Public Broadcasting Preservation Fellowship

University of Missouri Cohort

Handbook for Digitizing KOPN’s ¼ in. Tape Reels

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SECTION ONE: APPRAISAL / INVENTORY

- Cataloging Notes:
  - Current KOPN convention
    - Two-letter carrier code
      - Any ¼ in reel will start as RR
      - CD
      - DI (for digital files)
        - This will need some discussion with Jackie re: continuing to add things in the future
    - One or two letters for broad topic
      - Remember, these will be online, so don't worry that it's too broad and will be hard to find on a shelf. We can have multiple genre tags in the metadata! These are simply unique identifiers for the files.
        - W: Women
        - ML: Music (Live)
        - MP: Music (Programming)
        - O: Open (Misc. / freeform radio examples)
        - Other suggestions include:
          - C: Concerts
          - R: Religion
          - T: Theatre
          - Etc.
    - Four digit numeric code
      - These just tick up by one every time
      - Again, don't worry about order while you inventory: this is just an ID, not an organization system
  - EXAMPLE: **RRW0068** would mean *media ¼ in. Reel-to-Reel, category Women, number 0068.*

- Bring your selection to station at Allen Institute
  - Talk to Jackie about how much to take at a time

SECTION TWO: ANALOG to DIGITAL AUDIO SETUP

- On the MONO Studer (A807)
  - Step one: find a reel
    - Is the reel mono or stereo? If stereo, set aside.
    - Is the reel back-coated? If so, set in the sticky bin.
    - Does it smell off or stick when you try to unwind it? If so, set in the sticky bin.
    - Note: since you will be, in some cases, handling the tapes for the first time in 40+ years, the tape might sometimes have some slight “static clinging” and seem to be sticky when unwinding manually, when in actuality
it is not sticky. If the binding is missing in spots or otherwise damaged, or coming off while unwinding, it is sticky, so set aside. If not, continue to work with the tape, examining with extra care the effects of the tape on the machine.

- For information on back-coating on tapes and more discussion of “sticky tapes,” see https://reeltoreeltech.com/tape-problems/ Note: If this link goes down in the future, there is plenty on the web regarding this topic, and what you find there will apply in a general way to the MU digitization station’s setup. This note applies to all links embedded in this, the September 2018 Version 1 of this guide.

- If the tapes are actually sticky, set aside to later bake/dehydrate them so they can play and be digitized. See the BAKING section below.

- Step two: prepare the reel
  - Brush off any obvious dust with the fluffy brush
  - Does the tape have enough leader or tails? If not, splice on enough to thread the machine.

- Step three: prepare the machine
  - Clean the tape path, as indicated below (diagram from A807 Manual, located in the Google Drive of mizzoupbpf@gmail.com account). Use cotton swabs dipped in 99% or greater isopropyl alcohol to clean every part that the tape touches. Be careful on the repro head to not apply so much pressure that you damage it. Always clean the tape path after each reel.
Turn on the machine and check initial levels -- is the reproduction dial ("REP/SYNC") at max ("8")? Check the speed. Is it set for 7.5 (or whatever the reel says)? Note: ips = inch per second. In general, the faster the speed, the higher quality of audio. If the reel is mislabeled, you will know when you hear playback, because it will either sound too slow or too fast.

• Step four: load the reel
  o Does it say tails out or start with yellow tape? Load it onto the right hand spool, and make sure to lock it in place.
    ▪ Thread it along the tape path and attach it to the uptake reel on the left side. Right and left halves of the tape path should nearly mirror each other. See this illustrated in the image below.
  
  o Rewind (<) a few minutes
  o Hit play and listen to the playback. Are you playing in the right direction? If so, check your levels and finish rewinding.
    ▪ Are you playing backward? Fast-forward (>) to the end of the reel and treat it as a heads-first reel.
  
  o Does the reel case/reel not tell you what it is? Mount it on the left-hand spool.
    ▪ Thread it along the tape path, attach it to the right-hand uptake reel
    ▪ Hit play: is it playing forward?
      ▪ If not, > until the end, then move the newly full reel to the left spool and play normally

• On the STEREO Studer (B67) The physical reel setup is much like the setup for the mono machine, except that you have two tension arms, one on each side, plus more rollers in an arrangement that is more closely a mirror between left and right halves than found in the mono machine. The diagram
below, taken from http://artsites.ucsc.edu/EMS/music/equipment/analog_recorders/analog_recorders.html where you will find other helpful information, roughly corresponds with our Studer B67 (a photo of the actual machine is below this diagram) and provides the beginner with a helpful primer on the location of these parts and their names.

1. TENSION ARM
2. IDLE ROLLER
3. GUIDE
4. ERASE HEAD
5. TAPE LIFTERS
6. RECORD HEAD
7. PLAY HEAD
8. CAPSTAN
9. PINCH ROLLER

Initial Settings: The default settings for each reel are slightly different for the stereo machine than the mono. Start each of the four largest knobs on the overbridge at approximately where the previous owners have made a white mark. Leave the UNCAL buttons engaged (pressed in). UNCAL stands for “uncalibrated,” which means that the settings will not be constant, allowing you to better control the input/output of the machine. Because you will not know the production nexus of the tapes, and can assume they have suffered degradation over the decades, it’s best to exercise as much control as you can. Below you
will see the initial basic setup for the B67 stereo machine, with an important exception: the UNCAL buttons are not engaged, and they should be.

- **A Note on Both Studer VU Meters:** Both machines feature VU meters (pictured below): one for the mono machine and two for the stereo, representing the signal strength of each channel. The needle will bounce around, signifying the dynamism of the tape’s audio, but the signal level target is 0 VU, also known as 100%. The needle should be moving back and forth but consistently “peaking” around that point. (See https://www.youtube.com/watch?v=lkJhl1Xtt5M for a handy demonstration.) If the needle is consistently all the way to the right and in the red, make adjustments. If it is this much in the red, you should also be able to hear what overheated signal strength sounds like.

- **A Note on the Differences Between Mac and Windows in Audacity:** Currently at the station, the stereo Studer is connected to the Mac and the mono Studer is connected to the Windows machine. Future versions of this handbook might note the differences between them when digitizing tape reels, but it currently suffices to say that, for our purposes, there are no significant differences between the two beyond the differences of the two operating systems’ overall user interface. Nevertheless, a few differences noted by Audacity have been noted at the Audacity wiki here: https://wiki.audacityteam.org/wiki/Mac_OS_X

- **On the Behringer** *(your analog/digital interface)*
  - For the **mono** Studer, you need only worry about one channel, or input (Mono is all sound funneled into one channel). START with the GAIN 1 knob at zero, and the LINE/INST (line/instrument) and PAD open, or un-pressed. You will probably
need to adjust these with each reel, but start with these settings. If you are not hearing much in the playback, you can turn up the GAIN to amplify what sound there is. If the audio is particularly noisy with hisses or otherwise sharp noises, press in the PAD button to create a muffler on that background noise. Pay attention to the CLIP light, which signifies that your tape is “clipping,” or so noisy that the top frequencies are being “clipped” off. You want to turn your GAIN down to avoid that red light, and if it is particularly noisy, press in the PAD button. In time you will learn to visually monitor your sound just as you do aurally: not only by keeping an eye on the CLIP light but also watching the VU meter on the Studer and the sound levels as indicated on your Audacity sound editing software.

For the **stereo** Studer, you have one more input and channel to consider in the areas indicated by the red boxes in the diagram below. Other than adding a channel and input, the idea is still the same: Start with the GAIN 1 and GAIN 2 knobs at zero, and the LINE/INST (line/instrument) and PAD buttons open, or un-pressed. You might find, in playback, that one channel is coming in stronger than the other: adjust the GAIN knobs until you get a mix between the two channels that combines them together well and does not noticeably favor either channel. In time you will learn to visually monitor your sound just as you do aurally: not only by keeping an eye on the CLIP light but also watching the VU meters on the Studer and the sound levels on your Audacity editing software.

On the Computer

- Step one: prepare for digitization
  - Open Audacity
  - Open your note-taking file

- Step two: check Audacity settings: very important: make sure that the sampling rate for the recording, located in the image below at the bottom left under “Project Rate (Hz)” is at **96000 Hz**
  - Make sure that the Input is from the Behringer (might read as “UMC404” or another name for the Behringer.)
  - mono/stereo?
  - Click to start monitoring
SECTION THREE: DIGITIZING

- Is your reel loaded and ready to play in the correct direction?
- If so, press “play” on the Studer to give a quick listen to your material
- Adjust the Behringer until the levels look good / sound good
- Stop. Rewind back to the beginning.
- Hit “generate” in audacity, then hit “play” on the machine
- Watch your recording levels as the reel plays, adjusting as necessary
- When the reel ends, hit stop in audacity
  - Save the file as an audacity project
    - Name = KOPN unique ID
  - Clean up any major issues
    - Crop out long intro/outro silence
  - Export the file into preservation format
    - Broadcast wav
    - Name = AAPB GUID

NOTE: All of the above are merely guidelines to get you started. As you become more familiar with transferring tapes to digital files, you will learn more about all these different components and be able to make your own adjustments according to the physical and audio characteristics of the reel that you are digitizing. You will find that capturing a good transfer from the analog to the digital is not just a sequence of followed instructions and technical know-how but a process that calls on all of your senses as well as an increasingly informed intuition, amounting to both a science and an art. Good luck!
SECTION FOUR: METADATA

• Before and during the listening of the recording, take PBcore notes in a separate document
  o Focus
    ▪ Date
    ▪ Producer
    ▪ Program Title (Womenergy, Moon of Artemis, Women’s Weekend …)
    ▪ Episode Title (topic of the show)
    ▪ Any special guests/songs
    ▪ Quick summary of topic

• After the capture
• Take off the reel and put it in the box
  o Re-check the box for any information for metadata: what seemed not relevant before might have become in the context of the content you just listened to
• Put the reel in the finished drawer
• Turn off the Studer
• Clean the tape path!
• Repeat.

SECTION 4.5: This handbook does not cover final processing of the files, a procedure that takes place after the reel is digitized and metadata has been recorded. For now, know that after saving the files, you should also move those raw audio files (Audacity creates two sets of files for each project: the Audacity file and the data files. Keep both sets.) to the external hard drive. After properly processing these files so that they are ready to send to AAPB headquarters (having created checksums for your files, converted your raw audio files to both an archival audio file and a proxy file), ask Jackie where to send the finished reels.

SECTION FIVE: MAINTENANCE and RESTORATION (De-Magnetizing and Baking)

• De-Magnetizing
After every 10-12 hours of recording (some experts say more, some say less), it is a good idea to de-magnetize the Studer machines. Since the tape is magnetic, over time the heads and guides of the machines become magnetized, and if they become over-magnetized, these parts can erase tapes, starting with the high frequencies and then going from there (so you might not even notice at first).
  • Step one: MAKE SURE the machine is turned off.
  • Step two: DO NOT turn the de-magnetizer on or off in front of the heads of the machine. Turn on the de-magnetizer at least three feet away from the Studers – you might have to move a power strip to do this properly.
  • Slowly bring the magnetizer toward the machine. Very slowly and smoothly. Bring the tip of the de-magnetizer very close to each part of the machine in the tape path.
• Just as slowly and smoothly, move away from the machine until you are at least three feet away. Turn off the de-magnetizer.
• The slowness and the smoothness are required because you are changing the magnetic field of the metal parts ever so gradually, and to do this work quickly and jerkily would result in an incomplete de-mag that would yield unpredictable audio consequences.

• **Baking**
  • Sticky tapes can be temporarily restored to playability by baking or dehydrating. At the digitization station, we have a dehydrator, pictured below.
  • The tapes should be placed in the top rack: the dehydrator can handle about three 7 in. reels at a time or one 10 in., like the one in the picture.
  • Plug in the dehydrator. Bake sticky tapes at 130 degrees for four hours: the temperature and time controls are relatively simple to use and are located on the top of the dehydrator.
  • If the tape is still sticky after baking, repeat the process.
  • Note: moisture is what makes tapes sticky, and the baking process temporarily draws that moisture from the tape. To learn more, see the article “Kinetics and the Humid Aging of Magnetic Recording Tape,” at https://ieeexplore.ieee.org/document/1061957.