



# Avid Digital Cinema Camera Workflows

## Table of Contents

TABLE OF CONTENTS	2
OVERVIEW	3
AUDIO	4
24/25 CONSIDERATIONS	7
AMA VS. DAILIES TRANSCODE	7
AMT + DNXHD	8
RED DIGITAL CINEMA CAMERAS	9
FINISHING R3D FILES IN HD USING MEDIA COMPOSER OR SYMPHONY	14
MXF/DNXHD RELINK	16
AMA CONFORM FROM A REDCINE X PRO OFFLINE TRANSCODE	16
ARRI ALEXA	18
CODEC	18
LOGC LUT	19
ARRI PRORES OFFLINE/ONLINE	20
MEDIA COMPOSER OR SYMPHONY FINISH	21
ARRIRAW	21
BLACKMAGIC DESIGN CINEMA CAMERA	23
OFFLINE EDITORIAL	23
ONLINE	24
2K+ CONFORM	24
EDL AND AAF	24
EDL	24
AAF	26
SUMMARY	27
APPENDIX A: COLOR CORRECTION AND DAILIES SYSTEMS	28
APPENDIX B: AAF RESOURCES AND INFORMATION	29
APPENDIX C: RED CAMERA METADATA MAPPING	30
APPENDIX D: ARRI ALEXA METADATA MAPPING	31

## Overview

Since the introduction of the Sony 24p HD camera in late 1999, the world of digital cinema has changed. Digital technologies have been chasing film—the gold standard—not only in imagery, but also in providing additional benefits such as reduced costs and immediate access to the dailies in post. With changes in technologies, the advantages and disadvantages of new formats and solutions need to be weighed in context of the overall goals and delivery of the program itself. Content producers need to take a holistic approach to what is right for the entire production.

While cameras, formats, codecs, and resolution seem to change on a monthly basis, there are only a handful of options for a post-production editorial solution. Producers need to make decisions based on how flexible and extendable the system can be to meet not only the creative needs of the project, but also the overall deliverables for today's world of multichannel distribution.

Avid Media Composer is the industry-leading solution—both creatively and metadata-wise—enabling you to either finish projects “in system” for HD deliverables, or maintain all metadata and changes for conforming and finishing through third-party systems.

The migration from standard definition (SD) to high definition (HD) took almost 10 years, and is still an ongoing transition in many countries at the broadcast level. The move from HD to 2K to 4K happened in less than half that time, as cinematographers and filmmakers adopted higher resolution formats to meet their creative needs, or to future-proof their content for HD-and-beyond consumption.

Resolution is part of the equation, but color depth and color space must also be considered to allow as much creative control over the image as possible. Color correction is to the video workflow what the sound mix is to the audio workflow. Color correction can emphasize the mood or the moment of a scene beyond simply meeting broadcast standards. The quest for total image control and management in capture, editorial, and post will persist with the continued development of digital cinema-grade cameras.

High-resolution images allow for image extractions without quality loss when delivering 1920 x 1080 from a 2K+ image. For example, doing a slow push-in to emphasize a moment, adding a zoom in to remove a boom mic from the scene, or changing the composition from a two shot to a single. The additional resolution offers the flexibility to make creative or corrective decisions without losing image quality.

Many of the digital cinema cameras are hybrid cameras in the sense that they can record HD “proxies” in addition to their 2K+ formats. This gives you flexibility in your camera choice, as many jobs may not require a 2K+ capture. These cameras can record “editorial ready” media as Avid DNxHD or Apple ProRes. The advantage is you can instantly edit programs under tight schedules, and have perfectly captured images in an HD Rec. 709 color space. There are also several recorders that can attach to the HD-SDI or HDMI output of the camera and record HD media either as a higher quality format than the camera's internal codec format, or as a proxy to the camera's higher quality format; for example, the Sound Devices PIX when used in conjunction with a RED Digital Camera. Each of these solutions change the overall workflow of a production and need to be considered in addition to the primary and secondary deliverables of the program itself. You'll find the current list of Avid DNxHD licensees [here](#).

Typically, programs know what their primary delivery format is going to be. When producing a dramatic television series for a broadcaster, producers have access to the broadcaster's specifications for program delivery. If working with a post facility, they have these specifications on file. For independent producers, they are available upon request. The matrix of input formats and deliverables will dictate the workflow used for any one production. In most cases, the workflows share a common set of recommendations, but each of the cameras may carry specific steps that are unique for format, codec, or color management. This whitepaper will concentrate on workflows that are associated with greater than HD size capture (2K+), with finishing at HD or greater.

Content producers have so many choices in today's market for digital cinema-grade cameras, with various features, sizes, and prices to meet the needs of any production. What works as an "A" camera on a small budget film will also work as a "B" camera on a higher budget production. The common attributes are the quality of the images being captured and how they can be manipulated in post to achieve the desired look.

The workflows described in this document will focus on three popular camera formats:

1. RED Digital Cinema Cameras (EPIC and SCARLET)
2. ARRI ALEXA
3. Blackmagic Cinema Camera

While some of the processes will be common across these cameras, they each have unique features that need to be understood and considered to form a proper post-production plan. One consideration is the treatment of audio, as it is common to whatever camera is chosen for picture.

## Audio

Regardless of camera type, deciding whether to use a single or double system audio workflow is based on a variety of factors, including crew size and budget. A single system workflow can be more convenient, with picture and sound already in sync, as the camera is used to capture the audio recording. But this can come with some drawbacks, such as the cameraperson needing to pay attention to composition, focus, and movement—as well as audio levels—to ensure a quality recording.

With double system recording, you have a separate device and person solely responsible for sound recording, but you'll need to sync audio and video in post. A double system also gives you the advantage of being able to record more than four audio tracks, which is the limit typically found on these types of cameras. Sometimes, the "mix" is sent from the audio recorder device to the camera as a scratch track. This requires the camera to be tethered to the audio recorder through XLR cables, which may (or may not) hinder the type of camera work being performed. Also, once recorded on the camera, there is no reference to the original recording on the audio device other than a common timecode, which could be the same over the course of a several day shoot if shot at the same time of day. Productions need to be aware of this—especially if someone requests a conform back to the original BWF files.


You can use third-party applications as part of your dailies process, which can provide the ability to sync picture to double system sound. The sound post process needs to be considered as part of the overall workflow, as many of the free applications do not parse or retain enough of the audio metadata, making audio conform problematic at the very least. These applications are great for making review dailies, such as H.264, where the intent is not for editorial purposes—or when the audio synced will be the audio used in the final mix.

If your production pipeline allows it, the best solution is to sync in Media Composer if it fits your workflow. Media Composer properly parses and retains the metadata, as well as allows for one-step sync with the mix track only, rather than all of the ISO tracks. Because of the robust clip relationship architecture, you can easily match frames back to the original BWF file, should you want to edit with one of the ISO tracks instead of just the mix track. With this method, you're never more than two clicks away from the ISO tracks. The options available in the AutoSync tool allow for one-step syncing while managing a scratch track on the original video clips, as well as for selecting ISO and Mix tracks from the original multitrack WAV files.

Please note that AMA should never be used for double system sound syncing within Media Composer. You should always use "Import." There is no dedicated BWF AMA plug-in available; AMA defaults to using the QuickTime AMA plug-in, which lacks pullup and pulldown support and correct timecode decoding for 23.976/24/25 frame workflows.

Another advantage of syncing within Media Composer is its ability to easily slip sync when two devices don't have the exact same timecode. Devices can drift over the course of a day—especially if not properly jam-synced together on a frequent basis. Once slipped, Media Composer can keep track of the offset in 1/4-frame accuracy to ensure the downstream conform re-creates the perfect sync. This offset value can be found in the PerfSlip column—a negative (-) number indicates slipping audio earlier than picture, while a positive number (no minus sign) indicates audio being delayed later than picture. For example, in a 35mm project, a PerfSlip value of "6" would be the equivalent of 1.5 frames—or 3,003 samples at 23.976—and would represent audio being delayed in respect of the picture.

When using a double system workflow and syncing within Media Composer, there is no need to track the audio timecode in the SoundTC column. The resulting .sync subclip tracks both sources and will use either the "V" or "A" timecode as needed when generating the EDL. Also, the SoundTC column in all 1080 HD projects only counts at 30 fps, so tracking any rate other than 30 fps will end up being incorrect. If you need to track the timecode in an additional column, use one of the Auxiliary TC1 TC5 columns, as they always match the project frame rate.



With digital productions, you may choose to create a film project—despite the fact that no film is being used as part of the production—when working at 23.976 fps, 24 fps, and 25 fps. That's because you can only perform slip sync in a film project. The granularity of the slip is based on the film gauge selected:

- 35mm, 4 perf allows for a 1/4-frame resync
- 35mm, 3 perf allows for a 1/3-frame resync
- 16mm allows for a 1-frame resync

Selecting 35mm will give you the most granular control over sync, whereas 16mm is 1 perf per frame and, as a result, is frame-based, offering no advantage at all over a non-film-based video project.

A film project offers other functionality, but the “hard subclip” is the one that may affect your expectations the most, if you're not accustomed to working with film projects. For example, in a film project, when editing subclips in the timeline, you cannot go past the boundaries of the subclip itself—a similar behavior to reaching the edge of a masterclip. This was designed to protect metadata, which can be different at the head of each subclip such as KeyKode, Ink Numbers, and all timecodes except for “Start.” Other than this, you won't notice any differences when using a film project, and in some cases, the additional metadata columns, such as VFX and frame-based counts, allow for better and more precise metadata management due to the additional dedicated columns.

The BWF file carries a lot of valuable information logged by the production audio team on set. (Fig. 1) In addition to track information such as lav, boom, and perhaps even character name, they also log Scene and Take. Repurposing this metadata in Media Composer can save a lot of time in the logging process once clips are synced to their video equivalents. When AutoSyncing, Media Composer always defaults the naming of the resulting .sync clip to the name of the video clip. But in a file-based world, the name of the file is less than relevant to the editor, such as A004C010\_20100610\_R1JL in the case of an ARRI-created ProRes file. If the Scene and Take were logged on set, the resulting clip, once imported, will show the Scene/Take info in the “Name” column.

You can use this info to easily rename clips. Before AutoSyncing, create a custom column and duplicate the contents of the “Name” column into that column by using Command-D (Mac) or Control-D (Windows) and selecting “SoundRoll” from the pop-up menu in the dialog. Once the clips are synced, select the custom column with the Scene/Take information and duplicate it back into the Name column. In two easy steps, you've just renamed all clip names from that day's dailies.

The entire BWF file name ends up in the TapelD column, which is not available to the EDL Manager as a source when generating EDLs. However, you can highlight the entire TapelD column and create a “duplicate column” (use Command-D or Control-D and select SoundRoll from the pop-up menu in the dialog). This will copy the entire contents from one column to another, and will now be available in EDL Manager.

Name	Start	Duration	Scene	Take	Tracks	Tape	TapelD	Soundroll	Audio SR	TRK1	TRK2	TRK3	TRK4	Name2	Creation Date
30A/1	13:23:25:21	1:13:01	30A	1	A1-4	MV_17	MV_17032.WAV	MV_17032.WAV	48000	mix	boom	james	Abby	30A/1	8/5/2012 10:51:02
30A/2	13:25:06:10	1:06:20	30A	2	A1-4	MV_17	MV_17033.WAV	MV_17033.WAV	48000	mix	boom	james	Abby	30A/2	8/5/2012 10:51:02
30A/3	13:28:34:02	1:09:05	30A	3	A1-4	MV_17	MV_17035.WAV	MV_17035.WAV	48000	mix	boom	james	Abby	30A/3	8/5/2012 10:51:04
30A/3	13:27:12:05	22:11	30A	3	A1-4	MV_17	MV_17034.WAV	MV_17034.WAV	48000	mix	boom	james	Abby	30A/3	8/5/2012 10:51:04
30A/4	13:30:52:21	24:03	30A	4	A1-4	MV_17	MV_17036.WAV	MV_17036.WAV	48000	mix	boom	james	Abby	30A/4	8/5/2012 10:51:04
30B/1	13:35:47:17	44:07	30B	1	A1-4	MV_17	MV_17037.WAV	MV_17037.WAV	48000	mix	boom	james	Abby	30B/1	8/5/2012 10:51:05
30B/2	13:37:21:19	41:03	30B	2	A1-4	MV_17	MV_17038.WAV	MV_17038.WAV	48000	mix	boom	james	Abby	30B/2	8/5/2012 10:51:06
30B/3	13:39:42:15	43:17	30B	3	A1-4	MV_17	MV_17039.WAV	MV_17039.WAV	48000	mix	boom	james	Abby	30B/3	8/5/2012 10:51:06
31/1	13:53:26:13	1:33:02	31	1	A1-4	MV_17	MV_17040.WAV	MV_17040.WAV	48000	mix	boom	james	Abby	31/1	8/5/2012 10:51:06
31/2	13:55:16:17	1:34:03	31	2	A1-4	MV_17	MV_17041.WAV	MV_17041.WAV	48000	mix	boom	james	Abby	31/2	8/5/2012 10:51:08
31A/1	14:02:12:11	38:21	31A	1	A1-4	MV_17	MV_17042.WAV	MV_17042.WAV	48000	mix	boom	james	Abby	31A/1	8/5/2012 10:51:08
31A/2	14:03:42:03	39:10	31A	2	A1-4	MV_17	MV_17043.WAV	MV_17043.WAV	48000	mix	boom	james	Abby	31A/2	8/5/2012 10:51:08
31B/1	14:11:43:23	32:12	31B	1	A1-4	MV_17	MV_17044.WAV	MV_17044.WAV	48000	mix	boom	james	Abby	31B/1	8/5/2012 10:51:10
31B/2	14:12:54:23	44:02	31B	2	A1-4	MV_17	MV_17045.WAV	MV_17045.WAV	48000	mix	boom	james	Abby	31B/2	8/5/2012 10:51:10

Fig. 1 – Example of metadata from a BWF file.

## 24/25 Considerations

Productions in PAL-based countries use either 24.000 or 25.000 frame rates and rarely run into concepts of pullup or pulldown as part of their dailies process, as the offline will be done at the native frame rate of the recorded material. The difference between 24.000 and 25.000 is 4.1%. The decision to do a pullup or pulldown between these frame rates is common for distribution purposes, where a frame-for-frame speed-up or slow-down is preferred, as it does not introduce motion artifacts in the progressive frame rate conversion. There may also be a decision to correct for pitch, as the 4.1% speed change introduces a .7 semitone of pitch change.

Media Composer features Mix & Match, enabling you to mix any codec, raster, and frame rate in the same timeline, without changing the duration of the original material. This feature offers huge advantages for many productions such as documentaries, but has quality limitations as a means of Universal Mastering, where the frame-for-frame speed-up or slow-down is preferred. For example, a 24.000 production producing a 25.000 fps master will have a form of pulldown introduced to maintain the original duration of the program. The pulldown process introduces one repeated field every 12 frames so that  $2 \times (12 \text{ frames} + 1 \text{ field}) = 25$ . The introduction of the extra field into the cadence every 1/2 second is noticeable to the eye on scenes with any kind of movement.

Avid Symphony offers a solution with its Universal Mastering feature, which performs a frame-for-frame speed-up or slow-down during the digital cut process to tape-based formats, maintaining the higher quality conversion. It's not available as a file-based output directly, but could be handled in third-party conversion programs.



## AMA vs. Dailies Transcode

Introduced in Media Composer 5 and Symphony 5, AMA (Avid Media Access) is plug-in architecture that enables you to directly and instantly access material in a variety of camera codecs available today. The ability to sort, log, and edit instantly has distinct advantages for many program workflows—especially those with quick turnaround demands. Understanding the advantages and disadvantages of AMA depends on several factors, and there is no hard and fast rule for the same workflow every time. You need to consider the amount of footage to storage ratios, the expected system performance (lots of layers, multicam, etc.), working on a SAN, and your comfort level of managing all aspects of media vs. allowing Avid's MediaFile management system to handle things.

Also available are “dailies” software solutions for file-based formats. Solutions range from Blackmagic Design's free DaVinci Resolve software to paid applications such as ColorFront, Baselight, Flexity, YoYo, Pomfort, and Convey. (See [Appendix A.](#)) Deciding which tool to use once again comes down to your workflow—maybe you chose not to work natively with a camera's codec, or the codec itself is not supported natively, or the footage, as shot, requires a LUT to be viewed correctly using Rec. 709-calibrated monitors. Also, efficiencies can be gained by letting Media Composer do what it does best—edit and craft your story while letting other tools create the media.

One thing to note is how the source file is being tracked as metadata in the post workflow. Depending on where and how the files are accessed, the “name” of the file can be different, or tracked differently in Media Composer, which can have an impact on the final conform, whether it's being done with an Avid product or with a third-party mastering system. Also, some of the dailies solutions license the Avid Media Toolkit (AMT), which brings a single consistent interface to the MXF wrapper and, if they licensed the Avid DNxHD codec, can create native MXF-wrapped DNxHD media directly from the system. Some systems may only use the freely available Avid DNxHD QuickTime codecs and create the same essence with a QuickTime wrapper rather than MXF. All of these can work, but will have some impact on different parts of the workflow and the amount of source essence metadata being managed. Also note that native MXF-wrapped DNxHD media cannot be imported directly into a bin. These files must be copied or moved to a folder within the Avid MediaFiles/MXF/ folder hierarchy.



## AMT + DNxHD

As mentioned, the AMT (Avid Media Toolkit) and DNxHD combination allows any third party to create native MXF-wrapped DNxHD files in the exact same way as if Media Composer had originally captured the footage. Each third-party manufacturer may implement the SDK differently within their tools, so while a consistent output is possible, there may only be a subset of the codecs and such available at any one time. Avid maintains and updates the AMT SDK, but it's up to third-party manufacturers to update their own releases themselves. For example, some third-party solutions may already offer the new Avid DNxHD 444 codec, while others may offer that in a future release.

A few things to keep in mind when using footage created by AMT in third-party applications:

1. Media created by these solutions are not associated with an Avid project name. These files can be used in any project, but when looking at them in the Avid MediaTool, they will not be associated with a project. The only way to associate media with a project is to have that project create the media in the first place via a tape capture, import, render, or transcode.
2. The Source ID of the original camera media is only tracked in the TAPE column once in Media Composer. Only AMA and direct import into your Avid system will use the original file name (as seen at the directory level including extension) in the Source File column. There may very well be a mismatch between this and a direct import of the same file, which needs to be considered and managed accordingly. Media Composer 6.5 and Symphony 6.5 provide improved flexibility in relinking files being tracked in different columns and with varying nomenclature.


3. Audio transcoded via AMT does not have the ability to be addressed on the 1/4-frame boundary for accurate sub-frame syncing. This feature only works when audio media is created within a film-based project (35mm, 3 perf or 35mm, 4 perf) in Media Composer.
4. Limited metadata is added to the MXF wrapper, usually containing the source ID and timecode via the START column only. All other metadata is typically exported as an ALE file (Avid Log Exchange), if offered, which can be merged into the master clips before editing starts. You'll want to do this before adding any additional metadata logged on the clips, as it will be lost should you decide to merge after the fact. Detailed information on logging and metadata in Avid editing systems can be found [here](#).

## RED Digital Cinema Cameras



RED EPIC camera

One of the early entrants in the high-resolution digital cinema camera space was RED, with the introduction of the RED ONE. These cameras pioneered the large sensor, RAW-based recording solutions to meet the needs of productions looking to approximate the 35mm film standard of the moving image. There is plenty of information on the format and the history of the camera itself, but as with any technology, it advances. As better decoding and color science are developed, they can be applied to all images recorded to date, enabling image improvement over time.



RED camera workflows primarily focus on the R3D file format being recorded, and the use of RED's free image software REDCINE-X PRO. The workflows discussed here will be appropriate for all of RED's camera offerings, as all of them create the R3D file format. The differences between cameras are based on model and recording medium, such as resolution, frame rates, and support for HDRx in the newer cameras.

The use of R3D in a Media Composer workflow comes down to choosing whether to work with the format directly through AMA using the R3D AMA plug-in, or transcoding the material beforehand using a “dailies software” application. In the case of RED files, RED provides a free application—REDCINE-X PRO—to do this as part of the overall solution. One advantage of using REDCINE-X PRO is that feature enhancements will be available in RED's software before other third parties implement and release them via the SDK. REDCINE-X PRO can also be used in a hybrid manner, where the overall image look is set first, then applied in Media Composer via the RMD (RED metadata) file, which carries the color metadata. This works well when all of the parameters of the color controls are needed, since AMA exposes only a subset of the total parameters, but applies all of the settings from the RMD file.

If working in an offline/online scenario, where lower resolution proxies are being created, you can create the online files in REDCINE-X PRO and export as native DNxHD files, with all of the necessary controls. Be aware of the black and white levels of the resulting file to ensure they meet Rec. 709 video standards. In 8-bit terms, video black is 16|16|16 RGB and video white is 235|235|235 RGB. When exporting directly out of REDCINE-X PRO to Avid MXF-wrapped DNxHD, there is a setting for scaling to legal video levels. Since REDCINE-X PRO is working full swing across the entire RGB level set (0-255 in 8-bit terms), this setting will scale 0-255 to 16-235 to look correct on a calibrated Rec. 709 monitor. This is only done as part of the export when the look is baked into the Avid DNxHD media. The R3D AMA plug-in does not have a button to do the same scaling and will play back the full swing levels, resulting in a different look than if transcoded with those settings. The AMA plug-in interface does offer histograms with legal video level indicators, but you would need to adjust these on a per-clip basis.

The use of AMA and RED is already well documented and available on the Avid website.

```

TITLE: UNTITLED SEQUENCE.01
FCM: NON-DROP FRAME
001 001      V      C      01:00:39:00 01:00:40:28 01:00:00:00 01:00:01:29
002 253      V      C      23:38:52:23 23:38:55:13 01:00:01:29 01:00:04:16

```

Fig. 2 - Incorrect EDL from 720p 23.976 sequence.

Because the R3D file formats can be debayered on the fly to lower resolutions and data rates, AMA can be used to edit the native R3D file. Keep in mind that the full debayer is only available during transcoding and rendering. Media Composer and Symphony are designed to be HD and SD video editing and mastering products. The highest HD resolution is 1920 x 1080, which is just under a 2K-size image. Media Composer takes advantage of this, and when playing back, all files larger than 2K are debayered to their closest 2K extraction, then scaled to fit inside the 16:9 aspect ratio. So with the timeline setting at green/green, the debayer is set to half. A green/yellow setting would then be a 1/4 debayer (1K). Following the same logic, a 720p project using the same media would be a 1K extraction when in green/green mode, and green/yellow would be 1/8. For productions looking to eke out all the performance they can for a given system, you can use the project type and debayer combined with the timeline settings to create good-looking images.

Keep in mind that a 720p.23.976 project counts timecode as 30 fps with a 2:3 pulldown per SMPTE specs. AMA linking to an R3D file recorded at 23.976 will track as 23.976 without consideration of the pulldown. When mixing formats in such a project, an EDL generated from the project will not be accurate, as there is no flagging as to what the original frame was, resulting in source duration and record duration not being equal. An example of that is this sample EDL where the first event was a 23.976 capture from a 720p/59.94 with 2:3 pulldown removed. The second event is a 23.976 R3D file.

It's easy to see where event #1 is tracking the pulldown frames, and that the EDL is a "30 fps" EDL, since timecodes ending with :28 and :29 are visible in the first event. (Fig. 2) The second event is not as obvious as being native 23.976 since those timecodes are valid in both 23.976 fps and 29.97 fps (and 25 fps) formats. But if you loaded this EDL into a third-party system, it would either complain or make changes such as inserting black on the second event, where in a 24 fps count the duration is 02:20, and in a 30 fps count it's 02:17—a difference of three frames. If all of the footage is 23.976, and the production is using 720p to increase performance due to the project-to-debayer relationships, you should make all EDLs in a 1080p/23.976 project by changing the format in the project window beforehand.

The term "offline" really refers to working in a resolution that is not the resolution of the final mastering and delivery. This is done using lower data rate proxies. In Media Composer, Avid DNxHD 36 is the offline codec, which provides high-quality images at low data rates. This is valuable when you've got a large amount of dailies being produced, you need system performance for handling multiple-layer VFX without rendering, you're editing a multicam project, or for playing off a FireWire drive with ease in a portable on-set scenario. For example, a single 1 TB drive will hold around 65 hours of Avid DNxHD 36 video. Many productions, however, may benefit from working at the target resolution directly, skipping the additional conform and transcode step altogether. Since this varies on a project-by-project basis, the Avid Storage Calculator found [here](#) can help with storage considerations between different DNxHD formats.

Many productions may choose to use AMA to quickly view the footage in real time, make notes and comments, then transcode to an offline resolution. The advantage of this process is that all notes and comments created at this point will persist through to editorial. Note that if transcoding within Media Composer for offline dailies, the Debayer settings are defaulted to “Full” in the Media Creations setting. Transcodes are much faster when set to either a 1/2 or 1/4 debayer, and the image is still more than good enough for creative editorial. With the multicore support of the AMA plug-in architecture, dailies can be created faster than real time.

If you're creating offline dailies with REDCINE-X PRO, be sure that the target file is a native MXF/DNxHD format. REDCINE-X PRO offers QuickTime-wrapped essence as well, so you can create QuickTime-wrapped DNxHD files, but it will not take advantage of native Avid-managed MXF media within Media Composer.

The following files are created from each batch of transcodes from REDCINE-X PRO. (Fig. 3) A batch can contain a single file or an entire day's shoot. It depends on how your production wants to manage the media—by camera, by card, by day, etc.

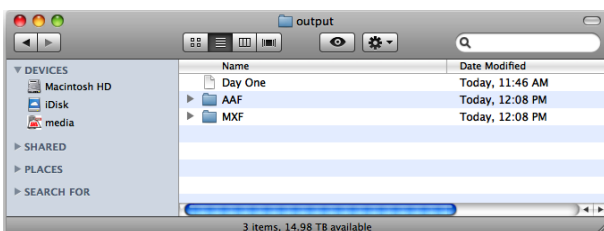


Fig. 3 - Here's a sample export from REDCINE-X PRO.

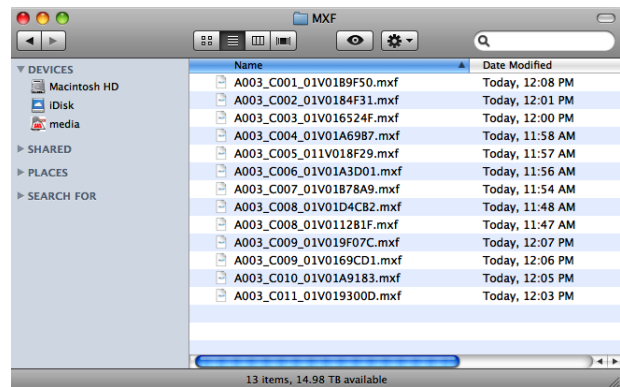


Fig. 4 – MXF folder containing the .mxf media (essence).

This is the native MXF-wrapped DNxHD media to be used for editorial. (Fig.4) If the dailies also include audio, each “clip” will have one video .mxf and one audio .mxf for each track within the original BWF file. So if dailies are synced with an 8-track audio file, you would see nine files associated with that clip in the MXF folder, then that is multiplied by the number of clips in the batch export. The MXF wrapper carries the minimum amount of metadata—the filename as source and the TOD timecode.

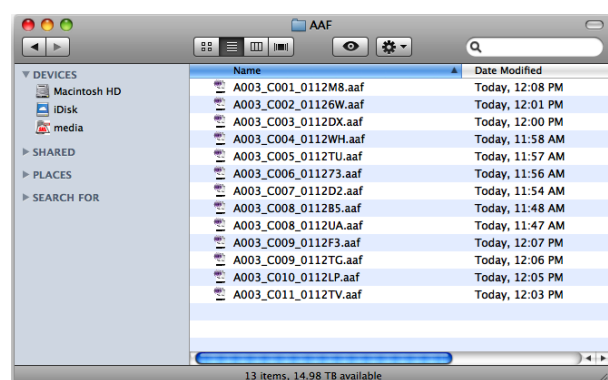


Fig. 5 – AAF folder containing the pointers to the MXF media.

Each clip in the batch export will have a single AAF associated with it. (Fig. 5) These are very small files that contain additional metadata, with the most important being the video and audio relationship pointers to the MXF files.



## ALE File

The ALE file contains all of the important metadata and parameters from REDCINE-X PRO and parses the metadata into the appropriate columns within Media Composer to track as needed in downstream post processes. This includes the in-camera timecode, color parameters, and the 8-character representation of the file, if working with third-party systems that only support that workflow (e.g., Final Cut Pro). REDCINE-X PRO will add to the ALE file if additional exports are done to the same folder/directory. This can be helpful in some cases, but you'll need to manage this media. For organizational purposes, keeping a separate folder for each batch export is easier overall. (See [Appendix C for R3D metadata mapping](#).)

To get these files into Media Composer, simply follow these steps:

1. **Copy the contents of the MXF folder into the Avid MediaFiles/MXF folder.** This folder exists at the root level of the media drives being used and will have the following path: Avid MediaFiles/MXF/1, where "1" is one of many folders containing the MXF files. Media Composer manages the number of files allowed by the operating system automatically to ensure that the files are available to you when needed. Once that count is exceeded, Media Composer automatically creates another folder. You can create your own numbered folders to manage dailies a little easier, such as "101" as a way to track dailies from day 1 for project 1, 102 for day two, and so on.

2. **Import the AAF files. Launch Media Composer and your project.** Create a new bin or open an existing one that will reference the new files. The easiest way to associate the media in the Avid MediaFile folders is to import all of the associated AAF files from the AAF folder. You can do this by going to File > Import or drag and drop the files directly into the bin after selecting all of them in the folder. There are several advantages to importing the AAF file:

- It quickly associates files to a project and bin for better organization
- It links immediately to MXF files without requiring any further relinking
- It supports both video and audio, whereas ALE relinking does not

Another popular method is to import the "msmMMOB.mdb" file directly from the numbered MXF folder to create the master clips. The disadvantage of this method is that if there are multiple projects with media from other days, the process will create master clips for them too. The AAF import only references the files from that batch.

3. **Merge the ALE into the existing master clips created by the AAF import.** Select "Merge based on known sources" in the Import/Shot log setting pane to insert all of the metadata from the ALE into the existing master clips. If you do not merge, you'll get new master clips that aren't yet linked to the media. We recommend that you NOT import the ALE file in lieu of the AAF file, and then take the extra step to relink the file via the Relink dialog. While this may work for video-only clips, it will not link to audio if synced within REDCINE-X PRO.

Don't just import the ALE file with the AAF files and then use "Relink" to the media. While this works in many scenarios, it does not allow linking to audio, and can become unlinked in certain processes during the post-production process. An ALE file is a logging and metadata transfer file and does not contain all of the relationship information of the master clip to media essence as does the AAF.

You can start editing from this point, sync to double system audio if needed, or perform further logging and organization. An optional organizational tip is to take all of the clips from the batch export and choose "AutoSequence" from the bin menu. AutoSequence creates a timeline or a virtual reel of all the takes, where the clips are aligned based on their time of day (TOD) timecode in the sequence. Basically, the record side timecode matches the source, so you can see at glance how all of the clips align to the time of day. Also, the sequences can be left in the dailies bin to have on hand should a master clip that was deleted by mistake need to be re-created.

Once editorial is complete using the offline proxy media, you must make decisions about where and how to conform the sequence back to its original camera files. The first choice is whether it will be finished in an HD resolution for television, DVD or web/mobile distribution, or as 2K/4K for a theatrical finish. Some choices for finishing applications can be:

- HD finish: Media Composer, Symphony, or Avid DS
- 2K+ finish: Avid DS or third-party resolution-independent applications

If finishing at 2K+, you can derive the HD deliverable from the high-resolution master, applying the proper color space conversion as needed. If the production wants to protect for theatrical delivery, all of the metadata will be available for conform when needed, and a finish at HD will be the primary deliverable.

### Finishing R3D files in HD Using Media Composer or Symphony

When finishing at HD with the original R3D media, and an offline done with proxy media, there are two methods to choose from when conforming:

- Link the sequence to all camera originals using AMA
- Transcode all selects in REDCINE-X PRO to a target mastering resolution and relink in Media Composer or Symphony

Depending on the number of original R3D files you have, both methods may benefit from the pull list to reduce the number of files to just the ones used in the final sequence. Depending on the complexity of the sequence, you can do this in a variety of ways. If the sequence is a simple single layer of straight cuts, you can generate an EDL directly from EDL Manager. But simple, single layers are rare these days, so the goal is to create a timeline that is just a single layer of clips used in the sequence. You can use the "Decompose" feature to accomplish this. Decompose breaks the sequence down into all of the elements that made it up. To make things easier, strip the sequence of its audio tracks to reduce the number of elements that will end up in the bin. Put the sequence into its own bin, and select "Decompose" from the Clip menu. Media Composer will make sure that all blended transitions have the proper handles applied, but you can enter an additional handle value for all events in order to have frames available for any small changes that may need to be done at the conform stage.

The result of the Decompose process is a set of .new master clips. The “sort” functions can help further separate the R3D clips from other camera formats if multiple formats were used. Select all R3D sourced clips and drag them into the record monitor to create a new timeline. This now represents all R3D clips to be “pulled” regardless of how many layers or nests these clips were used in for the program itself. Depending on the type of pull list you need, this method will list all spans of the same clip if used several times—not just a single listing of the file—regardless of the number of times it’s used. Using “set bin display” to show only “master clips” and “show reference clips” will make the bin only show the master clips in their entirety once. Select all R3D-related clips and drag them into the timeline to create the “pull” list to be used by REDCINE-X PRO.

The benefit of conforming via the pull list method is that regardless of how complex the sequence may be with layers, nests, and effects, all that is being changed out is the reference to the MediaFile itself. A perfect conform is guaranteed each time, as none of the creative decisions are ever being re-created.


Once the “pulled selects” timeline is created, an EDL is generated. Not all EDLs are created equally, and a certain type of EDL template must be used for file-based workflows. While the CMX-3600 EDL is popular, it has severe limitations when used with the thousands of files in a modern digital production. The CMX-3600 has the following limitations:

- No more than 8 characters can be used in the source name
- It can't contain no more than 254 sources
- It can't contain no more than 999 events

It's easy to exceed these limitations with today's cameras and formats, especially where each unique file name can now be considered a source. This is a challenge caused by using “standards” that were set over 40 years ago. In order to remove these limitations, new templates were created: File\_16 and File\_32. The numbers refer to the number of characters allowed to reference the source file name. The 16-character template works great for R3D files, but other camera formats, VFX elements, and such can easily take up to 32 characters. These templates also remove the source limitation and increase the number of events allowed to 9,999.

This Sequence Pull List EDL can now be imported into REDCINE-X PRO to generate the following options, based on either an AMA relink workflow or native Avid MXF/DNxHD media.

- Copy the entire original R3D file and associated RMD file with the original .RMD and .RDC folder structure to a target drive or directory
- Copy just the spans used in the EDL (from the Decompose method) as consolidated R3D files to a folder structure drive or directory
- Transcode to a new Avid DNxHD codec type for finishing (for example, Avid DNxHD 175x)



**Note:** When generating selects from the same original R3D file, the AAF folder will not contain an AAF for each of the elements. For example, if three sections of the long R3D file were used, the MXF folder would contain three MXF files, but the AAF folder will only contain one AAF. This is because the AAF file is not being versioned and is overwriting itself. The remaining AAF file will represent the last span created from that file. If all of the newly created MXF files are in their own numbered folder in the Avid MediaFiles/MXF folder structure, then the msmMMOB.mdb file from that folder can be imported into a bin, and the master clips will be created.

If using an EDL of the original sequence, and not a “Pull List” sequence with handles being defined in either Media Composer or REDCINE-X PRO, be sure to set the import EDL timecode to be “exclusive” in the Import Settings, meaning that it is +1 frame from the frame actually used in the sequence. Again, EDLs by specification are inclusive for the IN and exclusive for the OUT. If this is set to “inclusive,” the resulting MediaFile will be 1 frame short and will not relink. This isn’t an issue if handles were added somewhere in the process before the transcode takes place. Depending on the workflow chosen, the result will either be a folder of R3D files or a folder with MXF, AAF, and ALE, as generated with the offline workflow.

## MXF/DNxHD Relink

If MXF/DNxHD media was created, the process is very similar to the offline steps already outlined. Copy the MXF files to an Avid MediaFiles/MXF/ numbered folder, import the AAFs to a bin, and merge the ALE file. Once the media is online and accessible, highlight the original offline edit (not the pull list), as well as all of the newly created high-resolution clips. With the sequence and master clips highlighted, choose Clip > Relink. Within the Relink settings, select the “Relink to selected” option. This will force the sequence to only look at the newly created clips and relink. Because it’s difficult at times to tell the difference between DNxHD36 and DNxHD175x, for example, you can easily color the clips referencing the DNxHD175x with a single color, so once relinked, use “source color” in the timeline to quickly verify that all of the clips were relinked to the high-resolution files. The timeline also offers the ability to display a clip’s codec resolution as text, but that is not as quick as using color to verify a complete conform to the proper media. And it’s geared more toward a timeline, with multiple codecs used and a general relink performed, vs. the more targeted approach of “relink to selected.”

## AMA Conform from a REDCINE-X PRO Offline Transcode

The following process will only work in Media Composer 6.5 and Symphony 6.5 due to the inability of previous versions to relink spanned file names between Tape and Source File. For productions using earlier versions of Media Composer that started with a REDCINE-X PRO offline, the only solution is to use the REDCINE-X PRO pull list method and generate new DNxHD media. The same goes for starting off with AMA and using the transcode method for the online process.



The relink process uses an exact match method (with uppercase/lowercase ignored as an option) to make it all work. Third-party applications that use Avid's AMT to create native MXF/DNxHD media will always place the source file name in the Tape column. Depending on the application, the interpretation of the Source File name can be different, or left to you to define. In the case of R3D files, AMA sees the entire file name, including the extension, whereas REDCINE-X PRO (using AMT) only inserts the base file name. This becomes an issue with clips that pass the 2 GB file limit, and spanning is done to manage the files by adding a "\_001, \_002" extension. (Fig. 6) AMA will also add the extension, as in .r3d. The same original file generated by REDCINE-X PRO or linked via AMA will look like the following in Media Composer:

- REDCINE-X PRO: A118\_C004\_11022S and tracked via the Tape column
- AMA: A118\_C004\_11022S\_001 and tracked via the Source File column

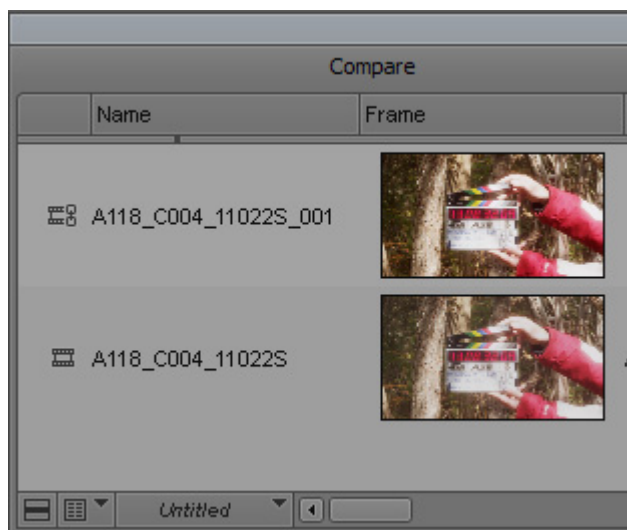


Fig. 6 - Spanned files via AMA

Changes in Media Composer 6.5 and Symphony 6.5 address this issue by allowing the relink process to ignore extensions, as well as any set of characters after the last "Insert Character or Symbol." In this example, "Ignore Extension" is active and an underscore ( ) is added to the "Ignore After." (Fig. 7) Internally, this ends up with both sources looking like R075\_C003\_12098T, enabling you to relink successfully. The relink function includes the ability to relink across different timecode fields, as well as columns, giving you full flexibility in conform when different vendors are making dailies and different fields are storing metadata.

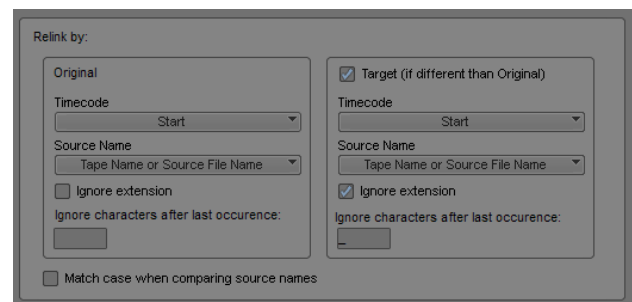



Fig. 7 - The Relink dialog in Media Composer 6.5



In many cases, it will be faster and more convenient to relink to the original R3D clips through AMA. This could be from the R3D selects using the Pull List method or directly to drives as originally archived. In either case, the process is the same; it's more about the number of files being linked to and management of the R3D files. The Pull List method reduces the number of files to just those being used and, depending on the shooting ratio, will streamline the file management process.

This method will also use the Relink to Selected method already described, but all R3D files will first need to be linked using AMA. Depending on file management procedures, you may end up with one bin of all selects, or multiple bins to represent the original camera files. It doesn't really matter to the relink process—it's more about how you wish to organize the process. Again, we recommend using clip color on all the AMA clips to quickly confirm that the relink process was successful.

The relink process is exactly the same as outlined in the previous method. Select all high-resolution clips in all bins as needed, as well as the original offline sequence. Select "Relink to selected," ignore the extensions and underscore (`_`), and the relink will be performed. We also suggest that you turn off the "match case" option for relinking with R3D files, depending on whether the ALE file was merged or not during the offline process from a REDCINE-X PRO transcode. If not, the file names will all be in lowercase, whereas the ALE merge updates them all in uppercase to match the original file name and, thus, AMA will reference them the same way. So, in addition to the different columns to manage the file names, you may see names that look like this:

- REDCINE-X PRO without ALE merge: r075\_c003\_12098t
- AMA: R075\_C003\_12098T\_001.R3D

Note that when linking the sequence to the original camera files, they no longer carry any of the user-generated metadata that may have been applied during the editorial process. Items such as clip name, comments, and descriptions will no longer be available via the sequence. You might consider exporting an ALE file from the offline clips and merging into the new AMA linked files to carry all relevant original metadata gathered during the post process. The success of this process will depend on whether the new files match exactly in START and END.

Once you've conformed the sequence, you can complete the additional finishing tasks, such as creating titles and mixing the sound, and then output directly from Media Composer or Symphony to meet the final distribution requirements.

## ARRI ALEXA



### ARRI ALEXA camera

The ARRI ALEXA offers two different workflows for digital cinematographers, depending on the needs of the production. The camera can record Apple ProRes and Avid DNxHD formats directly to the camera's SxS cards, or ArriRAW to an external recorder. The decision on which to use is usually based on the control of image in post, budget, turnaround time, and such.

The ability to record directly to Apple's 12-bit ProRes 444 with a LogC curve has become a very popular workflow in many feature film and television productions. While the camera can also record Apple ProRes 422 as well as Avid DNxHD 422 formats, LogC is what allows as much of the sensor's dynamic range to be captured. Because of the QuickTime wrapper to the ProRes codecs, you can use an NLE system to directly access these recorded files to jump-start the editorial process.

Media Composer supports Apple ProRes as a native editorial codec. The same considerations for user- or Avid-managed media apply here as with the RED R3D workflow. Even though the ProRes codec is native in Media Composer, which offers some performance advantages, you need to weigh in a transcode or consolidate step.

If your production wants to use Apple ProRes in an Avid-managed workflow, you'll need to "Import" the media and not use AMA. When consolidating Apple ProRes, a decode/re-encode process is applied, even if the same data rate is selected. On the other hand, import is a "fast import," and only copies the file to the Avid MediaFile/MXF folder structure.

This is not the case with Avid DNxHD recorded by the camera. Although these files are MXF-wrapped, they cannot be directly dropped into the Avid MediaFiles folder. You'll need to install the ARRI DNxHD AMA plug-in to ensure that all metadata is being extracted as part of the process (such as long and short reel IDs). Do not use the generic QuickTime AMA plug-in. (See [Appendix D for ARRI Metadata Mapping](#)).

You'll find the ARRI ALEXA plug-in on the Avid AMA webpage as a free [download](#). Once you access the MXF-wrapped Avid DNxHD files through AMA, you can perform a consolidation process to Avid Media if an Avid-managed media workflow is desired. One of the advantages for using AMA before a transcode/consolidate process is the ability to review subclips and select just the required takes, reducing time and overall storage needs.

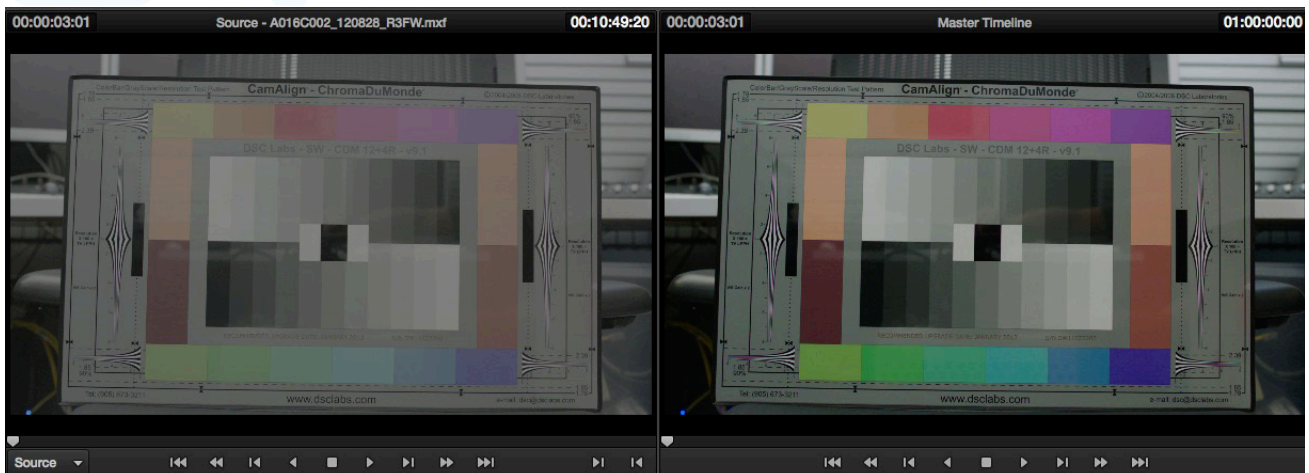


Fig. 8 - LogC footage before and after application of the proper LUT.

## LogC LUT

LogC LUT handling is another important choice to make, depending on your specific image manipulation workflow needs. Media Composer can directly access the media, but does not offer general LUT insertion as part of the video pipeline, unlike RED's R3D file format, where the color information in the RMD file is being handled by RED's SDK via the AMA plug-in. When LogC or another type of format is recorded with a color space other than Rec. 709, images will not look "normal" in editorial, so LogC > Rec. 709 LUT is usually chosen. If no correction LUT is applied, the images will have a washed out and desaturated look compared to what is expected. This is because the full dynamic range of the image is being "squeezed" into the chosen codec and, as a result, will display lifted blacks, reduced whites, differences in saturation, and more, which in turn gives the colorist more control later as to determining what is black or white and what detail stays or goes, gets crushed, and so on, as part of the creative correction process of the final image. (Fig. 8)

There are four ways you can handle LogC images in an offline editorial process:

1. Ignore the look of the images. Edit with the LogC material directly. This works great for very fast turnarounds where there is no offline/online workflow and files go straight to color correction.
2. Add a LogC > REC.709 LUT to the output of the HD-SDI or HDMI signal from Media Composer. Devices such as HDLink from Blackmagic Design, or third party I/O cards such as the AJA KONA card, can support a LUT. This provides the advantage of the bullet above and proper looking images to the attached HD monitor, but images in the source/record monitor will still have the original LogC look.
3. Apply a color correction to the sequence top layer, with adjustments to levels and saturation to approximate a 3D LUT with a 1D LUT control. The advantages are similar to the first bullet, but it only applies to sequences that can work in a pinch. And while sequences can be used as source, it's not an ideal long-term solution for editing and managing lots of source material.

4. Transcode material ahead of time as part of a dailies process to a DNxHD proxy codec, such as DNxHD 36, while applying a LogC > REC.709 LUT. This can be done with a variety of software solutions at different price points.

Additional information from ARRI about using LogC in an ARRI ALEXA workflow can be found [here](#).

### ARRI ProRes Offline/Online

Creating DNxHD proxy material using a dailies process is the most common method for larger productions, as they can benefit from the low storage requirements of DNxHD 36, as well as the proper color space of images in an HD offline editorial process. The important consideration here is how the source files are going to be referenced through the dailies creation system. In addition to being tracked in either the Tape or Source File columns within Media Composer, the ALEXA ProRes recording also inserts an 8-character REEL ID in the QuickTime header. Third-party dailies systems will always put some form of source file name in the Tape column, as only AMA and direct Media Composer imports allow the Source File column to reference sources. But what gets inserted into the Tape column and what might be available in an ALE export in these systems is what you need to plan for and discuss with the entire post-production team. Some systems will include all of the information from the sidecar files available from the recording as either XML or ALE. Other systems only use what is extracted from the file itself—either the embedded REEL ID or the file name, but not both.

For example, if you're using Blackmagic Design's DaVinci Resolve Lite to create native MXF/DNxHD dailies, you can extract the REEL ID with the following choices:

- Extract an entire or partial file name via expressions
- The folder name containing the media
- Embedded in the file itself
- User-defined

Most dailies and DI systems offer similar types of REEL ID extraction, as sources can be from anywhere, and it offers flexibility when doing a conform. But when creating dailies, a consistent method is more desirable. In third-party applications, the easiest method for ARRI ProRes-recorded material is to use the “embedded” option. If there is a desire to conform in Media Composer or Symphony using AMA to the original ProRes files, having only the embedded reel ID as a source will not relink to the material, as AMA only uses the entire file name and does not extract any metadata from the QuickTime header. This is not an issue with R3D files, as the embedded reel ID is the same as the file name. Careful consideration needs to be applied here.

As mentioned, some systems will insert both the file name and the reel ID from ARRI ProRes files into the ALE file, which can then be merged to the dailies to have both sources being tracked. If the dailies system does not offer the additional metadata or ALE export, then you can merge the camera-created ALE files, if available to them, into the master clips to have both source IDs available. This is something that needs to be planned on before the editorial process begins. If the final conform is going to be done in a third-party system that supports the embedded reel ID, there is no issue. It's all part of good planning ahead of time to allow for more flexibility and choices when it comes time to finish.

## Media Composer or Symphony Finish

You can also use a similar Pull List method, as described with the R3D workflow, here if finishing in Media Composer or Symphony. You can import the EDL (created by whichever chosen method) into a third-party dailies or DI system and create new MXF/DNxHD media, with or without LUT or additional color correction applied. This method assumes that most of the color correction and mastering will be done in Media Composer or Symphony.

If final color correction is to be done in a third-party application, but mastering and output is to be done in Media Composer or Symphony, you'll want to color correct in context of the sequence. You can do this by exporting an AAF or EDL of the edited sequence to your system of choice. Be aware that different systems have different levels of AAF support, and not all systems can conform the complex timelines that can be created within the editing systems—especially if the sequence utilizes plug-ins that are not supported in the color correction application.

One consideration for this type of workflow is to do a pre-conform within Media Composer to the original LogC material and then transcode to the Avid DNxHD 444 codec. Render any of the effects that are not expected to conform prior to sending the AAF sequence to the color correction system. The AAF will point back to the Avid-managed MXF media and be used for the color correction. From the color correction system, new MXF/DNxHD media is created with an updated AAF. You can then bring both of these back into your Avid editing system for final mastering and output. The MXF media will be placed in the Avid MediaFiles/MXF/ folder structure, and the AAF can be imported into the bin by choosing File > Import.

## ARRIRAW

If you're looking for extra image control with no compression at all, consider recording in ARRIRAW. ARRIRAW provides uncompressed image quality and flexibility in the post-production process. ARRIRAW is the uncompressed, 12-bit raw Bayer sensor data output from an ARRIFLEX D-21 or ALEXA camera and needs to be processed before editing can begin. Appropriate equipment and tools are needed to record and work with ARRIRAW, such as an ARRI-approved T-Link recorder. Several solutions are available to record ARRIRAW, such as Codex Digital and Convergent Design. All supporting vendors can be found on the ArriDigital webpage. ARRIRAW is recorded as sequential files, with .ari as the extension. An example of a sequence of files would look like this:

```
TEST-A02-04_ATA02.0227713.ari  
TEST-A02-04_ATA02.0227714.ari  
TEST-A02-04_ATA02.0227715.ari  
TEST-A02-04_ATA02.0227716.ari
```

Note that the entire file name is 29 characters, so you'll need to use the File\_32 EDL template if EDLs are to be generated. The camera can also record a ProRes or DNxHD file at the same time as the ARRIRAW files are being created on the external recorders. Many productions choose to record these as 444 LogC, more as a backup to the ARRIRAW files than as a proxy for editorial; either format will get transcoded through a dailies process in most cases in order for productions to begin using ARRIRAW.

The camera does not record Avid DNxHD 36 as a proxy format at this time, but, storage permitting, DNxHD 115/120 (at 24ps) can be used as the proxy for the ARRIRAW files. The proxy files contain the same file name and metadata, so a final conform can easily be done in third-party systems back to the original ARRIRAW files. These files can have a Rec. 709 look added to the proxy files while recording, as well as any other looks applied at the time of recording.

When recording with uncompressed RAW formats, the storage requirements are far higher than when recording with compressed ProRes or DNxHD formats. To compare, 1 TB of storage would hold the following number of hours of picture-only material at 24 fps:

Codec	Hours of footage per TB
ARRIRAW	1.82
Apple ProRes 444 (1080p)	9.8
Avid DNxHD 444 (1080p)	5.3
Avid DNxHD 422 (175x) (1080p)	13.24
Apple ProRes 422 HQ (1080p)	13.94

ARRIRAW workflows require a “dailies” process for the offline editorial, due to the amount of storage needed to edit the format natively, as well as the performance needed to do simple effects such as dissolves. Any of the dailies systems mentioned previously support ARRIRAW and follow the same workflow pipeline as described for ProRes.

## Blackmagic Design Cinema Camera

Blackmagic Cinema Camera




A new entrant to the market is the Blackmagic Cinema Camera. This low cost, high-resolution camera is ideal for productions considering similar-priced cameras, but want to have the choice to use more compressed formats such as H.264.

The Blackmagic Cinema Camera records in three formats:

- CinemaDNG (Digital Negative Format)
- Avid DNxHD 10-bit 422 formats (Choice of Film or Video dynamic range)
- Apple ProRes 10-bit 422 formats (Choice of Film or Video dynamic range)

The camera records in a 2.5K, 12-bit RAW format (2432 x 1366), and as with all RAW formats, allows for more control and quality in post, depending on production needs. The CinemaDNG is 12-bit Log, but the linearization table is built into the DNG headers, so CinemaDNG-compatible apps will take care of the conversion.



A 3D LUT for Apple ProRes and Avid DNxHD files using the Film mode are available in Blackmagic Design's DaVinci Resolve 9. The camera settings simply refer to it as the Film mode vs. Video Mode (Rec709). The camera only records one format at a time based on your needs. Similar to ARRIRAW, the recording is a series of sequential files. Storage requirements for CinemaDNG are similar to other RAW uncompressed formats; 1 TB will provide 1.98 hours of recorded material. Using ProRes and DNxHD recorded formats has already been covered in this document; you'll also find more info available in our collection of AMA Workflow guides on Avid.com

## Offline Editorial

Due to the nature of the CinemaDNG format, you'll most likely want to create proxies for offline editorial. The camera, when purchased, includes a copy of DaVinci Resolve, which can process the files into a native DNxHD codec. The CinemaDNG format is also supported by all other dailies and color correction systems, as it is an open format that can be implemented by any manufacturer.

The workflow with the Blackmagic Cinema Camera is very similar to the offline processes described with R3D files and ARRI ProRes, but is closest to ARRIRAW due to the sequential frames and uncompressed nature of the files themselves.

One of the unique aspects of this camera, compared to the other formats, is the additional metadata that can be applied directly to the recorded media as it's created. Both camera- and user-generated metadata such as comments, descriptions, scene, take, and more can be entered and becomes available to the editors to streamline the logging and identification process. Some examples of the available metadata (in addition to timecode) are:

- Manufacturer Type
- Camera ID
- Project Name
- Comments
- Favorite
- Keywords
- Reel
- Scene
- Shot
- Take
- Angle

The designation of the source name will need to be considered, as with the ProRes and ARRIRAW formats, whether it be the entire source file name or a metadata field embedded within the file itself. For QuickTime, the metadata is embedded as part of the file itself. For CinemaDNG, the metadata is recorded as XML and embedded in the audio file. This metadata will then be used for EDL and AAF generation for the mastering and conform process.



## Online

Neither Media Composer nor Symphony support the CinemaDNG format, so you'll need to use Avid DS or any of the third-party conform/DI systems on the market today to conform at the native 2.5K resolution.

## 2K+ Conform


If you need to conform at the native resolution of the camera originals, or higher than HD resolution, you'll need to look to systems that support these types of resolutions. Avid offers Avid DS, a resolution-independent software solution that has the best AAF conform of all the tools currently available on the market. Depending on the complexity of the project, turnaround time, and number of VFX, plug-ins, and titles used, the ability to conform most—if not all—of the creative decisions is a timesaver.

Avid DS also uses a file exchange format known as AFE. AFE offers the same sequence interchange information as AAF, but allows master clips and subclips from the bin to be attached as well. This is very useful if the mastering process needs access to alternate clips for versioning, such as “ratings” for some countries. Avid DS also supports any of the text you create in the Media Composer/Symphony title tool or the Avid SubCap effect, eliminating the need to re-create all of these titles by hand, as you would have to do in other systems. Titles can certainly be flattened and passed along, but changes within the title itself can no longer be done.

The market has seen an explosion of mastering tools over the past few years at price points available to all. DI, or digital intermediate, has expanded its feature set to not only be color correction for high-end features, but to also reach into other markets such as broadcast, cable, and independent productions. You'll find a list of solutions in [Appendix A](#).

## EDL and AAF

EDL and AAF are two interchange methods for conforming in these systems. Depending on the system, AAF is usually the preferred method, but your mileage may vary between vendors' software, depending on your timeline complexity (VFX, plug-ins, nested elements, and such) and the depth to which the third-party system has for parsing the information. Avid systems provide an XML presentation of your sequence, but it's a more specialized version that's based on Avid FilmScribe. It's not for conform, but can be used more as a sequence breakdown to parse elements in a database, or as part of a pull process for prepping elements in a DI-type workflow. You'll find information on the XML schema and dictionary on the Avid FilmScribe information [page](#).



When all else fails, you can use the CMX3600 EDL, but that comes with its own set of limitations based on the specifications of a now 40-year-old format. In order to remove some of these limitations, Avid EDL Manager offers two EDL templates: File\_16 and File\_32. Although the overall format is based on a CMX EDL, these templates remove the following limitations:

- Character limit of source reel—CMX3600 only allowed up to 8 characters, while File\_16 and File\_32, by name, indicate the number of source characters allowed in the EDL; this supports the longer file names now used as a source with cameras such as RED, ARRI, and SI-2K, as well as VFX workflows where versioning becomes part of the file name
- Number of sources—CMX allowed up to 256 sources per EDL; while tape-based formats allow up to 24 hours of footage to be associated with a single source ID, each file is its own source SD with file-based media, and because every take is a unique source, it can easily add up to thousands of sources in a single project or timeline
- Number of events—CMX limited the number of events of a single EDL to 999; these new templates have upped the event count to 9,999

Most, if not all, vendors have made changes to allow you to import and use these types of EDLs for the conform process.

In Media Composer, the following columns can be used for source identification in an EDL, depending on where that source file name is being tracked:

- Tape
- Source File
- Labroll
- Camroll
- SoundRoll

As mentioned earlier, depending on how dailies were created—by third-party system, direct tape capture, or AMA/Import—the source identification will most likely fall into either the “Tape” or “Source File” column in the bin. Since an EDL has to have some form of reel ID, Tape and Source File are combined as the default setting for EDLs. As a result, EDL Manager will first look for a value in Tape and use that; if none is found, then it will look to Source File. If you haven’t made any modification of sources, there will never be a value in both columns at the same time; it is either one or the other.

In some scenarios, a version of the source file may exist in either the Tape or Source File column, as well as in a column such as Labroll or Camroll. This is due to the fact that some cameras, such as RED and ARRI ALEXA, will provide an 8-character version of the file name to either support a legacy CMX3600 EDL format or NLE systems that don’t track and generate full file names in the EDL. In these scenarios, the “8-character” Reel ID can usually be found in either the Labroll or Camroll columns.

An example of an ARRI ALEXA ProRes-recorded file will have these two file names available for the same file:

- A064C001\_120524\_R2G4
- A064R2G4

The longer file name will be tracked in either the Tape or Source File column, while the shorter 8-character version will be in either the Labroll or Camroll column. How and where these file names get tracked is based on a variety of factors: where vendors choose to track them, where software solution providers decide to track them, and in the end, where you want to track them. The strength of Media Composer metadata management is that it can manage and output all formats of source tracking in either EDLs or an AAF as needed in the post-production pipeline.

## AAF


AAF (Advanced Authoring Format) is an open standard that was originally initiated by Avid, but then quickly adopted by many vendors, creating an association. The association is now called the Advanced Media Workflow Association (AMWA), and anyone can join and participate in the definition of the open standard.

There are two types of AAF exports available in Media Composer and Symphony: AAF and AAF Protocol. AAF Protocol is a subset of the AAF, as its primary goal is to establish a well-defined, albeit more constrained, set of the AAF to ensure 100% compatibility between vendors. An AAF Edit Protocol may not support all of the latest VFX and layer/nested elements in a composition. As such, it sits between an EDL (the most basic representation of a sequence) and AAF (the most rich representation of a sequence).

The added advantage of the AAF Edit Protocol export is that it can be used for media that Media Composer/Symphony is currently managing, and edited using AMA. The richer form of the AAF file can only be exported if your Avid system has transcoded and is managing the AMA-linked media in the Avid MediaFiles folder structure. The same goes for EDL creation; in order to create an EDL from an active AMA-linked sequence, you open the bin directly from within EDL Manager, as the integrated “get sequence” function relies on an AAF interchange.

Some third-party systems do not recognize conforming sources being tracked in the Source File column when using AAF, as the legacy workflow and vendors’ implementations of it have always been to track sources in the Tape field. If this scenario presents itself, generating an EDL will solve the problem at the risk of losing some of the supported additional VFX metadata.

AAF export presents a variety of options, but when referencing the original camera assets and not the MXF proxy, a “link to” is all that is needed. Additional management is based on track selection, as well as spans within the track, depending on the conform needs at the time of generation. For example, you could just send the video tracks to a DI color correction system, while sending an audio-only AAF to an Avid Pro Tools system. There are no further options to select, as all of the related metadata of the sources and sequence creative decisions are in the AAF file.



Before generating the AAF, you may want to simplify the sequence—especially in the case of multicam sources. Instead of sending all of the sources—whether they were used or not—you can optimize the sequence to remove the group information and only reference the camera angle/take used in the final sequence.

### Summary

With the ability to track multiple sources and timecodes, combined with AMA and open standards such as MXF, AAF, and DNxHD, Media Composer and Symphony give you the most flexibility in the post-production pipeline. Finishing and mastering can all be done directly within Avid products, or easily transported to third-party systems—or a hybrid between the two. The editorial process may seem complicated at first when dealing with high-resolution formats, but careful planning heads off any of the issues that may arise. Consult with all parties involved in both the production and post-production process for picture and sound to ensure that everyone is on the same page before the cameras roll or, in the file-based world, before the production capture process begins.



## Appendix A: Color Correction and Dailies Systems

- (B) Both
- (D) Dailies
- (C) Color correction
- (C) Adobe SpeedGrade color corrector
- (B) Assimilate Scratch color corrector
- (C) Autodesk finishing, VFX, and color grading systems
- (B) Blackmagic Design DaVinci Resolve
- (C) Digital Vision Nucoda FilmMaster color corrector
- (D) DFT Bones Dailies post-production solution
- (D) DFT Flexity dailies system
- (B) FilmLight Baselight color correction system
- (D) Gamma and Density 3cP on-set color correction system
- (B) Mistika finishing, compositing, stereo 3D, and color grading system
- (C) Pandora Revolution color corrector
- (C) SyntheticAperture Color Finesse color correction system
- (D) YoYotta YoYo dailies system

## Appendix B: AAF Resources and Information

AAF Edit Protocol Overview: [http://www.amwa.tv/past\\_events/ibc2005/aaf.edit.profile-web.pdf](http://www.amwa.tv/past_events/ibc2005/aaf.edit.profile-web.pdf)

Edit Protocol Specification: <http://www.amwa.tv/downloads/specifications/aafeditprotocol.pdf>

AAF Effects Protocol: [http://www.amwa.tv/downloads/specifications/AS-05\\_AAF\\_Effects\\_protocol\\_v1.pdf](http://www.amwa.tv/downloads/specifications/AS-05_AAF_Effects_protocol_v1.pdf)

Please note that Avid editing products do not support the AAF Effects Edit Protocol at this time.

## Appendix C: RED Camera Metadata Mapping

Name	A118_C004_11022S
Tape	A118_C004_11022S
Camera	A
Clip	C004
Start	13:08:32:10
Original_Start	13:08:32:10
End	13:09:58:09
Original_End	13:09:58:09
Auxiliary TC1	01:03:44:17
Tracks	VA1A2A3A4
DPX	A118_C004_11022S-000000
Shoot Date	20101102
Filename	A118_C004_11022S
TimeStamp	171059
FrameWidth	4096
FrameHeight	2304
ColorSpace	3
GammaSpace	7
Kelvin	5503
Tint	-9.8
ISO	500
Exposure	0.473
Saturation	1
Contrast	0
Brightness	0
GainRed	1
GainGreen	1
GainBlue	1
Black X	0
Black Y	0
Toe X	0.18
Toe Y	0.07
Mid X	0.5
Mid Y	0.5
Knee X	0.755
Knee Y	0.83
White X	1
White Y	1
CamRoll	A118_C004_11022S
UNC	D:/MissingWilliam/RedMaster_110210_06/A118_1102P6.RDM/ A118_C004_11022S.RDC/A118_C004_11022S_001.R3D
Labroll	A118C004
BWF Creation Date	39022
SoundRoll	MW_17029.WAV
Sound Filename	D:/Test Files/MissingWilliam/Deva Audio Master_110210 Day17/MW_17/MW_17029.WAV
Sound	13:08:32:10
Sound TC	13:08:32:10
Sound Offset	0
Sound Slate	737753
Video Slate	74
Sound Scene	A28
Sound Take	3
Sound Note	
Scene	A28
Take	3

## Appendix D: ARRI ALEXA Metadata Mapping

Content	Column	Column type
Clip Name	Name	Standard
File Name	Source File	Standard
Take Name	Clip	Custom
Clip Duration	Duration	Standard
Contained Tracks	Tracks	Standard
Start Timecode	Start	Standard
End Timecode	End	Standard
Project Fps (Timebase)	FPS	Standard
Video Codec	Original_Video	Custom
Audio Format	Audio Format	Standard
Audio Samplerate [kHz]	Audio SR	Standard
Audio Bit Depth	Audio Bit	Standard
Sound Reel Name	Soundroll	Standard
Frame Width [Pixel]	FrameWidth	Standard
Frame Height [Pixel]	FrameHeight	Standard
UUID	UUID	Custom
SUP Version (of camera)	Sup_Version	Custom
Exposure Index [ASA/ISO]	Exposure_Index	Custom
Gamma (SxS)	Sxs_Gamma	Custom
White Balance [K]	White_Balance	Custom
White Balance CC	Cc_Shift	Custom
Look Name	Look_Name	Custom
Look Burned In	Look_Burned_In	Custom
Sensor Fps	Sensor_Fps	Custom
Shutter Angle	Shutter_Angle	Custom
Camera Manufacturer	Manufacturer	Custom
Camera Model	Camera_Model	Custom
Camera Serial Number	Camera_SN	Custom
Camera ID	Camera_ID	Custom
Camera Index	Camera_Index	Custom
Project Fps (same as FPS column)	Project_Fps	Custom
SxS Serial Number	Sxs_SN	Custom
Production Info	Production	Custom
Cinematographer	Cinematographer	Custom
Director Name	Director	Custom
Location Name	Location	Custom
User Info 1	User_Info1	Custom
User Info 2	User_Info2	Custom
User Date	Date_Camera	Custom
User Time	Time_Camera	Custom
Master/Slave Info	Master_Slave	Custom
Channel Info	Eye_Index	Custom
Camera Reel Name	Reel_Name	Custom
UMID	UMID	Custom
Lens Type	Lens_Type	Custom
Lens Focus Unit	Focus_Unit_Lens	Custom
Lens Serial Number	Lens_SN	Custom

For Mac OS X users, there is a simple Clip Meta-View application that enables you to view and export ARRI Look Files from one or more ARRI ALEXA-recorded ProRes files. It's available from the Apple Store. If the original camera XML or ALE file was lost in the process, you can generate it again using the ARRI Meta Extract tools using the command line. These are saved out as .csv files, which can then be turned into ALE files with some basic text editing. See the Avid Metadata Logging and Management Whitepaper available here. (resent with this whitepaper for Avid to reference again on website)



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