

**Author(s):** Paul Conway, 2008-2010.

**License:** Unless otherwise noted, this material is made available under the terms of the **Creative Commons Attribution 3.0 License:**

<http://creativecommons.org/licenses/by/3.0/>

**We have reviewed this material** in accordance with U.S. Copyright Law **and have tried to maximize your ability to use, share, and adapt it.** The citation key on the following slide provides information about how you may share and adapt this material.

Copyright holders of content included in this material should contact [open.michigan@umich.edu](mailto:open.michigan@umich.edu) with any questions, corrections, or clarification regarding the use of content.

For more information about **how to cite** these materials visit <http://open.umich.edu/education/about/terms-of-use>.

Any **medical information** in this material is intended to inform and educate and is **not a tool for self-diagnosis** or a replacement for medical evaluation, advice, diagnosis or treatment by a healthcare professional. Please speak to your physician if you have questions about your medical condition.

**Viewer discretion is advised:** Some medical content is graphic and may not be suitable for all viewers.

# Citation Key

for more information see: <http://open.umich.edu/wiki/CitationPolicy>

## Use + Share + Adapt

{ Content the copyright holder, author, or law permits you to use, share and adapt. }



**Public Domain – Government:** Works that are produced by the U.S. Government. (17 USC § 105)



**Public Domain – Expired:** Works that are no longer protected due to an expired copyright term.



**Public Domain – Self Dedicated:** Works that a copyright holder has dedicated to the public domain.



**Creative Commons – Zero Waiver**



**Creative Commons – Attribution License**



**Creative Commons – Attribution Share Alike License**



**Creative Commons – Attribution Noncommercial License**



**Creative Commons – Attribution Noncommercial Share Alike License**



**GNU – Free Documentation License**

## Make Your Own Assessment

{ Content Open.Michigan believes can be used, shared, and adapted because it is ineligible for copyright. }



**Public Domain – Ineligible:** Works that are ineligible for copyright protection in the U.S. (17 USC § 102(b)) \*laws in your jurisdiction may differ

{ Content Open.Michigan has used under a Fair Use determination. }



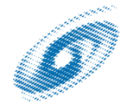
**Fair Use:** Use of works that is determined to be Fair consistent with the U.S. Copyright Act. (17 USC § 107) \*laws in your jurisdiction may differ

Our determination **DOES NOT** mean that all uses of this 3rd-party content are Fair Uses and we **DO NOT** guarantee that your use of the content is Fair.

To use this content you should **do your own independent analysis** to determine whether or not your use will be Fair.

# SI 678 Preserving Sound and Motion

Class 4 – Re-recording processes and standards

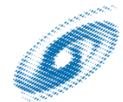


# Themes

## Themes

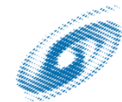
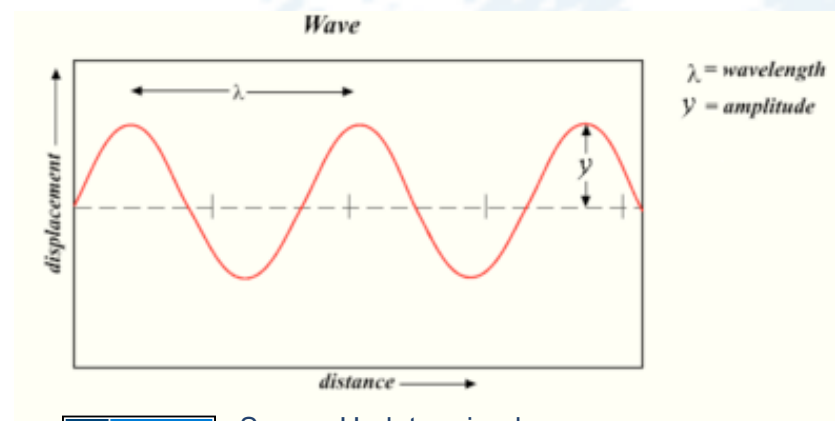
- Sound signals?
- Transfer processes
- Digital sampling standards
- Master file standard
- Format standard

*“Whenever rerecording becomes necessary, it must be done with historical faithfulness in mind” Schuller 1991*



# What is sound?

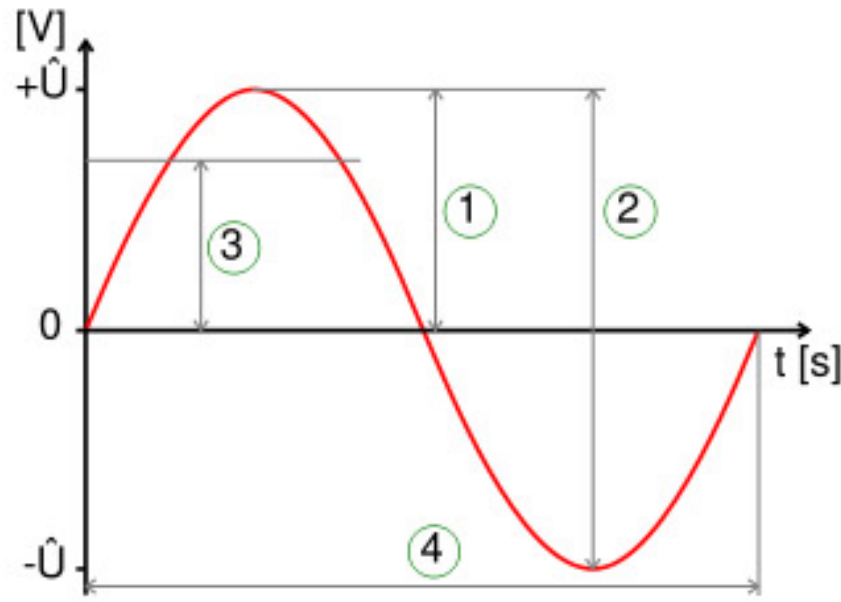
- Audible acoustic sound
  - Human ear as primary, but not only target
  - 20 kHz is maximum human hearing
- Sound waves with properties
  - Frequency (Hz), wavelength, period, amplitude, intensity, speed, and direction
- Sound pressure in dB per reference sound of 20 uPa.



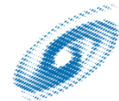
# Frequency and Amplitude

$$\lambda = \frac{v}{f}$$

- Where  $v$  is the propagation speed of the wave and  $f$  is its frequency. For sound waves in air, this is the speed of sound, 345 m/s (1238 km/h) in air at room temperature and atmospheric pressure.



© PD-INEL Source Undetermined



# Transfer processes

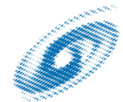
Re-recording

**Transfer**

Decision making

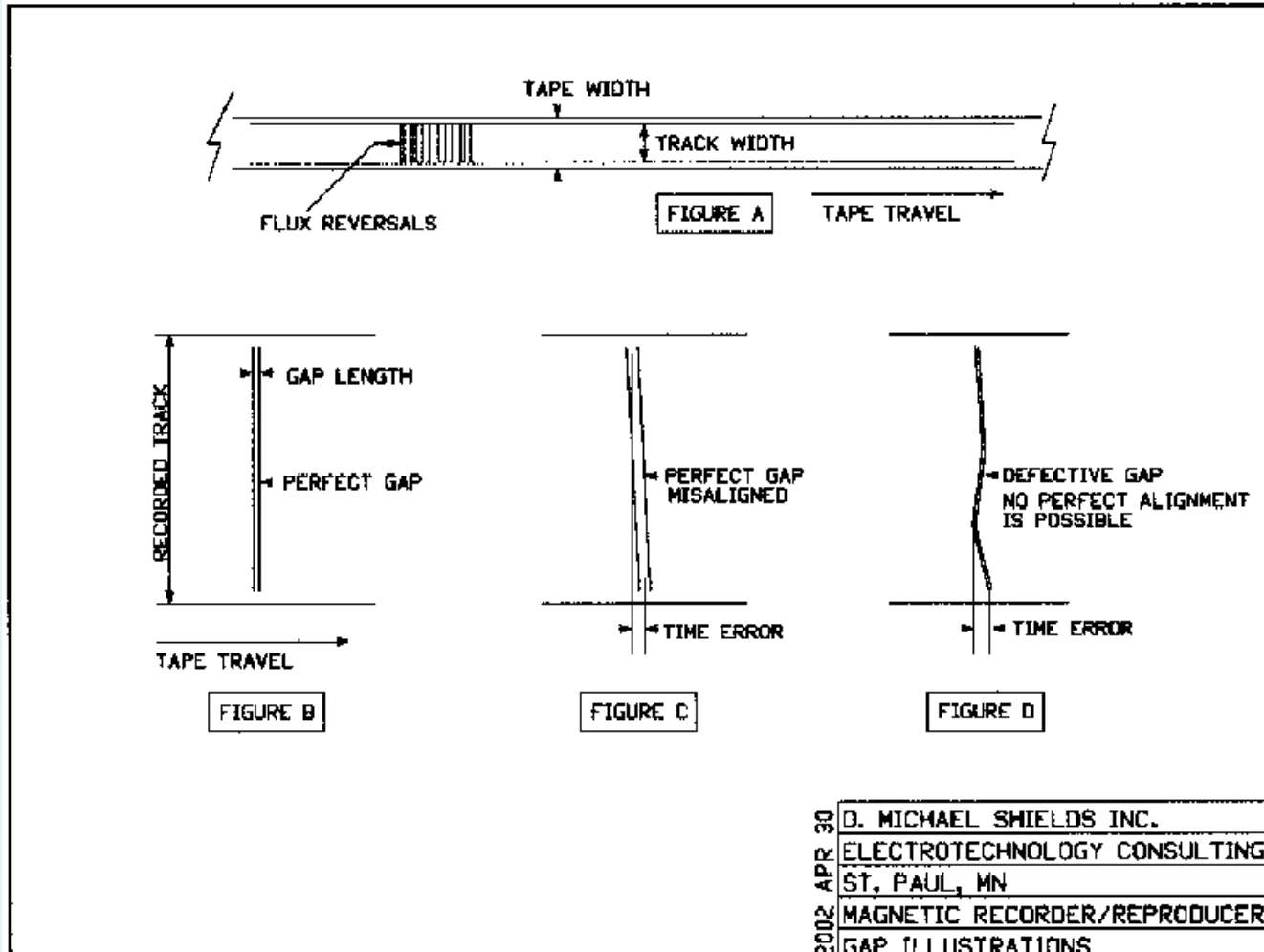
Sampling

1. Re-record from the “original”
2. Clean media and equipment
3. Use top quality equipment
4. Compensation for misalignment
5. Compensation for recording anomalies
6. Compensation for signal anomalies





# Tape Head Alignment



© PD-INEL

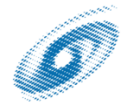
Shields, *ARSC Journal* 34:1 (Spring 2003) 48-53

SCHOOL OF INFORMATION  
UNIVERSITY OF MICHIGAN



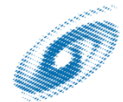
# IASA TC-03

- Ethics: Technical truth and consequences. Technical feasibility. User needs.
- 8. (p. 7): “It is important to understand that the intended signal is only part of a given sound document. The unintended and undesirable artefacts (noise, distortions) are also part of the sound document, either caused by limited historical recording technology, or subsequently added to the original signal by mishandling (eg clicks) or by poor storage. Both have to be preserved with utmost accuracy, which has consequences for the choice of digital resolution.”



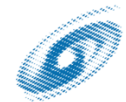
# Creating a Master File

- The master file listed here is under consideration as a future replacement for the open-reel analog tape recordings current designated as preservation masters.
  - Bitstream: Uncompressed PCM [no data reduction]
  - Configuration: Monophonic or stereo depending upon characteristics of source item
  - Sampling frequency: 96 or 48 kHz depending upon characteristics of source item
  - Word length: 24 bit word length
  - File format: WAVE
  - Enhancement: No cleanup, or minimal cleanup as agreed to by Library after analysis and recommendations at time of task order establishment
  - Filename structure: Item identifier as specified by Library, followed alpha character *m*, and extension *wav*, e.g., 1235m.wav



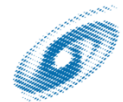
# Digital sampling

- Sample at over twice desired frequency
- CD standard – 44.1 kHz @ 16 bits
  - Compromise of fidelity and capacity
- DVD standard – 48 kHz @ 16 bits
- IASA standard [now also EBU]
  - 48/24 minimum
  - 96 kHz @ 24 bits - recommended
  - Need for international synchronization



# Broadcast Wave Format

- EBU approved metadata extension to Microsoft Wave format [fully pub.]
- Application of RIFF bitstream format [resource interchange file format]
- PCM [Pulse Code Modulation] and MGEP are the bitstream encoding methods.
- bext and mext chunks contains technical metadata
- Presently limited to 4gb files [EBU is working on this issue]



# Thank you!

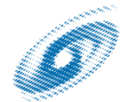
**Paul Conway**

*Associate Professor*

School of Information

University of Michigan

[www.si.umich.edu](http://www.si.umich.edu)



SCHOOL OF INFORMATION  
UNIVERSITY OF MICHIGAN