



# ULTRA SLOW AND STEADY

Ultra slow motion is not new to cinema but its adoption in live broadcast for greater analytical detail has been more recent, says David Bourgeois

Slow motion has been a familiar feature of the visual medium for many decades, from its origins in cinematic use with film cameras, to its adoption by broadcasters using video cameras.

Filmmakers have long used slow-motion as a dramatic tool to add emphasis at points of dramatic climax, but in broadcasting, its main role has been to slow down the replay of some fast-moving action, most commonly in sports coverage. You could, therefore, characterise the typical cinematic use of slowmo as adding to the emotional impact, while in broadcasting, it tends to add an analytical dimension to the coverage.

One factor that has played a big part in this difference has been the two camera technologies used in movies and in broadcast. Until recently, all movies were shot with film, and film cameras that can shoot at much higher frame rates than the standard 24fps have been available for some time. Movie directors, therefore, had access to a much wider range of slow-motion effects, from simply slowing the action a little or running it at half-speed, to showing it many times slower. Broadcast cameras were not designed to offer a big variation in frame rates, so directors and camera operators had to be satisfied with relatively limited



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slowmo options – typically around 75fps being available on some makes of broadcast cameras.

Researchers in science and industry were frequent users of slow-motion too, and until recently slow-motion cameras for scientific applications were film-based to achieve the very high frame rates required for analytical footage of extremely fast events in the field of ballistics or destruction-testing of metals, to give a couple of examples. And it is for scientific use that the first generations of ultra-slow-motion video cameras were developed, and with the advent of these cameras, there was at last the potential for broadcasters to add ultra-slow-motion to their toolkit. For a while, though, it remained only a potential development, since these ultra-slow-motion cameras were not designed for use in a broadcast context, were impractical to operate live, and delivered an image quality that did not meet the acceptable broadcast standards of the time. ▶

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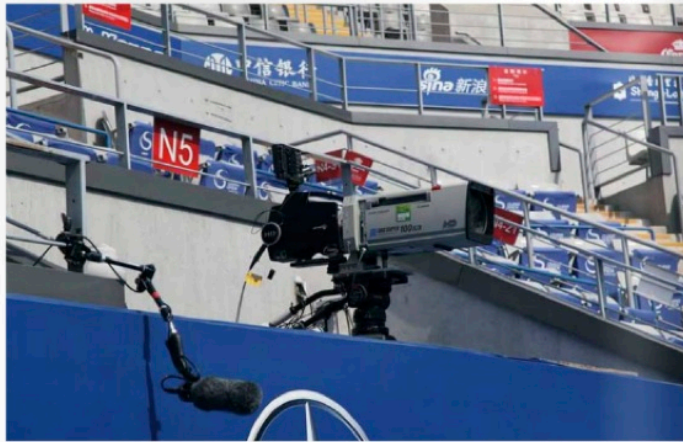
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With the latest generation of ultra-slow-motion cameras, and the availability of systems that provide completely integrated broadcast adaptations of them, producers and directors now have a new window on the action. Ultra-slow-motion is becoming part of the mainstream for broadcasters working in a live environment. At this point, for the sake of clarity, it's worth reminding ourselves that by 'ultra-slow-motion' we mean frame rates typically between 500 and 2000fps. Compared to 'ordinary' broadcast slow motion of 75 to 180fps, ultra-slow-motion opens up a dramatically different dimension of insight into the action. Directors with access to ultra-slow-motion for live broadcasts tend to use it not just to show a slower version of what the other cameras saw, but to find completely different shots that add something entirely new to the coverage. Ultra-slow-motion can show details such as a baseball compressing and expanding like a jelly as it comes off the bat, or the otherwise imperceptible expressions of emotion on the face of a competitor straining for maximum performance.

These shots require careful planning, and a high degree of skill from operators.

But broadcasters who go the extra mile to create them reap the benefits because they provide memorable moments with real impact on the audience.

Here's a brief guide to some key issues in using ultra-slow-motion for live broadcast:

- Plan your shots to give extra value.

Ultra-slow-motion delivers dramatic footage, and views on the action that cannot be delivered any other way. Don't waste the potential of the technology on shooting 'ordinary' slow motion.

- To really make ultra-slow-motion a part of your coverage, choose a system that is fully integrated for live broadcast and designed to be used by your own crew.

There are ultra-slow-motion systems that are not fully integrated for broadcast and these are hired out with a specialist crew — or you'll have a hard time getting them to work on your own. These are much harder to make an integral part of your broadcast coverage, and your use of ultra-slow-motion will be limited as a result.

- Ultra-slow-motion cameras nowadays provide an extra live signal beside the replay signal, and they're capable of continuous recording at the same time as playing back a shot. This is important as you can grab as many replays as you want,

still monitor what's happening live and get whatever more important action happens during that replay.

- A true ultra-slow-motion system should provide frame rates typically from 300fps up to 2000fps, with instant replay, and operating controls that are completely familiar to any broadcast live personnel.

- Choose the frame rate that you need: what you want to show in perfect sharpness is what will look blurred with standard cameras. It's not necessary to shoot at the highest rate your camera is capable of: increase the frame rate to the point at which motion blur disappears — this is determined by the speed of the action. Increasing the frame rate further will not bring more details and will slow down the action unnecessarily which will affect the rhythm of live coverage and this isn't a good thing, usually you want to keep a fast pace to keep the attention of the viewer.

- To film an athlete, typically 300fps will deliver good results, while for some ball sports between 1000fps and 2000fps can deliver stunning shots.

- The latest-generation cameras provide image quality that is accepted by most directors to use for live output at normal

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speed, as well as for ultra-slow-motion sequences, so if you choose the right system you can use it for both, saving costs in the process.

- Use a highly-skilled camera operator on the ultra-slow-motion camera. They will need to deal with some restrictions that ordinary broadcast cameras don't have, and in any case, the exceptional shots that ultra-slow-motion can deliver are likely to need a lot of creativity and a lot of skill to capture.

- Shoot short focus, not wide angle. Wide angle ultra-slow-motion shots can be very busy — and like not moving at all —, while tightly zoomed-in shots concentrate the eye on the minute detail that can't be seen any other way.

- Ultra-slow-motion cameras need a lot of light — more than conventional broadcast cameras. Sensitivity of the systems has been increasing all the time though light levels and flickering in some night-time sports can still be a problem, and you will need to plan carefully for this.

- Owing to the need for high levels of light, the cameras often need to be operated with the iris wide open, leading to shallow depth of field — another reason for using a skilled camera operator: accurate focus is vital.

- To increase the depth of field, it may be possible to close the iris down by increasing the gain, but eventually this will introduce noise.

- You're using a special camera with a

pool of other identical cameras: this special camera has different properties that will make it react and look differently than your other cameras in different lighting conditions: single high-speed CMOS sensor instead of 3-CCD sensors. Expect your video engineer to spend some time at every different venue to fine tune his settings according to the conditions and get the best color matching with your other cameras. A good video engineer will do wonders.

- Keep sensor and SMPTE optical fibers clean as these systems are more sensitive. Some simple good practices will get you trouble free.

- You're shooting in 720p as opposed to 1080, the sensor image is smaller, so you can save one stop at least with an adapted extender, making 1200fps at 720p equivalent to 600fps at 1080.

- Consider ultra-slow-motion is a creative tool. Some of the most intriguing shots come from shooting subjects that may not seem obvious at first: weightlifting, show jumping or other equestrian events and so on are not the fastest sports, but they yield exceptional ultra-slow-motion sequences.

- Thanks to multi-block non stop recording, you'll get plenty of footage. Though only a small part of this might be used live, a lot of clips will look astonishing in highlights, advertisements and will be a very valuable reference for sports analysis programmes that cover the games of the week, or focus on a specific player.

In essence, a lot of these materials are ideal for post-game programmes. In these cases, they might even get some shots at very high frame rates to get some more artistic clips they can use specifically for this purpose

3D is outside the scope of this article but there is only one broadcast 3D slow-motion camera system in the industry presently. All of the other super-slow cameras don't work in 3D. These special cameras, therefore, sometimes take the lead on other technologies that take a much longer time to develop.

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