PEAK OF FLIGHT NEWSLETTER

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IN THIS ISSUE

ROCKET LAUNCH PHOTOGRAPHY

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PEAK OF FLIGHT

Rocket Launch Photography

By Josh Frizzell

1.Get GREAT Rocket Launch Photos

You love your rockets. You've sanded, glued, sanded, primed, sanded, painted, and maybe sanded some more. You've worked hard on them. You're proud of them. All that work culminates in watching them scream off the launch pad in a blaze of glory. Your rockets should be immortalized in a way that does them justice and conveys what makes them so satisfying. In this article we'll explore photography principles as they apply specifically to model rockets and model rocket launches (as a bonus, what you'll learn is also applicable to photography in any situation, from portraiture to landscapes to whatever else you can come up with). If you're new to photography, no worries. This article is geared toward the person that is just starting out and will start from square one. If you don't have a "big" camera, still no worries. I'll also be including some tips on how to get started relatively inexpensively and also include some ideas on how to optimize mobile devices for rocketry photos.

2.Motor Selection for Launch Photography

A rocket's initial acceleration plays a major role in how easy it is to capture dramatic, high-quality photos. How a rocket-motor combination behaves at liftoff depends on several factors including the rocket's mass and the initial thrust generated by the motor. You can glean a good deal of information from a rocket motor's designation (e.g. B6-4 or H123-14A), but to determine how a particular motor will conduct itself during the first fractions of a second of a flight we'll need to delve into the motor's thrust curve.

Even motors with the similar designations can have vastly different acceleration characteristics at liftoff. Let's compare the Aerotech D10 motor to the Aerotech D21 motor (https://www.apogeerockets.com/Rocket_Motors/AeroTech_Motors/18mm_Motors_Single_Use). Both are "D" impulse motors, both are 18 mm diameter, and both use composite propellant. The may seem very similar on the surface, but their behavior at launch is quite different, and reviewing the thrust curves for each motor reveals why. The Aerotech D10 begins the burn with a about 20 Newtons of thrust, maintains that thrust for about half a second, then gradually loses thrust until the burn is finished at about 1.4 seconds. In contrast, the D21 starts its burn at about 30 Newtons of thrust and exhausts its propellant in just over 0.9 second. The motor designations sound very similar, but the visual effect at launch is not. In a rocket of a given mass, the D21 leaps off of the launch pad while the D10 will provide a more gradual liftoff. What that means in terms of photography is that the D10-equipped rocket will be easier to image since there will be more time, albeit slightly more time, to capture images. We'll discuss bursts of photo frames and camera equipment later in the article in more detail, but a quite capable camera optimized for sports and action photography shooting 10 frames per second (fps) struggles to get a good shot of the D21 rocket in this example

FIGURE 1 - A GREAT LIFTOFF PHOTO

but easily captures multiple frames of the same rocket

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fitted with a D10 between the time motor ignition occurs and the time the rocket is slightly above the top of the launch rod or rail. In the Figure 1 photo, we see the first frame after smoke first appeared in a 10 frame per second burst using a D21 motor with a relatively lightweight rocket. By the time the second frame in the sequence was captured, the rocket was already well off the launch rail and I had little time to capture images. That's not to say that the D21 is a bad motor (it may be actually be better than the D10 for certain applications), it simply means that the D10 will lift of more gradually in an apples-to-apples comparison. Likewise, a larger, heavier rocket with similar initial thrust will lift off relatively slowly and give more time to capture the drama of liftoff. The rocket in Figure 2, fitted with an Aerotech F20 motor, reveals a plume of fire and smoke in the first frame after the first sign of smoke in the previous frame. By the time the little rocket with the D21 was well on its way, the larger rocket riding the F20 was still sitting on the pad belching flame and smoke. Clearly, a slower liftoff give the camera more time to capture images, and the liftoff speed early in the flight depends on the thrust to weight ratio of our rocket-motor combination.

FIGURE 2 - SLOW LIFTOFF

To get the most time to capture sweet rocket liftoff images, selecting a motor for a slow but SAFE liftoff speed will help. One must keep in mind that safety overrules getting some slick photos. For liftoff photography, we want the rocket moving slowly but it also MUST be traveling fast enough for the fins to be effective before it leaves the launch rod or rail with a margin of safety to spare. Apogee generally recommends

a minimum speed of 30 miles per hour as a rule of thumb for a safe speed to leave the rod. Additionally, in their document "Launching Safely in the 21st Century", the National Association of Rocketry (NAR) recommended that a rocket should be configured such that it will have a forward velocity at least four times the velocity that the wind is blowing or gusting. Both recommendations should be considered minimums for safe flight. Rocket flight simulation software such as RockSim (https://www.apogeerockets.com/Rocket_Software/) can predict the rocket liftoff velocity that will result from a combination of rocket mass, motor characteristics, and launch rod/rail length. By simulating a flight before launch, we can arrive at a liftoff speed that is optimized for capturing dramatic rocket launch photos while maintaining confidence that the flight will be safe.

Thrust curves for commercially-produced certified motors are available for free at thrustcurve.org and are also helpful in comparing rocket motors.

Different propellants also offer different visual effects. When captured in photographs, black powder motors like

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those produced by Estes will put out a small orange flame and whitish smoke. Composite motors are available in a variety of propellants that produce smoke ranging from white to black, flame in a range of colors including green, red, blue, or white, and extra effects such as sparks (when safe to fly based on field conditions).

3. Camera Settings

3.1. Exposure

Big black cameras have knobs and buttons all over them. What could you possibly want with all that mess? After all, the camera has an "auto" setting, right? Well, yes, but the camera only understands that it needs to get a good exposure (make sure your image is not too bright and not too dark). But it doesn't have a clue about special considerations for your subject matter, artistic effects that you might be trying to achieve, or how light and dark variations in the scene could throw off its perception of good exposure.

FIGURE 3 - UNDER

FIGURE 4 - GOOD

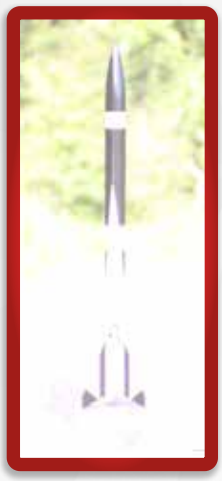

FIGURE 5 - OVER

To understand the limitations of a camera's auto setting, particularly in the context of rocket photography, let's delve into what "exposure" means.

A digital camera has a sensor that detects and records incoming photons of light. The more photons that reach the sensor for a particular image, the brighter (or more "exposed") the image will be. For example, Figure 3 is severely under-exposed (not enough light reached the sensor during the exposure), Figure 4 has a good level of exposure, and Figure 5 is severely over-exposed (too much light was allowed to reached the sensor during the exposure). The camera uses its fancy electronic wizardry to try to achieve something like Figure 4. As we'll see, however, the camera has three major adjustments that it can make to change how the exposure turns out, and the decisions that the camera makes aren't always the best for the photography situation that you're in.

FIGURE 6 - THE MANUAL SETTING

Let's explore those three major exposure control variables. To make our photos just how we want them in any photography situation, including rocket launches, we're going to flip our cameras out of "auto" mode and select the "M" setting on our mode selection dial. The "M" doesn't stand for "mysterious," it stands for "MANUAL," and it's the key to unlocking your camera's full potential (not to mention your full potential as a photographer). Once the camera is in manual mode, we have full control of the following three major exposure vari-

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ables, as well as several other settings.

3.1.1.Shutter Speed

Perhaps the most intuitive of the three exposure variables, shutter speed affects exposure by controlling the duration of time that the camera's sensor is open to incoming light. The shutter consists of a physical wall or walls that move up and down to reveal or hide the camera's sensor from light. The longer the sensor is open to incoming light, the more photons pile up on the sensor, and the brighter the image will be.

A problem with using shutter speed to brighten up an exposure arises when our subject is moving (as is the case with a rocket at launch). If the exposure is long enough, our subject will be in more than one place during the exposure, and the result will be that the subject appears slightly smudgy at best, or a total blur at worst, UNLESS we limit the shutter speed to a very short period of time. That way, the subject will have moved a tiny bit during the exposure, but the distance moved will be imperceptible in the image if our shutter speed is fast enough. The resulting image will appear sharp and clear despite the movement of the subject.

For rocket launch photography, crank your shutter speed up as much as your camera and lighting conditions will allow.

FIGURE 7 - SHUTTER SPEED, APERTURE, AND ISO SETTINGS

Most cameras have a fastest shutter speed setting of 1/4000 of a second or 1/8000 of a second. Your rockets are fast, so your camera will have to be faster. Use all the speed you can muster if you want a sharp image of your rocket in motion. Alternatively, use longer shutter speeds for an artistic effect that shows your rocket as a blur leaving the launch pad, giving a sense of motion and speed to the image.

For cell phones, shutter speed can be controlled using apps that make your camera behave like a larger camera in manual mode. ProShot is one such app, but there are many to choose from. Note that not all devices are compatible with such apps and therefore cannot be operated in full manual camera control.

3.1.2.Aperture

An aperture on a camera is a similar concept to the iris on an eye. The aperture can expand or contract like a dilating or constricting pupil in an eye to allow more or less light to reach the camera's sensor, thereby affecting an image's exposure.

Let's discuss how aperture works in practice and look at some examples. Aperture as the term is used in photography, in my opinion is somewhat of a misnomer. I find the term "focal ratio" that telescope enthusiasts use to describe the concept more intuitive. In rather simplified terms, the aperture (as photographers call it) is a ratio of the lens's focal length (more on that to come) and the diameter of the lens. It is expressed as an f-number, written as f/1.8 or f/8, for example (Figure 7). The smaller the number after the slash, the closer the length of the lens and the diameter of the lens are to being the same. The "iris" in the camera's eye (lens) can open wide or constrict to suit your lighting situation. For a lens that can open to f/1.4 at its widest, the f/1.4 setting will have the aperture open as far as it will go, while a setting of f/22 would constrict the opening in the lens down a very small hole (the diameter of the lens is effectively 22 times smaller than the length of the lens).

For yet another misnomer, photographers describe

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aperture settings as being "fast" or "slow." Don't think of it as speed that the aperture moves (that's not at all what the terms describe), but rather what shutter speed a given aperture setting lets you get away with and still have correct exposure. For example, opening the aperture way up to f/1.4 on a lens with a maximum aperture of f/1.4 lets in the most possible light and therefore lets you get away with a faster shutter speed and still get the correct exposure. On the other hand, "stopping down" to f/22 blocks out most of the light, so you'd need a slow shutter speed to give the camera's sensor enough time to gather up enough photons to correctly expose the image.

The aperture does control exposure, but also has an important artistic role. Aperture is one factor in what is known as "depth of field", and depth of field affects how the background in an image will look. By controlling depth of field we can either make the background appear blurry or sharp. Portrait photographers crave a blurry background with creamy smoothness (the quality of the blur is known as "bokeh") because the blurred background makes the subject of the photo stand out. The same holds true for a rocket at launch. Blurring the background draws the viewer's eye to the subject. The aperture setting can also make the background appear sharp and clear if that's how you want your image to appear. There's no right or wrong setting, but it's important to be able to make the image appear how you want it to appear.

FIGURE 8 - F/2.8

FIGURE 9 - F/22

In Figures 8 and 9, we see a comparison of aperture settings and their effects on the appearance of the background in an image. Figure 8 was shot with an aperture of f/2.8 while Figure 9 was shot with an aperture of f/22. Note the blurry background in Figure 8 and clearly discernable trees in Figure 9. Again, there is not right or wrong way to go about it, but it's important to know understand the effect aperture has on your image's appearance so you can end up with the look that pleases you. Some photographers feel that a sharp background clutters an image and prevents the subject of the photo from popping out. This is particularly true in portrait photography. However, depending on the goal of the photo, you might want the background to be sharp. It just depends on what story you are trying to tell in your photo, and you are in control of the image's appearance. For rocket launch shots I usually keep the aperture wide open. I want to make the rocket jump out from the background and also compensate for the fast shutter speed I'm using to prevent motion blur.

If you're after a blurry background, the following list of factors will make the background blurrier:

- Fast (open) aperture setting
- Longer focal length (described in later section)
- Camera positioned closer to the subject
- Subject positioned farther from the background

Some lenses are capable of faster apertures than others. A lens that can't achieve a fast aperture will not only be less able to blur the background, but won't collect light as well in low light situations.

Here's one area where cell phone camera shooters are somewhat out of luck. I'm not aware of a cell phone that has

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a physical aperture, but there are apps and software based solutions that can fake a blurred background if you want to achieve that look.

3.1.3. ISO

The last setting in our trifecta of primary camera settings is ISO. ISO allows the camera to function in situations where available light is less than ideal. Let's say you're shooting in a low light situation. You've got your aperture wide open to let in as much light as possible and you've got your shutter speed set as slow as you can without creating image blur. What to do then? You would turn up your camera's ISO setting. Increasing the ISO tells your camera to electronically boost the signal that the sensor puts out, artificially making the image appear brighter. This boost comes at a cost, however, and results in degradation of the image in the form of image noise. Image noise will make the image look grainy and pixelated. At lower ISO settings, the image noise usually isn't noticeable, but at high ISO settings the image noise can be distracting.

Some cameras handle high ISO better than others. Cameras with a "full frame" sensor (sensor the same size as a 35 mm film frame) generally perform better at high ISO than cameras equipped with smaller sensors but are also much more expensive. A smaller sensor (for example the common size called an APS-C for "crop" sensor) will do just fine for rocketry (and modern APS-C sensors will do well for most folks in most photography situations).

For rocketry, use the lowest ISO setting that your camera and lighting conditions will allow to end up with the best quality image you can. For most cameras that is ISO 100, but some can go lower. Turn it up if you need to in order to get the correct exposure.

Cell phones capable of running full camera control apps should also be able to provide ISO control.

3.1.4. Frame Rate

It's exceedingly difficult to get a shot at just the right instant if using just one shot at a time, so I like to use continuous frame shooting mode for rocket launches. Frame rate is simply how many shots your camera will take per section in spray-and-pray machine gun mode. My Canon 7D Mark II will take 10 shots per second in ideal conditions and continuous high speed frame rate mode (Figure 10). The Canon 7D and 7D Mark II are optimized for action photography such as sports and fast-moving wildlife, so 10 frames per second is on the quick side (though certainly not the quickest). The launch sequence in Figure 10 gives a sense of what 10 frames

FIGURE 10 - PHOTOS AT 10 FRAMES PER SECOND

per second looks like for a high-power rocket and moderate liftoff velocity. For entry-level cameras expect more like 3 or 4 frames per second. Slower, yes, but still capable of capturing some great launch images.

For launch photography select the fastest frame rate your camera will support. I usually start the burst when the countdown reaches "1" so I know I cover the parts of the launch that I want to capture.

Cell phones can take advantage of burst photo apps such as Fast Burst Camera. Such apps can achieve impressive frame rates (on the order of 30 frames per second), but do so at the expense of image quality. In bright, outdoor lighting conditions typical of rockets launches those apps will perform at their best.

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3.1.5. Focus Mode

You can buy the most expensive, slickest camera money can buy, but an out-of-focus image will still be just, well, bad. I'm usually more than willing to rely on my camera's autofocus system in the vast majority of shooting situations, especially those with fast-moving subjects. Rocket launches, however, are unique in that we know the rocket won't change distance from the camera much during launch. The camera points perpendicular to the launch rod or rail, so if we set focus with the rocket sitting on the pad the focus will be pretty much still correct by the time the rocket clears the rail. Why not just use autofocus? Frankly it would be fine in most instances, but there is a chance that the camera's autofocus could "hunt" for focus at the critical moment. That's why I set my focus with the rocket sitting on the pad and the camera on a tripod (more on that in later sections) and then switch the focus mode to manual. Look for the focus mode selector switch on your camera's lens.

FIGURE 11 - MANUAL FOCUS

3.1.6. RAW vs. JPEG

Warning: I'm going to ruffle some feathers with this one. By default most cameras save image files in JPEG format. Before saving a JPEG file the camera likely tweaks exposure and color and takes some liberties to reduce the file's size. RAW files, by contrast, are unaltered and preserve all data in the original image. Although the file size will be larger and the image might not looks as bright and colorful as the JPEG image (remember the camera tweaked the image before saving as a JPEG file), the RAW file will be the far superior file if you try to do and post-processing such as exposure adjustment using photo editing software. Detail that might have been hidden in shadows, for example, will be obliterated in the JPEG file but preserved in the RAW file. If you try to recover the detail in the shadows with digital post-processing you'd be glad to have the RAW file.

Therefore you should always shoot in RAW mode…. Unless you shouldn't. If I'm shooting portraits it's RAW all the way. But again, rocket launches are a unique situation. A camera has a "buffer", a short-term memory where a camera saves images until it can copy them onto your memory card. My camera's buffer will hold about 16 RAW files or about 51 JPEG files before it is overwhelmed and has to stop shooting to clear the buffer. 16 available shots at 10 frames per second means my buffer would be smoked in about 1.6 seconds. Big composite rocket motors can sit there and smoke for longer than that before flame erupts and the rocket gets moving, and therein lies the problem with shooting in RAW mode for rocket launches. The exact moment the rocket will fly isn't entirely predictable. RAW file shooting for rocketry can be done, but timing becomes much more critical. I'll admit there have been frames where I wished I had a RAW file so I could make adjustments, but for rocketry I usually shoot in JPEG mode.

To decide if RAW or JPEG is right for you, evaluate your priorities. Is this ability to manipulate your image later worth the risk of missing the shot at the critical moment, or would you rather have an image of potentially lower quality but higher likelihood of snapping the shot at the perfect instant?

Figure 12 shows the limitations of shooting in JPEG. If I try to reduce the exposure to darken the image and accentuate the flame from the motor, there's

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FIGURE 12 - JPEG IMAGES LIMIT EDITING OPTIONS (SEE CLOUDS)

only so much I can do with it before the cloud in the background look rough and unnatural and the image takes on a rough appearance. I do wish I had the RAW file for this one!

3.1.7. Focal Length

Focal length is the distance from the front of your lens to the point where it focuses behind the lens. In practical use, it determines how much "zoom" the lens will achieve. Focal length is usually adjusted by rotating a barrel on the lens. For typical entry-level cameras with interchangeable lenses and APS-C sensors, variable focal length or "zoom" lenses can be adjusted from 18 mm to 55 mm or 18 mm to 135 mm or similar. 18 mm is quite wide angle and 135 mm is moderately zoomed on the subject. At a given distance, the shorter focal length will make the subject appear smaller/farther away with much more of the background in view while the longer focal length will make the subject appear larger/closer with less of the background in view. From an artistic standpoint, varying focal lengths give a vastly different appearance to the image, even if you adjust your distance to make the subject appear the same size, because of the way they render the background. To illustrate, compare Figures 13 and 14. For both photos, I distanced myself from the subject to make the rocket appear approximately the same size. But compare the

FIGURE 13 - WIDE ANGLE

FIGURE 14 - NARROW ANGLE

backgrounds. In Figure 13, shot with focal length at 18 mm (wide angle setting) we can see much more of the background. In Figure 14, shot with focal length at 135 mm, we see much less field of view in the shot. The shed in Figure

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13 is nowhere close to being in the shot in Figure 14. For this reason, I prefer to set up my camera farther back from the launch pad and zoom in. I want to minimize the busy appearance of the background and hone in on the rocket.

An exception is dramatic effect that can be achieved with wide angle, short focal lengths. For example, Figure 15 was shot at 18 mm with the camera positioned very close to the rocket. The configuration gives a dramatic illusion of size.

Note the foreground in Figure 15 is blurry (remember our

FIGURE 15 - DRAMATIC EFFECT

FIGURE 16 - USE A REMOTE

discussion about depth of field?). To give the illusion of large size we wouldn't want a shallow depth of field (that's not how a huge rocket would appear). Recall that if you want to have a deeper depth of field and eliminate that foreground blurriness you could stop down the aperture (smaller hole in the iris of the lens) to increase the range of distances that appear in focus.

4. Remote Shooting

Shooting a photo like Figure 15 during a launch can give some truly amazing results, but you'd have to be truly nuts to position yourself for that shot with a live motor blasting off. For high power rocketry, a quick look at NAR tables for minimum personnel distances reveals that it might be impossible to get close enough to the launch pad to get the perspective we want during a launch. A shot like the one of the K motor powered rocket in Figure 16 could not be achieved safely with the photographer physically at the camera during launch without a super high-dollar long focal length lens.

The solution is to remotely trigger the camera. My preferred solution is a radio trigger. Personally I use the Vello FreeWave Plus wireless remote for is claimed range of 320 feet. Based on my experience that range is conservative and I can position the camera right up at the high power pads at club launch and trigger the camera reliably.

I set the camera up on a tripod, frame my shot, set focus, flip the focus mode to manual, and then head back to the viewing area. A stable tripod can be pricey, be for rocket launch photography we have an advantage and can get away with saving some money if desired. Our subject matter moves very fast, so recall that we need to use a fast shutter speed. That fast shutter speed helps overcome shakiness that a cheap tripod might suffer from. My tripod was 10 bucks. It's lousy. It's flimsy. It's rickety. But it works fine for rocket launches.

It's also fairly common for cameras to be equipped with Wi-Fi. It your camera is so equipped you may be able to remotely trigger your camera using your smartphone.

If selecting a remote shutter release, go with a radio based system. Avoid IR systems, which can have short ranges and can suffer interference from the sun.

If you are flying with a club that uses radio launch systems, it's prudent to make sure you're not going to step on their frequency and cause "unscheduled" launches. The likelihood of that happening is very low (most launch systems work on an encoded signal), but it's still prudent to verify.

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5. Mach Diamonds

Shock diamonds or "Mach diamonds" are AWESOME and they can be captured at model rocket launches! The key is to select a low-smoke motor so the Mach diamonds are not hidden by smoke and particulates. Aerotech Blue Thunder or Mojave Green propellants are examples. Mach diamonds are easier to see in larger motors but can be captured in small composite motors with a bit of effort and some luck. The closer your camera is to the launch the better they will appear, but that gives you less field of view and makes it less likely that the rocket will be in the frame. Setting your exposure slightly underexposed will help the diamonds stand out.

FIGURE 17 - MACH DIAMOND

FIGURE 18 - ZOOMED IN

Figure 17 is the launch of a rocket with a relatively small Aerotech F32 motor with Blue Thunder propellant. In Figure 18 I've cropped in on the exhaust plume and darkened the exposure using software. The Mach diamonds are subtle, but they're there.

6. Gear Selection – Getting Started

If you decide to shop for a camera for rocket launches, understand that cameras are engineered and optimized for specific photography scenarios. That's not to say that most cameras couldn't perform reasonably well for most photography situations, but photography is full of trade-offs, and camera equipment is no exception. Understanding a camera's strengths and weaknesses will help you get the best photos possible in a given photography setting.

Take cell phone cameras, for example. They are optimized for size and they pay heavy performance penalties to achieve their diminutive volumes. Their sensors are tiny, their lenses are engineered toward wide-angle shots, and they lack some of the physical mechanisms found in larger cameras that make certain artistic effects possible. However, some cell phone cameras are very capable despite their tiny sizes (and continuously get more capable) if the shooter understands how to use the camera in a way that emphasizes its positive attributes.

"Big" cameras are no exception. Although they will all perform reasonably well in most situations, different camera models are tricked out to be great at one particular photography task and decent at most of the rest. Some design elements that suffer some give-and-take include continuous frame rate ("burst" ability), sensor size, resolution, weather sealing, and cost.

My Canon 7D Mark II, for example, cranks out a respectable 10 frames per second continuous frame rate under

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ideal conditions and is optimized for action photography. The sensor, although enormous compared to that found in a cell phone, is smaller than the sensor one would find in a "full frame" camera that is optimized for image quality. One could buy a camera with a faster frame rate and a full frame sensor, but the resolution might be somewhat lower and the camera body alone without a lens would cost several thousand dollars. "Sports" or "action" cameras like the Canon 7D Mark II or Nikon D500 are well suited to rocket launch photography because they can capture multiple frames from the time the motor ignites to the time the rocket is slightly above the launch rail (depending on the rocket/motor combination as we discussed above) and the mid-sized sensor (called and APS-C or "crop frame" sensor) will do very well in bright, often sunny, outdoor lighting conditions we usually have for rocketry. That doesn't mean, however, that other big cameras, including those at the entry level, can't capture awesome rocket launch images. We just need to understand that everything is a trade-off and we need to appreciate our camera's strengths and weaknesses (an entry level camera will probably have a continuous frame rate on the order of 4 frames per second or so) so we can get the best images a camera can take. We should also appreciate that the biggest, baddest, flagship whiz-bang high-dollar camera will not capture top-notch images if the shooter doesn't understand how to dial in settings appropriate for the shooting situation, but an entry-level camera can do quite well in knowledgeable hands with an understanding of the camera's limitations.

Getting started tip: if you're considering buying a big camera, consider buying a used one. You can get a lot more camera power for your money. I buy most of my camera gear used on Ebay from sellers with established, positive track records. KEH camera is another source of used gear that I've had good experience with. There is some risk with going the used route, but purchasing from a reputable, established seller can save lots of money. For action cameras, the original Canon 7D (predecessor to the 7D Mark II) was a legend in its time among action photographers. Its low-light image quality is unimpressive but it has a quite good continuous frame rate of 8 frames per second (valuable to the rocket launch photographer) and a decent used one can be had for about $300. An analogous camera in the Nikon world could be the D7000 series. For camera bodies, try to determine the camera's "shutter count," or the number of shots the camera has taken. It's an indicator somewhat like the mileage on a used car. A camera with upwards of 150,000 to 200,000 shots is getting tired and is arguably more failure prone, although some go much longer. I had a Nikon D610 with over 230,000 shutter actuations that was still shooting like a champ when I eventually sold it. That said, the lower the shutter count the better.

7. Final Thoughts

With a little practice and a bit of luck one can pull off some dramatic photos that make rockets really shine. Even with a minimalist setup impressive images are possible with some planning and understanding of the limitations of your equipment. The overarching goal, however, is to make sure that all images are captured SAFELY. Go out and get some great shots of your rockets blasting away into the wild blue; just don't forget about the shots that you'll cherish the most.

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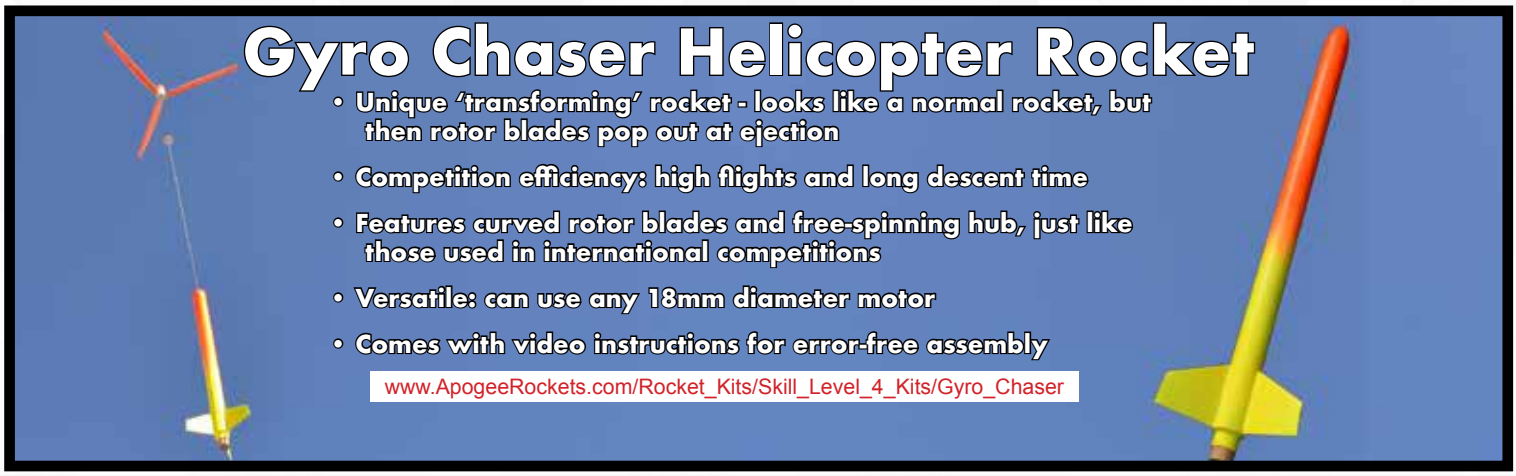
About the Author

Josh Frizzell got into rocketry during his childhood. When his own child was born he had to get into action photography to make his camera keep up with his very active son. Now Josh enjoys getting rocket action shots at club launches but his son remains one of his favorite photography subjects.

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