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 Digital Preservation and Restoration
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 Audio Lab Plan

Extent and Condition of Audio Materials:

A survey was conducted between January and April 2003 at Bobst Library by Mona Jimenez, Media Preservation Specialist, to determine the extent of the library's media holdings. Findings of the survey concluded that the dominant media format in the library is audio. In Bobst's special collections departments, the number of audio materials total 24,679. Tamiment Library and Wagner Archives have the largest audio holdings at 50% or 17,620 items. The University Archives holds 12% of the audio materials with 4,234 items, followed by 8% held by Fales Library with 2,825 items.

The audio holdings in the Special Collections comprise an array of formats including wire, LP, 45 rpm, 1" tape, 1/2" tape, 1/4" tape, cassette, micro cassette, DAT, and CD. Providing preservation and access to these diverse audio collections poses major economic and logistical challenges for repositories. Maintenance and procurement of playback equipment for these varied audio items, specifically older and obsolete formats, is extremely difficult. Please refer to the two tables below that provide a breakdown of the number and percentage of audio materials, and the number and percentage of audio formats in Special Collections at Bobst Library.

Table #1: Number/Percentage of Audio in Special Collections:

Archive	Total audio in each archive	% of audio holdings in each archive
Fales	2,825	8%
Tamiment/Wagner	17,620	50%
University Archives	4,234	12%
TOTAL	24,679	69%

Table #2: Number/Percentage of Audio Formats per Archive in Special Collections:

Archive	Wire	LPs	45s	1/4"	1/2"	1"	Cassette	Micro	Audio CD	DAT
Fales	—	199		496	89	2	1,508	69	334	
Tamiment /Wagner	87	—	—	6,895	—	—	10,630	6	2	84
University Archives	—	13	—	3,610	—	—	610	—	4	2
TOTAL	87	212	50	11,001	89	2	12,748	75	340	86
Total % of format	< 1%	1%	< 1%	45%	< 1%	< 1%	52%	< 1%	2%	< 1%

Most crucially, the physical media itself is susceptible to deterioration. The majority of the audio materials are magnetic media, which have forms of deterioration characteristic to the medium such as signal loss, "vinegar syndrome" for acetate-based tapes and

“sticky shed syndrome” for polyester-based tapes. Wire recordings, vinyl and shellac discs, and optical media such as CDs also bear unique forms of deterioration based on their chemical composition. However, all of these audio items are vulnerable to deterioration if exposed to the following conditions: improper housing and storage environments, poor handling, biological contaminants such as mold and bacteria, and environmental contaminants such as dirt and dust.

It should be noted that the Avery Fisher Center for Music and Media in Bobst Library, which is strictly an access collection, has an audio collection containing 50,257 items. Although this is not an archival collection, AFC does possess a small number of audio items that have been determined to be unique. These items should be further evaluated, as well as the need to integrate AFC into the media preservation initiative at the library.

Need for the Audio Lab

Conservation and Preservation of Audio Materials: Age and condition of audio materials will determine what appropriate actions need to be taken in order to properly care for them. Audio materials will require proper housing and storage conditions with appropriate temperature and relative humidity levels necessary for the longevity of the media. If certain audio materials need to be placed in off-site storage, these items need to be cataloged into a database where physical and intellectual information will be documented for each item. Full cataloging of audio materials in good condition that can be played back for identifying content must also be performed. Audio items need to be assessed to determine generation (i.e., originals, duplicates, etc.). If multiple copies are discovered, then possible de-accessioning of materials may be in order. Isolate items that are severely deteriorated and assess their value for immediacy of preservation action and/or continued custody of items. The Audio Lab can also acquire a re-mastering station for on-site re-mastering projects and the making of access copies. This will be dependent on the format and further research will need to determine which format would be best served by having an on-site re-mastering station. Simple cleaning of audio items is important, but if more extensive cleaning of materials is required they should be sent to an outside lab.

Staff Training and Curricular Support: The Audio Lab will be an effective training ground for Library staff, interns, and students in the care, handling, conservation, and preservation of audio materials. The Moving Image Archiving and Preservation masters program in the Cinema Studies Department of Tisch School of Arts will greatly benefit from the lab where it will provide much needed instruction space.

Implementation of Audio Preservation Standards for Libraries and Archives: Instituting standards and procedures for audio preservation are ongoing. The Audio Lab is the optimal environment where development and implementation of audio preservation standards can occur. Additionally, the emergence of digital materials has added to the discourse of audio preservation, and research in this burgeoning practice is essential. Collaborations between the Digital Library Team and the Preservation Department are

necessary. By working together these departments can address the mounting issues associated with the long-term maintenance of digital objects.

Scope of Audio Lab Activities

Each audio format will require different methods in order to carry out the necessary conservation and preservation actions for the materials. Preservation activities of source materials will need to be prioritized based on a number of criteria: the number of audio items per audio format, the age of the items and determining whether the format is obsolete or an older format nearing obsolescence, and the degree of degradation of audio items.

The Bobst Media Survey identified audiocassette (12,748 items) and ¼” reel-to-reel tape (11,001 items) as the dominant audio formats in the library. Presumably, the library may want to concentrate initial preservation activities on these formats.

Re-mastering projects can be performed in the Audio Lab to create preservation masters of select ¼” and audiocassette items. Tapes in good condition will be handled based on the current archival standards for re-mastering audio materials, which is to create digital preservation masters. Access copies of tapes in good condition can be produced in the lab. Destination formats for access copies such as gold CDs will be considered. A thorough condition assessment of the audio items should be conducted to determine whether the in-house lab is appropriately equipped to handle the preservation needs of said item. If the condition of a particular audio source is beyond the scope of the Audio Lab, outside audio restoration labs should be sought out and evaluated with a look into cost estimates, client base, projects worked on, so that Library materials can be sent for more intensive preservation actions. Upon completion of preservation projects, quality control inspections will be performed to ensure that content was successfully migrated meeting archival standards. The Audio Lab will need to apply this necessary playback procedure into its workflow.

The Audio Lab should include an area for physical inspection and temporary storage of materials being examined. The inspection process will help in identifying damage and/or deterioration of audio materials. Cleaning of audio materials is essential to this process in order to curb further deterioration. Careful rewinding of select tapes at library speed should be performed in order to ensure proper wind alignment of tapes; a preventive measure that will protect the tapes from possible physical damage when being handled and during playback. Re-housing of audio materials into archival containers and eventual placement in proper climate controlled storage is needed. Computer workstations will be required in this area in order to provide capability for immediate documentation and cataloging into Media Database.

Destination formats

Based on current audio preservation standards proposed by such organizations as ISO, ANSI, and ARSC, the proposed destination formats and sampling rates that should be practiced by the Audio Lab are as follows:

- **For digital preservation masters:** Wav files at 24-bit/96kHz
- **For CD access copies:** 16-bit/44.1kHz

Determination of robust CD stocks to that will be used by the Audio Lab for the production of is still under investigation. For archival purposes, it is recommended that CD-R's be used because they do not have the capacity to be rewritten preventing erasure of content. For standard access copies, the following manufacturers are being reviewed:

- HHB,
- Redbook
- Verbatim

For archival backups of CD quality digital audio files (16-bit/44.1kHz) for data storage, Mitsui Gold CD-R's will be used.

Redundancy of Data

The long-term maintenance of audio digital preservation files requires unique considerations associated with the medium. The Audio Lab should be in collaboration with Bobst's Digital Library Unit to implement effective practices for the proper production and preservation of digital items.

Jerry McDonough of the Digital Library Unit proposes the use of two servers for digital file storage. The two servers will serve as safe storage practices and disaster plan initiatives for in the event that problems arise on one server, the other server will have the data. Servers should hold at least 10 terrabytes. McDonough also proposes backing up digital files onto data storage tapes. Upon reviewing possible workflow strategies in the Audio Lab, the use of RAID's is being proposed because it can provide temporary storage of digital files while they are being created.

The Audio Lab wants to employ the most effective metadata schema possible that will best serve the preservation goals of the Audio Lab and Library. In consultation with the Digital Library Unit the following metadata schema are being considered:

- **METS:** A metadata schema that was adopted and highly endorsed by the Library community. However, it has not been endorsed by the larger community and could potentially pose concern for longevity of the schema.
- **MPEG-21:** This metadata schema is an ISO standard and has received user support. However, its broad framework needs to be considered in terms of how audio digital files will be sustained under a standard with minimal specificity for distinct formats.

Additionally, **DSpace**, an OAI (Open Archive Initiative) open source digital repository system with a Dublin Core schema, endorsed by Jerry McDonough, is being considered for use by the Audio Lab.

Use of the OAIS Reference Model will assist in these efforts to establish long-term control of the digital content.

Costs for producing and maintaining digital content can be high. Ultimately, funding will need to be secured to support the Audio Lab's model for production and maintenance of the digital audio materials.

Lab Equipment & Maintenance

Following is a list of equipment that encompasses the necessary tools needed for the effective operation of the Audio Lab. Please note that the list does not include prices per item. This information will be supplied subsequently. However, an estimate of \$50,000 represents the total cost to outfit the Audio Lab. This list was previously developed by Mona Jimenez in consultation with Jerry McDonough and W.A.V.E., a media technology company. Jeff Willens, Universal Mastering Studios-East, and Molly Wheeler, Archivist at the Josef and Anni Albers Foundation, have provided additional assistance.

Analog - Re-mastering and playback of 1/4" reel-to-reel, audiocassette, DAT, and CD:

- 2 1/4" open reel audio decks Otari MX5050BIII (source and possible mastering; only one needed if mastering to .wav files).
- 2 audio cassette decks Tascam 122MKIII. (source and duplication; only one needed if not doing cassette duplication).
- 1 Marantz PMD331 CD Player (source deck) or Marantz CRD510 Dual CD
- 1 Sony PCMR500 DAT Recorder/Player (source deck)
- 1 Genlec 1031A speakers
- 1 Mackie 16 track mixer (for signal routing)
- 1 Rane PE 17 5-band parametric equalizer (for analog audio processing)
- 1 Compressor
- 1 Editing block

Equipment for production of .wav files and for working digital – digital:

- 1 Mackie HDR 24/96 (for audio capture for .wav files)
- 1 Medea RAID (storage of .wav files)
- 1 Marantz 340 CD Recorder or equivalent (for making CDs)
- 1 Sample Rate Converter (converting between digital files)
- 1 Graham-Patten ADC-20 A-to-D audio converter (for out to speakers)
- 1 Apple dual processor G5 desktop workstation (running software for

- 1 digital audio processing)
Apple 20" Cinema Monitor

Racks will need to be purchased to house the audio equipment. One to two racks are recommended that will be placed 3 ft. from the wall.

Although the equipment list recommends the purchasing of Macintosh computer terminals, considerations will need to be made regarding the technical needs of the Mac operating system. Bobst's IT Department supports PCs only and it is important to have a solid working relationship with the IT Department to ensure operational control of lab.

Staffing

One full-time staff person and one part-time staff person are recommended to run the daily operation of the Audio Lab. The full-time staff person will serve as supervisor of the Audio Lab, and the part-time staff person will perform administrative and technical support for the lab. Salaries for both positions are currently being determined, and will be supplied subsequently.