

# HOW TO FILM YOUR ROBOT

## THE TECHNICAL PAPER

### INTRODUCTION

The technical aspects of how to film your robot, focusing on the 24/7 model presented in my seminar **HOW TO FILM YOUR ROBOT** that was presented at the 2014 FIRST World Championship Event. You can download the presentation from FIRST or from the Cyberfalcons website:

[www.cyberfalcons.com](http://www.cyberfalcons.com)

The goal of this paper is to offer general advice and to share some tips and "tricks" that will elevate your technical filmmaking to the next level. While the contents of this paper will be tailored to my 24/7 model, they can be applied to any filmmaking pursuits for FIRST teams.

### ABOUT THE AUTHOR

**Ian VanDuzer** has been a part of two FRC teams: **2056** (2007-2011) and **3710** (2012-Now) over the past eight years. He is a graduate of Queen's University's School of Film, Media, and Cultural Studies and holds a BAH in Film. He is now a practicing filmmaker who has had short films screened at film festivals across Canada, the US, and the UK.

### THE BASICS - WHAT IS A VIDEO?

Technically, a video is a series of still images projected in sequence at a high "Frame-per-second" rate that tricks the brain into seeing motion. Narratively, a video is a highly constructed media object that has an objective and conveys some sort of information.

In the case of 24/7 documentaries, or "Build Vlogs", video is used to tell a story (even if that story is an incredibly detailed breakdown of a mechanism or component).

## UNDERSTANDING YOUR VIDEO

In order to construct your video, you need to understand all the different parts that together make up your video.

**VIDEO:** The whole product. A series of sequences that together tell a story.

**SEQUENCE:** "mini-stories", sequences are a series of related shots that build off of each other to create meaning.

**CLIP:** edited shots. Multiple clips can be taken from one shot. They are separated by edits / cuts.

**SHOT:** what you are actually recording on "set". Long, short, close, wide, a take is everything that happens between when you start recording to when you stop.

**EDIT / CUT:** the act of moving from one shot to another. Highly psychological.

**DIAGETIC SOUND:** audio that you can see the source to: people talking in interviews, drills whirring as they appear on screen, etc.

**NON-DIGETIC SOUND:** audio that is not part of the set. Music, added sound effects, overlapped audio tracks, etc.

## EQUIPMENT – WHAT DOES AND DOESN'T MATTER

In general, the perception of videomaking is that you need lots of lights and high-quality cameras and microphones. In reality, as long as you aren't shooting on a "Point-And-Shoot" camera, you would be surprised at the quality you can achieve.

**Identify your platform.** If these videos are ending up on YouTube, then the *highest* quality they can be is **1080p**. This automatically gives you a lot of freedom in regards to what camera you can use.

I shoot using a **Canon Rebel T2i**. That's a 5-year-old camera. If you tried to CAD with a 5-year-old laptop, then you would be in trouble. But the smallest file

dimensions the T2i shoots at is **2592 x 1728 pixels**, which is *more than two times the size* of 1080p video. The Canon Rebel series are all excellent entry-level DSLR cameras that have the advantage of being modded with Magic Lantern software. **Nikons** are also great quality and have entry-level cameras.

**Magic Lantern** is a software mod available for most Canon DSLR cameras that optimizes your camera for shooting video. It adds tons of features to your camera, such as Audio Level Indicators, Focus Dots (little dots that cling to what you're focusing on; really good to be sure you're in focus) and Zebra Stripes (identifies over-exposed areas in your frame). It's free (**but download at your own risk**).

Audio is another huge issue. Do not rely on your on-camera microphone. Instead, pick up an onboard microphone that can plug into your camera's mic jack. Entry-level mics start at around \$150, and are a solid investment for any team that is looking to produce professional content. (I use the **RODE VideoMic Pro**; it plugs right into my camera and it's great at isolating sounds. I sprung for the \$300 one)

If you are not prepared to drop ~\$800 towards a camera and microphone, then use your phone camera. I have also shot episodes on my **iPhone 4S**. The iPhone has a HD camera that shoots 1080p video, while also picking up decent audio. Take advantage of the fact that almost everyone on your team will have an HD camera in his or her pocket. Just be mindful of the sounds you might pick up in your location: avoid rooms with loud fans, lots of computers, or tools running in the background, etc.

## PREPARING TO SHOOT

There are two main ways to shoot a documentary: on the fly, and with preparation. The second option will result in a much more cohesive and strong piece, unless you do the first option very well.

How do you prepare for something that is based on spontaneous moments? Simple: you plan for what is about to happen, as opposed to planning for results.

Prior to shooting, meet with the build heads of whatever you are focusing on. Ask what they think they will get done that day / week. Build the framework of a sequence around their expectations. Plan to be filming certain moments, but don't plan on specific actions or results happening.

Communication is key. Half of having a good video is being where the interesting stuff is happening. Make sure your team knows to let you know if they are about to do something interesting (like test a mechanism / put the final pieces into place).

Be flexible. Just because you didn't plan on shooting a particular group doesn't mean that you shouldn't if something interesting is happening. Preparation is key to making sure that your video isn't boring. But if something more interesting pops up, think about replacing your previous plans.

## MAPPING OUT YOUR VIDEO

After sitting down with all the involved parties, you should have a pretty clear idea of what you want to focus on. Now, break down your subjects into Exposition and Sequences.

This is my typical episode breakdown:



Gray segments are titles and credits. Orange segments are exposition. Red segments are sequences.

I start each episode with expository clips: a voice over narrator introduces an issue that surrounds the team that episode. If possible, I turn it into a sequence. I then cut to the title sequence.

Following the titles comes a bit more introduction, just to make sure the audience knows what's up. I introduce Sequence 1. After sequence 1, I introduce sequence 2. And then I wrap up the video with more narration.

I make sure that each episode has two sequences and lots of explanations (to keep the audience interested). Limiting myself to two longer sequences means a) I get to focus instead of skim, and b) I keep my video short.

## CONSTRUCTING A SEQUENCE

When thinking about what to shoot, keep in mind that you need to construct sequences in order to create a story. Using the following format will help you identify what you need to shoot.

**ESTABLISH:** show what you are focusing on (the subject)

**EXPLAIN:** have someone walk the viewer through what they are seeing

**ACTION:** show the subject in action

This formula is used extensively in documentaries. It simplifies the entire shooting process to three shots. Let's look at how it actually works: the following sequence is taken from my 24/7 video series.



**ESTABLISH:** We see a shot of the prototype we're about to talk about. We give the audience some time (2 seconds) to look at it and wonder about what it does.



**EXPLAIN:** I cut to Aaron, who explains how the slingshot prototype works. We isolated the student from the action to ensure better sound quality, and to get a more comprehensive explanation.



**ACTION:** I cut to a shot of the prototype throwing the ball into the air. Meanwhile, we still hear Aaron explaining what is happening.

This formula piques the audience's interest, then gives them an "aha!" moment when they find out what it does, and then gives them satisfaction when they see it in action.

You can tailor this formula to fit basically anything. For example, think about filming a sequence based on your Chairman's team:

**ESTABLISH:** A shot of your Chairman's team presenting to a group of mentors.

**EXPLAIN:** Have a student from the Chairman's team briefly explain what the award is and why it's important.

**ACTION:** A shot of the mentors offering a critique of the presentation.

OR, use the formula to show a "human element":

**ESTABLISH:** Show two friends joking around, playing air hockey.

**EXPLAIN:** Have one of the friends explain their relationship, how it was created and expanded by the team.

**ACTION:** Friend 1 wins the air hockey game. Much gloating is had.

When you use this formula, what you are essentially doing is creating a narrative. Simply showing something happening with no context is confusing. Having a student explain something without seeing what they're explaining is boring. Put the two together and you actually create a story.

## COMPOSING YOUR FRAME - RULE OF THIRDS

When it comes to actually shooting your video, you want to be conscious of where things are in your frame. Your frame is (visually) whatever your camera captures.

You want to focus your attention to certain points in the frame, called the "Power Points." The **Rule of Thirds** is a very good way to identify these points. Essentially, you divide your frame up into thirds both horizontally and vertically. Wherever the dividing lines intersect is a power point.

Take a look at the following screenshot from episode 3 of my 24/7 series:



Notice that Alex's face is right at one of those power points. This automatically tells the audience that he is the focus of the shot. His position in the frame also means that there is lots of "interesting space" to look at elsewhere in the frame.

The Rule of Thirds is not a super-strict rule to follow: do not scrap a shot because your subject is not exactly on a power point. But try your best to keep your subject relatively close to those points.

## EDITING BASICS

The following is a brief introduction to the psychology of editing. Editing makes up ~80% of the viewer's experience, so you need to focus on it and know what you are doing.

**JUMP CUTS:** you have a long clip, with something interesting happening at the beginning and at the end, with a whole lot of nothing in the middle. A jump cut is when you cut out that middle. It's called that because everything "jumps" around in your frame.

In professional filmmaking, jump cuts are bad. But in the context of YouTube, they are acceptable (think about your favourite vlogger - they cut out everything, even their own breaths!). Feel free to use, but use them sparingly. It's much better to "cover" your cut with an aptly-named "cutaway." Doing so also creates a mini sequence!

**MATCH FRAME:** the key to harmonious edits. Basically, it's a way to subconsciously connect shots together. If your clips are "connected" (part of the same sequence), then try to keep your subjects in the same part of the frame. Look at the example sequence with Aaron above: everything is clustered around the left two power points.

At the same time, you can also subconsciously signal a shift from one sequence to another. Check out the move from the left power point to the right in these two shots:



The focus shifts from one side of the frame to the other. Subconsciously, your audience becomes slightly disoriented as they search for the subject. It takes a fraction of a second, but it helps to signal the end of one sequence and the start of another.

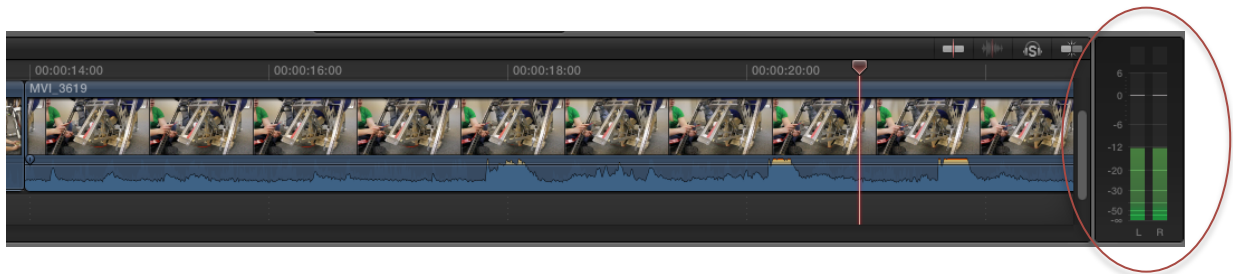


## EDITING AUDIO

Please note that the following advice will be tailored towards Final Cut Pro X users, although the general pointers can be carried over for use in any other program.

Nothing ruins a video like horrendous audio. In general, when you are shooting, you should try to isolate important sounds (people talking) from noisy locations (the shop) to capture clean audio.

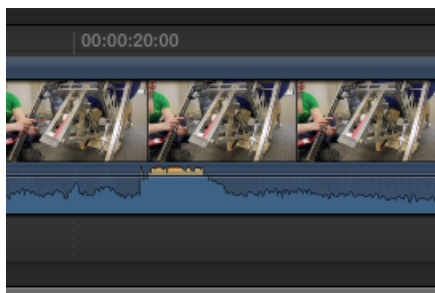
**AUDIOMETERS:** Somewhere on your workspace should be audiometers: vertical bars that move from green to yellow to red as audio is playing based on how loud your audio is. In FCPX, your audiometers are to the right of the timeline:



In general, you want to aim to have your audio hover between **-6db and -12db**. This keeps your audio from being too high and loud (deafening your audience = bad) and way too quiet (audience hears what you're talking about = good).

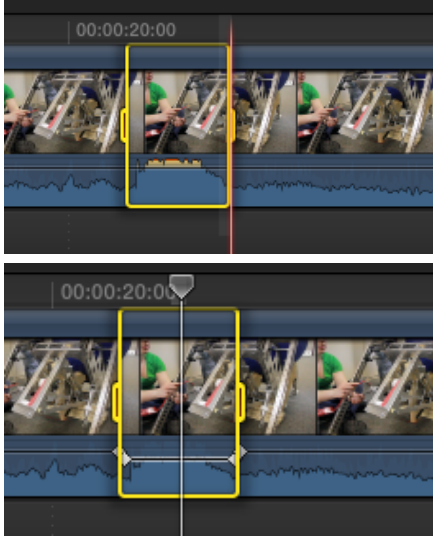
The most important thing is consistency. Keep all of your audio hovering around the same level. Your audience should have to adjust their speakers once at the beginning of the video, and not have to touch it for the rest.

**LEVELING YOUR AUDIO:** your audio will naturally "peak". You can see this in the audio waves below each clip. You want blue peaks, not yellow or red. Yellow and red peaks means the audio is too loud.



I'm going to adjust the audio levels for this clip. Notice the red and yellow peaks. We need to knock these levels down a bit to make them easier to listen to.





First, I go into the “Range” tool (using the “R” hotkey), clicking and dragging my cursor around the too-loud area. I purposefully go a bit overboard, leaving space on either side of the audio in question.

I can then click and “drag” the audio level line (the black line running across the clip) down to adjust its level. I want to do pull it low enough so that the peaks are no longer red or yellow.

I tweak it, paying attention to the audiometers. In this case, I drag it down to -6db, which puts my audio level where I want it.

**MUTING CLIPS:** follow the exact same steps above to mute sections of a clip, except drag all the way down to -96db. If you want to mute the whole clip, don’t use the range tool; just drag the whole line down.

**MAKING IT LOUD:** to raise the audio level into that -6db to -12db range, follow the exact same steps, except drag up instead of down. Note though that all the audio will be raised in that section, including room tone and “buzzing”.

**FINAL CUT PRO X:** if you are using FCPX, I would highly recommend Googling tutorials on how to use the program’s built-in audio filters: “Loudness,” “Background Noise Removal,” and “Hum Removal.” Really handy for quick, dirty adjustments.

## CONCLUSION

Thank you for using HOW TO FILM YOUR ROBOT: The Technical Paper. Please let us know if this advice helps you, or if you have any advice or other tips / tricks to share with us.

Email FRC3710 FSS Cyberfalcons: [fsscyberfalcons@gmail.com](mailto:fsscyberfalcons@gmail.com)

You can see the whole 24/7 series on our website: [www.cyberfalcons.com](http://www.cyberfalcons.com)

*Good luck, and good shooting!*

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