



## Recommendation for Delivery of Recorded Music Projects

080107 rev 48

This document has been created as a Recommendation for Delivery of Recorded Music Projects. This document specifies the *physical deliverables* that are the foundation of the creative process, with the understanding that it is in the interest of all parties involved to make them accessible for both the short term and the long term. Thus, this document recommends reliable backup, delivery and archiving methodologies for current audio technologies, which should ensure that music will be completely and reliably recoverable and protected from damage, obsolescence and loss.

The Delivery Specifications Committee, comprised of producers, engineers, record company executives and others working primarily in Nashville, New York and Los Angeles (and in conjunction with the AES Technical Committee on Studio Practices and Production and the AES Nashville Section), developed the Delivery Recommendations over the course of two years. During its development, the committee met regularly at the Recording Academy® Nashville Chapter offices to debate the issues surrounding the short term and long term viability of the creative tools used in the recording process, and to design a specification in the interest of all parties involved in the recording process. The committee reached consensus in July, 2002 and the committee's recommendations were finalized and presented to The Recording Academy Producers & Engineers Wing membership, the overall recording community, and to press in Nashville on July 19, 2002. The document was also presented to the AES in the Studio Practices and Production Tech Committee meeting on October 7th, 2002 in Los Angeles, and on March 24th, 2003 in Amsterdam. Updates to the document were introduced in 2004 & 2005 and new language was approved at the AES in Paris, May 2006. The current revision was completed in November of 2007.

The Delivery Specifications Committee intends to review the document vis à vis recording and storage techniques, hardware and formats periodically for its continuing relevance within commonly accepted industry practices. This Committee is open to all comment from interested parties, and notification of meetings is available by e-mailing [p&edeliveryrecs@grammy.com](mailto:p&edeliveryrecs@grammy.com).

Producers & Engineers Wing  
Delivery Specifications Subcommittee for Revision 011101.48

Chuck Ainlay  
Jeff Balding  
Alison Booth  
Barry Cardinael  
Tom Endres  
Jim Kaiser  
Kyle Lehning  
George Massenburg  
Pat McMakin  
John Spencer  
Bil VornDick

Producers & Engineers Wing  
Delivery Specifications Committee

Chuck Ainlay  
Jeff Balding  
Steve Bishir  
Alison Booth  
Tony Brown  
Barry Cardinael  
Eric Conn  
Sharon Corbitt  
Tom Endres  
Garth Fundis  
Susan Heard  
Scott Hendricks

Steve Marcantonio  
Pat McMakin  
Marshall Morgan  
Betsy Morley  
Jake Nicely  
Gary Paczosa  
Mike Purcell  
Traci Samczyk  
Kay Smith  
John Spencer  
Bil VornDick

Summary of the Delivery Recommendations

There are two Recommendations for Music Delivery:

1. Minimum
2. Preferred (includes “Minimum”)

For each of three recording technologies:

1. Analog Multi and Two Track Tape
2. Proprietary-Format Multi and Two Track Hard Disk Recorder (Proprietary HDD)
3. Digital Audio Workstation or DAW (HDD)

Delivery Recommendations:

The Minimum Delivery Recommendation provides the capability to reuse the original recording in the short-term and, if necessary, to re-create the original recording and/or mix as closely as possible. This will allow the owner of the master (Record Company) quicker access to the elements of the project in use at the conclusion of the mixing process.

The Preferred Delivery Recommendation provides a more robust solution to the long-term issues that confront Record Labels in their efforts to maintain their assets. It is therefore the Committee’s recommendation that all of the audio tracks<sup>1</sup> be “flattened” and migrated to the Broadcast Wave file format.<sup>2</sup>

For further information about the file structure of the Broadcast Wave File click on: [EBU Technical Documents Site](#). This will direct you to [Specification of the Broadcast Wave Format \(BWF\) - Version 1 - first edition 2001](#). You will also find supplements t3285-s1 through t3285-s5. A “flattened” file is one segment of digital audio that plays continuously from the start of the track to the end.

---

<sup>1</sup> For the purposes of this document, a “Track” is the place where one indivisible unit of source material is stored, and may be from 1 to n channels of audio; a “Track” is further defined in the Glossary of Terms.

<sup>2</sup> While the EBU has developed a recommendation for presenting multi-channel files in a standardized form, it has not been approved as of this document date. When the BWF Standard is so amended it is understood that this document will be updated to include multi-channel content in BWF files.

The Deliverables Committee now supports the use of Interleaved Stereo

Broadcast Wave Files. The Deliverables Committee is aware of the increase in usage of multi-channel interleaved BWF files and is following the standards efforts closely. [AES Standard AES31-1-2001 \(r2006\) AES standard for network and file transfer of audio - Audio-file transfer and exchange Part 1: Disk format](#) was implemented in October, 2006. However, we do not recommend the use of *Multi-channel* interleaved BWF files until this standard is more broadly implemented.

A *standard* file format (such as the Broadcast Wave format defined by AES31-1) and enterprise-class storage media provide access to the audio files after the proprietary equipment used to create them may no longer be available.

To fulfill the Minimum Delivery Recommendation:

Deliver to the record label the Primary Master (from Table 1) and *two* Secondary Masters (Backups or “Safeties”) for each and every master. The Secondary Masters (Backups or “Safeties”) should be delivered in two different, approved storage media taken from the Acceptable Transitional Master Backup Storage Media listing (Table 2). The Secondary Masters (Backups/”Safeties”) should have sampling rates and precisions equal to or better than the “Original Master” (88.2, 96, 176.4, 192, 352.8, and 384 kHz are recommended, as are 24 or greater bit depths). These same sampling rates and precisions are required for A/D conversion. Also, there should be no level adjustments, truncation, dither or noise-shaping, or modification of the digital signal. Please note: it is not advisable to “upsample” the Primary Master in order to create a Secondary Master.

The “Master” is defined as a collection of the various original components of the recording process for a given production, each in their originally recorded formats, and collected in a form that is ready for transition to the next phase of the process. (For example, the recorded ‘masters’ from the tracking and overdubbing processes are collected in a form that is ready for transition to the mixing process. The mixed ‘masters’ are collected in a form that is ready for transition to the mastering process. The mastered ‘master’ is ready for transition to the manufacturing process.) “Masters” include (but are not limited to) all open reel tapes, hard disk drives (HDD), and incremental backups made during the recording process. They include all of the original components of the recording process for a given production each in their originally recorded formats. There should be no deletions of useful material from the “Masters”, such as out-takes, artist’s talking, incomplete or unreleased recordings, etc. The constitution of “useful material” is determined by agreement between Record Company and Producer prior to the commencement of the recording project.

A Glossary of Technical Terms as well as a Glossary of Recording Technologies are also provided with the document. Some industry-standard nomenclature has been refined (for instance, “Masters” and “Tracks”).

Additionally, it is highly recommended that both paper and machine-readable documentation accompany all Master deliverables and Backup/Safety media.

Traditionally, this documentation has included tracking sheets, engineer notes, set-up notes, sketches of microphone placement, and any other data pertinent to the recording project. The Delivery Specifications Committee recommends that all Masters and Backups have concise labeling. We recommend a label such as the Media ID Label, a document developed by the Audio Engineering Society Nashville Section. The label should be completed and affixed to each and every Master and Backup/Safety for the recording project. The Media ID Label provides important data (expected to be formatted with metadata to accompany electronic delivery) about each physical Master and Backup/Safety deliverable, which can be included within Broadcast Wave files. A sample copy of the Media ID Label is attached to this document. Also, a document such as the Recording Map should be completed, as it provides important metadata about the entire recording process and methodologies. The Recording Map should be maintained throughout the course of the Recording Project as it details information about the original sources, transfers and backups/safeties. An example of a Recording Map follows this document.

To fulfill the Preferred Delivery Recommendations:

In addition to the Master and Backups/Safeties described in the Minimum Delivery Recommendation above, each track of each song should be “flattened” or converted to continuous Broadcast Wave Files without processing or automation. The Broadcast Wave Files should then be transferred to an Approved Long Term Backup Storage Medium (Table 4). In some situations ancillary processing may be understood to be a key component of the final product (volume level automation, compression, etc.) This processing may be included in a separate “flattened” file in addition to the unprocessed “flattened” file, as mutually agreed by the Producer and the Record Company.

Regarding Time Code for the Broadcast Wave Files:

If time code was supported in the recording process, the original positional reference should be incorporated in the Broadcast Wave file format in the “Time Reference” field of the “bext” chunk as a high-precision 64-bit integer representing sample count. All files/regions for each track should be consolidated to a single file. There should be no more than one (1) file per track. Every effort should be made for all Broadcast Wave files to be a bit-for-bit copy of the original digital tracks.

If no time code or positional reference was used in the recording process, all recorded tracks should be converted to the continuous Broadcast Wave file format with a start time of the sample count equivalent to 01:00:00:00 (wherever possible, e.g. 2” Analog Tape as well as AIFF files may have no time code present). All tracks including partial tracks, such as guitar solos, background vocals, etc. should have the same start time to maintain proper time relationships between tracks.

<sup>3</sup> As regards how “Track” is defined, see footnote 1 on preceding page.

<sup>4</sup> As regards how “Broadcast Wave Files” are defined, see footnote 2 on preceding page

Table 1. Primary Master Delivery Media<sup>5</sup>

Recording Technology		Media
<b>ANALOG RECORDER</b>	24 tk	2" analog tape
	16tk	2" or 1" analog tape
	8 tk	2" or 1" analog tape
	2 tk	1/4", 1/2" or 1" analog tape
<b>HARD DISK RECORDER</b>	IZ RADAR 5 / RADAR 24	(Proprietary) removable HDD
	Genex GX9000 / GX9048	(Proprietary) removable HDD
	Mackie HDR / MDR 2496	(Proprietary) removable HDD
	Alesis HD-24	(Proprietary) removable HDD
	Tascam MX-2424 / X-48	(HFS/HFS+/ FAT 32) SCSI HDD,
	Tascam MMR-8, MMP-16 (player only)	(HFS/HFS+/FAT32) SCSI HDD
	Euphonix R-1	(Proprietary) HDD
	Fairlight MFX / MFX plus	(Proprietary) HDD
	Fairlight Merlin	(Proprietary) HDD
<b>DIGITAL AUDIO WORKSTATION</b>	ProTools HD & HD-LE	(HFS/HFS+/FAT32/NTFS) FW HDD
	Nuendo	(HFS/HFS+/FAT32/NTFS) FW HDD
	Cubase VST	(HFS/HFS+/FAT32/NTFS) FW HDD
	Digital Performer	(HFS/HFS+) FW HDD
	Apple Logic	(HFS/HFS+) FW HDD
	Sonic Studio	(HFS/HFS+) FW HDD
	Merging Technologies Pyramix (PCM & DSD)	(FAT32/NTFS) FW HDD
	SADIE (PCM & DSD)	(FAT32/NTFS) FW HDD
Sonoma (DSD)	(FAT32/NTFS) SCSI/FW HDD	
<b>DIGITAL OPTICAL</b>	Alesis Masterlink	AIFF files on CD-24 (ISO9660 format on CD-R)

*Hard Disk Drives should be delivered in safe, shockproof cases such as the Pelican, which the Record Company may provide as necessary. ATA/IDE/EIDE Hard Drives are acceptable, but only in IEEE1394/Firewire-interfaced enclosures.*

<sup>5</sup> The P&E Wing's Delivery Specifications Committee will review this document vis à vis recording techniques, hardware and formats periodically for their continuing relevance within commonly accepted industry practices. This Committee is open to all comment from interested parties, and notification of meetings is available by e-mailing [p&edeliveryrecs@grammy.com](mailto:p&edeliveryrecs@grammy.com).

Table 2. *Transitional* Master Backup Storage Media

<b>Storage Technology</b>	<b>Media</b>	<b>Manufacturer</b>
<b>COMPUTER TAPE ARCHIVE</b>	AIT 1, 2, 3, 4, 5; (includes DSD archives)	Sony
	DLT/SDLT	Quantum
	LTO 1, 2, 3 & 4	Hewlett-Packard, IBM, and others
<b>COMPUTER HARD DISK</b>	FireWire I/F HDD (includes ATA/EIDE/IDE/SATA)	(many standard)
	Serial ATA I & II I/F HDD	(many standard)
<b>COMPUTER OPTICAL DISK</b>	CD-R	(many standard)
	CD-RW	(many standard)
	DVD±R	(many standard)
	DVD±RW	(many standard)
	DVD±DL (dual-layer)	(many standard)
	MO (includes DSD archives)	Genex

Hard Disk Drives should be delivered in safe, shockproof cases such as the Pelican case, which the Record Company may provide as necessary.

The Delivery Specifications Committee expects that direct delivery (via secure connection on the Internet & etc) will be commonplace in the future, and uploading files to very large-scale Digital Libraries will be recommended. *Digital source files should readily adapt to any general computing infrastructure* that is in place or anticipated to be put in place by the owners of the masters. The recording industry recognizes the need to make all of the audio elements available on the storage media types that are used by these systems.

### Archiving/Storage Applications

The Committee recognizes the necessity of incremental archiving/storage applications. Currently there are several widely distributed applications. There are several enterprise-class storage applications (such as IBM's Tivoli, Atempo and Bakbone) available. Some other "personal" storage applications such as "Stuffit" do not address streaming tape hardware. The focus of this document is directed towards personal storage applications and we have evaluated those that do address streaming tape media for archival purposes (see Table 3): TOLIS Group's "BRU" ([www.tolisgroup.com](http://www.tolisgroup.com)), EMC/Dantz Retrospect ([www.dantz.com](http://www.dantz.com)), and Unix <tar> ([tar for windows](#) not recommended for non-programmers). We recognize the significance of choosing an archiving application in terms of the reliability of long-term support. There are implications in the choice of formats (platform, operating system, file-type). Verification of the archive as part of the archiving process is essential.

Note that these are recommendations for individual archive resource backup methodology. Ours are not meant to be institutional recommendations.

### Archiving/Storage Applications Selection Criteria

The Committee considers as essential that backup methodologies provide:

1. ***Persistent, dependable*** availability and support of the archiving application,
2. A protocol for ***continued recovery of such archives*** written to data storage tapes regardless of business resolutions of vendors.
3. A storage format that can provide contiguous, ***uncompressed*** and ***unencrypted*** data archives, regardless of file structure.

We hope that backup methodologies will provide such *continued support* until such time as the delivery recommendations are modified to include other media (possibly beyond data storage tapes) and/or the tapes are "migrated" to another technology. Finally, we hope to persuade vendors to place their verified source code in escrow to further support continued archive recovery. Although we resist recommending specific vendors of either hardware or software archiving solutions, we present certain vendors for comparative example. The Committee has provided the above criteria to vendors in the hope that they will follow these recommendations and has to date received support from one vendor.

Table 3. A comparison of three incremental archiving/storage applications

Storage Application	EMC/Dantz Retrospect	<tar>	Tolis Group BRU
<b>Cross-platform support</b>	Limited; neither Retrospect catalogs nor archives are compatible between MacOS & Win; has Red Hat Linux support.	All, however UNIX tar doesn't recognize MacOS resource forks (although a UNIX "shell command" will convert resource to data forks). MacOS OSX isn't delivered with a Unix "tape device", and relies on drivers supplied by third-party vendors or written by users.	All
<b>License available for purchase</b>	Yes	No <tar> is open-source, and distributed under FSF license.	BRU reader is freely available. BRU writer is licensed.
<b>Source Code support</b>	None.	Open-source. latest version available from www.sourceforge.net	Tolisgroup has expressed willingness to put source code in escrow.
<b>Interface</b>	GUI	Command-line; (i.e., relatively user hostile)	GUI
<b>Backwards compatibility</b>	Manufacturer (EMC/Dantz) has recently released software that aren't backward-compatible with respect to updating catalogs as well as archives of previous versions.	Limited accountability; user support subject to support by open-source community.	Comprehensive
<b>Summary</b>	Manufacturer (EMC/Dantz) has declined to discuss long-term support of their products.	Older versions won't handle source files larger than 2 gbytes; hard to tell which version supports large files. <tar> is suggested for professional IT departments only	TOLIS Group has developed and delivered BRU since 1985. At the request of the P& E Wing Deliverables Committee, TOLIS Group will provide a letter certifying source-code escrow.

**We cannot emphasize enough that long-term restorability is the goal of the Committee and it's Recommendations. A "backup" alone does not guarantee the safety or viability of the archived asset.**

Based on the preceding criteria, acceptable media for the Preferred deliverables are listed in Table 4, below:

Table 4. Long Term Master Backup Storage Media

Storage Technology	Media	Manufacturer
COMPUTER TAPE ARCHIVE	LTO-1 LTO-2 LTO-3 LTO-4	Hewlett-Packard, IBM, Quantum

(or “What The Producer Delivers To Receive Final Payment”)

### **Minimum Delivery**

For all of the Recording Technologies listed below, the Producer and/or Engineer should deliver to the Record Label:

- a.) The Masters, in their originally-recorded formats (Table 1),
- b.) Two Secondary Backup/Safety masters as follows:
  - 1.) one Secondary Backup/Safety in one of the mediums from the “Currently Acceptable Transitional Storage Media Listing”, (Table 2),
  - 2.) a second Secondary Backup/Safety, in a different medium than the Backup/Safety archive as b.1), also listed on the “Currently Acceptable Transitional Storage Media Listing” (Table 2), and...
- c.) Catalog Files for HDD Backup/Safeties, if applicable.  
Digital Backups/Safeties should have sampling rates and precisions equal to or better than the Master.

In addition to the physical masters and safeties, include “Traditional” Documentation (Tracking Sheets, Lyrics, Charts, Orchestral Arrangements and Parts, Mix Documentation). For a guideline as to what constitutes documentation, we recommend using The Media ID Label for specific labeling of each element in the delivery, and The Recording Map for detailing the recording process and related methodologies.

### **Preferred Delivery**

In addition to the Minimum Delivery elements listed above, the Preferred Delivery would include “Flattened” continuous Broadcast Wave Files of every multi-track and two-track element, without processing or automation, on a currently-approved Long Term Master Backup Storage Media (Table 4). In some situations, processing is considered to be a key component of the final product (volume level automation, compression, etc.) This may be included as a separate file in addition to the unprocessed ‘flattened file’, as mutually agreed by the Producer and the Record Company.

### ***If You Are Recording or Mixing To:***

Analog Multi-Track or Two Track, 2”, 1”, 1/2”, or 1/4” Analog Tape is the Master.

Note: High-quality Analog to Digital conversion should be used to convert Analog Masters to Digital Backups/Safeties in either PCM or DSD form using sample rates of at least 88kHz and 24bits or greater depth. It has been determined that various DSD technologies are acceptable for analog backup. We strongly encourage all users of DSD technology to contact the DSD technology provider directly for further guidance. We would also warn that much of the available DSD technology is proprietary.

Proprietary-Format Hard Disk Drive Multi- or Two Track, the Proprietary HDD is the Master. (for Alesis Masterlink, CD-R is always the Master)

Digital Audio Workstation (DAW), the HDD is the Master

Note: See Table 1. *Primary* Master Delivery Media for specifics regarding above.

### **Glossary of Technical Terms**

**32 / 44.1 / 48 / 88.2 / 96 / 176.4 / 192 / 352.8 / 384kHz** – Refers to the sample rate of a PCM digital signal or recording (samples per second).

**16 bit / 24 bit / 32 bit** – Refers to the data bit *width* (sometimes called bit depth), or precision of a PCM digital signal (or recording).

**AIFF** – Audio Interchange File Format. A computer filetype that contains digital audio data. Notably, the AIFF format does not support time stamping.

**AIT** – Advanced Intelligent Tape. Helical-Scan Magnetic Tape Storage Format developed by and proprietary to Sony.

**ATA** – Advanced Device Attachment. Often used in the same context as IDE or EIDE. Short for *Advanced Technology Attachment*, a disk drive implementation that integrates the controller on the disk drive itself. There are several versions of ATA, all developed by the *Small Form Factor (SFF) Committee*:

- \* **ATA:** Known also as *IDE*, supports one or two hard drives, a 16-bit interface and PIO modes 0, 1 and 2.
- \* **ATA-2:** Supports faster PIO modes (3 and 4) and multiword DMA modes (1 and 2). Also supports logical block addressing (LBA) and block transfers. ATA-2 is marketed as Fast ATA and Enhanced IDE (EIDE).
- \* **ATA-3:** Minor revision to ATA-2.
- \* **Ultra-ATA:** Also called Ultra-DMA, ATA-33, and DMA-33, supports multiword DMA mode 3 running at 33 MBps.
- \* **ATA/66:** A version of ATA proposed by Quantum Corporation, and supported by Intel, that doubles ATA's throughput to 66 MBps.
- \* **ATA/100:** An updated version of ATA/66 that increases data transfer rates to 100 MBps.
- \* **SATA:** the current evolution of ATA technology; Serial ATA hard drives are characterized by the use of a serial (as contrasted with 8 or 16-bit parallel) data interface stream. At the present time there is some disagreement across manufacturers as to what “SATA I” and “SATA II” actually mean. Generally, a SATA I hard drive has a serial data speed that is specified as a minimum of 1.5GHz. Some newer drives are specified as 3.0GHz serial data speed; this is often termed “SATA II”. (Note that one’s computer interface hardware has to be rated at 3.0GHz to take advantage of the increased speed of these drives.)

**Blu-Ray** – A new, optical disk technology that utilizes a short-wavelength (hence, “blue”) laser to write and read, allowing far greater amounts of data to be reliably stored.

**Broadcast Wave File** – A computer file type which contains, among other items, digital audio data. The Broadcast Wave File format is an EBU (European

Broadcast Union) standard whose data format is based on the Microsoft RIFF wave format; there is room for additional information in the file (as specified in the “header”) which allows for storage of metadata. Technical specifications are available at [http://www.ebu.ch/tech\\_32/tech\\_32xx.html](http://www.ebu.ch/tech_32/tech_32xx.html) (click on document #3285).

**BWF** – Broadcast Wave Format. Same as above.

**B-Wave** – Broadcast Wave Format. Same as above.

**CD** – Compact Disc. 5.25 inch Optical storage medium that allows storage of either 74 min./650 MB or 80 min./700 MB of information.

**CD-R** – Compact Disc, recordable *one time*. The CD-R is 5.25-inch optical media with same storage capability as CD.

**CD – RW** – Compact Disc Recordable/Writable. 5.25-inch Compact Disc format that may be written to, erased, and re-written many times.

**Channel** – one indivisible “stream” of audio. “One” channel would refer to a mono source, “two” channels might refer to a stereo source, 6 channels (and perhaps more) could refer to a “Surround” source.

**Consolidate (as it refers to audio files)** – The process of taking the constituent audio files with edits & etc for a single track (“vocal”, “guitar” & etc) and combining them into *one continuous file*.

**DAW** – Digital Audio Workstation. ProTools, Nuendo, Fairlight, Digital Performer, Emagic Logic, Sonic Solutions, SADIe & etc.

**Deliverables** – Materials turned into the Record Label upon completion of a project. Refers to all media and documentation. NARAS Master Delivery Specifications set a Minimum and Recommended set of delivery requirements.

**DLT** – Digital Linear Tape. Magnetic tape backup format owned by Quantum.

**DSD** – Direct Stream Digital. Refers to the *process* used for encoding audio in a high sample rate (2.8224 MHz) / one-bit depth format. Certain recorders from Genex, Tascam, and DAW’s from SaDiE & Merging Technologies (see below) support this format type. DSD is the technology at the foundation of Sony’s SACD release format.

**DVD** – Digital Versatile Disc - 5.25 inch Optical storage format that allows for storage of 4.7 GB for single sided media and 9.4 GB for double-sided media. There are many types of consumer DVD’s (e.g., the well-known DVD-Video, and more recently DVD-A, which provides multiple formats including 5.1, or surround, audio) and personal computer formats (DVD-R, DVD-RW, DVD+RW, DVDRAM), some of which are not compatible with certain players.

**Ecrix (was Exabyte) 820/8505** – 8mm proprietary magnetic tape storage format.

Used in many RADAR II and RADAR 24 digital recorders as backup device. No longer manufactured.

**Ecrix (was Exabyte) VXA** – 8mm proprietary magnetic tape storage format. Currently holds a maximum of 66GB of compressed data per tape (33GB uncompressed). Can be considered as a replacement to Exabyte 8505/ 820 (see above).

**EIDE** - See ATA above.

**Enterprise-Class Storage Media** – Media types that are in use by large corporations (Fortune 500, etc.). These storage types include LTO, SDLT, and AIT.

**Exabyte** – see Ecrix

**FAT32** – Logical disk format method used by PC compatible machines.

**Firewire Drive** – Hard disk utilizing an IEEE1394/**Firewire** physical interface and typically composed of a Firewire to IDE bridge chip and, inside the box, most often an IDE/EIDE drive.

**Flatten (Audio Files)** – Refers to the process of taking audio files used on a Digital Audio Workstation and converting them into one continuous file for each track. Also referred to as “Consolidation” (see above).

**HDD** – Hard Disk Drive.

**IDE** – Integrated Device Electronics. See ATA above.

**HFS, HFS Plus (also called “Extended”)** – *Logical (as contrasted to Physical)* disk format method developed by Apple. HFS Plus increases the number of allocation blocks, especially useful for high capacity hard disk drives. (HFS = MacOS Standard, HFS Plus = MacOS Extended)

**Linux / Unix <tar>** – Logical format originally developed for archival of files on Unix Machines. tar is an acronym for “Tape Archive Retrieval”. tar format is accepted as a universal and open-source logical storage format. It is *most often* used with streaming tape physical media.

**LTO** – Linear Tape Open. Magnetic Tape Format co-developed by Hewlett-Packard, Seagate and IBM. Multiple vendors for both drives and media.

**Master** – A “Master” is defined as a collection of the various original components of the recording process for a given production, each in their originally recorded

formats, and collected in a form that is ready for transition to the *next phase* of the process. (For example, the 'Master' from the tracking process is collected in a form that is ready for transition to the overdubbing process. The 'Master' from the overdubbing process is then prepared for the mixing process. The mixed 'Master' is in a form that is ready for transition to the mastering process. And so on; e.g, the *mastered* 'Master' is ready for transition to the manufacturing process (where, presumably, other 'Masters' may prevail).

"Masters" include (but are not limited to) all analog master tapes, hard disks, optical media, and all backups in turn made of *these* during the recording process. The Masters include all of the various original components of the recording process for a given production in each of their originally recorded formats. These 'Masters' should have no deletions of useful material (out-takes, artist talking, incomplete or unreleased recordings, etc.). The constitution of "useful material" is determined by agreement between Record Company and Producer prior to the commencement of the recording project.

**Metadata** - Metadata is data (or "information") about data or other information.

**MO** – Magneto-Optical. Storage method which uses an optical laser and a magnetic field to record data on an optical disk.

**NTFS** – Logical disc format developed for Windows NT, and used for Windows 2000, Windows XP, and Windows Vista. NTFS supersedes the FAT file system, offering improved support for metadata and the use of advanced data structures to improve performance, reliability and disk space utilization.

**Optical Storage Media** – Understood as recordable media which consists of several materials, one of which is heated with a laser to allow absorption (instead of reflection) to expose the 'pits' in the material which, when read by a laser, can be interpreted as data. CD-R, CD-RW DVD-R, DVD-RW & etc.

**PCM** – Pulse Code Modulation that refers to an encoding process used when converting analog audio to a binary digital file that may be written in a variety of formats.

**PDF** – Portable Document Format. An Adobe product standard that generalizes document format; it allows the same document format to be created on, and transferred between many different types of computers.

**PHDD** – Proprietary Hard Disk Drive.

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

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

**SATA** – see **Serial ATA**.

**SCSI** – Small Computer Systems Interface. An interface often used on computers for connecting devices (usually hard drives) to a computer. SCSI is currently the fastest large format random access technology available, making it desirable for Pro Audio use.

**SDII** – Sound Designer II. Used to refer to a type of audio data file originally developed by Digidesign. Limited to a maximum sample rate of 48kHz. Not recommended for any use.

**SDLT** – Super DLT. Magneto-Optical tape format owned by Quantum. Next generation of the DLT format.

**Serial ATA** – High-speed, serial-interface version of ATA interface for hard drives. Currently two data transfer speeds are specified, 1.5 and 3 gbps.

**Time Code** – The most common type of Positional Reference, usually refers to SMPTE time code (developed by the Society of Motion Picture and Television Engineers). The number (30, 29.97, 29.97drop-frame, 25, 24) specifies the timecode reference in number in frames per second.

**Track** – “Track”, for the purpose of audio storage, is a place where elements of program (music & etc) material are put. Meanings abound, however...

Track (n.): Originally, in analog tape recording, a term synonymous with one channel of content. An Ampex 301 3-track recorder had the capability of 3 separate channels of audio.

Track (n.): (proposed modern definition for audio recording) A unique, irreducible element in the context of a “production”. A modern “track” may contain one or more channels of program material (e.g., the “lead vocal track” would most often be a single-channel track, whereas the “live room track” recorded on a DAW in surround, may have 4 or more “channels” of audio). Tracks might also include, or even be limited to, MIDI or sequencing data.

The word “Track” has various additional meanings in and around music and production.

Track (n.): One individual selection on a CD or an “LP” or etc.

Track (v.): The process of recording. (example, “to track a session”)

Track (v.): Logistically, to locate. (example, “can you track down a drummer who can play in tempo?”)

**VXA** – defines a mechanism of writing and reading data in individually addressed “packets,” which is accomplished by sweeping the entire face of the tape rather than the conventional method of sequentially tracing every track embedded on the tape.

## **Glossary of Recording Technologies**

**Alesis ADAT & XT** – 8-Track 16-bit Modular Digital Recorder that uses VHS videotape.

**Alesis HD-24** – 24-Track Hard Disk Recorder

**Alesis XT-20 / Alesis M-20** – 8-Track 20-bit Modular Digital Recorder that uses VHS videotape.

**Cubase VST** – Host Based Digital Audio Workstation software.

**Digital Performer** - Host Based Digital Audio Workstation software.

**Apple Logic** - Host Based Digital Audio Workstation software. Recently purchased by Apple (July 2002) from EMagic.

**Euphonix R-1** – Multitrack Digital Hard Disk Recorder. Configurable up to 96 tracks & supports 24-bit/ 96-kHz recording.

**Fairlight MFX / MFX Plus** – Digital Audio Workstation utilizing a proprietary Hard Disk Drive format for audio storage.

**Fairlight Merlin** – 24 or 48-Track 24-bit Digital Hard Disk Recorder

**Genex GX8500 & GX9048** – 8-channel High-Density 24-bit/ 96-kHz PCM (8500) & PCM/DSD (9048) Magneto Optical Disk Recorders.

**Mackie HDR / MDR 2496** – 24-Track Hard Disk Recorder manufactured by Mackie. HDR/ MDR recorders utilize removable IDE drives in a proprietary format.

**Nuendo** – Digital Audio Workstation software manufactured by Steinberg. Runs on both PC and Mac platform, using non-specialized hardware. Supports up to 32-bit / 192-kHz Recording.

**PCM 3348 / PCM 3348-HR** – Open-reel digital 48-track recorder. PCM3348-HR machines support 24-bit resolution. PCM 3348 machines support only 16-bit resolution.

**PCM 3324** – Open-reel digital 16-bit 24-track recorder manufactured by Sony.

**ProTools 24, Mix, Mix+** – Digital Audio Workstation manufactured by Digidesign. Limited to a maximum resolution of 48kHz, 24 bit. A “host-based” system, it runs on either a Macintosh or a PC.

**ProTools HD** – Newest revision of a host-based (meaning running on a Macintosh or a PC) Digital Audio Workstation released by Digidesign. Supports sample rates & resolutions up to 192-kHz/ 24-bit.

**Pyramix** – Digital Audio Workstation manufactured by Merging Technologies. Utilizes specialized hardware and software, and runs on PC platform only.

Supports up to 32-bit/352.8 kHz and DSD recording. Pyramix Native has reduced capability and uses non-specialized hardware.

**RADAR II / RADAR 24** – 24-Track Hard Disk Recorder currently manufactured by iZ Technologies. RADAR utilizes a proprietary hard disk drive format and generates proprietary backups on DVD or Exabyte 820 / 8505 8mm Media

**SaDiE** – Digital Audio Workstation manufactured by SaDiE. Utilizes specialized hardware and software and runs on PC platform only. In various versions supports up to 24-bit/192-kHz and DSD recording.

**Sonic Studio** – Digital Audio Workstation manufactured by Sonic Solutions (now Sonic Studio). Utilizes specialized hardware and software, and runs on Mac platform only. Various iterations beginning with Sonic Studio (aka “Classic”) Sonic HD, and currently, soundBlade. Current version supports up to 32-bit/192 kHz recording.

**Sonoma** – Digital Audio Workstation manufactured by Sony. Utilizes specialized hardware and software using Windows NT operating system. Supports DSD and 16-bit/44.1- kHz recording.

**Tascam DA-88 / Sony PCM 800** – 8-Track 16-bit Modular Digital Recorder which uses Hi-8 format tapes.

**Tascam DA-78 / Tascam DA-78HR** – 8-Track 16-bit Modular Digital recorder which uses Hi-8 format tapes. The DA-78HR refers to the High-Resolution version that supports 24-bit width recording.

**Tascam DA-98 / Tascam DA-98HR** – 8-Track Modular Digital Recorders with basic editing and routing functions which use Hi-8 format tapes. The DA-98HR refers to the High-Resolution version that supports a 24-bit width recording, the DA-98 is a 16 bit machine.

**Tascam DS-D98** – Modular Digital Recorder which may be configured as a 2-track tape- based DSD (SACD format) recorder or up to 8-Track digital recorder. Supports sample rates up to and including 192 kHz.

**Tascam MMR** – 8 or 16 - track (16 is play only) Hard disk recorder with removable media (SCSI hard disk in either FAT32 or MacOS format). Unusual in that it reads Digidesign-format project files.

**Tascam MX 2424** – 24-Track Hard Disk Recorder that uses both internal and removable SCSI Hard Drives formatted in either Fat-32 or HFS formats.