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DVD Delivery for In-Flight Entertainment

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FOREWORD

The DVD Working Group (DVDWG) was formed in December 1997, as a sub-committee of the World Airline Entertainment Association (WAEA) Technology Committee. The DVDWG membership includes representatives from a broad range of organizations associated with the In-Flight Entertainment (IFE) industry, as well as invited experts from outside the industry. The membership includes representatives of airlines, IFE equipment providers, movie studios and post-production houses, and experts in the fields of digital video, video compression, and security. The charter of the DVDWG is to identify and standardize specifications for the distribution of DVD media to In-Flight Entertainment systems.

WAEA Specification 0598: DVD Delivery for In-Flight Entertainment is the result of the committee's work. This specification identifies and standardizes several aspects of source media, digitization, compression and encoding, authoring and navigation, encryption, duplication and distribution media. Much of this specification comprises references to other international and industry specifications with parameterizations for the specific needs of the IFE industry. By utilizing other standards, the DVDWG and WAEA have aligned this specification with broader trends in the digital multimedia industries.

Specification 0598 is organized as follows: Sections 1 and 2 provide a brief introduction describing the purpose and scope of this specification. Sections 3 and 4 list references to other specifications and documents found in the normative and informative sections respectively. Sections 5, 6 and 7 provide definitions of terms, abbreviations, and a description of conventions used in this document. Section 8 defines the general reference model for systems and processes that are the subject of this specification. This section identifies the interfaces and processes that are specified in this document. The normative requirements mandated by this specification are found in Sections 9, 10, 11, 12 and 13. Section 9 deals with interface requirements. Section 10 provides authoring and navigation requirements. Section 11 describes security requirements. Section 12 has requirements for DVD media loaders for file servers. Section 13 covers quality assurance. Sections 14 and 15 provide normative and informative annexes respectively. There are appendices on binary metadata file format, representative security data file structure, the Content Scramble System (CSS) License and Specifications, participants and sponsors.

1. INTRODUCTION

1.1 Purpose

The purpose of this specification is to define methods of creating and formatting DVD media for IFE systems. The DVDWG recognizes that the commercial industry has created broad standards in this general area, including the DVD Forum and the Moving Picture Experts Group (MPEG). Wherever possible, this specification draws from those standards and applies them to this application.

This specification also includes specific provisions in order to promote greater inter-operability between content providers and post-production houses (the suppliers of digital media), and the various IFE platforms.

A unique specification is needed because there are certain requirements that are particular to IFE applications. For example, IFE systems are required to provide robust support for multiple languages, either as subtitles or supplementary audio programs associated with a single video program. Also, IFE systems are generally constrained as a result of requirements imposed for very low power, size and weight.

1.2 Overview of Content Types

There are many IFE content types that might use DVD media. In the interest of generating this specification in a timely manner, the DVDWG has decided to first address a set of core content types. Future versions of this specification may be created which address other content types. The core content types addressed in this version are as follows:

- a) Feature Entertainment
- b) Short Subjects (including advertising)
- c) News Features
- d) Sports Features
- e) Specialty Videos (Safety, Destination, Passenger Messages)
- f) Television Series
- g) Music and Audio Programs
- h) Program Specific Information, including Metadata

1.3 Overview of DVD Applications

The DVDWG has identified several possible uses of DVD onboard the aircraft, primarily divided between At-The-Seat and Head-End uses:

IFE DVD At-The-Seat Applications.

- Seat-Integrated Personal Video Players.
- Hand-Held Personal Video Players. This includes airline-supplied portable DVD PVPs and airline-supplied laptop computers containing a DVD device.

IFE DVD Head-End Applications.

- Overhead (Bulkhead) Displays.
- Multi-Channel Distributed Systems.
- Media Loader for Audio/Video On-Demand Systems.
- Cabin File Server Data Sources.

These applications generally support video programs with associated passenger-selectable multi-language audio and subtitles. Additionally, passenger-selectable multi-channel audio only entertainment is possible with most of these applications.

1.4 Reference Model

This specification defines an overall system reference model, which provides an abstract description of the overall process of creating DVD media and delivering it to IFE systems. The reference model identifies functions and interfaces between those functions. A detailed description of the system reference model is found in Section 8.

1.5 Interfaces

This specification specifies requirements for key interfaces in the reference model in order to ensure interchangeability of data across those interfaces.

2. SCOPE

This specification describes the specifications for DVD content delivery to IFE systems. This comprises detailed specifications for source media, digitization, compression and encoding, authoring and navigation, security, and distribution media. The scope of these specifications provides for the ability to deliver digital audio-visual content from its origin to DVD devices aboard aircraft. This specification is limited to applications where source media are encoded prior to being delivered to the aircraft.

3. NORMATIVE REFERENCES

The following international and industry standards contain provisions, which, through reference in this text, constitute provisions of this specification. At the time of publication, the editions indicated were valid. All of these referenced standards are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the referenced standards indicated below. Members of the International Electrotechnical Commission (IEC) and the International Standards Organization (ISO) maintain registers of currently valid International Standards.

14 CFR, 21	Part 21 – Certification Procedures for Products and Parts. U.S. Department of Transportation, Federal Aviation Administration, Federal Aviation Regulations. (Also known as FAR 21.)
14 CFR, 145	Part 145 – Repair Stations. U.S. Department of Transportation, Federal Aviation Administration, Federal Aviation Regulations. (Also known as FAR 145.)
ARINC 485	Cabin Management and Entertainment System Protocols.
ANSI X9.52-1998	Triple Data Encryption Algorithm Modes of Operation.
ARINC 628	Cabin Equipment Interfaces.
ATSC A/52 1995	Digital Audio Compression (AC-3) Standard. Available from < http://www.atsc.org >. (An errata for this document is available from < http://www.dolby.com >.)
DDPEG	Dolby Digital Professional Encoding Guidelines. Available from < http://www.dolby.com >.
CSS License	CSS License Agreement, version 1.0. October 2000. DVD Copy Control Association, Inc. Available from < www.dvdcca.org/dvdcca/ >.
CSS Specifications	CSS Procedural and CSS Technical Specifications, version 1.0. October 2000.

	DVD Copy Control Association, Inc. Available from < www.dvdcca.org/dvdcca/ >.
DVD Specification	DVD Specification for Read-Only Disc, Version 1.1; Part 1: Physical Specifications, Part 2: File System Specifications, Part 3: Video Specifications; December 1997. DVD Forum.
ECMA-267	120 mm DVD - Read-Only Disk; December 1997. Available from < http://www.ecma.ch/ >.
ECMA-268	80 mm DVD - Read-Only Disk; December 1997. Available from < http://www.ecma.ch/ >.
ECMA-272	120 mm DVD Rewritable Disk (DVD-RAM); February 1998. Available from < http://www.ecma.ch/ >.
ECMA-273	Case for 120 mm DVD-RAM Disks; February 1998. Available from < http://www.ecma.ch/ >.
ECMA-279	80 mm (1.23 Gbytes per side) and 120 mm (3.95 Gbytes per side) DVD-Recordable Disk (DVD-R); December 1998. Available from < http://www.ecma.ch/ >.
ECMA TR/71	DVD Read-Only Disk File System Specifications; February 1998. Available from < http://www.ecma.ch/ >.
FIPS 46-3	Data Encryption Standard. National Institute of Standards and Technology. October 25, 1999. Available from < http://www.itl.nist.gov/fipspubs/ >.
IEC Publ. 908:1987	“CD Digital Audio System”.
ISO 639	“Terminology - Codes for the Representation of Names of Languages”.
ISO/IEC 11172-1:1993	“Information Technology - Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbps, Part 1: Systems” (a.k.a., MPEG-1 Systems).
ISO/IEC 11172-2:1993	“Information Technology - Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbps, Part 2: Video” (a.k.a., MPEG-1 Video).
ISO/IEC 11172-3:1993	“Information Technology - Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbps, Part 3: Audio” (a.k.a., MPEG-1 Audio).
ISO/IEC 13346:1995	“OSTA Universal Disc Format (UDF) Compliant Domain” Volume and file structure of write-once and rewritable media using non-sequential recording for information interchange.
ISO/IEC 13818-1:1996	“Information Technology - Generic coding of moving pictures and associated audio information, Part 1: Systems” (a.k.a., MPEG-2 Systems).
ISO/IEC 13818-2:1996	“Information Technology - Generic coding of moving pictures and associated audio information, Part 2: Video” (a.k.a., MPEG-2 Video).
ISO/IEC 13818-3:1995	“Information Technology - Generic coding of moving pictures and associated audio information, Part 3: Audio” (a.k.a., MPEG-2 Audio).
JAR 145	Joint Aviation Requirements, Approved Maintenance Organisations, Change 2. Joint Aviation Authorities Committee. July 10, 1998.
OSTA UDF 2.00	Universal Disk Format Specification, revision 2.00; April, 1998. Available from < http://www.osta.org/ >.
Rec. ITU-R BT.601-5	“Studio encoding parameters of digital television for standard 4:3 and wide-

screen 16:9 aspect ratios”, October 1995. (Equivalent to CCIR 601.)

Rec. ITU-R BR.648 “Digital recording of audio signals”.

WAEA 1289-2, Rev. 1 “Specifications for Mastertape Recording and Tape Duplicating of Airborne Audio Entertainment Systems”, World Airline Entertainment Association, January 1993. Available from <<http://www.waea.org/tech/general/techspecs.html>>.

4. INFORMATIVE REFERENCES

The following references contain information that relates to this specification, but are not provisions of this specification. At the time of publication, the editions indicated were valid.

FIPS 140-1. Federal Information Processing Standards Publication 140-1: Security Requirements for Cryptographic Modules. National Institute of Standards and Technology. January 11, 1994. Available from <<http://www.itl.nist.gov/fipspubs>>.

RSA Laboratories. *Frequently Asked Questions About Today’s Cryptography*, version 4.1. May 2000. Available from <<http://www.rsasecurity.com/rsalabs/faq/>>.

Schneier, Bruce. *Applied Cryptography*, Second Edition (fifth printing or greater). John Wiley & Sons, 1996.

Stallings, William, ed. *Cryptography and Network Security: Principles and Practices*, 2nd ed. Prentice-Hall, Inc., 1999.

Taylor, Jim. *DVD Demystified*. McGraw Hill, 1998.

Taylor, Jim. *DVD Frequently Asked Questions*. September 27, 2000. Available from <<http://dvddemystified.com/dvdfaq.html>>.

World Airline Entertainment Association. *Specification 0395: Content Delivery for In-Flight Entertainment*, version 1.1. April 1996. Available from <<http://www.waea.org/tech/general/techspecs.html>>.

5. DEFINITIONS

At-The-Seat	The passenger seating environment where DVD devices may be utilized or controlled by passengers, which includes both airline-supplied seat-integrated DVD PVPs and hand-held DVD PVPs.
Authoring	The process of designing, creating, collecting, encoding and formatting material for DVD-Video.
Bit Rate	The rate at which the compressed bit stream is delivered from the channel to the input of a decoder.
Compression	Reduction in the number of bits used to represent an item of data.
Content Key	A symmetric cryptographic key used to encrypt content.
Content Scramble System	A form of data encryption used to protect DVD-Video discs.
Decoder	A circuit or program that decodes and thereby decompresses audio or video.
Decoding (Process)	A process that reads an input coded bit stream and outputs decompressed picture or audio samples.
Device ID	A unique identifier solely associated with a single IFE DVD device.
Device Key	A statistically unique key pair used to protect Content Keys, existing independently of a physical device.

Dialog Normalization	A Dolby Digital parameter that describes the long-term average dialog level of the associated program. It may also describe the long-term average level of programs that do not contain dialog, such as music. This level is specified on an absolute scale ranging from -1 dBFS to -31 dBFS. Dolby Digital decoders attenuate programs based on the Dialog Normalization value in order to achieve uniform playback level.
Dolby Digital (AC-3)	A multi-channel digital audio encoding technology used for end-user delivery applications.
Dolby E	A multi-channel digital audio encoding technology used for post-production and distribution applications.
Dual-Layer	The substrate of a DVD disc can contain one or two data carrying layers, where information is recorded in a pattern of microscopic pits. Discs containing two substrate layers read from the same side are commonly referred to as dual-layer discs.
DV	Digital Video. Refers to the digital videocassette standard developed by Sony and JVC.
DVCAM	Sony's proprietary version of DV.
DVCPRO	Matsushita's proprietary version of DV.
DVD	An acronym for Digital Video Disc and/or Digital Versatile Disc, an audio, video and data optical storage disc.
DVD-5	A 4.7 billion byte capacity single-sided, single-layer 12 cm DVD disc
DVD-9	A 8.5 billion byte capacity single-sided, dual-layer 12 cm DVD disc
DVD-10	A 9.4 billion byte capacity double-sided, single-layer 12 cm DVD disc
DVD-18	A 17.0 billion byte capacity dual-sided, dual-layer 12 cm DVD disc
DVD-Audio	DVD format for high quality audio presentation as defined in DVD Specification for Read-Only Disc, Part 4: Audio Specifications, version 1.0. See also DVD-ROM.
DVD-RAM	DVD format for rewritable disc as defined in DVD Specification for Rewritable Disc, Part 1: Physical Specifications and Part 2: File System Specifications, version 2.0. A format of DVD on which data can be recorded more than once using phase-change recording technology.
DVD-Recordable	DVD format for write once recording disc as defined in DVD Specification for Recordable Disc, Part 1: Physical Specifications and Part 2: File System Specifications, version 1.9. A format of DVD-ROM using organic dye polymer sublimation technology on which data can be recorded once (sequentially only).
DVD-ROM	DVD format for read-only disc as defined in DVD Specification for Read-Only Disc, Part 1: Physical Specifications and Part 2: File System Specifications, version 1.0. This is the base format for DVD-Video and DVD-Audio.
DVD-RW	DVD format for re-recordable disc as defined in DVD Specification for Re-Recordable Disc, Part 1: Physical Specifications and Part 2: File System Specifications, version 0.9. A phase-change re-writable format of DVD-ROM, using similar track pitch, mark length and rotation control as DVD-R.
DVD-Video	DVD format for high quality video and audio presentation as defined in DVD Specification for Read-Only Disc, Part 3: Video Specifications, version 1.1. See also DVD-ROM.
Dynamic Range Control	A feature of Dolby Digital that allows the end user to retain or modify the dynamic range of a Dolby Digital encoded program upon playback. The amount of control is dictated by encoder parameter settings and decoder user options.

Early Window Content	Audiovisual material (e.g., feature films) released in limited markets and/or territories as to be deemed by the content owner as requiring a high level of protection greater than that given to the consumer market.
Encryption	The alteration of the characteristics of data using cryptographic algorithms in order to protect said data from unauthorized use.
Elementary Stream	A generic term for one of the coded video, coded audio or other coded bit streams in Packetized Elementary Stream packets.
Encoder	A circuit or program that encodes and thereby compresses audio or video.
Encoding (Process)	A process that reads a stream of input picture or audio samples and outputs a compressed bit stream.
Fingerprinting	A technique for embedding into the IFE DVD device content stream a hidden value that is used to identify the device key(s) used to decrypt the content.
Head-End IFE Equipment	Centrally-installed IFE equipment which provides entertainment services and audio-visual content for distribution to the passenger(s) in the aircraft cabin.
I-Frame	An I-frame, or intra-coded picture, is coded using information only from itself (without motion compensation prediction).
Key	A data item used with a cryptographic algorithm for encryption/decryption.
Late Window Content	Audiovisual material (e.g., feature films) released in sufficient markets and/or territories as to be deemed by the content owner as requiring the same level of protection as the consumer market.
Metadata	Data about data, such as data about the video but not the video bits themselves.
Multiplexing	Combining multiple signals or data streams into a single signal or stream, usually achieved by interleaving at a low level.
Private Key	A data item (key) used with a cryptographic algorithm for decryption that is known only to the key holder.
Program	A program is a collection of program elements. Program elements may be elementary streams. Program elements need not have any defined time base; those that do, have a common time base and are intended for synchronized presentation.
Program Specific Information	Program specific information consists of normative data that is necessary for the de-multiplexing of Transport Streams and the successful regeneration of programs.
Public Key	A data item (key) used with a cryptographic algorithm for encryption/decryption that is publicly available and known.
Reserved	Reserved, when used in the clauses defining the coded bit stream, indicates that the value may be used in the future for WAEA defined extensions. Unless otherwise specified within this specification, all reserved bits shall be set to "1".
+RW	A non-DVD Forum format of optical disc that uses phase-change technology with wobbled groove and either CLV format for sequential video access or CAV format for random access.
Seat-Integrated DVD Device	A DVD LRU that is electrically and structurally certified to be an installed and incorporated payload on a passenger seat. The LRU shall only be removable for aircraft maintenance purposes and not easily accessible or removable by the passenger except for normal DVD handling and control.
Security Module	A dedicated security subsystem realized in electronic hardware within an Early Window Content IFE DVD device that has tamper-detection and tamper-resistance.

Single-Layer	The substrate of a DVD disc can contain one or two data carrying layers, where information is recorded in a pattern of microscopic pits. Discs containing one substrate layer are commonly referred to as single-layer discs.
Subpicture	Graphic bitmap overlays used in DVD-Video to create subtitles, captions, karaoke lyrics, menu highlighting effects, and so on.
Subtitle	A textual representation of the spoken audio in a video program. Subtitles are often used with foreign languages and do not serve the same purpose as captions for the deaf and hard of hearing.
Title	The largest unit of a DVD-Video disc (other than the entire volume or side). A disc can hold up to 99 Titles.
Transport Stream	A transport stream combines one or more elementary program streams with one or more independent time bases into a single bit stream.
Unicode	A 16-bit fixed-width character encoding that encompasses virtually all characters widely used in computers.
Universal Disc Format	A standard developed by the Optical Storage Technology Association as a subset to ISO/IEC 13346 recordable, random-access file system and volume structure format.
.Vob	A file extension for a file containing one or more Video Object Blocks.

6. ABBREVIATIONS AND SYMBOLS

AES	Audio Engineering Society
ANSI	American National Standards Institute
ARINC	Aeronautical Radio, Inc.
ASCII	American Standard Code for Information Interchange (a coding scheme which represents characters numerically).
ATSC	Advanced Television Systems Committee
ATVEF	Advanced Television Enhancement Forum
BITE	Built-In Test Equipment
BMP	Bitmap
CAV	Constant Angular Velocity
CCIR	Consultative Committee for International Radio
CD-DA	Compact Disc - Digital Audio
CFR	Code of Federal Regulations
char	Character
CLV	Constant Linear Velocity
cm	Centimeter
CRC	Cyclical Redundancy Check
CSS	Content Scramble System
DASH	Digital Audio Stationary Head
dBFS	Decibels relative to digital Full Scale
DCT	Digital Component Technology (a digital videotape format). Also, Discrete Cosine Transform (as used in the MPEG compression algorithms).
DES	Data Encryption Standard
dialnorm	Dialog normalization
DVC	Digital Video Cassette (an earlier name for DV)
DVD-R	DVD Recordable

DVD-ROM	DVD Read Only Memory
DVDWG	WAEA DVD Working Group
DVS	Descriptive Video Services
EBU	European Broadcasting Union
ECMA	European Computer Manufacturers Association
EDL	Edit Decision List
FAQ	Frequently Asked Questions
FAR	Federal Aviation Regulations
FIPS	Federal Information Processing Standards
GIF	Graphical Interchange File Format
HMI	Human Machine Interface
ID	Identification
IEC	International Electrotechnical Commission
IFE	In-Flight Entertainment
int	Integer (32 bit)
ISO	International Standardization Organization
ITU	International Telecommunications Union
JAR	Joint Aviation Requirements
JPEG	Joint Photographic Experts Group
KMA	Key Management Authority
LPCM	Linear Pulse Code Modulation
LRU	Line Replaceable Unit
Mbps	Megabits Per Second
mm	Millimeter
MPA	Motion Picture Association
MPAA	Motion Picture Association of America
MPEG	Moving Picture Experts Group
OMF	Open Media Format
OSTA	Optical Storage Technology Association
PCM	Pulse Code Modulation
PEL	Picture Element
PGC	Program Chain
PID	Packet Identifier
Publ.	Publication
PVP	Personal Video Player
RAM	Random Access Memory
Rec.	Recommendation
ROM	Read Only Memory
RSA	Last name initials of the three inventors of the RSA public-key cryptosystem: Drs. R. L. Rivest, A. Shamir, and L. Adleman.
SMPTE	Society of Motion Picture and Television Engineers
SPRM	System parameter (player data register)
struct	structure
S-VHS	Super VHS (an analog videotape format).
TAR	Tape Archive

TIFF	Tagged Image File Format
UDF	Universal Disc Format
UOP	User Operation (control data)
USCC	United States Closed-Captioning
VHS	Video Home System (an analog videotape format)
WAEA	World Airline Entertainment Association

7. CONVENTIONS

The mathematical operators used to describe this specification are similar to those used in the C programming language. The bitwise operators are defined assuming two's-complement representation of integers. Numbering and counting loops generally begin from 0.

7.1 Operators

7.1.1 Arithmetic Operators

x Multiplication.

7.1.2 Relational Operators

: Ratio of two numbers.

7.1.3 Assignment

= Assignment operator.

8. SYSTEM REFERENCE MODEL

8.1 Purpose

The system reference model identifies all of the pertinent interfaces between the source media and the IFE system. These interfaces are identified to form a common basis for understanding the overall system requirements. Some, but not all, of these interfaces are specified in this specification.

8.2 Overall System Description

The overall system is shown in the Top Level Reference Model of Figure 1.

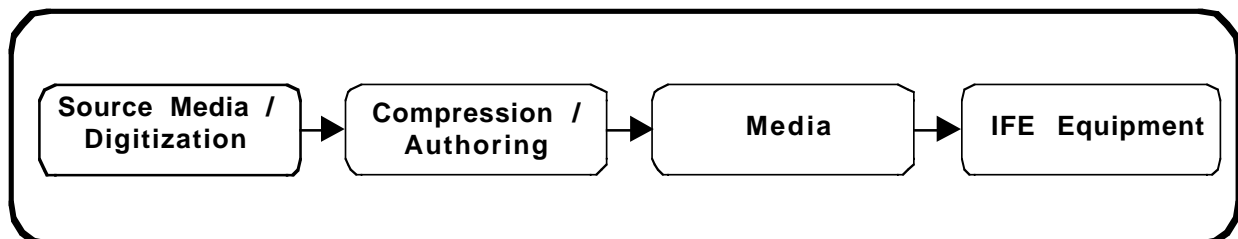


Figure 1 - Top Level Reference Model

This specification places restrictions on the processes that can take place in the three left-most functions of the reference model in Figure 1 and implies requirements for the right-most function. Additionally, requirements for the syntax and semantics of interfaces between the top level processes shown in Figure 1 are imposed. Specification of these interfaces further constrains industry standards for DVD production.

This overall system deals with getting content from the providers (e.g., film studios), through the laboratories (post-production, compression houses), and through the distribution process for secure delivery to DVD devices that are part of the IFE equipment. For the purposes of this specification, the DVD IFE system is considered to be either installed equipment on board an aircraft or a portable device used in flight. Two classes of DVD devices are the At-The-Seat applications and Head-End applications. At-The-Seat applications include: Seat-Integrated personal video players and hand-held personal video players. Head-End applications include: overhead (bulkhead) displays, multi-channel distributed systems, media loader for audio/video on-demand systems and cabin file server data source.

8.3 Detailed System Description

8.3.1 Source Media/Digitization

The Source Media/Digitization block of the top level reference model can be further broken into more detail as shown in Figure 2. This process results in ITU 601 or ITU 656 video and other elements as defined in Section 8.3.2.1.

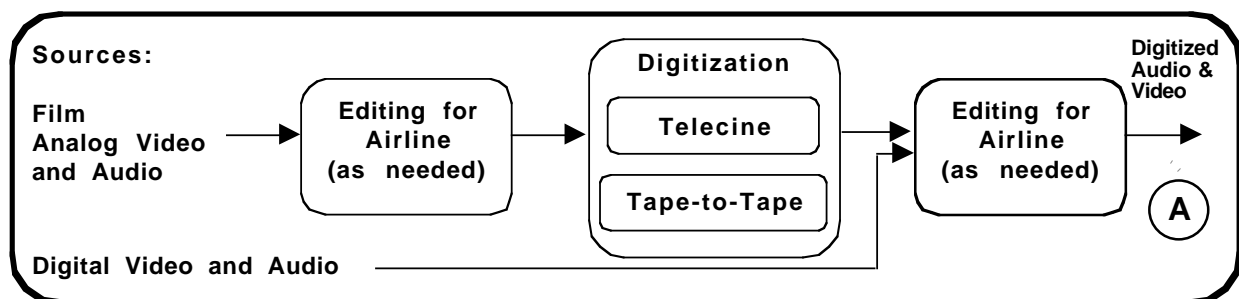


Figure 2 - Source Media/Digitization

8.3.1.1 Source Media

The possible source media may include, but not be limited to:

- a) **Film**
 - 35 mm, 16 mm, 65/70 mm
- b) **Analog Video**
 - Betacam SP & M-II - Analog component
 - 1" Type C & Type B - Analog composite
 - 3/4" U-matic - Color under analog composite
 - VHS, S-VHS, Hi-8, 8 mm Video, Miscellaneous video

c) **Analog Audio**

- Multi-track Open Reel Audio Tape
- Audio cassettes
- 16 mm, 17.5 mm, 35 mm magnetic audio film stock

d) **Digital Video**

- SMPTE 274M - High-Definition component digital
- D-1 / DCT / Digital Betacam / D-5 / D-9 – ITU 601 component digital
- D-2 / D-3 - composite digital
- DV
- DVCPRO
- DVCAM
- Betacam SX

e) **Digital Audio**

- DAT
- Hi-8 Metal-P Digital Audio Cassette (commonly referred to as DA-88)
- DASH

f) **Program Information Sources**

- Edit Decision Lists (EDLs)
- Open Media Format data (OMF)
- ATVEF
- Single-layer and multi-layer graphics and menu files (TIFF, BMP, JPEG, GIF, etc.)
- Chapter Stops
- Key information and security data
- Subtitling and captioning information
- Program Metadata

See Section 15.10 for informative guidelines regarding source material.

8.3.1.2 Editing for Airline (analog domain)

In the analog domain, editing for airlines, if required, includes film editorial processes and video editorial processes.

8.3.1.3 Digitization

This is an analog to digital conversion process. The majority of film digitization is performed by telecine systems. Tape-to-tape processes convert analog video to digital component video.

8.3.1.4 Editing for Airline (digital domain)

In the digital domain, editing for airlines, if required, includes video editorial processes, program information authoring, and possible further tape-to-tape manipulation. *Time compression is not recommended.*

8.3.2 Compression/Authoring

The Compression/Authoring block of the top level reference model can be further broken into more detail as shown in Figure 3. Two possible processes are described based on different data encryption methods. These processes result in compressed, encrypted, digital files.

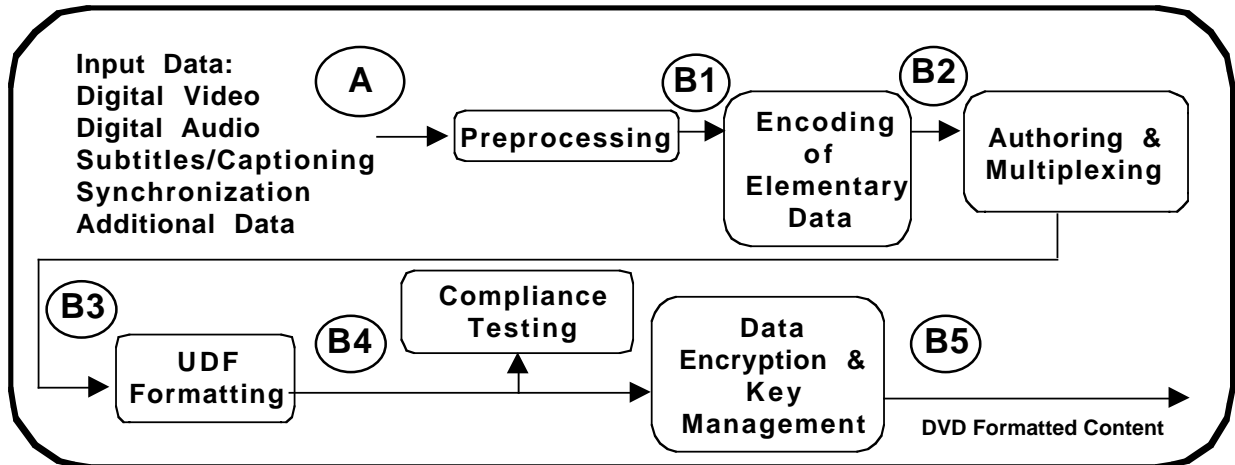


Figure 3 - Compression/Authoring With Sector Level Encryption

8.3.2.1 Input Data Types

The input data for Compression/Authoring include:

- a) **Digital Video**
 - ITU 601 program material
- b) **Digital Audio**
 - AES/EBU digital audio bitstream (channels 1-4 from digital video, or other media) @ 48 kHz sampling
 - Content to include possible additional languages, commentary, Descriptive Video Service (DVS), etc.
 - Monaural or stereo
 - Dolby E
 - Pull-up handles for resumption of audio encoding
- c) **Subtitles and Captioning**
 - Sub-pictures data set (text and timing data or file list, timing data, and associated graphics files)
 - Line 21 binary data file

d) **Synchronization**

- Time code embedded in elementary bit stream
- Encoding starts at the same time code for audio and video

e) **Additional Data**

- Chapter stops
- 3:2 pulldown instructions
- Content aspect ratio information
- Source PEL aspect ratio information
- Field dominance information
- Time code lists
- Audio dynamic range type
- Program information sources (EDL, OMF, video index, etc.)
- Program Metadata

8.3.2.2 Preprocessing

Optional preprocessing includes:

- a) Spatial/Temporal filtering:
 - Noise and grain reduction, electronic aperture correction, etc.
- b) Dirt & scratch removal processes
- c) Facility information, user defined data creation

8.3.2.3 Encoding of Elementary Data

This function includes encoding of elementary data:

- a) Data streams created:
 - Elementary video
 - Elementary audio
 - Subpictures

8.3.2.4 Authoring and Formatting

As defined in the DVD Specification for Read Only Disc, Version 1.1, Part 3.

8.3.2.5 Support for Compliance Testing

The formatted file may be subjected to compliance testing. Testing of compliance at points other than interface B4 may be reasonable.

8.3.2.6 Data Encryption & Key Management

The security function optionally includes:

- a) Encryption of data files or sectors
- b) Key generation and management.

8.3.3 Media

The Media block of the top level reference model can be further broken into more detail as shown in Figure 4. Via this interface, appropriate media is used to deliver the DVD video specification formatted, potentially encrypted, digital discs to the IFE DVD equipment onboard the aircraft.

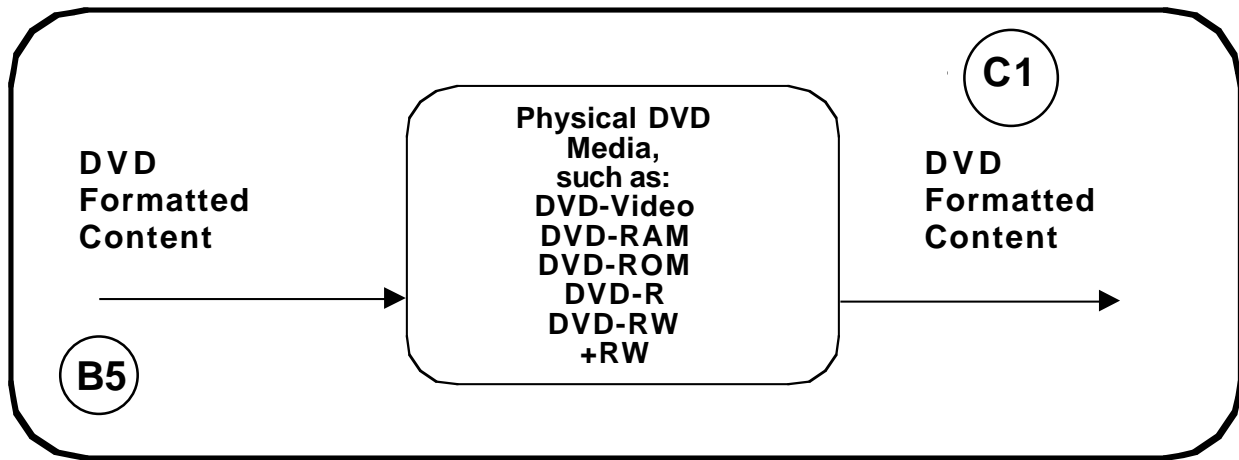


Figure 4 - Media

8.3.4 In-Flight Entertainment (IFE) Equipment

The IFE Equipment block of the top level reference diagram can be further broken into more detail as shown in Figure 5 and Figure 6. This is the actual place where the in-flight entertainment services are provided to the passengers. There are two possible equipment models: head-end and at-the-seat. In head-end models, the DVD device accepts content for forwarding into an on-board distribution system. There may be provision for an optional control back-channel between the DVD device and the on-board distribution capability. In at-the-seat models, the passenger accepts DVD media into an airline-provided personal DVD device for playback. In either case, the IFE equipment provides services to passengers, displaying picture, sound and other aspects of the human machine interface that eventually allows the passengers to enjoy the programming.

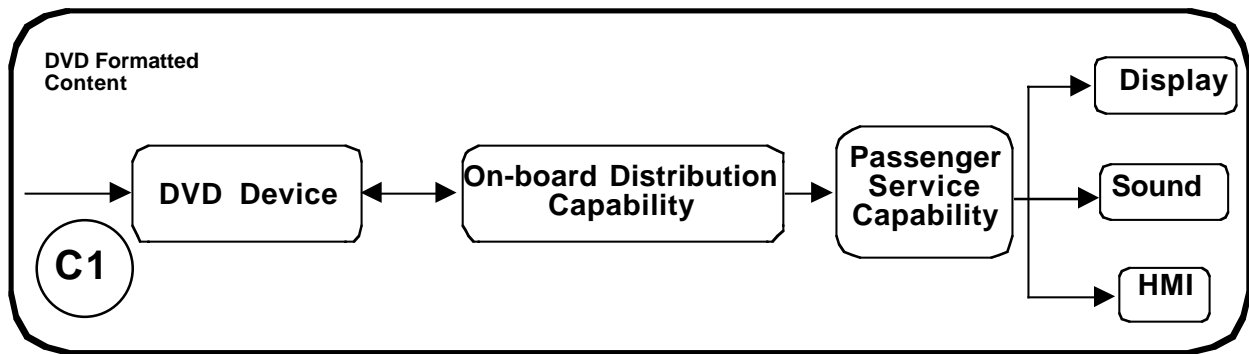


Figure 5 – Head-End DVD In-Flight Entertainment Equipment

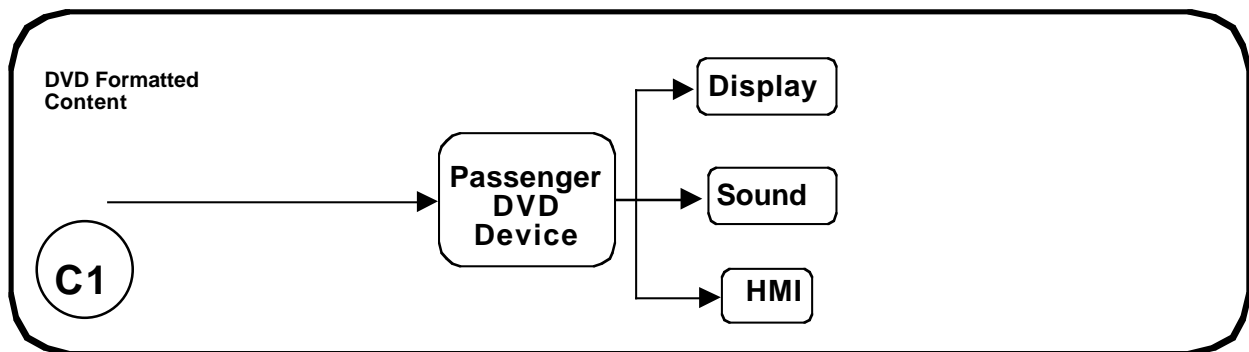


Figure 6 – At-the-seat DVD In-Flight Entertainment Equipment

9. SPECIFICATION OF INTERFACES

9.1 Interface A - Source Media/Digitization Output

Interface A provides the interface between the input data defined in Section 8.3.2 and possible preprocessing functions. This interface includes all digitized or coded content data with logical and temporal relationships to the compression encoding function. All video and audio elements described in Section 8.3.2 will be able to be conveyed across this interface. While captioning, subtitles, synchronization and additional data may be conveyed across interface A, some data may also be delivered directly to the B2 and B3 interface.

9.1.1 Audio and Video

Video shall be digitized according to Rec. ITU-R BT.601-5.

525/60 or 625/50 DVD-Video discs shall be permitted.

A mechanism shall be provided to allow audio and video information for a given program to be synchronized. SMPTE or EBU time code is recommended for this purpose.

Audio that is part of audio-visual programming shall be conveyed according to Rec. ITU-R BR.648. Audio that is part of audio-only programming shall be conveyed according to Rec. ITU-R BR.648 or according to IEC Publication 908:1987.

Since the quality of the resulting compressed digital output of the processes addressed in this specification will depend largely on the quality of the initial input, the input shall be created from the highest quality source material available. See Section 15.10 for informative guidelines regarding source material.

9.1.2 Binary Metadata File Information

Some of the information for populating the binary metadata file shall be provided by the content provider and shall be passed across this interface. The information shall be provided according to the syntax defined in Appendix A: Binary Metadata File Format. Some information is not known at this interface. This information shall be added at interface B3 as it becomes available. On an IFE DVD disc, the file containing the binary metadata file shall be named Metadata.md and be located in a directory named WAEA located at the root level of the directory structure.

9.2 Interface B1 - Preprocessing Output

Interface B1 provides the interface from the preprocessing function to the elementary data Encoding function. All preprocessing (such as filtering, dirt and scratch removal processes, and noise reduction) is optional, though highly recommended.

9.3 Interface B2 - Encoding Output

Interface B2 provides the interface from elementary data Encoding function to the Authoring and Multiplexing function.

9.3.1 Encoding of Elementary Data

The elementary data Encoding function includes the generation of MPEG-1 or MPEG-2 elementary video streams, Dolby Digital or LPCM elementary audio streams, and, optionally, MPEG audio or other proprietary audio formats, as defined in the DVD Specification.

9.3.1.1 Video Encoding

Video will be encoded using either MPEG-1 (ISO/IEC 11172-2) or MPEG-2 (ISO/IEC 13818-2), with further constraints as imposed by the DVD Specification. In the interest of maximizing video content quality, there shall be no constraints to or deviation from the DVD Specification except as otherwise defined in this specification. Consideration should be made during the encoding process for the fact that IFE DVD discs may increasingly be displayed on progressive scan monitors. Therefore, every effort should be made to ensure the accuracy of various MPEG-2 display parameters. These parameters include the progressive_frame flag as defined in ISO/IEC 13818-2 and also the capture_timecode as defined in the content description data amendment.

9.3.1.2 Audio Encoding

Audio shall be encoded pursuant to the DVD Specification, except as otherwise defined in this specification.

Dolby Digital Dynamic Range Control and Dialog Normalization specifications shall be followed, as described in the Dolby Digital Professional Encoding Guidelines.

9.3.2 Subtitles

Subtitles shall be encoded pursuant to the DVD Specification, except as otherwise defined in this specification. Subtitle placement should be optimized for both 4:3 and 16:9 display types.

9.4 Interface B3 - Authoring & Multiplexing Output

Interface B3 provides the interface from the authoring and multiplexing function to UDF formatting function. This is generally an internal interface within an authoring system. A contribution to this interface is the completed binary metadata file, if present.

9.5 Interface B4 - UDF Formatting

Interface B4 provides the interface from UDF formatting to the data encryption and Key management function.

The output of this interface is a binary disc image and control files. This interface provides a convenient point to perform compliance testing.

9.6 Interface B5 - Data Encryption & Key Management Output

Interface B5 provides the interface from the data encryption and Key management function to the media function.

9.7 Interface C1 - Media Output and IFE Equipment Input

The C1 interface specifies physical DVD media for transferring DVD formatted content to the IFE DVD devices on the aircraft.

DVD devices shall at a minimum be capable of reading DVD-Video discs (DVD-ROM and DVD-R) and CD audio discs (CD-DA). DVD devices should not adversely affect the integrity of a CD-R audio disc.

The DVD device shall accommodate 525/60 or 625/50 DVD-Video disc formats or both. However, standards conversion of content between 525/60 and 625/50 shall not be permitted. Spatial up-conversion of content is permissible under the following conditions. For 625/50 streams employing `progressive_frame=true` (typically film mode material), the DVD device may also perform temporal up-conversion provided that (refresh rate x two) is evenly divisible by the encoded field rate. Furthermore, for streams employing `repeat_first_field=true` and `progressive_frame=true`, (typically 525/60 film mode material), the DVD device may perform temporal up-conversion provided that (refresh rate x five) is evenly divisible by the encoded field rate.

For Head-End overhead and multi-channel distributed DVD systems, to ensure compatibility with existing IFE systems, the analog audio output of the DVD device should support the playback of at least four simultaneous audio streams.

For Head-End overhead and multi-channel distributed DVD systems, remote control via ARINC 485 pursuant to ARINC 628 shall include delivery of data from the binary metadata file, as described in Appendix A.

For Head-End overhead and multi-channel distributed DVD systems, the DVD device shall be fully compliant with ARINC 628, including ARINC 485 and BITE. This does not preclude the addition of features accommodating legacy equipment.

Data-only loading of application or operational software or data via DVD media or devices, not utilizing audio or video content, is outside the scope of this specification.

10. AUTHORING AND NAVIGATION REQUIREMENTS

Cross-utilization of Seat-Integrated and Head-End content is highly desirable. Therefore, Head-End overhead and multi-channel distribution system DVD devices shall have the same software requirements as At-the-Seat DVD personal video players. In furtherance of this objective, the user interface, including menu selection and interactive capabilities, shall have the following requirements:

10.1 DVD Disc Software Requirements

The use of multiple languages and language-selection options, including the use and selection of sub-titles, shall be implemented pursuant to the DVD Specification, except as otherwise defined in this specification.

Upon insertion of an IFE DVD disc into an IFE DVD device, a menu shall be displayed. At a minimum, said menu shall display available language and/or subtitle choice(s) and a prompt to initiate play. In addition, this menu may allow the user to select the preferred language and/or subtitle choice and play. This menu may be blocked or substituted as described in Section 10.2.

Authoring settings for IFE-compatible DVD discs upon startup in IFE devices shall be:

- If multiple aspect ratio versions of content are available on a DVD disc, the default aspect ratio selected shall be appropriate to the display based upon the system parameter settings.
- Subtitles shall be off by default.
- The default language shall be as defined by the Authoring process (i.e., software defined), based upon system parameter settings in the DVD device.

Cycling of language selection, including subtitles, shall be enabled via UOPs.

If the IFE DVD disc requires the enabling of elapsed and remaining time status information (calculated function), then authoring shall be constrained to sequential PGCs.

For the purpose of enabling random-access programming, separate addressable programs on a single IFE DVD disc shall exist in separate addressable Titles.

If present, the minimum parameter set of the binary metadata file as defined in Appendix A herein shall include:

- a) Running time
- b) Audio tracks: Available languages, Stream IDs, and number of languages
- c) Subtitles: Available languages, Stream IDs, and number of languages
- d) Content rating information (e.g., MPAA ratings)

- e) Content credits (e.g., actor(s), director, etc.)
- f) Plot summaries
- g) Table of contents for random access capabilities (i.e., programs on the disc may be programmed to be played in any order; this is similar to programming the tracks on a CD player)
- h) Version information (e.g., edited or theatrical)

10.2 Hardware Requirements

Pursuant to the DVD Specification, the user controls for the DVD device should be capable of permitting the cycling of language selection and subtitles without a menu selection having to be made.

The menu displayed upon insertion of an IFE DVD disc into an IFE DVD device may be determined through the use of an identification bit or by the IFE DVD system.

The preferred implementation of this functionality is through the use of a player SPRM bit. Until such time as an identification bit and its associated register is defined by the DVD Forum, it is recommended that Head-End IFE DVD systems block audio and video output while menus are displayed. The intention of this control is to prevent menus from being inappropriately displayed, such as on an overhead video display in the cabin of an aircraft.

11. SECURITY REQUIREMENTS

The DVD content delivery system must be capable of protecting intellectual property from unauthorized access. It is desirable that the security system have minimum impact on airlines for handling of protected content.

There are a number of mechanisms that can be used to protect intellectual property delivered using this specification. The intellectual property owner shall determine if a particular item or class of intellectual property must be protected, what level of protection is required, and if a particular implementation of the security protocol offered by an IFE vendor is acceptable.

The determination of Early Window Content and Late Window Content status shall be made unilaterally by individual content owners on a title by title basis.

11.1 Late Window Content Security Protocol

The Late Window Content security protocol is applicable to the following applications:

- All DVD devices intended for use on board an aircraft supplied by the airline, including DVD portable devices.

This protocol is limited to DVD-ROM discs, due to the requirements of CSS.

The Late Window Content security protocol shall not be used in DVD media loader applications. CSS licensing requirements restrict the transfer of CSS protected content from one media to another.

11.1.1 Requirements for Late Window Content Security Protocol

DVD discs and DVD devices for Late Window Content shall use CSS encryption as defined by the CSS License and CSS Specifications.

Late Window Content DVD *devices* on board an aircraft and supplied by the airline shall be coded ONLY with a Region 8 region code. Region 8 region code is defined in the DVD Specification for Read Only Disc. The DVD Forum approved the use of an additional region code, Region 8, for international use in IFE and other non-theatrical markets in August 1999. As required by the CSS License and CSS Specifications, multiple or all region DVD *devices* are not permitted.

Late Window Content DVD *discs* on board an aircraft and supplied by the airline shall be region coded to enable playback on a Region 8 DVD device. This does not preclude creating discs that are coded with additional region codes or discs that are so-called “all region” or “region free.”

Refer to the CSS License and CSS Specifications from the DVD Copy Control Association, Inc., for further information. Certain key provisions of the CSS License and CSS Specifications are referenced in Appendix C.

11.2 Early Window Content Security Protocol

The Early Window Content security protocol is applicable to the following application:

- A DVD device that is electrically and structurally certified to be an installed and incorporated payload on an aircraft. The DVD device shall only be removable for aircraft maintenance purposes and not easily accessible except for normal DVD disc handling and control.

Early Window Content shall be protected from unauthorized access, including playback on non-IFE DVD devices. Early Window IFE DVD security protocol is not for the general consumer market, and, accordingly Early Window IFE DVD security protocol shall not be distributed or otherwise made available in the general consumer market. The Early Window Content security protocol shall support multiple vendors for both key management and security modules.

11.2.1 Requirements for Early Window Content Security Protocol

Requirements for the Early Window Content Security Protocol are:

1. Each Early Window Content DVD device shall have one Security Module, containing, at a minimum, one statistically-unique private key known as the Device Key. The Security Module may include a secure authenticated channel between replaceable secure components. The Security Module shall provide all Early Window Content security functions for the IFE DVD device, including decryption, key protection, authentication and Fingerprinting, in a secure environment. Support for Fingerprinting within the IFE DVD device shall occur in a secure component. The encrypted content stream of Early Window Content shall pass through the Security Module for decryption. The unencrypted content stream shall not be retrievable on accessible interfaces or buses without Fingerprinting. Interconnections and interfaces between components of a Security Module shall be conducted through secure and tamper-resistant means. The Security Module shall be replaceable, but the Device Key shall be rendered unusable in the event of Security Module removal.

2. The content on an Early Window Content disc shall be encrypted using three key Triple-DES. At least one triple-DES Content Key shall be created for each Early Window Content disc. The Early Window Content encryption algorithm shall be common to all systems and shall be three key Triple-DES. Mode of operation shall be Electronic Code Book (ECB).
3. The Content Key shall be encrypted separately for each Early Window Content DVD device's Device Key.
4. The .Vob files containing Early Window Content on a DVD disc shall be encrypted, except for navigation packs which shall be entirely in the clear. Said encryption shall include the last 1920 byte data area of every encrypted sector in the .Vob files, leaving the leading 128 byte data area in the clear. Encryption shall be performed in 8 byte blocks.
5. The encryption scheme for encrypting the Content Key(s) need not be the same for all players, but shall in all cases be at least as secure as 1024 bit RSA.
6. There shall be a common security data file structure to include keys, which is defined in Section 14.4. On an IFE DVD disc, the file containing the key table shall be named KeyTable.kt and be located in a directory named WAEA located at the root level of the directory structure.
7. Early Window Content shall be encrypted until playback, including whenever it is being transferred between Secure Facilities.
8. Early Window Content DVD devices shall not have digital video outputs.
9. Device Keys shall be renewable and revocable.
10. Early Window Content DVD *devices* on board an aircraft and supplied by the airline shall be coded ONLY with a Region 8 region code. Region 8 region code is defined in the DVD Specification for Read Only Disc. As required by the CSS License and CSS Specifications, multiple or all region DVD *devices* are not permitted.
11. Early Window Content DVD *discs* on board an aircraft and supplied by the airline shall be region coded to enable playback on a Region 8 DVD device. This does not preclude creating discs that are coded with additional region codes or discs that are so-called "all region" or "region free."
12. Security Module robustness should meet the requirements of FIPS 140-1 Security Level 3. For the purpose of this specification, the definition of operator as defined in FIPS 140-1 refers only to those individuals having direct access to the cryptographic Security Module. The provisions of this specification prevail in cases of conflict with FIPS 140-1.

11.3 Requirements for Early Window Content Security Protocol Fingerprinting

The purpose of Fingerprinting of Early Window Content is the traceability of pirated content. Fingerprinting in this context is not for copy control management (though copy control management information is not precluded from the Fingerprint), but rather for the tracking of pirated content to its source.

Fingerprinting implementations shall be robust, upgradeable, traceable and enable revocation.

The Fingerprint shall not compromise the security of the system (e.g., the private portion of the device key shall not be revealed in the Fingerprint's hidden value).

11.4 Secure Environment and Facilities for Early Window Content

A Secure Environment is where access to Early Window Content IFE DVD devices, keys and content is closely controlled by Secure Facilities. Early Window Content IFE DVD devices with active Device Keys shall be maintained within Secure Environments and Secure Facilities. It is highly desirable that Early Window Content IFE DVD devices contain Device Keys only on the aircraft.

Secure Facilities have the following highly desirable characteristics:

- a. A clear, structurally-delineated restricted perimeter.
- b. Physical access to secured areas is monitored and limited to authorized personnel.
- c. Security processes and procedures are codified and enforced.
- d. Inventory and movement of individual Early Window Content IFE DVD devices, keys is tracked and traceable.

For the purpose of this specification, Secure Facilities have all the above characteristics and include at least one of the following:

- a. Facilities that have adopted the recommendations resulting from an MPA security review.
- b. Facilities that are JAR 145 and/or FAR 145 approved.
- c. Facilities that are JAR 21 and/or FAR 21 approved.
- d. Those portions of airport premises which are within the airport security perimeter (commonly referred to as "airside").
- e. IFE equipment installed on a commercial passenger aircraft.

Transport of Early Window Content IFE DVD devices with Device Keys between non-contiguous Secure Environments shall be traceable pursuant to JAR 145 and/or FAR 145. It is highly desirable that said device's Device Key be rendered unusable during transport between non-contiguous Secure Environments.

Transport of Device Keys shall occur only in encrypted form. This means that Device Keys shall not exist in clear form except within the boundaries of a Security Module.

11.5 Key Management

The content provider shall own its Content Keys. Therefore, key management authorities shall operate cooperatively under the direction of content providers.

Access control through the use of keys shall be managed jointly by the content provider, laboratory, the IFE DVD system provider, and the airline. The airline or their agent shall be responsible for maintaining the secrecy and security of their Device Keys and for implementing a new Device Key if said keys are compromised.

A lost or non-traceable Early Window Content IFE DVD device with a Device Key shall *de facto* be considered compromised and shall have its Device Key (or information leading to its Device Key) reported to, and de-authorized by, the appropriate key management authorities within 24 hours of discovery of the event.

If a Security Module is lost, malfunctioning or has evidence of tampering, it shall *de facto* be considered compromised and shall have its Device Key (or information leading to its Device Key) reported to, and de-authorized by, the appropriate key management authorities within 24 hours of discovery of the event.

The primary function of a Key Management Authority (KMA) is to provide assurance that content is enabled only for authorized playback devices and that all Device Keys used in the system remain confidential. Enforcement of KMA requirements shall be contractual with licensing agreements between content providers, airlines and KMAs.

Multiple companies can contribute to the charter of a KMA (e.g., a content provider, an authoring facility and a trusted third party may all participate in and be components of a single KMA). The functions described may be performed by one or more KMAs, each of whom may perform all or part of the indicated functions. In cases where the KMA functions are shared among multiple KMAs, they shall cooperate in a secure fashion under content providers', airlines' and device manufacturers' direction. The number of KMAs should be minimized to reduce security risks and to ease the handling of daily functions.

A Key Management Authority shall be responsible for:

- Secure creation, storage, assignment and configuration control of the Device Key and other device unique data (e.g., Device ID or Key-Loading Key) for each IFE DVD device.
- Secure support of Device Key updates as necessary.
- Secure creation, storage, assignment and configuration control of Content Keys (unless provided by the content provider).
- Secure generation of encrypted Content Key Tables for content based on a content provider's (or its KMA's) authorized Device Key list.
- Revocation of the Device Key if improper use is discovered.

Content providers shall be responsible for:

- Requesting the revocation of a compromised Device Key (which might be determined from a unique Device ID).
- Potentially, the secure creation, storage, assignment and configuration control of Content Keys.

Airlines shall be responsible for:

- Requesting the revocation of a compromised Device Key or Device ID.

Device manufacturers shall be responsible for:

- Requesting the revocation of a compromised Device Key or Device ID.
- Activation of a statistically-unique Device Key for each IFE DVD device manufactured.

A Key Management Authority shall document its policies and procedures for:

- Secure authenticated communication of data.
- Playback device activation, authorization and authentication, including handling of Key Loading Keys and Device Keys.
- Performing Device Key updates.
- Creating, managing and implementing lists of authorized Device Keys.
- Interacting with other KMAs.

12. REQUIREMENTS FOR DVD MEDIA LOADERS FOR FILE SERVERS

A DVD media loader is a device or group of devices used to transfer digital information from a remote location to an aircraft by means of DVD media. The data, in digital format, may be used onboard the aircraft for such items as, but not limited to, IFE content, software upgrades, or aircraft configuration information. The loading of data other than audiovisual content by a DVD media loader is outside the scope of this specification, though UDF support is recommended.

12.1 DVD Disc Format for DVD Media Loaders

The DVD disc shall be formatted to standard DVD-ROM specifications, as set forth in the DVD Specification for Read-Only Disc, Part 2: File System.

12.2 DVD Media Loader

The DVD media loader shall use only the UDF file space when reading the DVD-ROM discs.

If the media loader is utilized to load IFE DVD Early Window Content, it shall utilize the security protocol for same as set forth in this specification.

13. QUALITY ASSURANCE

Compliance with this specification does not guarantee acceptable quality of the encoded media, and does not replace the need for skill and judgment in the art and science of motion picture and video laboratory practices. Nothing in this specification is intended to replace normal content provider quality assurance processes.

14. NORMATIVE ANNEXES

14.1 Intellectual Property

The intention of this specification is to only require the use of intellectual property that meets the ISO/IEC/ITU guidelines for inclusion of intellectual property in international standards, which, paraphrased, requires licensing of intellectual property on a fair, reasonable and non-discriminatory basis. It is the responsibility of parties implementing this specification to ensure they obtain necessary licenses for use of intellectual property used in their implementation.

14.2 Specification Disclaimer

This specification is based on material submitted by various participants during the drafting process. The WAEA has not made any determination whether these materials could be subject to valid claims of patent, copyright or other proprietary rights by third parties, and no representation or warranty, expressed or implied, is made in this regard. Any use of or reliance on this document shall constitute an acceptance thereof “as is” and be subject to this disclaimer.

14.3 All-Airline Generic IFE DVD Discs

The use of all-airline generic IFE DVD-Video discs is strongly encouraged. To this end, an all-airline “generic” IFE DVD-Video disc shall contain only the program content and shall not contain airline logos, introductions or other forms of branding.

14.4 Security Data File Structure

This section describes the structure of the data contained in the Early Window Key reference file. Said structure shall:

- Support interoperability of IFE DVD discs and devices.
- Contain necessary data to decipher the encryption type.
- Obtain key data.
- Support multiple key management methods.
- Exist as a standard file in the MicroUDF system.

Appendix B includes a representative security data file structure, which is informative.

15. INFORMATIVE ANNEXES

15.1 Disc Labeling

Any IFE DVD disc that is unusable in a consumer DVD device should be labeled to that effect. In addition, it is desirable that IFE DVD discs display a similar warning on the IFE display screen upon initial playback.

15.2 DVD Device Configuration Methodology

It is desirable for the DVD devices within an airline environment to not contain certain user configuration functions that would normally be found, even required, within a consumer DVD device. This configuration information should be fixed by the factory or only settable by airline maintenance personnel. Specific IFE DVD device functions that need to be set and controlled are:

15.2.1 Default Audio

Default audio controls the spoken language of the DVD disc. This should be set to match the primary language of the airline. If the configured language is not available on any given disc then the default language of the disc will be used instead.

15.2.2 Default Subtitle Language

Default subtitle language controls the subtitle language of the DVD disc. This should be set to match the primary language of the airline. If the configured language is not available on any given disc then the default subtitle language of the disc (if defined) will be used instead.

15.2.3 Default Subtitle Display

Default subtitle display controls the display of subtitles and should be configured to *Off*. The subtitle language control may be overridden by the subtitle control of the disc. It is required in Section 10.1 that this feature not be used on initial disc startup. Furthermore it is recommended that a subtitle display button cycle between available subtitles *and* the off state.

15.2.4 Default Menu Language

Default menu language controls the menu language of the DVD disc. This should be set to match the primary language of the airline. If the configured language is not available on any given disc then the default menu language of the disc (if menus are defined) will be used instead.

15.2.5 Parental Level

Parental level ratings should be configured to allow all material to be displayed. In DVD parlance, the parental level shall be set to *None*, or “*No parental level.*”

15.3 Chapter Stops

Absent the existence of any other chapter stop information, a chapter stop may be forced in authoring every five or ten minutes for the purpose of fast access using chapter skips.

15.4 Methodology to present warnings and other screens based on DVD device region code

DVD *discs* can be coded with more than one region code. This allows DVD discs to be created for use in the consumer market with the same disc being useable for airlines using the Late Window Content security protocol. The differences in presentation needed (e.g., eliminating the private viewing only warning) for the two versions can be accomplished through the use of the SPRM(20) register, which specifies the region code of the DVD *device*. As part of the disc authoring process, commands can be included which will skip over or include various materials on the basis of DVD *device* region code. In effect, this will make a disc play as though it had a unique version, depending on playback in a region 8 or another region code DVD device.

15.5 Dialog Normalization and Dynamic Range Control

The requirements of WAEA 1289-2, Rev. 1, may be accomplished through the use of Dolby Digital Dialog Normalization and Dynamic Range Control, as described in the Dolby Digital Professional Encoding Guidelines provided with Dolby Digital encoders.

Audio tailoring for the aircraft environment may be accomplished through the use of dynamic range processing sub-systems located in IFE DVD device playback hardware. Because of this, careful selection of dialnorm values is imperative when authoring IFE compatible DVD discs.

It is anticipated that IFE DVD hardware dynamic range processing sub-systems may take advantage of this commonly encountered relationship between nominal dialog level and headroom. These devices may establish dynamic range compression coefficients based on the dialnorm value encountered on the DVD disc. Incorrect dialnorm values may lead to an unsatisfactory experience in the IFE environment.

15.6 DVD Menus and Navigation Simplicity

Special consideration should be taken to use simple DVD disc menus and consistent navigation procedures to ease operation of DVD devices and DVD discs by flight crews and passengers.

15.7 Headphones and PA Pause

Headphone jack output impedance, if supplied by the DVD device, should have headset compatibility from 32-300 ohms. It is desirable that the design of the passenger control unit for a seat-integrated DVD device supply power for noise cancellation headsets. It is also desirable that the passenger control unit have headset compatibility from 32-300 ohms. It is desirable that the PA pause actually pause the DVD device playback rather than simply mute the audio, in conformance with ARINC 628.

15.8 Single and Dual-Layered Discs

To the extent required by the DVD Specification, the DVD device must be able to play all DVD disc capacities (e.g., single and dual-layered discs, DVD-5, DVD-9, DVD-10, DVD-18).

15.9 DVD Media Loaders for File Servers

ARINC Report 615-3 on Airborne Computer High Speed Data Loader may offer some insights for use of DVD in media loading situations for file servers.

15.10 Input Sources

The source media may include:

a) Digital Video Tape

- Any digital video tape that can properly contain the information of Rec. ITU-R BT.601-5 is acceptable for storage of digitized film and video material.

b) Film

- Film usually originates as a 16 mm or 35 mm inter-positive element or low contrast print. This element is telecined to create a 4:2:2, 29.97 Hz, 2:1 interlaced, Rec. ITU-R BT.601-5 video version of the film. Most film originates as 24 fps and is converted to 29.97 Hz using 3:2 pull-down. The material should be inverse telecined to remove the 3:2 pull-down before compression.

c) Analog Video Tape

- Analog video tape sources are recommended only for material for which no suitable film or digital tape sources are available. Component analog tape sources are

preferable to composite analog tape sources. The quality of the conversion process will impact the eventual quality and compression performance of the overall system.

d) **Audio Sources**

- Audio may be pre-processed for dynamic range reduction for presentation in high noise environments such as aircraft. No audio signal processing can be assumed in the IFE systems to reduce dynamic range. Some IFE systems will include noise cancellation headsets so care should be taken to allow acceptable playback for both playback systems using the same audio source.

Common film and video editing in the analog and digital domain will likely be performed prior to digitization. These processes are outside the scope of this specification.

15.11 United States Captions for Deaf and Hard of Hearing People

DVD discs optionally carry USCC (line 21) data and some consumer DVD players include hardware that supports the activation of traditional downstream closed captioning display devices. This optional but common practice benefits consumers by providing access for deaf and hard of hearing viewers in a manner that is consistent across VHS, DVD and broadcast TV appliances.

Frequently, DVD releases duplicate the text of the USCC captions in the sub-picture stream. This additional, optional practice is not always followed. Some discs only provide properly formatted captions as USCC data. These discs offer subtitles, not captions, in their sub-picture streams. Captions are carried exclusively in USCC streams on these discs.

If discs such as these are played in IFE devices that do not include (optional) USCC display mechanisms, subtitles would be available to a passenger but captions would not.

Subtitles differ significantly from captions created for the express purpose of understanding by deaf and hard of hearing viewers. In the following key aspects, omission of USCC (line 21) caption data from the subpicture stream might inconvenience deaf and hard of hearing airline passengers.

- Captions for deaf and hard of hearing people include additional information that indicates who is speaking dialog or if the sound is a narrator's voice-over. By use of identifications (e.g., "Mr. Jones: I didn't kill her") or by placing captions underneath or near the speaker, clarity of content is achieved.
- Captions for deaf and hard of hearing people include additional information that indicates sound effects and other audio essential for understanding of content. For example, a caption for deaf and hard of hearing viewers reading "(gunshot)" allows the viewer to understand the motivation of the actors.

Users of this specification are encouraged to duplicate USCC captions as sub-picture streams and/or include USCC display mechanisms in their IFE DVD equipment.

15.12 Feature Film Trailers

It is suggested that a trailer for the feature film be included on the DVD disc with a metadata reference as to its location. This will enable programmed playback, if desired, of the trailer.

15.13 Compliance Testing

There are three desired areas of compliance testing for a system utilizing this specification:

- a) Disc image compliance testing, including DVD Specification compliance.
- b) Media physical compliance testing
- c) IFE equipment compliance testing

Disc image compliance testing is to certify the output of a content provider/laboratory. Media physical compliance testing is to certify the correct replication of DVD discs to physical tolerances and specifications. IFE equipment compliance testing is to certify the ability of IFE equipment to play a compliant DVD bitstream. It is possible that a bitstream may be allowed to meet only a partial subset of all specifications and still be considered to be compliant as long as the bitstream obeys the range limits and syntax rules. Compliant IFE systems may support specific profiles of this specification, e.g., in the areas of: number of audio channels, subtitling format, encryption method, and file media type.

For example, an MPEG compliant bitstream can consist of only I-frames which is syntactically compliant with the MPEG specification because the I-frame sequence is simply a subset of the full syntax.

Also, for example, a DVD disc image may be compliant with the DVD Specification and yet the media may not work in all DVD devices. For this reason, a replication check disc should be tested on each DVD device-type used for IFE.

In order for compliance testing to be successful, it is desirable that testing tools be available from multiple third-party sources.

APPENDIX A: BINARY METADATA FILE FORMAT

This appendix describes a binary file format for containing metadata on an IFE DVD disc and for transferring that data to a controlling system.

Benefits and Features

This is a packetized file format. Each packet has a unique ID and a length. A controller attempting to process this file can easily skip over any packet ids that it does not recognize, allowing features to be added to the file format without affecting operation of existing controllers. Also, data packets that do not apply can be safely omitted. Controllers should assume that if a given packet is not available, the data it contains is unavailable and not applicable as well. Data packets may also be in any order, with the exception of Binary File Format (ID 0), which must appear first, and Disc ID (ID 1) and Number of Titles (ID 3), which should appear next. A four byte CRC appears at the end of the file.

This file format was initially designed for video content, but is equally applicable to audio-only content, as well as other content types we may define in the future (see Binary File Format - ID 0).

Each title on the IFE-DVD disc gets a unique Title ID. Every other parameter in the binary file will relate back to that Title ID.

Packet Header

All packets begin the same way:

Packet ID	4 bytes	Indicates the <u>type</u> of data in the packet
Packet Length	4 bytes	Full packet size, EXCLUDING the first 8 header bytes: ID and Length, but including Packet Format
Packet Format	4 bytes	Indicates <u>how</u> the data is stored in the packet

To skip a packet, take the index point after the first 8 packet header bytes and add the length data.

Notes:

1. WAEA Specification 0395 Section 12.1 deals with the tape media TAR file and not content contained on the DELIVERY media. Most **Descriptions** below were originally taken from WAEA Specification 0395 and have been slightly altered to conform to DVD.
2. 4 binary byte field allows for over 4 billion options.

Packet Formats

Disc Related

Format 1

Packet Header

12 bytes

Packet Data

ASCII String, null terminated

Format 2
Packet Header
12 bytes
Packet Data
Binary Data

Format 3
Packet Header
12 bytes
Packet Data
Number of Titles – 1 byte
For each Title
Unique internal Title ID – 4 bytes
PID – DVD stream identification – 4 bytes

Title Related

Format 4
Packet Header
12 bytes
Title ID
4 bytes, ordered least significant byte to most significant byte
Packet Data
ASCII String, null terminated

Format 5
Packet Header
12 bytes
Title ID
4 bytes, ordered least significant byte to most significant byte
Packet Data
Binary Data

Format 6
Packet Header
12 bytes
Title ID
4 bytes, ordered least significant byte to most significant byte
Packet Data
Number of Data Items (Audio Channels, Subtitles,...) – 1 byte
For each Data Item
Unique ID by Title – 4 bytes
PID – Unique DVD stream identification – 4 bytes

Title Subgroup Related

Format 7
Packet Header
12 bytes
Title ID
4 bytes, ordered least significant byte to most significant byte
Item ID
4 bytes, ordered least significant byte to most significant byte

Packet Data
 ASCII String, null terminated
 Format 8
 Packet Header
 12 bytes
 Title ID
 4 bytes, ordered least significant byte to most significant byte
 Item ID
 4 bytes, ordered least significant byte to most significant byte
 Packet Data
 Binary Data

ID Ranges

This section defines the ranges for packet IDs. The ID field is 32 bits, allowing for over 4 billion values. Management of the Vendor ranges is not defined here.

Disc related 0-99	Vendor 9 Reserved 108000-108999
Title related 100-199	Vendor 10 Reserved 109000-109999
Audio Subgroup data 200-299	Vendor 11 Reserved 110000-110999
Subtitle Subgroup data 300-399	Vendor 12 Reserved 111000-111999
Vendor 1 Reserved 100000-100999	Vendor 13 Reserved 112000-112999
Vendor 2 Reserved 101000-101999	Vendor 14 Reserved 113000-113999
Vendor 3 Reserved 102000-102999	Vendor 15 Reserved 114000-114999
Vendor 4 Reserved 103000-103999	Vendor 16 Reserved 115000-115999
Vendor 5 Reserved 104000-104999	Vendor 17 Reserved 116000-116999
Vendor 6 Reserved 105000-105999	Vendor 18 Reserved 117000-117999
Vendor 7 Reserved 106000-106999	Vendor 19 Reserved 118000-118999
Vendor 8 Reserved 107000-107999	Vendor 20 Reserved 119000-119999

ID List

Disc Level

Keyword	ID	Format	Description	Values	Max	Default	Req'd
Binary File Format	0	2		4 bytes 0=IFE DVD 1=IFE Audio 2=Mixed Media 3=DVD ROM (files, no DVD structure) All other values reserved for future use			X
Disc ID	1	1 or 2					X
Disc name	2	1 or 2	User defined text string to aid in the identification of the contents of the product.				
Number of Titles	3	3					X
Disc Description	4	1 or 2	User defined text string to aid in the description of the contents of the disc.				

Title Level

Keyword	ID	Format	Description	Values	Max	Default	Req'd
Title Name	100	4	User defined text string to aid in the identification of the contents of the product (e.g., "Feature Film XYZ"). (Informational.)				
Title Summary	101	4	Description of content				
Title Keyframe	102	4	Graphic file – still representing title	--	Format to be defined		
running_time	103	5	Run time of product in minutes. (Informational.)	2 bytes, binary minutes			X
sequence_number	104	5	Number generated by the production house that when combined with post_production_house uniquely identifies this product_file_set. (Informational.)	4 bytes binary			
post_production_house	105	4	Name of post-production house that created this file. (Informational.)	<i>ASCII string, null terminated</i>			
episode	106	5	Number indicating the episode for episodic titles. A value of 0 indicates non-episodic.	4 bytes binary			
content_owner	107	4	Name of the content owner.	<i>ASCII string, null terminated</i>			
distributor	108	4	Name of the distributor.	<i>ASCII string, null terminated</i>			
release_date	109	5	Date program released by content owner. (Informational.)	4 binary bytes: Month Day Year (absolute - low/high)			
event_date	110	5	Date event occurred (for news events). (Informational.)	4 binary bytes: Month Day Year (absolute - low/high)			
event_time	111	5	Time event occurred (for news events). (Informational.)	2 bytes, binary minutes from midnite	1440		
file_date	112	5	Date that this file was last altered.	4 binary bytes: Month Day Year (absolute - low/high)			
encoding_date	113	5	Date that this file was encoded.	4 binary bytes: Month Day Year (absolute - low/high)			
aspect_ratio	114	5	One of two values, either "4:3" or "16:9". (Informational, provided in interface B4.)	1 byte	0=4:3 1=16:9		

Keyword	ID	Format	Description	Values	Max	Default	Req'd
category	115	4 or 5			to be defined		
genre	116	4 or 5			to be defined		
intended_audience	117	4 or 5			to be defined		
original_edited	118	4 or 5			to be defined		
editing_statement	119	4 or 5			to be defined		
color_bw	120	4 or 5			to be defined		
animated_live-action	121	4 or 5			to be defined		
mpaa_rating	122	4			to be defined		
credits	123	4			to be defined		
awards	124	4			to be defined		
reviews	125	4			to be defined		
synopsis1	126	4			to be defined		
synopsis2	127	4			to be defined		
synopsis3	128	4			to be defined		
synopsis4	129	4			to be defined		
identification_numbers	130	5			to be defined		
music_descriptors	131	4 or 5			to be defined		
Priority 1 language	132	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 2 language	141	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 3 language	142	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 4 language	143	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 5 language	144	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 6 language	145	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 7 language	146	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 8 language	147	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 9 language	148	4	3 bytes – 3 ASCII characters	ISO 639			
Priority 10 language	149	4	3 bytes – 3 ASCII characters	ISO 639			
number_audio_channels	200	6	Number of MPEG encoded audio streams (up to 16) per title.				X
audio_contouring	210	8	One of two values, either “on” or “off”. This field is required by the decoder to determine if additional contouring is required.	1 byte	0=off 1=on	1	
mode	211	8	Mode of encoding on MPEG audio channel. One of three values, either “joint_stereo”, “dual_channel” or “single_channel”.	1 byte	0= joint stereo 1= dual channel 2= single channel 3=ind. stereo	0	

Keyword	ID	Format	Description	Values	Max	Default	Req'd
Language Left	212	7	Three-letter code for the language assigned to this audio channel. Dual_channel encoded audio streams may have a different language on each channel. The language code is specified by ISO 639 Part 2.	3 bytes – 3 ASCII characters		ENG	
Language Right	213	7	Three-letter code for the language assigned to this audio channel. Dual_channel encoded audio streams may have a different language on each channel. The language code is specified by ISO 639 Part 2.	3 bytes – 3 ASCII characters		ENG	
Routing Left	214	8	Defines suggested output for Left Title/Audio Channel	1 byte		1	
Routing Right	215	8	Defines suggested output for Right Title/Audio Channel	1 byte		2	
number_subtitle_channels	300	6	number of subtitle channels encoded into auxiliary MPEG streams. The number of subtitle channels and the following subtitle channel information is required if subtitles are to be displayed, because it is not defined in interface B4.				
language	310	7	Three-letter code for the language assigned to this subtitle. The language code is specified by ISO 639 Part 2.	3 bytes – 3 ASCII characters		ENG	

Notation

The multi-byte binary parameters are ordered least significant byte to most significant byte.

Binary Example

00 00 00 00	File Format keyword
08 00 00 00	packet length
02 00 00 00	packet format
00 00 00 00	Format 0
01 00 00 00	disc ID keyword
0B 00 00 00	packet length
01 00 00 00	packet format
30 30 34 35 33 31 00	004531 – ID
02 00 00 00	disc name keyword
0A 00 00 00	packet length
01 00 00 00	packet format
54 45 53 54 31 00	TEST1 – disc name
03 00 00 00	number of titles keyword – Format 3
26 00 00 00	packet length
03 00 00 00	packet format
04 00	title count = 4
01 00 00 00	Title 1 ID
04 25 36 00	Title 1 PID
02 00 00 00	Title 2 ID
04 25 36 00	Title 2 PID
03 00 00 00	Title 3 ID
04 25 36 00	Title 3 PID

04 00 00 00	Title 4 ID
04 25 36 00	Title 4 PID
04 00 00 00	Disc description keyword
33 00 00 00	packet length
01 00 00 00	packet format
4D 79 74 68 69 63 61 6C 20 41 69 72 6C 69 6E 65 73 20 2D 20 62 75 6D 70 65 72 73 2C 20 74 72 61 69 6C 65 72 73 2C 20 61 6E 64 20 49 44 73 00	“Mythical Airlines - bumpers, trailers, and IDs”
64 00 00 00	Title Title keyword
13 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID
53 65 67 6D 65 6E 74 20 31 00	“Segment 1” – title
65 00 00 00	Title Summary keyword
1C 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID
54 68 65 20 42 45 53 54 20 6D 6F 76 69 65 20 65 76 65 72 21 00	Data “The BEST movie ever!”
66 00 00 00	Title Keyframe keyword
xx xx xx xx	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
zz zz zz zz	Data – graphic image
67 00 00 00	running time keyword
0A 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
2D 00	TRT=45 minutes
68 00 00 00	sequence number keyword
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
00 00 00 00	sequence number data
69 00 00 00	post production house keyword
10 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID
41 49 52 53 48 4F 58 00	“AIRSHOW”
6A 00 00 00	episode keyword
0C 00 00 00	packet length
05 00 00 00	packet format

01 00 00 00	Title ID
09 00 00 00	data
6B 00 00 00	content owner keyword
13 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID
50 61 72 61 6D 6F 75 6E 74 00	"Paramount"
6C 00 00 00	distributor keyword
13 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID
55 6E 69 76 65 72 73 61 6C 00	"Universal"
6D 00 00 00	release date keyword
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
05 13 CF 07	5/19/1999
6E 00 00 00	event date keyword
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
xx xx xx xx	event date data
6F 00 00 00	event time keyword
0A 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
D0 02	noon
70 00 00 00	file date keyword
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
xx xx xx xx	file date data
71 00 00 00	encoding date
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
xx xx xx xx	encoding date data
72 00 00 00	transport bit rate keyword
0C 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
xx xx xx xx	bit rate data

73 00 00 00	aspect ratio keyword
06 00 00 00	packet length
05 00 00 00	packet format
01 00 00 00	Title ID
00	4:3

C8 00 00 00	Audio Subgroup keyword
21 00 00 00	packet length
06 00 00 00	packet format
01 00 00 00	Title ID - 1
03	# audio tracks
01 00 00 00	track ID
12 34 56 78	track PID
02 00 00 00	track ID
22 34 56 78	track PID
03 00 00 00	track ID
32 34 56 78	track PID
C8 00 00 00	Audio Subgroup keyword
21 00 00 00	packet length
06 00 00 00	packet format
02 00 00 00	Title ID - 2
02	# audio tracks
01 00 00 00	track ID
33 34 56 78	track PID
02 00 00 00	track ID
44 34 56 78	track PID
C8 00 00 00	Audio Subgroup keyword
29 00 00 00	packet length
06 00 00 00	packet format
03 00 00 00	Title ID - 3
04	# audio tracks
01 00 00 00	track ID
31 34 56 78	track PID
02 00 00 00	track ID
32 34 56 78	track PID
03 00 00 00	track ID
33 34 56 78	track PID
04 00 00 00	track ID
34 34 56 78	track PID
C8 00 00 00	Audio Subgroup keyword
29 00 00 00	packet length
06 00 00 00	packet format
04 00 00 00	Title ID - 4
04	# audio tracks
01 00 00 00	track ID
41 34 56 78	track PID

02 00 00 00	track ID
42 34 56 78	track PID
03 00 00 00	track ID
43 34 56 78	track PID
04 00 00 00	track ID
44 34 56 78	track PID
2C 01 00 00	Subtitle Subgroup keyword
19 00 00 00	packet length
06 00 00 00	packet format
01 00 00 00	Title ID - 1
02	# Subtitles
01 00 00 00	track ID
81 34 56 78	track PID
02 00 00 00	track ID
82 34 56 78	track PID
D2 00 00 00	Audio Contouring Token
0D 00 00 00	packet length
08 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Audio track ID - 1
01	Contouring ON
D3 00 00 00	Audio Mode Token
0D 00 00 00	packet length
08 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Audio track ID - 1
00	Mode = Joint Stereo
D4 00 00 00	Audio Language Left Token
10 00 00 00	packet length
07 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Audio track ID - 1
66 72 61 00	Language = French (fra)
D5 00 00 00	Audio Language Right Token
10 00 00 00	packet length
07 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Audio track ID - 1
64 65 75 00	Language = German (deu)
36 01 00 00	Subtitle Language Token
10 00 00 00	packet length
07 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Subtitle ID - 1

66 72 61 00	Language = French (fra)
36 01 00 00	Subtitle Language Token
10 00 00 00	packet length
07 00 00 00	packet format
01 00 00 00	Title ID - 1
02 00 00 00	Subtitle ID - 1
64 65 75 00	Language = German (deu)
37 01 00 00	Subtitle Encoding Token
0D 00 00 00	packet length
08 00 00 00	packet format
01 00 00 00	Title ID - 1
01 00 00 00	Subtitle ID - 1
00	bitmap
37 01 00 00	Subtitle Encoding Token
0D 00 00 00	packet length
08 00 00 00	packet format
01 00 00 00	Title ID - 1
02 00 00 00	Subtitle ID - 1
01	unicode
8D 00 00 00	First Priority Language
0C 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID - 1
66 72 61 00	Language = French (fra)
8E 00 00 00	Second Priority Language
0C 00 00 00	packet length
04 00 00 00	packet format
01 00 00 00	Title ID - 1
64 65 75 00	Language = German (deu)
.....	More data ...
ZZ ZZ ZZ ZZ	4 byte CRC

APPENDIX B: REPRESENTATIVE SECURITY DATA FILE STRUCTURE (INFORMATIVE)

This appendix describes a representative structure of the data contained in the WAEA Early Window Key reference file.

File Header

```
struct key_reference_file {

// HEADER

int          count_provider_entries; // number of key management systems used
date         creation;               // date/time stamp of file creation
char         description[80];        // descriptive ASCII text
unsigned int  start_provider_blocks; // offset in bytes of start of provider blocks from
                                        // beginning of the file

// FINGERPRINT SETUP DATA POINTER
struct fingerprint {
int          version;                // version of fingerprinting system
unsigned int  start_fp_offset;       // offset in bytes of fingerprint setup data, from
                                        // beginning of the file
unsigned int  fp_block_length;       // length of fingerprint data block
};

// PROVIDER INDEX BLOCKS
struct provider_index_struct { // security hardware provider, used to find position in table
int          provider_ID;
unsigned int  start_offset;        // position from beginning of file where provider data block
                                        // starts, in bytes
unsigned int  block_length;        // size of the provider block, in bytes
unsigned int  block_entries;       // number of entries in the block
} provider_index[count_provider_entries];

struct fp_setup_data {
int          version;
char         filler[ ];            // fills data to an 8 byte boundary for encryption
char         data[ ];              // setup data, encrypted with content key
} fp_setup_data;

// PROVIDER SPECIFIC DATA BLOCKS
char         begin_data;           // beginning of provider blocks, format determined by each
                                        // security provider
}
```

Assumptions

- 1) This structure can allow the DVD device to be ignorant of all but the most basic file format issues. A particular DVD device implementation might only work with a particular provider implementation. Thus in-device processing can be split between the device and security subsystems by mutual agreement.
- 2) The DVD device knows, or learns the provider ID.
- 3) Structure is big endian and 32 bit processor model (i.e., int is 32 bits).

APPENDIX C: KEY PROVISIONS OF THE CSS LICENSE AND CSS SPECIFICATIONS RELATING TO REGION 8

The following provisions are excerpted from the CSS License and CSS Specifications with the kind permission of the DVD Copy Control Association, Inc. Readers are cautioned to fully consider all provisions of the CSS License and CSS Specifications, including any amendments that may have been adopted since this specification was adopted.

“CSS SPECIFICATIONS

I. PROCEDURAL SPECIFICATIONS

1. DEFINITIONS.

In addition to the terms defined in the License Agreement, which shall have the same meaning in these CSS Procedural Specifications, the following terms shall have the meanings set forth below for purposes of this Agreement. ...

1.34 ‘Special Purpose DVD Player’ shall mean a DVD Player that is designed solely for the playback of CSS Data contained on DVD Disc designated as Region 8.

1.35 ‘Special Purpose DVD Drive’ shall mean a DVD Drive that is designed solely for the playback of CSS Data contained on a DVD Disc designated as Region 8. ...

6.2 **Copy Protection.** In order to provide continued protection for CSS Data, the following conditions must be observed by CSS Licensees with respect to access to, playback of and transmission of CSS Data and/or analog signals constituting the content converted from CSS Data.

6.2.1 **DVD Players.** The following provisions are applicable to DVD Players in respect of their capabilities to read and playback CSS Data using internal decryption and decoding capabilities and related outputs to other free-standing products. ...

6.2.1.3 **Regional Code Playback Control.** Each DVD Player shall be designated for only one region and shall implement regional code playback controls so that CSS Data are not played back except in accordance with the regional code instructions contained on the prerecorded DVD Disc. DVD Players may play back such data

only if the data are coded for playback in the same geographic region for which the DVD Player is itself designated, including coding of such data that provides for playback in multiple regions where one of such regions is the single designated region for the DVD Player on which the disk is to be played back. A Special Purpose DVD Player shall play back only those DVD Discs designated as Region 8 and is permitted to be sold only in conformance with the conditions set forth in the License Agreement that are specific to the sale of Special Purpose DVD Players. ...

6.2.2.2 ... The user reset and service or manufacturing center reinitialization provisions of this subparagraph shall not apply to a Special Purpose DVD Drive, which may be designated to play back only those DVD Discs designated as Region 8. DVD Drives that are not Special Purpose DVD Drives shall not play back those DVD Discs designated as Region 8, either through initial setting or through consumer reset or service or manufacturing center reinitialization. A Special Purpose DVD Drive is permitted to be sold only in conformance with the conditions set forth in the License Agreement that are specific to the sale of Special Purpose DVD Drives.”

“CSS LICENSE

... 2. LICENSES GRANTED

2.1. Nonexclusive License. Subject to the terms and conditions of this Agreement, Licensor grants to Licensee a worldwide, royalty-free, non-exclusive, nontransferable right, under the Licensed Rights:

(a) to use and implement CSS to develop, design, manufacture and use DVD Products that are in the Membership Categories selected by Licensee and to practice any methods necessary for the manufacture or use of such DVD Products; and

(b) according to Licensee’s Membership Categories, to receive DVD Products in accordance with this Agreement and to distribute, offer to sell, sell, import and otherwise transfer DVD Products made in accordance with this Agreement, such distribution, offer to sell, sale, importation or other transfer of CSS Compliant Products to be allowable only as follows: ...

(v) Special Purpose DVD Players or Special Purpose DVD Drives only to purchasers that are required by contract with Licensee (x) to use the Special Purpose DVD Players or Special Purpose DVD Drives, as the case may be, for the purpose of the authorized playback of content originally encrypted on DVD Discs using CSS where such DVD Discs are designated as Region 8 discs and where such playback is intended to be in the commercial setting in which the viewer of the movie does not own the Special Purpose DVD Player or Special Purpose DVD Drive, whether or not such viewing is considered a public performance, or non-public performance, of the movie (e.g., airline, cruise ship, hotel or similarly applications); and (y) to sell or otherwise dispose of or distribute any such Special Purpose DVD Players or Special Purpose DVD Drives to another party only in

circumstances in which such other party is legally prohibited from using such Special Purpose DVD Players or Special Purpose DVD Drives, as the case may be, other than in the use described in (x), above. Licensee further agrees that with respect to any such contract, it will either provide for third party beneficiary rights for Motion Picture Companies or will itself take all reasonable efforts necessary to enforce the provisions of such contracts as described in (x) and (y), above. Records of sales of Special Purpose DVD Players and Special Purpose DVD Drives must be separately maintained by Licensee, and the names and addresses of each purchaser of Special Purpose DVD Players and Special Purpose DVD Drives shall be provided by Licensee to Licensor upon request by Licensor. Copies of contracts for such sales must be available for inspection by Licensor, at least with respect to the provisions relevant to the requirements of this subparagraph. With respect to any sales of Special Purpose DVD Players or Special Purpose DVD Drives made prior to the effective date of this Agreement, Licensee agrees (a) that any such sale will be subject to the recordkeeping and reporting requirements of this subparagraph, (b) that it will submit to Licensor, within 30 days of the effective date of this Agreement, a specific certification from Licensee that, to the best of Licensee's knowledge and belief, each purchaser intends to use the Special Purpose DVD Players and/or Special Purpose DVD Drives solely for the purpose described in this subparagraph; and (c) that Licensee will make all commercially reasonable efforts to amend the contract for such sale(s) to incorporate the restrictions required for such contracts entered after the effective date of this Agreement ...”

APPENDIX D: PARTICIPANTS

This specification could not have been produced without the dedicated involvement of many individuals and companies. The following persons participated in the creation of this document by attendance at one or more meetings of the WAEA DVD Working Group. Their company affiliation at the time of their participation is also given.

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APPENDIX E: SPONSORS

The following companies contributed financially to defray meeting expenses of the WAEA DVD Working Group. Their donations are gratefully acknowledged.

AirTV Ltd.

Buena Vista Non-Theatrical, Inc.

Cine Magnetics Video & Digital Laboratories

Columbia TriStar International Television

Crest National Digital Media Complex

Dolby Laboratories

IEC International Ltd.

LaserPacific Media Corporation

Matsushita Avionics Systems

Metro-Goldwyn-Mayer

Microsoft Corporation

Oxford Media Corporation

Post Modern Edit

Sony Trans Com Inc.

TEAC America, Inc.

Universal Pictures, Non-Theatrical