2025

DELIVERY RECOMMENDATIONS FOR RECORDED MUSIC PROJECTS

PRODUCERS +ENGINEERS

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ACKNOWLEDGMENTS

These Recommendations are the result of a collaborative effort by numerous professionals within the recording industry. The Recording Academy Producers and Engineers Wing extends its gratitude to all those who have contributed. Their insights, feedback, and commitment to excellence have been invaluable in shaping this document into the widely accepted reference it is today.

For a full list of committee participants since this document's inception, see page .

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"As studio practitioners, it is our responsibility for the future of music to ensure that the sound recordings made today are deliverable to long-term storage such that assets are organized and accessible, accurately reflect the original works, and are ready to be archived and preserved for the indefinite future."

—George Massenburg

INTRODUCTION

Managing and delivering music projects are essential steps in the recording process. As workflows become increasingly complex, it is important to follow established best practices in order to accomplish these tasks with accuracy and efficiency. These Recommendations outline best practices for music file delivery and are intended for all creators and content owners of music recordings, including audio engineers, producers, and artists. This document also serves as a learning tool for students and a resource for record labels.

The Recommendations were derived from a large and diverse group of leading professionals who shared their collective knowledge and perspectives. Introduced more than 20 years ago and revised as technologies have evolved, the document has gained worldwide acceptance within the recording industry.

While creativity has no bounds and there are many ways to arrive at an end result, these Recommendations provide a standard process framework to ensure optimal results. Whether you're new to the industry or a seasoned veteran, by following the practices outlined here, you'll have done your best to ensure that your music projects are organized and accessible and can be preserved for posterity.

NOTES ABOUT THIS DOCUMENT

These Delivery Recommendations outline best practices that provide three capabilities:

1. The ability to recreate the final mix or repurpose the original recording in the short term, with access to all of the original final mix elements.

2. Folder hierarchy structures for organizing and managing files throughout the creation and delivery processes.

3. A solution for the long-term storage and archival issues that confront Content Owners in their efforts to preserve and maintain their assets.

Broadcast Wave Format (BWF) File Recommendation

The Committee recommends the use of Broadcast Wave Format (BWF) files for delivery. The Broadcast Wave Format, a superset that includes a standard wav file format, is an audio data file format that contains the minimum metadata necessary for all broadcast applications. Note that Broadcast Wave Format files handle timecode with a stamp at the beginning of the file.

What Is a Master Recording?

A Master Recording is defined as a set of the various original components of the recording process for a given production, each in its original format and collected in a form that is ready for transition to the next phase of the process.

For example, the recorded Masters from tracking and overdubbing processes are collected in a form that is ready for transition to the mixing process. The Approved Master Mixes are collected in a form that is ready for transition to the mastering process. The Mastered Mixes are then ready for transition to distribution.

About the Term "Master"

The Committee recognizes that the term "master" carries an offense. While terms such as "Master Recording" or "Master Mix" have been deeply embedded in the industry for decades, we are currently collaborating with the music community at large to find an alternative to replace the terms.

How Should I Back Up My Master Files or Tapes?

For maximum protection, three copies of the Master should be created, and they should exist in at least two physical locations. This practice prevents the loss of a project if two versions fail during a backup process. *(For current best archival practices, see "How Do I Preserve Critical Data?" on page 38.)*

What Should I Save With My Master Recording?

Materials are saved for both delivery and archival; there should be no deletions of useful material from the Master Recordings, including outtakes, recordings of artists talking, or incomplete and unreleased recordings. The constitution of "useful material" is determined by contractual agreement between the Content Owner and Producer prior to the commencement of the recording project, and material should be provided to Content Owners with the artist's approval.

In some situations, ancillary processing (volume level automation, compression, etc.) may be understood to be a key component of the final product. This processing may be included in a separate flattened file in addition to the unprocessed flattened file, as mutually agreed on by the Producer and the Content Owner.

See the Glossary on page 43 for definitions of industry-standard nomenclature.

WHAT ARE THE TYPES OF MEDIA DELIVERABLES?

There are two recommended methods of delivery to the Content Owner:

1. Delivery of physical media, such as hard drives or analog tape.
2. Delivery through a secure cloud service or a secure FTP (SFTP).

DELIVERY OF PHYSICAL MEDIA

Digital Deliverables

Masters and duplicate copies should be at the same sampling rates and bit-depth precisions. The Committee recommends 48, 88.2, 96, 176.4, 192, 352.8, and 384 kHz rates and 24-bit or greater bit depths. *(High-resolution recording is considered to be 48 kHz/24-bit or greater resolution; for recommendations for high-resolution recording, see the Producers & Engineers Wing's* [Recommendations for Hi-Resolution Music Production](#) *document.)*

The Committee recommends that all audio tracks are recorded in Broadcast Wave File format (BWF) and consolidated for delivery. Each element of each song should be consolidated.

When delivering immersive projects, static speaker renderings should be delivered along with ADM files to Content Owners for long-term archival. *(For more information about static speaker renderings, see "Auro-3D and Static Speaker Rendering Delivery Recommendations" on page* 26.*)*

When creating backups and safeties, do not upsample or downsample the Primary Master. There should be no level adjustment, truncation, dither, noise-shaping, or modification of the digital (BWF) file format.

Deliver to the Content Owner:

• The final masters in their originally recorded formats. If you are recording or mixing to a digital audio workstation (DAW), the project digital files are the master.

• Two backups/safeties:
    1. One backup/safety in one of the media formats outlined in this section.
    2. A second backup/safety in a medium that is different from the one used for the first backup/safety.

Provide all recording metadata and other documentation in PDF format. *For a metadata checklist, see page* 33.

The Case for Upsampling in Certain Scenarios

Generally, upsampling is not recommended, but in specific situations it may offer advantages:

• Upsampling can provide the ability to take advantage of a higher-resolution DAC.

• Upsampling allows DAW software to function at a higher sample rate, opening up the bandwidth of its mixer and plug-ins.

• During upsampling, aliasing and other artifacts can move out of band, essentially becoming filtered out.

Analog Deliverables:

Alignment tone sets should be delivered with every analog tape format. Include track sheets, and label boxes appropriately. Digitized copies (192 kHz/24-bit or better) are not required but are recommended. Analog tape masters should be stored vertically, library wind, tails out.

Deliver to the Content Owner:

• The final masters in their originally recorded formats. If you are recording or mixing to analog multitrack or 2-track, then 2-inch, 1-inch, ½-inch, or ¼-inch analog tape is the master.

• Two backups/safeties:
    1. One backup/safety in one of the media formats outlined in this section.
    2. A second backup/safety in a medium that is different from the one used for the first backup/safety.

Provide all recording metadata and other documentation) in PDF format in PDF format. *For a metadata checklist, see page* .

DELIVERY USING CLOUD SERVICES

"Cloud Services" is a general term for a range of hosted services delivered on demand over the internet. These services let clients access data and applications from remote servers, computers, and databases without accessing local systems.

When selecting a cloud service, it's important to choose a mature, comprehensive platform that is designed for longevity and provides security, reliability, and accessibility. The Committee recommends password-protecting all uploaded files.

For guidance on choosing and working with cloud services, see Appendix: Cloud Services Considerations on page 50.

FTP (File Transfer Protocol) is a standard network protocol used to transfer files between a client and server on a computer network, typically over the Internet.

> ### Cloud Services and Accurate File Creation Dates
> Be aware that some cloud services modify a file's creation date, changing it to the date it is downloaded.

WHAT ARE THE ACTUAL DELIVERABLES?

Note that deliverables can change depending on stages of production; here, we outline best practices for delivery to Content Owners, versus delivering files for further production or direct to distribution.

The Recommendations for Recorded Music Projects help ensure a Content Owner's needs are properly met. This section outlines the following deliverables:

- Approved stereo mixes
- Approved immersive mixes
- Mastered mixes (stereo and immersive)
- Stereo stems
- Consolidated multitracks (for stereo mixes and immersive mixes)
- Metadata and documentation

File Naming Conventions:

The naming of BWF files is an extremely important step in a robust archiving methodology. The legal character set below was defined to best ensure the ability to recover data over the long term. If a character is not listed, it is assumed that that character is "illegal." For example, "white space" (e.g., a blank space) is illegal, and emojis are illegal. File aliases and hard or soft links should not be used in the creation of a valid filename.

The file name length shall not exceed 128 characters.

The Importance of "Safe" Characters in File Names

Including special characters in file names can introduce errors in song searches and royalty tracking. For the sake of file safety and standardization and to preserve tracking accuracy throughout the distribution chain, the Committee recommends following a simplified subset of the standard UTF-8 character set. UTF-8 is backward-compatible with ASCII and can represent any standard Unicode character. Avoid international alphabets, special characters (currency symbols; emojis, scientific symbols; @, $, &, #, and * symbols; parentheses; etc.), and punctuation marks (periods, exclamation points, commas, etc.), with the exception of the use of underscores and hyphens as outlined in this section.

"Legal" Characters Are the Following:

Uppercase characters (U.S. alphabet only): "A" … "Z"
Lowercase characters (U.S. alphabet only): "a" … "z" Numerals: "0" … "9"
Underscore: "_"
Hyphen: "-"

With so many digital audio files involved in each audio project, it is important that mix versions and stem files contain all relevant information within their file names and that file names are easy to understand at a glance. For example:

AI_SongTitle_MI01_Master_96k24.wav

This audio file name example contains the following information, with each segment separated by an underscore: artist initials, song title, mixer initials, mix revision, mix version, sample rate, and bit depth.

With all Master deliveries, check with the Content Owner to verify required deliverables and formatting.

RECOMMENDATIONS FOR STEREO (TWO-CHANNEL) MIX DELIVERY

Considerations

- In the event that a mix is recalled, it is considered a new delivery; thus, a new set of mix versions and/or stems should be created in a new version folder.
- Combining stems and changing levels would also be considered a new delivery. When titling a file or folder, the first letter of each word should be capitalized.
- For digital delivery, the stereo mix should be at the same sample rate/bitrate or better as the original source files.
- For analog tape delivery, provide the original master print; include leader tape and alignment tones and note tape speed, tape formulation, and any noise reduction. Analog tape masters should be stored vertically, library wind, tails out.

Recommended Mix Versions for Delivery:

- Approved Mix Master
- Vocal Up (from Approved Mix Master)
- No Lead Vocal (from Approved Mix Master)
- Instrumental (from Approved Mix Master)
- Lead Vocal Only With Effects ("Wet"; from Approved Mix Master)

For mix definitions, see appendix on page

Recommended File Naming Convention:

ArtistInitials_SongTitle_MixerInitialsMixRevision_MixVersion_sampleratebitdepth.wav

For guidance on legal characters in file naming, see page

RECOMMENDATIONS FOR STEREO STEM SET DELIVERY FROM THE APPROVED STEREO MIX MASTER

This segment of the Recommendations establishes a suggested deliverable stem set with a consistent audio file naming convention.

Stereo mix stems comprise the actual components of the approved mix master. The sum of the stems should add up as closely as possible to the equivalent of the approved mix master, however it is not recommended to be used as such.

Stereo mix stems have many uses, including immersive mixing, live concert stem playback, remixes, video games, and film, to name a few. Content Owners may request specific stem sets depending on their intended end use; therefore, the stem set outlined in this document is not specific to any use but is uniquely comprehensive.

Considerations

- All stems for any given song should be consolidated and printed with the same start and end point to ensure that each stem is in time with the others when imported into a new DAW session.
- When printing stems, take care to ensure their accuracy in order to preserve their integrity in future applications such as immersive mixes and live performances.
- When using analog noise emulations on plug-ins on groups or buses, be aware of potential compound effects across tracks. When printing stems, all tracks should be muted except for the track that needs to be printed to avoid situations in which analog noise or other noise is printed in excessive iterations.
- Because stems are often used to create immersive mixes, when printing stems, quality control is crucial; ensure all files are accurate. When delivering a stereo stem set for immersive mixing, refer to "Recommended Mix Versions for Delivery" on page 10 for a detailed stem list. Best practices should include providing a consolidated raw multitrack of the original mix session.
- Use the sidechain input on stereo bus compressors to trigger the compressor when printing stems. *(For more information, refer to "Keying the 2-Bus Compressor to Print Stems" on page 14).*
- Consider that certain processors, such as stereo imaging plug-ins, can cause adverse effects when processed stems are used for immersive mixes.
- A click track reference is not necessary on a single multitrack tape. However, When two machines are used together, a click track can be useful if the reels cannot be synced via time code.

Recommended File Naming Convention:

01_ArtistInitials_ SongTitle_MixerInitialsMixRevision_StemName_sampleratebitdepth.wav

The file name begins with a number that will inform file sequence. The best practice is to number related stems sequentially so they will stack together on import.

For definitions, see glossary on page 43. For guidance on legal characters, see page 9.

What Gets Delivered:

If a definitive stem set is not specified by the Content Owner, then the following stem set is recommended.

- Print each instrument separately with its effects.
- Separate recorded drum kits into kick, snare, toms, overheads, room, and effects stems.
- Grouped instruments and voices, such as strings, horns, winds, choirs, background vocals should be grouped according to sections and arrangements.
- When recording with ambient mics, identify sources.
- Print lead vocal and lead vocal effects as separate stems. Effects can also be broken out into separate lead vocal effects stems (e.g., lead vocal dry, lead vocal reverbs, lead vocal delays).

Stereo Bus Recommendations for Printing Stems

Helpful Hint: Keying the 2-Bus Compressor/Limiter to Print Stems

One of the biggest challenges when printing stems with a stereo 2-bus compressor is to have the mixed sum of the stems match the stereo mix, because the full stereo mix will drive the mix 2-bus compressor harder than the individual stem mixes. The solution is to use a 2-bus compressor that has a sidechain input and key the sidechain input with an uncompressed printed version of the stereo mix. This process will ensure the 2-bus compressor reacts consistently when printing the stem mixes. The diagram below outlines how to configure this for both an analog console mix and a DAW mix.

Typical Mix Print Chain

Mixing Console/DAW Mixer Playing Back Full Mix → 2 Bus Compressor → Mix Bus EQ → Master Fader → DAC Bounce

Stems Print Chain Part 1

Mixing Console/DAW Mixer Playing Back Full Mix → DAC Bounce → Outputs "Key Mix"

Stems Print Chain Part 2

Mixing Console/DAW Mixer Playing Back Full Mix → 2 Bus Compressor → Mix Bus EQ → Master Fader → DAC Bounce
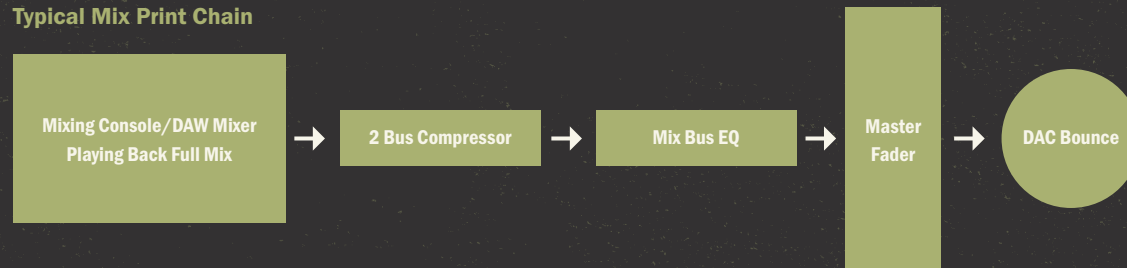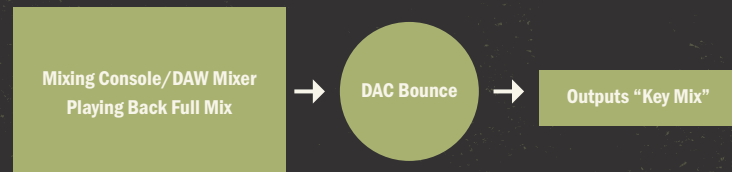
Key Mix → 2 Bus Compressor
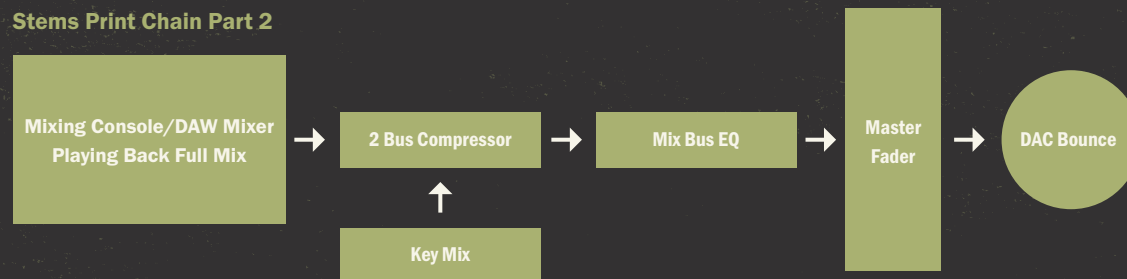
DAW Setup for Keying the 2-Bus Compressor/Limiter to Print Stems

1. Disable all plug-ins following the compressor sidechain on the stereo bus of your DAW mixer.

2. Print back to the DAW multitrack (or bounce to disk) the final mix with the master plug-ins disabled. This printed version will be referred to as the "Key Mix."

3. Re-enable all plug-ins on the stereo bus of your DAW and set the compressor sidechain input to read the Key Mix that you printed. Do not assign the Key Mix to the stereo output. It should only feed the sidechain input of the compressor. If your DAW compressor plug-in has a mono sidechain input, then summing the left and right channels of the Key Mix into the mono sidechain input should render the desired result for printing stems.

4 Mute all the tracks in the mix except for the track or stem group you are printing along with its associated effects returns. Repeat this process for each stem mix.

Analog Console Setup for Keying the 2-Bus Compressor/Limiter to Print Stems

Use the patch point just before the 2-bus compressor input and print a mix back to your multitrack. It should be noted that this patch point is before the master fader on the console and will not include the 2-bus compressor or any gear patched after the 2-bus compressor or the master fader. This printed version will be referred to as the "Key Mix."

1. Send the output of the key mix to the sidechain input of your 2-bus compressor and set the detector on the compressor to read from the sidechain input.

2. To print stems, mute all of the tracks on the analog console except for the track or stem group you are printing along with its associated effects returns. Print stems through the entire 2-bus chain and master fader with the Key Mix triggering the sidechain input of the 2-bus compressor. Repeat this process for each stem mix.

2-Bus Decisions and Stems

Some decisions made on the 2-bus are physically impossible to recreate in stems; bear this in mind when making creative decisions.

RECOMMENDATIONS FOR MULTITRACK DELIVERY

This section of the Recommendations establishes a suggested multitrack deliverable with a consistent audio file naming convention. Multitrack deliverables make up a final mix multitrack that is approved for release by the artist and producer.

Considerations

- All vocal tuning, editing, time aligning, elastic audio/flex time, and essential production-related elements (such as comps and mutes) should be consolidated so they do not have to be re-created.
- All virtual instruments should be committed as audio tracks.
- Export final consolidated files to a folder so they can be imported to any DAW program.
- All tracks for any given song should be consolidated with the same start and end point (at even integers) to ensure that each track is in time with the others when imported into a new DAW session. Note that some DAWs offset time; original timestamps must be preserved.
- When consolidating tracks, take care to ensure that consolidated tracks exactly match the original unconsolidated tracks in order to preserve their integrity in future applications such as immersive mixes and live performances.
- Analog master delivery should be first generation. The master should not be a clone of the original, and a second generation is not an acceptable master.
- Analog tape masters should be stored vertically, library wind, tails out.

Recommended File Naming Convention:

This section of the Recommendations establishes a suggested multitrack deliverable with a consistent audio file naming convention. Multitrack deliverables make up a final mix multitrack that is approved for release by the artist and producer.

> **01_ArtistID_SongTitle_CONS_sampleratebitdepth.wav**
> **02_ArtistID_SongTitle_CONS_sampleratebitdepth.wav**
> **03_ArtistID_SongTitle_CONS_sampleratebitdepth.wav**
> **04_ArtistID_SongTitle_CONS_sampleratebitdepth.wav**

For definitions, see glossary on page 43. For guidance on legal characters, see page 9.

What Gets Delivered:

- There should be no deletions of useful material from the Masters, including outtakes, recordings of artists talking, or incomplete and unreleased recordings. The constitution of "useful material" is determined by contractual agreement between the Content Owner and Producer prior to the commencement of the recording project, and material should be provided to Content Owners with the artist's approval.
- Deliver the final multitrack used to create the final master mix, in its final state including edits, time aligning, vocal tuning, etc.
- Record blank channels for unused tracks.
- Final analog multitracks should include clear labels and detailed track sheets.
- Both analog and digital multitracks should include project metadata and other important documentation.

RECOMMENDATIONS FOR IMMERSIVE DELIVERY

Immersive mixes are an integral part of music production and release, both for new projects and for catalog re-issues. At the same time, immersive formats are evolving, and these Recommendations will evolve with them. Immersive formats for delivery include (but are not limited to) Dolby Atmos, Sony 360 Reality Audio, Auro-3D, and traditional multichannel surround sound formats such as quad, 5.1, 7.1, etc.

Both final mixes and final mastered files, including Dolby Atmos DAMF or ADM files, Sony ADM files, and static speaker renderings in other formats, also serve as long-term archives. Be sure to prepare appropriate full-resolution, format-independent versions of these for archival. (For current best archival practices, see "How Do I Preserve Critical Data?" on page 38.)

Note that file naming conventions vary depending on the file delivery path, e.g., to the client, mastering, distributors, or archival.

File-Naming Considerations for Direct Distribution

Be aware that each aggregator may have its own desired naming convention and acceptable formats.
Examples:

Delivery to Content Owner:
TrackNumber_Artist/nitials_SongTitle_PositionalReference_MixerInitialsRevisionNumber_SampleRateBitDepth

Delivery to Content Owner:
TrackNumber_Artist/nitials_SongTitle_PositionalReference_MixerInitialsRevisionNumber_SampleRateBitDepth

Delivery to Content Owner:
TrackNumber_Artist/nitials_SongTitle_PositionalReference_MixerInitialsRevisionNumber_SampleRateBitDepth

For definitions, see glossary on page 43. For guidance on legal characters, see page 9.

Considerations

- Pay close attention to translation between speakers and headphones, because a large percentage of consumers listen to immersive music on headphones. Because immersive mix methodologies vary and headphone codecs are always evolving, it is imperative to evaluate mixes in both speaker and headphone environments, including but not limited to binaural and Apple Spatial Audio.

- The LFE channel is a full-range channel. If you are listening to lowpass-filtered material on a bass-managed speaker system and then create a binaural rendering, consider that that rendering will include full-range LFE information and your mix will be impacted unless you apply an external lowpass filter. Some streaming services lowpass the LFE channel at 120 Hz. If you lowpass the LFE, note the threshold frequency in your documentation.

- It is recommended that clients reference mixes in as many relevant current immersive formats as possible.

- When stereo and immersive mixes are intended to be interchangeable on music streaming services, the immersive mix should materially match the intent of the stereo mix, including pitch and file length.

- If the immersive mix is not intended to be the same as the original stereo mix or production decisions in the immersive mixing process vary from the intent of the original mix, generate a new stereo mix that is materially the same as the immersive mix.

- When assembling an album, the delivery requirement is to align the entire program's stereo and ADM file start and end times. The Committee acknowledges that when delivering Immersive mixes, Dolby recommendations, in conjunction with Apple requirements, call for file lengths to be within 50ms of the intentional and delivered stereo mix to allow leeway to align frame rates.

- Some streaming platforms stream the immersive mix to the consumer as a default if the playback device is compatible.

- In file naming, align the mix revision number with the DAW session version.

- From time to time, DAWs and delivery platforms are updated with new functions, and many DAWs now incorporate ADM printing and bouncing. It is recommended to regularly check your system for updates. As immersive audio production and delivery platforms evolve, this document will be updated to reflect the most current delivery recommendations.

- Be aware that the path to proper immersive playback varies as devices and operating systems evolve and proper reference mix playback is not guaranteed. Consult the latest documentation from Apple and other providers to confirm content access and playback workflows.

DOLBY ATMOS DELIVERY RECOMMENDATIONS

Considerations

• Be aware of Dolby Atmos binaural settings metadata, which affects the way your mix is experienced on headphones. (Rendered immersive mixes played on speakers are not affected by these binaural settings.) Currently, Apple Spatial Audio does not utilize binaural render mode settings. Note that the Dolby Atmos Renderer, whether external or internal, filters the LFE at 120 Hz, 24dB/oct. Creating a BIN file automatically applies a lowpass filter to the LFE.

Immersive Format Nomenclature

Immersive formats, like traditional multichannel audio formats, follow standard numerical nomenclature representing speaker channels in a playback system configuration:

• **Dolby Atmos:** A three-numeral format, separated by periods, outlining full-range front and surround speakers, subwoofers, and overhead (or "height") speakers. Example: 7.1.4
• **Sony Reality Audio 360:** A four-numeral format, separated by periods, outlining floor-level channels, LFE channels, height channels and below-floor channels. Example: 5.1.5.3
• **Auro-3D:** A two-numeral format, separated by periods, outlining all full-range (front, surround and height) channels and subwoofer channels. Example: 9.1 (would become 5.1.4)

See chart on page 28 for channel numbering and naming conventions.

Recommended File Naming Convention:

ArtistInitials_TrackNumber_SongTitle_MixerInitialsRevisionNumber_ApprovedAtmosMix_ADM_format_sampleratebitdepth.wav
Example:

ArtistInitials_TrackNumber_SongTitle_MixerInitialsRevisionNumber_ApprovedAtmosMix_ADM_format_sampleratebitdepth.wav

Note: this nomenclature applies to delivery to the content owner and to archiving. Format is defined as platform configuration, for example: 714. For definitions, see glossary on page 43. For guidance on legal characters, see page 9.
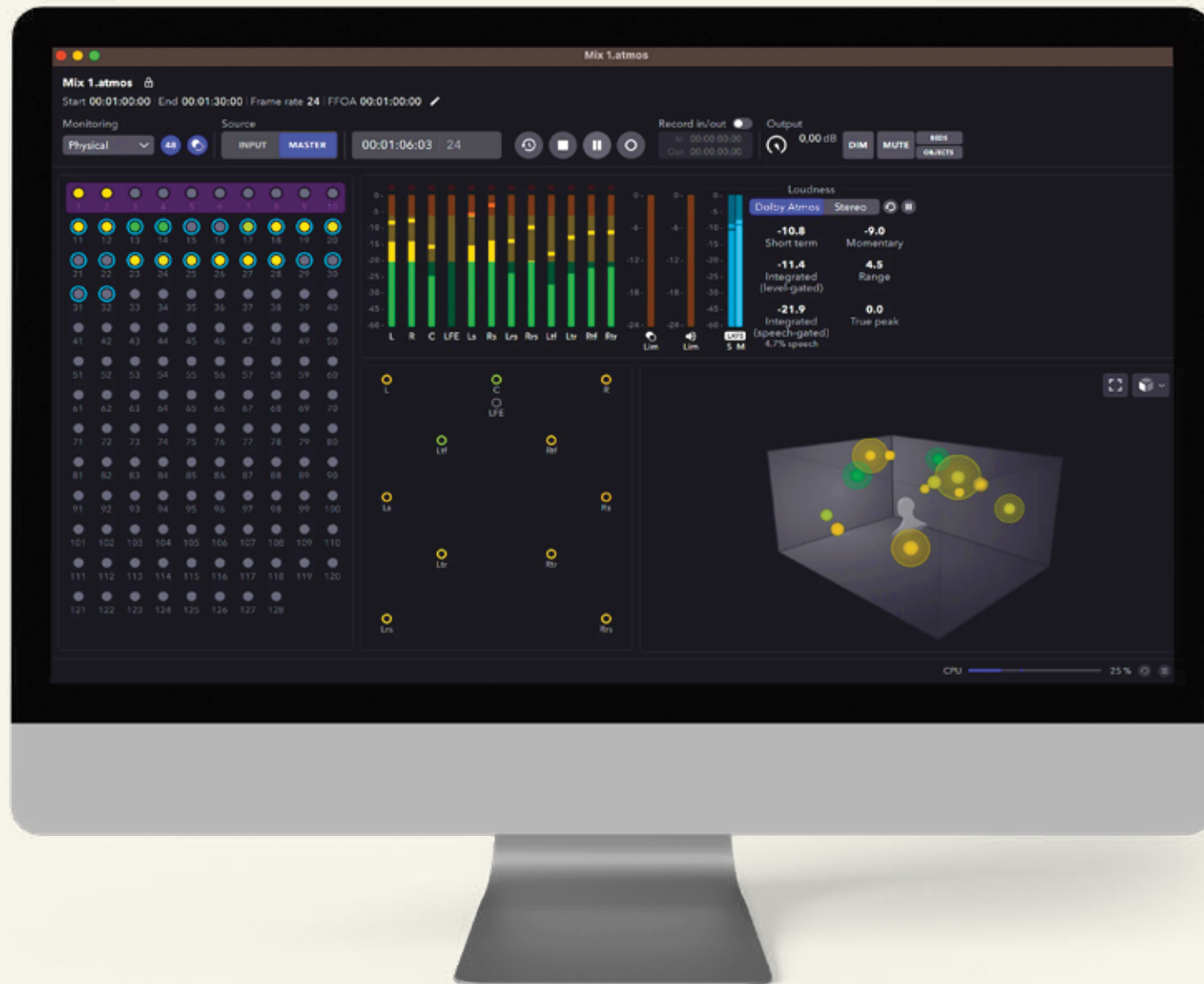
Image: Dolby Atmos Renderer

What Gets Delivered:

- Deliver a 48 kHz ADM BWF master mix file. If the immersive mix was created at 96 kHz, deliver a 96 kHz DAMF file. 16, 24, and 32-bit resolutions are supported. Full-resolution, platform-independent files are crucial for long-term archival.
- Any of the following additional renders may be required by the Content Owner. Downmixes can always be re-rendered from the high-resolution ADM or DAMF file.
  - Dolby DAMF
  - 5.0.2
  - 5.1
  - 7.1
  - 7.1.2
  - 7.1.4
  - 9.1.6
  - Binaural
  - MP4
  - IMF
  - Stereo fold down

- When delivering an album, songs may be at any acceptable audio frame rate but all songs in the project must be at the same frame rate.
- Dolby's recommended reference level is -18 LUFS (integrated) with a limit of -1.0 dBTP in reference to speaker output. This is a song recommendation; the natural dynamics of an album may vary. Many distributors require this reference level. There is a practical reason for this requirement: It ensures consistent results with the range of limiters that may interact with the binaural (HP) codec.
- Include a log sheet with metadata details, including artist, project title, UPC/EAN code, ISRC codes, track lengths, and any other pertinent project information.

About ADM and DAMF Files

The ADM specification is an open-source format. There is currently no fully agreed-upon standard and file architecture varies with platforms. ADM is a standardized audio format based on Broadcast Wave. It is standardized in ITU-R BS.2076. Metadata is stored in an XML chunk at the beginning of the file.) Dolby and Sony ADM files are currently non-interchangeable and differ in some aspects. A Dolby Atmos Master File (DAMF) file is the native output format produced by Dolby content creation tools; a DAMF file is a master set of files that the Dolby Atmos Renderer reads.
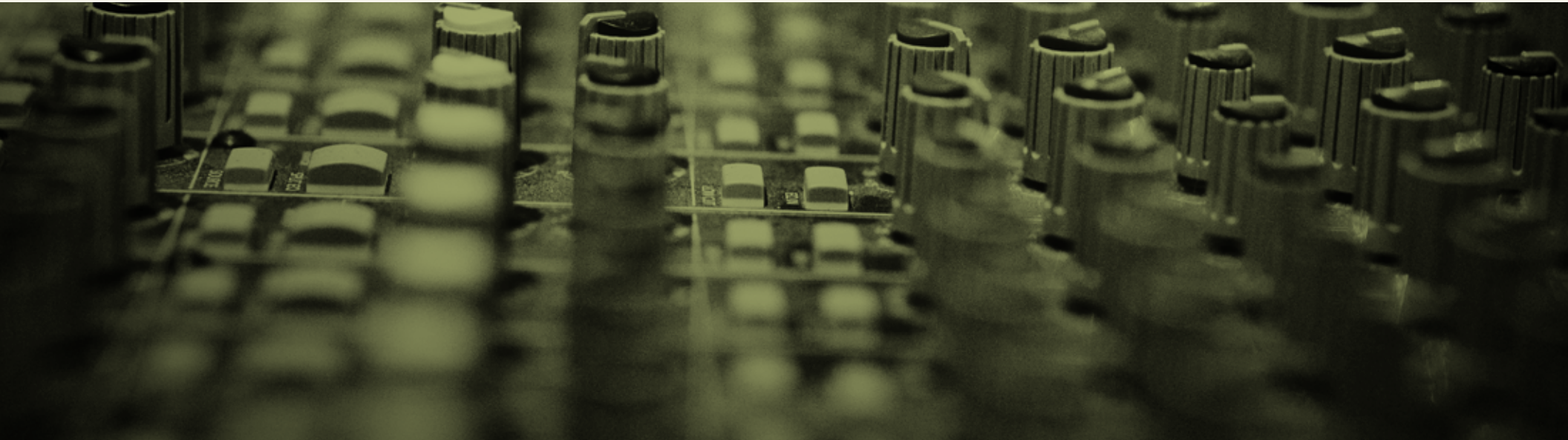
SONY 360 REALITY AUDIO DELIVERY RECOMMENDATIONS

Considerations

- Do not change Sony's auto-generated folder hierarchy.
- Be aware that normalization, if selected, will affect all selected renderings and will impact album leveling.
- Be sure that the DAW bounce location matches the Sony default export folder location.

Recommended File Naming Convention:

ArtistInitials_TrackNumber_SongTitle_MixerInitialsRevisionNumber_Approved360RAMix_format_48k24.wav

Example:

ArtistInitials_TrackNumber_SongTitle_JB01_Approved360RAMix_714_48k24.wav

Note: this nomenclature applies to delivery to the content owner and to archiving. For definitions, see glossary on page 43. For guidance on legal characters, see page 9.

What Gets Delivered:

- Deliver an ADM file where currently accepted. If not, deliver the following items:
  - Deliver the following pre-renders: level 0, level 1, level 2, level 3, unprocessed.
  - The "speaker" folder of the 360 WalkMix Creator exports should contain 13 mono .wav files for each track.
  - Package the "unprocessed" export with pre-renders.
  - Supply the following renderings:
    - MP4/MPEG-H render: four level options: .05, 1, 2, 3
    - SAM/WAV render: four level options: .05, 1, 2, 3
    - Unprocessed rendering
    - Speaker channels rendering
    - Headphone channels
  - Include a log sheet with metadata details, including artist, project title, UPC/EAN code, ISRC codes, track lengths, and any other pertinent project information.
- Sony recommends a level reference of -13 LUFS (long-term) in reference to speaker output.

Image: Sony WalkMix Creator

AURO-3D AND STATIC SPEAKER RENDERING DELIVERY RECOMMENDATIONS

Current delivery recommendations for Auro-3D are equivalent to static speaker renderings. A static speaker rendering is a file print of the audio information sent to each speaker in an immersive playback system.

Static speaker renderings can be re-rendered in most formats including Dolby Atmos configurations ranging from 5.0.2 to 9.1.6, Sony 360RA configurations ranging from 13.0 to 15.1, and Auro-3D 5.1.4 (9.1).

Static speaker renderings are not recommended as the primary or only form of long-term archival, but are considered an appropriate secondary archival set.

Considerations

- Speaker renderings should be rendered in the same configuration as the room reference speaker configuration.
- Folder naming conventions should include speaker layout; see chart below for details.
- The recommended delivery set includes static channels as individual, properly named BWAV files. These should be specific to the format.
- If you deliver a multitrack interleaved file, you must include a document with clear descriptions of channel assignments for the file.
- All files should be rendered at the same length, resolution and sample rate as the mix session.
- Static speaker renderings should be delivered along with final masters to Content Owners for long-term archival.
- Deliver files at the same sample rate and bit resolution as the original mix files.

Recommended Folder Hierarchy and Naming Conventions for Static Speaker Renderings:

Dolby Atmos

📁 Auro-3D ▸ | 📁 7.1.4
📁 Dolby Atmos ▸ | 📁 ADM
📁 Sony RA360 ▸ | 📁 BIN
 | 📁 Binaural Render Mode Settings
 | 📁 MP4
 | 📁 Stereo

Sony RA360

📁 Auro-3D ▸ | 📁 ArtistName_ProductTitle_ProductNumber_RA360 ▸ | 📁 13_1_OfflineRenders
📁 Dolby Atmos ▸ | 📁 Content Files
📁 Sony RA360 ▸ | 📁 Headphones
 | 📁 PreRenders
 | 📁 StereoRef

Auro-3D

📁 Auro-3D ▸ | 📁 Individual Channel Renders
📁 Dolby Atmos ▸
📁 Sony RA360 ▸
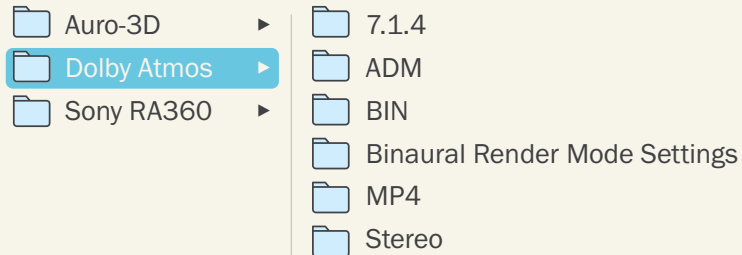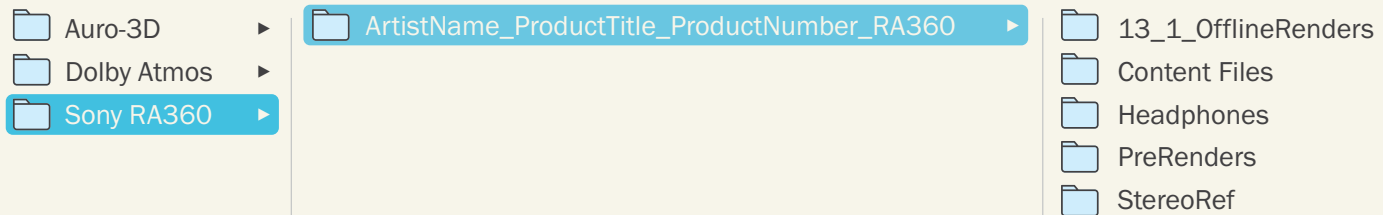
Static Speaker Rendering System Configurations

Immersive formats use proprietary naming conventions to denote speaker and channel placement, causing confusion for both content creators and consumers.

This document aims to provide consistent immersive file nomenclature so channel names will be predictable, consistent, and repeatable, now and in the future. This is important for both establishing consistency as the immersive landscape evolves, and for establishing archival protocols.

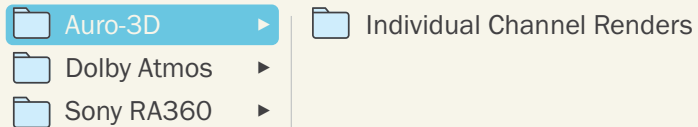The chart below establishes a common channel naming and numbering convention based on a consistent description outlining X, Y, and Z axes. For example, in the **LFT** example below, the first letter, **L**, represents **Left** (X-axis), the second letter, **F**, refers to **Front** (Y-axis), and the third letter, **T**, refers to **Top** (Z-axis). The same goes for the letters representing location.

The channel output numbers are listed next to the respective channels in each of the current three main formats.

The Recording Academy Producers & Engineers Wing hopes that this nomenclature is adopted across the audio ecosystem and is continuing to work with organizations such as the Audio Engineering Society to develop a more simplified channel naming structure across all immersive formats.

Speaker	Proposed Naming Convention	Dolby Atmos 9.1.6	Auro-3D	Sony 360RA
Left	L	L (01)	L (01)	L (01)
Right	R	R (02)	R (02)	R (02)
Center	C	C (03)	C (03)	C (00)
LFE/Center Bass	LFE	LFE (04)	LFE (04)	BC (12)
Left Side Surround	LS	Lss (05)	LSS (05)	LSS (03)
Right Side Surround	RS	Rss (06)	RSS (06)	RSS (04)
Left Rear Surround	LR	Lsr (07)	LRS (07)	LRS (05)
Right Rear Surround	RR	Rsr (08)	RRS (08)	RRS (06)

Speaker	Proposed Naming Convention	Dolby Atmos 9.1.6	Auro-3D	Sony 360RA
Left Top Front	LFT	Ltf (09)		
Right Top Front	RFT	Rtf (10)		
Left Side Top	LST	Lts (11)		
Right Side Top	RST	Rts (12)		
Left Rear Top	LRT	Ltr (13)		
Right Rear Top	RRT	Rtr (14)		
Left Wide	LW	Lw (15)		
Right Wide	RW	Rw (16)		
Left Front Height	LFT		TL (09)	TL (08)
Right Front Height	RFT		TR (10)	TR (09)
Left Side Height	LST		HLSS (11)	
Right Side Height	RST		HRSS (12)	
Left Rear Height	LRT		HLRS (13)	TSL (10)
Right Rear Height	RRT		HRRS (14)	TSR (11)
Center Front Height	CFT		HC (15)	TC (07)
Left Bottom	CB			BL (13)
Center Bottom	LB			BC (12)
Right Bottom	RB			BR (14)
Voice of God	VOG		VOG (16)	

Recommended File Naming Convention:

ArtistInitals_SongTitle_MixerInitialsRevisionNumber_format_channelnumber_sampleratebitdepth.wav

Example:

ArtistInitials_SongTitle_JB01_714_01L_48k24.wav

*Note: *Note: this nomenclature applies to delivery to the content owner and to archiving. Positional reference is defined as the recommended speaker abbreviations outlined in the chart above, not non-standard abbreviations used by manufacturers. Format is defined as platform configuration, for example: 714. For definitions, see glossary on page 43. For guidance on legal characters, see page 9.*

What Gets Delivered:

- Deliver mono BWAV files, properly named according to the conventions outlined above.
- Include a log sheet with metadata details, including artist, project title, UPC/EAN code, ISRC codes. track lengths, and any other pertinent project information.
- Dolby Atmos speaker configurations: 5.0.2 to 9.1.6
    - Follow Dolby recommended level reference of -18 LUFS (integrated), -1.0 dBPT peak, in reference to speaker output.
- Sony 360RA speaker configurations ranging from 13.0 to 15.1
    - Follow Sony recommended level reference of -13 LUFS (long-term), in reference to speaker output.
- Auro-3D: 5.1.4 (9.1)
    - Follow Auro-3D recommended level reference of -18 LUFS, in reference to speaker output.

HOW DO I MANAGE DOCUMENTATION AND METADATA?

Metadata is data that provides information about other data. Recording project metadata is information related to a specific recording that identifies details including but not limited to participants, label, song titles, album name, and recording and mix technical documentation. There are many types of recording metadata:

- **Ownership and Performing Rights Metadata** documents intellectual property rights and use information and is used to determine who gets paid.
- **Descriptive Metadata** is information about the contents and identifying characteristics of a recording, including title, contributor credits, and instrumentation. Descriptive metadata is used for discovery and identification.
- **Technical Metadata** contains file details such as file format and file size, and explains how to open, access, and use the file.
- **Recommendation Metadata** includes genre and mood classification and optimizes discovery and the fan experience.

This document focuses on Technical and Descriptive metadata, which are relevant to producers and engineers.

Ultimately, it is the responsibility of the Content Owner in collaboration with the producer(s) to collect and document all necessary project metadata. Content owners also have a responsibility to provide complete metadata information to aggregators.

Making recordings can be a complicated process; it is to the benefit of all project participants to be mindful about ensuring that metadata is complete and accurate. Because recording metadata includes credits, it doesn't just facilitate your paycheck as a producer or engineer, it's also your business card–the way you get recognized for your work.

It's important to start documenting metadata at the beginning of a project and to continue collecting information throughout. Leaving documentation to the end of the project risks errors, because information becomes available at various phases in the workflow, and some information will likely change as the project moves toward completion.

Why Save Project Information?

Because recording metadata includes credits, it doesn't just facilitate your paycheck, it also serves as a producer or engineer's business card. Collecting and saving this basic information is necessary for creative contributors and their work to be properly recognized and documented in perpetuity. This information is essential for songwriters, performers, producers, and engineers for many purposes, including:

• Contractual obligations with media/record companies/recording copyright owners.

• Performance royalties (and other potential sources of revenue) for performers, songwriters, producers, and royalty-entitled engineers.

• Historical documentation of the recording for cultural and financial reasons.

• Eligibility for voting membership in the Recording Academy.

• Eligibility to receive a GRAMMY® nomination and/or Award.

RECOMMENDED RECORDING METADATA CHECKLIST

Artist Name: _____

Song Title: _____

Album Title: _____

Composers/Arrangers/Lyricists/Songwriters: _____

Producers: _____

Engineers (recording engineers, mixing engineers, mastering engineers, etc.): _____

Performers/Musicians (names and roles): _____

Does the Recording include samples that may need clearance? _____

Country of Recording: _____

Date range of Recording: _____

Location(s) of Recording (studio name and location): _____

Original Source Recording Format (examples: 96 kHz/24-bit; 48 kHz/24-bit; analog, etc.): _____

Mix Recording Format (examples: 96 kHz/24-bit; 48 kHz/24-bit; analog, etc.): _____

Record Label/Media Company/Content Owner: _____

Song Publisher(s) and Administrators; Performing Rights Organization(s) (ASCAP, BMI, SESAC:) _____

Identifiers (when available) ISNI (International Standard Name Identifier) for persons, ISRC (International Standard Recording Code) for the recording, ISWC (International Standard Work Code) for the composition, IPN (International Performer Identifier) for performers, and IPI (Interested Party Identifier) for songwriters, composers, and music publishers. _____

What Are ISRC, ISNI, ISWC, IPN, and IPI Codes?

A recording can involve many people and organizations, and there can be many recordings of a song. Identifying each musical work and its contributors with internationally recognized, unique codes improves the accuracy of royalty collection and distribution. Think of these codes as digital footprints that track your work throughout the digital music industry ecosystem. Each code represents a different aspect of a musical work, and each impacts royalties.

ISRC: The International Standard Recording Code (ISRC) is a globally recognized system of identifying sound recordings and music video recordings. ISRCs are used throughout the digital commerce chain to track sales and identify recordings for royalty payments. An ISRC is a permanent identifier for a specific recording, independent of rights holder or format; one song will have multiple ISRs if several recordings of that song exist.

ISNI: An International Standard Name Identifier (ISNI) code is a global standard for uniquely identifying a contributor to a creative work. An ISNI code identifies a person, such as a producer, engineer, songwriter, or artist; or an organization, such as a record label or publishing company.

ISWC: An International Standard (Musical) Work Code (ISWC) is a unique reference number that identifies a song. Note that an ISWC can be linked to several ISRCs, but each ISRC is linked to a specific recording, because the ISWC represents the composition and the ISRC represents the sound recording.

IPN: An International Performer Number (IPN) is a unique identifier for performers. The use of IPNs improves the accuracy of royalty distribution because absolute identifiers eliminate ambiguity in the reporting process.

IPI: An Interested Party Information (IPI) number is a unique, international identification number assigned to songwriters, composers, and music publishers. Performing rights organizations use IPI numbers to link creators to musical works in order to track performances and pay royalties.

Recommended Supporting Documentation

These materials include recording and mix documentation detailing vocal chain and microphone choices, automation snapshots, analog processing information, etc. Traditionally, this documentation has included tracking sheets, engineer notes, set-up notes, sketches of microphone placement, and other pertinent data.

Project Metadata Folder Hierarchy

All Masters and Backups should include comprehensive and concise labeling, including metadata. Documentation should be stored as a PDF file on the project hard drive, within the Song Title folder in the Project Metadata folder. *(See chart: Sample Project Folder Hierarchy on page .)*

FYI: DDEX and RIN: What Is the RIN Standard and Why Does It Matter to Me?

The international organization **DDEX** (Digital Data Exchange) develops standards for communicating music metadata along the digital supply chain. The **DDEX RIN** (Recording Information Notification) standard is an XML machine language file format that gives you the ability to capture, store and communicate recording information, including participant roles (performers, producers, engineers), from the beginning of the project through final delivery.

RIN files can travel with the sound files themselves between studios— including any places where music is being recorded, mixed, or mastered —and to the companies that make use of such information when the final recording is released. Because RIN files are in XML machine language, they are universally accessible for transmission to designated recipients who are also using the RIN standard. Third-party companies offer resources for collecting recording metadata in the RIN standard format.

HOW AM I ORGANIZING MY FILES AND DATA?

The Project Folder Hierarchy chart at right is derived from general best practices. It is provided as a starting point, with the expectation that it will be customized according to personal workflows, from recording, mixing, and mastering to delivery.

Note: When a date is used in the file or folder name, the ISO (International Organization for Standardization) date format should be used. Numbers without hyphens are acceptable (e.g., YYYYMMDD).

Aliases, shortcuts, hard links, soft links, and the like should not be used in the folder hierarchy.

For folder notes and definitions, refer to appendix on page *.*

Sample Project Folder Hierarchy

[1]All alternate versions and remixes are considered songs.

HOW DO I PRESERVE CRITICAL DATA?

Because the world relies on digital technology, it's important to ensure that critical data is preserved. This is paramount for music recordings, which are irreplaceable if they are lost. Content creators have a responsibility to act as stewards of this data and to follow best practices for safeguarding it against loss, damage, and obsolescence. Be aware that this chain of responsibility is different in every project scenario and is not always explicitly defined.

Preserving and archiving music recording data ensures that they can be accessed and recreated at any point in the future. This is essential for preserving the livelihood of content creators, for documenting the craft and culture of recording, for providing the next generation of archivists and audio technicians with sustainable content, for ensuring that future owners of these recordings have access to them, and ensuring future generations can enjoy these recordings in perpetuity.

> **There's a rule about archiving: "If you keep it in three places, you own it. If you keep it in two places, you're borrowing it. If you keep it in one place, you're giving it away."**

Short-Term Backup Versus Long-Term Archival

File backup and archiving both play critical roles in data preservation and protection; it's important to understand the difference.

A backup, or "safety," is a copy of original files that can be used to restore information if it is lost or corrupted. Backups provide the ability to repurpose the original recording or recreate the final mix in the short term. *(For recommendations for short-term file backup, see "How Should I Back Up My Masters?" on page .)*

A preservation archive is a collection of final assets for long-term storage. The archive provides a single source of truth for all completed projects and preserves recordings in perpetuity.

We cannot emphasize enough that long-term access to the archived data is the goal of the Committee and its Recommendations. Making a backup does not guarantee the safety or viability of an archived asset; periodic migration of backup media is necessary.

Understanding "Failability" and the Pitfalls of Long-Term Archival

When considering archival options, recognize that any format-analog or digital—is vulnerable to damage, loss, or failure. Tape-based media, both analog and digital, are subject to degradation over time, even when best practices for preservation and storage are observed.

Hard drives fail and digital formats change. Technologies become obsolete, and companies go out of business. Do not rely on a vendor's projected lifespan when making archival decisions.

Migration of both hardware and media is essential to long-term preservation.

Analog tape has a limited practical lifespan, and analog media integrity is degraded with each new duplication. Therefore, the Committee recommends that information be transferred to a high-resolution digital format with the highest practical sample rate to ensure access to the data in perpetuity.

Care must be taken to preserve timecode in original recordings. The new BWAV files should have a timecode stamp that is relative to the timecode on the original analog master, if any.

Hard drives should not be considered as permanent archival solutions. Content owners are often responsible for data preservation and archival yet do not always possess the relevant hard drives. In addition, left dormant, drives become vulnerable to mechanical issues including static friction or "stiction" when read/write heads become stuck to disk platters.

Ensuring File Integrity

When preserving data files, it's important to create bit-level accurate copies and verify file integrity when moving or copying files. The Committee recommends including an MD5 checksum with file delivery. An MD5 is a unique 64-bit digital fingerprint, included with a file download, that is used to verify the identity and integrity of that file.

Free tools are available for creating checksums for individual files as well as checking for data errors when copying entire drives with various file types. Many of these tools can be found on the Federal Agencies Digitization Guidelines Initiative (FADGI) website: www.digitization guidelines.gov.

Archival Platforms

There are a number of ways to archive music recording data. Cloud services (network-accessible storage) have emerged to be accessible, affordable, and highly reliable solutions that provide a great deal of flexibility when it comes to accessing and managing data.

Cloud services offer many advantages for long-term archival: They provide archiving with near-infinite scalability, while offering intelligent management features. Providers build layers of security in their services, and users can share and access files remotely without impacting their local storage systems.

For more information about cloud services and considerations, see appendix on page 50.

LTO (Linear Tape Open) open-standard magnetic tape technology has long served as a data archival standard. LTO and cloud services both offer the necessary storage capacity, shelf life, and scalability for audio data archival; they differ in security features, short-and long-term costs, data accessibility/portability, and maintenance requirements. LTO tape backup systems are very reliable and provide a high degree of protection against data loss, but can be more expensive to set up and maintain than cloud-based solutions.

Note: Hard drives are not recommended for long-term storage.

For more information about LTO archival, see appendix on page 52.

Hard Disk Storage

While the Committee recognizes that hard drive storage may be the only option for some Content Owners, consider this a short-term solution and follow best practices for storage and maintenance, including:
- Store drives in a climate-controlled, dust-free environment.
- Power up drives at least once a year.
- Store a duplicate archive in a separate location.

HDD Versus SSD: Which Is More Reliable?

HDD and SSD drive technologies continue to improve. Each technology offers advantages and disadvantages—HHDs are less expensive, and SSDs tend to be more reliable, for example—but statistical differences between HDDs and SSDs are not yet firm.

Perhaps the biggest difference between HHDs and SSDs is that HDDs are mechanical devices and over time, mechanical devices will fail. Mechanical hard drives are particularly vulnerable to "stiction," or static friction, which occurs when read/write heads become stuck to disk platters, preventing them from spinning. Other HDD downsides: They are prone to excess power consumption, generate noise and heat, and they don't work as fast as SSDs.

SSDs have become much more common in recent years, and are standard-issue products for major computer manufacturers. Those using a computer with a SATA hard drive will see a major improvement in performance by switching to an SSD. What's more, the cost of SSDs has dropped dramatically over the course of the past couple of years, so it's less expensive than ever to upgrade.

SSDs are not without their downsides. Although an SSD drive has no moving parts, each of its memory banks has an inherent finite life expectancy—a limit on the number of times it can be written to before it stops functioning.

The committee expects emerging data to support the increasing reliability of SSDs but at this time recommends SSDs only for long-term storage that is written to once and put on the shelf.

Note that neither HHDs or SSDs are recommended for archival storage.

APPENDICES

The Recording Academy | Delivery Recommendations for Recorded Music Projects

GLOSSARY

2-Bus Compressor: A stereo compressor designed to process stereo mixes in a DAW or console 2-bus.

ADM: An ADM, or Audio Definition File, is a Dolby Atmos master distribution file. An ADM file can also be used to import the data into your DAW and play back each object and bed correctly.

ADM BWF: An ADM BWF (Audio Definition Model Broadcast Wave Format) file is a type of audio file that includes metadata describing the position and timing of individual audio objects within an immersive mix.

AES3: A standard developed by the Audio Engineering Society and the European Broadcasting Union for the interchange of digital audio projects between systems. AES3 is a two or three-wire digital connection most often encapsulating stereo PCM-encoded audio. It can connect audio devices over various transmission media including balanced lines, unbalanced lines, and optical fiber.

AIFF: An AIFF (Audio Interchange File Format) is a computer file type that contains digital audio data. Notably, the AIFF format does not support time stamping.

Apple Spatial Audio: A sound format that recreates a three-dimensional experience and dynamic head tracking through compatible headphone models.

Auro-3D: An immersive audio format, developed by Belguim-based Auro Technologies, that utilizes height channels and a layered approach to create a three-dimensional sound field.

BagIt: A hierarchical file packaging format designed to support disk-based storage and network transfer of arbitrary digital content. A bag comprises a "payload" (the arbitrary content) and "tags," which are the metadata files intended to document the storage and transfer of the bag.

Binaural: A method of recording and reproducing sound that uses two microphones or speakers placed at the same distance and angle as the human ears to capture and create a three-dimensional sound image that simulates the way humans hear sounds in the real world.

Broadcast Wave File (BWF): A computer file type which contains, among other items, digital audio data. The AES31-2 Broadcast Wave File format originated as an EBU (European Broadcast Union) specification whose data format is based on the Microsoft RIFF wave format but carrying additional metadata, including a unique identifier and high-precision time reference.

Checksum: A numerical value calculated from a set of data using a specific algorithm, used to verify the integrity of the data and ensure that it has not been altered or corrupted during transmission or storage.

Channel: One indivisible stream of audio. One channel would refer to a mono source, two channels might refer to a stereo source, and six or more channels could refer to a "surround" source.

Cloud: Software, servers, and companion services that are accessed over the Internet.

Committed Audio File: Refers to a single continuous rendered digital audio file that incorporates all edits, automation and all plug-in and hardware processing.

Consolidate: The process of combining multiple audio clips into a single continuous audio file.

DAW (Digital Audio Workstation): A software system used for recording, editing, and producing digital audio files, typically used in music and audio production.

DAMF (Dolby Atmos Master Format): An output format that is used by Dolby content creation tools used in studios and post-production suites.

DDEX (Digital Data Exchange): A standards-setting organization focused on the creation of digital value chain standards that make the exchange of data and information across the music industry more efficient.

Deliverables: Materials turned into the record label or Content Owner upon completion of a project, including all media and documentation.

Dither: The practice of adding low-volume noise to a digital audio signal when converting from a higher to lower bit resolution in order to lessen the effect of distortion caused by quantization error.

Dolby Atmos: An object-based surround sound technology that uses height channels and sophisticated audio processing to create a highly immersive, three-dimensional audio experience.

EAN (European Article Number) code: A unique 13-digit product identification code used to track and manage inventory in retail and commercial settings.

eSATA: A computer port used for external connection to a SATA drive.

FADGI: The Federal Agencies Digital Guidelines Initiative, an organization created to develop common digitization best practices.

FLAC (Free Lossless Audio Codec): A lossless audio compression format that compresses audio files without any loss of quality, making it popular for storing and archiving high-quality audio files. FLAC supports any sample rate and bit depths up to 24 bit.

FTP (File Transfer Protocol): A standard network protocol used to transfer files between a client and server on a computer network, typically over the Internet.

HDD (Hard Disk Drive): A data storage device that uses magnetic disks to store and retrieve digital information.

IaaS (Infrastructure as a Service): IaaS cloud services provide virtualized computing, networking, and storage resources on demand, eliminating the need for enterprises to manage infrastructure themselves. IaaS providers host and maintain storage servers and networking hardware.

IMF (Interoperable Master Format): A standard for mastering and distributing high-quality video and audio content, designed to streamline the production and distribution process for multiple distribution channels and platforms.

Interleaved Stereo Broadcast Wave File: A stereo Broadcast Wave File in which data making up the left and right channels are stored together as one contiguous block of data.

IPI (Interested Party Information) Number: A unique international identification number assigned to songwriters, composers, and music publishers. Performing rights organizations use IPI numbers to link creators to musical works, to track performances and pay royalties.

IPN (International Performer) Number: A unique identifier for performers. The use of IPNs improves the accuracy of royalty distribution because absolute identifiers eliminate ambiguity in the reporting process.

ISNI (International Standard Name Identifier) Code: A global standard for uniquely identifying a contributor to a creative work. An ISNI code identifies a person, such as a producer, engineer, songwriter, or artist; or an organization, such as a record label or publishing company.

ISO (International Organization for Standardization): A non-governmental organization that develops and publishes international standards for various industries and activities.

ISRC (International Standard Recording Code): A globally recognized system of identifying sound recordings and music video recordings. ISRCs are used throughout the digital commerce chain to track sales and identify recordings for royalty payments. An ISRC is a permanent identifier for a specific recording, independent of rights holder or format; one song will have multiple ISRCs if several recordings of that song exist.

ISWC (International Standard [Musical] Work Code): A unique reference number that identifies a song. Note that an ISWC can be linked to several ISRCs, but each ISRC is linked to a specific recording, because the ISWC represents the composition, and the ISRC represents the sound recording.

Library Wind: A process in which analog tape is wound from one reel to the other at

reduced tension and at a speed that is much slower than full rewind speed, resulting in a very even wind on the take-up reel and a tails-out configuration.

LUFS (Loudness Units Full Scale): A unit of measurement used to quantify the perceived loudness of audio signals, taking into account the frequency response of human hearing.

LTO (Linear Tape Open): A magnetic tape data storage technology co-developed by Hewlett-Packard, Seagate, and IBM that provides high-capacity storage, fast transfer rates, and reliable data protection. LTO is commonly used for long-term archival and backup storage.

Master: A set of the original components of the recording, mixing, and mastering processes for a given production, with elements preserved in their originally recorded formats and collected in a form that is ready for transition to the next phase of the process.

Original Master: The first (or original) collection of the various components of the recording process for a given production in its original recorded format.

Primary Masters: Include (but are not limited to) all analog master tapes, hard disks, optical media, and all backups of these created during the recording, mixing and mastering process. Masters include all of the original components in each of their originally recorded formats. These Masters should have no deletions of useful material (outtakes, artists talking, incomplete or unreleased recordings, etc.). The constitution of "useful material" is determined by agreement between the record company and producer prior to the commencement of the recording project.

MD5: A unique 64-bit digital fingerprint, included with a file download, that is used to verify the identity and integrity of that file.

Metadata: Data that provides information about other data, such as the content, context, and structure of a particular set of data. In this context, metadata is data (or "information") about the recorded music project.

MPEG (Moving Picture Experts Group): A family of standards for coding and compression of digital audio and video signals that are widely used in a variety of applications, including broadcast, storage, and playback.

Normalization: The process of adjusting the volume of an audio file to a consistent level, typically to maximize loudness and avoid distortion while maintaining the original dynamic range.

Object-Based Audio: An audio format that represents sound as individual objects, allowing for immersive and customized listening experiences through dynamic placement and manipulation of audio elements. Each individual sound source is stored as its own (usually mono) audio file with accompanying metadata that defines characteristics such as level, location, and movement in a three-dimensional space.

PaaS (Platform as a Service): A cloud computing model that provides a platform for developing, testing, deploying, and managing applications, without the need to manage underlying infrastructure.

PCM (Pulse-Code Modulation): A digital audio encoding method that converts analog audio signals into a series of binary values, allowing them to be stored, processed, and transmitted in a digital format.

PDF (Portable Document Format): A file format developed by Adobe that allows for the creation and sharing of documents with consistent formatting across different devices and platforms.

Positional Reference: Timing reference used during the recording/overdub/mixing process to synchronize devices and mix automation.

PRO (Performing Rights Organization): A company that collects and distributes royalties on behalf of songwriters and music publishers for the use of their musical compositions.

RF64: This 64-bit audio file format was originally developed by the EBU in 2007 to fulfill the longer-term need for multichannel sound in the entire program chain from capture to editing and play out, and for short- or long-term archiving. The file format was designed to be a compatible extension to the Microsoft RIFF/-WAVE format and to the BWF. Its 64-bit architecture extended the maximum attainable file size, thus allowing for multichannel sound in broadcasting and audio archiving. RF64 achieved backwards compatibility with 32-bit BWF files by enabling on-the-fly switching from the BWF RIFF size field to the 64-bit riff Size value

registered in a <ds64> chunk. This typically happens when a recording application passes the 4 Gbyte file size.

RIN: The DDEX RIN (Recording Information Notification) standard is an XML (Extensible Markup Language) message that can capture and communicate metadata about all of the parties and tools that were involved in a recording. More information and a free implementation license can be found on the DDEX website at kb.ddex.net.

SaaS (Software as a Service): In the Saas cloud model, a provider makes hosted applications available to customers over the internet. SaaS services include file storage and backup, web-based email, and project-management tools.

SACD (Super Audio Compact Disc): A 5.25-inch optical format that uses Direct Stream Digital (DSD) technology to record and play music with a "single-bit" running at a very high sampling frequency (2.8224 MHz).

SATA (Serial ATA): The standard hardware interface for connecting hard drives, solid state drives, and optical drives to a computer motherboard. Specialized eSATA computer ports allow connection of external SATA drives.

SFTP (Secure File Transfer Protocol): A secure method of transferring files over a network, using an encrypted SSH (Secure Shell) connection to protect data during transmission.

Sony Reality Audio 360: An immersive audio technology that creates a spatial sound field by mapping audio elements to individual objects within a three-dimensional space.

SSD (Solid State Drive): A storage device containing non-volatile flash memory, used in place of a hard disk drive. SSDs have no moving parts, and offer faster read and write access and are more durable and quieter than hard disks.

Stem: An audio track or group of tracks that contain a specific element or group of elements from a larger audio mix, such as vocals, drums, or guitars.

Stiction: A condition that occurs when the read/write head of a hard disk drive gets stuck to the platter surface, preventing it from moving and causing the drive to malfunction.

Timecode: The most common type of positional reference; usually refers to SMPTE timecode, developed by the Society of Motion Picture and Television Engineers. Specified in number in frames per second: usually 30, 29.97, 29.97 drop-frame, 25, or 24.

Track: In the context of audio storage, a track is a place where elements of program (music, etc.) material are placed. A track can also refer to one channel of content, a unique, irreducible element in the context of a "production. Tracks might also include or be limited to MIDI or sequencing data. The word track can also refer to an individual selection in a compilation of songs, or the process of recording itself.

Truncation: File word-length reduction, e.g., reducing a 24-bit audio file to a 16-bit audio file.

UPC (Universal Product Code): A barcode symbol that is used to uniquely identify and track consumer products at the point of sale in retail stores.

Upsampling: A process of increasing the sample rate or bit depth of an audio signal to increase its file resolution, typically using digital signal processing algorithms.

White Space: As it pertains to file naming conventions, white space is any blank space within the file name that contains no characters (usually achieved by hitting the space bar on the computer keyboard.) Note: A white space is considered to be an illegal character in file names.

XML: Extensible Markup Language. A file with a .xml file extension is a plain text file that describes the transportation, structure, and storage of data.

MIX DELIVERY DEFINITIONS

Mix Version: Any mono, stereo, or multichannel surround mix created during the mixing process and containing all of the final desired elements of the multitrack production that has a changed perspective of any of the mix's elements. For example, a " Vocal Up" version of the Mix Master would be considered a Mix Version.

Approved Mix Master: A mono, stereo, or multichannel surround mix created during the mixing process and containing all of the final desired elements of the multitrack production. The Master Mix is considered to be the final Mix Master approved by the artist, producer, and engineer, intended for commercial release.

Vocal Up: A complete replica of the Mix Master in which the vocal level is raised.

Instrumental: A complete replica of the Mix Master containing no vocals.

No Lead Vocal: A replica of the Mix Master that includes backing vocals but contains no lead vocal and/or no artist vocals. In the past, this has been referred to as "TV Track."

Lead Vocal Only With Effects ("Wet"): An a cappella mix containing just the lead vocal and its effects.

It's important to note that the "No Lead Vocal" mix and "Instrumental" mix are considered stems. However, since they are currently also considered part of a standard minimal mix delivery, for the purposes of this document, they are listed in the version category.

FILE NAMING DESCRIPTIONS AND NOTES

Artist Initials (AI): The artist initials are usually two letters, taken from the first and last name of the artist.

Song Title: The full song title or useful abbreviation thereof. Capitalize each word or word fragment. Title contains no spaces, punctuation, or diacritical markings (accents) in order for names to be universally file-compatible. Song title names should be fewer than 15 characters if possible. Lengthy titles may be routinely abbreviated by other programs when imported.

Sample Rate and Bit Depth: List the sample rate at which the audio file was created, followed by the bit depth. The single letter "k" is sufficient to abbreviate "kilohertz." Include the number representing bit depth but not the word "bit." For example, a song recorded at a sample rate of 96 kHz and a bit depth of 24 bits is abbreviated "96k24."

File Extension: Generally generated during file creation. If you have the option to show or hide the file extension, it should always be shown. Only one period should be used in the file name and it should be placed before the file extension.

CLOUD SERVICES CONSIDERATIONS

"Cloud Services" is a general term for a range of hosted services delivered on demand over the internet. These services let clients access data and applications from remote servers, computers, and databases without accessing local systems. Cloud services include both hardware and software components and fall into three categories:

- **Software as a Service (SaaS):** In the SaaS model, a provider makes hosted applications available to customers over the internet. SaaS services include file storage and backup, web-based email, and project-management tools.
- **Platform as a Service (PaaS):** PaaS providers host application-development platforms and tools (including database, operating system, and programming language) and make them available to customers over the internet.
- **Infrastructure as a Service (IaaS):** IaaS services provide virtualized computing, networking, and storage resources on demand, eliminating the need for enterprises to manage infrastructure themselves. IaaS providers host and maintain storage servers and networking hardware.

Clouds can be public or private: Public cloud services are available to anyone on the internet, and are generally free or available with on-demand and subscription-based pricing. Private cloud services are proprietary networks that are dedicated to the needs of a single organization; private clouds limit hosted services to select users and offer extra layers of security and privacy.

Benefits of Cloud Services

Cloud services are accessible, affordable, and reliable archiving solutions that provide a great deal of flexibility in managing data. Cloud services can be accessed from anyplace with an internet connection and eliminate the need to invest in archiving software, hardware, and infrastructure. Services can be used on an as-needed basis and can scale with usage requirements.

Choosing a Cloud Service

When choosing a cloud archive service, it's important to select a mature, comprehensive platform that is designed for longevity and provides security, reliability, and accessibility. The following is a list of features to consider when choosing a cloud service. Priority features vary with production scenarios, usage requirements, etc.

Cloud Service Features for Consideration

Management and Administration

- Tiered access/permissions
- Scalability from individual to enterprise use
- Collaboration features
- Customizable front end/interface

Cloud Service Features for Consideration (cont.)

Archive Access and Retrieval
- Short-term vs long-term archive accessibility
- App, browser, and client-based access
- Incremental backups
- Offline features (e.g., offline archival)
- File-sharing features
- Retrieval support
- Versioning access and control
- Configurability features (e.g., folder automation)
- Metadata searchability
- File dating accuracy

Performance
- Upload/download speeds

Security
- End-to-end data encryption
- Data redundancy: number and location of backups
- Ransomware protection

Integration
- Application (e.g., Microsoft Office) integration
- OS support/ecosystem integration
- Sync across devices

Business and Financial
- Up-front and long-term costs
- Customer support
- Country of origin legislative/compliance issues

LINEAR TAPE OPEN (LTO)

LTO, or Linear Tape Open, is an evolving large-data storage technology that is suitable for small-to-medium producers and extensible to extremely large tape libraries.

Planning for LTO's Useful Lifespan

LTO tape and drive manufacturers quote the lifespan of both LTO drives and LTO tapes as ranging from 15 to 30 years; tape will last longer. LTO tapes are sensitive to their environment, so a 30-year life expectancy assumes ideal storage conditions: a constant temperature of around 50 degrees Fahrenheit and 40% relative humidity.

LTO media and drive lifetimes are dependent on transitional technology. When considering the quoted storage life of a data carrier such as LTO tape, one should not infer that appropriate hardware will be available; but, in some foreseeable circumstances, it may be possible to take a forensic approach to attempt to recover the data. Given the potential for this hypothetical situation, the Committee's guidelines for legal file name characters are considered the best solution for the long-term viability of BWF files.

LTO and the Linear Tape File System

With LTO-5, the Linear Tape File System (LTFS) was introduced to the LTO community. This system eliminates the need to keep separate catalog files with the LTO tapes themselves. Additionally, the LTFS file system allows LTO media to be mounted like a hard disk and written directly through drag-and-drop storage and retrieval of individual files without additional software.

This information can be saved as a PDF document that outlines the contents of the LTO tape. In addition, the LTFS file system allows LTO media to be mounted like a hard disk, allowing drag-and-drop retrieval and storage of individual files without unpacking the entire tape.

The Committee recommends writing LTO backup takes using LTO media that supports LTFS. LTO drives are able to read "n-2"–generation media, meaning that an LTO-9 drive can read LTO-7/8/9 media; LTO drives can write data to "n-1"–generation media, meaning an LTO-9 drive would be able to write to LTO-8/9 media.

Regarding storage volume, LTO-9, which is capable of storing 45 terabytes of compressed data or 18 terabytes of native data, is preferred for very large archives, such as immersive projects.

LTO and the Archiving Ecosystem

Additional software may be needed to support the seamless integration of LTO hardware and the creation and recovery of LTO data tapes, both catalog-based and LTFS. It is important to choose an appropriate archiving application to connect computers to LTO tape drives. Both hardware and software choices have significant implications, so interoperability among platforms, operating systems, and

applications is crucial. As always, verification of a newly-created archive should be considered an essential part of the archiving workflow.

The Committee recommends that those who endeavor to develop their own LTO backup strategy consider all of the necessary components—hardware, software, firmware, and connectivity—to ensure a robust backup workflow.

Long-Term Master Backup Storage Media

Storage Technology	Media	Manufacturer
Computer Tape Archive	LTO-4, LTO-5, LTO-6, LTO-7, LTO-8, LTO-9	Fuji, Hewlett-Packard, IBM, Quantum, Sony, and others

NOTE: LTO tapes are "n-2" read and "n-1" read/write capability. In other words, each generation can read and write the previous generation, and each generation can read the generation before the previous. Often, new generations of LTO follow a features roadmap and update every two years.

METADATA CHECKLIST

Artist Name: _____

Song Title: _____

Album Title: _____

Composers/Arrangers/Lyricists/Songwriters: _____

Producers: _____

Engineers (recording engineers, mixing engineers, mastering engineers, etc.): _____

Performers/Musicians (names and roles): _____

Does the Recording include samples that may need clearance? _____

Country of Recording: _____

Date range of Recording: _____

Location(s) of Recording (studio name and location): _____

Original Source Recording Format (examples: 96 kHz/24-bit; 48 kHz/24-bit; analog, etc.): _____

Mix Recording Format (examples: 96 kHz/24-bit; 48 kHz/24-bit; analog, etc.): _____

Record Label/Media Company/Content Owner: _____

Song Publisher(s) and Administrators; Performing Rights Organization(s) (ASCAP, BMI, SESAC:) _____

Identifiers (when available) ISNI (International Standard Name Identifier) for persons, ISRC (International Standard Recording Code) for the recording, ISWC (International Standard Work Code) for the composition, IPN (International Performer Identifier) for performers, and IPI (Interested Party Identifier) for songwriters, composers, and music publishers. _____

SAMPLE PROJECT FOLDER HIERARCHY NOTES

The following notes provide clarity and context for select folders outlined in the Sample Project Folder Hierarchy on page 27. *For expanded term definitions, see the general Glossary on page 43.*

Approved Mixes: This folder should contain only those mixes approved by the client for mastering or release. These Approved Mixes are a duplicate of the approved mixes in the Master Mixes folder.

This folder should contain only those mixes approved by the client for mastering or release. These Approved Mixes are a duplicate of the approved mixes in the Master Mixes folder.

Artist: The Artist folder contains all subsequent folders and files regarding all projects associated with a given artist. It is recommended to title this folder with the full artist name.

Consolidated Multitracks: Once the project is finished, delivery of the consolidated multitrack master files may be requested by the Content Owner. Those consolidated master multitrack sessions/audio files would be placed in this folder.

Credits: This folder contains documentation outlining participants in each song and for the overall project, including performers, producers, engineers, musicians, songwriters, etc.

DAW Multitracks: This is a separate folder containing all of the session files for the current incomplete mix versions of each song.

Exported Files: This folder contains exported files or sessions that are configured for vocal tuning, for musicians to use for overdubs, etc. Other exported file examples include stem sessions containing a click, specialized instrument stems, and vocal stems.

Master Mixes: This folder contains all master mix versions and all recall mix versions.

Mastered: This is a folder for the approved final masters, ready for distribution, delivery, or for label/client archive.

Mastered Mixes: This folder contains all mastered mix files from the mastering engineer, organized in subfolders by format.

Mixes: This folder contains all versions of project mixes organized by mix version and type of mix.

Mixing Documentation: Including but not limited to mix setup and recall information, client mix notes, etc.

Project: There should be a separate Project folder for each project for a given artist (for example, an album project, a live recording project, a surround mix project, etc.). If a project has multiple producers, then create a separate Project folder (within the Artist folder) for each producer of a project and label accordingly.

SAMPLE PROJECT FOLDER HIERARCHY NOTES (cont.)

Project Metadata: This folder contains recording project metadata, including participants, label, song titles, album name, and recording and mix technical documentation. This folder should also contain codes, such as ISRC, ISNI, ISWC, UPC, etc., associated with the project. For a metadata checklist, see page

Recording Documentation: Including but not limited to notes about the session date and location, performers and other personnel, instruments, equipment used, signal paths including vocal chain documentation, photos of mic setups and location, etc.

Reference Mixes: This folder contains any printed reference mixes. All reference mixes sent to the client and artist should be archived for future reference.

Song Title: Create a Song Title folder for each song in a project. All alternate versions and remixes are considered songs.

Source Files: This folder contains original files from an outside source that are imported into the DAW Multitrack folder. This includes project source files, tuned vocal files, overdubs from outside sources, etc. While this folder might contain duplicate files of the DAW Multitrack folder, it should preserve them in their original format.

Stems: This folder should contain any stem audio or stem multitrack sessions created from a Master Mix. In the Project Folder Hierarchy, the two stem folders are duplicates.

Unmastered: This folder contains all approved mixes, in sub-folders denoting format, before mastering.

HOW WE ARRIVED AT THIS DOCUMENT

The Recording Academy's Producers & Engineers Wing® Delivery Specifications Committee, comprising producers, engineers, record company executives, and other music professionals, in conjunction with the AES Technical Committee on Studio Practices and Production and the AES Nashville Section, developed the original Delivery Recommendations document in 2002. Updated versions were published in 2004, 2005, 2008, 2013, and 2018. This current version was completed in spring 2024.

This guide is considered a "living document": As technologies evolve, The Committee will continue to review and update these Recommendations in the context of emerging recording and storage techniques, hardware platforms, and media and storage formats to ensure its continuing relevance within commonly accepted industry practices

The document is open to comment from all interested parties. Contact us by emailing pe.wing@recordingacademy.com.

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NOTES