

# HDV: The little camcorder that could, and does

By Anne Rawland Gabriel

**T**here's a new technology myth in town and pubcasters who believe it could waste hundreds of thousands of dollars equipping crews for high-definition.

While the myth takes various forms, it boils down to this: Don't even think about using the inexpensive, yet remarkably advanced, high-end consumer HDV camcorders because their footage supposedly won't stand up, short- or long-term, to output from their professional HD cousins.

In lay terms, advocates say, the myth is comparable to saying you need a Rolls Royce because a Honda won't get you to the grocery store.

Not surprisingly, the Rolls Royces are the professional HD cameras, which weigh 25 to 30 pounds and cost about \$70,000. Similarly, the Hondas are the so-called "prosumer" HDV cameras, which scale-in under 5 pounds and cost about \$5,000.

What may be surprising is that PBS viewers are already watching programming shot with HDV cameras. "*Frontline* began incorporating HDV nearly two years ago," says Director of Broadcast Tim Mangini. "And *Frontline/World* is now shot almost exclusively on HDV."

Back in America's heartland, HDV cameras are booked solid at Twin Cities Public Television (TPT), opening heretofore off-limits opportunities for HD production. "For example, we're producing a documentary about the St. Paul Chamber Orchestra's Eastern European tour this coming summer," says Robert Hutchings, a 25-year videographer and postproduction specialist at TPT in St. Paul, Minn. "We'd have declined the project without HDV because a 'professional HD' camera's size and shooting expenses would have been too prohibitive."

But is HDV really ready for prime time? As in other production decisions, that's a matter of respecting the technology's strengths and weaknesses.

## HDV is real HD—and looks it

For many pubcasters, HDV suffers by association with analog's amateur video formats of the past, whose quality was compromised by the inherent frailties of analog tape. "Go back 15 to 20 years, and the bias against consumer video cameras was justified," says Adam Wilt, of Mountain View, Calif., a respected writer and tester of HD technologies who is also a veteran videographer and engi-



**Frontline/World is prepping to shoot its fourth segment in HDV. Pictured: Josiah Hooper during earlier shoot in Uganda. (Photo: Carl Haynes, Kiva.org.)**

neer. "But, with HD digital, the difference in picture quality has narrowed significantly."

Bruce Jacobs, as chief technology officer at TPT, was wrestling with HD camera purchasing decisions early last year. At that time Jacobs was also serving on the PBS advisory committee for HD standards, where HDV generated considerable debate.

Coincidentally, TPT was asked to post-produce a documentary that required blending footage from a professional Panasonic VariCam and a prosumer Sony Z1 HDV camera.

Curious whether viewers could tell the difference, Jacobs set up an impromptu test. "I said to our editor, 'Don't tell me what's HDV; let's see if I can guess,'" recalls Jacobs. After viewing the finished product, he thought he'd nailed it. "Instead, I failed—completely."

Jacobs began taking HDV seriously and laid out his findings at the 12th annual Iowa DTV Symposium last October.

Despite their smaller price and size, HDV gear yields video in the same 1080-line interlaced format that public TV has chosen as its standard: 1920 x 1080 pixels. That's roughly 2 million pixels per frame, compared with about 300,000 pixels per frame of standard-definition (SD) broadcast video.

Not surprisingly, shooting HD produces literally billions of bits of data per second. Given the limits of today's broadcast technologies, these bulky files must be compressed regardless of the type of camera.

"Professional HD" cameras capture image

data on individual frames, requiring relatively expensive tape media for storage plus costly transports for ingesting the footage into a postproduction system. In the editing system, when "professional HD" footage is compressed, each individual frame is processed independently. Theoretically, data loss is unnoticeable or at least unobjectionable. In comparison, HDV cameras perform an aggressive form of MPEG-2 compression during acquisition. In short, the scheme handles frames in a set of 15 called a "group of pictures" (GOP).

In each GOP, the first frame captures a complete image and the remaining 14 frames retain only data that differs from the first. As a result, HDV cameras use the more affordable tapes and transports already developed for standard-definition prosumer DV cameras. Hence, the term HDV was derived by combining "HD" and "DV."

When an HDV camera is held steady, lighting is sufficient and the subjects move relatively slowly and minimally, HDV footage can appear as good as "professional HD." But HDV's capabilities are challenged by complex, rapidly changing images filled with ultra-fine detail—fast-panning handheld footage of a busy soccer game, for instance. This can create artifacts—mild to severe image noise.

However, muffing movement isn't entirely the format's fault. "It's important to separate the camera section from the recording format section," says Bruce A. Johnson, a veteran videographer for Wisconsin Public Television in Madison. "What's lacking in HDV, today, is sufficient quality in the camera portion."

In the near term, fine HD quality distinctions may not be visible to home viewers, because the full image quality doesn't reach them.

First, for stations to jam high-def into the 19.4 Mbps broadcast pipe, DTV encoders put HD through further MPEG-2 compression.

At the viewers' end, even the priciest HDTV monitors are based on hardware standards hammered out in 1996, rather than software-based standards that could be upgraded. This essentially dooms today's sets to be stuck with MPEG-2 quality even as better formats, such as MPEG-4, are coming on the scene.

"Over the foreseeable future, viewers won't be able to differentiate between HDV and HD, assuming shooters know their craft and their cameras," says Johnson of WPT's

Digital Innovations Unit. "Remember, poorly shot 'professional HD' looks terrible on an HDTV, no matter how much a camera costs." TPT's Hutchings, concurs. "I've shot a bunch of footage with a lot of quickly moving little details," he says. "So far, I haven't seen the codec break down enough for most people to notice."

## Right camera for the job

Early adopters of HDV emphasize that the real question isn't a simple choice between pro HD and HDV. Rather, it's "what's the right camera for the job?"

"Unlike with analog, absolutism doesn't always give you the correct answer in the digital world," says Wilt, whose production house uses both "professional" and "prosumer" cameras. "You must mix practicality with purism."

*Frontline* and TPT both find it practical to use HDV as B-roll cameras, for example. "As a second camera, HDV's far less expensive for getting cutaways and shorter shots, which we judiciously intercut with footage from our bigger camera," says TPT's Hutchings. "And, for a Discovery Channel shoot, the producer operated the B camera because he had to be there anyway."

HDV may also be the best choice wherever you'd be risking a camera that costs more than a Mercedes-Benz. "Let's say you're on a river, behind a waterfall or anywhere that's wet," suggests Wilt. "If you soak an HDV camera, you go buy another one for \$5,000." But ruining the lens alone on a professional camera might set you back \$20,000.

Safety and access are other concerns solved by diminutive rigs. "I shot some documentary footage in an acrobatic plane," says Wilt. "It was difficult enough with a 3-pound camera, much less with a shoulder-mount that could fly off at the wrong time and hit the pilot in the cockpit."

For *Frontline*, HDV reduces danger from men with guns. "Some producers who spend significant time in war zones, such as Iraq or Afghanistan, prefer to work with gear that draws less attention to itself," Mangini says.

An HDV camera looks like something a tourist would carry, echoes Bill Megalos, an international documentary filmmaker and USC professor whose credits include the PBS series *Quest for the Killers* and *Legendary Trails*. "They're less intimidating to subjects," Megalos, who has traveled widely in Asia. "Plus, I love breezing through customs with my HDV where I'd otherwise be questioned, or even prohibited, if I were carrying a 'news' camera."

At TPT, Hutchings agrees. "We're a *News-Hour* bureau," he points out. "Our journalists go to countries where you couldn't get the story with a high-profile camera."

In a YouTube world where viewer-generated content is prized, the cheaper equipment also makes it practical for stations to lend out cameras like never before.

"When cameras cost nearly \$100,000, there are few in the community," says Megalos. "But, the HDV price point, along with some training, allows for putting cameras into the hands of more people—including talented viewers. That's what the excitement over HDV is really all about."

For David Felland, engineering chief at Milwaukee Public Television, HDV cameras are good for many types of local programming and he regularly entrusts student interns with HDV cameras. When producing a railroad program he doesn't mind attaching HDV cameras to a locomotive.

But Felland doesn't believe HDV is appropriate for national broadcasts. He also prefers pro HD for longevity and greater flexibility, while maintaining quality during postproduction.

"We always try to err on the side of a higher-quality acquisition format, if we can afford it," says Felland, whose station was among the first HD producers in public TV. "The acquisition format is the limiter—you can't reconstruct what you never had."

Therefore, Felland goes with the best affordable professional equipment, which typically has larger and better pickup devices. "The cost of the professional hardware has fallen dramatically, making it more affordable for public television programs," he says. While others strongly agree with focusing on quality, they reiterate the issue isn't black and white. "Nobody's suggesting that stations bypass professional HD cameras altogether," stresses TPT's Jacobs.

Also, any problems encountered in repurposing of HDV footage some day may be mitigated by the advance of technology. "By the time it's a viewer issue, software advances will do a better job of up-scaling to new formats," argues WPT's Johnson.

## What doesn't work so well

Despite their praise, HDV users are quick to point out the format's imperfections.

"HDV uses what's called a 4:2:0 'color space,' which means a lot of compression in the color information," says Megalos. "So, HDV is unsatisfactory for mattes and keys. In other words, HDV doesn't do green screen very well."

To avoid putting the images through an additional round of severe compression during editing, users advise that producers down-convert it to SD or up-convert it to HD.

For the production that doubled as TPT's impromptu comparison test, postproduction specialist Ezra Gold used common sense as his guide. "Since the broadcast product would be HD, it made sense to cross-convert

on ingest to the more robust HD editing format."

"But, HDV's a sort of oddball format," he continues. "Although up-converting doesn't change the quality, it provides more editing options, such as higher resolution graphics." From his experience, Gold recommends open communications between acquisition and editing departments. "It's important for shooters and production to understand the best ways to use the format," he says. "Then, enlightened decisions can get made in the field."

*Frontline* reports inconsistent time-code handling has caused considerable post-production conflicts. "In particular, the Sony HVR Z1U in 'fast start' mode can create time-code errors that ripple throughout the digitized material from a camera tape," says Mangini. "Turning off 'fast start' seems to help, but doesn't solve everything."

"Due to the long GOP, time-code in any HDV camera can be problematic," he continues. "Be sure to test your camera and productions systems, off-line and online, together. Then make adjustments. While this is a cautionary tale, it's not a warning to abandon HDV."

Indeed, Wilt also recommends thoroughly testing HDV cameras in real-life shooting situations. "Come at HDV without the FUD (fear, uncertainty and doubt) injected by certain players," he says. "Shoot some of the things your station is likely to encounter. Then decide where the small cameras are appropriate and where they fall short."

The next infatuation

Prosumer cameras can help producers minimize the pain of inevitable obsolescence, as new pro gear arrives. But even HDV's longevity is in question.

In 2006 the video industry was abuzz over the introduction of "AVCHD" cameras, so-named because they use the more advanced MPEG-4 AVC/H.264 compression format. Developed and pushed by Sony and Panasonic—but not embraced by all manufacturers—the relatively high-quality AVCHD equipment also promises to turbo-charge production efficiency by recording data on nonlinear, tapeless media such as hard drives, memory cards and 8cm DVDs.

While computer jockeys are accustomed to navigating such swiftly changing tech currents, broadcasters are still learning to accept shorter equipment lifecycles. Luckily, the barriers to change are falling with prices, says Megalos. "Even if you only use HDV cameras for two or three years, you'll more than recoup your investment." ■

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