Preservation Action Plan for Digital Audio Records
National Archives and Records Administration (NARA)

DRAFT 20190801
Template 201907

Electronic Record or Digital Surrogate Types and Associated Formats

The Digital Audio category encompasses formats used to encode recorded sound as machine readable files by converting acoustic sound waves into digital signals. Digital audio formats are generally composed of both a wrapper format, usually the common name associated with the file extension, and an encoding method or codec.

Digital audio is defined as an audio waveform

Essential Characteristics of this Record Type

To render an authentic digital audio file one must preserve the structural and technical metadata that allows for proper transmission of the audio signal (duration, channels, channel mapping, sampling frequency, and bit depth).

General requirements for digital audio records: Digitize to standards appropriate for the accurate preservation of the original audio when converting analog material (e.g., audio cassettes, record albums, and reel-to-reel audio tapes, etc.). Transfer digital audio at a minimum of 16 bits per sample, but 24 bits per sample is encouraged; and Transfer digital audio at a minimum sample rate of at least 44.1 KHz, but sampling at 96 KHz is encouraged.
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Appearance

Name	Definition	Function Description
Size	Determined by bit depth, sampling rate, number of channels, and duration	

Structure

Name	Definition	Function Description
Layout Structure	Embedded technical metadata describing, among other things: format, interleaved channels, samples per second, data rate, data block size, bits per sample, and GUID	

Behavior

Name	Definition	Function Description
Display	Waveform	Audio signal is visually represented as a waveform, or data elements that characterize a sound.

Context

Name	Definition	Function Description
Descriptive Metadata	This includes but is not limited to: Unique identification number assigned by the creator; Title; Creator; Copyright: Summary	Digital Audio Files could contain, or link to: metadata that describes any attribute that could be heard in a recording or provides information about the recording.

Technical Metadata	This includes but is not limited to: Originator: Unique identification number assigned by the creator; origination date; coding history; levels	Digital Audio Files could contain or link to: data on the recording/ digitizing process including signal chain specifics, sample rate and bit depth, and other elements.
Administrative Metadata	This includes but is not limited to: catalog URL; classification or access level	Digital Audio Files could contain, or link to: metadata that describes how/ where to access the record

Current NARA Transfer Guidance for this Record Type

Preferred:
- Broadcast Wave (BWF)
- Free Lossless Audio Codec (FLAC)

Acceptable:
- Audio Interchange Format (AIFF)
- MPEG Audio Layer III (MP3)
- Wave Waveform Audio File Format (Wave, WAV)

Current NARA Public Access/Reference Format(s) for this Record Type
This Plan references existing public access file formats for electronic records at NARA, determined with a survey of the available public access formats in the National Archives Catalog. These references do not represent recommended public access formats under NARA policies. They are intended for informational purposes only.

Reference Format: MPEG Audio Layer III (MP3)

Public Access Format: MPEG Audio Layer III (MP3)

Comments and Notes

European Broadcast Union (EBU). Tech Specification of the Broadcast Wave Format (BWF) – Version 1: (https://tech.ebu.ch/docs/tech/tech3285.pdf)

Specification of the Broadcast Wave Format (BWF) - Version 2: (https://tech.ebu.ch/docs/tech/tech3285.pdf)

FLAC Format Specification version 1.21: (http://flac.sourceforge.net/format.html)

Audio Interchange File Format: "AIFF" A Standard for Sampled Sound Files Version 1.3 Apple Computer, Inc.: (http://wwwmmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/Docs/AIFF-1.3.pdf)

MPEG Audio Layer III (MP3) MP3enc, Lame - ISO/IEC-11172-3 Information technology – (https://www.iso.org/standard/22412.html), (https://www.iso.org/standard/26797.html)

Wave Waveform Audio File Format (Wave) - (http://www-mmsp.ece.mcgill.ca/Documents/AudioFormats/WAVE/Docs/riffmci.pdf)

Adaptive Multi Rate Audio

NARA Format ID: NF00102

Extension(s):
- **amr**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000254.shtml
- http://filext.com/file-extension/AMR
- http://www.voiceage.com/AMR-NB.AMR.html
- http://www.3gpp.org/dynareport/26-series.htm
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=1102
- https://en.wikipedia.org/wiki/Adaptive_Multi-Rate_audio_codec
- https://www.ffmpeg.org/ffmpeg-codecs.html

Risk and Prioritization Analysis

- ✓ Low Risk
- ☐ **Moderate Risk**
- ☐ **High Risk**
- **30 Numeric Risk Rating**
- **22 Numeric Prioritization Rating**

Proposed Preservation Plan

- ✓ **Retain** file format in its existing format.
- ☐ **Transform** file to a new format.
    Selected Format:
- ☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
- ☐ **Procure/develop tools** to transform the format to the preferred normalized form.
- ☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
- ☐ **Explore Additional Options**

Justification: The file format is well documented, there minimal files in the holdings, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- QuickTime Player
- Audacity

Audio Interchange Format (AIFF)

NARA Format ID:
- **NF00115**
- **NF00116 (AIFF with LPCM Audio)**

Extension(s):
- AIFF_LPCM
- IEF
- X-AIFF,
- X-PN-AIFF

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000005.shtml
- https://en.wikipedia.org/wiki/Audio_Interchange_File_Format
- http://sox.sourceforge.net/AudioFormats-11.html#ss11.1
- http://filext.com/file-extension/AIFF
- http://www-mmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/AIFF.html
- http://www-mmsp.ece.mcgill.ca/Documents/AudioFormats/AIFF/Docs/AIFF-1.3.pdf
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=1192

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**
18 Numeric Risk Rating
18 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.
☐**Transform** file to a new format.
>   **Selected Format:**
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented, there are only 5102 files in the holdings, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player

Broadcast Wave Format (BWF)

NARA Format ID: NF00136

Extension(s):

- wav

Documentation

- European Broadcast Union (EBU). Tech Specification of the Broadcast Wave Format (BWF) – Version 1: (https://tech.ebu.ch/docs/tech/tech3285.pdf)
- Specification of the Broadcast Wave Format (BWF) - Version 2: (https://tech.ebu.ch/docs/tech/tech3285.pdf)

Risk and Prioritization Analysis

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
47 Numeric Risk Rating
47 Numeric Priority Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.
☐**Transform** file to a new format.
   Selected Format:
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: Preferred format, ubiquitous and well-documented.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player

Free Lossless Audio Compression (FLAC)

NARA Format ID: NF00198

Extension(s):
- flac

Documentation

- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=1019
- https://en.wikipedia.org/wiki/FLAC
- https://xiph.org/flac/format.html
- https://xiph.org/flac/
- http://filext.com/file-extension/FLAC
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000198.shtml

Risk and Prioritization Analysis

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
31 Numeric Risk Rating
31 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.
☐**Transform** file to a new format.
      Selected Format:
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- Microsoft Windows Player
- Adobe Premiere Pro with **FLAC** plugin

QuickTime file with AAC Encoding

NARA Format ID: NF00392

Extension(s):
- **QTA**
- **AAC**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000110.shtml
- http://filext.com/file-extension/M4P
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000052.shtml
- http://fileformats.archiveteam.org/wiki/AAC
- https://www.iso.org/standard/38538.html

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**
13 Numeric Risk Rating
11 Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions (more than one can be selected):

☐**Retain** file format in its existing format.

✓ Transform file to a new format.
      Selected Format: BWF or MP3
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented but it is proprietary and protected by Apple. There are several hundred thousand files in the holdings, and there are limited tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- Easy M4P Converter

Preferred Viewer/Access Software

- VLC
- Windows Media Player

Advanced Audio Encoding (AAC) MPEG-2 Audio

NARA Format ID: NF00106

Extension(s):
- **AAC**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000110.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000052.shtml
- http://fileformats.archiveteam.org/wiki/AAC
- https://www.iso.org/standard/38538.html

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

✓ **Low Risk**
☐ **Moderate Risk**
☐ **High Risk**
33 Numeric Risk Rating
25 Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions (more than one can be selected):

☐**Retain** file format in its existing format.

✓ **Transform** file to a new format.
> **Selected Format: BWF or MP3**
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented but it is proprietary and protected by Apple. There are several hundred thousand files in the holdings, and there are limited tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- Easy M4P Converter

Preferred Viewer/Access Software

- VLC
- Windows Media Player

Advanced Audio Coding (AAC) Encoding MPEG-2, MPEG-4

NARA Format ID: NF00107

Extension(s):
- **AAC**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000110.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000052.shtml
- http://fileformats.archiveteam.org/wiki/AAC
- https://www.iso.org/standard/38538.html

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

13 Numeric Risk Rating

11 Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions (more than one can be selected):

☐**Retain** file format in its existing format.

✓ Transform file to a new format.

   Selected Format: BWF or MP3

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented but it is proprietary and protected by Apple. There are several hundred thousand files in the holdings, and there are limited tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- Easy M4P Converter

Preferred Viewer/Access Software

- VLC
- Windows Media Player

Advanced Audio Coding MPEG-4 Low Complexity Object

NARA Format ID: NF00108

Extension(s):
- **Advanced Audio Coding, MPEG-4, Low Complexity Object (AAC_MP4LC)**
- **MP4**
- **MPA**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000110.shtml
- http://filext.com/file-extension/M4P
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000052.shtml
- http://fileformats.archiveteam.org/wiki/M4P
- http://fileformats.archiveteam.org/wiki/AAC
- https://www.iso.org/standard/38538.html
- https://www.m4p-converter.com/

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
23 Numeric Risk Rating
15 Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions (more than one can be selected):

☐**Retain** file format in its existing format.

✓ Transform file to a new format.
> **Selected Format: BWF or MP3**
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented but it is proprietary and protected by Apple. There are several hundred thousand files in the holdings, and there are limited tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- Easy M4P Converter

Preferred Viewer/Access Software

- VLC
- Windows Media Player

MP3 File Format (MP3)

NARA Format ID: NF00335

Extension(s):
- **MP3**
- **X-MP3**
- **MPEG3**
- **MPEG**
- **X-MPEG3**
- **MPG**
- **X-MPG**
- **X-MPEGAUDIO**

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000105.shtml
- http://www.rfc-editor.org/rfc/rfc3003.txt
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000012.shtml
- https://en.wikipedia.org/wiki/MP3
- https://www.iso.org/standard/19180.html
- http://www.mp3-tech.org/patents.html

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**
17 Numeric Risk Rating
17 Numeric Prioritization Rating

Proposed Preservation Plan

✓ Retain file format in its existing format.

☐**Transform** file to a new format.
> **Selected Format:**

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding if this is required in the future.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Media Monkey

Moving Picture Experts Group (MPEG-1) Audio Layer

Please See: MPEG-1 in Digital Video Formats Preservation Plan

Sound Designer II Audio File

NARA Format ID: NF00407

Extension(s):
- sd2

Documentation
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=935
- https://en.wikipedia.org/wiki/Avid_Audio
- https://web.archive.org/web/20100302031525/http://www.riverpast.com/en/support/tutorials/convert/sd2/aif.php
- http://duc.avid.com/showthread.php?t=218838
- https://whatis.techtarget.com/definition/SD2-Sound-Designer-II-or-SDII
- https://www.pro-tools-expert.com/home-page/2018/2/1/tutorial-how-do-i-handle-old-pro-tools-sessions-with-sound-designer-2-files
- http://www.railjonrogut.com/sdTwoWav.htm
- http://nixdoc.net/man-pages/IRIX/man4/man4/sd2.4.html

Risk and Prioritization Analysis

☐**Low Risk**
☐ **Moderate Risk**

✓ **High Risk**

-38 Numeric Risk Rating
-48 Numeric Prioritization Rating

Proposed Preservation Plan

☐**Retain** file format in its existing format.

✓ Transform file to a new format.
  Selected Format: .WAV
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is not well documented, only older versions of the AVID software (Pro Tools) allow for conversion, and there are limited tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- Pro Tools
- sdTwoWav

Preferred Viewer/Access Software

- None - they must be transcoded to access them

Waveform Audio (WAV)

NARA Format ID: NF00438

Extension(s):
- WAV
- PCMWAVEFORMAT
- WAVEFORMATEX

Documentation

- https://en.wikipedia.org/wiki/WAV
- http://filext.com/file-extension/WAV
- http://www-mmsp.ece.mcgill.ca/Documents/AudioFormats/WAVE/WAVE.html
- http://www.tactilemedia.com/info/MCI_Control_Info.html
- https://msdn.microsoft.com/en-us/library/ms713498.aspx
- http://www.nationalarchives.gov.uk/pronom/fmt/6

Risk and Prioritization Analysis

✓ Low Risk

☐ **Moderate Risk**

☐ **High Risk**

39 Numeric Risk Rating (average of related file type)

39 (average of related file type)Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.

☐**Transform** file to a new format.
> **Selected Format:**

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- QuickTime Player

Windows Media Audio

NARA Format ID: NF00446

Extension(s):
- wma

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000027.shtml
- https://en.wikipedia.org/wiki/Windows_Media_Audio
- https://docs.microsoft.com/en-us/windows/desktop/WMP/file-name-extensions
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=692
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000067.shtml
- http://web.archive.org/web/20140419205228/http://msdn.microsoft.com/en-us/library/bb643323.aspx
- https://en.wikipedia.org/wiki/Windows_Media_DRM
- https://support.microsoft.com/en-us/help/11594/windows-media-components-license-agreements

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

☐ **Low Risk**

✓ **Moderate Risk**

☐ **High Risk**

16 Numeric Risk Rating

14 Numeric Priority Rating

Proposed Preservation Plan

Recommended actions:

✓ **Retain** file format in its existing format.

☐**Transform** file to a new format.
> **Selected Format:**

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented, there are only 491 files in the holdings, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player

RealMedia

NARA Format ID: NF00396

Extension(s):
- .rm
- .ra
- .ram

Please See: RealMedia in Multimedia Formats Preservation Plan