Shoot the Shot: Cameras and Rockets

ARTICLE 1: CHOOSING THE SHOT AND CAMERA

Image: Runcam orange, 1080p@60fps

By TR Garman

We don't TAKE photographs, We MAKE photographs.

We choose the type and make and model of camera that we shoot the picture with. We choose the subject matter, composition, lighting, camera orientation and other factors affecting the image. We choose when to press the shutter button. We press the shutter button. We post-process the image. We choose how and in what format to view and display our images.

All of these decisions contribute to the final image, MADE by us.

Introduction

When I was a kid back in the 60's and 70's, I saw as much footage of the NASA launches as I could. Some of my favorite shots were of the orbital staging from onboard cameras. I wanted to see the same types of shots from my own rockets.

Estes came out with a camera rocket called the Cine-Roc. I got myself a Cine-Roc and started shooting. I had limited success with it but I had enough of a passion to keep trying.

The Cine-Roc had an integrated super-8mm film camera that shot out the side and had a mirror to reflect the image so that the view was down the side of the rocket. While being somewhat limiting in its usage, the Cine-Roc was well suited to its task.

In order to get the shot that we want of or from our rockets, we would be well served to choose a camera that is well suited for our tasks. Given the wide variety of cameras on the market today, we have quite a choice.

This article will attempt to provide some information on the choosing of our cameras and the shots that we want to see.

This is the first in a series of articles that will deal with cameras and rockets. Following articles will focus on mounting the camera and getting the shot, "The Image As Data", post production and how to "Make" the photo that you want, and a few other related topics/subjects.

Image: Sony Handicam HDR-CX240, 1080p@30fps

An onboard shot from 2004.

A wireless video system transmitted the image to the ground where it was recorded on digital videotape at 720 X 480.

Notice the ghosting due to analog video images being interlaced.

The video system (camera, video TX, video RX, videotape recorder, batteries, etc) cost over $1000.

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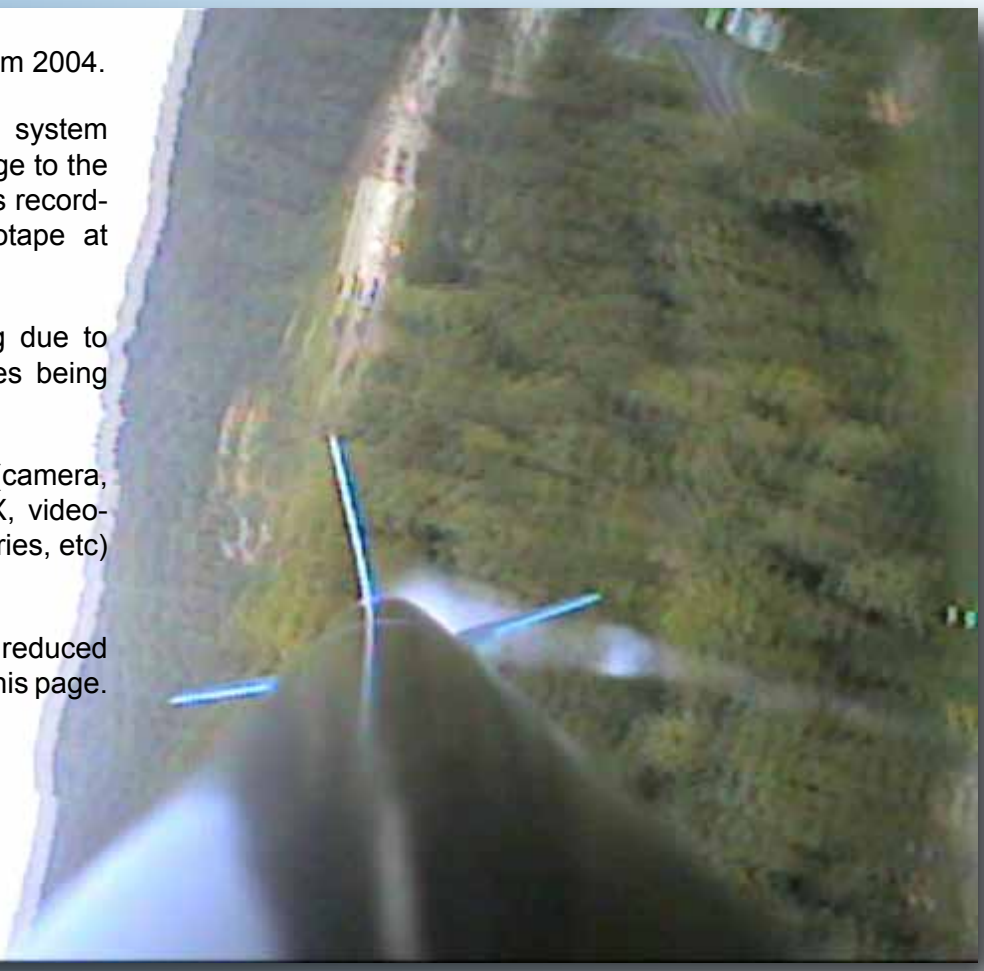


A similar shot from 2020.

Recorded with a Runcam Split, 1080p@60fps. Camera and memory card: less than $100.

This image was reduced about 75% to fit on this page

What do I want to see?

Start by asking yourself what you want to see from your images. Are you looking for an onboard shot FROM the rocket or a ground shot OF the rocket? Another way of asking is do you want to see the rocket itself or what the rocket sees? Getting both can be challenging. Once you have a shot in mind, often this will lead you to the type of camera that is best suited to your task.

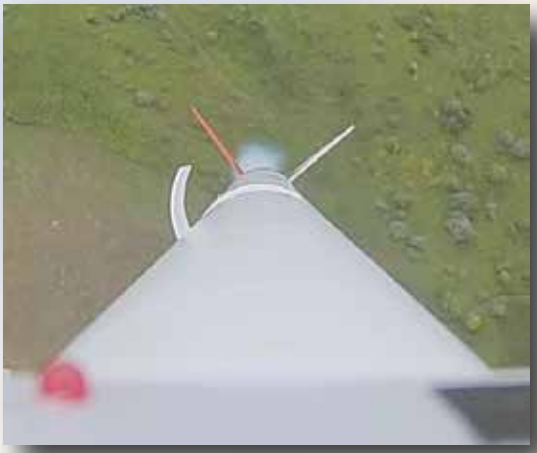
Another question is do you want a still photo or video? Many cameras can do both. However, a camera that shoots high resolution still photos may not shoot the video format that might be best for our needs.

Something to consider about still vs video. Because both still images and video are digital data, they can be converted back and forth. That is, a still can be made from a video, likewise a video can be made from stills (or edited into a video). So even if you want a still image, it might be best to shoot video and take a frame out.

An additional question would be the type of shot that you want. Are you looking for a pretty, "Postcard" type of shot or are you looking for a shot that will tell you why your parachute keeps tangling? A Documentary shot that is very informational to us may not be as interesting to our friends online. A "postcard" might be better shot as a still image, whereas video tends to tell us more if we are looking for a more "informational" shot. Postcards can always be taken from stills.

The shot we get depends on the type of camera that we choose, how we use it and where we put it.

Always remember that nearly every shot ends up being documentary at some point in time. Something that we look at today as a bland shot may have great value tomorrow.



Why a Camera?

Many years ago a friend of mine asked me why I wanted to put a camera in my rockets. I couldn't immediately respond.

To me, it was obvious. It was the thing that everyone wanted. On every rocket. More than one camera on every rocket was what I wanted.

"It adds weight, and that thing sticking out the side drags it down," he would say while soldering something on a wooden table. And he was correct. It did add weight and it did drag it down.

"Just get rid of that junk and fly the rocket," he'd say as he tamped out the fire.

And again he was right. Cameras are not necessary for a successful flight.

For me however, cameras are necessary for flight. I have learned so much from watching my ground and onboard videos that I design all of my rockets around the cameras and electronics. I assume that I'll have multiple ground and onboard shots at the end of the day for every launch. And occasionally it really pays off.

Recently I was flying a very stable vehicle for the last flight of the day. As it cleared the launch rail it cork screwed and got rather squirrelly, looking very unstable. Not I nor anyone else watching could see any anomaly during the flight. I had a suspect however.

Watching the video confirmed my suspicions. I had neglected to secure one of the hatches. Once the rocket gained speed, the hatch opened (as can be seen below left) and steered the rocket off course. I never would have known without the camera view.

In my opinion the question "Why use a camera" is a valid one and we should all ask ourselves this question.

The answer to that question is obvious to me. The wealth of data that video can provide is but one of many reasons. Not to mention all the pretty pictures.

Continuing...

A few notes...

Tripods. A tripod can be a necessary piece of equipment that is often overlooked or treated as an afterthought. A quality tripod makes the day go much smoother while a cheap one can be like a rock in your shoe. Think about your tripod needs and spend a little extra, you'll be glad in the long run. I'll present tripods in the next article in depth.

Storage. Most of the cameras we might use will store on flash media such as SD cards. SD cards come in many flavors. Get a card that matches or exceeds the recommendations for your camera. Again, don't be cheap.

Batteries. Batteries provide the lifeblood of our cameras. Without batteries our cameras don't work. Most of our cameras have removable batteries. Some have small batteries that don't record all day, so get some extras. And make sure they are all charged fully. Don't treat batteries as an afterthought.

Audio. Because this series of articles deals with the image, I'm not going to go into audio in any great detail. I will however, mention it here and there as audio recordings can be just as valueable as the images. Audio is complex. Getting good audio recordings can be downright hard. Nearly all of the cameras presented here record audio when shooting video. Don't expect studio quality recordings but you may get more than you think. I'll mention more about audio in later articles.

Always ask yourself questions.

When you see photos or videos that you like, analyize them. Ask yourself how it was shot, at what angle, with what type of camera? How was the shot lit? What is it that you like about the image? Answering these questions can advance our goals more than one might think.

In the following pages I will provide some basic camera information that applies to all cameras. I'll define some shot types and give examples. And I'll give some info about camera types and uses.

Sidebar: The Lens

A lens that has the appearance closest to human vision is known as a *Normal Lens* and is the relative basis for other lenses. The *Normal Lens* is based on sensor size, so a camera with a larger sensor requires a larger *Normal Lens*. Lenses other than a Normal Lens will distort the image compared to a Normal Lens.

An old 35mm (film size) film camera had a *Normal Lens* of 50mm (lens length). A *Normal Lens* for todays DSLRs range from about 35-50mm. The length is known as the *Focal Length* of the lens.

Lenses with a shorter *Focal Length* than the *Normal Lens* are considered *Wide Angle* Lenses. The shorter the lens, the wider the angle. The angle refers to the field of view of the lens. The wider the field of view, the more can be seen in front of the camera. The wider the angle, the more distorted the image. Depth becomes exaggerated. Lines curve more as they approach the edges of the lens.

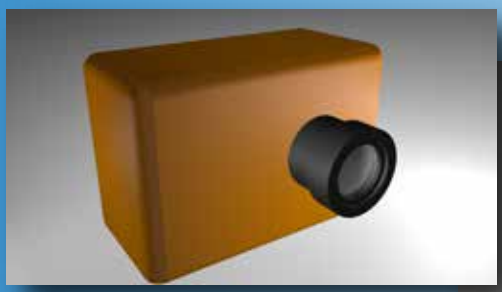
Lenses longer than the *Normal Lens* are considered *Tele-photo*. *Tele-photo* lenses will flatten the image compared to the *Normal Lens*.

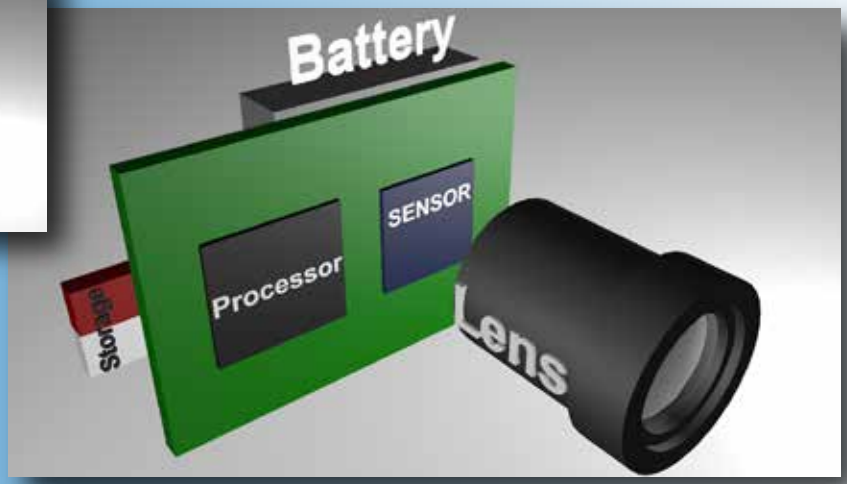
A lens with a fixed *Focal Length* is known as a *Prime Lens*. A *Prime Lens* does not zoom. Prime Lenses are referred to with a single number, eg: 75mm.

A lens with a variable *Focal Length* is known as a *Zoom Lens*. A *Zoom Lens* does zoom. Zoom Lenses are referred to with a range, eg: 35-105mm. An *Optical Zoom* Lens has movable lens elements that alter the Focal Length of the lens. A *Digital Zoom* zooms in on the image in software losing resolution.

The lens on some cameras can be changed. Some cannot.

What is a Camera?





Inside the case of nearly any camera we find more or less the same things. If we remove the case of our fictitous camera above, we see the basic parts in the image to the right. Let's remember that cameras are computers with lenses.

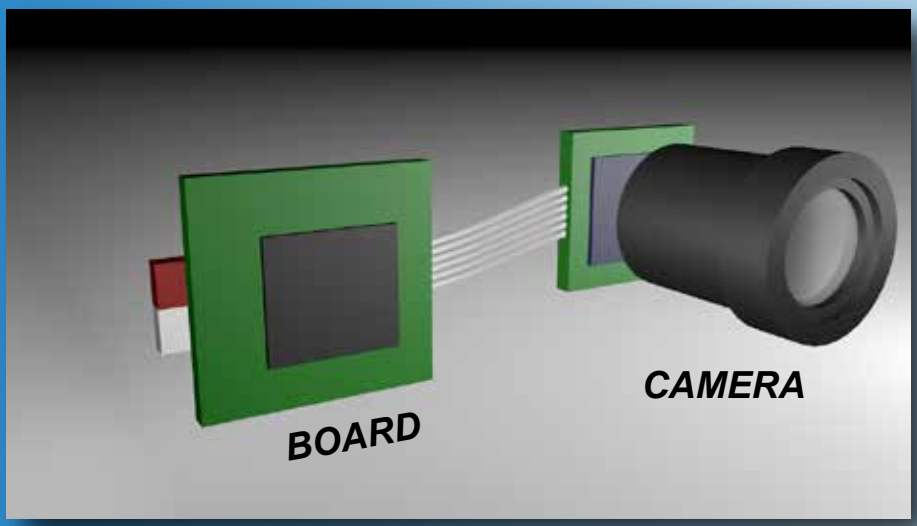
The LENS focuses the light from our image onto the SENSOR (a specialized computer type chip that responds to light). Data from the SENSOR is transferred to the Processor that creates our image. Our image is then transferred to the Storage (often an SD or microSD card). The Battery powers the whole thing.

Not seen in the image is a small, light tight black box that couples the LENS to the SENSOR and isolates the light of our image from stray light. With some cameras, a DSLR for example, the case of the camera itself is the light tight black box. In other cameras, the black box is inside the case of the camera. The Processor and SENSOR are mounted on a circuit board (in green) as are connections for the Storage and Battery.

Some cameras are configured as per the illustration below. The LENS and SENSOR (and black box) are one package, the CAMERA. The Processor and Storage are on a separate package, the BOARD. A configuration as this is particularly well suited for rocketry as the CAMERA and BOARD can be mounted separately. We can hang a minimal CAMERA outside the rocket while keeping the BOARD and the rest of the guts inside. Not many cameras are configured like this and I do NOT recommend taking apart your DSLR or camcorder to find out. There are a couple however, that are specifically designed this way.

The Runcam Split and the Caddx Turtle are sold as racing drone cameras and are stripped down to the CAMERA and BOARD. Small and lightweight, these cameras are very well suited to onboard use. No Battery is included with split type cameras. Wiring is required.

If you are designing an integrated system with multiple cameras and other electronics, the lack of battery is not an issue, in fact it can be an advantage. The cameras can all be wired together with the electronics and controlled via a single switch. Battery capacity can be tailored to demands and installation.



Split type cameras are ideal for rocketry, just be aware that they are not *Plug and Play*. A split cam requires wiring, design and integration so may not be the best choice for an existing model.

And don't forget that inside every camera out there is something like what is illustrated on this page. While I do NOT recommend disassembling your smart phone, a cheapo knock-off might be worth experimenting with.

Resolution

The resolution of a camera is identified by the number of pixels (picture elements or dots) that make up our images. More pixels means a sharper image. More pixels come at a price however, so often we have to balance our desire for more pixels with reality.

Still cameras often refer to the number of mega-pixels that the sensor (modern equivalent to the film) can capture as well as an actual dimension of the image.

As an example, I was recently shooting with a DLSR with a stated image of 24 MPixels and a photo size of 6000 X 4000. Meaning that my photo should measure 24 million pixels (total) and 6000 pixels across and 4000 down.

Video cameras have similar specs but are listed somewhat differently. Olde tyme TV type cameras have resolutions starting at 640 X 480. In the nineties, High Definition Video was introduced that have resolutions known as 720p (1280 X 720) and 1080p (1920 X 1080).

In the last decade video resolutions have increased with a format known as 4K (K=Kilo or thousand) which is roughly 4000 pixels across. 5.2 K and higher have become available. It should be expected that the quest for higher resolution will continue ad infinitum. 8K televisions are not far down the road.

Frame Rates

Frame Rates, denoted as fps (Frames Per Second) applies primarily to video cameras but also applies to still cameras.

Standard broadcast video (like on TV) is 30fps. Which means that our TV displays 30 pictures each second. Computers and newer televisions can display other frame rates that can appear as slo-motion. Cameras that shoot at higher frame rates than 30 fps can be used to see things that are too fast for standard video. Cameras today can shoot 60, 120 or 240 fps with some specialty cameras shooting even higher rates. These rates apply to video. Videos are often .mpeg or .mov type files.

For still images, cameras also refer to fps and for the most part, it means the same thing. Except in practice they work a little different. DSLR cameras typically have shooting modes that allow for continuous shooting of high quality still images. Press and hold the shutter button and it starts taking pictures. Release the shutter button and it stops. A still camera that shoots 15fps is pretty fast. Each time we shoot, the camera records a single image, often a .jpg type file.

What do you want to see?

A number of years ago I was shooting some small rockets with a stationary ground mounted video camera. Analyzing the footage I found that the time from ignition to the rocket leaving the frame was about 1/10 of a second. As I worked more and more I realized that 1/10 of a second was a good standard for video use when dealing with rockets. Rockets are fast. In case you haven't noticed.

Below is an illustration of what we get in 1/10 of a second of video recording, at the respective settings.

Thus in 1/10 of a second we get 24 small pictures or 6 medium or 3 large pictures depending on the recording mode. Which you choose depends on whether you want more small pictures or fewer large pictures or something in between.

A general rule is that we either get large image size or we get fast frame rates. Getting both is costly.

Since rockets tend to be fast moving, I prefer to shoot at the highest frame rates that I can.

Camera makers are increasing the frame rate of cameras regularly. The GoPro Hero 8 shoots 4K@60fps and 1080@240. I would expect the race for higher frame rates to continue just as with image resolution.

Also to Consider...

In addition to the other specs of our cameras, two critical issues arise that we need to address about the functionality of our cameras.

• How is our camera powered up?
• How do we activate the shutter / video record?

While these may seem trivial, they are vital to the chance of success of our endeavor. I have missed enough shots to realize that these two functions are of paramount importance.

Rarely do we need to adjust our white balance settings while our rocket sits on the launch pad. But we do have to power it up and start recording. In addition, we need to KNOW that the camera is powered up and recording.

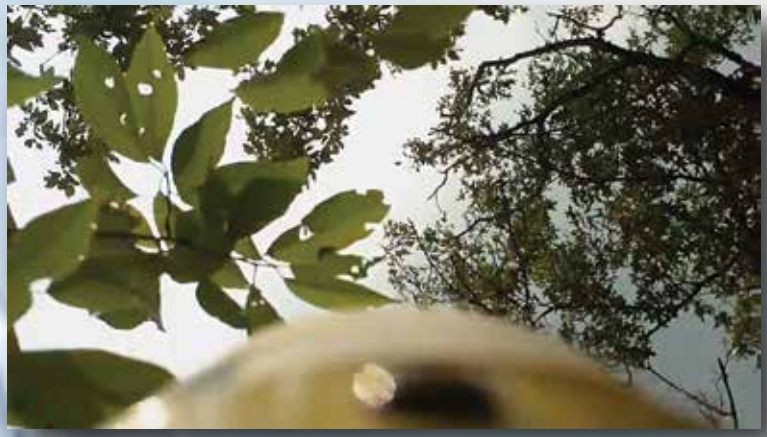
Images: 2008, AipTek ActionCam, 720p@60fps.

Years ago I built a 4" diameter rocket with a stripped down camcorder onboard. This particular camera would function normally when it was reduced to the minimum of the circuit board/camera assembly. The case, screen, battery and everything else could be removed without affecting its ability to record (it still required a battery). I installed a slide switch for power and a momentary push-button for the record function. I headed out to our launch facilities.

We launched the rocket and recovered it from the tree. Checking the memory card afterward revealed nothing. Nothing had been recorded. We made some adjustments and tried again. This time there was a video recorded that showed us in the pits and loading the rocket onto the pad. I got a great shot of my shoe. The video ended just before liftoff. Apparently we had begun recording in the pits and when I thought I was starting the recording, I was in fact stopping the video. It became clear that I needed better indicators as to what happening with the camera inside.

The video circuit board had 2 lights, blue and red LEDs that indicated power and recording status. The blue LED lit solid when the camera was powered up and remained lit until power down. The red would blink when recording.

I cut a hole in the rocket to see LEDs and headed back out to the field. This worked but had a couple of issues. One problem was that the LEDs that were easy to see indoors were not so easy to see in sunlight. So in order to see them clearly enough to tell the status, I had to climb up the ladder and press my face up against the payload section. In the end I got 1 of 2 videos of that day. I had to do better.



After stripping down the LCD screen of the camcorder I realized that it would not add enough weight to be overly concerned so I went back to the drawing board and built a new payload section with the screen in place.

Returning to the forest that we called a flying field I tried again. After 3 flights that day, I got 3 videos complete with tree recoveries. The LCD screen onboard made successful recording of my videos an almost guarantee as there was no question as to when the camera was functioning the way I wanted. Which brings up other issues that I'll address in the "When to Push the Button" sidebar.

In the end, I *was* able to adjust the white balance on the launch pad.

More is Always better. Except....

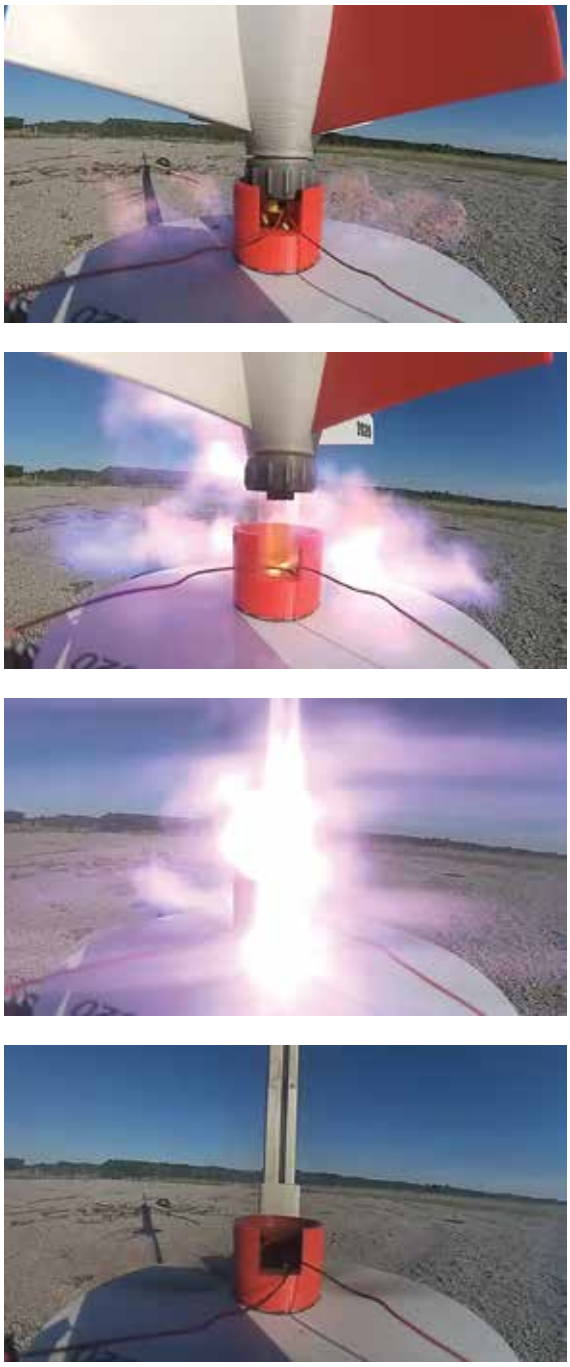
Higher resolution means a sharper picture. Higher Frame Rates means more pictures per second. That speck from our sparky motor might be a single dot (pixel) in our picture or video at a lower resolution or it could be a number of pixels that describe the spark in more detail at higher resolution. Likewise the spark could be seen in a single frame at 30 fps or it could tracked across the screen in multiple frames at 240 fps. Higher resolution and frame rates come at a cost however and there are a couple of factors that one should consider.

One factor is the actual cost. More usually costs more. As of this writing, a new GoPro costs $300-400 and will shoot 1080p at 240 fps and 4K at 60 fps. There are many GoPro knockoffs that can be had for $100 or less, but none will shoot above 720p at 240 fps. In addition, higher resolution and fps requires faster memory cards which cost more.

Another factor is post production and viewing. Editing 1080p video (especially higher frame rates) requires a powerful computer. Working with 4K video requires more. High resolution still images also need computing power. Software to edit is even more to consider. Another factor is that the higher end video formats require HEVC, AVCHD or other advanced codec (computer software) which may require computer upgrades.

Higher resolution images require better lenses. Once you get above 15 MegaPixels (roughly) common plastic lenses become an issue. To get the most out of high res cameras and images, glass lenses may be required. Glass lenses are heavier and more expensive.

So while we always want higher resolution and faster frame rates, don't forget the extra costs. And get extra batteries.



One way to present your material is to create a series of still images from a video. Often referred to as a *Filmstrip*, the images can tell a story if chosen properly.

In the images presented here, the video was shot at 240 frames per second and these images were taken from successive frames. Because the timing of video is very accurate, we know that the rocket goes from not moving to leaving the frame in less than 1/60 of a second (4 frames = 4/240, 4/240 = 1/60). If we know the distance in the frame, we can determine even more information. More about *Data* in future articles.

In addition to the utility factor, a *Filmstrip* makes for some interesting viewing. Can you find the rocket in the final frame on the bottom?

Postcard Shots

We should all have postcard shots of our rockets. At least one. More is even better.

These are great for printing, so higher resolution is desired. Even a shot taken from 720p video can look good though. Photo paper can make them nicer than you might expect. Frame it and stick it up on the wall.

Shots - Onboard Exterior

Exterior onboard shots are always crowd pleasers. Mounting cameras *outside* a rocket allows us to see what the rocket sees in flight. In no other way can we see this. Onboard shots almost always require us to shoot video. Stills can be shot with an intervalometer.

Exterior onboard shots can make some of the nicest Postcards. But sometimes the real value is contained in the images that might not be chosen for their aesthetic appearance. An exterior shot may catch some action that an interior shot misses, even though the two are pointed in the same direction.

An exterior view will contain primarily scenery, not rocket. The rocket will remain fixed (if mounted fixed) with the outside world moving through our image. Movement can be fast and erratic. Don't be discouraged if you don't get exactly the shot you expect.

Four Runcam cameras mounted on a 4" diameter booster, two pointed up and two pointed down.

The downward cameras give us the Cine-Roc shot, seen above.

The image below was taken from one of the up facing cameras.

Shots - Onboard Interior

Interior shots may not get the ooo's and ahhh's that the exterior shots get, but they often are more documentary and informative.

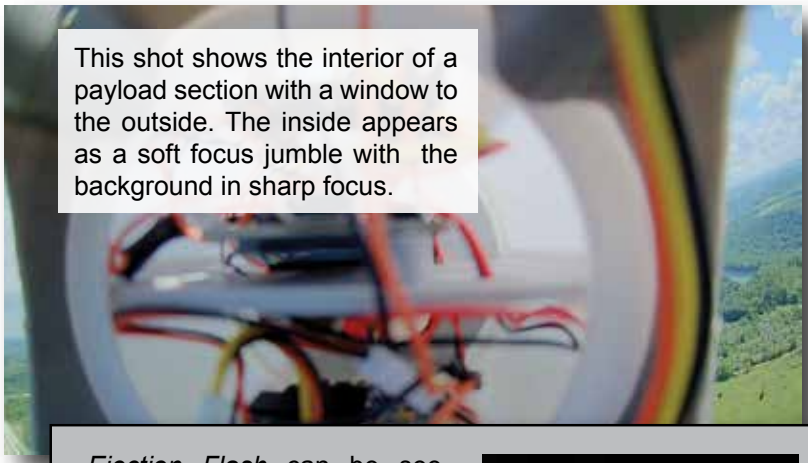
Fixed mounting provides a view of the action inside the rocket with the camera anchored in the rocket.

"Floating" cameras, mounted on a shock cord or parachute can move in dynamic and unexpected ways.

Lighting can be an issue for interior onboard shots. Daylight can be utilized in many cases, but in some circumstances lights may be required in order to illuminate the subjects we want to see.

An interior shot that opens to the outside can be subject to what I call Ejection Flash. This occurs because the inside of the rocket is dark compared to the sunlight outside. Due to the darkness, the camera opens the aperture of the lens (or boosts the electronic gain) while inside the rocket. Once the ejection charge opens the rocket to the outside, the camera is blinded. For a number of frames while the camera adjusts, all you see is blown out white. You might be surprised how much we can miss in just a couple of frames.

Much more information will come in future issues about onboard interior shots.



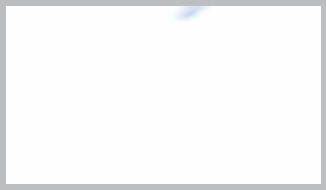
This shot shows the interior of a payload section with a window to the outside. The inside appears as a soft focus jumble with the background in sharp focus.

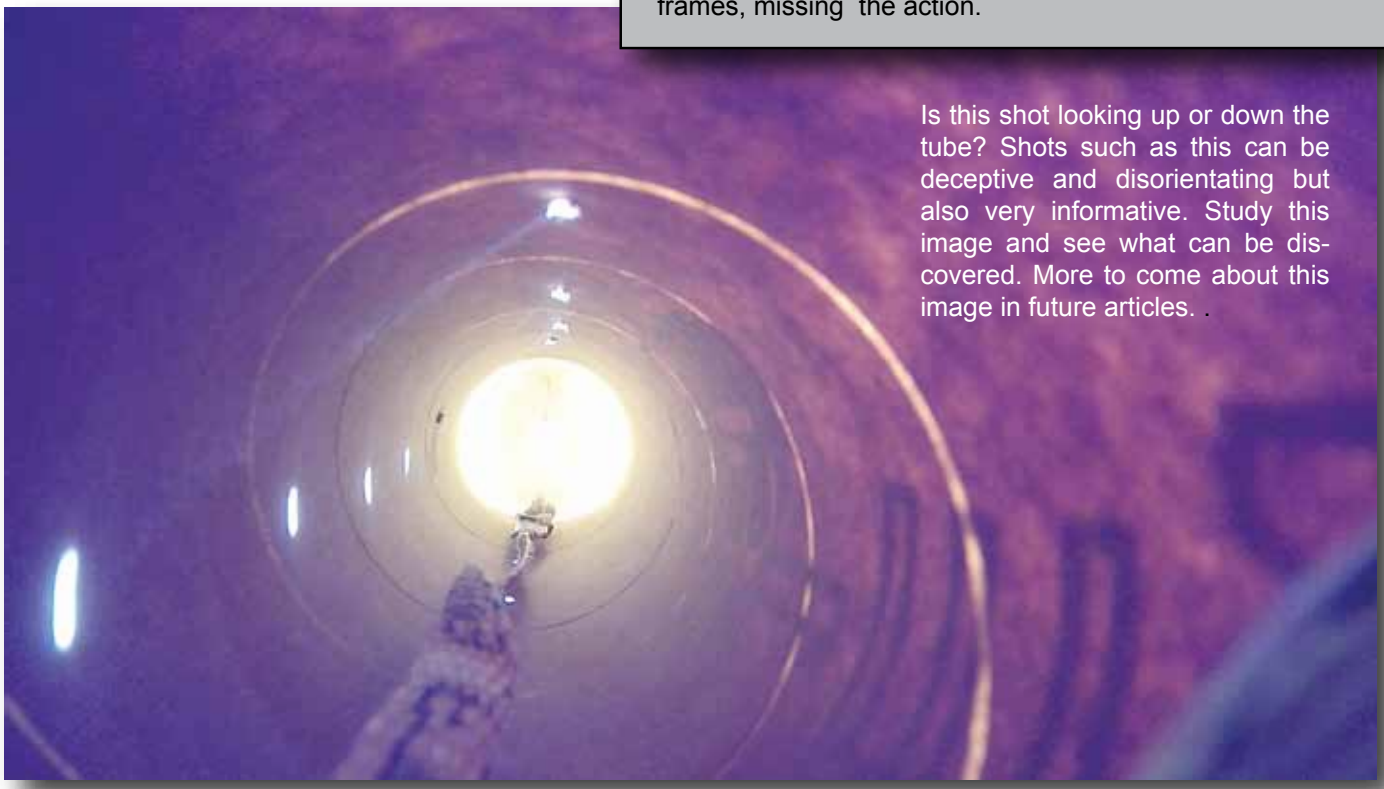
Ejection Flash can be see here in this sequence shot at 60 fps. In just 3 frames we go from dark to blown out white.

The first (dark) frame is looking down into the tube of the rocket. The sunlit spiral can just barely be seen.

Once the ejection charge fires, the camera begins to move out of the tube. The middle image shows the second frame in the sequence.

In the third frame the image blows out to white and remains so for about 15 more frames, missing the action.





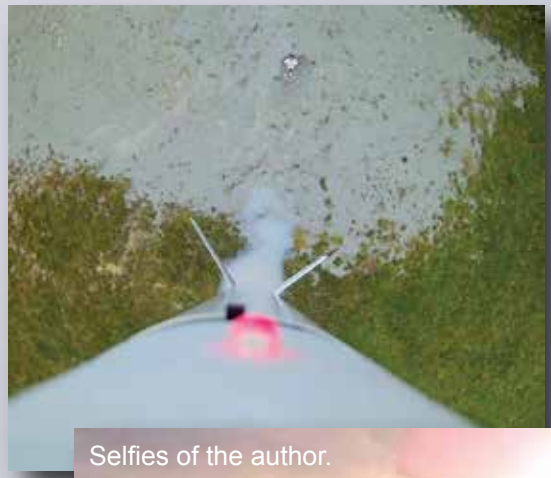
Is this shot looking up or down the tube? Shots such as this can be deceptive and disorientating but also very informative. Study this image and see what can be discovered. More to come about this image in future articles. .

Shots - The Selfie

We have all seen them. Or appeared in them. The posed shot holding our rockets. Or standing next to them on the launch pad. *Yawn.* Get creative.

Now I realize that getting a selfie from a rocket can be a real challenge and that a large rocket out in the field/desert is not the thing that we can stand next to during launch. But there are ways to make our selfies with our rockets if we get creative.

Don't forget that we MAKE our images and our selfies are no exception. If we want to make a selfie, or any image, we can use any material to assemble the picture. Just because we want a single, final image doesn't mean we have to start with a single image. We can use any number of images to composite together our final single image and make them look any way we like.



Selfies of the author.

Shots - Drone

As drones are so new and many of the rules are still in the making I do NOT recommend using drones for rocketry. Safety must be paramount. Drones should only be flown by experienced pilots and according to local, state, federal and any other regulations. Even if no one at the club objects, you shouldn't fly.

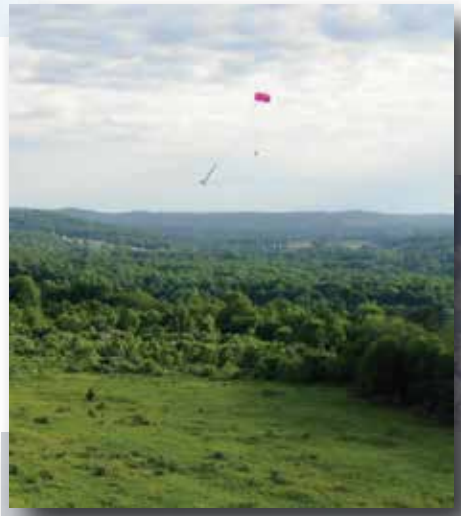
That being said, drones can provide a platform for our camera that no other can. Using a drone for capturing video or photos of our rocket can be challenging at best. Drones don't move anywhere as fast as even the slowest rockets, so don't be surprised if you miss the shot on your first try. Keep trying.

Cameras are either built in or use your own. Most of the consumer level camera drones have integrated cameras with gimbal stabilization that provide steady shots. Using a drone with a non-built in camera requires skill and cash.

There are many companies that offer drones, but DJI is the leader in both sales figures and in technology. No other drone has the level of integration of the drone and camera and image quality. DJI copters fly well too.

One of the best uses for a drone is for location of rockets once back on terra firma (or in my case, tree). Our club uses drones with nearly 100% success rate when trying to find our rockets. They have become essential at bigger launches.

I want to stress again the importance of safety. Only with an experienced pilot should a drone be used at a rocket launch. Drones are expanding on a continous basis, so more will be coming in future articles.



Shots - Misc

Rocket launches are singular events. We may fly every weekend, but each launch is still individual. Once the event is over, the footage on our memory cards is all we can ever get. So we would do well not to miss anything we want to record. Multiple cameras help. Shooting both video and still pictures may be useful also.

Leaving video cameras to record for long periods of time can capture shots that you might not realize. The shot above right is one example.

Loading rockets onto the pads can reveal much and provide us with some interesting photos. Make a time lapse version of the loading process. Funny Stuff.

Shots around the pits can be the most documentary of any pictures or videos that you make. Take a lot. There are never enough afterward.

Don't discount the oddball cams. Leave a 360 camera around the pits to see what you get. You may be pleasantly surprised.

Image: Yi 4K Action Cam, 720p@240fps

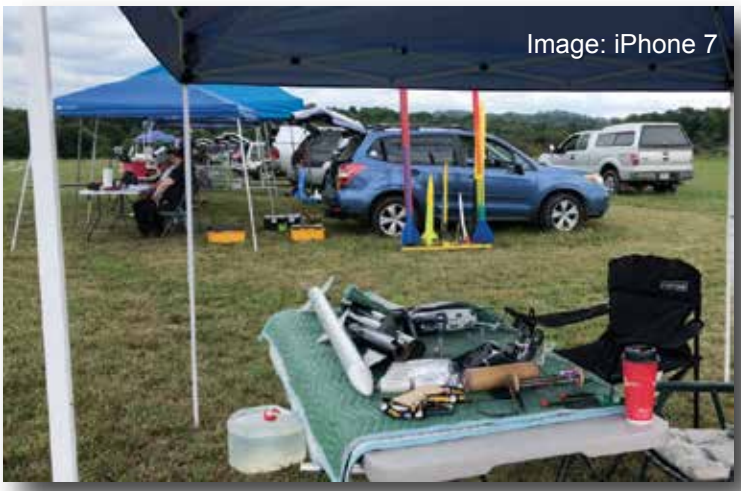


Image: iPhone 7

Image: Jolt Duo, 30fps

Cameras - Intro

With the number of cameras available today, the choice can be daunting. On the following pages I'll present a small breakdown of some cameras that I like to use for different kinds of shots.

While we don't need to capture every *Big Bertha* flight from dozens of camera angles, every camera we have means another shot. Multiple cameras help. And no matter what type of camera we are using, each camera captures exactly one shot.

Keep in mind each camera's needs. Every camera we use requires: memory cards, batteries, storage/hauling case, tripod or mount, etc. And each camera needs to be tended/operated. Small size begins to be a very desireable trait.

Another thing to consider is that each rocket launch is individual. We cannot recreate that particular launch. We can launch that rocket again (if we can get it out of the tree), but this is another instance. So the more cameras that we have recording, the more views we get of the singular event that cannot be repeated.

So look into your camera choices on the following pages and I'll add more here and there in the upcoming articles.

When to press the Button

If we want to record a particular *Action*, a standard rule of thumb when recording video goes like this:

1. Start recording before *Action*.
2. Record *Action*.
3. Record for 5-10 seconds after *Action* completes and stop recording.

And as rules of thumb go, it's a pretty good one. It gets us all of the *Action*. But it doesn't get us anything extra. It is not uncommon that the *Before* and the *After* can be just as interesting. And often it provides a backstory to our *Action*. Allowing the camera to record more than just the *Action* adds footage that we might not otherwise capture.

So if you want to record the *Action*, follow the rule above. If you want *more*, record more. Let the camera roll. You may be pleasantly surprised.

Types of cameras - DSLR

I tell my students and anyone who is interested in still photography to get an SLR camera. Learning to use just a few of the basic functions can make a big difference in photo quality. The history of the SLR goes back more than a century. It is probably the most versatile camera available today and you might even use it for something other than rocketry.

The Single Lens Reflex (SLR) camera has interchangeable lenses and the ability to manually control all functions for the shot. There are a multitude of lenses and other accessories available for SLRs. Nearly all DSLRs can shoot video as well as still photos.

The DSLR is the digital version of the classic film SLR.

For decades professional photographers used Nikon cameras to large degrees. Canon later entered the market and is now a favorite of many. Both Canon and Nikon offer a starter kit with a couple of lenses, a kit bag and some accessories for $400-500. Not a bad deal for someone who doesn't want to invest a lot to start learning. There are many other fine cameras out there as well.

A DSLR may not be the best option for onboard shots but for ground shots it is tough to beat. More will be covered in future articles.

Don't let the controls and settings overwhelm you. Read and practice just a little and you will be shooting like a pro.

GoPro is essentially the Grand Daddy of the Action Cam. Originally developed for surfing and skiing, the GoPro is great for any *Action* type shot. Its small size make it great for getting into places that larger cameras cannot. Easy to use... charge the battery and insert a microSD card and press the button to record.

While the GoPro is great for ground and onboard shots, some of its clones and offshoots might be even better for specific onboard applications. GoPro images (still or video) are some of the best for this type of camera. The current model is the GoPro 8 and will shoot 1080p at 240 fps. No other camera available today shoots at this resolution and frame rate for about $350.

The latest GoPro has a slew of other features such as WiFi connectivity, One Button Recording, and even voice control. GoPro has some of the most extensive software available as well as more features/settings/options than most (or any) other action cams on the market.

While the lens on a GoPro *can* be changed, it is NOT recommended. The lens is integrated in such a manner that removal is difficult if not impossible without damaging the camera.

The GoPro Hero 1. c. 2010. The first GoPro to record in HD (High Definition) video. 720p@60 fps (fast for the day) and 1080p@30fps.

The GoPro Hero 3. c. 2012. The lightest of the GoPro cameras as the model changed with the Hero 4.

The GoPro Hero 5. c. 2015. Size and weight have increased due to integration of water-proof case design.

The GoPro Hero Session. Smaller and lighter than the full size models.

The GoPro Hero 8, 2018. This is the current model as of this writing. It will shoot 4K@60fps and 1080p@240fps

Types of cameras - RunCam

Runcam cameras are designed for drones. The Split for racing drones. Both of these models are particularly well suited for rocketry, especially onboard.

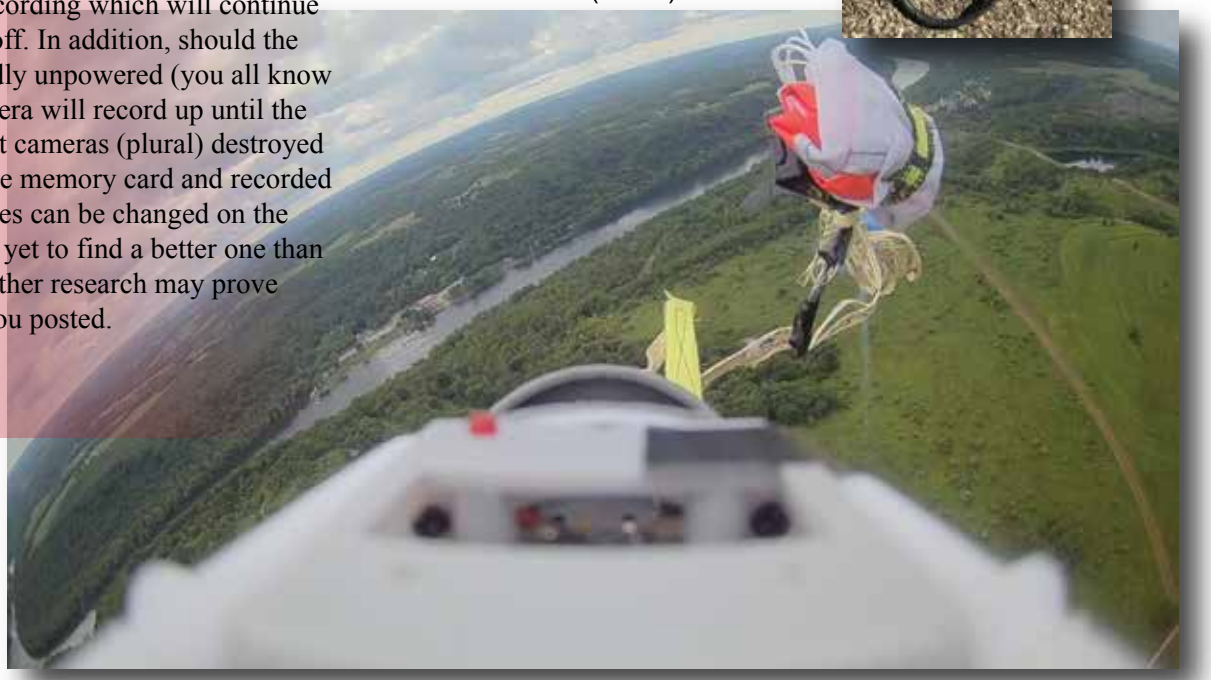
The basic Runcam (Orange case) and the Runcam Split (bare circuit board and camera module) both are excellent options depending on your application. Both will shoot at 1080p@60fps. Newer versions shoot 4K. WiFi setup and One Button Recording. Small, lightweight and inexpensive. Durable also. Wide angle lenses (up to 180 degrees depending on model) provide wide views.

The basic orange version is essentially a GoPro with a different cam/board relationship. Where GoPro has the lens sticking out the flat side of the box, Runcam has it sticking out the end. If you want to use one of these for an exterior onboard shot you still have a brick outside your rocket, albeit a smaller one. Use them in pairs to balance out the drag. The basic orange is easy to use... charge battery, install memory card and press button. Don't expect GoPro quality or list of features, but it's one of the best knock-offs out there.

The Runcam Split is one of the best options I have found for a custom installation. The Split requires a battery and wiring in addition to mounting. One advantage to the Split is the ability to wire multiple cameras together (along with additional electronics, of course). A single switch can power the cameras and begin recording which will continue until being switched off. In addition, should the camera be unexpectedly unpowered (you all know what I mean) the camera will record up until the event. I have had Split cameras (plural) destroyed in such events with the memory card and recorded video surviving. Lenses can be changed on the Split, although I have yet to find a better one than the included lens. Further research may prove otherwise. I'll keep you posted.

The basic orange Runcam (left) and an onboard shot from it (below).

The Runcam Split, Nano 3 (right) and an onboard shot from it (below).



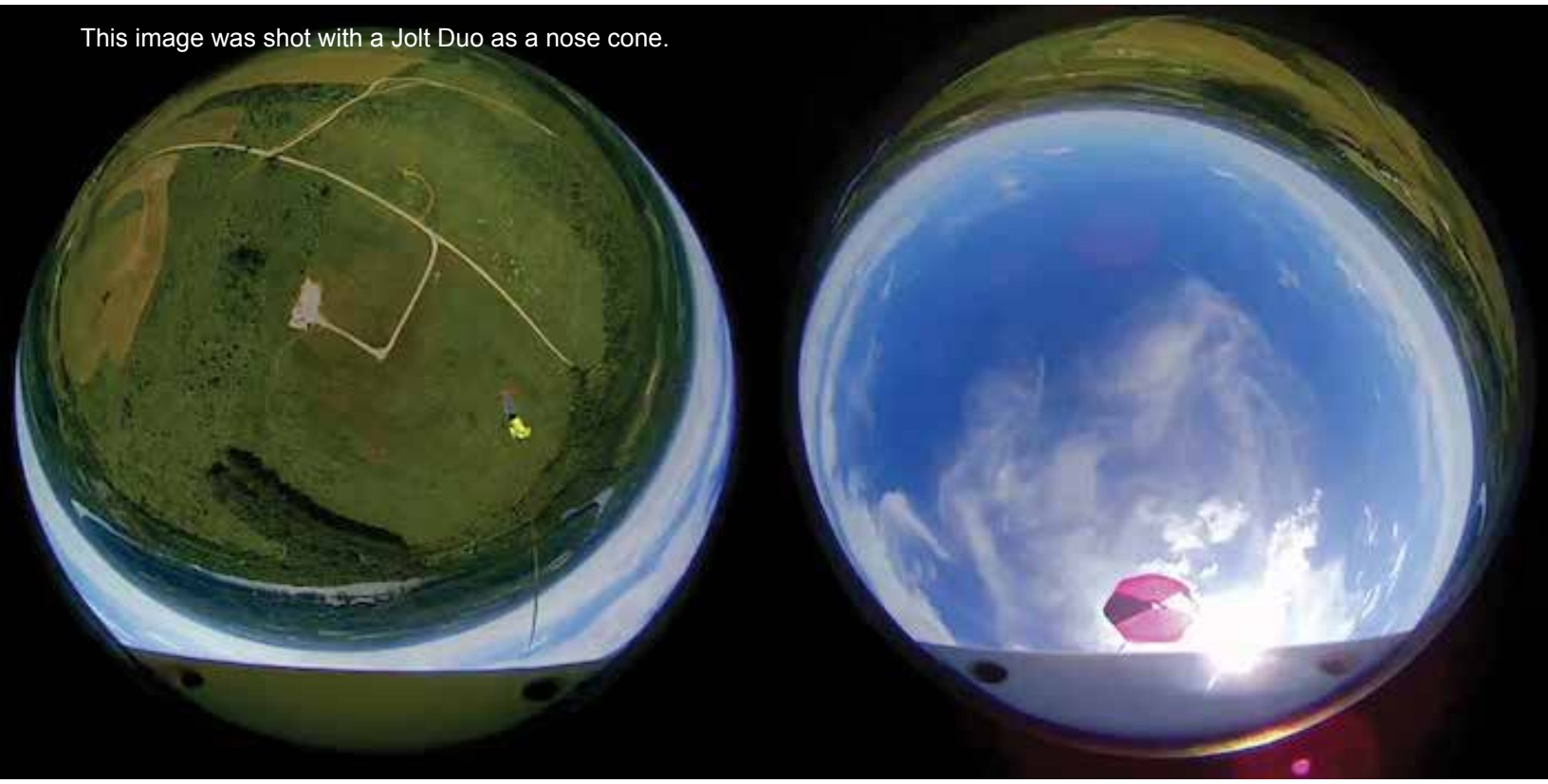
Cameras - 360 Cam

The 360 camera is something of an oddball. Literally. Many of the 360 cameras are spherical shaped (or close to it) and shoot round images in a 360 degree sphere around the camera. Few other cameras will capture as much as 360 cams. As you can see the images are circular and highly distorted.

The Jolt Duo runs under $50 so it's not a big outlay to give one a try.

The Jolt Duo and the Samsung Gear 360 have lenses front and back for a 360 degree spherical view.

The 360Fly has a single lens and produces a single circular image.



This image was shot with a Jolt Duo as a nose cone.

Test, Test and TEST

No matter what kind of camera that you use, you should spend some time with it. When you first get it, charge the battery and install the memory card. Get familiar with the controls. Make sure that you know how to turn the thing on.

Study your footage. Watch videos frame by frame.

If you are going to be shooting handheld ground shots, practice on other moving subjects. Birds in the sky, aircraft overhead and automobile traffic all make good practice shots. Try zooming while following your subject. Its not as easy as it sounds.

If you are building a large or involved project, perhaps start with smaller test versions. Do the same with your camera setups.

Test and practice. Don't expect to get good shots on your first tries. Keep at it.

Don't get discouraged when you end up in the trees. Or your rocket plugs into the ground. Or if you end up getting a shot of the back end of the N motor rocket. Keep trying.

Cameras - Scam Cams - BEWARE

There are a world of cameras that are available that I refer to as *Scam Cams*.

These cameras are often unbranded. Low prices make them seem attractive. Often sold as *4K Action Cam* or *HD Action Cam*. They appear as a generic form of GoPro but they may also be in the form of a keychain fob, pen, spyCam or lighter.

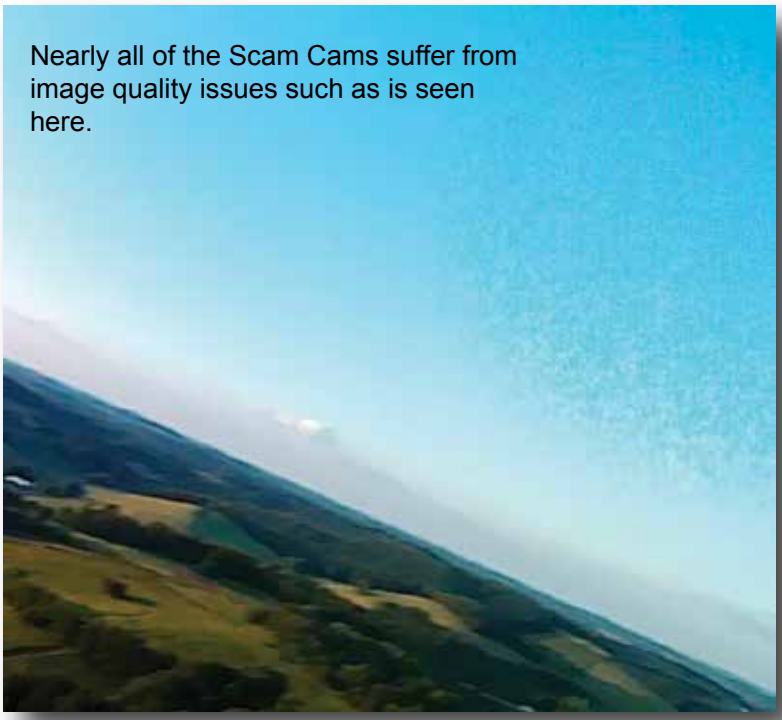
These cameras suffer from a range of issues. LCD screens are nearly useless in even low sunlight. LED indicators are not much better. Often recording will just stop for no reason. Image quality is generally low. Most will suffer from issues as seen at right.

Nearly all *Scam Cams* have a time/date stamp in the corner of the image. While most of these can be removed, doing so can be tricky at best.

One thing to note is that they also have a couple of things in their favor. One is that they are lightweight, even with the case on. But they also are easy to remove from the case which makes them even smaller and lighter. Controls can sometime be replaced with custom wiring which can also make them attractive.

It may be that you can find a camera that works well enough that makes you happy. I have yet to find one.

So if you purchase one of these cameras, please BEWARE! You may end up tossing it in the bucket.



Nearly all of the Scam Cams suffer from image quality issues such as is seen here.

In Conclusion

Have you answered any of my questions? Do you know what kind of shot YOU want to get? If so, you should have a good idea of what kind of camera you want and need for YOUR kind of shot.

Now that you have your camera we need to get it set up and recording so be sure to tune in for the next article, “Camera mounting and getting the shot.”

I hope this has been useful for everyone, or at least someone.

And as a photography professor of mine used to say, as he banged the table with a stick used to stir chemicals, “Now go make some Pictures!”