers capture unique shots.



GUIDE TO LENSES

COMPLETE YOUR NEW CAMERA KIT WITH THESE ESSENTIAL LENSES

BY WILLIAM SAWALICH

So you've got yourself a new camera. Great! But in order to build your kit, you're going to need quality glass. Here's a look at some lens options to make your camera really work.

ALL ABOUT LENSES

Let's assume your new camera came with no lenses. The first thing to figure out is what focal lengths are most essential to the type of photography you're going to be doing.

A "normal" lens on a full-frame DSLR is 50mm. For decades, this was the standard kit lens that came with a new 35mm film camera. The angle of view, they say, approximates human vision. In fact, it's a bit wider, but it's still the standard for a normal angle-of-view, general-purpose lens. Lenses shorter than this are wide-angles—typically in the range of 24-35mm. These lenses expand a scene, similar to your car's "objects in mirror may be closer than they appear" warning. Wide-angles are useful for all sorts of things—particularly when context is important. This can be for candid photography, landscapes, architecture, street photography—all sorts of subjects can be photographed with wide-angle lenses in the 24-35mm range.

Lenses even shorter than that are known as ultrawides, which can dip down to the 10mm mark. In practice, even a 15mm ultrawide offers an extremely wide field of view—100 degrees and more. Some ultrawides are fisheye lenses. These can be full-frame or circular, and produce a distorted, ultrawide field of view even beyond 180 degrees. In practice,

fisheyes are special-effects lenses that aren't practical for everyday use. If you find yourself shooting subjects that require ultrawide angles of view (like interior architecture, for instance), traditional ultrawide lenses in the teens up to 20mm or 24mm will be much more versatile.

Lenses longer than a normal lens are known as telephotos. These lenses compress a scene and bring distant objects closer. Medium telephotos typically range from about 70mm up to 135mm. These are ideal portrait lenses, as they compress scenes, make shallower depth of field easier to achieve (in order to separate subject from background) and minimize the distortions of wide-angle lenses that exaggerate the features of a human face.

Longer telephoto lenses, from 150mm and up, are useful mostly for photographing distant subjects such as wildlife and sports. Professional sports and outdoor photographers sometimes rely on supertelephoto lenses in the 600mm to 800mm range. These lenses are very large and prohibitively expensive for all but the most dedicated professionals, but they sure do a good job of reaching out and pulling distant subjects in for close-ups.

A lens with a fixed focal length is called a prime lens, in contrast with zoom lenses that are adjustable across a range of focal lengths—say, from 24mm to 70mm, for instance. Zoom lenses are particularly useful for photographers who don't want to carry a lot of lenses with them. In place of a wide-angle, normal and short telephoto lens, that one 24-70mm does the same job at a fraction of the size and weight.

Some zoom lenses cover an extreme focal range, from wide-angle all the way to supertelephoto. For instance, a 30-300mm superzoom can be a go-everywhere, do-everything lens. The sacrifice typically made with a superzoom is a subtle lack of fine sharpness when compared to the very highest-quality lenses as well as compromised maximum apertures. Superzoom lenses typically have variable maximum apertures that aren't capable of opening as wide as most fixed maximum aperture lenses. This means their low-light performance can suffer comparatively.

Speaking of apertures, one of the benefits of working with prime lenses is that—along with being optically simpler and therefore often very sharp lenses—prime lenses frequently have very wide maximum apertures. This makes a lens “fast,” because it's capable of delivering a faster shutter speed even in low light. Another benefit of fast lenses (with apertures bigger than $f/2.8$, which means smaller numbers such as $f/2$, $f/1.8$ and $f/1.4$) is

that they're capable of producing extremely shallow depth of field. This look is particularly popular with portrait photographers, and the combination of a medium telephoto with a fast $f/2$ maximum aperture makes for an ideal portrait lens.

Another specialty lens that's incredibly useful for photographing tiny objects is the macro lens. Yes, you'll sometimes see the macro logo (a little flower icon) represented on standard telephoto zoom lenses or even on point-and-shoot cameras, but all the icon really indicates in this circumstance is the ability to focus slightly closer to the subject, increasing the chances for a successful macro photograph. In fact, for photographers interested in dedicatedly pursuing macro photography, a true macro lens such as the Micro-NIKKOR 40mm macro lens or the Micro-NIKKOR 105mm macro lens will provide much closer focusing and the ability to photograph items at actual life-size or even larger.

Some lens names are appended with IS, which stands

GEAR

CANON EF-M 18-150MM $f/3.5-6.3$ IS STM

The Canon EF-M 18-150mm $f/3.5-6.3$ IS STM is a new compact extreme telephoto lens for Canon's mirrorless M3 and M5 cameras with an equivalent focal range of 29mm to 240mm. Optical image stabilization makes it easier to handhold at slow shutter speeds, and a stepper motor allows for silent autofocus while recording video.

Price: \$499.

Website: usa.canon.com



AF-S NIKKOR 70-200MM $f/2.8E$ FL ED VR

Built for the FX mount on Nikon full-frame cameras, the AF-S NIKKOR 70-200mm $f/2.8E$ FL ED VR is the newest telephoto-zoom in the Nikon lineup, and one of the fastest, too. With a constant $f/2.8$ maximum aperture, the 70-200mm lens can shoot handheld in low light at $f/2.8$ and produce the shallow depth of field wide open that portrait photographers demand. The Silent Wave Motor makes autofocus quick and quiet, while built-in optical vibration reduction increases the hand-holdability of this user-friendly, versatile lens.

Price: \$2,900.

Website: nikonusa.com



A portrait lens, with good background defocus (often called "bokeh"), is an essential tool for any type of photography.

for “image stabilization,” or VR, for “vibration reduction.” This is a great tool for handholding telephoto lenses at slower shutter speeds. An optically stabilized lens may deliver a full two stops of additional handholdability—meaning if you’re normally able to produce sharp pictures with a 100mm focal length at 1/125th of a second, with IS engaged you may be able to achieve the same results all the way down at 1/30th of a second. This, too, makes IS

especially useful for photographers working in low light.

The acronyms EF-S, DX and DC refer to smaller-than-full-frame-sensor formats, such as APS-C. This is essential information because an EF-S lens designed to produce a smaller image circle to cover the smaller sensor size won’t function correctly when attached to a full-frame camera. The reverse, however, usually isn’t true. But when using a full-frame lens on an APS-C sensor, there’s a multiplication factor

GEAR

OLYMPUS M.ZUIKO DIGITAL ED 12-100MM *f*/4 IS PRO

The Olympus M.Zuiko Digital ED 12-100mm *f*/4 IS PRO is made for the company’s line of Micro Four Thirds cameras, such as the Pen and OM-D, where it behaves like an equivalent 24-200mm extreme telephoto. This lens, however, sports a constant maximum aperture (*f*/4) and the ability to focus closer than one inch from a subject. This really is one go-everywhere, do-everything lens.

Price: \$1,299. **Website:** getolympus.com



SIGMA 500MM *f*/4 DG OS HSM SPORTS

Wildlife and sports photographers rejoiced at the new, supertelephoto 500mm *f*/4 DG OS HSM Sports lens from Sigma. Designed for professional users, the magnesium lens with carbon-fiber hood is built to withstand the rigors of professional use and abuse. It’s also dust- and splash-proof and features a drop-in

filter slot for polarizers and other filters. The fast *f*/4 maximum aperture makes sure you’re able to use fast motion-stopping shutter speeds even in fading light. Available in mounts for Canon, Nikon and Sigma SLRs. This lens’ only real shortcoming is its price.

Price: \$5,999. **Website:** sigmaphoto.com



(sometimes called a crop factor) that makes lenses perform like longer versions of themselves. With a crop factor of 1.6x, for instance, a 100mm lens really behaves like a 160mm telephoto. That may be no big deal, but when compared to a 24mm lens that actually performs like a 37mm lens, the difference is dramatic. As you may imagine, sports and wildlife photographers may consider a crop factor a benefit, as it makes a 300mm lens behave more like a 480mm

lens—much better for zooming in to distant animals or athletes. Either way, it's essential to be sure that photographers using APS-C sensors purchase lenses designed for the format and rely on "equivalent" focal lengths to determine whether a lens is wide, normal or telephoto. A wide-angle lens for Nikon's DX (APS-C) format may have an actual measurement of 10mm, though on the smaller sensor it performs equivalent to a 15mm lens on a full-frame sensor. DP



FUJINON XF50MMF2 R WR

Fujifilm's new Fujinon XF50mmF2 R WR is a fast 50mm prime for the Fuji X system of cameras. The WR in the name is for "weather resistant," as it's built to withstand the rigors of dirty and wet working conditions. It's also capable of working in temperatures as low as 14°F. On an APS-C-sized camera, the lens offers the equivalent of a 76mm angle of view. Coupled with the fast $f/2$ maximum aperture, the lens is ideal for portrait shooters and photographers who want to work in low light.

Price: \$449. **Website:** fujifilmusa.com

TAMRON SP 90MM $f/2.8$ Di MACRO 1:1 VC USD

One of the newest lenses in the Tamron lineup is the SP 90mm $f/2.8$ Di Macro 1:1 VC USD. Capable of life-size enlargement of tiny objects and focusing just under 12 inches, the 90mm macro, with its built-in vibration reduction and fast autofocus, is a great choice for photographers who want to focus on small subjects such as flowers and insects. Because macro photographers frequently work in nature, the lens is built to be dust- and moisture-resistant, while a durable front element coating minimizes the risk of condensation, smudging and scratching. Vibration reduction eliminates the tiniest of shakes that occur when handholding—which is particularly important when shooting close-ups. The 90mm focal length makes it a practical lens for general use, as well, especially for portraiture. Tamron manufactures this lens with Canon, Nikon and Sony lens mounts.

Price: \$649. **Website:** tamronusa.com



SONY PLANAR T* FE 50MM $f/1.4$ ZA

Sony stepped up its lens game in 2016 with great new lenses for demanding photographers. Case in point, the Sony Planar T* FE 50mm $f/1.4$ ZA. It's a Carl Zeiss-made lens for the E mount of the full-frame lineup of Sony Alpha mirrorless cameras. Fast autofocus and weather sealing make it suitable for pro users, who are sure to love its crazy-fast $f/1.4$ maximum aperture, which combines with 11 aperture blades to produce beautiful bokeh (the out-of-focus area of an image) and offers the ability to shoot at fast shutter speeds even in low light.

Price: \$1,399. **Website:** sony.com

Photographers will recognize many parts of this high-end Canon motion camera, as it's an evolution of the company's video-capable still cameras.



EXPANDING YOUR VISION

EVOLVING FROM PHOTOGRAPHY TO VIDEO PRODUCTION

TEXT & PHOTOGRAPHY BY DAN BROCKETT

More photographers are starting to experiment with and become proficient in video daily, thanks to the high-end video tools being added to today's digital still cameras.

For still photographers interested in transitioning to or supplementing their still work with professional video projects, we'll explore expanding the skills you're probably already fluent in—composition, lighting and visual storytelling—and how those skills can easily translate to video/cinema. We'll also take a look at the new skills a still photographer will need to acquire to be successful in video production.

WORLDS COLLIDING OR CONVERGING?

While it will vary from photographer to photographer, what are some of the reasons you might want to consider learning how to shoot video at a pro level? If you shoot weddings, you already have a built-in audience that usually wants to also purchase professional video services. Fashion and editorial photographers have been dealing with video requests for their clients for years. As you may or may not know, the first DSLR cameras that had pro-level video capability were conceived for still photojournalists with news agency clients who were also requesting simple video clips for web use of the same story subjects that were being covered in stills.

The bottom line is, the worlds of still photography and video have been converging for almost a decade. At this point, depending on your market, clients and their requirements for delivery, you can bury your head in the sand and keep stating over and over to yourself, "I am a still photographer," or you can begin exploring the worlds of video and cinema and how their convergence is affecting your business.

THE BUSINESS CASE

How can you best utilize video production to increase your potential client base and income? Most successful photographers already have a website, social media presence and, most importantly, a loyal client base. Not only can video add value to your existing clients by you becoming a "one-stop shop" for their media needs, but you also may discover new clients and markets as your skills and reputation grow. But let's face it, in a world where almost everyone carries a relatively capable stills and video camera in their pocket or purse in the form of a smartphone, video,

like still photography, has become commoditized. While anyone can shoot at least passable-quality stills and video for many applications, the ability to tell compelling stories through your still and video work is the differentiator that will encourage clients to hire you and pay you handsomely for a product/story/visual concept that they're not capable of shooting themselves.

VIDEO AND FILMMAKING ARE COLLABORATIVE

It's pretty simple to grab a camera and lens, some lighting gear and a subject, and begin shooting beautiful images solo. Video and film are a bit different. That's not to say that you can't "one-man band" it when shooting video—you can, but you may find it frustrating and the quality of what you're shooting may be compromised when you try to go it alone. Ironically, "one-man banding" it with film and video, which is what many still photographers tend to do as they make the transition from still to motion, is one of the most difficult and frustrating ways to shoot.

It takes skill in several different disciplines that evolved with a fully staffed crew in mind. As a general rule, being aware of your limitations and collaborating with others who are experts in their fields will give you confidence, and your end product will be much better than if you try to do everything yourself.

MULTITASKING OR HIRING?

Just as in still photography, budgets these days for video projects are shrinking. When you conceive of a video project or are hired to produce a video project, one of the first issues to consider is how to best allocate the budget and, therefore, resources. Some questions to consider are:

- What will your role be in the production?
- Which job functions needed to complete the project on budget and on time are your strengths and which are your "areas of opportunity?"
- Are you capable of one-man banding this project, or will you need to hire crew?
- If you don't have sufficient budget to hire a full crew, what will be the most efficient use of your budget to hire limited crew?
- Can your crew fulfill multiple roles?

Besides crew and positions, you also need to consider all of the gear needed to carry off the shoot besides just your

camera(s) and lighting. Some possible equipment gear concerns to think about are:

- Camera support gear. Will you just need a tripod or possibly a slider, dolly, Steadicam, gimbal, car rigging or shoulder mount for handheld shooting? What about an outboard video recorder, monitor, cabling or an extended power battery system?
- Grip equipment to control, mold and shape the lighting.
- Sound equipment—which microphones, mixer, recorders, cabling and other audio gear will be needed?
- Props.
- Sets or backgrounds/set dressing if shooting interviews.
- Practical effects gear like a fogger, hazer, TV flicker box or greenscreen.
- Wardrobe.
- Hair.
- Makeup.

This list can obviously be larger and much more detailed, but this is a good basic place to begin thinking about what other equipment you may need to carry off your shoot. Along with all of this extra equipment, think about the crew and skills needed to put all of this equipment to work.

SOUND IS THE THING

Recording sound seems to be the one area where most new video shooters skimp or don't plan accordingly and that has the most impact on your finished product. As photographers and image-makers, we often don't think this way, but audio is typically the single most important component of video and film production. Period. Think about it: If the lighting isn't optimal but the sound is clear and audible, the audience won't perceive the production as being of the highest quality, but at least they will hear the actors, interviewee or voice-over clearly and will understand what's being

GEAR

The most practical approach to gear for a still photographer is deciding what can be used from your existing equipment (camera, lighting, C-stands, light stands, sand bags, various lighting control tools) and what you will need to acquire to successfully shoot video. Starting in video isn't inexpensive, but the quality of the gear has recently increased as costs have fallen, so even the lower-end gear has some pretty amazing capabilities in the right hands.

CAMERAS

The video camera market has exploded in recent years, and there are now more video-capable still camera models than ever before. Many still photographers are more comfortable shooting with a video-capable DSLR, Micro Four Thirds or mirrorless camera than a dedicated video camera, and this can be a good way to break into video shooting for many. On the other hand, dedicated video cameras often have features that video-capable still cameras lack that are superior for shooting video, like dedicated XLR audio inputs, built-in ND filters, time-code capability and more.

VIDEO-CAPABLE MIRRORLESS

The Panasonic Lumix GH5 is a new Micro Four Thirds stills/video camera for 2017. The camera boasts a 20.3-megapixel Digital Live MOS sensor, Venus Engine Image Processor, 4K video with no crop and an unprecedented internal 4:2:2 10-bit 4K video-recording capability. Price: \$1,998

The Sony a7R II full-frame mirrorless camera is 4K-capable and features a 42.4-megapixel sensor, built-in five-axis image stabilization and a max ISO of 102,400. It uses Sony's easy-to-adapt to E-mount lens mount system. Price: \$3,199



Panasonic Lumix GH5



Sony a7R II

said. Conversely, if the images are beautifully lit and composed but the dialogue is poorly recorded and hard to hear, it simply won't matter to the audience; they will disengage immediately because they won't be able to tell what's going on in the production.

SECRETS OF THE ONE-MAN BAND

Shooting video solo can be challenging. As a photographer, your main focus will tend to be on the camera setup, composition and lighting. You can't forget all of the other tasks that, at a minimum, must be performed to capture high-quality footage.

GRIP AND LIGHTING

Lighting is time consuming, and doing it all yourself is possible but takes time. Make sure you build enough time into your shooting schedule to not only load in all of your gear to the shoot location, but that you also allocate enough time before

shooting begins to unload and set up all of your grip and lighting gear, and have a lighting plan beforehand so you remember to bring all of the gear you will need.

SOUND

Let's just come out and say it: The best strategy is to always hire a pro sound mixer. Recording production sound is its own discipline, not a last-minute, casual afterthought. If you don't have the budget to hire a pro sound mixer, wireless microphones can be a solo shooter's friend but aren't the right choice for every situation. We could easily cover wireless microphone systems themselves in an entire multi-page article, but you also need to learn about how wired microphones, lavaliers, shotgun and cardioid microphones function, which are best for your needs, if you'll need an audio mixer or outboard audio recorder, cabling, microphone placement and many other skills needed to record high-quality audio.

MID-RANGE VIDEO/DIGITAL CINEMA CAMERA

Blackmagic Design's Ursa Mini 4.6K camera features a Super 35mm CMOS sensor, 4608x2592 video up to 60p, Compressed Raw Recording, ready-to-edit ProRes 444 + 422 Recording, 12G-SDI Output, and time code and REF Input. The rugged magnesium-alloy body also houses a 1080p flip-out screen with Touchscreen Interface and dual XLR Audio Inputs with Phantom Power. Price: \$4,995



Blackmagic Design
Ursa Mini 4.6K

Canon's EOS C100 Mark II is a popular choice with a wide variety of video users and is compatible with all Canon EF, EF-S and Cinema CN-E lenses. The camera features a Super 35mm 8.3-megapixel CMOS sensor capable of recording at 1920x1080p at 59.94/50/29.97/25/23.98 frame rates, Canon's built-in Dual Pixel CMOS AF Hardware recording and AVCHD + MP4 recording to dual SDHC/SDXC cards. Price: \$3,999



Canon EOS C100 Mark II

Space precludes us from covering sound recording in depth here, but seek out resources like the Audio Assist column on our sister publication's website (hdvideopro.com/columns/audio-assist) and other audio articles to learn more about production audio equipment and skills in detail. **Camera Tips**

Even when shooting solo, there are camera equipment and techniques you can utilize that will make your footage look more professional. The first to consider is the use of multiple cameras and angles. It can be beneficial to have shots from multiple points of view. Solo shooters can shoot with multiple cameras by themselves, but it can be taxing because the shooter will have to mind the focus, shot composition, battery and recording media of more than one camera by themselves.

Another useful tool is Face Tracking autofocus. Focus in HD, 4K and higher resolution can be a challenge as most viewfinders, flip-out screens and external video monitors don't have



GEAR

CAMERA SUPPORT

Tripod packages for video cameras range from low-cost basic units like the \$249.95 Benro Aero 4 Video Travel Angel Tripod Kit with a weight capacity of 8.8 pounds to medium-range units like the \$3,960 Sachtler FSB 10 ENG 2 MCF Carbon Fiber Tripod System with Side-load Plate, which is rated for loads up to 26.5 pounds, all the way up to the top-of-the-line units like the \$14,625 OConnor 2575D Ultimate Fluid Head package that can support camera packages up to 133 pounds.

Gimbals are camera-stabilizing devices that provide a smooth, floating movement to video cameras without needing as much training and practice that more expensive and larger Steadicam and Steadicam-like devices require. Devices like the \$639.99 Zhiyun-Tech Crane are popular for small and light mirrorless and M43 cameras, while larger cameras that weigh more function well with gimbals like the \$1,599 Letus Helix Jr., while larger, heavier camera packages require a gimbal like the \$6,500 Freefly MōVI Pro.

Camera sliders are useful for adding small, dolly-like moves to your footage without the expense, weight or size of a real camera dolly. The \$249 Konova K2 Slider has 31.5 inches of camera movement and allows smooth movement. For those interested in a motorized camera movement system that can function as a second camera operator or can be used to shoot time-lapse video, the \$1,829 Rhino Gear Ultimate Slider Bundle is simple to set up and use, and allows for programmed camera moves up to 42 inches.



Konova K2 Slider



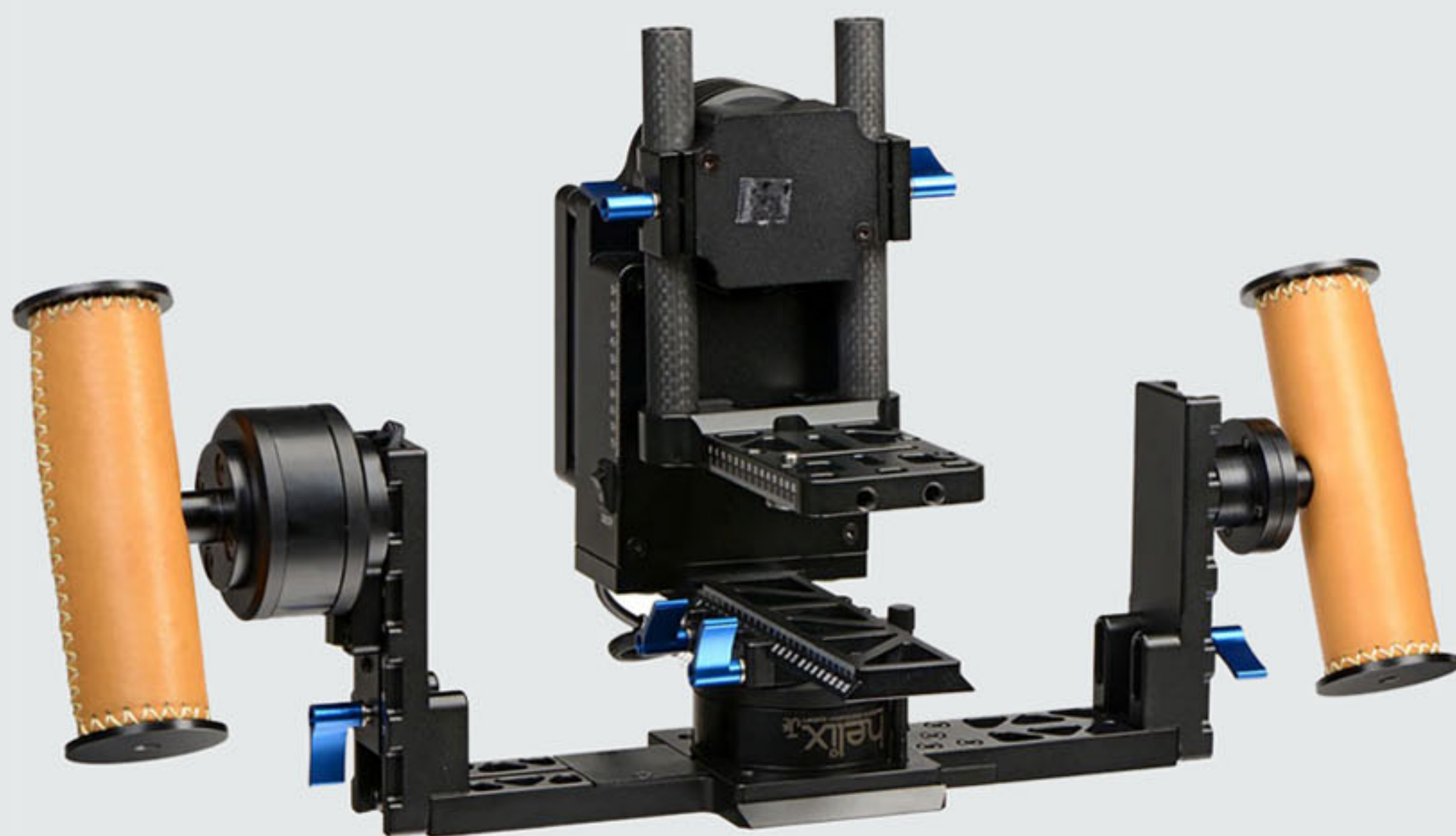
Benro Aero 4 Video Travel Angel Tripod Kit



Freefly MōVI Pro



Photographers who get into video often end up trying to do everything themselves, though video is much easier done with a crew.



Letus Helix Jr.



Zhiyun-Tech Crane

**Rhino Gear
Ultimate Slider Bundle**



**Sachtler FSB 10 ENG 2 MCF
Carbon Fiber Tripod System
with Sideload Plate**



enough resolution to view razor-sharp focus in all situations. Traditionally, autofocus on video cameras rarely worked well; the camera would hunt for focus at the most inopportune times, so pro shooters pretty much used manual focus exclusively. Some newer-generation cameras now have features like Canon's Dual Pixel Autofocus, which includes Face Tracking. The camera can actually recognize, lock in and track subjects' facial features as they move. Just be aware that this technology isn't perfect and still needs to be carefully monitored, as the focus can stop working if the subject leaves the frame or obscures their face momentarily.

BESIDES THE EQUIPMENT

A video project generally begins with a project outline, sometimes referred to (incorrectly) as a treatment. This document captures the idea the project will communicate to the viewer in a simple, high-level overview format. This document should be written without details about equipment, gear and technology, using language

about how the viewer will experience the project. The script is the bible for the entire production and spells out everything about the production and describes every shot and scene that needs to be captured in detail to most effectively tell the story. Storyboards aren't needed for every production but can be invaluable when visually complex or difficult scenes need to be visualized for the crew and talent. Casting is more the realm of the producer and director, but is also something that you may have to do yourself on smaller productions when you're the producer, director and crew.

Rehearsal is important not only for the talent but for the crew; it helps to determine where, when and how the equipment and people resources will need to be positioned and allocated to capture a given scene most effectively. Interviews and documentary shoots aren't rehearsed, but anything with a story and characters needs to be blocked and rehearsed. The location scout is used to select or verify the suitability of a given location for the production. Production is the act of shooting all of the footage needed to

GEAR

GRIP EQUIPMENT

There are several popular brands of grip equipment. The most common grip gear utilized in basic video production are Century stands, light stands, flags, cutters, diffusion and sandbags, although there are literally hundreds of different grip items available. It's well worth taking a look at the websites of Matthews Studio Equipment as well as American Grip, Norms Studio Equipment and Manfrotto's Avenger Grip Equipment.

LIGHTING

If you already own professional "hot lights" or other constant light sources like professional video LEDs or Kino Flo fluorescent lighting you use for still work, there's no reason why you can't use it for video. If you don't have any constant-source lighting, the five most popular video lighting technologies are Tungsten, LED, Fluorescent, Plasma and HMI. Many lighting manufacturers offer pre-assembled lighting kits like the \$1,699 ikan IB508-v2 Bi-Color LED 3-Light Studio Kit, which give you at least the basics to light small scenes and interviews. Others prefer to assemble their own lighting kit using different technology, like using the versatile bi-color \$885.99 Kino Flo Diva-Lite 415 fluorescent fixture as a key source and building out from there. Those who shoot outdoor or in shaded sunlight often prefer an HMI kit like the \$7,980 K 5600 Lighting Joker-Bug 200W HMI Pair Kit. If you mostly light indoor scenes, Tungsten kits like the \$3,867.50 Softbank IV Tungsten 5 light kit are excellent choice.



ikan IB508-v2 Bi-Color LED
3-Light Studio Kit



K 5600 Lighting Joker-Bug
200W HMI Pair Kit

assemble the finished work. Shooting for the edit is working in a way that the footage captured provides “coverage” for the editorial process. This means that all scenes are captured with satisfactory performances, performance variations and alternate takes, all with “handles” so that the editor has enough footage to have options in assembling the final project.

MANAGING YOUR MEDIA

Since we’re shooting in the era of high-resolution 4K and greater video and digital cinema, video production, especially with multiple cameras, generates huge amounts of files and data. The key to success in media management is redundancy. If you’re working on a multiple-day or even multiple-week shoot and generating hundreds of gigs or even multiple terabytes of data daily, it’s important that you offload the data onto multiple drives constantly.

Fortunately, there are inexpensive drives now available almost everywhere and software that can perform much of the

downloading and verifying of footage for you, but, in the end, it still takes someone organized and responsible to ensure that all of the footage shot is downloaded and cloned for redundant backup before any camera media is scrubbed.

A good strategy is that no camera media is erased until it’s verified to be complete and archived on at least three different drives, and the drives are located in at least two different physical locations. It’s up to you to determine which level of backup and redundancy you’re comfortable with, but needless to say, this process is probably the single most important component of the entire production process.

DP

*Writer, producer and cinematographer **DAN BROCKETT**’s two decades of work in documentary film and behind the scenes for television and feature films have informed his writing about production technology for HDVideoPro Magazine, Digital Photo Pro Magazine and KenStone.net. Visit danbrockett.com*



**Tascam DR-70D
4 Channel Recorder**



Sennheiser MKH 50

Countryman B6



AUDIO

There are basically two ways to record sound for video. If you own a video camera with dedicated XLR inputs, recording your sound in-camera is a viable way to work. If you utilize a mirrorless, M43 or DSLR camera, with their consumer 3.5mm microphone inputs, the sound quality on all of these cameras isn’t professional quality, so many record on an external recorder like the \$215 Tascam DR-70D 4 Channel Recorder, recording a guide track on the camera’s internal microphone, used for syncing the camera picture and the external recorder audio later in post.

Wired microphones for video come in two basic categories: small lavaliers, which are placed on talent, and boom-mounted microphones, often referred to as shotgun microphones, but they actually can be shotgun/lobe, cardioid or hyper-cardioid, each with their own distinct pickup pattern. Some popular lavalier microphones are the \$319.95 Countryman B6, favored for its microscopic size and high-quality sound; the industry-standard \$389.95 Sennheiser MKH 50; and the \$489 Sanken COS-11D. Any of these microphones can be ordered with an attached power supply for shooting hard-wired or with various connections used in wireless microphone transmitters.

Shotguns like the \$1,199 Sennheiser MKH 50 are popular for capturing dialogue as are alternatives like the \$1,450 Sanken CS-3e. If a smaller, shorter mic is needed for camera mounting or tighter spaces, consider the \$169 Audio-Technica AT875; it’s a great budget choice with low-handling noise.



GET PERFECT SHOTS EVERY TIME

BY FOLLOWING THESE GUIDELINES, IT'S EASY TO GET PRECISELY
EXPOSED IMAGES OF THE OUTDOORS WITH PRACTICE AND PATIENCE

TEXT & PHOTOGRAPHY BY RICK SHEREMETA



With a wide range of highlights and shadows in this panorama of Glacier National Park's Swiftcurrent Lake, understanding a camera's exposure settings is key to a properly exposed image.

When I talk with other photographers, many confess that they always shoot in one of the camera Program Modes. The consensus seems to be something along the lines of: Does it really matter, since I'm really not sure how to correctly determine exposure, and my DSLR generally comes up with a good exposure on its own, and then I can always fix problems later in Photoshop or Lightroom! On the surface, that might be true to a certain extent. While today's sophisticated cameras are pretty good at getting exposure right most of the time, a lack of understanding metering and exposure control can be a severe handicap to the photographer.

If one relies entirely on the camera's auto or program modes, not only does it limit creative control, but also the chance of getting consistently good images now becomes pure luck. With that in mind, it makes perfectly good sense to get as close as possible to optimal exposure when taking the photo. This will result in less time and effort required to make any necessary or interpretive adjustments in post-capture processing and will provide much more latitude when it comes to doing so. Moreover, if exposure is too far off, any corrective adjustments may be severely limited or not even possible. Photography is all about the control of light and its interaction with the subject so as to achieve a desired effect. Keeping that objective in mind, let's take a look at how light is measured, and then how those measurements are used to determine best exposure for shooting outdoors.

WHAT CONTROLS EXPOSURE

DSLR cameras measure light that's reflected from the subject through the lens (TTL) to the meter. Camera meters are calibrated to measure neutral tone as 12.5 percent gray, which forms the basis upon which all exposure settings are made. Before we get too far along on this subject, understand that there are three means by which exposure is controlled—shutter speed, aperture and ISO—and we'll discuss each of these briefly. In creating a photograph, a conscious effort is required to choose which of these parameters, either singly or in combination, govern to attain the desired outcome. It's important to understand the role that each of these factors plays, so let's take a brief peek at what these things actually do.

Shutter speed is used to control motion—the goal being to either stop or blur motion. A fast shutter speed will freeze motion, and the faster the subject is moving, the faster the shutter speed needs to be to accomplish this. Conversely, the slower the shutter speed, the more a moving object will be blurred. While this might seem intuitive, a full understanding of the correct shutter speed to use will only come with experience and experimentation. It's important to remember that doubling or halving the shutter speed will respectively reduce or increase exposure by 1 exposure value (EV) or stop. For example, going from 1/125 sec. to 1/250 sec. increases the shutter speed by a factor of two, thus reducing exposure by 1 EV or 1 stop. Going from 1/125 sec. to 1/60 sec. decreases the shutter speed in half, with the result of an increase in exposure of 1 stop or EV.

The next thing that controls exposure is lens aperture. This is the size of the opening through which light passes on its

way to the sensor or film plane. It's used to control depth of field, or how much of the scene is sharply in focus from near to far. Aperture is measured in *f*-stops. For example, *f*/2.8 is considered a wide aperture (or fast lens), which allows more light to reach the sensor but with a very shallow depth of field, whereas *f*/16 is a small aperture that permits much less light but with a much greater depth of field. Each full *f*-stop represents a doubling or halving of light. Case in point, going from *f*/2.8 to *f*/4.0 (a full stop) halves the amount of light reaching the sensor, and vice versa.

ISO is the last parameter that has a bearing on exposure. Put simply, this is a measure of the camera sensor's sensitivity to recording light. The higher the ISO number, the greater the sensor's ability to capture light, but generally at the cost of image quality. Conversely, the lower the ISO value (typically 50 to 100 for many cameras), the lower the ability to capture light but the higher the image quality. At high ISO values, digital noise can be introduced into an image. Noise will be visible in shadow or dark areas, where the appearance of red and green dots occurs. With continuing advances in technology, ISO numbers are increasing exponentially with better quality and less likelihood for the introduction of digital noise. This improvement is being reflected in the latest camera models as they're unveiled. Again, as with shutter speed and aperture, a doubling or halving of the ISO value doubles or halves the amount of sensor light sensitivity, respectively. It's always best to set ISO at its lowest value for highest image quality, only increasing it as necessary to obtain higher shutter speeds and/or smaller apertures in low-light-level situations.

METERING

Okay, now that we completely understand what controls exposure, let's look at light metering—how to do it and what it means. The first thing to consider is what metering mode to

SPOT METER READING TO USE AS STARTING POINT FOR ESTIMATING EXPOSURE:

• Rocks	-1 to +1
• Evergreens	-1
• Green Foliage	0 to +1
• Whitewater	+2
• Blue Sky	-1 to +1
• White Cloud	+2
• Grey Sky/Cloud	-1 to +1
• Green Grass	-1 to +1
• Yellow Flower	+1
• Palm of Hand	+1



Figure 1. Here are the rules of thumb for setting initial exposure. In this image of Glacier National Park's St. Mary Falls, I selected an aperture, then metered the whitest water, while adjusting shutter speed until the meter reading was +2. Then, for confirmation, I metered the foreground rocks, which measured 0 EV, and the blue sky at +1 EV.

be used. There are several options available—from Evaluative/Matrix/Pattern (synonymous depending on camera manufacturer) to Center Weighted to Partial to Spot—each going progressively from a larger to smaller area within the viewfinder that’s being used to measure light input.

It’s vital to understand that every object or thing in a scene will have a certain tonality, or level of brightness, regardless of its color (doesn’t need to be a gray shade). It’s possible that some elements or areas of the scene may have the same brightness (tonality) level while others may vary by several stops or exposure values (EVs). The important concept to remember is that the relative relationship of each object will stay the same regardless of lighting conditions, or any changes thereto, and each one will be relative to every other one so that if one changes in value all the others will change by the same amount. What this means, for example, is that if we change exposure to lighten the sky, shadow areas will be lightened by the same amount, with the converse being true as well. Understanding that concept, and knowing what to expect, is the whole key to understanding metering and control of exposure. Taking this a step further, an ever-green forest will generally always be 1 EV or stop darker than a neutral-tone blue sky when in the same light—so if the sky

gets darker or lighter, the forest will still be 1 stop darker or lighter, respectively. Makes sense?

SETTING EXPOSURE

To best understand the concepts to be presented below, I suggest that the camera mode be set to Manual and metering to Spot (or Partial if Spot isn’t available on your particular camera). Manual Mode allows the camera’s meter to actually function as a gauge, showing relative brightness or darkness between various objects or areas within the scene in terms of “stops” above or below neutral or 0 EV. The camera’s meter doesn’t control or set exposure like in the Auto/Priority or Program Modes—we’ll control how exposure is set and will do that in the next step. By Spot metering, you can isolate specific areas or objects (zooming in might better help segregate an element in certain cases). Looking through the viewfinder or LCD screen, you’ll see the meter; it’s either at the bottom or side of the display, depending on make and model of camera. To proceed, depress the shutter release halfway and hold it. This engages the meter and will also focus the lens (assuming autofocus is turned on). Now point the camera at different parts of the scene that have different values of brightness. As the camera is moved around, the meter readings will change depending on how light or dark the objects are, i.e., showing exposure in stops or EVs relative to 0 EV or neutral tonality.

To help grasp this concept better, I suggest first starting by metering a blue sky (metering the northern sky will give best results) as indicated above, then adjust shutter speed and/or aperture, while still holding shutter release halfway until the sky meters 0 EV or neutral—this is your initial exposure. You’ll notice that as the shutter speed or aperture is changed, the meter’s pointer will move to reflect how that change has affected the exposure, either toward plus (overexposure) or minus (underexposure) on the scale.

Now, without changing anything, continue to meter other mid-ground and/or foreground elements—noting the different meter readings. Regardless of what or where you start metering, the first question to ask yourself is, what do I want to control the exposure and how brightly do I want it to be rendered? To assist in this task, I’ve developed some handy rule-of-thumb values for different objects that are shown in Figure 1. These are good values upon which to set initial exposure. Be aware, however, that they’re by no means cast in stone, as exposure is relative and can vary throughout the day, as the light changes or with changing weather. There’s nothing absolute—the main thing is that you’re in control and can get as inventive as you wish, basing exposure on how you prefer the scene to be interpreted and rendered; after all, the photograph is your creation.

Things will come together more as we look at an example as shown in Figure 2. To begin our exposure evaluation, we’ll use an area of white cloud as the starting point to set the initial exposure. This works out well since we would normally expect the whitest part of a cloud to be +2 EV from our rules of thumb. For landscape images such as this, maximizing depth of field is desirable, so we’ll start out by first setting the aperture at $f/16$, then, while metering the white cloud area, we’ll adjust shutter speed until our meter reads +2 EV.

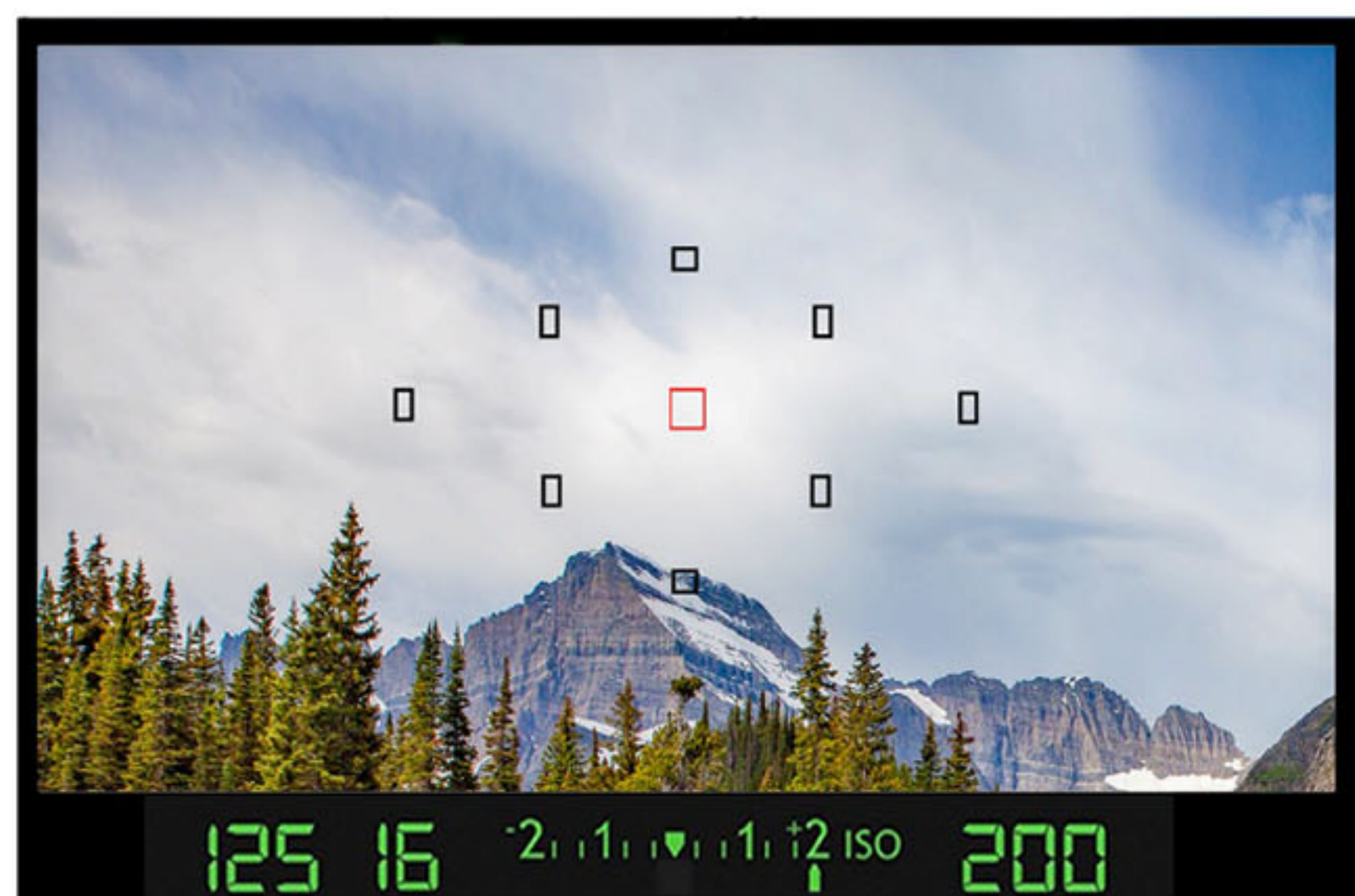
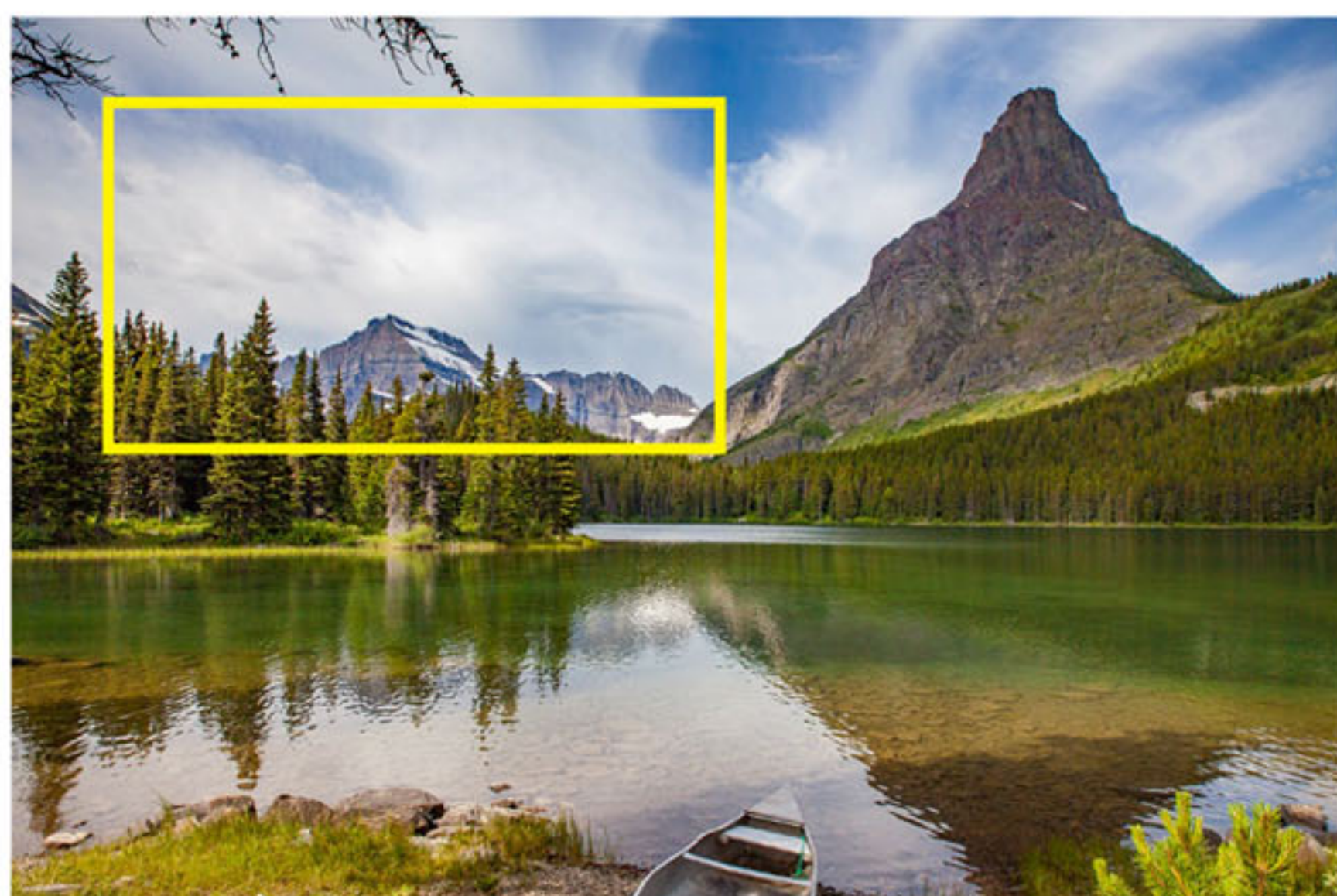


Figure 2. At top is the opening image in this article. Above is the image as seen in the viewfinder, zoomed in to the whitest area of the clouds and spot-metered to set exposure. With the ISO set at 200 and aperture set at $f/16$, shutter speed is adjusted (1/125 sec.) until the meter reads +2 EV.

Without making any other changes, we'll then meter the blue part of the sky, as shown in Figure 3. It meters 0 EV, which works fine for us. Lastly, we'll measure something that we think should be a little brighter; in this case, the front of the canoe suits our purpose, and it meters +1 EV as shown in Figure 4. It doesn't matter where you start your exposure evaluation just as

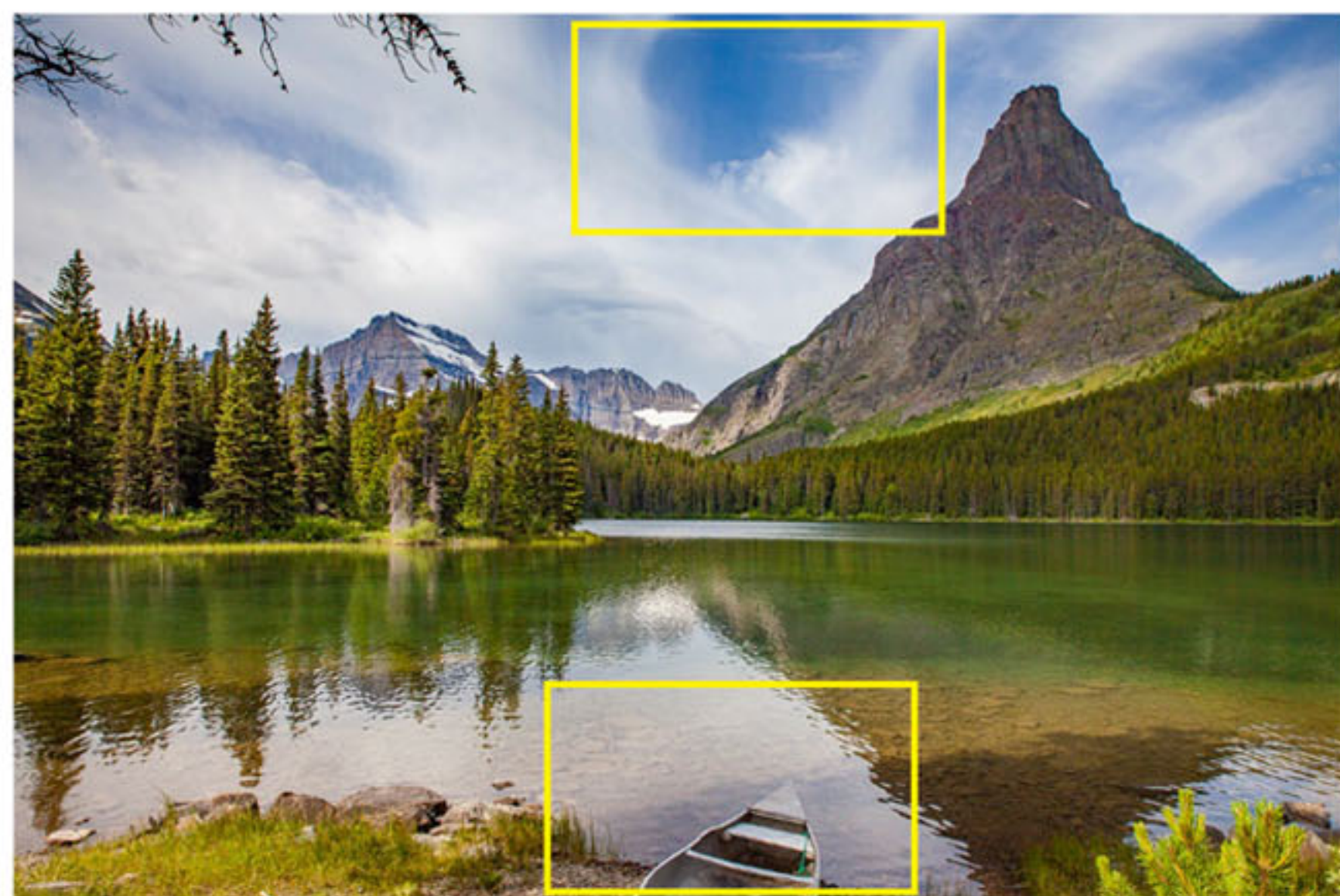


Figure 3. To confirm the initial exposure setting, I now meter the bright blue sky. It meters 0 EV or neutral-toned, as the reading shows. In this case, I didn't have to change any of the camera's settings—the sky is 2 EV darker than the white cloud area, which in this case works perfectly.



Figure 4. Metering the bow of the canoe, we see that it measures +1 EV. This provides additional confirmation that our exposure is spot on. Notice that there are no changes to camera settings.

long as the objects or areas you measure fall within the range you would expect them to be. Like anything else, getting good at this takes practice—so don't get discouraged on the first try. You'll get better at estimating EVs as you gain experience, and soon it will become second nature.

Since we now feel confident that the exposure is acceptable, we can go ahead and take a test shot, then check the preview screen along with the histogram for confirmation of good exposure. Don't just rely on the preview you see on the LCD screen, as it can be misleading—the key is a correct histogram. Learning how to properly interpret the histogram is an art unto itself, as it may vary considerably from scene to scene based on many factors—subject matter, time of day, uniformity of light, cloud cover, etc. Looking at the histogram, bright areas show to the right of center and dark areas to the left, respectively. As long as the histogram isn't severely clipped (pushed up against the right or left axes), which would indicate over- or underexposure with resulting loss of useful information, things should be okay. Anything clipped will have no detail, and it can't be recovered in post-processing no matter what's done. Overexposure is far worse than underexposure, particularly where sky is concerned, and is to be avoided even if shadow areas need to be compromised. Keep in mind that some minor clipping in highlight areas such as white clouds and/or whitewater is to be expected and is acceptable—it's just a matter of degree, and too much isn't a good thing.

I highly recommend that Highlight Alert warning be set for your LCD preview screen. This can be done through the camera's custom functions and will help your understanding considerably as to how the histogram reflects the amount of overexposure. Any area(s) overexposed will blink black and white in the preview screen to alert you. Unfortunately, there's no similar preview alert for underexposure. If you have concern that the scene isn't exposed correctly, readjust shutter and/or aperture in one-stop increments (exposure bracketing), taking additional test shots until you're satisfied or until there are a tolerable amount of "blinkies" remaining.

Trouble occurs when meter readings measure beyond the right/top or left/bottom limits of the meter screen (typically shown as a blinking screen). When this undesirable situation occurs, it's indicative that the scene is either completely under- or overexposed. As with anything, there are exceptions—for example, the sun, white water, bright snow, the brightest part of a cloud, etc., can show as overexposed. Things that are pure white or pure black have little or no detail anyway, so this can be accepted with no ill effects to the overall image as long as they don't dominate the entire scene. The main thing is to understand what and how much over- or underexposure is acceptable—this will only come with experience. Keep in mind that the process of metering, setting exposure based on the meter reading(s), taking a test shot and checking the histogram are all part of the normal photographic workflow. This is an iterative process, and it needs to be gone through with each and every shot until you get proficient at it.

We've spent a lot of time explaining the basics of exposure using Spot Metering. What about other metering modes? Well, they work the same as Spot except that a larger portion of the image frame is used for measuring light input. This is a personal

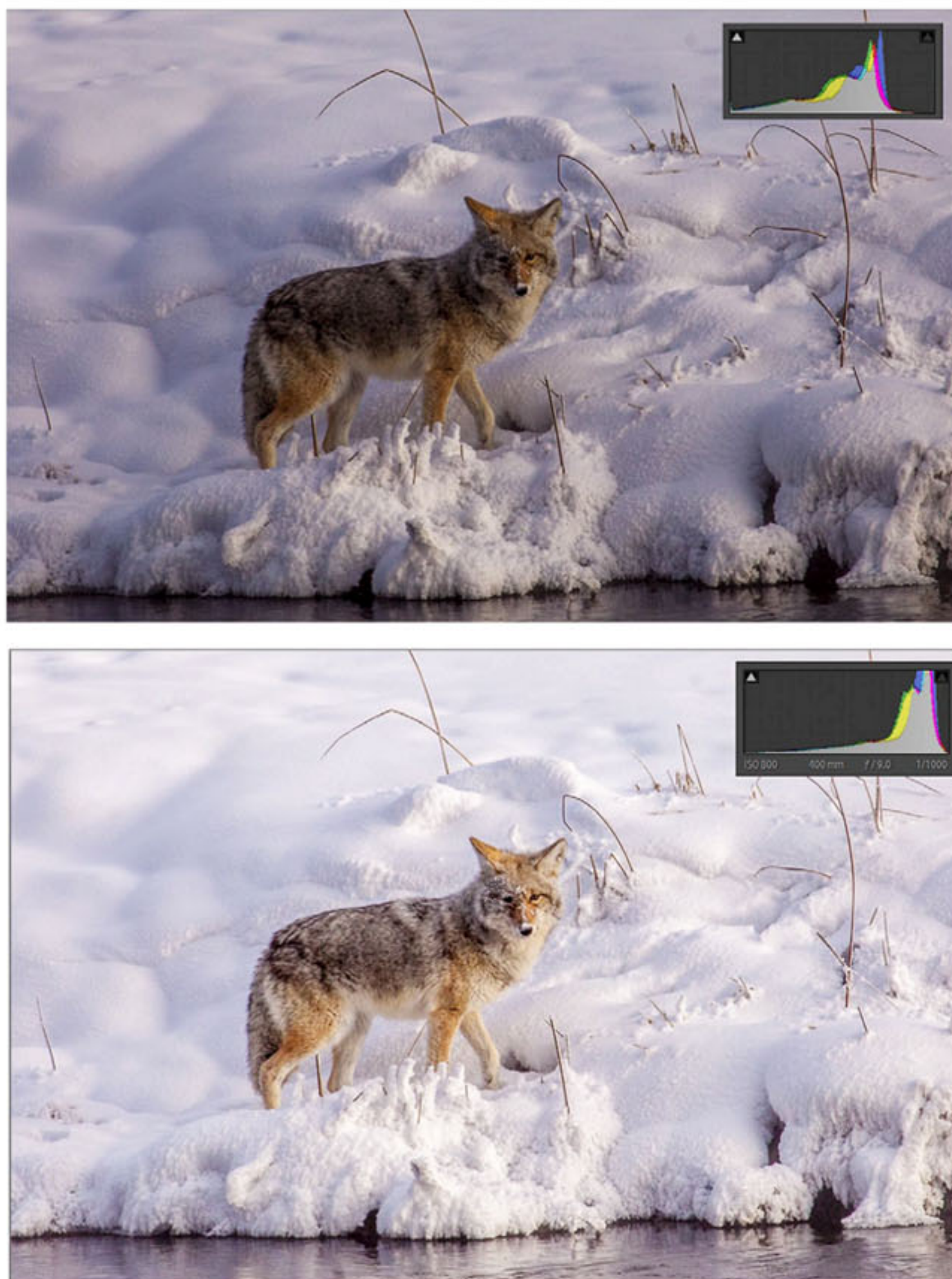


Figure 5. The top image was taken using Evaluative Metering in Shutter Aperture Priority Mode with the resulting gray (underexposed) cast to snow. The above image was taken in the same manner, but with +2 EV exposure compensation, resulting in correct exposure.

thing, but I never use anything but Spot and Evaluative Metering. You may find that other modes work for you depending on the type of photography you do. Evaluative Metering is best suited to scenes that are evenly lit with consistent light, such as midday or when overcast.

Setting exposure will be most troublesome under variable light conditions, or when very bright or dark objects dominate significant parts of the frame, such as early and late in the day. If there are great tonal differences in a scene, e.g., when very bright sky or deeply shadowed foregrounds dominate much of the frame, the dynamic range of exposure may be beyond the camera's means to capture it. That being said, under those situations, it'll be time to make a conscious decision as to how to best capture the image. One way is simply to let a portion of the scene's exposure be compromised, and this is generally more preferable to allow shadow areas to go black—because nobody wants a blown-out sky. Another way to deal with unforgiving light is to use a graduated neutral-density filter. This permits exposure between bright sky and dark foreground to be evened out—expose for the dark foreground and hold the dark part of the filter over the bright sky. I generally use a three-stop graduated neutral-density filter for this, as I've found that it works in most situations. Use of HDR techniques with multiple exposures in post-processing is yet another way to go.

By all means, if there's any doubt whatsoever as to exposure, take a series of bracketed shots at 1 EV/stop intervals and select the frame you feel works best after getting home and reviewing them on your computer screen—you may have only one opportunity to capture that special moment and pixels are cheap, so this isn't the time to be thrifty.

How does shooting in Aperture or Shutter Priority or Program Mode affect things? The basics are exactly the same. However, in any automatic camera mode, the camera will take over control of setting exposure by adjusting aperture or shutter speed or ISO to render the scene based on where the camera is pointed when the shutter is released. It will set exposure for neutral tonality (12.5 percent gray), regardless of how bright or dark the scene should be. Unfortunately, not all scenes are neutral tone—for instance, white snow will be rendered as gray if the camera is left to its own accord. When the scene is not neutral tonality, the camera must be instructed to adjust how it interprets the scene, i.e., to over- or underexpose and by how much. This is termed "exposure compensation," and you'll need to refer to your camera manual to see how your particular make and model handles this. When setting exposure compensation, one-stop increments are generally sufficient. For example, white snow may require exposure compensation to be set between +1 EV and +2 EV to be rendered correctly depending on how brightly the scene is lit. This is illustrated in Figure 5.

Similarly, for a scene in which darks dominate, negative compensation, such as -1 EV for a twilight scene, may be fitting, otherwise it may be depicted as too light. A word of caution: If Spot Metering in a program mode, things can go awry if the image is reframed after initial metering. The camera will automatically change exposure based on what it sees in the reframed scene unless Automatic Exposure (AE) Lock is engaged until the shutter release is fully activated. Evaluative Metering can be more forgiving when using Aperture or Shutter Priority Modes, because light and dark areas can balance each other to give a more uniform exposure. Things will work fine as long as you're aware of and comfortable working with these limitations.

PRACTICE

You can hardly ever go wrong using Spot Metering in Manual Mode if you follow these guidelines, and this is how I teach all of my students regarding metering and setting exposure. True, you're forced to make a conscious decision with each shot to select a shutter speed and aperture appropriate to the situation, but then isn't that what photography is all about?

As with everything worth doing, the art of metering and setting exposure correctly requires practice. Yes, this can seem a little intimidating at first, but the more experience you gain, you'll come to recognize that it makes perfectly good sense. This effort will become second nature, and your photographic efforts will improve dramatically.

DP

To learn more about **RICK SHEREMETA's** photography and his photo workshops, or if you have any questions, visit his website at alpenglowproductions.com or check out his Facebook Page at [facebook.com/AlpenGlowProductions](https://www.facebook.com/AlpenGlowProductions).



Vitamin Sea

BY PHILLIP HOTSON

"I captured this image in Hope Cove, Devon, UK, a small, once fishing harbour, with Inner Hope and Outer Hope sitting on either side," writes photographer Phillip Hotson. "I had been waiting a few days for a good sunset and, luckily, on this day, the cloud broke just enough and just in time. I set up on the footpath behind the tidal wall and had planned the shot using the PhotoPills app earlier that day, so I knew where the sun would be in the scene and at what time." You can follow Phillip Hotson on Instagram @shuttermonkey_

Fujifilm XT-1, Fujinon XF18mmF2 R, LEE Super Stopper and ND graduated filters, 3 Legged Thing punks tripod

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