Fulldome Master Show File
IPS Standard Adoption

Version 0.5 • 12 September 2005

About the Standards Formation Process

- Formation of an official IPS Fulldome Standards Subcommittee with voting members including representatives from materially affected and interested parties.
- Development and consensus on a Proposed Standard by Subcommittee.
- Broad-based public review and comment on draft standards.
- Consideration of and response to submitted comments.
- Incorporation of approved changes into a Draft Standard.
- Right to appeal by any participant that believes that due process principles were not sufficiently respected during the standards development.
- Ratification of Draft Standard by IPS and possibly ANSI.

Overall Goal

Develop a standard data format and procedure for transferring fulldome programs.
Facilitate the automated insertion of fulldome shows with minimal human interaction.
Allow for the expansion of the specification to include 3D datasets, spatialized audio and other new technologies.

Basic Elements of a Fulldome Master Show File

I. Metadata: File carrying "data about the data" that describes contents of the Show File.
II. Dome Masters: Set of "fisheye" graphics frames that comprise visuals for program—includes alignment frames.
III. Audio Files: Files holding audio tracks—includes test tones.
IV. Standard Tech Trailer: IPS standard test patterns and audio files.
V. Distribution Medium: Recommended medium for Master Show File transfer
VI. Digital Rights Management: Encryption, etc.

I. Metadata Spec

Well-constructed metadata would provide sufficient information for automated reading and processing of contained files, and also provides important user information about the program. Possible elements include:

1) File format: XML and text, plus translation script between the two
2) Show Name, version, institution, copyright statement, and other user data

3) Number of frames (Dome Master files or length of encoded video file)
4) Resolution of Dome Master frames
5) Geometry — dome tilt, theater orientation, vertical and horizontal field of view
6) Dome Master file format or codec (e.g., TIFF, JPEG, MPEG, MPEG-2, etc.), including color bit depth, format, compression, other parameters
7) Dome master file naming convention (e.g., *filename_[#####].tga*)
8) First frame designation (e.g., 0 or 1 based)
9) Number of audio tracks
10) Audio file format
11) Audio file format parameters — sample rate, bit depth
12) Audio track parameters — track designation for, e.g., 5.1 or stereo, or virtual tracks
13) Virtual audio track parameters — e.g., STEM files, speaker placements per standard coordinates
14) Audio file naming convention (cf. Section III)
15) Time code start and end value
16) Time code parameters — e.g., 29.97 versus 30.0, drop versus non-drop, LTC/VITC, etc.
17) Media structure — location of files, number and names of disks, etc.
18) Other

II. Dome Master Spec

1) Render format – equidistant azimuthal "fisheye" render representing up to full sphere with bottom of the frame representing the front-bottom of the dome screen, and the right and left hand sides of the master correspond with the respective right and left sides of the dome to a viewer sitting at dome center within the theater. Top and sides of polar image are tangent to edges of image frame.
2) Recommended File Formats
    a. sequentially numbered lossless files: SGI RGB, TIFF or TARGAs with RLE compression, JPEG at highest-quality (i.e., lossless) setting
        i. Recommended file name format <NAME_nnnnnn.ext>
        ii. Recommended folder name format <filename_nnnnnn_mmmmmm> (where nnnnnn is min frame number and mmmmmm is max frame number).
    b. encoded movie files: MPEG-2, Motion JPEG, M-JPEG 2000, Wavelet
3) Bit Depth — 8, 10, or 12 bits/color, Cineon, etc.
4) Pixel Resolution — standard resolutions (e.g., 720, 768, 1024, 1280, 1408, 1536, 2200, 3200, 3600, 4096, 8192)
5) Recommended Frame Rate — 24 fps, 25 fps, 29.97 fps, 30 fps, 48 fps, 59.94 fps, 60 fps

6) Alignment Frames — set of standard frames included in dome master that establish synch and test proper geometric alignment, gamma, color balance, etc.
7) Unidirectional "Safe Action" area approx. ±50° longitude (measured from dome front/center), and ranging from 10–60° latitude (altitude)
8) Recommended nominal camera tilt of 15° great circle (cf. reference frame)
9) Region exterior to active pixel area colored black (except for file data)
10) Timecode (top line) and frame number (second line) in upper LH corner outside active pixel area (need to specify font size).
11) Upper RH reserved for producer use
12) Handles and pips for sync at installation — two seconds on front, one second before end of picture?

III. Audio Files

Audio Format. To accommodate for variations in sound systems in different venues, the original digital "stem" tracks can be available for re-mixing or encoding for individual venues. A "generic" 5.1 mix is derived from these files as well as a number of odd formats such as 16.1. It is preferable to re-mix the sound in each venue when possible utilizing a portable editing system.

1) Surround Format – Stereo, 5.1, 6.1, 7.1, 8.1, or stem tracks
2) File Format – WAV, AIFF
3) Leader with test tones (-18dbv)
4) Sample Frequency (e.g., 48kHz) and bit depth (e.g., 16 bits)
5) Frame rate for video sync (29.97 vs. 30 fps)
6) Start frame of 01:00:00:00
7) Basic audio file naming convention:

FILENAME	CHANNEL
filename_L.wav	Front Left
filename_R.wav	Front Right
filename_Ls.wav	Rear Left
filename_Rs.wav	Rear Right
filename_C.wav	Center Mid
filename_T.wav	Center High (Top)
filename_LFE.wav	Low frequency channel (Sub-bass)
filename_XXX.wav	T.B.D.

IV. Standard Tech Trailer

IPS standard test patterns and audio files, media sync, color balance, black-and-five, pink noise w/annunciated channel check.

V. Distribution Medium

1) Media < 4GB shall be delivered on DVDs
2) Media > 4GB shall be delivered on PC-formatted (NTFS file system) 6-pin, Firewire + USB 2.0 drives.
    a. Where multiple drives are used, same metadata should appear on each drive.
3) Video should be organized into folders according to frame numbers, typically with a maximum of 10,000 frames per folder.
4) Audio should be organized into folders according to frame rate (e.g., 25fps, 29.97fps, and 30fps folders), with sub-folders for stereo and x.x surround mixes.
5) Top level directories: "Frames" and "Audio." Etc.

Please contact Ed Lantz (ed@visualbandwidth.com) or Ryan Wyatt (wyatt@amnh.org) with any comments or questions.