A New Approach To High-Definition Video Production

JVC and CineForm have reinvented high-definition video production, enabling inexpensive, real-time HD productions today.

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JVC has significantly reduced the price barrier for high-definition video acquisition with the introduction of the JY-HD10U camera, opening a broad market for new customers to shoot HD material. CineForm has solved the HD production and video editing needs of these new users through its new product named Aspect HD™, which allows real-time production of HD content using Adobe® Premiere® on standard PC hardware. Aspect HD can perform tasks that exceed the capabilities of $200,000 systems, but with a total investment under $10,000 including the JVC JY-HD10U camera, Aspect HD, and a new PC (if needed). The combination of new video technologies from JVC and CineForm makes this revolution possible.

New Video Compression Widens the Market for HD

The JVC JY-HD10U stores video as an MPEG2 transport stream (MPEG2-TS) on a standard mini-DV cassette. Video captured in the JVC MPEG2-TS format can be easily transferred to a standard PC through the common IEEE-1394 (FireWire) ports that are present on all modern computers – no additional hardware is required. Because of its highly compressed format which yields a relatively low bitrate, the MPEG2-TS format used by JVC allows high-definition video to be acquired and stored on cameras and tape decks that are within the budgets of large numbers of potential users of HD video technology.

After acquisition, these users also need to edit the captured HD content for their own productions. Unfortunately, the internal structure of a compressed MPEG2-TS stream makes real-time editing very difficult. In fact, it is not possible to edit this format in real-time without expensive special-purpose hardware. Further, rendering a video production into MPEG2 during the editing process degrades image quality due to large generational losses when using special effects, overlay titles, video transitions, and color correction.

Professionals in the high-end post-production market avoid problems with MPEG2 compression by avoiding compression altogether: editing material in an uncompressed format preserves image quality and eliminates multi-generational losses. The disadvantage to using uncompressed video for editing is twofold: 1) very high system hardware costs (up to $200,000) result due to large disk storage and bandwidth requirements, and 2) the ability to perform real-time video editing is sacrificed. Within Aspect HD, CineForm has developed technology known as Carlsbad. By providing a novel solution to video compression that is ideally suited to video editing, Carlsbad solves the problem of how to perform real-time video editing at low cost while maintaining very high image quality.

Carlsbad - Optimized Compression for Video Editing

To allow real-time video editing with high image quality, Carlsbad converts the MPEG2 Transport Stream capture format from external devices into a representation that is both: i)
visually lossless, and ii) optimized for video editing. To increase editing performance with standard computing hardware, the algorithms within Carlsbad take advantage of two things that are quite new: i) video is stored in a format that allows more efficient retrieval from hard drives, and ii) its compression format allows for very efficient video effects processing. Considering its software implementation, Carlsbad’s performance is optimized for fast video editing within today’s Intel processors by exploiting special CPU instructions known SSE II.

Carlsbad’s video format is optimized for transport over the relatively fast internal PC hardware rather than the slower transfer to video tape or video distribution where established formats are still preferred. Other compression solutions are more suitable for acquisition and storage (HDCAM, DVCAM, and DV) or distribution (MPEG2, WindowsMedia, and RealVideo), but as editing formats, these are beyond the boundaries of practical workstation-based video editing systems, and will often result in poorer video quality in the finished production. Conversely, Carlsbad by CineForm offers a format that is optimized for real-time editing on a Pentium 4 processor while maintaining visually lossless video quality.

**Better Image Quality**

**Q:** What does using an intermediate video format mean for the image quality of a video production if the video must be converted from the camera format?  
**A:** It means the final image quality is better that it would be if editing were done in the original video format.

**Q:** How can the image quality improve by using an intermediate format for video editing?  
**A:** Logically, it would seem that exporting data from the camera’s format to the target format of the final video production would be the most direct path to highest image quality, but the nature of video editing is that even simple productions will manipulate the video using image processing operations such as color correction, overlaid titles, and transitions. Each manipulation requires that the video be decompressed, modified, and then recompressed which introduces a quality loss.

The more complex the production (through the addition of special effects and multiple video layers), the greater the likelihood more of the video will have been degraded by recompression. The extent of the degradation is directly related to the amount of compression applied, so the logical solution is to minimize compression to maintain image quality – this is what CineForm’s Carlsbad technology does.
Q: Why is it important to remain in the source format?  A: It isn’t. The MPEG2-TS format used by JVC has a short GOP structure that works well for video acquisition, but is not the same as the long GOP MPEG2-TS formats that are optimized for distribution. Neither format functions well as an intermediate compression format that is efficient for the editing process.

Once we realize that the source video format will necessarily differ from the distribution format for the final video production (as will normally be the case for the JVC JY-HD10U camera), there is no reason to remain in the source format through the various stages of video production.

Throughout the editing process CineForm’s Carlsbad uses a relatively high bit-rate (approx. 100Mb/s) compression format yielding very low visual loss to achieve excellent final-production image quality. Plus the editing performance has been optimized to provide real-time playback for most video editing operations, greatly enhancing the editing experience while eliminating generation losses.

<table>
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<th>Source video Short GOP MPEG2-TS (JY-HD10U or HDGR1)</th>
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Image Quality

Real-Time CineForm Editing

Q: So if we are using a new format with excellent image quality, what output formats are supported?  A: CineForm’s Carlsbad, operating through Adobe® Premiere®, allows the video editor to export to a wide range of video formats. Here are just a few:

- 1280x720 long GOP MPEG2-TS format for output to D-VHS.
- 1280x720 Windows Media® 9 high-definition format.
- Standard definition NTSC to DV tape or analog tape format (video output card required.)
- Anamorphic widescreen MPEG2 for DVD.
- Hybrid DVDs that play 16:9 on every DVD player, yet contain full resolution HD files for PC playback (Windows Media 9, HD RealVideo or HD QuickTime.)

The export format can be chosen late during video production, because shooting video in high-definition and maintaining high quality using CineForm’s Carlsbad technology during editing allows a final production to support the widest range of video formats and resolutions.

Shoot, edit, and output high-definition video today with JVC’s JY-HD10U or GR-HD1 and CineForm’s Aspect HD with Carlsbad technology.