HIGH DEFINITION Frequently Asked **Questions**

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The following FAQ is a collection of interview excerpts combined with data from ITVS and PBS on the topic of high definition (HD) production and programming. The interviews were conducted in early 2009 with a number of industry professionals:

- POST PRODUCTION HOUSES
  - Pillar to Post (PP)- Jim Powell, General Manager
  - Video Arts (VA)- David Weissman, General Manager
  - Splice Here (SH)- Heidi Shuster, Production Manager
- CINEMATOGRAPHERS
  - Vicente Franco (VF)
  - Jon Shenk (JS)
  - Michael Canzoniero (MC)
- EDITOR
  - Heather Weaver (HW)
- PRODUCERS
  - David Grabias (DG)
  - John Kabasakalis (JK)
  - Peter Rosen (PR)
  - Juan Mandelbaum (JM)
  - Doug Hawes Davis (DHD)
  - Marco Ricci (MR)
- REFERENCES TO PRODUCTION
  - Doculink
  - Creative Cow

CAVEATS

⇒ Please note that where possible we have tried to synthesize answers, although we have done this with a minimum amount of editing.

⇒ Answers to questions are the opinions of the interviewees and should be read accordingly. Sometimes answers may reflect contradictory opinions.

⇒ Nothing within this document should be construed as a recommendation by ITVS or ITVS staff.

CATEGORIES PAGE

TRENDS – PBS/ITVS/Broadcasters

ITVS: What questions do producers ask ITVS most often in regards to HD?

ITVS: Some of the frequently asked questions addressed to the ITVS production team include:

- Is it true that PBS is requiring delivery only in HD?
  - Answer: No, as of early 2009, PBS is still receiving Standard Definition (SD) Program Masters.
- Is mastering in HD going to make my show look better?
  - Answer: If your show was shot in Standard Definition, mastering in HD will not increase image quality. On the other hand, if your show was shot in HD, mastering in Standard Definition will hurt image quality. HD mastering will retain the most accurate representation of the image quality that a show was originally shot in.
- How many HD programs is ITVS receiving?
  - Answer: See next page.
- Should I do the upconversion?
  - Answer: See Upconversion section.
- Can I get an extension on delivery deadlines and budget due to technical difficulties with my HD show?
  - Answer: This scenario is determined on a case-by-case basis.
- What does PBS consider full HD?
  - Answer: See below.

ITVS: What does PBS consider HD?

PBS: HD is defined, per industry standards, as the picture formats 1920x1080 (i or p) and 1280x720p with an aspect ratio of 16x9 at any frame rate.

High Definition Acquisitions:
Video acquired in the image formats noted above (1920x1080 (i or p) and 1280x720p) at any frame rate. 35mm film is accepted as an HD acquisition format if converted to video on a high resolution—minimum 2k-telecine.

HD programs may contain non-HD content. Examples of non-HD footage include archival footage, up converted SD footage and HDV footage. Consumer grade models are not acceptable for HDV acquisition. The total amount of non-HD content from all sources in an HD program shall not exceed 30 percent.

High Definition Programs:
Those programs with content that meet the criteria as set forth for herein. Programs with more than 30 percent non-HD content shall be considered SD Widescreen programs.

High Definition Program Submission Format:
High Definition programs should be submitted on Sony HDCAM 1080i/29.97. Regardless of the acquisition format or frame rate all program submissions must be converted to the submission format.

ITVS: What is the HD format that PBS accepts as their HD standard tape delivery of programs?

Editor, Heather Weaver (HW):
PBS takes HDCAM, which is a particular HD format 1080 60i.

ITVS: How many applications received through ITVS Open Call were noted as being shot originally in HD?

ITVS: In 2008 Open Call Phase II, out of 368 applications, 148 were in HD (40 percent). In 2008, Phase III, 9 programs out of 31 were in HD. In 2009, in Phase III, 21 programs out of 31 were in HD.

ITVS: How many films are being delivered to *Independent Lens* in HD?

ITVS: *Independent Len's* 2008-2009 season has 11 HD programs out of 26 total programs. According to the Indie Lens team, PBS has taken on the job of upconverting all IL programs not delivered in HD to High Definition by pillarboxing them.

ITVS: How many ITVS Domestic programs have been delivered in HD?

ITVS: Since the inception of ITVS in 1990, approximately 52 programs have been delivered in HD out of 890 total programs delivered.

ITVS: How many ITVS International programs have been delivered in HD?

ITVS: Since the inception of the ITVS International initiative in 2004, 10 programs have been delivered in HD out of 43 total programs delivered.

ITVS: What is the preference of HD over SD programming? What happens to SD programs delivered? To what extent will PBS accept SD?

ITVS: Currently, many PBS shows such as *American Experience*, *Nova* and *Antiques Roadshow* are being produced in HD (90 percent), so there is a real push from PBS Programming toward HD. However, PBS will continue to broadcast native HD alongside SD programs that are upconverted as they move to prioritize HD. PBS has stated that it will continue to accept SD for the foreseeable future, especially from the independent producers and ITVS in particular.

ITVS: How many PBS stations have an HD channel?

ITVS: The majority of local PBS affiliate stations have an HD channel.

ITVS: Will delivering in SD hurt the chances of a show going to PBS?

ITVS: Despite moving towards making their HD channel the primary PBS channel, PBS will continue to simulcast native HD shows along with upconverted SD shows. PBS Programming executives have said that in the case of *Independent Lens*, and working with independent producers, they will always look at the content first when making programming decisions.

ITVS: If I do a home video deal with PBS, can they distribute my HD program on Blu-Ray?

ITVS: Yes, PBS DVDs are now available in the Blu-Ray format

ITVS: Of all shows being broadcast on networks and cable, what percent are being delivered in HD?

ITVS: At this point, most of the non-PTV broadcasters that are working with documentary filmmakers are making strong moves toward HD production. For example, the National Geographic Channel has said that it will only broadcast 10 percent of its programs in SD. In addition, they said they don't accept HDV and HDCam formats. This is similar to information we've been getting from Discovery and A&E where there are very specific delivery requirements involving HD (see below).

ITVS: Other non-PTV broadcasters require specific HD cameras to be used for their productions, in order for their productions to qualify as having originated in "native HD". When you say that Discovery and A&E require specific cameras for their HD production, how do they know what camera you are using to shoot those productions?

Producer David Grabias(DG):

You tell them what camera you're using; the budget is in the contract you have. That's all worked out and stipulated, but what ends up happening is after I deliver the master it ends up going to quality control (QC]) They put it through a whole set of tests: to make sure there are no glitches, to make sure the time code is solid, there are no drops, there are no weird blacks, that the resolution is what it is consistently across the piece, they put it through a scope to make sure the whites and blacks are all broadcast safe and that kind of stuff. And often times those guys say, "Hey, this show looks really gummy" or "It doesn't look like it was shot on a Vericam or whatever else," and that's where you can get into trouble. Because if you get into issues with QC; if QC is saying it's not exactly the resolution or it doesn't look like it was shot in the resolution that you said it was, theoretically you're in violation of the contract, and bad things happen.

ITVS: Are A&E and the National Geographic Channel currently receiving anything but HD?

DG: They are. Basically, it all comes down to how much they want the film. (Laughing) How much they want the project. And if they love it and it's shot in DV, then they don't care. But nowadays, if they are commissioning, or the idea—the origin of the film comes primarily from their side—then they pretty much mandate HD.

ITVS: When you say A&E and the National Geographic Channel "mandate" HD, what format specifically? Are they talking about 1080i for the most part?

DG: They'll take 1080i. They'll take 1080, they'll take 720, but it has to be delivered on HD Cam, and the show has to be at least 80 percent or 90 percent shot on a 2/3 inch chip camera. And that does not include for the most part HDV or hand-held cameras. It has to be a shoulder-mount camera for the most part.

TRENDS – Industry

ITVS: What kinds of trends have you been noticing in terms of shooters adapting to HD?

Cinematographer Vicente Franco (VF):

There seems to be a growing gap between prosumer and professional equipment and formats out there, that's for sure, especially in the lack of technological expertise. But I do believe that the basics are not going to change. We are just discussing tools. The folks that use those tools are going to be different. There are professionals using prosumer equipment, as well as beginners using professional gear. When film was king, there were a number of folks still shooting on Super 8.

ITVS: On the program delivery side, as an on-line post house, what percentages of HD delivery are you seeing right now?

Post Production House Pillar to Post (PP):

Off the top of my head: 10-15 percent. And at this point we're going to see the number go from 15 percent to well over 50 percent within the next six months. That's the trend I'm seeing. It's been hit or miss: just watching the programs on the shelf and seeing the numbers. Plus, I've been speaking to producers about upcoming projects, and as they're moving into the future, everyone's preparing for HD delivery, whether they're shooting on HDV or HD Cam or Vericam or DVC Pro 100. There are a lot more producers who are doing their acquisition in HD, and they're feeling a little more comfortable about cutting together their program on Final Cut, in HD, and we're giving them the opportunity to deliver the programs through us on a hard drive, or another method so they don't have to run out and buy an HD Cam deck.

ITVS: Will the other formats (non-HD) be obsolete? If so when, and who knows this information?

DG: It is hard to tell when the formats will be obsolete. The digital transition for broadcasters speeds up the requirements programmers impose on producers delivering to them (National Geographic, History Channel, ESPN, the networks and Discovery all program strictly on HD). On the other hand, Public Access stations and Corporate Video for the Web still use lower end Standard Definition cameras for their fast turnaround, low cost projects.

PP: Don't ever expect any format to become obsolete soon: look at BetaSP. People have been using it since 1988. Even DV, has been around since 1996. Of course, some formats have gone by the wayside, such as D-VHS and D-9.

ITVS: Are there any online streaming or download sites delivering in HD?

ITVS: Yes, many websites are starting to move to streaming in HD. There are particular IPTV set-top box technologies and services like Vudu and Netflix's Roku that deliver HD programs to your HD television over an Internet connection.

TECHNICAL – Tips

ITVS: If a producer decides to shoot in HD, what HD format would you recommend?

HW: When producers are considering HD formats, I would consider shooting at least 60i, so you don't have to deal with the weird cadence issues of shooting 24p. Or if you are dying to use 24p, or 30p, go and see what it looks like when it's going to be HDCam 1080 60i, to make sure you like the way it looks. So you're not thinking, 'Oh, my, why is it looking stubby and weird?'.

ITVS: What should producers consider about shooting in HDV?

HW: When considering HDV there are issues. The BBC doesn't recognize HDV as HD, except for extreme cases. A few years ago, PBS did come out publicly and said, well, we'll accept it. But HDV has issues. First of all, because it's MPEG encoded, you actually don't have all the frames that you're working with. The computer has to think to make up the frames. So, in an off-line process that could really bog down your system; since the frames aren't actually there, the machine has to think to make that frame up. You're asking the computer to do a lot more work. You also have to consider the way things look. If somebody has already started, what can you do? But if you haven't, you should look at it very carefully, especially what it does in regards to motion. HDV is particularly bad if you're panning or driving, because everything is moving constantly, that's a lot of predicting to do. An interview subject is not going to be as bad.

ITVS: What are some of the issues in terms of deciding which frame rate to use?

PP: For somebody sitting there talking, you don't notice a big difference between 24p and 30i. A trained eye can kind of pick it out and see the frame rate. You can notice the frame rate. Some people like 24p because it's a better way to convert to film for a theatrical release. If you're looking for a reason to do 24p vs. 30i on your acquisition and your editing, it would be if you were planning on doing theatrical release and going to film, or mixing with film materials to give you a consistent look.

ITVS: Are there any issues, in the post-production side, in terms of mixing formats?

Post Production House Video Arts (VA):

It's better to not mix formats—less costly post, possibly better picture. Our mantra at Video Arts is: "Pick a frame rate and stick with it." For PBS HD projects, the easiest way to go is to shoot 1080i, acquire stock footage that is either 1080i, or standard def at regular 29.97 fps video speed. All of your footage will then be at the same frame rate, and it will all be interlaced. All will go pretty easily and cheaply this way, unless and until you decide you want to try to qualify for an Academy Award nomination. Now you've got a problem, because the Academy (of Motion Picture Arts and Sciences] will require that you convert your program to 24 fps progressive. And that's a daunting, quality-compromising task.

TECHNICAL – Upconverting

ITVS: What are some of the basic issues with upconversion?

PBS-HD Delivery Video: Perhaps the most critical consideration when talking about upconverting video footage is the video quality, or resolution. The factors that determine resolution determine the crispness, variety of colors and overall quality of the image.

A key difference between animation and video is the way straight lines are created. Video uses a Raster algorithm, which calculates and interpolates pixels through horizontal and vertical lines. It is unable to calculate on the diagonal, therefore there is a jagged or stair-stepping effect.

When video is upconverted, these interpolations and estimations must be made in order to compensate for the lower resolution.

When we convert standard def footage to high def, we are creating new picture information that was not there to begin with. The horizontal and vertical lines of the 720 x 540 image are interpolated to the new dimensions, 1920 x 1080. The limitations of the original format become apparent, even magnified.

Added to the inherent problems of standard definition footage upconverted to high definition footage, is the distribution life cycle of PBS shows, or their codec cycle. Our shows can start at the highest resolution level at ingest, which is 145Mb per second, and yet end up airing at a noticeably lower quality.

ITVS: How does upconversion affect the budgets?

DG: The big issue is if you're combining HD and standard definition. Or if you're really silly you would also get HDV involved in the mix. Then when you get to that final stage, after you've done your editing and you go to an on-line facility, like Video Arts, and they're doing that final conforming—then they have to sit there and upconvert and conform all the clips to HD. That can take a lot of time and it can be costly, depending on how you upconvert the standard definition clips (there are different ways to do it, using software or hardware). You could spend a lot of money doing that. They have this machine called the Teranex, which upconverts from standard definition to HD, and it's $300 or $400 an hour. So, it's a pricey process.

VA: Upconversion is something you want to avoid if possible. Some of our customers think that upconversion is some sort of alchemical process, where they hand us their program and it's made of silver and they think that upconversion makes it gold. And it doesn't do that. It just makes it a bigger picture, and hopefully does not exaggerate any piece of existing artifacts. But for a documentary producer that has a project they are going to start this year, I don't think they should hesitate too much to decide to produce it in HD. The obstacles are not that big these days. Depending upon the specific needs they have, it might be more challenging, but in general it isn't. We work with a lot of people who have very small budgets and they've been able to switch over to HD.

VA: When you upconvert, you're basically inventing pixels that weren't there. You're multiplying the pixel count by six. So when you start with an anamorphic SD image, you're starting with an image that actually has sort of squeezed into it, greater resolution than a 4x3 SD image, and its aspect ratio is identical to HD aspect ratio. So you're not having to change the aspect

ratio, which is a big deal when you upconvert; and you're starting with the maximum amount of resolution that standard def can handle. So you're not really pushing it up as much as if, for instance, you started with a letterboxed image. That's a big deal, to take a letterboxed program and make it full-screen HD 1080, is considerably more enlargement than starting with an anamorphic image.

VA: The issues with upconversion are very similar to the issues with taking a videotape and transferring it to 35mm film and showing it in a movie theatre. It's putting it on a giant screen instead of on a television set, you know. So, you have to really have a good eye on everything that's going on in the frame. Because if you see something that looks strange, you can just know that it's going to be very obvious when you upconvert. One of the issues we stick to with upconversion, is if you mix frame rates in standard def, which you can do, you can shoot with certain Panasonic cameras, you can shoot so called 24p, which is actually very good, but if you mix that with non-24p material the upconversion becomes much more problematic and has to be done in multiple passes to do a really nice job. So that's another issue. If you're using Standard Definition footage in your HD program, you get the best quality stock footage, the highest quality format you can afford. But almost as important, or maybe more important again is the consistency.

WORKFLOW – Production and Post Production

ITVS: Can we get an overview of the post workflow for HD and SD and contrast?

PP: On the on-line side, we accept either HD Cam or a hard drive from a Final Cut or an Avid system. Usually we'll ask the producer to create a QuickTime version using the highest quality codec available in their system. So, for Final Cut they might be using a Pro-Res HQ codec and they'll often do two things: they'll take their full Final Cut project and put that onto a USB or Firewire drive along with a rendered QuickTime using the Apple codec.

ITVS: What issues arise when shooting in native HD?

Jon Shenk (JS):

I can speak to two realms. At Actual Films, we bought the VariCam and we bought a DVC Pro HD Deck. Even though those things are expensive, the reality is for us, it's a relatively easy, fairly straightforward means of production. You shoot on tape and you digitize in Final Cut Pro (FCP). A big part of this is FCP and the way it has matured over the years. Now the DVC PRO HD codec is really nice. It can withstand a couple generations of dubbing and transferring in and out of Final Cut, straight from the deck into your machine at native res, at 24. You can either stay in-house for the color correction or put it back onto a hard drive and bring that to a color correction facility, and it's just awesome. You're working at your native res the entire time. It's kind of like the workflow that was invented when DV came out: there's the Mini DV, you put that into Final Cut. In DV, you never go back to the tape, and that's kind of what we do with the VariCam. Now, it's trickier when you're shooting the Sony HDCAM stuff because that codec is so much more memory intensive, it takes so much more hard drive space, and you need faster, bigger drives because it's such a beefier codec. Now some people argue that it's worth it because the HDCAM is just a better, cleaner codec: it's 1920 x 1080 vs. 1260 x 720. But we found for us the VariCam looks great, and we've had it converted to film and for us it's kind of a nice middle ground. It's not the super high-end HDCAM, but, on the other hand, it's way nicer than some of these smaller HD cameras. It's a real camera in the sense that you can have real lenses and it's not a little palm-corder type thing.

That's worked for us, but there are all kinds of people out there. There are people who don't want to shoot on the VariCam because it's not clean enough, the codec is too compressed for them, and they would rather shoot with the Sony HDCAM. And now there's a whole other realm of thought, that these codecs that were invented five or six years ago are no longer good enough. So now you have the Apple Pro-Res and the Web camera, and there's a whole second generation of HD cameras coming out that are in the next couple years, that are probably going to take hold. And really, what I consider the first generation of HD—like the VariCam and the Sony HDCAM, the F-900 cameras, I think those cameras are going to go away and you're going to see these nicer codec cameras and different options coming out. In a way we're at a place right now where we're sort of at the end of the first generation of HD and you have all this tapeless stuff that's coming out, that offers certain options.

ITVS: It seems like if you're working with your VariCam or your HDCAMs, the work flow is still pretty much the same, where you produce your camera masters on to tape and those tapes get digitized. Is this correct?

JS: In either case, the VariCam or the HDCAM, you have to have the camera and you have to have the deck. Whether you rent it or own it is another story, but you have to have both those things. The nice thing about the VariCam is

that most people can buy FireWire drives that can handle the VariCam, like DVC PRO HD resolution, but HDCAM is kind of a different story. Most people don't have the processing power or hard drive power to handle uncompressed or even HDCAM compressed files. Then you get into this whole thing of having to digitize an off-line version and then going back to your tapes in the end, to on-line.

ITVS: What are some of the issues when shooting with P2 cards?

DG: In the old days, the cameraperson would hand me a tape and I would scribble a number (101, 102, whatever it is) on the tape and I'd put it in my bag, and as long as I didn't lose the tape, we were fine. Now it's different. I need to be much more on top of the cards as they come in – making sure that they're actually getting downloaded—duplicates of them and—that I've got the drives in my bag, safe at the end of the day. You have to be much more attentive to that whole process. In some ways it's a challenge. It adds more work for the producer, but I think it also makes me, quite honestly, pay more attention to what we're shooting. Which definitely makes me a better director, in the field.

ITVS: What are some of the issues in terms of post production workflow when using P2 cards?

DG: The clips are copied off of the p2 card onto a portable FireWire drive in the field. That drive comes into the edit bay. It's copied onto two different drives. There's a duplicate of it. One copy just goes on the shelf as a back-up. With the other copy we then open up the files in Final Cut Pro and import them into Final Cut Pro. The P2, the original files are MXF files, we save those, archive those, in case we ever need to go back to them, and then Apple creates the QuickTime files. Basically, with Final Cut Pro, we open one project, we import all of the media into Final Cut Pro - it's QuickTime files that have the same exact name as the original MXF files. I save that. That Final Cut Pro project becomes just our original import project, and then we create a *new* Final Cut Pro project that the assistant editor, or I, or the editor goes into, and they essentially copy the clips over into the new project, re-name them, and kind of log or organize them there. That way, if there's ever an issue with the QuickTime clips being corrupt and we need to go back to the original MXF files, I can open up that original import project and I know exactly what the connection between the QuickTime files and the MXF files. We can track it back, essentially. There's a real connection there. It's very easy. I don't have to guesstimate or dig around. It takes two minutes to re-capture something if something goes wrong. And that does happen. I've had it happen once. But it does happen occasionally that the QuickTime files get corrupt; it's a disk issue or a software issue, and you have to re-capture them, or re-import them into Final Cut Pro, and if you've re-named the clip, there's no way of knowing which MXF clip it is.

DG: That import project, as an intermediary step, allows us to track it back. And then, once it's in, we work with the QuickTime files, edit away, and basically edit the project ALL in Final Cut Pro, in-house. And when the project is done and Picture Locked, we media manage it on a portable drive. We take the project and the media that's associated with that specific media managed project into a Final Cut Pro bay that has an uncompressed output. They go through, make sure everything is rock solid, that there's no weirdness in the project. Typically they do the color correction. And then they do an uncompressed output to HDCAM, and then that's our broadcast master, and then the audio mix gets laid back to that as well. So, basically we do everything up to the final form and output in my office in the Final Cut Pro bay that we have. Again, with P2 I never have to go back to the decks, all I need is a lot of disk drives and that's it. I can plug away, happily.

ITVS: What are some of the issues in terms of post production workflow when using the HDV format?

DG: Honestly, we've shot one film on HDV for A&E, and we had a lot of issues in post. In production it's easy, but in post we had a lot of issues. For example, we digitized the material at E resolution, a lower resolution so that we would use less space, so that we would be able to edit without having to render all the time. We spent 8 weeks editing, and then at the end of the editing process we went to re-capture all of the material at full HD resolution, again, in an uncompressed situation with a deck using an HDMI output going directly into the system so that we were getting full HD resolution going onto the tape, and we had all sorts of problems with time code matching up where there were slippages. That apparently is very common, that the time code is not rock solid in that format, so that if you're going back to re-capture and conform the piece in HD, for an hour show, there's probably 300 shots in the show and out of those 300 shots, maybe 50 didn't match up. A lot. Then you have to eye match all of those shots, and when you're in an on-line situation, where you're paying anywhere from $150-$200 an hour, the bill goes up quickly. And that's really the issue with HDV—in the field, it's just like shooting DV really, there is no big difference, the camera feels the same, looks the same, the tapes are the same. There's not a whole lot of difference in terms of the production workflow. In post-production, when you're editing in HDV format, since this is a really memory intensive format, it will require you to render all the time. So, in documentaries obviously there are a lot of cuts; you're re-editing stuff all the time, and rendering slows the process way down. Most editors don't want to work that way. Or you're editing in DV resolution, and you're looking for trouble when you go to on-line the piece. My advice would be to stay away from these.

DG: The renders are super-intense. I have a pretty fast computer, and all that kind of stuff, so especially when you're getting towards the end of the editing process when you've got a complex project, there's a lot of media attached, layers of stuff. You're going to have real significant render issues. Personally, at the end of the day I'd rather not deal with that, I'd rather deal with the conforming issue later on, and just plan for it. Understand that working in HDV means that you're going to have an on-line process that may take you three or four days. It's not just a simple render and output, there are other things you are going to have to take into account. To be safe, you should budget for it.

ITVS: Are there any issues if a filmmaker decides to shoot in 24 progressive?

PP: If you're shooting at 24p, because you like that look, then ideally you would edit in 24p and then in the very last step, convert your finished product from 24p to 1080i. One reason for doing that is so that if you make digital files for distribution through Amazon or iTunes, or any of those digital delivery venues, they're going to want those files to be created from the native frame rate. So, there are two ways you can get to your native frame rate. One is you can make a digital file directly from your 24p source. If you're doing the 1080i conversion as the last step, you can run an inverse telecine on the 1080i project and get it back to 24p. But this is only if you haven't done any editing in 59.94i or 30i. If you edit after doing the conversion—let's say you take your source material, you clone it to a 30i time base, you're editing in 30i because you know your broadcast copy is going to need to be 30i—well, you're doing yourself a disservice there because at every cut point the cadence of your conversion gets altered.

PP: We'll suggest to the producer to edit in their native frame rate. There are a couple of reasons for this. It's a lot easier on their system to stick with the existing frame rate, and just put the program together like that. The only thing, this is another pitfall, is in calculating the real running time. If their

project happens to be a non-drop frame, 24-frame program, they may have difficulty in calculating what the actual TRT of the program is.

ITVS: So as an on-line editor, do you advise producers, "Hey if you shoot 1080i from the get-go, you are probably going to save money in the long run'" or is that not necessarily the case?

HW: You would have to sit down and do the math. It would also depend on what people have access to. I think that probably the easiest thing would be whatever you decide to shoot, hopefully it would be 60i format. I would get SD window dubs, and I would probably off-line in SD, and then go back to the on-line and bring everything in high resolution, especially if you're going to try to do it at home, because the HD takes up so much hard drive space too. Again, it depends on the project and how much money you have, if you have tons of drive space, maybe it's no big deal.

ITVS: If you have your HD masters, and you make SD window burns from it, is there an issue of timecode slippage that could come back and create challenges?

HW: There shouldn't be. Not if they're done correctly at a good facility. I'm not saying that can't happen, but if you're working with competent people it should not happen.

ITVS: What is the best way to archive your source material?

DG: Some people archive to DLT (Digital Linear Tape). It's a digital tape, like a DVD, only it is in tape format. We actually keep it on hard drives. For $100 you can get a 500 gig hard drive, and that holds most of the projects we shoot, (which) are pretty short, or the shooting ratio is pretty low, so it's pretty easy to keep it on the hard drive. We've been shooting P2 now for, I guess two years, so not terribly long. We don't have tons and tons of drives in the closet, but I probably have 10 drives that are full of stuff that we have on the shelf. And then once every six months, every so often, we throw the drives—we just turn them on, just to boot them up, make sure they work.

VA: There's a big debate about this. Nobody really knows what the best archival format is for digital acquisition. I think you're right about hard drives. Hard drives can just die on you. Some people are talking about Blu-Ray discs, because they can hold 50 gigs. And they're supposed to be a little bit more reliable.

PP: If I had a production company and I was dealing primarily with P2 cards and I wanted to back them up, I might consider going to a tape drive as one option. So you've got your data, and, in fact it's one of the things we're doing here. It's called an LT03. Now the downside is it's anywhere from $6,000-$7,000 for an LT03 tape drive. Now the tapes themselves hold 400 gigabytes, and they're about $30-$40. So, for $40 you get 400 gigabytes. You can store quite a bit onto that, but you've got that initial hit for the drive itself. The good news on these things though, is they are intelligent tape drives. They recognize media files like MXF and the other types of digital video assets. Certain ones are specifically made for video application. The lifespan of the tapes is about 40 years, so it's a very secure way of backing up your data for archival purposes.

ITVS: If I produce in HD, should I also mix in 5.1 sound? Are any documentaries being mixed in 5.1?

ITVS: Some might mix 5.1 for their Blu-Ray distribution, but as of this report, PBS does not require a 5.1 sound mix for HD delivered programs.

BUDGET IMPACTS – Production

ITVS: To what extent is there conflicting information about budget impacts?

ITVS: HD is a format undergoing an evolution. Second generation HD cameras are now hitting the market and manufacturers are in a frenzied battle for market share, hence the instability of the technology, workflow and budgets. One of the biggest conflicts, in terms of production budgets, comes from the wide range of producers' technical expertise. Producers that are diving into HD production without the appropriate research are running into budgetary overages well into their production schedule. The large number of formats (HD and others) and format inconsistencies create greater post production costs for the on-line session.

ITVS: What additional costs—in terms of specific line items—are involved in HD production vs. SD production?

ITVS: The line items that get affected the most are 1) on the production side: camera rental/purchase rates and stock (videotapes, P2 cards, optical disks) and 2) on the post production side: deck rentals/purchase, stock footage and faster hard drives for digitization.

ITVS: For P2 card cameras, there is a specific cost difference during production if there is an extra person downloading P2 cards on site. For post production, assistant editors need to be more knowledgeable on format specifics, so a higher knowledge base is needed (training). The extra cost comes down to infrastructure (camera rentals, deck rentals, on-line cost). The workflow stays pretty much the same.

ITVS: What do you see as the benefits of shooting with P2 cards as opposed to shooting on tape- or disc-based format?

DG: It's a financial benefit. The big benefit is that, if I'm renting the camera package, the price of the cards is included in the camera package rental price. So, I'm not having to pay any tape stock charge. I'm shooting HD, so it's at least $15 or 20 a tape. And if you're shooting a long project that adds up pretty quickly to hundreds of thousands of dollars.

BUDGET IMPACTS – Post Production

ITVS: What kind of computer would be best for editing off-line HD? What are the spec requirements?

HW: Apple's Final Cut Pro (FCP) edit systems are regarded as the industry standard for off-line video editing (similar cost Avid systems are also an option). This is due to the fact that Apple has been producing hardware/software solutions for video editing for some time (since 2000). Even though lower cost solutions are available, system reliability is at risk. In contrast, FCP systems have hardware, operating systems and editing software engineered by the same company, and are therefore more reliable. In addition, editor and maintenance talent pools are much larger for FCP systems. In order to edit HD, you would need a "top of the line" FCP system.

DG: Deck rental, tape stock rental. You're looking at $500 a pop.

ITVS: What about on-line costs of HD compared to SD?

VA: The range in increasing budget is sometimes as little as a 20 percent increase, but it can be as much as a 50 percent increase. There are a lot of different factors that go into the increase. One of those factors is how many different formats did they try to mix together in the program. (Due to technological restrictions, when different types of media are being mixed, they each have to be treated separately to up-sample to an HD program; this adds to editor's and machine's processing time.) The more different formats, especially frame rates that they try to mix together, the longer it's going to probably take to really make it look good. 20 to 50 percent, I know it's a big range. It's just that HD post production can be much more complicated, as a process.

Every format has a particular way to get to the end product. Each one—every frame rate, every frame size, every frame aspect, every color space and every codec—has a best way and a less optimal way to get from A to B, and oftentimes people go way out to C and all the way out to F before coming back to B.

Again it gets back to trying to mix lots of different formats together. And with a documentary, it's not uncommon to maybe shoot somewhere between 25 percent to one-third of the program with some sort of HDCAM. And the rest is just all this footage that they acquired: somebody's home movies, something recorded from a local television news station, some stock footage that they bought from Getty, some still images, some PAL from DVD. More of that stuff that doesn't fit the final mastering format for PBS, which is 1080, 1920x1080, 59.94 interlaced fields per second. The more stuff that doesn't conform to that, the longer it's going to take, and the more expensive it's going to be.

Now in regards to post, we have found that HD post can be anywhere from 20 to 100 percent higher. Here are some of the factors:

1. Cost of HD stock/archival footage is higher than SD stock footage.
2. Cost of upgrading your edit system (the CPU, the drives, the monitor).
3. Increased render times compared to DV.
4. And the biggest factor is lack of knowledge about using Final Cut for HD editing, especially when mixing formats, due to computer rendering and editor's time in adjusting frame size, frame ratios, etc.
5. The best way to save money in HD production and post is to shoot with a format that is easy for FCP to ingest, and to work only at high-res, from off-line through on-line. Don't consider off-lining with downconverts,

and then later on-lining with the full-res camera originals. That will cost you a bundle!

ITVS: In terms of budget increases, what about the costs of tape mastering?

DG: It's $150 for the HDCAM masters, and again, you need it texted, text-less, you need two copies of it, one for you, one for the broadcaster, so that's a couple grand, just for your masters, which is significantly more than working in the standard definition world. So again, that's another additional chunk of change.

ITVS: As an on-line post house supervisor, do you give projects longer mastering timelines because they're on HD?

PP: Yes. There's a slightly longer timeline, and when I say that, I'm talking about usually an extra day or two. It's not really a day or two of work here, but just in terms of keeping things on schedule, we'll add a day or two to what we promise for getting an HD program turned around. And you're normally just talking about one or two additional evaluations, and then...dealing with the technical issues that come up: if you have to make a correction to the HD or the SD version of the program, all of the normal things that we would deliver to ITVS. If we do an HD program, then we're creating both the captioned HD Master and a digital BETA letterbox master. And that package is $1,986. So it's a difference of $500, which is about 25 percent I guess.

ITVS: In terms of workflow and momentum, an off-line editor won't want to deal with these challenges during the off-line. When it comes to paying by the hour in an on-line system, should you address these challenges then?

DG: You're not talking about tons of money, but you're talking about adding an extra three or four grand to the end of the process, just to be safe so that you know that with the master you deliver, you're going to have the time for any problems you run into, in terms of the re-capturing or the conforming, or that final render process with HDV—that you'll be able to afford it and you're not stuck up a creek without a paddle.

ITVS: So, if you are looking at that kind of budget difference, if you're starting from scratch, would you spend that money to buy a better camera, for instance?

DG: Exactly, let's say it's a five grand difference. Adding five grand to make sure that your HDV project is on-lined correctly, that five grand can go towards a slightly better camera, depending upon how many days you're shooting; it can go towards shooting on tape, shooting P2 and doing that kind of system, different ways to move that money around. And personally, I'd rather shoot on the DVC Pro HD format, which is a solid, well-headed format. With everything I do at my bay here, there's no additional rendering, or anything we have to worry about once we leave here. So that's why I make that choice. But at the end of the day, I know myself. I'd rather save on the camera rental and see if I can get by post, and see if I can squeeze through. You know, that's what people do; it's the age-old thing.

ITVS: What about work flow difference? And specific costs associated with this?

ITVS: The biggest and most consistent impact in the workflow is the increased off-line equipment costs and the increased on-line budgets due to the troubleshooting of mixing HD and HDV formats.

ITVS: Are there big cost differences for audio editing in HD vs. SD?

PP: Obviously audio doesn't change much, unless you're doing surround vs. straight stereo. Color correction: maybe a 25 percent increase in cost, because we're dealing with the HD. Editing: HD non-linear editing is $225/hr, vs. standard def non-linear editing (which) is $180/hr.

ITVS: What's the best way to monitor HD footage when editing?

Depending on monitor types and features, some choices include:

LCD Monitors:
Dell UltraSharp 2407WFP for around $900
JVC DT-V24L1DU 24" Multi-Format LCD Monitor for about $3,200

CRT/BT Monitors:
Panasonic BT-LH2600W for about $4,000
Sony BVM-A series CRT monitor for around $11,000

For bigger spaces, plasmas might be a good alternative.
(Source: Creative Cow forum)

ITVS: What are some recommended compression codecs for various HD formats?

VA: When digitizing onto an FCP system, the three codec settings designed for HD are: HDV (good for off-line and lower budget formats), DVCPRO HD (for higher end Panasonic HD footage, without using too much storage), and Apple Pro Res (for Native HD and RED camera footage, uses an incredible amount of storage and requires faster drives).

ITVS: What is the best way to store my uncompressed HD footage?

ITVS: Fibrechannel arrays, as well as higher end RAID arrays are recommended. Uncompressed HD footage uses six times the amount of storage SD does.
(Source: Apple website)