

Federal Agencies Audio-Visual Digitization Working Group

Held at the National Archives and Records Administration, College Park, February 18, 2009

Abstract: Seven agencies represented, discussion of film scanning and DPX format, plans to document specifications for MXF wrapping JPEG 2000 and uncompressed video, plans for an audio-file metadata embedding project, plans for testing audio digitization system performance, and discussion of audio production problem regarding integrity of files and writing to disk.

NASA presentation about moving image work, including film archive and film scanning; by telephone from the Johnson Space Center (JSC), Houston.

Discussion of extent of holdings in the *flight film collection* and the *institutional film collection*. The total comes to several million feet, mostly 16mm, some 35, with extensive quantities of full coat magnetic film. A new telecine system was set up in Houston last year and JSC is now doing some film scanning, producing high resolution DPX files. These extremely large files are managed in a special multi-element storage system, one element of which employs LTO tape.

In the Q&A following the NASA presentation, some comparative information was provided by attendees, including the National Archives and the Library of Congress. Film scanning efforts at these two agencies are just getting rolling and are most frequently used to fulfill service requests, e.g., from documentary videomakers or to make viewing copies for institutional reading rooms.

DPX is an SMPTE standard that is widely used for mastering: if you wanted to watch the movie, the content would first have to be output from DPX to video or film. The specification is limited to picture content. But in many cases, the films being reformatted have soundtracks, either on the print or, as in some of the NASA examples, on separate reels. The group discussion and some follow-up emails highlighted an issue that arises when sound films are scanned. How are the digitally reformatted soundtracks to be synchronized to the picture at output time? Organizations in both industry and government use a variety of non-standardized approaches to manage DPX pictures and accompanying sound. The discussion of this topic highlighted the usefulness of having our Working Group to explore approaches and develop one or more best practices. Thus this topic goes on the future to-do list.

Discussion with the consultant about the documentation of MXF/JPEG 2000 and MXF/uncompressed video specifications.

This pertains to the exploration of target formats for the reformatting of videotapes. Although no agency has had enough experience to say with confidence, "this format is the one," three federal agencies (LC, NARA, and the Smithsonian) have purchased high efficiency equipment for their current video reformatting efforts. The default output of these devices is an MXF file that wraps (a) picture information compressed with lossless JPEG 2000 and (b) sound information as uncompressed LPCM. But these formats--MXF, JPEG 2000, and LPCM--each allow for some variation in how they are structured. The documentation provided by the manufacturer is helpful on this formatting but it does not provide comprehensive information. Among other things, this lack of complete information inhibits validation.

The consultant Chris Lacinak (AudioVisual Preservation Solutions), outlined his approach to planning out the documentation effort, to be carried out by specialist experts in the field, future funding permitting. In the course of planning, Lacinak said he would also consider issues related to embedding metadata.

In the discussion that followed, one member asked, “Do people in the Working Group think that the added action of applying lossless JPEG 2000 encoding is worth the effort?” Others pointed out that *uncompressed* representations had been favored in digital preservation reformatting for raster images and recorded sound. In these cases, the uncompressed representation is very transparent; little decoding is needed to recover the picture or the sound. One participant, an expert video engineer, said that, in contrast to uncompressed raster images and audio, video signals are not transparent. Video is always encoded. For him, it was a toss-up which bitstream is more complex: uncompressed video or JPEG 2000.

Meanwhile, others noted that storage costs keep coming down; the need to compress is always being reduced. But there was a recognition that video files are very large and, in addition to storage, these big master files need to move thru local area networks.

Discussion with the consultant about developing a plan for an audio-file metadata embedding project.

Most in the Working Group believe that all preservation-oriented digital files (and derivative files) ought to have some metadata embedded in them. This is partly a matter of good housekeeping, Files get separated from their context, they (or derivatives) may be provided to patrons, and so on. Embedded metadata can be valuable to determine what a file contains and where it belongs. Everyone agrees that what ought to be embedded--at least when producing or archiving files--ought to be minimal, and that appropriate identifier(s) are very important. The audio subgroup of this Working Group had prepared for this consultancy by proposing a set of seven metadata elements to consider for embedding. Following the meeting, this proposal is being refined, especially considering the constraints on what can be put into WAVE and Broadcast-WAVE files as currently structured.

Lacinak discussed the matter of workflow-related “when-to-embed” questions, which pertains to the development of tools to support embedding (tools to be planned now, carried out later, funding permitting). In most reformatting production activities, metadata in a database can be output, tagged, and then handed off for embedding. One option is to embed while a file is in the hands of the transfer engineer. The other option is to embed in a post-process, perhaps run on files in the local storage system that often is part of an audio-transfer lab.

The discussion also considered expanded ideas for the future, for actions that would follow this consultancy. These included consideration of the EBU specification for the *axml* chunk (part of the Broadcast-WAVE specification) and the use of the MXF format as a wrapper for WAVE or Broadcast-WAVE files. These approaches would permit the inclusion of a more expansive block of metadata.

What about reading the embedded metadata? The group highlighted the important role that is likely to be played by JHOVE (and JHOVE2, presently underdevelopment). JHOVE permits archives to determine the validity and well-formed-ness of the files they are working with, and the software can report on the contents, including a representation of embedded metadata. The current JHOVE module for WAVE files recognizes the *bext* and *axml* chunks, and also reports out the content of the WAVE INFO list.

Discussion with the consultant about developing a plan for testing audio digitization system performance.

The issue here is “how do you know your digitization system is doing what it should?” Lacinak said that there were tools and methods for testing systems but these require both engineering quality equipment

and engineering knowledge. This task is intended to plan for the development of a tool that could be used by persons with less advanced skills and knowledge. As currently stated, the task entails confirming (or adjusting) the pass-fail points provided in IASA document TC-04, which many in the meeting accepted as reasonable and appropriate. The “input” point for this performance measurement action would be the final spot for an analog signal, i.e., at the equivalent point to the output of a tape or disc player. This is not to look at the performance of analog playback devices themselves, but rather at what happens to the analog signal downstream, as it moves through the a-to-d converter and to the file-writing device, i.e., the DAW.

The discussion that followed turned on a new element to consider, not part of the task statement of work as drafted. Lacinak pointed out some happenstances that could lead to defects in the newly created digital file. Some of these result from the operation of competing processes in the DAW computer, e.g., virus checking, launching a screen saver, and other background processes. To a point, a trained engineer can be expected to know enough to turn some of these processes off, but what about the invisible ones? Similar problems may arise from the use of metadata collection tools (does the engineer keyboard metadata during the digitization process?), and when USB or Firewire “chains” are in use. High-end graphics cards on workstations may rob from other processes as they present visual information. One member observed that some of these competing processes may be required by federal agency security rules, e.g., virus checking. One agency had established private VLANs (virtual local area networks) for their workstations, in order to get permission to eliminate some required security elements from media workstations.

The introduction of this topic led to testimony from agency specialists who had encountered corrupted files, some of which had been created by vendors (“we hear mysterious clicks on playback that were not in the original recordings”) and some created by internal staff. One person remarked that this issue is “one of the hidden secrets in digital audio.” There was enough testimony to indicate that there was a problem here that ought to be addressed, to the degree possible in this consultancy, and perhaps in additional future work.

To what degree can an approach be developed to address this family of problems? Since the background processes that interfere with the integrity of writing files may run intermittently, and may additionally be hard to track down, can a workstation be pre-checked? (Answer: up to a point.) If an application tried to monitor ongoing activity, would it itself contribute the problem? (Answer: that this can be addressed, at least up to a point.)

Following the meeting, Lacinak sent an email in which he wrote that he was thinking about a separate A/D chain that does not go into the computer (audio workstation). The output of this would be compared to the signal that is fed into the computer and variance would indicate an issue.