From a one-camera stream on a boat, to a multi-camera ESPN3-level telecast

How Harvard University uses Wirecast to live stream their sports

This article was written by Imry Halevi, Director of Multimedia and Production at Harvard University's Department of Athletics and appeared in its original form on Stretch Internet's blog, "Taffy". Stretch Internet is an official partner of Telestream and helps support Wirecast for more than 300 of its clients.

It was not too long ago that planning for different sizes and scopes of video productions meant planning to use different gear and different software. Small productions could be supported by a software-only solution (such as Telestream's Wirecast or Adobe's Flash Media Encoder), while large productions called for physical switchers and lots of conversion gear.

Well, with new advances in technology, and on-going trends of lower equipment costs, those planning sessions have become much simpler. This past year at Harvard, we had the opportunity to plan and execute three completely different productions, and we did them all using the same core equipment and setup. All of this was possible due to our use of Telestream's live streaming software Wirecast. This software has become so powerful and diverse that we now use it for all but our largest of productions.

Powerless, Wi-Fi-less and on a boat
Our simplest, and yet most challenging production setups are online streams for rowing races. Harvard has four rowing teams, and since long races on a river are not the best spectator sports, we have started streaming those races online.

There are obvious limitations and difficulties for streaming live video and audio from the middle of a river. However, we have come up with a compact and easy to deploy solution, which provides us with the flexibility to put together HD quality productions with no connection to land-based infrastructure. To start us off, here is a list of ALL the equipment we bring with us on a boat:

- Apple Macbook Pro with Retina Display (15", 2.2GHz, Core i7, 16GB Memory) + power cable
- Blackmagic Design Ultra Studio Mini Recorder + Thunderbolt cable
- JVC GY-HM600 Camera (with batteries)
- JVC Tripod Zoom and Focus Controller
- Portabrace Rain Slick for JVC camera
- Manfrotto 502 HD Tripod
- Sennheiser HMD280-XQ Headset
- Sennheiser HD280 Headphones
- BNC Cable
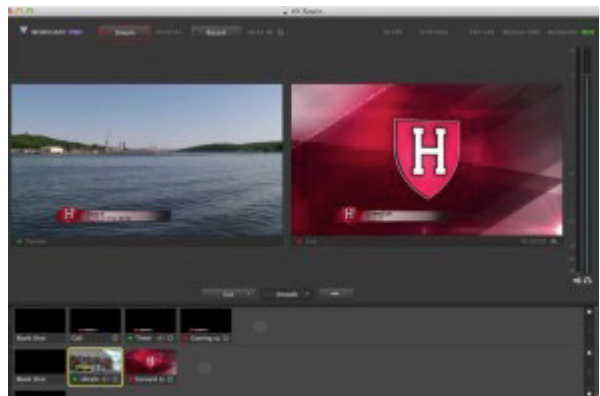- Verizon 4G Jetpack
- Black & Decker Portable Power Station

We take all our gear on a launch (a motor boat that follows the crews along the race course) and set up. The general setup revolves around the MacBook Pro with Wirecast on it. We set up a camera on a tripod at the bow of the launch, and cover it with a rain slick (since we do encounter a lot of splashing when going at high speeds). We then use a short BNC cable to get a HD-SDI output from the camera into a Blackmagic Design Mini Recorder. The Mini Recorder is connected to our MacBook Pro using a Thunderbolt cable. The laptop and all the gear are at the bow as well, just behind the camera. We have one commentator join us for the broadcast. They usually sit by the driver, and have a HDM280 headset. The headset connects directly into the camera (both input and output).

With Wirecast at the heart of the production, we're able to stream, record, add graphics, add a race clock (more on that later), control audio and add pre-recorded videos, all without the need for any other gear. Since Wirecast is such a powerful program, we used to have to carefully monitor the computer's CPU usage, as that was the only limiting factor. However, with Wirecast 6.0's 64-bit infrastructure, CPU usage has gone down across the board, and so have our worries.

Our troubles begin (and end) with connectivity. Since we're on a moving boat in the middle of a river, neither wired Internet nor Wi-Fi are viable options for us.
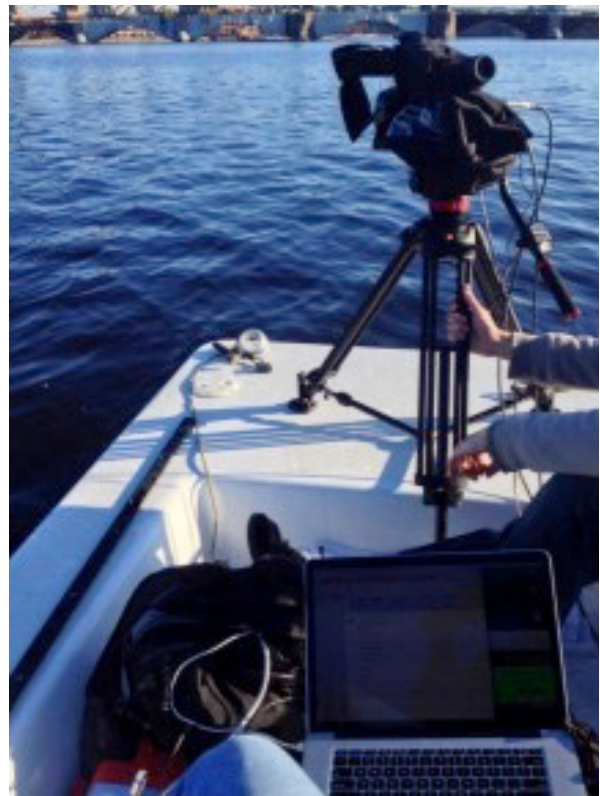
A JVC GY-HM600 streaming from the bow of a launch

Wirecast Rowing Setup (actually showing Wirecast 5.0)

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Therefore, we use a 4G hotspot (in our case, a Verizon 4G Jetpack) to generate a Wi-Fi signal for the broadcast. We've done multiple tests and have gotten upload speeds of about 2-2.5Mbps. Not the best when trying to stream a 720p 2Mbps production, but manageable. If we get too much buffering, we lower our data rate to 1.5Mbps, which usually helps. In case the hotspot doesn't work, we always have an iPhone standing by, which can provide 4G tethering Wi-Fi if needed.

Black & Decker Portable Power Station

Another aspect of connectivity relates to power. A typical day on the river begins at 6:00am, and often ends around 10:00am. Our camera can easily last that long on its batteries. However, even with the best batteries available, our MacBook Pro and 4G Jetpack usually lose their power around the 2-hour mark. We've tried reducing the MacBook's CPU usage or lowering the screen brightness to reduce its power needs. We even tried to stop streaming and recording between races. However, we've always run out of power before the end of the day.

Therefore, this past year, we've started experimenting with a Black & Decker Portable Power Station. I think it's actually meant for jump-starting your car, but it works! When we plug in our laptop and hotspot to the power station, we get about 2-3 hours of uninterrupted 120V AC power. After that runs out, we rely on the batteries for the remainder of the time, which isn't a problem since they're all still fully charged.

Even though the production itself is small in scope (though we've definitely thought of adding more cameras, a live drone or other aspects to the broadcast), we usually get very positive feedback from fans who enjoy watching these races live. Even though we just use this setup for rowing, I think that this kind of mobile and untethered production could work for many

colleges and universities in venues where little to no infrastructure exists. From streaming baseball to rugby to soccer, a 2-hour game is easily doable with just a handful of gear.

A standard broadcast, with many score bug options

Streaming from a boat is fun, but our typical production is not nearly as untethered. For all Harvard productions of soccer, swimming & diving, volleyball, water polo, wrestling, field hockey, rugby and softball we connect one or two cameras to a laptop (with one or two Blackmagic Mini Recorders), we have commentator headsets and an ambient microphone connected to a mixer, and we put it all together in Wirecast (while adding some graphics and videos).

The flexibility of Wirecast is really evident when we add score bugs to our productions. Besides video quality and tripod smoothness, I think that a professional, clean and branded score bug is one of the most important aspects of any production. With just a little pre-production work, Wirecast really makes it easy to make your own graphics and score bug. One of the most important aspects of a good score bug (for most sports) is a running clock. Depending on our setup, we use one of three methods to get a clock into our production.

Our simple setups for streaming
Women's Rugby

1. Clock Cam – The easiest and most common way to get a clock into your Wirecast production is to point a camera at a clock, and then crop and clean the feed in the software. While this solution is quite easy, it does take some work to make it look good. Most times, if the clock cam moves or if the cropping wasn't done right, the clock on the score bug serves as a distraction, rather than a convenient feature. We use a clock cam for our Field Hockey productions, when no other option really works.

2. All-Sport CG – For our large-scale non-Wirecast productions, we use a Daktronics All-Sport CG device to get scoreboard data from the All-Sport 5000 scorekeeper box, and then bring it in to our LiveText computers for insertion into score bugs. The All-Sport CG also has the capability to take in a video feed, insert a score bug, and then output the com bined feed. The problem is that this process only works with analog composite video. Since all our productions are done in digital HD, we really want to avoid downgrading everything just for a score bug.

Therefore, we've come up with a solution that allows us to use the All-Sport CG score bug, but maintain our HD video. For any venues where we can conveniently get Daktronics scoreboard data (either wired or wireless), we use an All-Sport CG. We then take an output from the device, and bring it into Wirecast (without anything going into the input port on the CG). We then have a new shot in Wirecast that's just a black screen with a live score bug. We crop and scale the clock from the bug, and overlay it on top of our branded graphics. Even though the clock shot is in SD, it's so small and with little motion that it doesn't really change the overall quality of the production. We use a Diamond Multimedia USB 2.0 Video Capture device to bring in the composite video feed.

Diamond Capture Device

A swimming and diving streaming setup with the green TimeMe.com window in the corner

3. Online Clock – This past season, we started incorporating one new option for score bug clock – an online timer/stopwatch. We use a website called TimeMe.com to generate a count-down or count-up timer. The website allows you to change the font name, size and look of the clock, to make sure it fits your overall production graphics. We open up the TimeMe.com website in a Mozilla Firefox window, and then use Firefox's default settings to change the background color of the site to green. Using Wirecast's Local Desktop Presenter feature, we bring in the Firefox window, then crop it and key out the green background. It's actually quite easy to do, and provides a clock that is cleaner and better looking than either of the previous two options. The only two limitations with this option is that the Firefox window needs to remain visible on the screen at all times, and that the clock must be controlled manually (stop, start, reset, etc.). Despite the added effort, we've used this clock for many of our productions this year, including as a timer for our rowing race productions. It's also good to always have on-hand as a backup, in case your first choice for score bug clock doesn't worK.

Using every input and output possible – and off to ESPN3

The previous two production setups are what we're used to. Small productions, 1-2 cameras, limited staff, and Wirecast at the helm. It's what Wirecast is built for, and what we've always expected it to do. However, this past November we had to use Wirecast in an unexpected way. Our women's soccer team won the Ivy League conference title, and was selected to host a first round game in the NCAA tournament. We received a phone

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call from ESPN, asking that we produce a broadcast of the game for ESPN3, as we do for some football, hockey and basketball productions. Unfortunately, our control room was already busy that day for a scheduled hockey game, so we were stuck. Instead of getting back to ESPN3 with an unfortunate rejection, we decided to pull off the largest and best-produced broadcast we could…all using Wirecast on a laptop. The basic setup included three cameras connected to the laptop. In addition, we added three major things to make our production more professional, and better suited to ESPN standards:

1. **Graphics** – We created custom graphics in Wirecast specific to this NCAA game. From score bug, to intro graphic, to side panels, to lower thirds – having branded graphics made a big difference, and differentiated our broadcast from any "typical" web

   stream out there.
2. **Program Open** – As typical, we had two commentators call the game. However, in our effort to "look more professional," we decided to pre-tape a complex open, as we do with our larger shows. We started with exterior establishing shots we recorded ahead of time (with an underscore of intro music), then we put the commentators on camera with lighting and stand-up stick mics. Finally, we alternated between our other cameras, each with a game-relevant graphic (such as head-to-head stats, players to watch, bracket, etc.). As expected, the first couple of tries didn't go so well, so we practiced the open over and over again. Eventually we got it right, and were able to use that recording to start our Wirecast show, and then transition to live cameras once the game began. This professional opening to the broadcast made a big difference, and set the tone for the overall show.

3. **Output** – When we typically use Wirecast, we output our production in two different ways – a MP4 recording to an external hard drive for archive purposes, and a RTMP stream to the Ivy League Digital Network. However, neither of those was relevant to ESPN. They wanted us to transmit the production to Bristol, CT using a special HD-over-IP encoder they provided (which takes the place of a standard satellite uplink truck, or dedicated Vyvx

fiber). We had never done anything like that before using Wirecast. The encoder had many different inputs options, and we spent a considerable amount of time with ESPN Transmission trying to figure out what we could do. We really wanted to use a Black-magic Mini Monitor to get a HD-SDI output from Wirecast into the encoder. However, all our Thunderbolt ports were already in use. Our next choice was the built-in HDMI out of the laptop. That worked well, but for some reason the encoder did not receive embedded audio within the HDMI feed. Therefore, we also had to take analog audio from the laptop (using a 3.5mm TRS to DB9 cable) and bring that into the encoder. All-in-all, not the simplest of solutions, but it did provide crystal clear video and clean audio, without taxing the laptop too much.

We were very excited to see that Telestream had released Wirecast 6.0 shortly before this production. The upgraded 64-bit version allowed us to use all inputs and outputs on the laptop with low to moderate CPU usage. We were also able to try out Wirecast's new replay feature, which we plan on incorporating into more of our productions in the future.

Wirecast on ESPN3
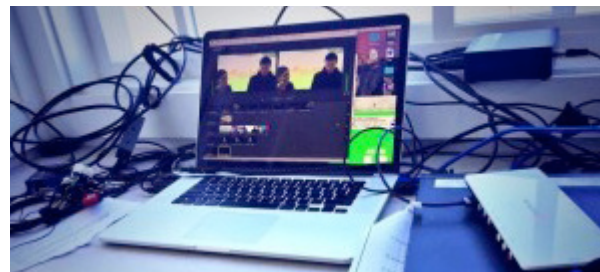
Wirecast and ESPN3 HD-over-IP encoder

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As described in this post, Wirecast provides incredible flexibility in usage – from a one camera stream on a boat, to a multi-camera ESPN3-level telecast. With new features coming out with every software update, and with technology improving and becoming cheaper by the day, these productions are really within reach for almost anyone. All you need to do is plan ahead, watch the details, and test…test…test.

About The Author

Imry Halevi is the Director of Multimedia and Production at Harvard University's Department of Athletics, with responsibility over live event broadcasting and post-production. A native of Maccabim, Israel, Imry lives with his family in Nashua, NH.