Digitizing Video for Long-Term Preservation:

An RFP Guide and Template

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I. Preface

Digitizing Video for Long-Term Preservation: An RFP Guide and Template is intended to take an institution step-by-step through the process of drafting a Request for Proposals (RFP) for the transfer of analog video formats to digital carriers for preservation. This template can be used by libraries, archives, and other cultural heritage institutions and submitted to qualified transfer vendors.

Funded by The Andrew W. Mellon Foundation, the *Digitizing Video for Long-Term Preservation* publication is part of the Video at Risk project undertaken by New York University and two partner institutions, Loyola University New Orleans and the University of California, Berkeley. The authors of this publication set out to create a template that would identify the key elements integral to the transfer of the video and audio signal from Standard Definition VHS to a preservation-quality digital file. From the beginning, the development of the RFP was approached with the intention of creating a template similar to the one that was created in the 1990s by the Research Libraries Group for use in brittle books microfilming. Obviously, microfilming and digitization are not the same; one involves chemistry and optics, the other involves computer technology, but the *intent* to preserve content in a long-lasting medium is the same for both. Both efforts seek to create a high quality surrogate of the original content.

Many cultural institutions large and small have never contracted with a vendor for digitization of analog video and are unaware of the technical specifications needed to produce preservation-quality masters. *Digitizing Video for Long-Term Preservation* provides the technical specifications needed to produce preservation-quality digital files from VHS analog tapes. The purpose of the analog-to-digital RFP template is to guide a novice through the process of creating an RFP that will result in the creation of a vendor-produced preservation-quality copy of an analog VHS tape. As part of the process of long-term preservation, three copies are created: a digital master file, a mezzanine copy (if needed), a use or access copy, and the necessary metadata that must accompany each transfer.

Digitizing Video for Long-Term Preservation was a multi-institutional endeavor developed over the course of three years with the guidance and recommendations of video engineers, vendors and other professionals and stakeholders in the field of media preservation. William Miller, a Society of Motion Picture Television Engineers (SMPTE) engineer and former Engineering Vice-President of SMPTE (from 1996-2001), was retained for advice and guidance on technical areas of the RFP to ensure that the final document was in alignment with the SMPTE standards. Several vendors, including Bay Area Video Coalition, DuArt, George Blood Audio Video, MediaPreserve, and SPECS Brothers also provided valuable comments and feedback on several iterations of the document. The RFP was the subject of a forum at NYU, attended by preservation administrators, video engineers, media collection managers, as well as faculty from NYU's Moving Image Archiving and Preservation (MIAP) graduate program. Finally, the RFP document was tested by the participating partners in the Video at Risk project: the University of California, Berkeley and Loyola University New Orleans.

It is important to understand, at the outset, the technical infrastructure needed for digital

preservation. A preservation master file must be stored properly for long-term preservation. First, preservation master files are uncompressed and, thus, very large and require an appropriately sized, secure server as well as a separate secure location for back-up files. We recommend using the Reference Model for an Open Archival Information System, or OAIS. Once the master, mezzanine, and access copies are created, the process of creating the submission information package (SIP) follows. BagIt is recommended as open source software to contain a SIP package that includes the master and mezzanine files, plus metadata. Checksums must be produced to verify that files were not modified in transit and bags can be validated using validation scripts. The content can then be uploaded to a server and backed up by geographically-replicated storage. An ongoing commitment to managing the digital files must include provisions for periodic migration of files as technology changes.

An institution without the technical support to follow the necessary steps for a sustainable preservation program for digital files may choose to purchase managed storage from a trusted company or organization that uses the OAIS model.

Digitizing Video for Long-Term Preservation is arranged in sections. The first section is organized in the sequence that an RFP should be organized for the vendor. Within each component of the RFP, there is an explanation of what specific information should be included for the vendor. Where possible, every attempt has been made to describe processes and procedures in terms a non-technical person can understand and follow. Highly technical details have been omitted but references and links to more information are available should the reader wish to pursue them.

The RFP begins with an introductory section meant to introduce the vendor to the institution and the project. In Section 1, the institution creating the RFP briefly describes itself and provides a description of the project and expected timeframe. Section 2 articulates the technical requirements the institution expects, including file formats and metadata. Section 3 makes clear to the vendor how the analog video is to be transferred and the quality control expected. The schedule and turnaround time are covered in Section 4, followed by delivery of files, including naming conventions, and return of the physical source tapes in Section 5. Section 6 describes how to handle files that do not pass the institution's quality control. Lastly, sections 7 through 10 include such issues as sub-contracting, insurance, pricing, and special instructions.

Additional documentation to support and assist institutions in the development of an RFP appears in appendices A through E. Appendix A, a completed RFP using a fictitious institution, is meant to exemplify the application of each component of the RFP. While this sample illustrates the contents of each recommended section in an RFP, additional documents found in appendices B through E are also intended to assist the reader in the process of building an RFP. Appendices include:

- Appendix A -- completed sample of an RFP for a fictitious cultural institution
- Appendix B -- a suggested metadata model
- Appendix C -- a suggested method of collecting transfer notes from a vendor
- Appendix D -- a glossary of terms and concepts which define various characteristics of analog video and digital files, as well as the analog-to-digital transfer process.
- Appendix E -- a selected resource list

Once developed, the RFP can be distributed to a selection of vendors. Vendors will then have the opportunity to submit a completed proposal to the institution for review. When a vendor is selected, it is highly recommended that the institution then complete a contractual Statement of Work (SOW) which will serve as a binding contract between institution and vendor.

II. Acknowledgements

The "Video at Risk" project has been a collaboration from the start – between the NYU Tisch School's Moving Image Archiving and Preservation program and the NYU Libraries; between NYU, Loyola University of New Orleans and the University of California, Berkeley. Lastly the project has been a partnership with the libraries, archives and vendors around the country whose work has been crucial to all our efforts to understand and preserve these collections.

We want first to acknowledge the critical role in the project that has been played by our partners, Loyola University of New Orleans and the University of California, Berkeley. Working with Loyola and Berkeley has given the project a breadth and depth of data and experience and a vital test bed for the development of workable language for the RFP guidelines and template.

We want as well to thank The Andrew W. Mellon Foundation, without whose generous support the "Video at Risk" project would not have been possible.

We also want to thank the long list of librarians, archivists and vendors that participated in a two-day forum in November 2012 or commented on drafts of the RFP to help us shape the document: Howard Besser, NYU; Antonella Bonfanti, University of California, Berkeley; George Blood, George Blood Audio Video; Peter Brothers, SPECS Brothers; Walter Forsberg, NYU Libraries; Janet Gertz, Columbia University; Carleton L. Jackson, University of Maryland; Mona Jimenez, NYU; Chris Lewis, American University; Carol Mandel, NYU Libraries; William McKeldin, NYU Libraries; Bill Miller, Society of Motion Picture & Television Engineers; Benjamin Moskowitz, NYU Libraries; Kate Murray, National Archives and Records Administration; Barclay Ogden, University of California, Berkeley; Laurie Phillips, Loyola University New Orleans; Erik Piil, DuArt Film & Video; Lauren Sorensen, Bay Area Video Coalition; Scott Spicer, University of Minnesota; Bob Strauss, MediaPreserve; Judith Thomas, University of Virginia Library; Kent Underwood, NYU Libraries; Pamela Jean Vadakan, University of California, Berkeley; Steven Villereal, University of Virginia Library.

We also wish to acknowledge the exceptional work by members of the vendor community, whose workshops, websites and engagement with clients has fostered our understanding of video preservation standards and RFP language: George Blood, George Blood Audio Video; Peter Brothers, SPECS Brothers; Erik Piil, DuArt Film & Video; Lauren Sorensen, Bay Area Video Coalition; Bob Strauss, MediaPreserve. We also want to recognize the contributions of Chris Lacinak, Audio Visual Preservation Solutions, who has helped to define the field and whose teaching in the Tisch School's Moving Image Archiving and Preservation program has shaped a generation of MIAP students.

Final responsibility for these documents, of course, lies with the staff of the Barbara Goldsmith Preservation Department of NYU Libraries, whose research, hard work and deep well of experience have shaped its final form.

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III. Request for Proposals (RFP) Guide and Template

1: Introduction

In the introduction, you should provide a brief overview of your institution, the scope of the project, and the expected project timeline. You will be required to provide further detail in subsequent sections.

1.1: Project Description

In this section, you will expand on the information provided in the introduction, including:

- A brief (1 to 2 sentence) description of your institution.
- A description of the collection you intend to migrate, noting its cultural and/or historical significance. This is to impress upon the vendor the importance of the content for transfer.
- Information about the physical material you intend to transfer, including format(s), signal standard(s), provenance, and general condition and/or storage notes.
- A brief summary of deliverables that you will require. This will be listed in greater detail in the next section but it should be included here briefly.

2: Technical Requirements

Migrating the analog signal to a digital signal and carrier is currently the agreed-upon best practice for the preservation of analog video material. However, there must be a system in place at your institution for the storage and care for these new digital objects. If you are unsure of whether this exists, we advise you to contact your IT department to inquire about your institution's capacity to store and maintain the files that will be generated. It is unadvisable to embark on a preservation project if your institution cannot maintain the deliverables that will be generated.

Long-term preservation of digitized video files requires a standardized file format to be maintained in an institution's digital repository. These specifications draw from agreed upon best practices in the field and will ensure that the analog signal from the source tape will, with proper metadata management, be preserved and made accessible in a digital environment to ensure long-term stability and access. To preserve and provide access to one analog video, it is recommended that three separate digital video file formats be created. These include:

- *Preservation File*: one file of the highest quality which serves as a preservation master file for long-term preservation and will not be "touched" once ingested in your digital repository

- *Mezzanine File*: serves as a surrogate for the master file and is the file that will be accessed for editing, transcoding, etc. Note: mezzanine files are recommended for institutions that regularly use the content in a production environment; see *Section 2.1.2*) for additional information
- *Access File and/or DVD*: serves as a general use copy for viewing

2.1: Deliverable File Formats

In this section, you will detail the deliverables you require the vendor to produce. As noted in the Preface, additional information on analog and digital video can be found in Appendix A, *A Glossary of Terms and Concepts*. Please consult this section for details on terminology and processes.

2.1.1: Preservation Master File

The preservation master file is the digital file that is saved for long-term preservation; thus, it must be a high-quality representation of the video and audio signals from the original analog video recording. The digital preservation master file should reproduce the most accurate version of the original analog video possible. Preservation master files are quite large; for example, YUV uncompressed 10-bit preservation master files produced from standard definition video are approximately 100 gigabytes (GB) per hour.

Uncompressed 10-bit is generally agreed upon as the best codec for the preservation of analog video, as it is lossless and captures the maximum resolution of analog video.[1] Pulse-Code Modulated (PCM) is a lossless, uncompressed audio codec. Because of the smaller bandwidth of audio on video, 48Khz is sufficient to capture the available audio signal using a bit depth of 24 to accurately describe the audio samples. These streams can be "wrapped" in a variety of file containers depending on the capabilities of your institution's file repository.

JPEG2000 (MJ2) and ffv1 are both promising codecs but, because they are not playable on platforms commonly used by cultural institutions, are not currently recommended for preservation.[2,3] If JPEG2000 or ffv1 become playable across a wider range of platforms and begin to be widely adopted by cultural institutions, they may serve as other preservation master file options to consider.

There are different wrappers, which contain the video and audio streams, that your institution can use based on your needs. Currently, the most popular wrappers are the QuickTime format (.mov) and Audio Video Interleave (.avi).[4,5] Typically, these formats are determined based on the operating system used by your institution to optimize your

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[1] "Sustainability of Digital Formats Planning for Library of Congress Collections, http://www.digitalpreservation.gov/formats/fdd/fdd000352.shtml

[2] For more information on Motion JPEG 2000, refer to the Library of Congress's Sustainability of Digital Formats, http://www.digitalpreservation.gov/formats/fdd/fdd000127.shtml

[3] For more information on ffv1, refer to FFMPEG's explanation of the codec, http://www.ffmpeg.org/~michael/ffv1.html

[4] A thorough history of the QuickTime format is available here: http://en.wikipedia.org/wiki/QuickTime

[5] For more information about .AVI, http://en.wikipedia.org/wiki/Audio_Video_Interleave

workflow. The Matroska wrapper (.mkv), like ffv1, is an open-source digital file container that is actively being developed but currently not used or adopted outside of open-source communities.[6]

File Wrappers (determined by your institution): .mov, .avi, .mkv
Video Stream: Uncompressed, 10-bit
Audio Stream: 48 kHz/24-bit PCM

Example of Preservation Master File Requirements:

Wrapper: QuickTime (.mov)
Video Stream: Uncompressed, 10-bit 4:2:2 YUV
Audio Stream: 48Khz/24-bit PCM

2.1.2: Mezzanine File

The use of the word mezzanine is taken from the broadcast industry and is the "workhorse" file that should be used for editing, the creation of derivatives, and other general uses at your institution. Mezzanine files can also be referred to as production masters. Since the aim is to access your preservation file as minimally as possible, the mezzanine will be the file that you "touch" for use. However, the mezzanine file is only necessary if you plan to use your content regularly in a production environment. If your institution is only planning on providing access on the premises or via streaming files, access copies may be sufficient. Additionally, it will become necessary to refresh your access copies in the near future. Based on the volume of one's archive, it will be less time-intensive to create new access copies from the mezzanine files, as opposed to transcoding the master files.

Although YUV 10-bit is appropriate for the master file, we recommend DV50 as the mezzanine file as there is little visual/aural loss to the end user. The mezzanine file should be stored in a manner in which it can be easily accessed, such as in a digital asset management system (DAMS), as opposed to backed up to LTO tapes.

Example of Mezzanine File Requirements:

File Wrapper: QuickTime (.mov)
Video Stream: DV50
Audio Stream: 48Khz/16-bit PCM

2.1.3: Access Copies

Use or access copies are used to view the digitally converted VHS recordings and can be either digital files or optical media (DVD, Blu-ray Disc). These are highly compressed files created to play on the Internet; in common media players, such as Windows Media Player, QuickTime, VLC, Mplayer, etc.; or in a DVD player or computer. There are a number of factors to consider when selecting and creating your preferred access copies:

[6] For more information about the Matroska file wrapper, please refer to the development site at: http://matroska.org/technical/whatis/index.html

How does your institution provide access to material?
This is the key determining factor in selecting your access format, as it is advised that you request derivatives that are aligned with your institution's access policies. For example, if you only provide access to researchers on the premises, you may want to ask for DVDs that can be kept fairly restricted in terms of security.

Does your institution provide access via the Internet?
If your institution has a web portal that provides access to researchers and other constituents via a secure protocol, you will want to ensure that your access derivatives meet the technical specifications for the streaming server and application. For example, if you use a web portal that allows the streaming of H.264 files at a data rate of 20 Mbps, you should ask the vendor to create your access derivatives to this specification.

Does the access derivative faithfully reflect the source material?
Analog signals are inherently interlaced while typically displayed to the public on a progressively scanning monitor.[7] To ensure a faithful reproduction of your source material, it may be advisable to de-interlace the picture so that it displays properly on 16:9 flat screen monitors.

Example of Access Copy Requirements:

File Wrapper: Windows Media (.wmv)
Video Stream: Windows Media at 700 Kbps
Audio Stream: 44.1Khz/16-bit AAC

and/or

DVD: MPEG-2, Variable Bit Rate 7 Mbps

It is important to keep in mind that optical media and highly compressed files do not have a long shelf life. For optical media, there is a significant variation in the longevity of discs, as various dyes and coatings have different rates of deterioration. Without proper storage, discs can fail in as little as 3-10 years.[8] Technological obsolescence will also shorten the lifespan of the access derivatives: DVDs have already been supplanted by Blu-ray Disc for optical disc media storage. Additionally, access derivatives such as RealMedia, which was once a common access file, are no longer supported by playback applications.

2.2: Metadata Requirements

The National Information Standards Organization (NISO) describes metadata as, "structured information that describes, explains, locates, or otherwise makes it easier to

[7] For more information on interlacing, please consult Appendix D.
[8] "Optical Disc Longevity Study: Final Report," Library of Congress and the National Institute of Standards and Technology, September 2007, p. 8, http://www.loc.gov/preservation/resources/rt/NIST_LC_OpticalDiscLongevity.pdf.

retrieve, use or manage an information resource."[9] Metadata is often referred to as "data about data" or "information about information." In the context of an analog video signal converted to digital signal, information about the digital file created must be collected to ensure that it is retrievable and usable in the future. The following classes of metadata must be considered for any digital project: *descriptive*, *structural*, *rights*, *provenance*, and *technical*.

In the preservation workflow, metadata is most often retained for the preservation master file and the mezzanine file, but not for access files (as access copies are not maintained for the long term). Decisions regarding the collection of metadata should be outlined in the vendor agreement and clearly articulate the types of metadata to be collected by the institution and the types of metadata to be provided by the vendor.

The newly-created digital files should be associated with the following metadata: descriptive, structural, rights, and provenance metadata, in order for the digitized material to be stored and retrievable. *These types of metadata are supplied by the institution, not the vendor. Typically, you will supply the vendor information for reference, then populate the relevant rights and structural elements after the files are created.* Commonly used metadata standards include MODS, METS, PREMIS and PBCore. However, some digital asset management systems (DAMS) use their own structures to contain these metadata elements and an institution's digital repository may have metadata requirements and/or preferences for specific metadata schemas. *It is important to consult with your IT Department and/or Digital Library staff before selecting a metadata schema to ensure it can be supported by your institution's infrastructure*. Regardless of the schema(s) selected, the metadata should include the elements outlined in the subsequent sections. Please see Appendix B for additional examples.

2.2.1: Descriptive Metadata

When an institution requests a vendor to perform transfers of analog tapes, descriptive metadata must be sent to the vendor to ensure proper identification and allow for cross-reference between the original materials and the files created. Below is an example of the MODS descriptive metadata schema, which is commonly used.[10] This metadata is generated by your institution prior to the shipment of source materials to a vendor.

> *Sample descriptive metadata fields*:
> Title
> Creator
> Item unique ID
> Collection
> (Additional descriptive metadata can include: Date of Creation, Place of Creation, Language, Genre, Abstract, Contributor)

[9] "Understanding Metadata," National Information Standards Organization, 2004. www.niso.org/publications/press/UnderstandingMetadata.pdf

[10] For information on MODS, visit: http://www.loc.gov/standards/mods/

2.2.2 Provenance Metadata

Provenance metadata documents the history of digitized materials, their technical characteristics, the collection from which an item comes, as well as information about the original carrier. PREMIS is a recommended choice for provenance metadata.[11] Video recordings typically include the following:

Sample provenance metadata fields:
Format
Gauge
Length
Stock brand
Stock duration
Signal encoding (recording standard)
Markings on container

This is generally populated by your institution and provided to the vendor in an .xls or .csv file. Typically, this information will follow the Descriptive Metadata and precede the Technical Metadata described in the next section.

2.2.3 Technical Metadata

Technical metadata is vital, as it provides essential information on the digitized files in order to ensure that the digital video file is playable over time. Given the rapid changes in both digital video formats and their distribution models, a *minimum* set of technical metadata is required.

Technical metadata can be broken down into two categories: (a) embedded metadata are the technical details retrievable *within* the digital file; (b) non-embedded technical metadata is the technical information about a file that is external to the file itself, e.g., as a spreadsheet or in METS, MODS, or PREMIS, and is provided by the institution and/or vendor; both require inclusion or standardization in a vendor agreement and are explained in more detail below.

2.2.3.1 Embedded Technical Metadata

Embedded metadata is the metadata held within the body of a digital file that contains instructions for playing the digital video signal. This information can be machine-extracted via software. Currently, the open source software MediaInfo is helpful in performing this function.[12]

Sample embedded technical metadata fields:
Complete File Name
Video Format
Video Codec ID

[11] For information on PREMIS, visit http://www.loc.gov/standards/premis/
[12] Media Info website, http://mediainfo.sourceforge.net/en

Video Bit Rate
Video Width
Video Height
Video Standard
Video Color Space
Video Frame Rate
Audio Format
Audio Codec ID
Audio Bit Rate
Audio Bit Depth
Audio Sampling
Audio Resolution
Format Extension
MIME Type
Format Version
File Size
Duration
File Modified Date
Encoded_Date
Tagged_Date
Encryption

2.2.3.2 Non-Embedded Technical Metadata

In an analog-to-digital conversion, non-embedded technical metadata is created at the time of transfer and should document: (a) the equipment used for the conversion, i.e., the analog-to-digital (A-D) hardware and software and settings used to convert the signal; and, (b) the name of the operator or vendor that created the files with the date of conversion. This type of non-embedded technical information is called *process history* and is important to the analysis of the files in the future.[13] It also provides a record of the preservation history for the files. Currently, there is no standard schema for documenting the process history. Listed here is a modified version of AES57 (which was developed by the Audio Engineering Society to document the transfer of analog audio material) and NYU's 'Environment of Creation' metadata. This is only included as a reference, as your institution should decide on the schema and field names that best serve your needs.[14]

The process history information should be maintained for the preservation master file. This will allow programmers to extract information, as needed, for migration.

Non-embedded technical metadata for *each* VHS recording is required, as follows:

[13] http://isites.harvard.edu/icb/icb.do?keyword=k13588&pageid=icb.page72649

[14] Audio Engineering Society. "AES57-2011: AES Standard for Audio Metadata - Audio Object Structures for Preservation and Restoration," 2011.

Sample non-embedded technical metadata fields:

Computer Fields
computerManufacturer
hostComputerName
hostComputerVersion
hostComputerBuild
operatingSystem
operatingSystemVersion

Reproducing Device Fields
videoReproducingDeviceType
videoReproducingDeviceManufacturer
videoReproducingDeviceModelName
videoReproducingDeviceModelVersion
videoReproducingDeviceModelSerialNumber

Correction Fields
videoCorrectionDeviceType
videoCorrectionDeviceManufacturer
videoCorrectionDeviceModelName
videoCorrectionDeviceModelVersion
videoCorrectionDeviceModelSerialNumber

Capture Device Fields
videoCaptureDeviceType01
videoCaptureDeviceManufacturer01
videoCaptureDeviceModelName01
videoCaptureDeviceModelVersion01
videoCaptureDeviceModelSerialNumber01
videoCaptureDeviceDriver01
videoCaptureDeviceDriverVersion01

Capture Software Fields
videoCaptureSoftwareManufacturer01
videoCaptureSoftwareName01
videoCaptureSoftwareVersion01

The vendor must also track errors found in the analog source tapes in real time. These transfer notes should be placed in a .txt or .xml document in the file directory of the digitized item. An example is included in Appendix C.

2.2.4 Structural Metadata

Structural metadata provides a link between the digital file's name and the original item's catalog record. It also ties together pieces that are in separate files, e.g., a title spread over

two or more files, or a title published on two or more videotapes (i.e., volume 1, volume 2). METS is recommended for structural metadata requirements.[15]

Sample structural metadata fields:
Relationship
RelationshipType
RelationshipSubType
LinkingEventIdentifier

2.2.5 Rights Metadata

For future access purposes, an institution should retain and associate the following rights metadata information for each item so clear access conditions accompany the files. One of the primary goals of rights metadata is to document what may or may not be done with collection items in order to reduce the risk of inadvertently mishandling collection content. METSRights was created to expedite the inclusion of minimal essential rights information into digital collections.[16] In addition, PREMIS includes a section on rights metadata, which may be of interest to others in the digital library community.

Typically, the following information is needed:

Sample rights metadata fields:
Rights Declaration
Rights Holder Name
Rights Holder Contact Designation
Rights Holder Contact (address, phone, email)

3: Vendor Information

3.1: Vendor Production System Information

In this section, you must define how the vendor is to care for and transfer your collection materials. You want to be as specific as possible to ensure that the technical requirements are met. This section can also be readily repurposed into a Statement of Work (SOW), which will serve as a binding contract between your institution and the vendor once the project is awarded.

3.1.1 Facility Guidelines

- *Registrar* – The vendor should provide confirmation that all of your institution's materials have arrived safely. Request that any tapes with damage or other condition issues be reported to your institution immediately.
- *Care and Handling* – All staff should be familiar with the care and handling of the format(s) you are entrusting to their care. It is advisable to request a list of all staff members assigned to your project, and their associated experience.

[15] For information on METS, visit: http://www.loc.gov/standards/mets/
[16] For information on METSRights, visit: http://cosimo.stanford.edu/sdr/metsrights.xsd

- *Environmental Control* – Vendors should be able to offer climate-controlled storage. Magnetic media should be stored in a climate-controlled environment of 60-65 degrees Fahrenheit / 35-40% relative humidity (RH).
- *Tape Storage* – Magnetic media should be stored upright (vertically), spine-out.
- *Equipment and Maintenance* – Vendor should provide a list of all equipment to be used in the transfer process, as well as a maintenance schedule.
- *Security* – The vendor should provide information on the security of materials, as well as security on any vault for higher value items.

3.1.2 Workflow and Transfer Specifications

The following example requirements apply to the original signal content and concern modifications, enhancements, and requirements for handling specific types of errors found on the original source tapes.

- Representation *of Source Material* -- The digitized preservation master file should represent the original source tape as closely as possible. Master files should retain the source formatting, including interlacing, frame rate, aspect ratio, audio levels, and recording standard (NTSC, PAL, SECAM).
- *Source* Head *Information* -- All source head formatting should be included in the preservation *master* file; e.g., if the source tape has bars and tone, the preservation master file should include them.
- *Pre-Roll Requirements: Bars, Tones, and Slates* -- Provide instructions to the vendor on pre-roll requirements, including bars, tone, and title and/or copyright slates. If calibrated bars and tones exist on the original recording, they should be used to evaluate the transfer. Otherwise, digital conversion should be completed as a "flat transfer" (see Appendix D for definition). It is advisable to prescribe the exact timing of the pre-roll; for example: 15 seconds of black, 30 seconds of SMPTE bars and tone, 15 seconds of slate (indicating that the video was digitally converted with date and location of conversion), 10 seconds of title, 5 additional seconds of black, and the start of the tape. You must provide the vendor with the precise language and formatting of the title and copyright slates.
- *Acceptable Artifacts* -- Specify the extent of acceptable artifacts added to the preservation master file, such as dropout compensation and noise reduction. Inherent to all analog playback is some dropout (when portions of the signal are not displayed correctly due to physical or electrical error). If the intent of the transfer is to capture the analog material "as-is," then no error correction should be applied to the signal. However, the content of the tape may supplant the importance of capturing the state of the signal on the tape. In this case, dropout compensation (which will draw from lines surrounding the errant line to interpolate the image) and noise reduction (which will apply a filter to the signal to reduce electrical noise inherent in the aural and visual signal) may be needed. These are just a few examples of signal correction and you should consult with the vendor as well as other professionals in the field to determine what is needed for your collection.

- *Enhancements and Improvements* -- Indicate whether it is acceptable to apply enhancements and improvements to mezzanine files and use/access files. Also specify what type of modification is allowable (i.e. de-interlacing, frame rate, aspect ratio, audio levels).
- *Audio Tracks* -- All tracks of audio on the original source tape must be checked for content and all audio content on all channels should be digitized in full.
- *Closed Captioning* -- If the original source tapes contain closed captioning, you should indicate whether to extract it and the preferred method to do so.
- *End of Source Tape* -- Indicate the period of time the operator should wait to ensure there is no remaining content on a source tape (typically 3-5 minutes).

3.2 Quality Assurance and Quality Control

Quality Assurance (QA) and Quality Control (QC) should be performed by both the vendor and the institution. Clearly outline the responsibilities for QA and QC of both parties and how both workflows will operate.

3.2.1 Quality Assurance (QA)

3.2.1.1 Vendor QA

All vendors providing digital conversion for analog video should be able to assure the highest quality transfer during the transfer process. Quality assurance provides a guarantee that the vendor's machine line, software settings, and workflow are consistent. This is often managed by the vendor's engineer who reviews the equipment and software lines to make sure that the equipment is neither attenuating nor strengthening the signal. Engineers check the equipment through a series of signal tests, including bars and tone, which pass through the digitization chain to make sure that the signal is not distorted in any way. They will also check the digital files created for color consistency, proper aspect ratio, and conformance with the standards outlined by the client institution in the RFP and/or SOW.

3.2.1.2 Institution QA

Your institution should perform QA on all of the transfers delivered by the vendor to ensure the files match the findings of the vendor's QA process. This consists of checking the validity of the files and their associated checksums upon receipt of the files, as well as after migrating them to your digital repository. In addition, you will want to analyze the technical metadata of the files upon ingest to confirm that the color space, aspect ratio, etc. conform to your expectations.

3.2.2 Quality Control

Quality control is an essential part of the preservation workflow. The goal of QC is to guarantee that the digital files created during digitization match the visual and aural characteristics of the original analog video recording, while also conforming to the transfer requirements outlined by the institution. After the vendor creates the digital files, they

should conduct QC before sending them to the institution. On the vendor side, QC is conducted by checking the analog source tape against the digital tape in. In some cases, the importance and/or uniqueness of the source tape may require that QC be conducted in real time. Some vendors may charge an additional fee for this service.

When the institution receives the files from the vendor, they must also complete QC. In an analog-to-digital conversion, the QC staff may notice two different types of issues with the video signal: damage in the original signal and/or damage created by the digitization process. Damage in the original signal is not considered an error in the conversion process because it exists within the original. It should, however, be recorded in the vendor's QC transfer notes. Damage created during/by the conversion process does constitute an error and is unacceptable unless agreed upon in advance.

3.2.2.1 Vendor QC

Quality control (QC) is required for all digital files to ensure the files created during digitization match the visual characteristics of the original VHS recording. Visual inspection will be conducted at three places on the digitized video file (the head, middle, and tail) for approximately one minute at each interval. Operators should verify that the digital content is complete, matches the original source tape, and that there is accurate sync between audio and video.

QC must also include attention to the following details:

- The aspect ratio must be the same as the original.
- All three digital files (master, mezzanine, and use/access) must play properly.
- Artifacts that were not in the original source tape must not appear in the transfer.
- The entire program should be digitized without clipping, cropping, or trimming.
- There should be no change to the audio or video portions of the file.
- The technical characteristics of the converted files must be in accordance with the specifications outlined in the RFP or SOW.
- The preservation master file must have the same interlacing as the original source tape.
- Audio and video sync should always be checked and confirmed.
- All slates, labels, and metadata (embedded and external) should be compared and checked for accuracy and completeness.

3.2.2.2 Institution QC

To ensure that the digital files conform to the standards specified and confirm the faithfulness of the transfer, the institution should perform quality control on all of the files and ensure that:

- The correct number of assets have been delivered for each source tape;

- All files are correctly named;
- Transfer notes are included for each source tape;
- Process history metadata has file been submitted in the directory;
- The technical characteristics of the master, mezzanine, and access files are correct; and
- All files play, as determined by checking the head, middle, and tail of the files as described above.[17]

4: Schedule and Turnaround Time

Clearly stipulate the duration of the project, outlining the overall project time frame, with included estimated start and end dates. Institutions should take into consideration any funding agency deadlines. It is also recommended that institutions indicate:

- Anticipated date of shipment of materials to vendor, indicating whether the materials will be delivered in a single batch or in multiple batches.
- A date by which the vendor must deliver digital files and physical access copies to ensure that you have sufficient time to complete QC. If materials are to be delivered in batches, a schedule should be outlined at the outset to ensure that all parties can adhere to the work plan.

5: Delivery of Completed Work

The following instructions to the vendor are divided into two major components: the packaging and shipping instructions for the *digital files* and the packaging and shipping instructions for the *physical materials*. The former is quite technical and must conform to best practices for the transfer of digital files.

5.1 Digital Files

5.1.1 File Naming

Your institution should develop a policy for file naming to ensure that future staff and users can distinguish between file groups and identify collections by file name. Unique file names are essential to avoid potentially over-writing content. File names should never include blank spaces or special characters, such as: & , * % # ; * ( ) ! @$ ^ ~ ' { } [ ] ? < > -. These characters, which are commonly used in programming language, can actually break parts of the workflow, render a file unreadable, and/or confuse software programs and operating

[17] Depending on your institution's level of staffing and resources, you may want to consider viewing each preservation file on a similar set-up to the transfer environment (typically an analog-to-digital converter outputting to a CRT monitor), which will allow you to see if the transfer was successful and accurate. This, however, is time-intensive and many institutions lack the equipment to conduct this more exacting type of QC. The benefits of viewing on a CRT relate to interlacing and overscan: the CRT will show the image as it was intended to be displayed originally. Viewing the image on a computer monitor will show the interlaced fields as frames (which appear as jagged edges around lines) and the full information from all of the fields (which may include head switching and closed captioning).

systems.[18] File names that are unrecognizable or indecipherable to future custodians of digital collections will make stewardship of these materials difficult or impossible.

5.1.2 Directory Specifications and the Secure Transfer of Files

Like a library's card catalog, the structure of the file and directories should follow consistent rules that will always lead to the location of a file. Specify the file directory specifications in which you would like the files to be delivered. This should conform with your ingest workflow for ease of transfer. It should be a simple structure that will help to preserve the relationship of the files but also describe the content succinctly.

It is recommended that digital files and their associated metadata be packaged and linked together so they can be stored together. BagIt, developed by the Library of Congress, is a popular and recommended tool for completing this work .[19] BagIt packages all of the files and associated metadata together, along with built-in fixity checks, in a simple structure which aids in the movement and tracking of the files.

All files associated with one source tape should be maintained in a single directory without subdirectories, if possible. A typical upload directory might include the following components. Please note that file naming conventions will vary by institution.

< uniqueItemID >_m.mov	*master file*
< uniqueItemID >_d.mov	*mezzanine/ derivative file*
< uniqueItemID >_s.mov	*service/ access file*
< uniqueItemID >.xml	*for projects where XML is exported; Vendor QC*
< yyyymmdd-format-workstation-EOC.csv>	*Processing History Environment of Creation (EOC) metadata (.xls or .csv)*
< uniqueItemID >_qc.txt	*for QC notes, if not included in XML notes can be included*
< uniqueItemID >_readme.txt	*for additional information, as needed*

5.2 Physical Materials

5.2.1 Labeling of Access Materials

If your institution requests physical access copies, such as DVDs, you will want to provide the vendor with clear instructions on how to label the material so that it conforms to your

[18] For additional guidelines on file naming, visit: http://ucblibraries.colorado.edu/systems/digitalinitiatives/docs/filenameguidelines.pdf and http://library.uoregon.edu/datamanagement/filenaming.html.
[19] This tool is available for download at www.sourceforge.net.

institution's labeling system. It is common to include the institution name, collection name, file name(s), and total running time on the disc label.

5.2.2 Delivery Method

Specify the delivery method of your digital files that conforms to your institution's policy for ingest. Currently, the two primary delivery methods are on spinning disc external hard drive or Linear Tape-Open (LTO). Both have their strengths and weaknesses and it is advisable to consult with your IT department on how best to ingest the files, which will inform your preferred delivery method.

5.2.3 Return of Source Materials Post-Digitization

- The source tapes should remain with the vendor until the digitized files have been received, inspected, and accepted by the requesting institution.
- Original video recordings must be returned in the same order listed on the original packing slips per carton/box.
- Stipulate your preferred shipping carrier.
- Clarify the insurance liability for return shipments.
- All shipments must be scheduled for delivery only on contiguous work days to ensure that tapes are not left in an unregulated environment for an extended period of time.

6: Failures

If errors are identified by the institution during quality control, they should be reported to the vendor within a specified time frame. Institutions should articulate the manner in which errors should be reported and corrections performed.

Errors should be reported to the vendor in a coherent and organized manner. The basic steps are as follows:

1. Requesting institution identifies the problem
2. Requesting institution describes the problem
3. Requesting institution notifies the vendor
4. Vendor and institution develop solution to rectify said issue
5. Vendor notifies requesting institution that problem has been addressed and resolved
6. Requesting institution verifies that problem has been fixed
7. Restart the process if the issue has not been adequately addressed

What constitutes as an error, or failure, should be well defined. Please review section *3.2.2.1: Vendor QC*. If there are any further specific characteristics of failure the institution wishes to include this must be clarified in writing before the agreement is signed. It is advisable to outline:

- The amount of time the institution has to discover the error.
- The amount of time the vendor has to correct the error, once reported.
- A clear end date to this process. For example, once the project end date has passed or the source materials have been returned to the institution, a vendor may request additional compensation for re-work.

To avoid confusion over versions, clearly indicate how the vendor should document the corrections, name re-created files, and return the corrected files to the institution for QC. Generally renaming the files, as follows, has been successful for NYU:

Directory/Folder Name: uniquitemID_redo
uniqueitemID_000001_m.mov
uniqueitemID_000001_d.mov

Failures identified during QC must be corrected by the vendor without additional charges. Additional shipping and handling costs incurred in the process of error correction should be covered by the vendor.

7: Special Instructions

This section is a placeholder for any specific instructions that are particular to your institution and fall outside of the sections listed in this RFP guide.

8: Sub-Contracting

A stipulation in the RFP disallowing sub-contracting is recommended because it ensures that the chain of custody for the original source tapes and the digital files entrusted by the institution and the vendor will not be violated. However, in some cases the vendor may request to sub-contract for specific reasons, such as mold remediation treatment. Within the RFP, it should be clearly noted when sub-contracting is permissible. The vendor should communicate with the institution when a potential need to sub-contract arises.

9: Insurance

All material should be insured during transit and for the entire time it is at the vendor's facility. Appropriate insurance depends on the institution's insurance policy. Institutional insurance may cover materials off premises in what is called the "blanket coverage" section of the insurance policy. Check the policy wording carefully as there may be specific geographical restrictions to off-site insurance. Also, institutions are advised to research their blanket coverage for transit insurance, which is the preferred method of insuring items.[20]

[20] "In most cases the insurance should be through the museum policy. Carriers assume only a limited liability, unless excess value is declared. A shipper making an excess declaration is, in effect, purchasing insurance coverage through the carrier." Rebecca A. Buck and Jean Allman Gilmore, *Museum Registration Methods, 5th Edition*, (Washington, DC: Association of American Museums Press, 2010), p. 336.

If the institutional policy is insufficient, reliable transit companies will be willing to provide transit insurance at an extra charge. Vendors will also be able to add the value of your items to their own insurance for the duration of the project and pass that cost on to the requesting institution.

The cost of insurance depends directly on the declared value of the items insured. In some cases it is deemed appropriate to give items a blanket value (for example, $50 per tape). In the case of any irreplaceable or unique VHS recordings, the institution may wish to have an appraisal done on a per-item basis. Insurance can then be calculated on that item-by-item amount.

10: Details of Proposal Deliverables

In this section, describe how vendors should submit project proposals. RFPs should always include a date by which proposals should be submitted for consideration. It is also recommended that institutions indicate a date by which proposals will be reviewed and awarded.

10.1 Submitting Proposals

Request that qualified vendors submit a bid for the project provide the following information. Written proposals -- format at the discretion of the vendor – should address the requirements listed in this RFP, including:

- Demonstrated understanding of the scope of work and project time frame;
- Description of vendor's facilities and equipment, detailing that they meet the criteria listed in *Section 3.1: Vendor Production System Information*;
- The vendor's QA and QC procedures and how they satisfy the requirements listed in *Section 3.2: Quality Assurance and Quality Control*; and
- Name, address, email address, telephone number of the primary and secondary contact at the vendor's company.
- A minimum of three (3) references from other institutions for which the vendor has completed comparable work.

10.2: Pricing and Invoices

Vendors should provide pricing information that describes all the relevant services offered in relation to your project's scope. These price estimates must reflect all line items that will potentially be included on an invoice.

Costs may include:

- Project set-up
- Digitization (by duration of source tape; for example, 0-30 minutes, 31-60 minutes; or per item)

- Metadata creation
- Creation of additional files (mezzanine and/or access)
- Re-housing materials
- Baking, Cleaning, and Repair
- Delivery media (External hard drives, Linear Tape-Open (LTO), DVDs, etc.)
- Engineer time
- Shipping/Handling
- Insurance
- Additional Services/Special Handling

Digital transfer costs can be reflected as a 'per item' cost, or 'per hour' of digitized recordings. An established unit of cost should be selected for the total volume of work. Baking, cleaning, repair, and special handling should appear separately from the digital transfer cost. In some cases, an institution may choose to direct the vendor not to perform these actions without written permission or, in other cases, not at all for budgetary reasons. Vendors should clearly indicate and describe what constitutes "special handling." Metadata creation may also be accounted in a separate charge from the transfer costs.

Shipping costs may be negotiable with vendor. Some vendors will pay for the shipping costs of multiple batches of work and charge the final cost to the institution at the end of the project. Or, your institution can use its preferred shipper and account. Either way, the estimated cost of shipping should be requested by the institution and provided by the vendor in the proposal.

Insurance charges should be indicated as a separate line item, as well as any other additional charges for work requested in the proposal. Additional charges might include quality control or visual inspection in excess of what is normally provide by the vendor (for example, especially fragile or unique material might require additional QA and QC).

The vendor must state in the proposal whether the pricing provided is firm for the duration of the project and, if not, state explicitly when incremental increases in pricing are likely to occur.

The institution should indicate in the RFP the manner in which vendors should submit invoices and to whom they should be sent. Large, multi-batched projects may require a schedule of invoicing and the transfer work may be subject to deadlines, especially those funded by granting agencies. These should be spelled out in the RFP.

10.3: Samples

Testing a sample of analogous VHS recordings is recommended, particularly when using a new vendor. The goal is to test the vendor's ability to adhere to an institution's specifications and provide the institution with a sample of the quality the vendor is able to produce.

There are two methods for approaching the vendor test: (1) provide the vendor with a small sample of the VHS recordings to be digitized, or an analogous sample of videotapes. This also provides the institution with an opportunity to test the effectiveness of the planned workflow and troubleshoot any workflow issues early on in the process. (2) The institution can provide the vendor with a tape with standard test signals in order to determine the vendor's to provide the quality specified in the RFP. A test tape is a professionally-made recording of a series of short video test patterns meant to test the performance of the vendor's equipment.

Most vendors will agree to conduct a small sample without charge. Negotiate the timeline for the testing phase and sample test size with the vendor. The institution should conduct a thorough inspection of the digitized files in a timely manner to determine whether the vendor is qualified to work on the larger project.

Appendix A:
Sample Request for Proposals (RFP)

1: Introduction

Gotham University (GU) is undergoing a large-scale project to preserve the Wayne Family Collection housed in the University's archives. The Wayne Family Collection consists of photographs, personal ephemera, genealogical records, and audiovisual materials relating to the Wayne Family, who have served as active philanthropists since GU's founding. GU is requesting proposals for the preservation of the family's analog video collection, focusing on the VHS material. This project will commence in January 2014 and be completed by July 2014.

1.1: Project Description

- Gotham University is an Ivy League institution that operates one of the most renowned libraries in the country. The Gotham University Library's mission is to provide access to the cultural and historic legacy of Gotham City for current and future scholars.
- The Wayne Family Collection contains video oral histories with members of the Wayne family, event documentation, and home movies.
- The University is embarking on a project to digitize 700 standard definition (SD) NTSC VHS tapes for preservation and access purposes within the library. The VHS tapes have been maintained in climate-controlled storage since their acquisition in 2001. Previously, they were held in the estate of the Wayne Family; some of the tapes were held in a damp basement.
- The purpose of this Request for Proposals (RFP) is to identify and select a vendor who can facilitate the following:
    - Physical condition assessment of VHS materials
    - Digitization of the analog VHS tapes to the following deliverables:
        - *Preservation Master*: Uncompressed, 10-bit QuickTime files
        - *Mezzanine File*: DV50 QuickTime files
        - *Access File*: Windows Media Player files

2: Technical Requirements

Gotham University requires the following technical specifications for the transfer of analog material to digital preservation files.

Set-up
Audio and video set-up must be performed for each tape to ensure that the tape is captured faithfully and accurately with no information loss or degradation. If there are bars/tone present on the source tape, the luminance and chrominance should be adjusted using a processing amplifier (proc amp) to bring the levels within line to Engineering Guideline EG

1-1990 SMPTE reference bars.[21] The tone shall be set to zero VU on a VU meter and -20dBFS on a digital/peak meter. These requirements must be monitored using oscilloscope meters to measure each aspect of the signal.

If there are no bars/tone at the head of the tape, or the content of the tape is not representative of the bars/tone at the head, the levels should be set to the content of the tape. Using known references (for example: blue sky, known blacks and whites, flesh tone, etc.), levels should be set to prevent any clipping or crushing of the luminance or chrominance.

The vendor must set the audio level so that the content averages zero VU and -20dBFS with levels not exceeding zero VU to ensure that the audio does not suffer from distortion or clipping. All audio tracks must be checked for content and transferred in full, maintaining the channel assignment.

No image/sound processing should be introduced to the signal chain at any point in the creation of preservation and mezzanine copies. This includes, but is not limited to, drop-out compensation, noise reduction, audio equalization, limiting and filters.

Signal Path
All components in the signal path must be calibrated and tested to pass the audio/video signal without distortion or interference. At all times, the shortest signal chain must be used in transferring the signal from the source to the destination. There may be no components in the signal chain that are not necessary, and no "daisy-chaining" of equipment is allowed.

The highest quality output available to the source format shall be used for transferring the signal. For the purposes of this project, all VHS material shall be transferred via component with Y/C output at a minimum. Use of composite is not within the scope of this RFP.

Equipment
All equipment shall be of the highest grade and quality. A broadcast-level analog to digital (A/D) converter must be used for all transfers.

2.1: Deliverable File Formats

Gotham University requires that the vendor migrate the analog VHS material to the following file formats for preservation, editing, and access.

2.1.1 Preservation Master File

Wrapper:	QuickTime (.mov)
Video Stream:	Uncompressed, 10-bit 4:2:2 YUV, 486 x 720, 4:3 aspect ratio, 29.97fps, pixel size: Rec. 601

[21] Society of Motion Picture and Television Engineers, *EG 1:1990: Alignment Color Bar Test Signal for Television Picture Monitors*. January 1, 2004; st-170-2004: (1) part1.

Audio Stream(s): 48Khz/24-bit PCM

2.1.2 Mezzanine File

Wrapper: QuickTime (.mov)
Video Stream: DV50 4:2:2, 29.97fps, 486 x 720, 4:3 aspect ratio, pixel size: Rec. 601
Audio Stream(s): 48Khz/16-bit PCM

2.1.3 Access Copies

For streaming:
Wrapper: Windows Media (.wmv)
Video Stream: Windows Media 700Kbps
Audio Stream: Windows Media Audio 160kbps

For internal access:
DVD: MPEG-2, Variable Bit Rate 7Mbps

2.2: Metadata Requirements

For this preservation project, GU will provide vendors with descriptive, provenance, structural, and rights metadata in an .csv file; vendors will be required to populate and deliver to GU the technical metadata described below in a .csv file.

2.2.1 Descriptive Metadata

GU will generate the descriptive metadata for the Wayne Family Collection and provide it to the vendor. The vendor should use this metadata to ensure that all source tapes are received and identified, and to aid in the proper packaging of the preservation files.

2.2.2 Provenance Metadata

The provenance metadata is to preserve information about the original analog source and tie this to the new digital preservation files. GU will provide the provenance metadata to the vendor; during initial physical inspection of the source materials, the vendor will confirm that the information provided is accurate. It is the vendor's responsibility to edit/update the fields accordingly.

2.2.3 Technical Metadata

2.2.3.1 Embedded Metadata

The vendor will be required to extract the embedded metadata from the newly-created digital files using MediaInfo, and populate it in the .csv. If the vendor has a preferred method (such as using an automated script with MediaInfo), please include details on the proposed work plan in *Section 10*.

2.2.3.2 Non-embedded Metadata

GU requires the vendor to maintain two types of non-embedded metadata: processing history and transfer notes. The processing history documents the entire signal chain used in the transfer process, as it relates to the transfer process. The non-embedded processing history metadata fields include:

Computer Fields
computerManufacturer
hostComputerName
hostComputerVersion
hostComputerBuild
operatingSystem
operatingSystemVersion

Reproducing Device Fields
videoReproducingDeviceType
videoReproducingDeviceManufacturer
videoReproducingDeviceModelName
videoReproducingDeviceModelVersion
videoReproducingDeviceModelSerialNumber

Correction Fields
videoCorrectionDeviceType
videoCorrectionDeviceManufacturer
videoCorrectionDeviceModelName
videoCorrectionDeviceModelVersion
videoCorrectionDeviceModelSerialNumber

Capture Device Fields
videoCaptureDeviceType01
videoCaptureDeviceManufacturer01
videoCaptureDeviceModelName01
videoCaptureDeviceModelVersion01
videoCaptureDeviceModelSerialNumber01
videoCaptureDeviceDriver01
videoCaptureDeviceDriverVersion01

Capture Software Fields
videoCaptureSoftwareManufacturer01
videoCaptureSoftwareName01
videoCaptureSoftwareVersion01

GU also requires that vendors track errors found on the source tapes in real time. These technician transfer notes should be maintained in a .txt file included in the BagIt file directory of the digitized item.

2.2.4 Structural Metadata

GU will populate the structural metadata fields, which serve as the internal link between the cataloguing system and the new digital objects.

2.2.5 Rights Metadata

GU will populate the rights metadata fields, which will tie the access conditions that govern the object to the digital files.

3: Vendor Information

3.1: Vendor Production System Information

3.1.1: *Facility Guidelines*

Registrar

- Upon receipt of the material for transfer, the vendor will immediately inventory the contents of the shipment and confirm receipt with the project contact.
- The vendor is required to visually inspect contents to ensure that all materials arrived safely. If damage or any other issue is identified, the vendor is required to communicate this information to GU's project contact immediately. If possible, the vendor will propose a method of treatment and carry out the treatment promptly, if approved.

Care and Handling

- All staff must be knowledgeable about the handling and care of magnetic media, specifically VHS. Materials must be handled only by qualified and trained technicians. Vendors are required to provide a list of all staff that will be handling the material at each step of the process, from arrival of the source materials at the vendor's facility to the return of the source materials and deliverables post-digitization.
- Food and drink should not be consumed with collection materials present.
- If record tabs are present, vendor is required to remove them before transfer.

Environmental Control

- The tapes should be stored upright, spine out in a temperature-controlled environment (63 - 68 degrees Fahrenheit with relative humidity of 30-35%) throughout the transfer process. Vendor must be able to provide environmental monitoring reports upon request.

Equipment and Maintenance

- A list of the equipment used in the transfer process and a description of maintenance work on the equipment should be provided by the vendor;

- All equipment must be cleaned with 99% isopropyl alcohol and lint- and abrasion-free wipes before transfers are performed.
- A regular maintenance schedule of the facility should be provided to the project contact.

3.1.2 Workflow and Transfer Specifications

Prior to digitization, vendor must provide a description of workflow path and monitoring practices and adhere to this workflow throughout the course of the project. If any changes or modifications become necessary, they must first be communicated to GU for approval.

Representation of Source Material

- The digitized preservation master file must represent the original source tape as closely as possible. Master files should retain the source formatting, including interlacing, frame rate, aspect ratio, audio levels, and recording standard (NTSC, PAL, SECAM).
- The transfer must capture the entirety of the tape's native resolution and color space, which for VHS is YUV and 240 lines of horizontal resolution.[22]

Source Head Information

- All source head formatting should be included in the preservation master file. If the source tape has bars and tone, the digital files should include them as well.

Calibration

- Waveform and vectorscopes must be calibrated to SMPTE Engineering Guideline EG 1-1990 reference bars.
- The audio and video must be calibrated to a known reference before transfer.
    - If bars/tone are present on the tape, the audio and video signals shall be set to those reference bars.
    - If bars/tone are not present, the luminance and chrominance levels must be adjusted to meet broadcast legal limits, with whites peaking just under 100 IRE and blacks no lower than 7.5 IRE. The vendor must locate an appropriate reference within the tape's content (for example, blue sky, skin tone, and known black and/or white objects) and then adjust levels using these references as guides. If vendor is not confident with the adjustments, the vendor should contact GU.

Pre-Roll Requirements: Bars, Tones, and Slates

- GU requires that the vendor produce these pre-roll conditions: 15 seconds of black, 30 seconds of SMPTE bars and tone, 10 seconds of transfer slate (indicating that the video was digitally converted with date), 10 seconds of title slate, 15 seconds of copyright statement slate, 5 additional seconds of black, and the start of the tape.

[22] http://videopreservation.conservation-us.org/dig_mig/video_formats_v4_850.html

- Title Slate – Vendor is to use titles provided in descriptive metadata spreadsheet.
- Copyright Statement Slate – "The copyright law of the United States (Title 17, United States Code) governs the reproduction of copyrighted materials. This reproduction is provided solely for personal, noncommercial use in private study, scholarship, or research. Further distribution, or later uses in excess of fair use (17 USC 107), may expose the user to liability for copyright infringement."

Acceptable Artifacts

- No error correction should be applied to the signal.

Enhancements and Improvements

- No error correction, enhancement, or restoration mechanisms should be utilized unless agreed to in writing by GU.

Audio Tracks

- All audio tracks on the original source tape must be checked for audio content on all channels on the VTR audio monitors prior to transfers. All tracks should be digitized in full. If no tone is present on the tape, the audio levels should be adjusted according to the tape's content such that the audio signal remains at zero (0) VU on a calibrated VU meter or -20 dBFS on a calibrated digital/peak meter.

Closed Captioning

- If the original source tapes contain closed captioning, GU requests that it be extracted with the MacCaption software. Closed captioning should be delivered to GU in two ways 1) .srt files should be added to the file directory; and 2) CC tracks should be used to create sub-title tracks on DVD access copies.

End of Source Tape

- To ensure that all content from the source tape is captured, the transfer engineer should allow the tape to play back for an additional five minutes past what is believed to be the end.

Additional Notes

- The transfer should be captured "fat," meaning the digital capture should be started before the tapes begin playback to ensure the entire signal is migrated.
- If any anomalies or errors that could impact the source tape or the signal are detected, the vendor should stop the transfer and contact GU.
- Source tapes must be transferred only once, with minimum handling.
- The transfer must be fully monitored by the technician.
- Tapes must never remain in decks unattended before, during, or after transfer.

3.2: Quality Assurance and Quality Control

The vendor is required to fully monitor each transfer and document any errors in the transfer in the attached transfer log sheet (see Appendix C). In the event of significant errors, the engineer is required to notify GU and re-perform the transfer, if necessary.

3.2.1 Quality Assurance

3.2.1.1 Vendor QA

To ensure the transfer is performed properly and faithfully, the engineer must fully monitor the entire process from start to finish. The engineer will regularly check relevant oscilloscopes in meters (both analog and digital) during the entire transfer process to ensure the levels remain within legal limits. The vendor is required to assure the quality of the transfer process by following the prescribed workflow:

- Upon completion of the capture process, the vendor will generate a checksum value for the file that was created. This value will be documented in the metadata schema provided by Gotham University.

3.2.1.2 Gotham University QA

GU will perform its own internal QA on the files to ensure that the transfer was accurately and faithfully produced. This includes:

Validation of File Structure/Naming Conventions
GU will verify that the files have been delivered in the specified file structure, adhering to the naming conventions outlined.

Validation of File Metadata
GU will validate the metadata using various automated tools as well as manually by a technician. Any incorrect entries or unpopulated fields will be communicated to the vendor to rectify and adhere to in the future.

Validation of Checksum
GU will validate the checksum twice upon receipt of the files: once while the file is on the hard drive and a second time when copied locally. Any negative validations will require the files to be delivered again on a different hard drive.

Validation of File Format
GU will validate the file format using various tools, including MediaInfo and ffmpeg in the command line. Any variances will be communicated to the vendor to rectify.

Audiovisual Content
GU will view the entire preservation master on a calibrated, broadcast monitor (calibrated using Engineering Guideline EG 1-1990 SMPTE reference bars) via a

Blackmagic decklink studio A/D on a MacPro as well as isolated speakers or headphones for the audio.

Using calibrated analog and digital oscilloscopes and digital VU meters, GU will additionally monitor the audiovisual signals and ensure they are represented accurately.

3.2.2 Quality Control

3.2.2.1 Vendor QC

When the transfer is complete, the vendor must conduct quality control (QC) on all digital files to ensure the files created during digitization match the visual characteristics of the original VHS recording. Visual inspection will be conducted at three places on the digitized video file (the head, middle, and tail) for approximately one minute at each interval. Operators should verify that the digital content is complete, matches the original source tape, and that there is accurate sync between audio and video.

QC staff must also confirm that:

- The aspect ratio is the same as the original.
- All three digital files (master, mezzanine, and use/access) must play properly.
- Artifacts that were not in the original source tape must not appear in the transfer.
- The entire program should be digitized without clipping, cropping, or trimming.
- There should be no change to the video or audio portions of the file.
- The technical characteristics of the converted files must be in accordance with the specifications outlined in the RFP.
- The preservation master file must have the same interlacing as the original source tape.
- All slates, labels, and metadata (embedded and external) should be compared and checked for accuracy and completeness.

3.2.2.2 Gotham University QC

When GU receives the files from the vendor, staff will perform QC to determine whether there are any issues with the digital files. GU will use the above checklist. If damage appears to be from the original source tape signal, the QC staff will refer to the vendor's transfer notes to see if there is any notation of such. If there are issues that appear to have been created during/by the conversion process, GU will notify the vendor immediately and request that the work be re-done if necessary.

4: Schedule and Turnaround Time

The project will commence in January 2014 and is scheduled to be completed by July 31, 2014. GU will ship a batch of 100 tapes per month to the vendor. GU requests that the deliverables be sent back on hard drives with one set of DVD access copies. Upon receipt of the digital deliverables, GU will ship another batch of 100 tapes within thirty days.

5: Delivery of Completed Work

Upon the completion of a batch of tapes, the vendor will ship the hard drives with the preservation masters, mezzanine files, and access derivatives. Gotham University will complete QA and QC on the files in a time frame agreed upon between the vendor and GU. Any errors revealed in the QA process conducted by the client will be communicated to the vendor and actions will be taken for re-transfer or clarification on the problems that the client is seeing.

All tapes will be kept by the vendor until the QC/QA process has been completed by GU and any re-transfers have been completed.

The vendor will store a copy of the Preservation Masters, Mezzanine files and Access derivatives for 60 days after the project has been completed. The vendor will communicate confirmation of the deletion of the files via email when the 60 days have passed or GU has given permission to delete the materials.

5.1 Digital Files

5.1.1 File Naming

Each file created from a unique piece of media should be named with the Unique ID, followed by an "_m" (master); "_d" (derivative); "_s" (service).

5.1.2 Directory Specifications and the Secure Transfer of Files

The directory structure for the digital files and the supporting metadata and documents must be "flat" (without subdirectories) for each VHS recording.

Each discrete preservation directory will be "bagged" using the BagIt software.[23] The BagIt folder will be named with the Unique ID.

The following items should be within each folder:

- **bag-info.txt** *Created by BagIt software; identifies the software version*
- **bagit.txt** *Created by* BagIt *software; describes items in bag*
- **"data" folder** *Contains* files *for master(s) and derivative(s)*

[23] http://sourceforge.net/projects/loc-xferutils

    - Process History / Environment of Creation (EOC) .xls
    - A text file or spreadsheet with the technician's transfer notes
- manifest**-md5.txt**
    - checksum for files
- tagmanifest**-md5.txt** *Checksum for entire bag*

5.2 Physical Materials

5.2.1 Labeling of Access Materials

GU requests that access DVD labels contain the following:

- Collection Name: *Wayne* Family Collection
- Institution Name: Gotham University Library
- Unique ID: [insert here]
- Created from *VHS* original on [insert date here]

5.2.2 Delivery Method

GU requests Mac-formatted external hard drives for the digital files. GU will return the hard drives to the vendor within 60 days of project completion.

5.2.3 Return of Source Materials Post-Digitization

GU will first provide written notification when the digital files and DVDs have passed QC. Upon completion of the project, GU requests that the vendor ship all source materials back to GU in the original packing order.

6: Failures

Any transfer failures will be halted immediately and communicated to GU on the day that the error arises. A detailed transfer log will be emailed to GU describing the error, what went wrong, and a proposal on how to prevent the failure from occurring again. Once the vendor has approval from GU, the material will be prepped and transferred again. Confirmation of a successful transfer will be communicated to GU upon completion.

7: Special Instructions

GU may require special "rush" services throughout the time of the project as research requests are made. Within the workflow, the vendor should allot for time when certain tapes may be prioritized for delivery by request of the project contact.

8: Sub-Contracting

All digitization will be done on the vendor's premises. No subcontracting of this work will be permitted without prior communication and approval from GU. Permissible instances of sub-contracting, subject to the approval of the University, include treatment of tapes that

falls outside of the vendor's capabilities or handling of formats that the vendor does not have the capacity to accommodate.

9: Insurance

The vendor is required to provide proof of insurance that covers its liability in the care of the original material. Please refer to the guidelines for adequate insurance accepted by Gotham University for vendor projects: www.gothamU.edu/insurance/.

10: Details of Proposal Deliverables

Completed project proposals should be sent in hard copy to: Gotham University, Attention: Alfred Pennyworth, 1234 Batman Way, Gotham City 98765.

GU will review proposals beginning October 31, 2013. Vendors will be notified of GU's decision on or before November 30, 2013.

10.1 Submitting Proposals

Qualified vendors wishing to submit a bid for the project must provide the following information. Written proposals can be formatted at the discretion of the vendor, but must address the requirements listed in this RFP:

- Demonstrated understanding of the scope of work and project time frame;
- Description of vendor's facilities, equipment, and staffing, confirming that they meet the criteria outlined in "Section 3.1: Vendor Production System Information";
- The vendor's QA and QC procedures and how they satisfy the requirements listed in "Section 3.2: Quality Assurance and Quality Control";
- Name, address, email address, and telephone number of the primary and secondary contacts at the vendor's company; and
- A minimum of three (3) references from other institutions for which the vendor has completed comparable work.

10.2 Pricing and Invoices

Vendors must provide a complete price estimate that addresses all of the relevant services offered in relation to the workflow for this project. GU recognizes that there may be difficulty in estimating costs when not all of the durations of the source tapes are known.

The price estimates must reflect all line items that will potentially appear on an invoice, including:

- Project set-up
- Digitization (by duration of source tape, for example, 0-30 minutes, 31-60minutes; or per item)

- Metadata creation
- Creation of additional files (mezzanine and access)
- Re-housing materials
- Baking, Cleaning, and Repair
- Delivery media (DVDs and external Hard Drives)
- Engineer time
- Shipping/handling
- Additional Services/Special Handling

Vendors must indicate whether the pricing provided is firm for the duration of the project.

All invoices should be directed to: Gotham University, Attention: Alfred Pennyworth, 1234 Batman Way, Gotham City 98765.

Invoices will be processed and paid within 90 days.

10.3: Samples

A requirement of the submission is a sample transfer done from a provided reference tape. Gotham University will send each vendor a VHS tape and thumb drive which will serve to demonstrate that the equipment and signal integrity is accurate. The vendor will submit both the reference tape and generated file with the above documentation.

Appendix B:
Sample Metadata Schema

Descriptive Metadata	**Title**	The Wayne Family Foundation Benefit
	Creator	Gotham TV
	ItemUniqueID	WF0001
	Collection	Wayne Family Collection
	DatofCreation	2/2/1995
	PlaceofCreation	Gotham City, NY
	Language	English
	Genre	Documentation
	Abstract	
	Contributor	
Provenance Metadata	**Format**	VHS
	Gauge	1/2 inch
	Length	45min
	Stockbrand	Ampex
	Stockduration	60
	SignalEncoding	SP
	OriginalMarkings	None
Technical Metadata (Embedded)	**CompleteName**	0001_m
	VideoFormat	YUV (AJA Video Systems Xena)
	VideoCodecID	v210
	VideoBit Rate	221184000
	VideoWidth	720
	VideoHeight	480
	VideoStandard	NTSC
	VideoColorspace	YUV
	VideoFrameRate	29.97
	AudioFormat	PCM
	AudioCodecID	PCM
	AudioBitRate	1536000
	AudioBitDepth	16
	AudioSampling	48000
	AudioResolution	16
	FormatExtension	mp4 m4v m4a m4p 3gpp 3gp 3gpp2 3g2 k3g jpm jpx mqv ismv isma f4v
	MIMEType	
	FormatVerson	
	FileSize	28570737033
	Duration	1026240
	FileModifiedDate	UTC 2012-11-08 19:43:27
	EncodedDate	
Technical Metadata (Non-Embedded)	**computerManufacturer**	Apple, Inc
	hostComputerName	MacPro

	hostComputerVersion	Power PC
	hostComputerBuild	3.4.1
	OperatingSystem	OS X
	OperatingSystemVersion	10.6.3
	VideoReproducingDeviceType	VHS
	VideoReproducingDeviceManufacturer	Sony
	VideoReproducingDeviceModelName	SVO
	VideoReproducingDeviceModelVersion	SVO5800
	VideoReporoducingDeviceModelVersion	
	VideoReproducingDeviceModelSerialNumber	596203925
	VideoCaptureDeviceType01	Analog to Digital Converter
	VideoCaptureDeviceManufacturer01	Blackmagic
	VideoCaptureDeviceModelName01	Decklink Studio 2
	VideCaptureDeviceModelVersion01	2
	VideoCaptureDeviceModelSerialNumber01	98573920
	VideoCaptureDeviceDriver01	Blackmagic Video Capture
	VideoCaptureDeviceDriverVersion01	2.3
	VideoCaptureSoftwareManufacturer01	Blackmagic
	VideoCaptureSoftware01	Media Express
	VideoCaptureSoftwareVersion01	2.1
Structural Metadata	**Relationship**	1 of 2
	RelationShiptype	Multiple
	RelationshipSubType	
	LinkingEventIdentifier	
Rights Metadata	**RightsDelcaration**	Owner
	RightHolderName	Bruce Wayne
	RightsHolderContactDesignation	Family
	RightsHolderContact	1 Wayne Manor, Gotham, NY

Appendix C:
Sample Transfer Notes

Tape unique ID: 325.056

Technician notes (Video—indicate timecode):

00:02:20 Drop out for 4:36
00:09:21 Break
00:10:03 Drop out
00:10:11 Drop out
00:19:11-13 Drop out
00:22:58 Drop out
00:23:27 Drop out
00:23:36 Drop out
27:47-49 Head clog recorded in

Technician notes (Audio—indicate timecode):

10:28-24:03 Ch 1,2 at head; Ch 1 only
25:47-25:51 Ch 1 only
26:02-27:35 Ch 2 only
27:25-tail Ch 1 only

Additional Technician Notes:

Compilation tape with various artifacts recorded in per generation of source material. Head switching, minor drop out throughout. Luma is hot on tape. Extraneous material at tail.

Appendix D:
A Glossary of Terms and Concepts

This video preservation primer is organized into the following sections:

- Characteristics of Analog Video
- Analog-to-Digital Transfer Terminology
- Characteristics of Digital Files

Characteristics of Analog Video

Audio
Depending on the format of tape, between 2 to 8 channels of audio can be present on an analog video tape. The audio signal is encoded separately on the tape as well as in the digital realm. Audio is typically sampled at 48Khz and a bit depth between 16 and 24. For more about sampling and bit depth, please consult the "Characteristics of Digital Files" section of the glossary.

Chrominance
The Chrominance portion of the video signal is the color information of the picture. Only the red and blue values are present in the signal and the green is derived mathematically. Chrominance is typically represented as UV or PbPr, with the U/Pb representing blue and V/Pr representing red. Chrominance is of lower significance in the video signal and present at a lower rate than the luminance portion of the single as well as sampled less.

Closed Captioning
This is the presence of a transcript or textual information of the content of the tape that is embedded in the vertical blanking of the video signal. Closed Captioning information is transmitted and present in Line 21 of the video signal. A decoder is necessary to display the textual information. In the analog realm, a CRT would typically be preset with the decoder. In the digital realm, a Closed Captioning decoder is necessary in the application for the text to be displayed.

Component
Component is a type of signal transmission. The luminance is transmitted separately from the chrominance and the chrominance is separated into the blue and red signal, which are also sent separately from one another. In the analog realm, this is the best possible transmission of the signal as it allows for the greatest separation of the signal, which results in greater fidelity and accuracy.

Composite
Composite is a type of signal transmission. The luminance and chrominance are transmitted together as one signal.

Head Switching
Head switching is when the heads on the drum of the video tape recorder (VTR) alternate when reading back the video signal. This is present in the video at the bottom of the

horizontal lines. Typically, head switching was not visible on CRT monitors, as they inherently overscan the image and crop this information out. Because digital migration will result in making all of these available lines visible, this information will be present visually in your preservation master and subsequent derivatives.

Interlacing
In order for visual information to be transmitted on the available bandwidth in the 1950s, it was quickly realized that keeping the image in "frames" (much like film) would exceed the bandwidth limitations. To lower the bandwidth of the video signal, interlacing takes the available 525 lines of information in the NTSC signal and splits them into A and B fields consisting of 262 lines each. These were transmitted at 30 fields per second (fps), alternating between the even and odd line information. Because of the eye's persistence of vision, the fields would combine to accurately represent the picture and movement.

Luminance
The Luminance portion of the video signal is the black and white information of the picture. This is typically represented with a "Y" in terms of signal types (e.g. Y/C or YUV). Luminance is the most critical element of the video signal and is typically transmitted with a higher bandwidth and sampled at a greater rate.

NTSC
Developed by the National Television Systems Committee, NTSC is a video standard used most commonly in North America and based on the 60Hz power cycle. NTSC runs at 30/29.97fps and uses 525 lines of available video information.

Overscan/Underscan
CRT monitors operate in an "overscan" mode which effectively crops the portions of the video signal that are designated either for data or other extraneous, non-visual information. To view this material, you will have to use a broadcast-quality monitor and go into "underscan" mode to see all available lines of information visually.

PAL
Phase Alternating Line (PAL) is a video standard most commonly used in Europe and based on the 50Hz power cycle. PAL runs at 25fps and uses 625 of available video information. Also, the transmission of color is alternated between red and blue rather than at the same time.

SDI
SDI, or serial digital interface, transforms the analog signal and packages the audio and video signals together.

Sync
The sync present in the video signal is what stabilizes the picture. The two main signals are vertical and horizontal sync which tell the equipment where the picture starts and stops. The same way that a typewriter will ding at the end of a line, a sync pulse tells the monitor or CRT when to stop drawing one line of video information and to start on the next.

Time Code
A labeling system developed by the Society of Motion Picture and Television Engineers (SMPTE) to label video "frames" with a numerical value. In video, this is transmitted and present in the vertical blanking of the video signal, much like the Closed Caption information, which is known as Vertical Interval Time Code (VITC).

Y/C or S-Video
Y/C is a type of signal transmission. The luminance is transmitted separately from the chrominance signal, which allows for less "bleed" between the two signals and a greater amount of fidelity.

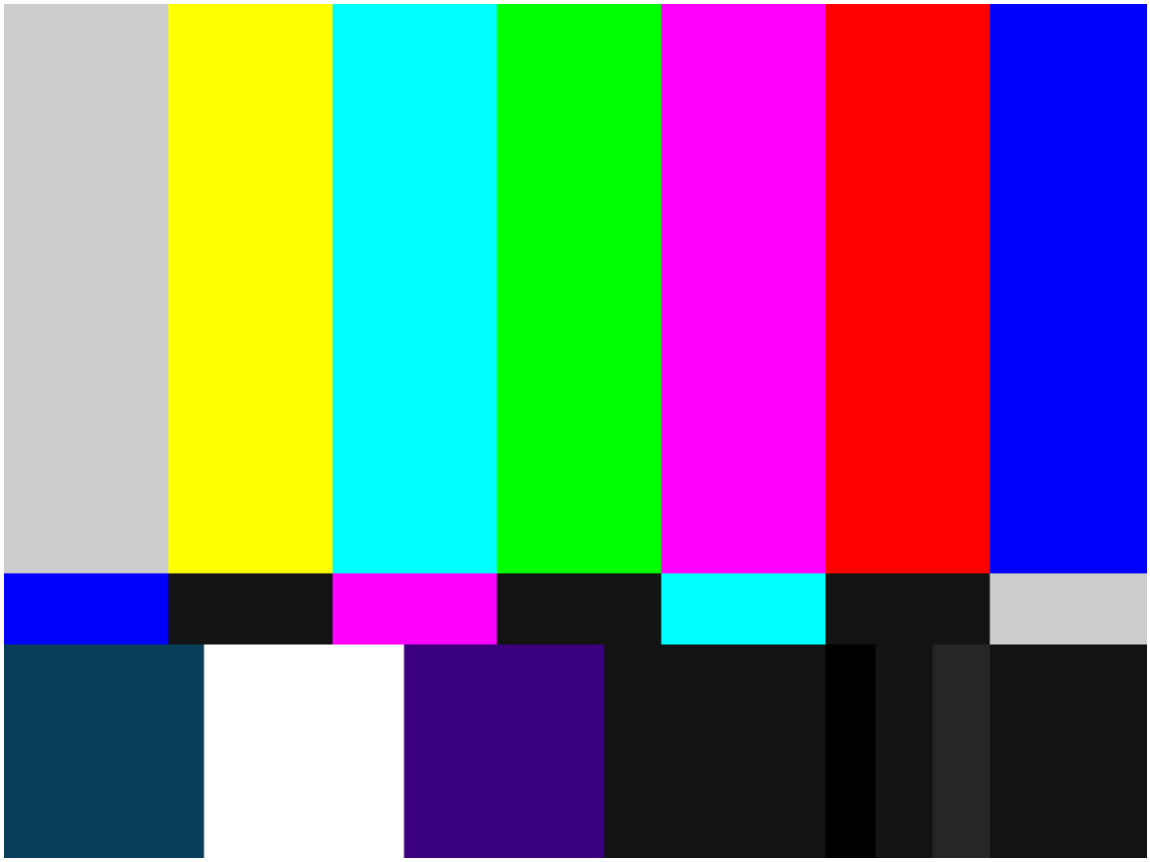
Analog Errors[24]

Dropout
When particulate or damage appears on the tape, this can cause the phenomenon known as dropout. Dropout, simply, is when the signal necessary to transport a particular line or lines of information is disrupted. Visually, this appears as a black or white artifact that is noticeable in the video image. There are corrective measures that can be taken by using a dropout compensator which will draw from other available lines around the damaged area and interpolate, or create, what that line should represent visually.

Dot Crawl
Dot crawl is inherent to the composite method of signal transmission and is visually represented by a moving series of dots in areas of high color saturation (typically most noticeable around red).

[24] For a more comprehensive list of analog errors, visit: *A/V Artifact Atlas*. Bay Area Video Coalition. Available online: http://preservation.bavc.org/artifactatlas/index.php/A/V_Artifact_Atlas. Also, see: Johannes Gfeller, Joanna Phillips, and Agathe Jarczyk. *Compendium of Image Errors in Analogue Video*. (Zürich, Switzerland: Scheidegger and Spiess), 2013.

Bars/Tone
SMPTE developed a standard reference signal for the calibration of equipment for optimal visual and aural representation. The SMPTE bars represent the key aspects of the signal: the brightest white value, the blackest black value, a reference sync signal and known values for the color.



White **PLUG Bars for black**

Analog-to-Digital Transfer Terminology

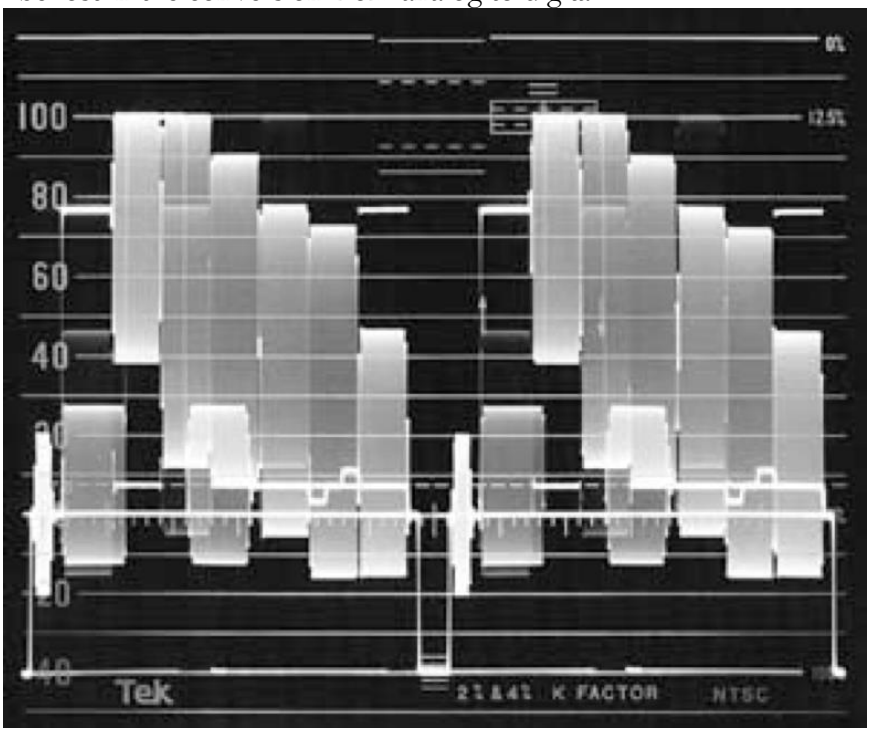
Daisy-chain
"Daisy-chaining" is an engineering term that refers to connecting multiple video tape recorders (VTRs) to each other to pass the signal to multiple destinations at once or to transform a signal to a different type. This may be beneficial for quick fixes, but is not recommended for preservation-quality transfers as each VTR can impact or degrade the signal as it passes through the chain. If the goal is to transform the output signal, it's best to use a dedicated piece of hardware, such as a scaler or dedicated time-based corrector (TBC).

Gain Stage
Gain refers to the ability to adjust the levels on the audio signal. It is advisable to set levels to 0VU/-20db depending on how you are monitoring the audio.

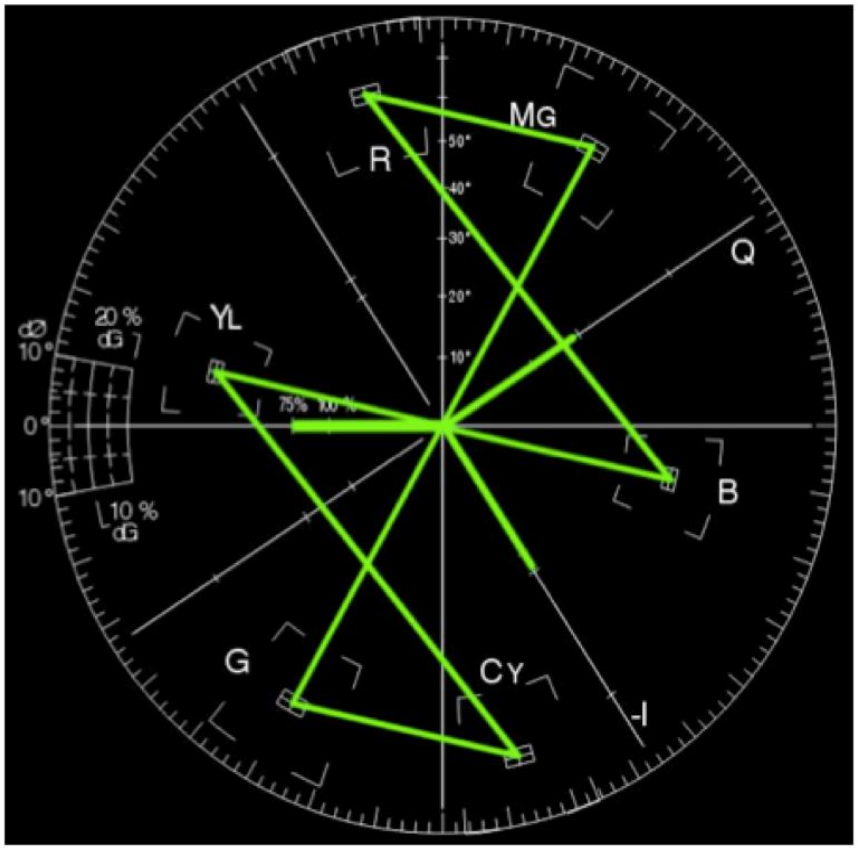
Processing Amplifier (Proc Amp)
To allow adjustment of the luminance and chrominance signal, a Processing Amplifier will be used to manipulate the individual signal characters to bring them into "legal" limits as described above.

Scopes
In addition to the CRT, which shows the actual picture information, two sets of oscilloscopes are used to monitor the video signal in an objective manner.

Waveform Monitor
This is used to analyze the luminance information and ensure that the signal is transmitted faithfully and captured accurately. If values go above the "legal" limits of the scope (above 100IRE or below 7.5IRE) there is the possibility that this information will be lost in the conversion from analog to digital.



Vectorscope Monitor
This is used to analyze the chrominance information and ensure that the colors being displayed are accurate and remove any subjectivity that the human eye may introduce (for example, color blindness). Colors are represented on the scope as a 360º color wheel with the "black burst" representing the known reference for calibrating the scope.



Set-Up

Set-up is an engineering term that refers to the way in which the transfer system is calibrated when migrating analog video material.

Flat
When the system chain is calibrated to known references (typically SMPTE reference bars and a 1Khz tone), this is described as "flat." After this calibration, all material is migrated "as-is" with no adjustments to the luminance and chrominance. This allows all of the material to be treated equally but there is the potential that the signals may be clipped or crushed in the transfer process. This loss of information is irretrievable.

Half
Half set-up is when a system is calibrated to a batch of tapes or to reference bars at the head of each tape. This will typically mean that a single tape will be used to adjust levels on the processing amplifier and audio gain. All subsequent tapes in the batch will be migrated using these adjustments.

Full
Full set-up is when a system is calibrated to each tape. The luminance and chrominance will be adjusted to the reference bars at the head of the tape. However, if the content on the tape does not correspond to this reference, the system will be re-adjusted to capture the entirety of the video signal on the tape as accurately and faithfully as possible.

Signal Generator
This is used in a video transfer set-up to sync or "gen lock" all of the relevant pieces of equipment together so that they all are operating from a standard reference, which in a NTSC system is CC601.

Time-Based Corrector (TBC)
A video tape recorder (VTR) will typically output a "dirty" signal, meaning the sync pulses will be unstable and display incorrectly. To compensate for this, the signal will pass through a TBC which replaces the sync pulses with a set reference to stabilize the image signal. The TBC can either be a separate piece of equipment or included in the VTR.

Characteristics of Digital Files

Bit
A bit is the most granular form of digital storage and refers to the simple binary of 0 and 1.

Bit depth
This is the amount of bits used to describe each discrete sample. The greater the bit depth, the more accurately the sample is described. Audio sampled at 8-bit versus 16-bit allows for double the amount of description of the sample, which captures the signal with greater accuracy. In video, the bit depth corresponds to the available bits used to describe the red, green and blue colors. 8-bit allows for 256 levels to describe the color gradient and 10-bit allows for 1024 levels to describe the color.

Byte
A byte is a collection of 8 bits, which are then encoded or translated into a byte.

Checksum
A checksum is an alphanumeric value that is generated via an algorithm for each file to detect errors that may have been introduced in transmission or storage. This unique combination of numbers and letters, when generated by the algorithm, will always match unless the file has been altered.

Codec
Short for EnCODe/DECode, the codec is the how the video signal is encoded into a digital data stream and subsequently decoded for playback via a playback application. During the encoding process, the analog stream will be run through a specific codec for encoding into the digital realm. To play it back, the application will need that same codec within its institution to know how to properly decode the video and audio streams.

Data rate
Data rate, in reference to digital video, is the amount of data that must be processed per second for playback. This is typically expressed as Megabytes per second (MB/s) or Megabits per second (Mbps).

Fixity
Fixity, or fixity checks, is a process of ensuring that the data you have has not changed in any way. This typically involves running a checksum on the files to ensure that no corruption has been introduced to the file on a machine-readable level.

Sampling
Video and audio signals are digitized through a process of sampling, which converts the signal into a numeric sequence. Based on the Nyquist–Shannon sampling theorem, which was devised to transform a continuous electrical signal into a sequence of values, sampling takes a signal and assigns values to points of the current which are then stored digitally.

Wrapper
A digital file container packages all of the video and audio streams, as well as any other material, and tells the computer how to handle this information. Common wrappers include: QuickTime (.mov), Audio Video Interleave (.avi), and Motion Picture Engineers Group (.mpeg).

Appendix E:
Selected Resources

Activists' Guide to Archiving. Witness. Available online: http://archiveguide.witness.org/

A/V Artifact Atlas. Bay Area Video Coalition. Available online: http://preservation.bavc.org/artifactatlas/index.php/A/V_Artifact_Atlas

Bachman, Rebecca. "Video Preservation: Glossary of Terms." Bay Area Video Coalition. Available online: http://cool.conservation-us.org/byorg/bavc/bavcterm.html

Bensinger, Charles. *The Video Guide*. Video-Info Publications. (Santa Barbara, CA: Video-Info Publications), 1981. Available online: http://videopreservation.conservation-us.org/vid_guide/

Boyle, Deirdre. *Securing the Future of the Past.* (New York: Media Alliance), 1993.

Digital Moving Image Archives Guide for Independent Filmmakers, Available online: http://dmia.drupalgardens.com

"Digital Preservation." Library of Congress. Available online: http://www.digitalpreservation.gov/

Frost, Hannah, ed. "Video Preservation" Available online: http://cool.conservation-us.org/bytopic/video/

Gfeller, Johannes, Joanna Phillips, and Agathe Jarczyk. *Compendium of Image Errors in Analogue Video*. (Zürich, Switzerland: Scheidegger and Spiess), 2013.

Luther, Arch and Andrew Inglis. *Video Engineering*, Third Edition. (New York: McGraw-Hill Professional), 1999.

Poyton, Charles. *Digital Video and HD, Second Edition: Algorithms and Interfaces*. (Waltham, MA: Elsevier, Inc.) 2012.

"Preservation 101." Independent Media Arts Preservation. Available online: http://www.imappreserve.org/pres_101/index.html

The Association for Library Collections and Technical Services Preservation and Reformatting Section. *"Minimum Digitization Capture Recommendations,"* http://www.ala.org/alcts/resources/preserv/minimum-digitization-capture-recommendations, June 2013.

Vitale, Tim and Paul Messier. *Video Preservation: Video Migration in the Preservation Laboratory*. 2013. Available online: http://videopreservation.conservation-us.org/index.html

Weise, Marcus and Diana Weynand. *How Video Works* (Burlington, VT: Focal Press, 2007).

Wheeler, Jim "Video Preservation Handbook" Media Matters. Available Online: (http://www.media-matters.net/docs/resources/Traditional%20Audiovisual%20Preservation/WheelerVideo.pdf