

## Video Reformatting Equipment and Workflow Steps

Important: Please note that these recommendations for equipment and processing are based on budgetary needs first, and then proximity to best practices given those budgetary constraints. For documentation on best practices, see *Sustainability of Digital Formats: Planning for Library of Congress Collections*.<sup>1</sup>

### Included in this document:

1. Analog to Digital VHS Tape Conversion
2. Analog to Digital Betamax, Betacam, BetacamSP, and U-Matic Video Conversion
3. Typical File Size

Please note: All equipment included in this are recommended as examples based on the experiences by partners in the Digital Library of the Caribbean using this equipment. This document should not be taken as an endorsement of any manufacturer's product. Those using this as a guide for their own purchases should be cautioned that equipment suited to each institution's specific needs, source materials, or fitness-for-purpose determinations may not be suited to another's. All prices are based on current estimates and are listed in USD.

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<sup>1</sup> See *Sustainability of Digital Formats: Planning for Library of Congress Collections*, <http://www.digitalpreservation.gov/formats/content/video.shtml>

## **1. Analog to Digital VHS tape conversion**

### **Equipment:**

S-VHS VCR with Hi-Fi, manual tracking adjustment, 2 heads and S-Video and RCA output, dubbing capability (need two decks for dubbing)

~\$500 - \$1300 (Recommended: Sony SVO-2000 S-VHS Videocassette Recorder

Video capture card for PCI or USB 3.xx video capture device

~\$120 (Card); Recommended cards: AVerMedia C027 AVerTV HD DVR

OR

~\$150 (Capture device); Hauppauge HD PVR2 Gaming Edition - High Definition Video Recorder in H.264 w/ HDMI & component interface and One-touch Record button

### **Software:**

Prices and features vary. There are hundreds of video editors and capturers, some very costly and not very extensible; others are free and nearly professional-grade. Many capture cards and external devices come bundled with editing and capture software (Most current capture cards come with proprietary capture software that compresses to MPEG-4 natively; while other devices compress in other codecs contained in AVI files).

Given the variables in proprietary software, it is often cheaper to use freely distributed software that can interact with your capture device to produce a variety of file formats and codecs.

### **Recommended video capture/editing software:**

**SUPER © (Simplified Universal Player Encoder & Recoder)** Proficient at packaging raw, uncompressed video and audio which are best kept as archival masters for storage and editing). Can do light editing.

OR

**Avidemux:** Versatile with a user-friendly GUI. Can edit and export in various containers with various codecs.

OR

**Adobe Premiere** - Industry standard device capture software with flexible editing and formatting.

OR

Vegas Movie Studio - device capture software with flexible editing and formatting.

Recommended (free) video encoding/playback software:

SUPER ©: can bulk transcode and contains multiple encoders with a GUI front end.

OR

VLC Media Player: can play almost any file format with almost any encoding; also effective as a transcoder.

OR

Windows Media Player

#### **Hardware installation:**

1. Connect one end of red and white RCA cables to VCR's AUDIO OUTPUT.
2. Connect other end to capture device's AUDIO INPUT.
3. Connect one of S-Video (or yellow RCA) cable to S-Video or RCA to VCR's VIDEO OUTPUT.
4. Connect other end to capture device's S-VIDEO or RCA VIDEO INPUT.

#### **Sample Workflow:**

1. Turn on VHS
2. Insert tape into device and play it (viewing through your capture software) to assess its native quality and integrity.
3. Once satisfied, rewind tape and prepare your capture software for recording.
4. In the selected capture software, you will need to:
  - a. specify the input device (your capture device)
  - b. specify the file format for export after capture (preferably uncompressed YUY2, UYVY, or YVYU packaged as an AVI)
  - c. Begin capturing before beginning playback of tape in order to give yourself some lead-in for editing purposes.
  - d. Begin playback of tape.
5. Once capture is complete, it will (depending on software used) save to a preselected directory as the output file format specified earlier. Make one copy of the output to serve as an archival master video files, and make one additional copy to perform any necessary edits or derivatives.
6. Make any necessary edits to the video file. With files transferred for preservation, often no edits are made.
7. Save the file in MPEG-4 (H.264 codec) file format, which serves well as an end-user product. The resolution should be, as close to the original analog media native source

resolution, or the highest resolution that the video card can capture if the analog source resolution exceeds the capture card capabilities (unlikely unless HDMI 2.0).

8. Using either the VLC or SUPER © encoder, make derivatives from the edited source file in any containers or codecs needed for distribution or archiving.
  - a. Recommended service formats for distribution:
    - i. MP4/MOV (h.264 AVC + AAC audio)
    - ii. MPEG2-TS (MPG2 + MP3)
    - iii. WMV (WMV2 + WMA2)
    - iv. OGG (Theora + Vorbis or FLAC)
9. Direct users to open source media players like VLC Media Player that are capable of playing most file formats in most codecs.

## **2. Analog to Digital Betamax, Betacam, BetacamSP, and U-Matic Video Conversion**

Please note: The equipment, software, and workflows are almost identical to VHS. VHS has been separated for readability because most institutions will only handle VHS in-house and will outsource conversion for these materials. If handling these in-house, the same equipment, software, and workflows used with VHS can be used.

### **Equipment:**

Betamax Player

Betacam Player

BetacamSP Player

U-Matic Player

Each of these playback devices plays a specific type of video tape and is no longer widely produced. Multi-format Betacam players are still manufactured by Sony but are prohibitively expensive (Sony J30SDI ~\$15,000). In most cases it is more cost effective to purchase used equipment and have it cleaned or refurbished or to borrow equipment if possible (in the case of U-Matic players, there is no other option).

Video capture card for PCI or USB 3.0 video capture device

~\$120 (Card); Recommended cards: AVerMedia C027 AVerTV HD DVR

OR

~\$150 (Capture device); Hauppauge HD PVR2 Gaming Edition - High Definition Video Recorder in H.264 w/ HDMI & component interface and One-touch Record button

### **Software:**

Prices vary. There are hundreds of video editors and capturers, some very costly and not very extensible; others are free and nearly professional-grade. Many capture cards and external devices come bundled with editing and capture software (Most current capture cards come with proprietary capture software that compresses to MPEG-4 natively; while other devices compress in other codecs contained in AVI files).

Given the variables in proprietary software, it is often better to use freely distributed software that can interact with your capture device to produce a variety of file formats and codecs.

Recommended video capture/editing software:

SUPER © (Simplified Universal Player Encoder & Recoder) Proficient at packaging raw, uncompressed video and audio which are best kept as archival masters for storage and editing). Can do light editing.

OR

Avidemux: Versatile with a user-friendly GUI. Can edit and export in various containers with various codecs.

OR

Adobe Premiere - Industry standard device capture software and flexible editing and formatting.

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Recommended (free) video encoding/playback software:

SUPER ©: can bulk transcode and contains multiple encoders with a GUI front end.

OR

VLC Media Player: can play almost any file format with almost any encoding; also effective as a transcoder.

OR

Windows Media Player

**Hardware installation:**

**Betacam & BetacamSP:**

Connect one end of red and white RCA cables to VCR's AUDIO OUTPUT; connect other end to capture device's AUDIO INPUT. Connect one of S-Video (or yellow RCA) cable to S-Video or RCA to VCR's VIDEO OUTPUT; connect other end to capture device's S-VIDEO or RCA VIDEO INPUT.

**Betamax:**

Most models have BNC outputs and will require BNC-to-S-Video or BNC-to-RCA cables in order for them to interface with your capture device. In any case, you will need to connect the player's VIDEO OUTPUT to the capture device's VIDEO INPUT; and the player's AUDIO OUTPUT to the capture device's AUDIO INPUT.

**U-Matic:**

Similar to Betamax, the video connections will probably be BNC. However, the audio connections will likely be XLR (3-pin), similar to the cables used for many microphones. You will need an XLR-to-RCA audio cable in order to connect the player's AUDIO OUTPUT to the capture device's AUDIO INPUT.

## **Sample Workflow:**

1. Turn on device.
2. Insert tape into device and play it (viewing through your capture software) to assess its native quality and integrity.
3. Once satisfied, rewind tape and prepare your capture software for recording.
4. In the selected capture software, you will need to:
  - a. specify the input device (your capture device)
  - b. specify the file format for export after capture (preferably uncompressed YUY2, UYVY, or YVYU packaged as an AVI)
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5. Once capture is complete, it will (depending on software used) save to a preselected directory as the output file format specified earlier. Make 1 copy of the output to serve as an archival master, and make 1 additional copy to perform any necessary edits.
6. Make any necessary edits to the video file. With files transferred for preservation, often no edits are made.
7. Save the file in MPEG-4 (H.264 codec) file format, which serves well as an end-user product. The resolution should be, as close to the analog media's native source resolution, or the highest resolution that the video card can capture if the analog source resolution exceeds the card capabilities (unlikely unless HDMI 2.0).
8. Using either the VLC or SUPER © encoder, make derivatives from the edited source file in any containers or codecs needed for distribution or archiving.
  - a. Recommended service formats for distribution:
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9. Direct users to open source media players like VLC Media Player that are capable of playing most file formats in most codecs.

### **3. Typical File Size**

There are many different variables affecting the size of a video file to typify a rule of thumb. However once some of the variables have been determined based on the particular use of the file a generalization can be quantified. Generally speaking the file size of a video depends on four things:

1. The video codec used - as compression goes up and bitrate goes down the file size shrinks; the mp4 codec is an excellent compromise between file size and image quality.
2. The Audio codec used. Similar as with video in terms of compression and bitrate, but there may be multiple sound channels, such as stereo (2 channels), 2.1 (3 channels), 5.1 (6 channels), 7.1 (8 channels). Each added audio channel will increase the file size.
3. The video resolution in terms of pixel height and width.
4. The length of the video.

There are many video file size calculators on the internet to assist in planning the allocation of needed file space.