

What's All the Hoopla About? A Primer on the RED ONE Digital Cinema Camera

by Scott H. Jones

Okay, so let's assume you've never heard of the RED ONE, or at most you've heard about it in passing. Let's also assume that you're thinking to yourself, "So what? Why should I care? It's just a camera!" I can't be sure that after reading this you'll care. But what I can do is try to communicate to you why we care and why we think the RED ONE is a revolutionary, technological marvel that will bring benefits to many, far beyond the frothing fan-base of users. I'm going to do my best to keep the tech talk to a minimum here, working on the assumption that most of those not yet familiar with the RED are not technically inclined, at least not in the area of cinematography.

RED Digital Cinema was started by the founder and former owner of Oakley Sunglasses & Apparel, Jim Jannard. Jim is an imaging enthusiast who owns, by his own estimate, more than a thousand cameras. Among them are some of the highest-end cinema cameras made. The only cameras he doesn't own are those that can't be bought -- they can only be leased. Among his many cameras, Jim saw opportunity. There wasn't one that combined all of the features he wanted to see in a single camera. He believed, in short, that he could build a better mousetrap. Now, the idea of an individual setting out to build something as technically sophisticated as a cinema camera from the ground up is audacious indeed. But several things combined to make the idea plausible. First, resources: Jim had become quite wealthy with Oakley, and he eventually sold his entire interest in the company for more than \$2 billion. Second, technology: advances in technology, and specifically in imaging technology meant that the idea was possible. And third, passion: Any dispassionate observer can reason that even with his sizable resources, Jim's passion alone would not be enough. He would have to marshal the passion of an army to make his dream real. It was one thing to build a camera -- but would people buy it? If so, how many? Would the RED prove to be a niche curiosity or would enough people buy it so that it could continue to evolve and improve? Was it possible that the economies of scale and scope would be such that the fledgling start up could force the big boys -- the established cinema camera manufacturers -- to stand up, take notice, and re-think their tired status quo methodologies, particularly the repugnant concept of planned obsolescence?



To date, RED has sold in the neighborhood of 4,000 RED ONE cameras, and has delivered close to 2500. Two new cameras and a 4K (definition to come) playback device have been announced, and other products are in the offing. The RED ONE is now being used on movies, commercials, documentaries and other kinds of productions worldwide. Unlike the how, the why is simple: Jim wasn't the only one who wanted this camera. A legion of cinematographers around the world also harbored dreams of the perfect camera. But none of us had Jim's resources, vision, or passionate determination. The key to RED's success, defined as building a cinema camera that would rapidly gain significant market share, was harnessing the passion and loyalty of cinematographers around the globe. It took a lot of brilliant minds to build the RED, and getting cinematographers -- by nature a precise, picky, finicky lot -- to buy it would require an equally brilliant marketing plan. Suffice it to say, the big boys have taken notice.

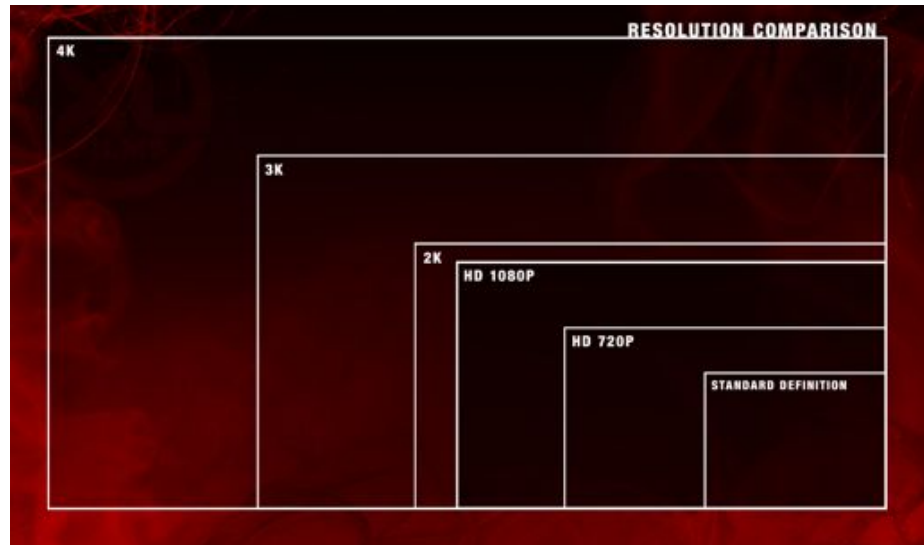
I have to confess here that early on, my business partner, Ken Kosub, and I were among the RED skeptics. When RED showed up at NAB (the National Association of Broadcasters trade show) in 2006 with just an idea, a cool tent, and a non-functioning camera body prototype, we were not among the 500 or so individuals who put down \$1,000 to reserve a RED ONE camera. In fact, having been burned in the past by ultra-cool manufacturers who didn't deliver what they promised, we didn't even bother visiting the booth.

NAB 2007 was a different story. We held off for the first three days of the show as lines around the RED booth persisted. Finally, on the fourth and last day, we decided to see what all the hoopla was about. We stood in line for an hour and a half before being led into a small theater in the back of RED's booth. We then watched a short WWI film called "Crossing the Line", directed by Peter Jackson, director of "Lord of the Rings" and "King Kong". Shot on a RED ONE prototypes just two weeks before the start of NAB, and projected in full 4K (definition coming, promise), the film was stunning. It looked as good or better than anything we'd ever seen in theaters. After the film, we listened to a short workflow demo showing how the relatively large files generated by the RED ONE camera could be

edited in Apple's Final Cut Pro Studio 2. Since we're an all-Mac shop, our interest was more than a little peaked. Finally, we clawed our way across the booth where three working cameras were being shown. I have to say the designers at RED know a thing or two about industrial design. The RED ONE looks like no other camera. To anyone who sees it, but especially to cinematographers, it is, well... seductive. We got our hands on one, looked through the viewfinder, and asked a few questions. Then we walked straight over to the nice young girl taking the orders and put a deposit down on RED ONE #1720. Afterward we worried for a short while that we'd made an impulse purchase. But RED had offered a money back guarantee if we changed our minds; obviously we didn't. Ginger arrived a year later, and I must say, we simply love this camera.

We'd began studying the RED ONE long before ours arrived, but once it was actually in-house the education process rapidly accelerated. In addition to trade shows like NAB and traveling road shows by RED's marketing chief, Ted Shilowitz, the camera has been marketed almost exclusively via the RED user forum, REDUser.net. There the camera's advocates teach and learn, defend and inspire, and, of course, sell other filmmakers on the virtue of all things RED. I know viral marketing via forums is, in this day and time, nothing new. But RED's transparency is astonishing, and to my mind is one of the things that really separates the company from its competitors. Jim Jannard and most of his key employees can be found almost daily in posts on REDUser.net, educating the user base, announcing upcoming features, and, most importantly, listening to user feedback -- communicating! What a concept! In the seminars we've been teaching on the RED ONE, I describe the camera's advent and evolution as a cultural phenomenon. My guess is down the road the launch and subsequent success of RED will be studied in business schools all over the world. But I digress.

Okay, so you might still be asking yourself, "Why should I care?" So, in order to drive this home I'm going to have to break down some of the features of the camera for you. First, 4K (finally!): 4K is shorthand for an image resolution of 4096x2304 pixels. Contrast that with the best available high-definition resolution of 1920x1080 pixels and you can see that 4K is more than four times the resolution of HD. 2K is half the pixel height and width of 4K and is slightly larger than HD; 4K is exactly four times the size of 2K.



No question a large image is a great place to start. But, of course there's more. A lot more. HD cameras use a 2/3 inch or smaller imaging sensor. The digital sensor that generates the RED ONE's 4K images, called the Mysterium, is the same size as the imaging area on a 35mm film camera, yielding the same aesthetically-pleasing shallow depth of field characteristics as 35mm film.



Notice in the image on the right how the foreground and background elements are soft, leading the eye to Mike (from Monsters, Inc.), the object of focus. When looking at the image on the left, the eye tends to dance around since we're not quite as sure what we're supposed to focus on. This works mostly on a subconscious level, but whether audiences know it consciously or not, it is something they appreciate. It's one of the major reasons 35mm film is still a desirable, albeit expensive, format. Selective focus is a tool

cinematographers relish. It's essential to their craft, really, and prior to the RED ONE, not having it was a constant frustration when working with digital cinema cameras.

Bit depth has to do with color resolution. Most HD cameras use an 8-bit or 10-bit sensor; the RED ONE's sensor is 12-bit. Bite rates increase exponentially. Thus, an 8-bit sensor will deliver a little less than 17 million possible colors; a 10-bit sensor will yield a little more than 1 billion possible colors; and a 12-bit sensor, like the RED ONE's, will deliver 68.7 billion possible colors. For every pixel in a 12-bit image there are more than four thousand possible colors; for every pixel in an 8-bit image there are 255 possible colors. This means that the RED ONE is able to deliver a much richer and much more nuanced color image. Different shades of the same color remain discernible and don't blend into one shade. And when the color is pushed and pulled in post production in order to achieve particular looks, there's simply a lot more color information that can be accessed.

The latitude of a digital sensor or film stock is expressed in stops or f-stops (fractional stops). When the camera's iris is wide open, the maximum amount of light is able to enter the lens and strike the sensor or film emulsion. When the camera's iris is closed, no light can get in. The scale between closed and wide open is marked in f-stops. As we open the iris each successive f-stop allows in twice as much light as the previous f-stop. It would seem that the latitude of any given camera sensor or film stock is an objective measure, however the definition of latitude is the number of stops in which the sensor or film stock can discern detail in the image. Consequently, camera manufactures often state a higher latitude than cinematographers are willing to accept. It's why most cinematographers do their own exposure tests -- the amount of acceptable latitude is subjective. RED places the RED ONE's latitude at 11.3 stops and we've found this to be a reasonably accurate measure of the camera's latitude, approaching and in some case exceeding the latitude of film. Most advocates of film will argue this point, pointing specifically to the RED's latitude, or rather lack of latitude, on the high end, in the whites. This is usually countered by the argument that the high-end latitude of the RED ONE is far and above that of all other HD cameras and approaches that of film. And the RED ONE is almost universally lauded for its large amount of latitude in the blacks. Given this and the many other advantages the RED ONE offers, complaining about a little less latitude in the whites amounts to nit-picking.

The RED ONE records in the RAW format, the same format used by most digital still cameras, onto reusable Compact Flash (CF) cards or hard drives. The all-digital workflow means that media costs, particularly when amortized over time, are significantly reduced. A 16GB CF card costs \$500; a 320GB RED-DRIVE costs \$900. Both are reusable, whereas a 400' roll of 35mm film that will record less than 5 minutes of footage costs around \$250, can only be exposed once, and once exposed has to be processed and then transferred to tape or a digital format, at a rate that is typically more than \$500 per hour. The media costs for 16mm film and HD are a little less (though HD requires access to very expensive tape machines in order to ingest the footage into an editing system), but by now I'm sure you get the point: shooting with the RED ONE is much cheaper than film, not to mention easier.

While lower cost and ease of use are certainly appealing features of the all-digital workflow, a prime advantage and appeal to shooting RAW, at least to us, is aesthetic. The frame rate, shutter and iris settings are the only adjustments made at the time of exposure that are permanent. All other parameters concerning the image are recorded as metadata, and can be accessed and changed after the recording is made. This is a feature borrowed from the world of digital still cameras and is one no film or video camera can match. Recording in RAW affords filmmakers a tremendous amount of flexibility in post production, especially considering, once again, that we have so much information in the image that we can manipulate.

I could go on describing the many desirable features of the RED ONE. Chief among them is because the RED ONE is software-based, new features are being constantly added. And RED has stated that firmware upgrades will be free for the life of the camera. Equally exciting is that the RED ONE's hardware, short of the body's form factor, is all upgradable: no more planned obsolescence. Then there's the ability to record up to 120 frames per second for slow motion, a built-in intervalometer for shooting time lapse, a lossless compression scheme called REDCODE that keeps the data throughput rates down to a manageable size, the ability to use 35mm lenses -- it should be easy to see why filmmakers and cinematographers are so excited about this camera. Why should you care? Because from a quality perspective, the RED ONE is the first digital cinema camera to truly challenge 35mm film; from a cost perspective the RED ONE demolishes film. Now, for a cost that is about the same as HD, your film, in the hands of skilled filmmakers using the RED ONE, will look as good or better than anything you will see in movie theaters.

Scott H. Jones is a Houston-based
Director and Director of Photography,
and is a co-owner of XL Films, Ltd., www.xlfilms.tv

