DigitalFilm Tree

white paper

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Dust to Glory: A Film

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Dust to Glory: The film

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Dust to Glory, a Dana Brown film (IFC Films, 2005) is an extraordinary film about the most notorious and dangerous race in the world, the 36th Annual Tecate SCORE Baja 1000.

Far from a traditional documentary, "Dust to Glory" (D2G), directed by Dana Brown ("Step into Liquid"), is all-encompassing in its depth and breadth. It also breaks new ground with the methods by which it was made. D2G may be the most elaborate, complex, high-end digital film to ever be completed using a high-definition digital intermediate with a Windows-based PC system: Adobe Premiere Pro and Adobe After Effects, CineForm's Prospect HD, Synthetic Aperture's Color Finesse, with BOXX and AJA technology.

"This is a tough man's game."
-- From the trailer for D2G

DigitalFilm Tree, a post production/visual effects facility based in West Hollywood, was engaged to consult during "Dust to Glory" post-production. "We felt that 'Dust to Glory' was a great project for a place such as ours," says DigitalFilm Tree CEO Ramy Katrib. "In a collaborative effort with Laser Pacific and the filmmakers themselves, we were able to be part of a revolutionary workflow that involved almost every format imaginable. Together, this team established a digital domain unique to the challenges faced and produced a viable and beautiful piece of celluloid in the end."

This white paper takes you behind the scenes to reveal secrets of how D2G was produced, shot, edited, and finished — saving nearly half a million dollars along the way.

Dust to Glory: The film

The Baja 1000 has inspired generations of adventure seekers from around the globe. Perhaps no other race in history has given its participants, winners and losers alike, a greater sense of achievement and purpose...and greater sense of glory.

Ironically, this may be the most famous race few people have seen. Being the longest point-to-point race in the world, staged over incredibly rugged terrain, the Baja 1000 discourages filmed coverage. Until now.

Dust to Glory is all about action, spectacle, landscape, and vroom. But it is also a story of people. Celebrities such as racer Parnelli Jones, actors James Garner and Steve McQueen, and multi-Baja winner Malcolm Smith, among others, were part of the early fabric of the race. Dreamers, innovators, and pioneering thrill seekers are still drawn to the race. The filmmakers wanted audiences to appreciate characters with the gumption to face down 1,000 miles of round-the-clock desert driving — a seemingly impossible challenge.

As DP Kevin Ward says, "D2G is all about the personalities, with the action just being the backdrop."

"When Mike ("Mouse") McCoy and I were riding or racing down there, we would say things like, somebody has got to make a movie about this place! One day, Mouse decided he'd talked about it enough, and it was time to take action. He managed to get introduced to Dana Brown and Scott Waugh, who had just finished Step into Liquid. Mouse sold them on the idea of covering the Baja 1000 in Dana's style, and off we went."
-- Kevin Ward, D2G director of photography

"As we were finishing Step into Liquid, Mike "Mouse" McCoy mentioned (the idea of D2G) to Scott Waugh and myself: It's your kind of thing, dude, he told me at the time. I asked him to not say, Dude.
-- Dana Brown, director

The creative team financed development of D2G itself. Rich Wilson, from "Step Into Liquid," with his background in high technology and finance, became executive producer. He raised capital, handled sponsorships, and located potential distributors for what ended up being a $2-million project. Early on, Wilson found a couple of key investors to commit. Waugh and Wilson also took out second mortgages — borrowing on their houses — to help finance the start of the film.

How to capture the scope and drama of the Baja 1000? Director of photography (DP) Kevin Ward, producers Scott Waugh and Mike McCoy, and director Dana Brown needed to find a way to cover the race expansively while minimizing costs.

Director Dana Brown sums up the story vision: "It's the coming together of generations, ages, sexes, abilities, and motivations. NASCAR driver Robbie Gordon and Indy racer Jimmy Vasser represent one end of the spectrum — the glamour boyz. On the opposite end, we feature a team racing a 1983 stock VW Bug and an all-Mexican team simply trying to complete the course before time expires. Then there are three generations from one racing family competing against each other — a 73-year-old father, his two sons, and the 16-year-old grandson. There's an all-women team composed of wives and daughters of other Baja racers. Out in front of the pack are reigning five-time defending champs getting a serious challenge from a former teammate who wants to prove he belongs. Then we have Mario Andretti, stranded during a test run, and on and on. But at the center is one story. One quest. The attempt by Mouse McCoy to race the entire 1,000 miles by himself, something no one has done on a motorcycle or dared try. He came to tilt at windmills and ended slaying a dragon."

The Initial D2G Team

The Initial D2G Team
Dana Brown - Director, Writer, Editor
C. Rich Wilson - Executive Producer
Scott Waugh - Producer, Editor
Mike "Mouse" McCoy - Producer
Kevin Ward - Director of Photography

"There's a reason that no one has done a film on the Baja 1000. The sheer logistics are a challenge. It is the toughest race in the world, and the elements make it hard for any film camera to work well. The heavy dust clogs cameras. The weight of film cameras is too forbidding for most drivers to allow on their vehicles — even so, you'd get four minutes before the roll runs out. It is digital technology that makes it even possible to make a film like Dust to Glory."
-- Scott Waugh, producer

Scouting and Pre-production

Before committing to undertake D2G, producer Scott Waugh and director Dana Brown decided they needed to see first-hand whether there was indeed a story. They went to Baja to watch the baby-brother race, the Baja 500, in June, 2003, which incidentally Kevin Ward was competing in. "In the first hour, we knew we had to do this film," Waugh says. "The energy and the people there were amazing. Hollywood could not write this film."

The group drove the course with James DeGaines, a Baja expert, and began devising a shooting plan. Because the final course of the Baja 1000 is not announced until one month before the race, this initial scout was preliminary. However, Sal Fish, owner of the race, eventually provided Waugh and Brown with the official course route six weeks before the race so they could do a final scout.

Using Global Positioning System (GPS), the team plotted coordinates and shot digital stills for every spot they identified as a good camera set-up. On returning from a five-day scout, the team plotted each selected GPS point onto a large map of the area, decided where to station crews, and how to move them around to get the best coverage.

Of course, production always means risk and surprise — especially with one-chance shooting conditions. As with any film production but especially for realtime documentaries, the more time spent in preparation, the better. Unknowns such as new gear, equipment compatibility, film stocks, printing/processing choices at the lab, digitizing, sound recording — these are just some of the issues that are better tested in advance so fewer unexpected problems and crises arise before it's too late to solve them.

With the idea of using an HD digital intermediate to strike film prints for final distribution, the need for preparation was even more essential. The plans for shooting D2G included using both film and digital video. Ward decided to have "film out" tests made from digital video during pre-production to see how they would look against film. He shot sample footage using various formats and had the video scanned to film negative, from which test film prints were made. He discovered a potential drawback when mixing digital video with film footage; the look of DV is very different in comparison with film — mostly due to DV's extreme depth of field. The team learned that the best thing to do was to keep f-stop settings on the digital cameras wide open (f2.8) and to keep the focal length long. This helped DV approximate film's shorter depth of field.

Kevin Ward (DP) wanted to test nightscope systems (HD and film) because so much of the race would have to be filmed at night. "Choosing the right film stock for nightscope was tricky," Ward says. "We had to discover which ASA (f-stop rating) film stock properly captured the electronically generated signal coming from the system's image intensifier. We also shot tests with 'ice-cube' cams and the Panasonic DVX100 cameras — then up-rezed them to Hi-Def to see what kind of artifacts we had to deal with. We were blown away by how good the DVX100 footage looked. With up-rezing the 'ice-cube' DV cam footage, we found a pleasant surprise: Subjects or environments directly in front of the lens stayed stable, while the edges of the frame had a staccato look, like the effect in a film camera when the shutter is narrowed down. This footage was going to be action exclusively, so we were happy with the results."

At this point, the team also determined an ideal, lightweight camera package for all units: Each 16mm crew had one zoom, one prime lens and three magazines of film stock (400' each, or 11 minutes).

Unlike circuit events such as the Indy 500 or NASCAR races, where cameras are mounted at fixed locations, cameras for D2G would all have to be mobile to follow competitors along a more-or-less linear route. Winners cross the line in 16 hours, so after the race begins, production would have to operate continuously for that same period of time — a taxing schedule for the crew. The buggies and other cars don't finish until 32 hours later. Plans had to accommodate this stretched-out time frame so the diversity of race vehicles could be shown in the finished film.

"We had to leapfrog crews and move them across the race. Some crews waited all night for their target cars. Once they passed through, we moved crews around to maximize their usage. Everything was worked out in advance. We had radio communication, but it was hardly used during the race. Everyone knew what they had to do. No one got hurt, and there were few glitches, if any...except a DV camera got run over.
-- Kevin Ward, director of photography

Production

Crew members selected for production had to be hardy and dedicated, with a passion for getting shots under rugged conditions. Many of the camera people normally worked as directors and directors of photography — and here they were, working at a fraction of their normal rates — camped overnight in the middle of the desert.I It was a BYOCS shoot: "Bring your own craft services."

In the Nick of Time
Executive producer, Rich Wilson describes how funds to pay the D2G crew arrived just in time. "After picking up one of our investors in San Diego and driving her to the start of the race, I turned around and drove back to San Diego to sign the loan documents for the second mortgage on my house. The loan closed the day of the race. The money was wired into the account, so the day after the race, we could pay the crew in cash on the spot."

While race action was covered by cameras on the move, the creative team also wanted to record action from the racers' point of view and to get interview material. How to obtain such a wide variety of footage?

Producer Mike McCoy came up with a maxim to inform the production strategy: Form follows function. "Every format used was the result of what would work best in that environment," according to DP Kevin Ward. Two of the four helicopters that followed cars and trucks used 35mm film with cameras on Tyler mounts (allowing the camera operator to reload while still in flight). However, motorcycles presented a special set of problems. Long lenses would have to be used in order to see the motorcycles fill the frame — a much smaller subject. Those telephoto lenses, in turn, require an external gyroscope-stabilized mount to override bumps and helicopter vibration, which are exaggerated when shooting long focal lengths. A gyro mount means the camera is not accessible while in flight for changing film magazines. So an HD camera with a remote HD deck in the helicopter had to be used.

"We had to use the camera that fits. In a car, in the air, on the ground, rustling around in the commotion of the pits. Different tools for different jobs. It's a real race. No second takes. No faking it. Making do at the moment, best you can."
-- Dana Brown, director

For camera teams shooting race action on the ground, Super 16mm film was the way to go. These cameras are lightweight, durable, and highly portable. They can also over-crank up to 150 frames per second (fps) for shooting slow motion. Each of the Super 16 crews also carried Panasonic DVX100 cameras, which enabled them to capture cutaways, additional angles, and quality sound or dialog, if needed.

Ground units assigned to cover people used HD format for interviews with the racers, which director Dana Brown conducted. These cameras roll continuously, so the interviews could proceed without having to stop to get synch slates, or interrupt action by yelling "Roll" or "Cut," as required when shooting film with separate synch sound.

"Production Challenges?
Anything can happen out there in the desert so far from civilization and completely out of contact. One of my memos to the crew went like this: If you find yourself buried in sand with a broken axle on your support vehicle miles from where you are supposed to be at race time — you still need to deliver. Roll over some rocks and stage a scorpion fight in the hot sun. Break out the beer with the locals and start some wagering on the outcome. Start a fistfight. Come back with a story. No excuses."
-- Kevin Ward, director of photography

Weight and space were major considerations for cameras installed on the various vehicles as well as for helmet cameras. Small digital three-chip "ice-cube cameras" and "cigar cams", used on cars and motorcycles, recorded to clamshell DV decks.

Film was the format to use for wide vistas, beauty shots, and landscapes given its wide latitude for shooting under varying lighting conditions. The team went into production knowing it would not try to pass off DV footage as film. So a stylistic strategy emerged: beauty shots in 35mm, interviews in HD, ground units shooting 16mm, on board and helmet cam footage in DV. By establishing and maintaining this convention consistently throughout the film, the team felt audiences would come to accept the different looks.

Production Equipment

A total of 70 crew members used 55 cameras.

Helicopter #1: Sony HD F900 camera mounted on a gyrostabilizer head fed to a remote deck. This helicopter covered motorcycles.

Helicopter #2: Arriflex III - 35mm film camera on a Tyler mount. This helicopter covered trophy trucks exclusively.

Helicopter #3: Arriflex III - 35mm film camera. This helicopter floated among all the different class type vehicles.

Helicopter #4: Sony F900 Hi-Def camera. This helicopter focused on racer Robbie Gordon.

Helmet cam: three-chip Toshiba "ice-cube cam" into a DVCAM clamshell. Isolated on Lou Franco, a pro motorcross racer on bike. Sal Fish, owner of the Baja 1000, gave permission for Lou to go onto paved roads and to take shortcuts to get behind vehicles for the purpose of obtaining footage. All bike-to-bike shots were from this rig.

Arriflex 16mm SR3 High-Speed camera mounted on an off-road Class 1 buggy, integrated into the chassis, with a special suspension arm fully dampened to move in any direction. Operated with a remote head.

Four solo Panasonic DVX100 camera units recording in 24p. Each was assigned to specific vehicles. They also recorded "lifestyle" material: an old man who lives along the racetrack, the weatherman who broadcasts from the top of Mt. Diablo, etc.

Thirteen ground units, each comprising a camera operator, an assistant camera, and a driver/loader. Among these units:

Nine Arriflex SR3 Super 16mm. Four of these with night scopes. Two units had Bolex camera for time-lapse. (In post-production, this material was "cropped" to proper 35mm aspect ratio (1.85:1) by zooming into the 16mm frame.) Crews also had a DVX100 (24p) for sound-recording purposes.

Five HD Sony F900 Cameras, three with night scopes.

One Gzap 16mm camera.

One Photosonics 1VN Super 16mm camera.

Racers' cameras. Many had their own internal on board systems, mostly Hi-8. Other vehicles had Sony lipstick cameras, Sony XCD "cigar cams", and Toshiba's three-chip IK-TU51 "ice-cube cams" fed into DVCAM clamshells.

It was an advantage for DG2 that many racers had already planned to rig their vehicles with cameras. Footage from many of these teams ended up in the finished film. Most racers (understandably) did not stop to reload their lone tape after it was exposed. All race footage was shot "clean" — no filters were used. This was done to preserve all color correction options for post-production. The film crews did not have any sound capabilities other than their DVX100 cameras because the producers did not want to hire 13 separate sound crews.

"Images from the Panasonic DVX100 blew me away by how good they looked."
-- Kevin Ward, director of photography

How to Be Inventive:
Amazingly, an accident occurs in D2G — a buggy rolls over. However, the quality of the video was almost too poor to use. Instead of struggling to improve a bad image or throwing out this dramatic shot, a fake red recording light was added in post-production to lower viewer expectations — making it clear that a low-quality buggy-cam got that valuable shot.

Film Stocks Used

In bright daylight:
Eastman Kodak EXR 50D 5245 35mm/7245 16mm, 50 ASA daylight-balanced.

For low light, open shade, and slo-mo:
Eastman Kodak 200 T 5274 35mm/7274 16mm, 200 ASA, tungsten-balanced.

At night:
Eastman Kodak Vision2 500 T 5218 35mm/7218 16mm, 500 ASA, tungsten-balanced. Force processed 2 stops.

For nightscope:
Eastman Kodak Vision 250D 5246 35mm/7246 16mm, 250 ASA daylight.

All film shot with available light. No artificial lighting was utilized.

Having shot footage in so many different formats presented the D2G team with another problem: how to incorporate all that material into one standard for editing and for final output to make release prints for theatrical distribution? In pre-digital days, this question was answered with a compromise in visual quality. Video material would have been transferred to film negative, losing at least two generations in the process. And making 35mm theatrical prints from 16mm negative meant enlarging film negative — another step down in quality.

However, a new kind of mastering method, a "digital intermediate," gives films like D2G a higher-quality alternative, which also averts problems of format conversion. After all the shot footage is digitized for editing, it stays in the digital domain all through post-production, including color correction, until a final internegative is output, from which release prints can be struck.

Audio Gear

The two sound crews preferred older analog reel-to-reel Nagra recorders. They found a digital recorder distorts sound quality when racing engines revved to very high RPMs. Like digital and HD cameras, which record no information when they are overexposed, a digital recorder does not deliver when stressed by over-modulation. Analog tape has a wider latitude and records information even when levels are completely off the scale.

Formats Used in D2G

35mm film negative
16mm film negative
Super 16mm film negative
DVCAM
MiniDV
VHS (archival footage)
HDCAM
DigiBeta

What is a Digital Intermediate?

In the traditional method for making release prints, the lab uses the cut negative as little as possible before making a duplicate negative — the cut camera negative is far too valuable to be running through the lab over and over to make thousands of release prints. The chances of it breaking, tearing, or otherwise wearing out are high. Because it 's not possible to make a negative from a negative, the lab would first create an interpositive from the cut camera negative, and then strike a dupe negative from the interpositive. In this method, the image quality is reduced by two generations (the interpositive and the internegative).With a digital intermediate (DI), the interpositive is eliminated. The "dupe negative " for striking release prints is not really a duplicate — it's first generation, created directly from a digital file, or in the case of D2G, from an HD master. A film scanner is used to get film negative digitized into data files. With D2G, the data files get created from the HD online. One of the benefits of a DI, then, is not having to cut the original camera negative that was processed by the lab. Not having to cut the original negative means it will remain fully intact, just as it was processed in the lab. A DI also means the filmmakers can use a precise, sophisticated, digitally based color correction (or grading) system not available in the analog film world.

Post-production – Offline Edit

Like most unscripted documentaries, D2G is a film discovered during the editing. Sure, there was a production plan that determined which vehicles, drivers, and moments were filmed, and insured that coverage would be adequate. And to begin the editing, there were notes from director Dana Brown and a short outline. But just how scenes and sequences would be cut for maximum impact, and how they would be structured together — that could be decided only by trying out various combinations.

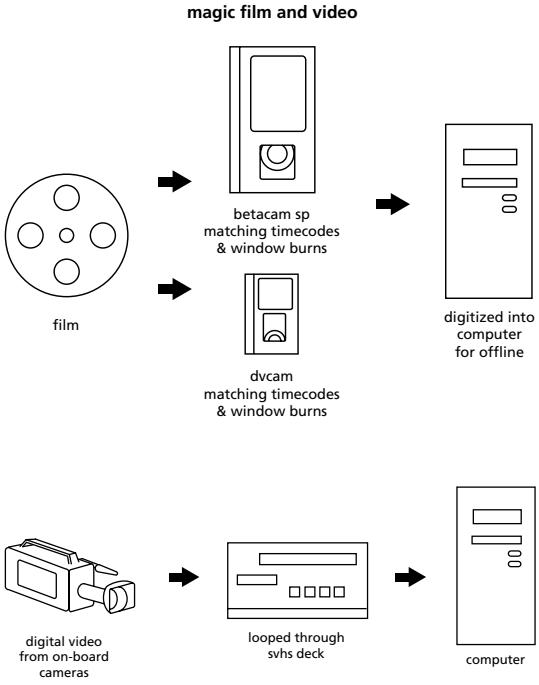
The 55 cameras used shooting D2G produced over 250 hours of material. According to producer/editor Scott Waugh, it took nearly four months to digitize and log it all — agonizing perhaps — but how else to know the footage first-hand and be able to make story decisions about how to use it?

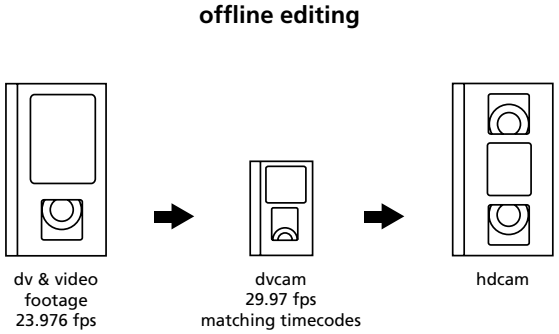
For offline editing, the original DV footage, shot at 23.976 fps, was cloned. HDCAM material was down-converted to matching Beta SP and to DVCAM (29.97fps). The DVCAM down-converts had matching timecodes.

All film material was sent to Magic Film and Video in Burbank for processing and telecine transfers (best light) directly to Betacam SP and DVCAM with matching timecodes and window burns. Those tapes were then digitized for the offline. Digital video from on board cameras was brought into the session by looping that footage through an SVHS deck although that work-around meant losing timecode.

"Everything is a potential disaster until the first paying customers arrive in their seats."
-- Dana Brown, director

"We needed to know every frame. So, with help from my son Wes, Scott and I digitized on our separate edit machines hour after hour, day after day. Eventually, one of us or both turned jelly-brain, and we'd stop to edit a small segment. This was the light at the end of the tunnel that kept us perpetually 'almost done' digitizing. In the end, every last frame was viewed and considered.
-- Dana Brown, director





Scott Waugh and Dana Brown edited on two Avids — Dana in Long Beach on an Avid 10.1 Film Composer (Mac), and Scott on an Avid DV Xpress 3.5. They worked on separate scenes until each reached a point of creative fatigue. Then they exchanged sequences, linked media, and kept working. The offline, which took six months to complete, was compiled in 20-minute chunks because the completed film would be printed and delivered in 20 minute reels, a requirement for "change-over" theatrical film screenings that use two projectors. The first cut ran 2:10.

"It seems like when you do a film, you do it four times. First there is the offline. Then there is the online. Then you do the audio mix and then all the color correction. What would be nice is if you did this all once. Adobe Premiere Pro and its compatibility with the rest of the Adobe family makes this possible."
-- Scott Waugh, producer/editor

"It took nine months of 16-hour days, seven days a week to do the offline. We'd work on segments separately, Scott and me, then switch. Once it was refined to a pretty fine point, we'd hash out the finished version of the segment together, then put it in the show, like a piece to a puzzle. I made the final decisions but don't remember ever having a disagreement about the direction we were headed."
-- Dana Brown, director

Post-production – A trailer leads to breaking rules

The producers wanted to prepare a trailer, or short sample, they could take to the 2004 Sundance Film Festival to help promote D2G and to begin attracting interest among potential distributors. Conveniently, producer Mike McCoy, also being a partner at Sample Digital, a digital media service facility in Hollywood, could step in to help. Sample Digital is known for its Windows Media 9, encoding for high end DVDs — among its credits, Terminator 2. So Sample Digital prepared a D2G trailer in Windows Media 9. When it was shown that year during the Sundance Festival, it attracted a lot of attention.

This soon led to Adobe Systems entering the picture at the NAB (National Association of Broadcasters) Show in Las Vegas in 2004. With the project coming to Adobe's attention, the idea of using Premiere Pro took hold. Soon after NAB, editor Jacob Rosenberg started working with some of the footage from D2G on an HD Roadshow for Adobe. Discussions began about doing the entire online editing in Premiere Pro. Rosenberg, based in Los Angeles, is an Adobe Premiere expert and had worked closely with Adobe's software development team for eight years.

"They wanted to master in HD and print film from the HD master," Rosenberg recalls. "I was confident we could do the online in Premiere Pro. But what excited me was not only the fact that we were doing an HD digital intermediate from a compressed file, it was also that the project incorporated every format with a workflow of coloring, titling, and doing additional effects without leaving Adobe's Video Collection."

At this time, it was a commonly held assumption that proper color correction could not be done with a system using compressed HD, such as Adobe Premiere Pro. CineForm, a relatively young company based in Carlsbad, California, which provides high-performance software products for media professionals working in film and high-definition video post-production, had a solution. CineForm had developed Prospect HD, a software program with a codec (compression/decompression) for the purpose of working in realtime using compressed HD. Codecs designed for digital video are consumer formats meant for tape-based editing using constant bit rates (CBR) as opposed to codecs for computers, which use variable bit rates (VBR). "We set out to create a codec that was not designed for tape but for computer processing unit (CPU)," says David Newman of CineForm. "They are variable bit rate and always have the bits when needed," Newman adds. CineForm refers to its system as "constant quality codec." The AVI file structure used in CineForm's Prospect HD ensures compatibility across a broad range of Windows-based applications, including Adobe After Effects and Windows Media Player.

Jacob Rosenberg and the D2G producers met with CineForm for a demo of Prospect HD working in conjunction with Color Finesse. They saw it would allow "visually lossless" compression technology in HD 1920 x 1080, 10-bit, 4:22. Rosenberg and the D2G producers walked away impressed. Using CineForm's Prospect HD on D2G meant having all their media on the hard drives. They could instantly see picture-in-picture effects, colorizing, speed changes, and other effects. There was no need to render these effects.

"When people see this movie in theatres they won't have any idea how many 'rules' were broken in delivering such a high-quality HD master for the film print. The CineForm intermediate compressed format provided flawless reliability and stunning visual quality through multiple recompressions, holding true to the original source quality. My job benefited by having manageable file sizes, real-time editing performance, and a seamless integrated online workflow – and running on a PC from start to finish!"
-- Jacob Rosenberg, online editor

Post-production – Online Edit

After the offline version of D2G was completed, the next step was preparing to do the online, when high-resolution footage would be matched (conformed) to the low-resolution offline edit using Adobe Premiere Pro software. Because the offline had been done using the Avid system, an extra workflow was necessary at this stage to obtain key codes for material that originated in film. Had the offline also been done using Adobe Premiere Pro, these special steps would not have been needed.

As Scott Waugh explains, "Avid Xpress DV does not deal with film key codes or FLEx files." Key codes are the alpha/numeric numbering system that gets burned into negative film stock when it is manufactured. When film negative is cut to conform to an edited workprint, these numbers provide the negative cutter with a foolproof system for matching frames.

The team went back to Magic Film and Video, which had done the original film-to-tape telecine. There, Matchback software was used to create a "selects list" for the negative cutter to pull takes from the original camera negative. Waugh had first exported a CMX 3600 EDL of film-based clips utilized in the offline version. Using this EDL and Matchback, Magic extracted the proper roll numbers and key codes and then pulled about 10 hours of film(flash-to-flash).

The pulled negative was taken to LaserPacific, a film and video lab in Hollywood, where a Spirit DataCine transferred the 16 mm film to 2K, and 35mm to 4K digital files. These were converted into Qubit files and stored on Quvis/Qubit DDR drives (a better signal-to-noise ratio than even D-5, according to LaserPacific.) The material was captured as 1920 x 1080 pixel, 23.976 fps, 10-bit, 4:2:2 files.

At this point, any DV footage to be used in the online was converted and up-rezzed to HD at LaserPacific via a Teranex format conversion box, then captured from an HDCAM deck into Adobe Premiere Pro.

All the HDCAM and HD footage went directly into the BOXX system via HD/SDI. Now, all the material for the online, regardless of its format origins, was in one common digital format. Another major milestone reached.

FLEx (Film Log EDL Exchange) protocol is intended to permit the automated communication of information between the telecine bay and off- and online editing systems. This information consists of a database relating all original film reel, positional, and key code data of transferred "elements" (scenes and takes) to the corresponding destination videotape reel and time code. In some cases, an additional timecode representing sound "sync" and sound reel are carried in the database to assist the process of conforming sound to picture.
--From: Gary Adams, TLC Product Manager, da Vinci Systems http://www.davsys.com/TLC-FLEx/flex1005.html

On Beginning the Online
"When I started assembling the online, I realized how massive an undertaking the offline was. Each reel had at least 350 shots — all from different formats. As I'm conforming and assembling, I'm getting immersed in the film. After about a week of just working on reel one, I was completely in love with the film. By the time I was two weeks into the offline, my hours started to get longer and longer, but my passion for the film was ignited. I felt like part of team. But I wasn't completely baptized until I broke up with my girlfriend, par for the course because everyone else on the production lost their significant others during the making of D2G."
-- Jacob Rosenberg, online editor

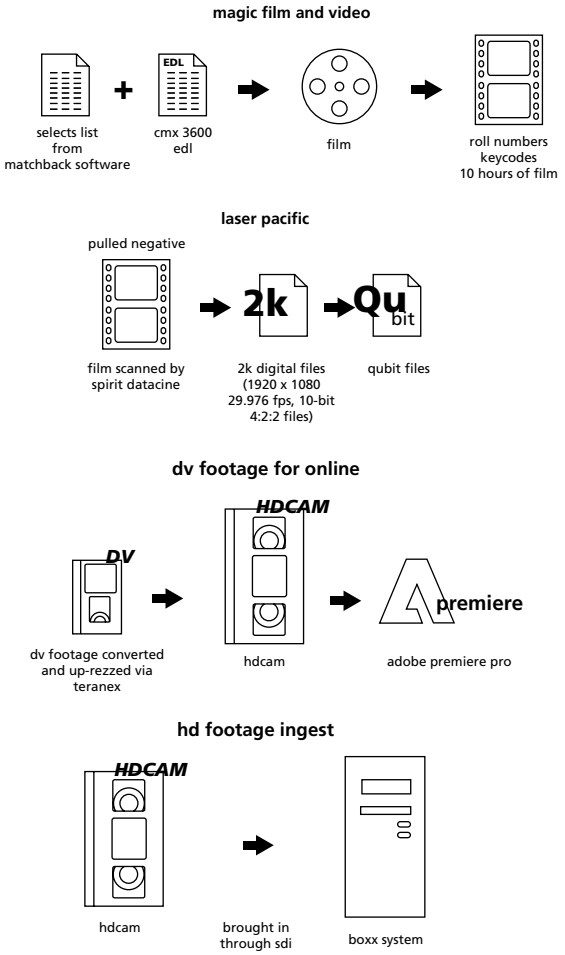
"We asked a lot of Jacob: a lot of time, a lot of patience, a lot of brain cells," Dana Brown says later about online supervisor Jacob Rosenberg. "The long hours would make us a pretty goofy group. Jacob decided to save energy by paring his vocabulary down to two sentences. When something was positive he'd say, 'It's all good.' When something was negative he'd say, 'I'll kill you.' Scott (Waugh) and I, being frayed, found this hilarious. Jacob was a revelation — hard working, understanding of what we were doing with the film, and he brought an expertise, artistically and technically. He also kept the director in cookies and beer... 'It's all good!'"

"The workflow was mapped out on paper, but it was pretty much in my head and certainly hadn't been tested," Rosenberg says later. "I have been using Premiere for 10 years, I wrote a book on it, I did a ton of training, and I can honestly say that I know every good and bad thing about the program. So as the online developed, I just navigated certain issues and took advantage of other strong points. The first obstacle was dealing with the 29.97 to 23.976 EDL conform. I brought in Zed Saeed from DigitalFilm Tree, and we threw ideas around for a few hours and then solved the problem. Fortunately, I had a week to do the first reel of the show, and that was the most difficult conform because I would see where the issues resided. It was pretty much what I had in my head except that in my head, I would always be scared something would happen. But in reality...it was all good."

One of the primary benefits for D2G using Adobe's Premiere Pro editing system is its native ability to digitize and work with a wide variety of formats.

"All I could think about was finishing. Nothing could stop me. For me, it's an adventure."
-- From the D2G trailer

Among its other benefits, being able to work in compressed HD meant no loss in film output quality, and the source material occupied only one-seventh the disc space as uncompressed material. Rosenberg would also be able to run three, even four streams in realtime, with transitions and graphics, and without rendering. As it turned out, the entire 90-minute film rendered down in full HD took up about 100 gigs.



At this stage, the producers worked with Jacob Rosenberg to make final modifications to the online. The online room at Laser Pacific was wired into a digital theatre via the HD-SDI output of the system. This enabled Brown and Waugh to make changes and watch the film as an audience would on a traditional movie screen.

There were actually two complete passes made during the online:

- Pan and scan/full frame — 16:9 aspect ratio — for theatrical and widescreen TV
- Pillar boxed — 4:3 aspect ratio for standard TV

"My goal as the online editor/supervisor was to try and do everything without needing any support from any other hardware or software devices that weren't on our system. The only other tools we did use were the Teranex Box for converting SD to HD and the Qubit Drive for moving data off our system over to Laser's master control. So the workflow was dictated by what I knew After Effects could do and what Premiere Pro could do."
-- Jacob Rosenberg, online editor

"We liked Adobe Premiere Pro a hell of a lot. What we are truly excited about is the next project and how simplified it'll be on Premiere Pro. What we'd love to do is to eliminate tape altogether. We'd love to go directly to disk from the Sony HD F900 camera!"
-- Scott Waugh, producer/editor

Post-Production Challenges
"The initial challenges were color correction and conforming all the different production formats into a single format for making prints. Because the final edit was at 23.976, we had to bring in a 29.97 EDL and parse it to 23.976, which Premiere does automatically. For the HDCAM, this was fine because the timecode matched. But for the MiniDV and for the original film transfers, the timecode didn't help. For those two formats, the online would have to be an eye match. Our other challenge with color correction was how far we could push corrections for each of the formats we were coloring. For example, when you up-rez DV to HD and then start to drastically change the color, artifacts can appear. Finding the right range for color correction was a challenge."
-- Jacob Rosenberg, online editor

Dust to Glory: The film

Post-production – Color Correction

What is color correction, and just what does a colorist do? In spite of the terminology, this is more than just "correction." It's not simply a matter of making "fixes." A colorist, working with the editor and director, creates a certain look and feel to support the story. A colorist works shot-by-shot while also looking for ways to enhance certain elements within a shot. The goal is always giving each visual sequence a specific emotional tone. The colorist is truly an artist, much as color correction is an artform of the modern digital age.

The entire D2G project was color-corrected using Adobe After Effects and the Color Finesse plug-in. DP Kevin Ward worked together with DigitalFilm Tree colorist, Henry Santos, for nearly a month. Santos worked an additional month on his own. Santos says the color correction with Color Finesse in After Effects compares favorably with the da Vinci system because it has curves that allow manipulation of shadows, as well as extra channels, like a da Vinci."

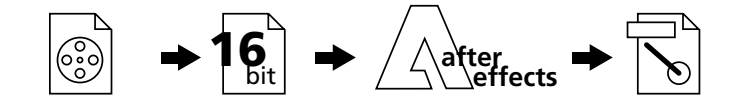
--DigitalFilm Tree's Henry Santos

Workflow for color correction

- After a reel was locked, online supervisor Jacob Rosenberg created a new project by trimming the reel. Each 20-minute "reel" became a separate project with its own sequence and associated clips.
- A 16-bit project was created using After Effects 6.5 with the Color Finesse plug-in.
- These Premiere Pro projects were imported into After Effects. All clips translated correctly between Premiere Pro and After Effects: speed changes, motion effects, transform, opacity, dissolves, and positioning.
- Henry Santos began the color-correction process. With Kevin Ward, the DP, they created presets for easily generating certain recurring looks.

"I can't even imagine doing my color correction without the PC/ Premiere Pro system. I would have spent another month if the production team had let me!!"
--Kevin Ward

color correction workflow



project broken into 20 minute reels

16-bit project created with color finesse

premier pro projects imported into after effects

presets created for recurring looks

Post-production – Graphics and Effects

Designer Amul Patel created templates and moving titles. Static title cards were done in Adobe Premiere Pro. Animated title cards were done in After Effects. Uncompressed QuickTime files were made in After Effects with alpha channels. The open and end credits were also done in After Effects. After Effects designer Jason Woliner was brought in to do additional work including compositing, overlays, transforms, an opening map shot, and some still image work.

Rosenberg used Adobe Photoshop to create 2D still elements for After Effects composites. For the opening, this involved "stitching" together several global maps to create one still shot, which then was manipulated through camera moves. Images of cloud layers were added, along with a zoom-in move to complete this sequence that begins the movie.

Dust-busting

Over 100 shots that originated in Super 16mm film needed cleaning up — hair and minor dust — especially in the time-lapse footage. This was accomplished using the new Clone-tool in After Effects 6.5. Dust-busting was done at the same time as the color correction.

Integral Plug-ins for After Effects

- Color Finesse for primary and secondary color correction.
- The BOXX plug-in, "Minotaur," which allows the After Effects comp window to be sent out via the HD-SDI spigot off the video card.
- Prospect HD's CFHDIO plug-in by CineForm which allows import and export of footage with CineForm codec.

Testing Color Correction: Don't Believe What You See

Rosenberg took one or two clips from each type of format represented in D2G: Hi-8, DVX100 footage, DVCAM, Super 16mm, 35mm, and HDCAM. He applied color correction using the Color Finesse plug-in (32-bit, floating-point), which comes as part of After Effects in the Adobe Production Bundle.

The color-corrected clips were output to HD and then printed to film.

The D2G group went into the projection room at LaserPacific. First they screened the HD version to establish a baseline in their minds. They decided to play it a second time. Then they called the projectionist and asked him to run the film version. The projectionist said, "You just watched film!" The film print was so accurate that 15 people with discriminating eyes could not spot the difference between HD and film out from HD. It was a go from there!

The systems used to finish D2G (specified here) should also be considered by medium-to-large sized post-production facilities looking to set up a state-of-the-art, PC-based digital editing suite. This hardware and software configuration is also workable for independent filmmakers — especially if they are using the latest digital formats: HDCAM, DV, HDV, etc. This is a very stable system that serves both prosumer and professional users. D2G was a professional production with high production values aimed at multiple exhibition venues: theatrical, TV, and DVD. It could achieve those objectives while sticking to a down-to-earth budget.

Additionally, as the D2G team discovered, integration is the key. Having system cohesion was a major advantage when time and money were at stake. With Premiere Pro working so well with After Effects, Photoshop, and Encore, the focus stayed on creative challenges, not systems problems.

Systems Employed on D2G

BOXX Technologies HD Pro RT with Adobe Video Collection 2.5 – AMD DUAL OPTERON
External Qubit Drive (10bit 4:2:2)
AJA Xena HD-SDI card - I/O plus Genlock and 6-channel AES/EBU I/O
1.5TB of Raid 5 storage and 3GB DDR memory for the CPU
Samsung SyncMaster 243T monitor

Post-production – Finishing

Rendering

- Each reel was rendered as one movie file from After Effects.
- Final renders done as CineForm files with no audio.
- Three different versions were rendered:
    - Text version for U.S.: Marry with titles and layoff to Qubit drive.
    - Textless for foreign versions: Turn off title tracks and layoff to Qubit drive.
    - Version with temp audio as guide track for final sound mix.
- Rendered files were taken back into Premiere Pro and placed in the timeline.

Making the Film Out

- Qubit files with rendered material converted to Cineon files
- Cineon files printed to film using Arrilaser film recorder at Laser Pacific
- Optical audio track added to film out at Magic Film and Video

Creating the Digital Output for Window Media HD Video (MWV HD)

- QuBit file transferred to D5 tape and married to 6-channel audio mix.
- Sample Digital converts CineForm encoded HD master clips directly to Windows Media Player 9 (WM9).
- WM9 1080p data file prepared for digital playback.

Making DVDs

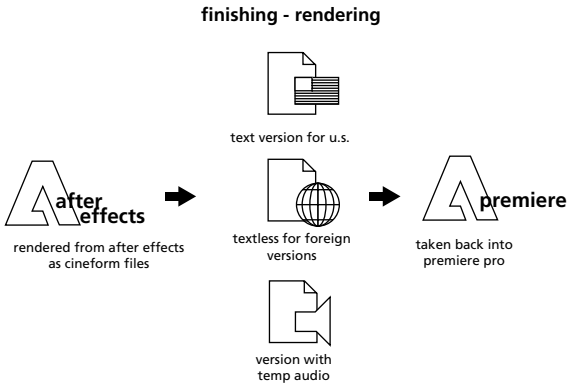
"At any point during editing, we could export directly to a DVD from our timeline," says online editor JacobRosenberg. "When it came time for screening copies or putting together a teaser for a tradeshow or event, I would simply assemble what needed to be exported (in full HD resolution) and choose File>Export>Export to DVD.' Since the frame rate for DVD is the same as our master project (23.976), it would auto-scale the frame from 1920 x 1080 to 720 x 480, tag it for 16 x 9, and spit out a DVD. This was a huge timesaver. And the quality of the DVDs was second-to-none

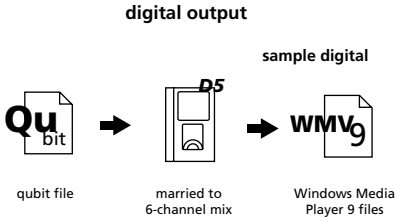
Marketing and Promotion

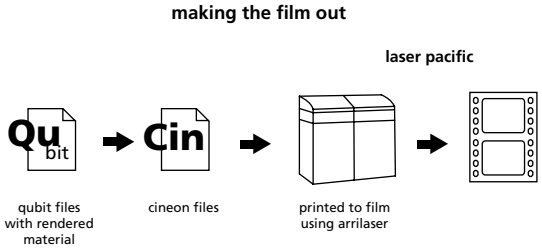
By this time, according to executive producer Rich Wilson, D2G had co-branded marketing arrangements in place with Honda, Red Bull, BF Goodrich, and Microsoft to promote D2G in a variety of ways, including regular ad placements in Sports Illustrated and other publications.

Dust to Glory: The film

a white paper by digitalfilm tree







Versions — Previews and Screenings

Windows Media 9

Short clips from original sequences were produced in WM9 for presentations and demos before completion of D2G. Also, in the final stages of the film, WM9 versions were used to create small, portable, high-resolution files to demonstrate workflow and to see preliminary results of color correction, titling, and dust-busting. D2G is also being released in the Windows Media High Definition Video (WMV HD) format. The final theatrical WMV HD file was encoded by Sample Digital using Windows Media 9.

Audience Test Screening

Within three weeks of the start of the online, the D2G edit team delivered an HDCAM version of the film with 90% of all the picture elements in HD resolution. Screening held August 26, 2004 in Burbank.

Theatre Industry Screening

Delivered a QuBit layoff for an industry screening September 9, 2004 in Anaheim, projected digitally.

Theatrical Release

Dust to Glory is distributed in North America by IFC Films. The film appears in theaters beginning in April 2005.

What's the Difference?

Feedback from audiences attending early screenings indicated it was difficult for them to tell difference between film prints and the HD digital projections except that the film print had visible grain. With IFC Films distribution, the film will be seen on both digital projectors and traditional film projectors.

"We'd been up three straight days, trying to get it into shape. I was convinced we were doomed. Turned out the audience ate it up. It tested through the roof. We finished without having to take even a tiny suggestion. No drama or bad blood. Only the movie."
-- Dana Brown, director

Summary and Conclusions

Why is Adobe Premiere Pro the ideal choice for a major project such as Dust to Glory? Producer/editor Scott Waugh: "It is an ideal tool for how Dana and I work together. Everything stays inside one system. We always make changes late in the game. Having one system facilitates that. We make changes even after the audio mix. A more conventional workflow does not work well for that. Adobe Premiere Pro allowed us to do the ultimate final tweaks."

"If you look at the wide landscape of formats that had to be wrangled into a final output for D2G, it is amazing that it can be done today on a desktop," says Ramy Katrib, CEO of DigitalFilm Tree. "And we're happy to say that through this entire process, the workflow stayed within the stream of Adobe products. That is a testament to the durability and the flexibility of the Adobe Software."

Difficult technical problems encountered in finishing D2G were minimized having used Adobe products. "I was surrounded by people who knew the tools and what those tools were capable doing," says online editor/supervisor Jacob Rosenberg. "The tools have a capacity to do a lot. It's a matter of using them enough to learn how to navigate. The only problems were bumps in the road that I wouldn't anticipate. Because of the flexibility of the tools, I could get through them."

"To be able to walk up to your system and add a color correction and be in the tool correcting without anything else is an incredibly powerful feeling."
-- Jacob Rosenberg, online editor/supervisor

As for color correcting an entire feature using After Effects and Color Finesse, this was a huge milestone and represents the future. "Having all these tools working in HD resolution," Rosenberg continues "plus the ability to color correct within that same resolution is a huge deal for filmmakers because it increases the accuracy of the artist's vision. The $1,000/hour coloring suite still has its place, but if you don't have the time or money, desktop tools can legitimately and accurately get the job done. You can tinker around, explore a ton of different looks, or just tweak part of the image. Of course, you want a proper broadcast monitor and external scope, but the point is all your color correcting can accurately be applied to your film. The results are just as good as the high-end tools."

"The CineForm digital intermediate format and pipeline was a blessing for D2G," Rosenberg says. "The file size is manageable and the resolution is high, so we were able to edit quickly, play back effects in realtime, and then play out an HD signal that could be either laid off to tape or sent out to a digital projector. What gave me the most satisfaction was knowing that when effects were applied and when titles were overlaid, and these frames were recompressed into our final outputs, I knew the variable bit rate of the CineForm format would give me the best results for each rendered frame."

For the next project, Rosenberg says he'd eliminate tape altogether by digitizing all the HD and telecined footage directly into the system from the beginning. He says that with two terabytes of storage, 60 to 80 hours of HD content can fit on a single PC.

Of course, the hardware and its technical support should not be overlooked. The right hardware is essential for watching HD footage properly, either on an external monitor or on a digital projector. The same goes for capturing the HD material into the system. "The Xena HD card was a rock on this show," Rosenberg says. "It gave us consistent high-quality input and output of audio and video. With the HD-SDI splitter we would send out full-resolution HD to monitors and projectors."

Rosenberg reports that the BOXX Technologies hardware was key: "It enabled us to get technical support for any hardware or software issues relating to the system. When you're doing something like this for the first time, you want to be able to pick up the phone and have someone answer because they know the value in what you're doing."

In the end, of course, methods and technologies should be transparent. "You can take all the high tech machines and all the long-winded analysis," director Brown says, "all the why, when, and how and put it all away. If we did our jobs, the film should have a spirit of its own. The magic trick is complete. I understand the tricks but not the magic. In the dark, watching it unfold, the audience responds to that spirit. It's no longer mine or ours. It's theirs. The audience will think about it, cherish it, be influenced by it. Now it's theirs and for all the audiences to come."

"The old version of Premiere had a reputation that it wasn't ready for prime time. This (film) validates the fact that Premiere Pro is as capable as any application on the market for getting serious high-end work done."
-- Ron D. Nyam, senior product manager for Adobe Premiere Pro

DigitalFilm Tree

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