ALLIED ENGINEERING DOCUMENTATION PUBLICATION

AEDP-8 (Edition 2)

NATO INTERNATIONAL STAFF - DEFENCE INVESTMENT DIV.

NATO Motion Imagery (MI) STANAG 4609 (Edition 2) Implementation Guide

JUNE 2007

NORTH ATLANTIC TREATY ORGANIZATION

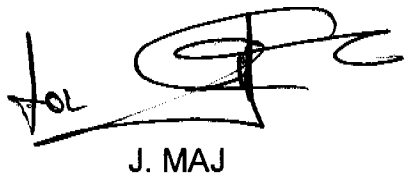
NATO STANDARDIZATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

15 June 2007

1. AEDP-8 (Edition 2) - NATO Motion Imagery (MI) STANAG 4609 (Edition 1) Implementation Guide - is an UNCLASSIFIED publication.

2. AEDP-8 (Ed.2) is effective upon receipt.



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RECORD OF CHANGES

Change Date	Date entered	Effective Date	By Whom Entered

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ALLIED ENGINEERING DOCUMENTATION PUBLICATION (AEDP-8)
NATO MOTION IMAGERY (STANAG 4609) IMPLEMENTATION GUIDE

NATO Motion Imagery Objectives

This document provides implementation guidance for users of NATO STANAG 4609 and it includes technical implementation information, configuration management procedures, and test and certification information for the digital motion imagery community. The primary objective of the NATO Motion Imagery (MI) standard (STANAG 4609) is to provide common methods for exchange of MI across systems within and among NATO nations. STANAG 4609 is intended to give users a consolidated, clear and concise view of the standards to which they will need to build and operate motion imagery systems. The STANAG includes guidance on uncompressed, compressed, and related motion imagery sampling structures; motion imagery time standards, motion imagery metadata standards, interconnections, and common language descriptions of motion imagery system parameters. The objective of STANAG 4609 is to provide governance so as to allow participating nations to share MI to meet intelligence, reconnaissance, surveillance and other operational objectives with interoperable MI systems.

PHILOSOPHY

Conformance with the STANAG 4609 will allow any compliant system to decode all compressed data types (Standard Definition, Enhanced Definition, and High Definition) up to a minimum level but each Nation may choose to ORIGINATE one, two or all data types.

AEDP SCOPE

This document provides the technical information that was developed during the production of the STANAG. This information was identified as important to the acquisition communities of the member Nations, but inappropriate for the STANAG. This information is divided into seven discrete sections, each provided in the Annexes to this AEDP as shown in Figure-1.

Annex A explains the background and application scenarios. Annex B provides the recommended practices and engineering guidelines. Annex C provides specific guidance to the acquisition communities in the form of recommendations for specifications. Annex D includes the Compliance Test and Certification procedures for verifying that a product meets the standard. Annex E includes the configuration management plan for managing the STANAG and this documentation. Annex F provides application notes. Finally, Annex G is a global glossary for the entire AEDP.

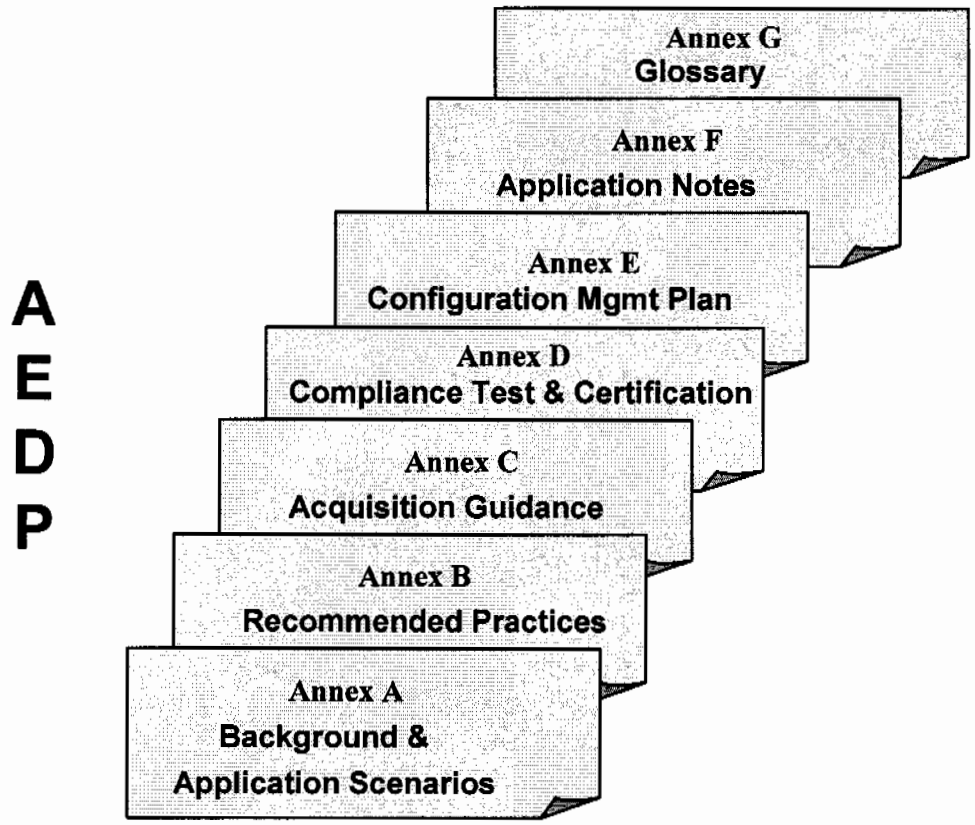


Figure-1
AEDP Structure

Applicable or Referenced Documents:

AEDP-2	NATO Imagery Interoperability Architecture (NIIA)
AEDP-3	Declassification/Sanitization Procedures
DOD 5220.22-M	National Industrial Security Program Operating Manual
EIA/RS-422	Electronic Industries Association RS for serial transmissions
ISO/IEC 4873	Information technology - ISO 8-bit code for information interchange – Structure and rules for implementation
ISO/IEC 7498-1	Information Technology – Open System Interconnection – Basic Reference Model
ISO/IEC 10641	Information technology - Computer graphics and image processing - Conformance testing of implementations of graphic standards
ISO/IEC 10646-1-1993	Information Technology - Universal Multiple-Octet Amd 2: 1996 Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane - Amendment 2: UCS Transformation Format 8 (UTF-8)
STANAG 3350	NATO Analogue Video Standard for Aircraft Systems
STANAG 4250	NATO Reference Model for Open Systems Interconnection
STANAG 4545	NATO Secondary Imagery Format
STANAG 4559	NATO Standard ISR Library Interface
STANAG 4575	NATO Advanced Data Storage Interface
STANAG 4609	NATO Digital Motion Imagery Standard
STANAG 7023	Air Reconnaissance Imagery Data Architecture
STANAG 7024	Imagery Air Reconnaissance Cassette Tape Recorder Standard
STANAG 7085	Interoperable Data Links For Imaging Systems
IEEE STD 1394-1995	Standard for a High Performance Serial Bus - Firewire 1995
ISO/IEC 13818-1	*Information technology - Generic coding of moving pictures and associated audio information, Part 1: Systems*, 2000 (also known as MPEG-2 Systems).
ISO/IEC 13818-2	*Information technology - Generic coding of moving pictures and associated audio information, Part 2: Video*, 2000 (also known as MPEG-2 Video).
ISO/IEC 13818-3	*Information technology - Generic coding of moving pictures and associated audio information, Part 3: Audio*, 1998 (also known as MPEG-2 Audio).
ISO/IEC 13818-4	*Information technology - Generic coding of moving pictures and associated audio information, Part 4: Compliance Testing*, 1998 (also known as MPEG-2 Compliance)
ISO/IEC 13818-6	*Information technology - Generic coding of moving pictures and associated audio information, Part 6: Extension for Digital Storage Media Command and Control*, 1996 (also known as MPEG-2 DSM-CC).
ISO/IEC 13818-9	*Information technology - Generic coding of moving pictures and associated audio information, Part 9: Real-time Interface Specification*, 1996 (also known as MPEG-2 RTI).
ITU-R BT.601-5	*Studio encoding parameters for digital television for standard 4:3 and wide-screen 16:9 aspect ratios*, 1995.
SMPTE 12M-1999	*Television, Audio and Film - Time and Control Code*
SMPTE 170M-1999	*Television - Composite Analog Video Signal - NTSC for Studio Applications*
SMPTE 259M-1997	*Television - 10-Bit 4:2:2 Composite and 4 fsc Composite Digital Signals – Serial Digital Interface.*
SMPTE 274M-1998	*Television - 1920 x 1080 Scanning and Interface*
SMPTE 291M-1998	*Television - Ancillary Data Packet and Space Formatting*
SMPTE 292M-1998	*Television - Bit-Serial Digital Interface for High-Definition Television*

	Systems
SMPTE 294M-2001	*Television - 720 x 483 Active Line at 59.94-Hz Progressive Scan Production - Bit-Serial Digital Interfaces*
SMPTE 295M-1997	*Television -1920 x 1080 50-Hz - Scanning and Interface*
SMPTE 296M-2001	*Television - 1280 x 720 Progressive Image Sample Structure - Analog and Digital Representation and Analog Interface*
SMPTE 297M-1997	*Television - Serial Digital Fiber Transmission System for ANSI/SMPTE 259M Signals*
SMPTE 305.2M-2000	*Serial Data Transport Interface (SDTI).*
SMPTE 309M-1999	*Transmission of Date and Time Zone Information in Binary Groups of Time and Control Code*
SMPTE 335M-2001	*Metadata Dictionary Structure*
SMPTE 336M-2001	*Data Encoding Protocol Using Key-Length-Value*
SMPTE 355M – 2001	*Format for Non-PCM Audio and Data in AES3 – KLV Data Type*
SMPTE RP210.7-2004	*SMPTE Metadata Dictionary Contents*
SMPTE EG37-2001	*Node Structure for the SMPTE Metadata Dictionary*
ITU-R BT.1358	*Studio Parameters of 525 and 625 Line Progressive Scan Television Systems*, 1998
SMPTE EG 41-2004	Material Exchange Format (MXF) Engineering Guideline (Informative)
SMPTE 377M-2004	Material Exchange Format (MXF) File Format Specification (Standard)
SMPTE 378M-2004	Material Exchange Format (MXF) Operational pattern 1A (Single Item, Single Package)
SMPTE 379M-2004	Material Exchange Format (MXF) MXF Generic Container
SMPTE 380M-2004	Material Exchange Format (MXF) Descriptive Metadata Scheme-1 (Standard, Dynamic)
SMPTE 381M-2005	Material Exchange Format (MXF) Mapping MPEG streams into the MXF Generic Container (Dynamic)
SMPTE 391M-2004	Material Exchange Format (MXF) Operational pattern 1B (Single Item, Ganged Packages)
SMPTE EG 42-2004	Material Exchange Format (MXF) MXF Descriptive Metadata
	Advanced Authoring Format Object Specification, V 1.1, AAF Association, November 2004
SMPTE 342M-2000	*HD-D5 Compressed Video 1080i and 720p Systems – Encoding process and Data Format*
ISO/IEC 13818-1:2000/AMD 1	"Information technology -- Generic coding of moving pictures and associated audio information: Systems, AMENDMENT 1: Carriage of metadata over ISO/IEC 13818-1 streams".
SMPTE RP 217-2001	*Nonsynchronized Mapping of KLV Packets into MPEG-2 System Streams*
SMPTE 349M-2001	*Transport of Alternate Source Image Formats through SMPTE 292M.*
SMPTE RP 214-2002	*Packing KLV Encoded Metadata and Data Essence into SMPTE 291M Ancillary Data Packets*
ISO/IEC 13818-1:2000/FDAM 3	"Information technology -- Generic coding of moving pictures and associated audio: Systems, AMENDMENT 3: Transport of AVC video data over ITU-T Rec. H.222.0/ISO/IEC 13818-1 streams" (DRAFT)

BACKGROUND AND APPLICATION SCENARIOS

1. Summary

1-1 Definitions and objectives

Motion Imagery is defined as imagery [a likeness or representation of any natural or man-made feature or related object or activity] utilizing sequential or continuous streams of images that enable observation of the dynamic, (temporal), behavior of objects within the scene. Motion Imagery temporal rates, nominally expressed in frames per second, must be sufficient to characterize the desired dynamic phenomenon. Motion Imagery (MI) is a valuable asset for commanders; it enables them to meet a variety of theatre, operational and tactical objectives for intelligence, reconnaissance and surveillance. STANAG 4609 is intended to provide common methods for exchange of MI across systems among and within NATO nations. Relevant technologies and solutions have been extensively developed by the video, broadcast and movie industries, which have established a strong standardization base to exchange programs worldwide. STANAG 4609 and associated AEDP identify such commercial standards and their applicable profiles that define interoperability among nations for high image quality environments and systems (such as common control vans, interconnections nodes, imagery ground systems and NATO command centres).

1-2 Commercial environment

Digital Motion Imagery is the state of the art in the video, broadcast and movie industries; over the years, these industries heavily invested to develop the best possible technological solutions and products in a business model which assumes that a huge number of consumers must have an inexpensive and generic access to the programs.

Exchange of material between parties being in the nature of this business, all the aspects of the video chains are covered by interoperability standards, most of them controlled by the SMPTE (Society of Motion Pictures and Television Engineers). These standards however incorporate multiple legacy layers and variants, to such extent that selection among the multiple options is mandatory to achieve interoperability. This is the rationale of STANAG 4609 further detailed by the present AEDP.

Hardware and software solutions are cost-effective and cover a very wide range of image quality from low rate internet up to second to none movie wet-film class. In all cases, it is made use of lossy compression to some degree.

2. Application Scenarios

2-1 NATO ISR Interoperability Architecture (NIIA)

In the NATO ISR Interoperability Architecture (NIIA) document number AEDP-2 volume 1, four levels or Degrees of interoperability are defined.

STANAG 4609 concentrates on Degree 2 (Structured Data Exchange) which involves the exchange of human interpretable structured data intended for manual and/or automated handling, but requires manual compilation, receipt and/or message dispatch.

Critical interfaces for this Structured Data Exchange within a coalition are also identified in the NIIA. Such interfaces are the ones through which systems exchange unprocessed or processed data with other systems or with communication means.

2-2 **Possible Scenarios**.

STANAG 4609 is assumed to be applicable in a number of situations among which three scenarios are identified hereafter.

The first scenario involves a limited action where coalition forces are operating with limited resources. If more than one nation were to provide reconnaissance capabilities, the deployment could be accomplished using one ground station from one of the nations.

The second scenario involves a larger scale operation. It is assumed that multiple ground stations have been deployed and that an aircraft has diverted to a base other than its main operating location. Use of the interfaces defined in this document, would allow the reconnaissance data collected to be rapidly accessed and exploited, limiting the possible mission degradation due to the diversion.

The third scenario involves the direct interface at base-band of the primary (raw) or secondary (processed) motion imagery.

To a large extent these scenarios apply in a national framework when different platforms or systems are involved.

3. Rationale of the Standard and Associated AEDP

3-1 **General**

Only digital video is considered in STANAG 4609. Analog video is treated as legacy only (and is already covered by STANAG 3350).

The main difference between commercial domain and ISR applications is the vital importance of dynamic geo-localization metadata. Nevertheless, the commercial solutions to carry such data exist and are adopted in STANAG 4609 without any specific development.

Compared to traditional reconnaissance (typically as per STANAG 7023), Motion Imagery introduces a new dimension and, as a result, completely new criteria to assess operational effectiveness. This is a complex area which is still under study. It has been proven, for example that a very low resolution source unusable in freeze frame, may become, with motion, extremely valuable in ISR applications.

3-2 **Compression**

Commercial video has benefited from extensive research in compression algorithms with impressive results, but also multiple variants largely responsible of the multiplication of standards. Furthermore, for a given application, it is always possible to develop a compression scheme better than the generic one previously selected.

STANAG 4609 uses only open, international standards to insure interoperability without proprietary access rights, allowing use of commercial processing tools and systems.

3–3 **Critical interfaces for interoperability**

The purpose of the STANAG is to define minimum interoperability criteria at the critical interfaces through which coalition members will exchange motion imagery and associated metadata. The motion imagery criteria are defined with reference to the table given hereafter (levels 0 to 14), and detailed subsequently. The metadata is defined in STANAG 4609 and Annex B.

It is assumed that a host system designed to a profile of a given level will accept all profiles of the levels below. **It is agreed that nations implementing STANAG 4609 shall be able to accept and decode Motion Imagery up to and including Level 10 (high definition format).** MISM Level 10 defines lightly compressed high definition motion imagery with a compression ratio between 5:1 and 10:1. This high quality motion imagery has few to no

compression artefacts and should be readily exploitable. The data rate, if live, should be between 34 and 100 Mbits/second. Nations may choose to operate in non real time. Both 720-line and 1080-line progressively scanned high definition formats may be used. The decoder should at a minimum automatically decode the transmitted motion imagery

Data rate aspects associated to the different levels are often confusing, as they are only indicative of operation at native frame rates. To give an example, a Level 9 ground system designed to accept the 10 Mbps output of a data-link (typically as per STANAG 7085), will also accept native frame rate data to Level 6 (or eventually Level 7) at reduced rates.

Much intelligence value is found in the metadata and Nations shall be able to extract KLV metadata.

3–4 Interoperability Considerations

STANAG 4609 defines a series of commercial standards that allow for the exchange of motion imagery essence and associated metadata. The STANAG does not define physical interfaces for connectivity nor does it determine specific system configurations.

It is build upon the premise that end users require maximum flexibility for operational system design and therefore outlines levels of spatial and temporal resolution as shown in Table 1. The table defines levels of compression with suggested roles within the imagery chain. In general, the lower the level is, the lower is the imagery quality.

The table is built on multiple resolutions, the principals of which are high definition, enhanced definition and standard definition. In each category there are three levels of compression, high compression for the dissemination of motion imagery and metadata on bandwidth challenged communication links and storage systems. The middle level is one of moderate compression for more demanding uses and the high level for little or no compression. Nations will choose in which level of motion imagery they wish to originate. All nations shall be able to receive (decode) all motion imagery types up to and including level 10 in order to be interoperable. Nations can originate at any MISM Level, but interoperability is not assured above Level 10.

4. Motion Imagery System Matrix

ENGINEERING GUIDELINE 0220 - Motion Imagery System Matrix

The "Motion Imagery Systems (Spatial and Temporal) Matrix" (MISM) defines an ENGINEERING GUIDELINE for the simple identification of broad categories of Motion Imagery Systems. The intent of the MISM is to give user communities an easy to use, common shorthand reference language to describe the fundamental technical capabilities of NATO motion imagery systems. The "Motion Imagery Systems Matrix" includes tables of Technical Specifications and related Notes.

Furthermore, the "Motion Imagery System Matrix - Levels" (MISM-L0 – MISM-L14, where MISM-L14 defines the highest spatial and temporal resolution systems) should be applied to all processing nodes within the end-to-end motion imagery chain; individual nodes within the processing chain can operate at different levels. The overall system specification would equal the lowest motion imagery system matrix processing node specification.

The MISM (EG 0220) has six general bands:

0220a – Advanced High Definition Motion Imagery (MISM-L12 –MISM-L14)

0220b - High Definition Motion Imagery (MISM-L9 – MISM-L11)

0220c – Enhanced Definition Motion Imagery (MISM-L6 – MISM-L8)

0220d - Standard Definition Motion Imagery (MISM-L3 - MISM-L 5)

0220e - Low Spatial/Temporal Definition Motion Imagery (MISM-L2 and MISM-L1)

0220f – Very Low Temporal Definition Motion Imagery (MISM-L0)

All Nations shall be able to RECEIVE (decode) all Motion Imagery types that are defined in STANAG 4609 up to and including MISM-L10. Nations will choose which ORIGINATION level they use for their national Motion Imagery sensors / systems / capabilities whether it is standard definition, enhanced definition, or high definition. For example, one NATO system may originate MISM-L5 and the signal can be decoded by all NATO compliant decoders.

Table 1 depicts the general outline of the MISM-L. The following Tables and their accompanying Technical Notes provide detailed technical specifications of the general performance of each MISM-L level. MISM-L includes tabular descriptions of Motion Imagery system attributes, to include: Spatial Definition (Very High, High, Enhanced, Standard, Low, and Very Low); Temporal Definition (Very High, Medium to High, Standard, Low, and Very Low); Generation Resiliency (High, Medium, Low, Very Low).

EG	MISM-L	Description
0220a	14	
	13	Advanced High Definition Motion Imagery
	12	(Reserved for Future Implementations)
0220b	11	
	10	High Definition Motion Imagery
	9	
0220c	8	
	7	Enhanced Definition Motion Imagery
	6	
0220d	5	
	4	Standard Definition Motion Imagery
	3	
0220e	2	Low Bandwidth Motion Imagery
	1	
0220f	0	Low Temporal Definition Motion Imagery

Table 1. Motion Imagery System (Spatial and Temporal) Matrix-Levels (MISM-L)

The following tables are further divided into sublevels H and M to distinguish between H.264 and MPEG-2.

ENGINEERING GUIDELINE 0220a - MISM, Advanced High Definition Motion Imagery

(Reserved for Future Implementations)

System Level	Common Description / Intended Application	System Attributes: Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horizontal Resolution	Nominal Vertical Resolution	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L14	Advanced High Definition (AHD) / Acquisition	Very High	Very High	High	TBD	≥ 1920	≥ 1080p	8 or 10 or 12 or >12	48 – 120 FPS	Zero	3 - 4 Gb/s	TBD	OC-96-192
MISM-L13	Advanced HD / Processing / Archiving	Very High	Very High	Medium	TBD	≥ 1920	≥ 1080p	8 or 10 or12	48 – 120 FPS	TBD	TBD	TBD	TBD
MISM-L12	Advanced HD / Distribution	Very High	Very High	Low	TBD	≥ 1920	≥ 1080p	8 or10 or12	48 – 120 FPS	TBD	TBD	TBD	TBD

Table 2. Advanced High Definition Motion Imagery

ENGINEERING GUIDELINE 0220A - MISM, Advanced High Definition Motion Imagery, Technical Notes

MISM-L14 Motion Imagery System Matrix-Level 14 (MISM-L14), Uncompressed Advanced High Definition Motion Imagery, is defined as including the following specific acquisition formats:

1920 x 1080, frame rates 60p, 50p; 16:9 Aspect Ratio;
2048 x 1080, frame rate 48p, 1.896 aspect ratio;
1998 x 1080, frame rate 48p, 1.85 aspect ratio;
2048 x 858, frame rate 48p, 2.39 aspect ratio.

MISL14 Note 1: Only PROGRESSIVE SCAN formats are authorized for advanced high definition NATO Motion Imagery acquisition applications (systems used to originate, acquire, produce, process, manipulate, exploit, store, archive and disseminate motion imagery in support to imaging applications, including (but not limited to) Intelligence, Reconnaissance, and Surveillance).

MISM-L13 Motion Imagery System Matrix Level 13 (MISM-L13), Mezzanine Compression Advanced High Definition Motion Imagery is defined as any HD format of MISM-L14 using mild compression. MISM-L13 is intended to describe Advanced HD signals that use mild compression to process and transport Advanced HD signals.

MISM-L12 Motion Imagery System Matrix-Level 12 (MISM-L12) is defined as any HD format of MISM-L14/13 that is highly compressed to use end-user (final link) transport delivery.

Note about bit depths: While multiple bit depths are allowed, higher bit depths are preferred. For example, if 12-bit, 10-bit and 8-bit implementations are allowed under the standard, 12-bit implementations are preferred.

ENGINEERING GUIDELINE 0220b - MISM, High Definition Motion Imagery

System Level	Common Description / Intended Application	System Attributes: Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horiz. Res.	Nominal Vert. Res.	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L11	High Definition (HDTV) / Acquisition	High	Medium - High	High	SMPTE 296M-2001, Progressive modes of SMPTE 274M, 295M, 292M	1280 – 1920	720p - 1080p	8 or 10	24 - 60FPS	Zero	1.485 Gb/s	0.36 Gb/s - 2.4 Gb/s	SMPTE 292M, OC-48
MISM-L10M	HDTV / Processing / Archiving	High	Medium - High	Medium	SMPTE 296M-2001, Progressive modes of SMPTE 274M, 295M MPEG-2 MP@HL	1280 – 1920	720p - 1080p	8	24 - 60FPS	10:1	80 Mb/s	34 Mb/s - 100 Mb/s	SDI, E3, T3, OC-12
MISM-L10H	HDTV / Processing / Archiving	High	Medium-High	Medium	SMPTE 296M-2001, Progressive modes of SMPTE 274M, 295M H.264 MP@L4.1(8b) H.264 HP@L4.1 (8b) H.264 Hi10P@L4.1 (10b)	1280 – 1920	720p - 1080p	8 or 10	24 - 60FPS	20:1	40 Mb/s	17 Mb/s – 50 Mb/s	T3
MISM-L9M	HDTV / Distribution	High	Medium - High	Low	SMPTE 296M-2001, Progressive modes of SMPTE 274M, 295M MPEG-2 MP@HL	1280 – 1920	720p - 1080p	8	24 - 60FPS	45:1	19.4 Mb/s	10 Mb/s - 44.7 Mb/s	TCDL, Half to Full T3, ATM
MISM-L9H	HDTV / Distribution	High	Medium - High	Low	SMPTE 296M-2001, Progressive modes of SMPTE 274M, 295M H.264MP@L3.2(720) H.264 MP@L4.0 H.264 HP@L4.0	1280 – 1920	720p - 1080p	8	24 - 60FPS	80:1	10 Mb/s	5 Mb/s – 20 Mb/s	TCDL

Table 3. High Definition Motion Imagery

ENGINEERING GUIDELINE 0220b - MISM, High Definition Motion Imagery, Technical Notes

MISM-L11 Motion Imagery System Matrix-Level 11 (MISM-L11), Uncompressed High Definition Motion Imagery, is defined as including the following specific acquisition formats:

1920 x 1080, frame rates 30p, 25p, 24p; 16:9 aspect ratio;
1280 x 720, frame rates 60p, 50p, 30p, 25p, 24p; 16:9 aspect ratio

MISM-L11 Note 1: Only PROGRESSIVE SCAN formats are authorized for high definition NATO Motion Imagery acquisition applications (systems used to originate, acquire, produce, process, manipulate, exploit, store, archive and disseminate motion imagery in support to imaging applications, including (but not limited to) Intelligence, Reconnaissance, and Surveillance).

MISM-L11 Note 2: 1920x1080x30i (60 field per second interlace) or 1920x1080x25i (50 field per second interlace) systems are not recommended but may be considered for end-user display systems in non-critical applications.

MISM-L10 Motion Imagery System Matrix-Level 10 (MISM-L10), Mezzanine Compression High Definition Motion Imagery is defined as any HD format of MISM-L11 using mild compression. MISM-L10 is intended to describe HD signals that use mild compression to transport and process HD signals. Note that a lower data rate can be obtained for the same motion image quality using H.264 versus MPEG-2. H.264 L4.1 can be used for data rates up to 50 Mb/s. The H.264 High profile should be used for 10-bit motion imagery.

MISM-L9 Motion Imagery System Matrix-Level 9 (MISM-L9) is defined as any HD format of MISM-L11/10 that is highly compressed to use end-user (final link) transport delivery, such as DVB-T or the ATV transport delivery system. MISM-L9 may also include other transport layer delivery systems used by NATO. Note that a lower data rate can be obtained for the same motion image quality using H.264 versus MPEG-2. H.264 L4.0 can be used for data rates up to 20 Mb/s.

Note about bit depths: While multiple bit depths are allowed, higher bit depths are preferred. For example, if both 10 bit and 8 bit implementations are allowed under the standard, 10 bit implementations are preferred.

ENGINEERING GUIDELINE 0220c - MISM, Enhanced Definition Motion Imagery

System Level	Common Description / Intended Application	System Attributes: Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horiz. Res.	Nominal Vert. Res.	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L8	Enhanced Definition (ED) / Acquisition	Enhanced	Medium - High	High	ITU-R BT.1358, SMPTE 294M-2001	640 – 960	480p - 576p	8 or 10	24 – 60 FPS	Zero	360 Mb/s	135 Mb/s - 540 Mb/s	SDI, OC-12
MISM-L7M	ED / Processing / Archiving	Enhanced	Medium-High	Medium	ITU-R BT.1358, SMPTE 294M-2001 MPEG-2 MP@HL	640 – 960	480p - 576p	8	24 - 60 FPS	10:1	25 Mb/s	10 Mb/s -50 Mb/s	T3, ATM
MISM-L7H	ED / Processing / Archiving	Enhanced	Medium - High	Medium	ITU-R BT.1358, SMPTE 294M-2001 H.264 MP@L3 (L3.1 > 30 FPS)	640 – 960	480p - 576p	8	24 - 60 FPS	20 :1	12 Mb/s	5 Mb/s – 14 Mb/s	T3, ATM
MISM-L6M	ED/ Distribution	Enhanced	Medium - High	Low	ITU-R BT.1358, SMPTE 294M-2001 MPEG-2 MP@HL	640 – 960	480p - 576p	8	24 – 60 FPS	45:1	5.5 Mb/s	3 Mb/s - 15 Mb/s	GBS, ATM
MISM-L6H	ED/ Distribution	Enhanced	Medium-High	Low	ITU-R BT.1358, SMPTE 294M-2001 H.264 MP@L3 (L3.1 > 30 FPS)	640 – 960	480p - 576p	8	24 – 60 FPS	80 :1	3 Mb/s	2 Mb/s – 8 Mb/s	GBS, ATM

Table 4. Enhanced Definition Motion Imagery

ENGINEERING GUIDELINE 0220c - MISM, Enhanced Definition Motion Imagery, Technical Notes

MISM-L8 Motion Imagery System Matrix-Level 8 (MISM-L8), Uncompressed Enhanced Definition Motion Imagery, is defined as digital progressive 480-line and 576-line acquisition formats at 24 to 60 frames per second.

MISM-L8 Note 1: MISM-L8 can be considered to yield a good combination of improved spatial and temporal resolution capabilities at minimal increased cost as compared to today's broadcast quality digital interlace (Rec. 601-5) systems. However, 720x480p and 720x576p systems do not utilize square pixels and there are insufficient horizontal pixels to properly deliver 16:9 aspect ratio imagery.

MISM-L7 Motion Imagery System Matrix-Level 7 (MISM-L7), Mezzanine Compression Enhanced Definition Motion Imagery is defined as any ED format of MISM-L8 using mild compression. Note that a higher compression rate can be used for H.264 versus MPEG-2. H.264 L3.0 can be used for frame rates up to 30 Hz. H.264 L3.1 must be used for frame rates above 30 Hz.

MISM-L6 Motion Imagery System Matrix-Level 6 (MISM-L6) is defined as any ED format of MISM-L8/7 that is highly compressed to use end-user (final link) transport delivery systems. MISM-L6 includes transport delivery systems used by US Treaty partners. Note that a higher compression rate can be used for H.264 versus MPEG-2. H.264 L3.0 can be used for frame rates up to 30 Hz. H.264 L3.1 must be used for frame rates above 30 Hz.

MISM-L6 Note 1: MISM-L6 has the advantages of progressive scan, bandwidth efficiency, higher vertical resolution and lack of interlace artifacts as compared to standard definition television (MISM-L3 – MISM-L5).

Note about bit depths: While multiple bit depths are allowed, higher bit depths are preferred. For example, if both 10 bit and 8 bit implementations are allowed under the standard, 10 bit implementations are preferred.

ENGINEERING GUIDELINE 0220d - MISM, Standard Definition Motion Imagery

System Level	Common Description / Intended Application	System Attributes: Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horiz. Res.	Nominal Vert. Res.	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L5	Standard Definition (SD) / Acquisition	Standard	Standard	High	ITU 601 SMPTE 259M (4:2:2)	720	480i – 576i	8 - 10	24 – 60 FPS	Zero to 2.5:1	270 Mb/s	270 Mb/s - 360 Mb/s	SDI, OC-12
MISM-L4M	SD / Processing / Archiving	Standard	Standard	Medium	MPEG-2 MP@ML	720	480i – 576i	8	24 - 30 FPS	5.5:1 –10:1	15 Mb/s	10 - 20 Mb/s	Half to Full T3, TCDL, ATM
MISM-L4H	SD / Processing / Archiving	Standard	Standard	Medium	H.264 MP@L3	720	480i – 576i	8	24 - 30 FPS	5.5 – 20:1	10 Mb/s	5 - 10 Mb/s	Half to Full T3, TCDL, ATM
MISM-L3M	SD / Distribution	Standard	Standard	Low	MPEG-2 MP@ML	720	480i – 576i	8	24 – 30 FPS	28:1	6 Mb/s	3 - 10 Mb/s	GBS, T2, ATM, DVD
MISM-L3H	SD / Distribution	Standard	Standard	Low	H.264MP@L3	720	480i – 576i	8	24 - 30 FPS	56:1	3 Mb/s	1.5 - 5 Mb/s	GBS, T2, ATM, DVD

Table 5. Standard Definition Motion Imagery

ENGINEERING GUDELINE 0220d - MISM, Standard Definition Motion Imagery, Technical Notes

MISM-L5 Motion Imagery System Matrix-Level 5 (MISM-L5), Uncompressed Standard Definition Motion Imagery, is defined as uncompressed, 4:2:2 digital interlace motion imagery, including 720 x 480 (to 576) x 24-60 or ITU-R BT.601-5 (4:2:2) Component Video. Note that storage systems (such as some digital motion imagery tape formats) that use bit-serial interface 4:2:2 input/output protocols but use 2.5:1 (near lossless) internal compression will be considered as meeting MISM-L5. Furthermore, all primary routing and distribution hardware systems must comply with SMPTE 259M Level C and D (270/360 Mb/s) implementations to meet MISM-L5. Users are cautioned that true uncompressed processing may be required for the most demanding MISM-L5 applications.

MISM-L4 Digital MPEG-2 compressed motion imagery, with no more than 10:1 compression and H.264 with no more than 20:1 compression defines MISM-L4. Note that 10:1 compression ratio compliant MPEG-2 Main Profile @ Main Level based systems meet MISM-L4 as well as 20:1 compression ratio compliant H.264.

MISM-L3 Digital 4:2:0, MPEG-2 compressed motion imagery, with no more than 28:1 compression and H.264 with no more than 56:1 compression. Note that both these systems meet MISM-L3.

Note about bit depths: While multiple bit depths are allowed, higher bit depths are preferred. For example, if both 10 bit and 8 bit implementations are allowed under the standard, 10 bit implementations are preferred.

ENGINEERING GUIDELINE 0220e - MISM, Low Bandwidth Motion Imagery

System Level	Common Description / Intended Application	System Attributes: Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horiz. Res.	Nominal Vert. Res.	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L2.2H	Medium/ Distribution	Medium	Medium	Low	H.264 L2.2	640 - 720	480 – 576	8	24 – 30 FPS	110:1	1.5 Mb/s	1,024 – 1,500 kb/s	T1/ E1
MISM-L2.1H	Low-Medium/ Distribution	Low-Medium	Medium	Low	H.264 L2.1	320 - 352	480 - 576	8	24 – 30 FPS	165:1	1.0 Mb/s	768 – 1024 kb/s	T1/E1
MISM-L2.1M	Low-Medium/ Distribution	Low-Medium	Medium	Low	MPEG-2 MP@ML	320 - 352	480 - 576	8	24 – 30 FPS	110:1	1.5 Mb/s	1,024 – 1,500 kb/s	T1/E1
MISM-L2.0M	Low/Distribution	Low	Medium	Very Low	MPEG-1	320 - 352	240 – 288p	8	24 – 30 FPS	165:1	1.0 Mb/s	768 – 1024 kb/s	T1/E1
MISM-L1.3H	Low/ Distribution	Low	Medium	Very Low	H.264 L1.3	320 - 352	240 - 288p	8	24 – 30 FPS	430:1	512 kb/s	384 - kb/s	Partial T1/E1
MISM-L1.2H	Very Low/ Distribution	Low	Low	Very Low	H.264 L1.2	320 – 352	240 - 288p	8	12 – 15 FPS	650:1	256 kb/s	192 – 384 kb/s	RTP/RSTP, Wireless
MISM-L1.1H	Very Low/ Distribution	Low	Very Low	Very Low	H.264 L1.1	320 - 352	240 - 288p	8	6 – 7 FPS	1300:1	128 kb/s	56 – 192 kb/s	RTP/RSTP, Wireless
MISM-L1.0H	Lowest/ Distribution	Very Low	Low	Lowest	H.264 L1.0	160 - 176	120 – 144p	8	12 – 15 FPS	5200:1	32 kb/s	< 56 kb/s	RTP/RSTP, Wireless

Table 6. Low Bandwidth Motion Imagery

ENGINEERING GUIDELINE 0220e - MISM, Low Bandwidth Motion Imagery, Technical Notes for Ed. 1

MISM-L2 MPEG-2 (4:2:0, half horizontal resolution using Adaptive Field Frame techniques) or MPEG-1 compressed video, using SIF image resolution decimation at 25-30 FPS temporal rate can be used for MISM-L2. They are, however, included for legacy purposes. H.264 will provide image quality equal to MPEG-2 at less than half the data rate. Therefore, the preferred compression method for Levels 2.1 and 2.2 is H.264, which will yield higher quality motion imagery at these data rates. The following data rates are recommended for H.264:

- 1,024 – 1,500 kb/s use H.264 L2.2 at full resolution and 24 - 30 FPS
- 768 – 1,024 kb/s use H.264 L2.1 at half horizontal resolution and 24 – 30 FPS

MISM-L1 H.264 is expected to meet the requirements for MISM-L1. MPEG-2 (4:2:0, using Adaptive Field Frame techniques) and MPEG-1 at SIF resolutions are not usable at these data rates. The following data rates are recommended for H.264:

- 384 to 768 kb/s use H.264 L1.3 (CIF (352x288) at approximately 24 - 30 fps)
- 192 to 384 kb/s use H.264 L1.2 (CIF at approximately 12 - 15 fps)
- 56 to 192 kb/s use H.264 L1.1 (CIF at approximately 6 - 7 fps)
- Less than 56 kb/s use H.264 L1.0 (QCIF at approximately 5 - 15 fps)

ENGINEERING GUIDELINE 0220f - MISM, Very Low Temporal Definition Motion Imagery

System Level	Common Description / Intended Application	System Attributes : Spatial Definition	System Attributes: Temporal Definition	System Attributes: Generation Resiliency	Applicable Standard (Note: Other Profiles, Practices may apply)	Nominal Horizontal Resolution	Nominal Vertical Resolution	Nominal Bit Depth	Frame Rates	Nominal Compression Ratio	Nominal Data Rate	Data Rate Range	Candidate Transport Channels (Nominal Rates)
MISM-L0	Very Low Temporal Motion Imagery / Distribution	High	Very Low	Variable	NSIF	720 -1920	480 - 1080	8 or 10 or12	Still - 2 FPS	10:1	256 Kb/s	56 – 512 Kb/s	Non Real Time POTS, ISDN

Table 7. Very Low Temporal Motion Imagery

ENGINEERING GUIDELINE 0220f - MISM, Very Low Temporal Definition Motion Imagery, Technical Notes

MISM-L0 Low frame rate motion imagery based on digital video sources using full MISM-L11/8/5 spatial resolution but having very limited temporal resolution (on the order of stills to 1 or 2 FPS). At these low temporal rates, the imagery is no longer considered to be video (thus the motion imagery nomenclature). MISM-L0 is intended to describe applications where the most severe bandwidth limitations preclude delivery of true motion video. For these very low bandwidth applications, systems should deliver full spatial resolution but may need to severely decimate temporal elements to the point of producing only still frames (and delivering such frames in non-real-time, based on the data rate capacity of the delivery channel). For the specific cases of still imagery derived from video sources, such imagery shall be formatted to conform to NSIF standards (see STANAG 4609, Standard 0206 - Motion Imagery Still Frames).

RECOMMENDED PRACTICES

RECOMMENDED PRACTICE 0200 – Authorized Limited Applications of DV Format Video

Consumer cameras that capture digital motion imagery in near-professional quality using the Digital Video (DV) format are now available commercially and at low cost. In addition, the DV proprietary format is being transitioned from a proprietary standard to a published standard within SMPTE.

For "handheld" motion imagery applications the DV format promises a good tradeoff between image quality and system cost. Therefore, DV video format is authorized for specialized NATO applications requiring the use of consumer-grade palm-sized camcorders to meet limited, low profile (covert) mission requirements, provided that: 1) No less than 1st generation DV footage will be directly digitally transferred into computer processing systems using IEEE 1394 interfaces; 2) Such motion imagery DV clips will not be forwarded nor interfaced to any NATO communications nodes for subsequent processing.

Affordable devices are now commercially available to convert from the DV format to STANAG approved digital formats for distribution and exploitation. (For example, a single chip is available that converts 25 Mbps DV to 6 Mbps MPEG-2.) Thus, DV-originated motion imagery that meets the above criteria may be distributed when it is converted to an approved digital format such as MPEG-2.

RECOMMENDED PRACTICE 0201 – NODE STRUCTURE FOR THE SMPTE METADATA DICTIONARY

SMPTE EG37-2001, *Node Structure for the SMPTE Metadata Dictionary,* is the NATO Engineering Guideline for the structure/formatting of metadata elements in the Metadata Dictionary.

RECOMMENDED PRACTICE 0202 - Xon2

"Xon2" is the name of a concept to support the "seamless" implementations of advanced video compression technologies without disrupting current and future operations and systems. "X" defines existing or future video compression technologies adopted by NATO and "on2" refers to the use of MPEG-2 transport streams and files. "2on2" payloads have been successfully deployed using standards compliant MPEG-2 compressed video elementary streams, audio elementary streams, and SMPTE KLV encoded metadata as MPEG-2 private data streams.

Building on this baseline "2on2" capability, "Xon2" will provide a migration path to inject improved compressions technologies, which will yield improved image quality and / or reduced bandwidths. For example, H.264 ("264on2") can be carried over the MPEG-2 transport streams using ISO/IEC 13818-1:2000/FDAM 3: "Information technology -- Generic coding of moving pictures and associated audio: Systems, AMENDMENT 3: Transport of ISO/IEC 14496 part 10 [ITU-T H.264] video data over ISO/IEC 13818-1" (DRAFT).

File Formats

MPEG-2 with embedded KLV metadata – Current state of file transfer (simple file format).
For simple file applications, MPEG-2 Transport or Program Streams may be used for NATO applications. All NATO systems must be able to receive and decode Program Streams and Transport Streams. Additionally, SMPTE 217 KLV metadata streams in the Transport Stream shall also be decoded when present. It should be noted that all MPEG-2 decoders are not KLV metadata enabled.

MXF Wrapper – Advanced File Format.
In the other applications, where digital video files need to be exchanged, real-time or not, between collection platforms, users and data-bases with random access to the motion imagery based on metadata indexing, the Material Exchange Format (MXF), SMPTE 377M, can be used. Those systems that support MXF must also support MPEG-2 transport streams. This format makes use of the sampling, compression and metadata rules and provides advanced features for easy access and exchange over communication networks.

As MXF covers a large number of options and application domains, the present standard restricts as follows the applicable MXF possibilities to a minimum level mandated to achieve interoperability between the implementing nations:

- Only operational patterns 1a (OP-1a) and 1b (OP-1b) as per SMPTE 378M will be used.
- The essence will be wrapped frame by frame using the generic container as per SMPTE 379M and SMPTE 381M.
- From the complete list of metadata sets and properties given by SMPTE 380M, the participating parties will be required to interpret only a minimum profile (derived from ASPA Profile) listed here. It must be noted that it is a design rule of MXF players to accept dark (unknown) data which obviously will not be interpreted.
- The dynamic metadata will be interleaved within the body.

RECOMMENDED PRACTICE 0204 - MXF Profile for Aerial Surveillance and Photogrammetry Applications (ASPA)

Scope

This recommend practice documents the ASPA profile for the Material Exchange Format (MXF). The profile constrains the contents of MXF files to promote interoperability among Nations.

The purpose of this document is to state the Nation's requirements for MXF files to address specific operational needs.

Introduction

The Material Exchange Format is a multimedia file format developed to promote file-level interoperability across different platforms in the digital cinema and television industry. While MXF was designed initially for the entertainment industry, the parallels between their digital production, post-production, archiving, and product distribution processes using MXF and those needed for digital motion imagery in the ISR Community are remarkable.

The proposed MXF Profile for Aerial Surveillance and Photogrammetry Applications (ASPA) forms the basis for development of a prototype demonstration of the MXF format in Product Libraries.

Additionally, ASPA files may be stored in accordance with Version 1.1 AAF format specification. All data and constraints specified herein apply equally to ASPA-MXF files as to ASPA-AAF files.

The ASPA Profile document must be read in conjunction with the MXF and AAF Specifications. The major sections and subsections of this document are matched with those of the MXF Specification.

File Kinds

In this document, some shorthand phrases are used to avoid repetitive language:

"File" – means any MXF File, whether conforming to the ASPA Profile or not.

"ASPA File" – means an MXF File which conforms to the ASPA Profile.

"non-ASPA File" – means an MXF File which does not conform to the ASPA Profile.

"Other File" – means any file which is not an MXF File.

Manner of Specification

This document must be read in conjunction with the MXF Specification. The major sections and subsections of this document are matched with those of the MXF Specification.

This document does not repeat any of the contents of the MXF Specification. Instead, it defines three kinds of variations on the MXF specification: numerical constraints, semantic constraints and extensions.

Numerical Constraints

Numerical Constraints on the MXF specification limit the capacity of a File. They may be constraints on the number of a given Object allowed in an ASPA File, or specific ranges for given Property values in an ASPA File. Numerical Constraints are given in the form of tables.

Semantic Constraints

Each set of numerical constraints is followed by a set of semantic constraints, which serve two purposes: they give a prose explanation of the given numerical constraints, and they

define additional restrictions upon combinations of Objects and Property values which are not possible to clearly tabulate.

Numerical and Semantic constraints are presented in the same order as the MXF Specification to which they relate and with corresponding major section and sub-section numbering.

Extensions

Extensions are specifications for Classes, Objects, Properties, Types and Definitions peculiar to ASPA Files that are not built in to the standard MXF Specification or SDK. All Extensions are created using the standard MXF extension model.

Extensions are presented after the Constraints in each major section of this document.

Class Packages

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Structural Metadata Classes

Header

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

The ASPA Profile does not change any numerical constraints on this class. Thus:

ASPA Files shall contain one and only one Header object.

Semantic Constraints

ASPA Files shall contain only the Preface subclass of Header, as defined by MXF.

Extensions

Preface defines three required properties: OperationalPattern, EssenceContainers and DMSchemes.

Identification

The ASPA Profile does not alter this MXF Class Specification in any way.

Dictionary

The ASPA Profile does not alter this MXF Class Specification in any way.

ContentStorage

The ASPA Profile does not alter this MXF Class Specification in any way.

Mob

The ASPA Profile alters this MXF Class Specification as follows:
ASPA Files shall contain only the following subclasses of Mob

- MasterMob
- SourceMob

Each Mob in an ASPA File shall contain the following numbers of Slots:

0 or 1 TimelineSlot, with a DataDefinition equal to Picture.

0 or 1 StaticSlot, with a DataDefinition equal to Picture.

1 or more StaticSlot, with a DataDefinition equal to DescriptiveMetadata.

– plus any other Slots specified for subclasses of Mob (see below).

CompositionMob

The ASPA Profile does not alter this MXF Class Specification in any way.

However, note that CompositionMob objects are not present in ASPA Files

MasterMob

The ASPA Profile alters this MXF Class Specification as follows.

Numerical Constraints

ASPA Files shall contain one and only one MasterMob.

Semantic Constraints

The MasterMob shall contain at least a StaticSlot with DataDefinition equal to DescriptiveMetadata; containing Level 0 Metadata.

Level 0 Metadata is carried in a DMSegment containing an ASPA_Framework (see 0 below), which in turn contains a DM_Set_File (see 0 below). .

SourceMob

The ASPA Profile alters this MXF Class Specification as follows.

Numerical Constraints

ASPA Files shall contain one top-level SourceMob for each EssenceData object in the file (a top-level SourceMob is one that is directly referenced by a MasterMob).

ASPA Files may also contain a lower-level SourceMob for each EssenceData object in the file (a lower-level SourceMob is one that is referenced by another SourceMob).

ASPA Files may contain additional top-level SourceMobs for which there is no EssenceData object in the file. These SourceMobs describe external essence. ASPA Files shall contain one lower-level SourceMob for each external essence SourceMob object in the file.

Semantic Constraints

Each top-level SourceMob shall contain at least a StaticSlot with DataDefinition equal to DescriptiveMetadata; containing Level 1 Metadata.

Level 1 Metadata is carried in a DMSegment containing an ASPA_Framework (see 0 below), which in turn contains a subclass of DM_Set (see 0 below). The subclass of DM_Set shall be of the class appropriate to the Essence type.

Additionally, the top-level SourceMob may contain zero or more Slots with DataDefinition equal to DescriptiveMetadata; containing Level 2 Metadata.

Each top-level SourceMob shall contain a subclass of FileDescriptor appropriate to the Essence type. The top-level SourceMob shall contain at least one Slot with a DataDefinition appropriate to the Essence type. The Segments of such Slots may contain a zero-value SourceReference, or a SourceReference to a lower-level SourceMob.

Each lower-level SourceMob shall contain an ImportDescriptor with a Locator naming the file that was imported to create the top-level SourceMob and EssenceData object.The lower-level SourceMob shall contain at least one Slot with a DataDefinition appropriate to the Essence type. The Segments of such Slots shall contain a zero-value SourceReference.

Slot

The ASPA Profile does not alter this MXF Class Specification in any way.

TimelineSlot

The ASPA Profile does not alter this MXF Class Specification in any way.

EventSlot

The ASPA Profile does not alter this MXF Class Specification in any way.

StaticSlot

The ASPA Profile does not alter this MXF Class Specification in any way.

KLVData

The ASPA Profile does not alter this MXF Class Specification in any way.

Note: the SMPTE KLV Sets contained within KLVData objects may include any of the MISB-defined KLV Sets including Security Metadata Sets (MISB RP-0102), Predator Standard Metadata Sets (MISB EG-0104) and so on.

TaggedValue

The ASPA Profile does not alter this MXF Class Specification in any way.

Parameter

The ASPA Profile does not alter this MXF Class Specification in any way.

ConstantValue

The ASPA Profile does not alter this MXF Class Specification in any way.

VaryingValue

The ASPA Profile does not alter this MXF Class Specification in any way.

ControlPoint

The ASPA Profile does not alter this MXF Class Specification in any way.

Locator

The ASPA Profile does not alter this MXF Class Specification in any way.

NetworkLocator

The ASPA Profile does not alter this MXF Class Specification in any way.

TextLocator

The ASPA Profile does not alter this MXF Class Specification in any way.

Component Classes

Component

The ASPA Profile does not alter this MXF Class Specification in any way.

Transition

The ASPA Profile does not alter this MXF Class Specification in any way.

Segment

The ASPA Profile does not alter this MXF Class Specification in any way.

Sequence

The ASPA Profile alters this MXF Class Specification as follows:
ASPA Files shall not contain any Sequence objects

Filler

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any Filler objects.

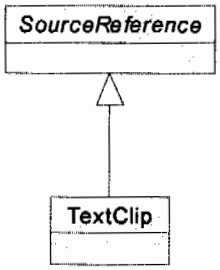
SourceReference

Extensions

The ASPA Profile defines the TextClip subclass of SourceReference, as follows:

TextClip has a weak reference to a Slot describing text essence data.

TextClip is an abstract class and is a subclass of SourceReference.



The TextClip class does not define any properties.

TextClip references a Mob Slot containing text essence data.

SourceClip

The ASPA Profile does not alter this MXF Class Specification in any way.

Event

The ASPA Profile does not alter this MXF Class Specification in any way.

CommentMarker

The ASPA Profile does not alter this MXF Class Specification in any way.

DescriptiveMarker

The ASPA Profile alters this MXF Class Specification as follows:.

Extensions

The ASPA Profile defines the DynamicMarker subclass of DescriptiveMarker, and the DynamicClip subclass of DynamicMarker, as described in section below.

GPITrigger

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any GPITrigger objects.

Timecode

The ASPA Profile does not alter this MXF Class Specification in any way.

TimecodeStream

The ASPA Profile does not alter this MXF Class Specification in any way.

TimecodeStream12M

The ASPA Profile does not alter this MXF Class Specification in any way.

Edgecode

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any Edgecode objects.

Pulldown

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any Pulldown objects.

OperationGroup

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any OperationGroup objects.

NestedScope

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any NestedScope objects.

ScopeReference

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any ScopeReference objects.

Selector

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any Selector objects.

EssenceGroup

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any EssenceGroup objects.

Definition Classes

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Essence Data Classes

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

EssenceData

The ASPA Profile does not alter this MXF Class Specification in any way.

Standard Essence Descriptor Classes

EssenceDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

FileDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

DigitalImageDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

CDCIDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

RGBADescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

TapeDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any TapeDescriptor objects.

FilmDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any FilmDescriptor objects.

Essence Descriptor Classes for Non-Normative Essence Types

WAVEDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any WaveDescriptor objects.

AIFCDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files shall not contain any AIFCDescriptor objects.

TIFFDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

Essence Descriptor Classes for Common Compressed Picture Types

MPEG2VDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

DVDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

JFIFDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

Essence Descriptor Classes for Sound Essence Types

SoundDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

PCMDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

PCM8Descriptor

This section of the MXF Specification is presently not complete.

ASPA Files shall not contain any PCM8Descriptor objects.

AES3PCMDescriptor

The ASPA Profile does not alter this MXF Class Specification in any way.

NonPCMDescriptor

This section of the MXF Specification is presently not complete.

The ASPA Profile does not alter this MXF Class Specification in any way.

Essence Descriptor Classes for Multiple and Generic Container Essence Types

MultipleDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

MultipleDescriptors in ASPA Files may contain RP217Descriptor objects or MPEG2MetadataDescriptor objects.

ASPA Files shall not set the EssenceContainer property to GC_PS or GC_PES or GC_ES (defined in the SMPTE Labels Registry).

Semantic Constraints

ASPA Files may contain only MPEG-2 Transport Streams, with or without RP217 KLV Private Data Streams.

MPEG2SysDescriptor

The ASPA Profile alters this MXF Class Specification as follows:

Numerical Constraints

ASPA Files may contain instances of this class.

Semantic Constraints

ASPA Files may contain only MPEG-2 Transport Streams, with or without RP217 KLV Private Data Streams.

SysDescriptor

ASPA Files shall not contain any SysDescriptor objects.

AuxDescriptor

ASPA Files shall not contain any AuxDescriptor objects.

Descriptors for Physical Essence

The PhysicalDescriptor class is an abstract superclass which is the parent class for all descriptors of Essence which are indirectly manipulated by MXF applications. It is a peer of the FileDescriptor class (which is the parent class for all descriptors of Essence which are directly manipulated by MXF applications).

The PhysicalDescriptor class is a subclass of the EssenceDescriptor class. The ASPA Profile does not alter this MXF Class Specification in any way.

PhysicalDescriptor does not add any new properties to EssenceDescriptor.

ImportDescriptor

An ImportDescriptor specifies the external file that was imported to create a SourceMob and EssenceData object.

An ImportDescriptor is a concrete subclass of AbstractPhysicalDescriptor. The ASPA Profile does not alter this MXF Class Specification in any way.

ImportDescriptor does not define any new properties.

RecordingDescriptor

ASPA Files shall not contain any RecordingDescriptor objects.

AuxiliaryFileDescriptor

AuxiliaryFileDescriptor specifies an auxiliary file to be included in an ASPA file. The ASPA Profile does not alter this MXF Class Specification in any way.

AuxiliaryFileDescriptor is a concrete subclass of AbstractPhysicalDescriptor.

AuxiliaryFileDescriptor adds the following properties:

Property Name	Type	Explanation
MimeType	String	the registered MIME media type used by the data as defined in RFC 2046 and registered according to RFC 2048. Example: L"text/html" Required.
CharSet	String	the registered character set used by the internal and external representation of the data as defined in RFC 2048 and http://www.iana.org/assignments/ character-sets Example: L"ISO-8859-1" Optional.

Additional Descriptors for ASPA Profile

The ASPA Profile defines the following additional Descriptors:

RP217Descriptor

The RP217Descriptor class specifies how KLV packets are contained within an MPEG-2 Systems Stream in a FileSourceMob in an ASPA File.

The RP217Descriptor class is a subclass of the DataEssenceDescriptor class.

RP217Descriptor adds the following properties:

Property Name	Type	Explanation
RP217DataStreamPID	Uint16	The ISO 13818-1 Transport Stream PID for the KLVPDS stream Required.
RP217VideoStreamPID	Uint16	The ISO 13818-1 Transport Stream PID for the Video stream Required.

Numerical Constraints

ASPA Files may contain instances of this class.

Semantic Constraints

The ContainerFormat property of the FileDescriptor shall be set to the constant value for KLVA as defined in the SMPTE Labels Registry: 0x060e2b34 04010102 0D010301 02090602. This corresponds to MPEG-2 TS, PES private data, clip wrapping.

MPEG2MetadataDescriptor

The MPEG2MetadataDescriptor class specifies how metadata packets are contained within an MPEG-2 Systems Stream in a FileSourceMob in an ASPA File.

The MPEG2MetadataDescriptor class is a subclass of the FileDescriptor class.

The MPEG2MetadataDescriptor does not add any new properties to the FileDescriptor.

Numerical Constraints

ASPA Files may contain instances of this class.

Semantic Constraints

The ContainerFormat property of the FileDescriptor shall be set to the registered value for KLV formatted per ISO 13818-1:2000- Amd 1 as defined in the SMPTE RP224 Labels Registry:.

NITFDescriptor

The NITFDescriptor class specifies how NITF images are contained within a FileSourceMob in an ASPA File.

The NITFDescriptor class is a subclass of the FileDescriptor class.

The NITFDescriptor does not add any new properties to the FileDescriptor.

Numerical Constraints

ASPA Files may contain instances of this class.

Semantic Constraints

The ContainerFormat property of the FileDescriptor shall be set to the constant value for NITF, which shall be registered in the SMPTE RP224 Labels Registry.

ParsedTextDescriptor

ParsedTextDescriptor specifies a text file to be included in an ASPA file.

ParsedTextDescriptor is an abstract subclass of FileDescriptor.

ParsedTextDescriptor adds the following properties:

Property Name	Type	Explanation
Encoding	String	the registered character set used by the external representation of the data as defined in RFC 2048 and http://www.iana.org/assignments/character-sets Example: L"UTF-8" Required.

SGMLDescriptor

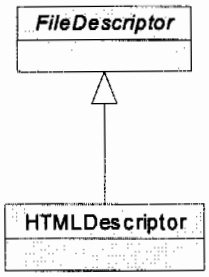
SGMLDescriptor is an abstract subclass of ParsedTextDescriptor.

The SGMLDescriptor does not add any new properties to the ParsedTextDescriptor.

HTMLDescriptor

HTMLDescriptor specifies that the essence data is in HTML text format.

HTMLDescriptor is a concrete subclass of SGMLDescriptor. An HTMLDescriptor object is owned by a File SourceMob object.



An HTMLDescriptor object specifies that the File SourceMob describes an HTML object, which contains text, formatted according to the HTML standard.

HTMLDescriptor adds the following properties:

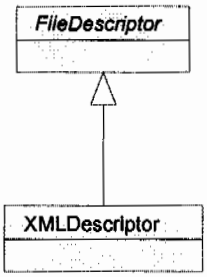
Property Name	Type	Explanation
DocType	String	the complete <!DOCTYPE > declaration for this HTML document as defined in the relevant **www.w3c.org/TR** documents Required.

Example: L"<!DOCTYPE HTML PUBLIC \"-//W3C//DTD HTML 4.01 Transitional//EN\">"

XMLDescriptor

XMLDescriptor specifies that the essence data is in XML text format.

XMLDescriptor is a concrete subclass of TextFileDescriptor. An XMLDescriptor object is owned by a File SourceMob object.



XMLDescriptor adds the following properties:

Property Name	Type	Explanation
DefaultNamespaceURI	String	the URI of the default namespace for this XML document as defined in the relevant www.w3c.org/TR documents Example: L"http://www.smpte.org/test" Required
NamespaceTags	StringArray	the Namespace Tags used in Qnames in this XML document Example: L"mxf", L"xsi" Optional
NamespaceURIs	StringArray	the URIs associated with Namespace Tags used in Qnames in this XML document Example: L"http://www.smpte.org/test",L"http://www.w3.org/2001/XMLSchema-instance" Optional

An XMLDescriptor object specifies that the File SourceMob describes an XML object, which contains text, formatted according to the XML standard.

Dynamic Metadata

SMPTE377M MXF Format and SMPTE EG42 MXF Descriptive Metadata define abstract classes for Descriptive Metadata. The ASPA Profile defines concrete subclasses for Dynamic Metadata, as detailed in the following subsections.

ASPA Files may include as optional properties of Descriptive Metadata classes any other attributes for which a SMPTE Universal Label for that attribute has been defined. Methodology for adding these properties is described in above. The SMPTE Universal Label shall be used as the unique identifier of this attribute in a PropertyDefinition for the ClassDefinition of the appropriate class in the MetaDictionary of this ASPA File.

Methodology for properly adding properties is as follows:

When a new property is required to be added to ASPA, the following steps must be carried out:

1. Ensure the property is present in ISO 19115
2. Identify the appropriate MXF Class

   If the Property applies to a single Product_Format, use the ASPA_DM_Set for that Product_Format

   If the Property applies to multiple concrete classes, use the ASPA_DM_Set superclass (the MXF superclass which they all have in common)
3. Choose a symbolic name for the Property (it need not be unique beyond the direct ancestor and descendant classes, but it must not contain punctuation other than _)
4. Identify the data type (from MXF Types, as recorded in SMPTE Registry)
5. Obtain a SMPTE UL from the appropriate registry (This is the normative reference.)

   Determine which Registry applies (RP210, DoD Public, DoD Private)

   RP210: submit entry to SMPTE W25

   DoD Public: submit to TBD

   DoD Private: submit to TBD

   Table 2 Create an MXF Property Definition in the application code

Each Property registration requires a single API call on the appropriate class Definition

(in future, write and publish the MXF-X schema fragment)

Similar procedures are used to define new Classes

Similar procedures are used to define new Types (including enumerated values)

ASPA_Framework

The ASPA_Framework class is a container for dynamic metadata defined by ASPA. The classid of the ASPA_Framework class identifies the dynamic metadata as conforming to ASPA.

The ASPA_Framework class is a concrete subclass of the DMFramework class defined by SMPTE EG42.

DMFramework adds the required SetReference property:

Property Name	Type	Explanation
SetReference	Strong Reference to DM_Set	The dynamic metadata of the appropriate class. Required.

ASPA_DM_Set

The ASPA_DM_Set class is a container for dynamic metadata defined by ASPA.

The ASPA_DM_Set class is a abstract subclass of the DM_Set class defined by SMPTE EG42.

DM_Set predefines the following properties:

Property Name	Type	Explanation
Security_Classification	String Required	The string that represents the Security Classification
Country_Code_Method	String Optional	The coding method used to identify the NATO classifying country and countries in the releasing instructions. Method is restricted to ISO-3166 two letter, ISO-3166 three letter, FIPS10-4 two letter
Non_US_Classification_ Country	String Optional	This metadata element contains a value for the NATO classifying country code.
Caveats	String Optional	All pertinent caveats/codewords from each category of the CAPCO register
Release_Instructions	String Optional	Valid list of country codes to which countries the file is authorized for release. When multiple countries are listed, countries are separated by a space.
Classification_Comment	String Optional	Comments pertaining to security
Product_Format	String Required	The code that represents an NSGI standard format for a DATASET (per the NERS Appendix D Table 2), or a format that is available from a Library as an alteration (also known as an export format). The native format in which the NSGI Library stores the data
Product_Title	String Optional	The name by which the DATASET is known.
Creation_Time	Timestamp Optional	Identifies the date or the date and time that the product was created or last modified.
Originators_Name	String Optional	The text that represents the originator.
Originating_Station_ID	String Optional	The identifier that represents the originating organization, system, station or product.

Instances of DM_Set shall include all properties marked as Required, and may include any of the properties marked as Optional.

DM_Set_File

The DM_Set_File class is a container for ASPA level 0 metadata, which is metadata that pertains to the total file. The DM_Set_File class is a concrete subclass of ASPA_DM_Set.

DM_Set_File inherits all properties of ASPA_DM_Set, and predefines no additional properties. Instances of DM_Set_File shall include all properties marked as Required, and may include any of the properties marked as Optional.

The required property Product_Format of the superclass DM_Set shall have the value "MXF_ASPA".

DM_Set_MPEGKLV_Layer

The DM_Set_MPEGKLV_Layer class is a container for ASPA level 1 metadata, which is metadata that pertains to a product of type MPEGKLV within the file. The DM_Set_MPEGKLV_Layer class is a concrete subclass of ASPA_DM_Set.

DM_Set_MPEGKLV_Layer adds the following properties:

Property Name	Type	Explanation
Image_Source_Device	String Optional	A free text identification of the particular image sensor type and serial number.
Start_Date_Time	Timestamp Optional	The date and time an image was collected.
Bounding_Rectangle	Geographic Area Optional	Defines the boundary for an area of inclusion or exclusion for an IMAGE.
Platform_Designation	String Optional	Platform ID. From KLV Platform Designation.
Target_ID	String Optional	Combination of BE Number, OSUFFIX, and Country Code. From KLV Target Id.

Instances of DM_Set_MPEGKLV_Layer shall include all properties marked as Required, and may include any of the properties marked as Optional.

The required property Product_Format shall have the value "MPEGKLV".

DM_Set_NITF_Layer

The DM_Set_NITF_Layer class is a container for ASPA level 1 metadata, which is metadata that pertains to a product of type NITF within the file. The DM_Set_NITF_Layer class is an abstract subclass of ASPA_DM_Set.

ASPA Files may contain one of the concrete subclasses of DM_SET_NITF_Layer:

DM_Set_NITF21_Layer
DM_Set_NITF20_Layer
DM_Set_NSIF10_Layer

DM_Set_NITF_Layer adds the following properties:

Property Name	Type	Explanation
Date_and_Time	MXFTimeStamp Optional	This field shall contain the time of the image acquisition. From NITF IDATIM.
Target_ID	String Optional	For NITF 2.0: Combination of BE Number, Functional Category Code and Country Code. For NITF 2.1 and NSIF 1.0: Combination of BE Number, OSUFFIX, and Country Code from NITF TGTID.
Geographic_Location	Geographic Polygon Optional	Defines the boundary for an area of inclusion or exclusion for an IMAGE. This shall be calculated as the bounding rectangle that includes all IMAGE layers within the NITF file.

Instances of DM_Set_NITF_Layer shall include all properties marked as Required, and may include any of the properties marked as Optional.

The required property Product_Format shall have the value "NITF", optionally suffixed by the NITF version number, for example: "NITF02.10".

DM_Set_JFIF_Layer

The DM_Set_JFIF_Layer class is a container for ASPA level 1 metadata, which is metadata that pertains to a product of type JFIF within the file. The DM_Set_JFIF_Layer class is a concrete subclass of ASPA_DM_Set.

DM_Set_JFIF_Layer adds the following properties:

Property Name	Type	Explanation
Description	String Optional	The text that describes source material for an IMAGE.

Instances of DM_Set_JFIF_Layer shall include all properties marked as Required, and may include any of the properties marked as Optional.

The required property Product_Format shall have the value "JFIF".

DM_Set_HTML_Layer

The DM_Set_HTML_Layer class is a container for ASPA level 1 metadata, which is metadata that pertains to a product of type HTML within the file. The DM_Set_HTML_Layer class is a concrete subclass of ASPA_DM_Set.

DM_Set_HTML_Layer adds the following properties:

Property Name	Type	Explanation
Description	String Optional	The text that describes source material for an HTML document.
Lang	String Optional	Code indicating the language used on an item.

Instances of DM_Set_HTML_Layer shall include all properties marked as Required, and may include any of the properties marked as Optional.

The required property Product_Format shall have the value "HTML".

DynamicMarker Classes

(This chapter of the MXF Specification is presently intentionally unused, reserved for specifications of additional MXF Classes).

DynamicMarker Class

The DynamicMarker class is a container for synchronous dynamic metadata defined by ASPA.

The DynamicMarker class is a concrete subclass of the DescriptiveMarker class of MXF V1.2 (aka the DMSegment class defined by SMPTE EG42).

The reference time for the synchronous dynamic metadata is carried in the Position property of the Event superclass. The synchronous dynamic metadata itself is carried in the KLVData property of the Component superclass.

The DynamicMarker class adds the following properties to DescriptiveMarker:

Property Name	Type	Explanation
ToleranceMode	ToleranceModeType	An integer that enumerates the mode of determining the reference time of this DynamicMarker. Allowed values are as follows: Estimated Assumed Precise Window Interpolated The meaning of these modes is described in section 0 below Required.
InterpolationMethod	WeakReference InterpolationDefinition	A reference to the well-known interpolation method used to interpolate metadata values to the reference time. Optional
ToleranceWindow	Indirect	The time window associated with the ToleranceMode, if any. If positive, the window shall be centered on the given reference time. If negative, the window shall end at the given reference time. Optional. This is an Indirect type – the value starts with the 16 byte identifier of the actual type.

Note: if the actual type of the ToleranceWindow is Length, the size of the window shall be calculated using the edit rate of the MobSlot in which the DynamicMarker is contained. This is to match the semantics of the SourceClip class. In all other cases, the window shall be calculated in absolute terms

Note: the ASPA specification does not provide any standard method to indicate the estimated error in a data value.

DynamicClip Class

The DynamicClip class containes a reference to the source of synchronous dynamic metadata defined by ASPA.

The DynamicClip class is a concrete subclass of DynamicMarker.

A DynamicClip may be used in place of a DynamicMarker to indicate the SourceMob, slot(s) and position from which the synchronous dynamic metadata value is obtained. If the KLVData property of the Component superclass is not present, the value must be obtained from the indicated source whenever it is required. Conversely, if the KLVData property is present, it shall contain a copy of the referenced synchronous dynamic metadata.

The DynamicClip class adds the following properties to DynamicMarker:

Property Name	Type	Explanation
SourceMobID	MobIDType	The MobID of the SourceMob from which the synchronous dynamic metadata is obtained. Required. A distinguished value of 0 indicates that the source of the metadata is unknown
SourceSlotIDs	Uint32Array	The SlotIDs of the slot or slots in the SourceMob from which the synchronous dynamic metadata is obtained. Optional
SourceIndex	Indirect	The index of the dynamic metadata within the referenced source, using the type given. Optional. This is an Indirect type – the value starts with the 16 byte identifier of the actual type. Normally, this value will be the identifier of the Position type
SourceSpecies	Indirect	The selectors of the elements from the source that are used in the referring MobSlot. All other elements from the SourceMob shall be ignored. Optional. This is an Indirect type – the value starts with the 16 byte identifier of the actual type.Normally, this value will be the identifier of the "ArrayOfAUID" type.

Notes: if the actual type of the SourceIndex is Position, the position in the SourceMob shall be calculated using the edit rate of the MobSlot in which the DynamicClip is contained. This is to match the semantics of the SourceClip class. In all other cases, the SourceIndex shall be calculated in the frame of reference of the SourceMob.

Support Classes for ASPA

(This chapter of the AAF Specification is presently intentionally unused, reserved for specifications of additional MXF Classes).

Geographic Area

The Class Geographic Area has the following properties:

Property Name	Type	Explanation
GeographicArea_ NorthWest	Geographic_ Coordinate	The NorthWest corner point of the area
GeographicArea_ SouthEast	Geographic_ Coordinate	The SouthEast corner point of the area
GeographicArea_ SourceDatum	String Option	Code indicating the source datum from which the coordinates are measured, per DIGEST spec. Optional, default = "WG84" Default value = "G" Other values: "GEO" "WG84"

Geographic Polygon

The Class Geographic Polygon has the following properties:

Property Name	Type	Explanation
GeographicPolygon_ Coords	Geographic_ Coordinate_ Array	The corner points of the polygon, in clockwise sequence
GeographicPolygon_ SourceDatum	String	Code indicating the source datum from which the coordinates are measured, per DIGEST spec Optional Default value ="G" Other values: "GEO" "WG84"

Unused Chapter

This chapter of the MXF Specification is presently intentionally unused.

Data Types

The ASPA Profile adds the following Data Types to the MXF Specification:

Fix32Dec3

The Type Fix32Dec3 is used to represent a value with 3 decimal places. In ASPA files, geographic Latitude and Longitude are measured in 1/1000 of an arc-second and are represented as Fix32Dec3 values.

Geographic Coordinate

The Type Geographic Coordinate is a Record with two members: Latitude and Longitude, both of Type Fix32Dec3.

Geographic Coordinate Array

The Type Geographic Coordinate Array contains a variable-length array of Geographic Coordinates as used in a Geographic Polygon

ToleranceModeType

The type ToleranceModeType enumerates the mode of determining the reference time of a DynamicMarker. Allowed values are as follows:

Symbol	Value	Explanation
Estimated	0	The value at the given reference time is estimated, not using any known interpolation method.
Assumed	1	The data was observed and the time of observation is assumed to be as given. No analytical weight can be given to the observation time or the size of the Window – they are guesstimates. Any interpolation is suspect
Precise	2	The data was observed at the precise reference time given.
Window	3	The data was observed sometime within a window of time relative to the given reference time.
Interpolated	4	The data value is the interpolated value that would be expected at the given reference time, using the given InterpolationMethod over the actual data received in the given time Window relative to the given reference time.

DataDefinitions

The ASPA Profile extends the provisions of this chapter of the MXF Specification as follows:

DynamicMetadata

ASPA defines the label DynamicMetadata, which is registered in the SMPTE Labels Registry RP224 v7

Extensible Enumerations

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Operation Groups

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Tutorial on Compositions

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Tutorial on Describing Essence

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

MetaDefinitions

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Extensions

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Bibliography

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

Conventions

The ASPA Profile does not alter the provisions of this chapter of the MXF Specification in any way.

RECOMMENDED PRACTICE 0206 – Security Metadata Universal Set for Digital Motion Imagery

1. Scope

This Recommended Practice (RP) describes the use of security metadata in MPEG-2 digital motion imagery applications. For applications involving national security it is mandatory that each part of a motion imagery file be marked correctly and consistently with security classification and other security administration information. The approved practices in this RP shall be applied to all MPEG-2 motion imagery implementations and shall be used to link security metadata to essence (video, audio, or data) and/or other metadata.

This RP defines only the format of embedding security metadata in MPEG-2 files. The methods used to gather security information, create files and insert security-metadata into files are the responsibility of application system developers. Similarly, the proper display of security information on screens, computer displays, printed output, etc. is the responsibility

of system application developers. Originators and application users are responsible for the proper handling and ultimately for the use and disposition of classified information.

2. References

2.1 Normative References

Director of Central Intelligence, Community Management Staff, Controlled Access Program Coordination Office (CAPCO), *Intelligence Community Classification and Control Markings Implementation Manual*, 10 Sep 1999, amended 12 Oct 2000

Director of Central Intelligence Directive (DCID) 6/3, *Security Requirements for Interconnected Information Systems*, 4 Feb 2000

CAPCO Authorized Classification and Control Markings Register, 12 Oct 2000

SMPTE 335M-2001, *Data Encoding Protocol Using Key-Length-Value*

SMPTE 336M-2001, *Metadata Dictionary Structure*

SMPTE 330M, *Unique Material Identifier (UMID)*

SMPTE RP210-2001, *Metadata Dictionary*

ISO/IEC 13818-1:1996, *Information Technology – Generic coding of moving pictures and associated audio information: Systems* (commonly called MPEG-2 Systems)

MIL-STD-2500B, *National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard*, 22 August 1997

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions: Country Codes*, 1 October 1997 and updated by the ISO 3166 Management Authority (MA) at: http://www.din.de/gremien/nas/nabd/iso3166ma/codlstp1/index.html

Federal Information Processing Standards (FIPS) Publication 10-4, *Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions*, National Institute of Standards and Technology, April 1995 (through Change Notice 6, 28 January 2001)

MISB Standard 0107, *Bit and Byte Order for Metadata in Motion Imagery Files and Streams*, 11 October, 2001.

2.2 Informative References

MISB RP, *Use of MPEG-2 Systems Streams in Digital Motion Imagery Systems*

Director of Central Intelligence Directive 1/7, 30 Jun 1998

Executive Order 12958, Jun 1995

3. Introduction

This RP defines the contents and the application of a Security Metadata Set in digital motion imagery. The first section explains the individual elements in a Set that are normative in the Metadata Dictionary (SMPTE Standard 336M and SMPTE RP210). The construction of a Security Metadata Set from these elements follows SMPTE Standard 335M using the KLV metadata encoding protocol. Finally, this RP defines how the Security Metadata Set shall be used for tagging essence and other metadata sets in MPEG-2 Transport Streams (TS) and Program Streams (PS).

4. Security Metadata Set for Digital Motion Imagery

The sections of this RP are applicable only to MPEG-2 bitstreams. The practices shall be followed to ensure that all parts of an MPEG-2 TS or PS are tagged correctly with security information for use by applications. All metadata shall be represented using big-endian (most significant byte – MSB – first) encoding. Bytes shall be big-endian bit encoding (most significant bit – msb – first).

4.1 Security Metadata Elements

The following Security metadata elements comprise information needed to comply with CAPCO and other referenced security directives. These normative documents govern when certain fields are mandatory and when fields are optional. Table 1 is a summary of metadata elements within the Security Metadata Universal Set.

4.1.1 Security Classification

This metadata element contains a value representing the entire classification of the file. Possible values are: TOP SECRET, SECRET, CONFIDENTIAL, RESTRICTED, and UNCLASSIFIED (all caps).

This is the first section of the classification line. If the classification is US, then it is followed by a double forward slash "//". If the classifying country is Non-US the classification contains no slashes.

Example of US classification: **SECRET//**
Example of Non-US classification: **SECRET**

4.1.2 Classifying Country Releasing Instructions Country Coding Method

This metadata element identifies the country coding method for the Classifying Country (Par. 4.1.3) and Releasing Instructions (Par. 4.1.5) metadata. This key is a free text field. The Country Coding Method shall use FIPS 10-4 two-letter or four-letter, alphabetic country code or ISO-3166 two-letter or three-letter codes. This metadata element is not needed if the default FIPS 10-4 two-letter code is used. The following string shall be used for FIPS 10-4 four-letter: "FIPS10-4-4". The following string shall be used for ISO 3166 two letter method: "ISO-3166-2". The following string shall be used for ISO 3166 three letter method: "ISO-3166-3".

Example of Country Coding Method: **ISO-3166 Three Letter**

4.1.3 Classifying Country

This metadata element contains a value for the classifying country code preceded by a double slash "//." The default is the FIPS 10-4 two-letter code.

Example of Non-US classifying country: **//DEU** (Example of ISO-3166 code)
//UK (Example of default FIPS 10-4 code)

4.1.4 Caveats

This metadata element set contains a value representing all pertinent caveats/codewords from each category of the CAPCO register. These caveats form a field in the classification line marking. Entries in this field may be abbreviated or spelled out. This field shall be used to indicate FOR OFFICIAL USE ONLY or may be abbreviated as FOUO. It shall always be preceded by the classification element containing the string UNCLASSIFIED// and shall not stand alone.

Examples of Caveats: **NOFORN**
REL TO
RELEASABLE TO
FOR OFFICIAL USE ONLY
FOUO

4.1.5 Releasing Instructions

This metadata element contains a valid list of country codes in accordance with ISO 3166 to be used to determine the countries to which a file or metadata is releasable. Country codes shall be separated by single blanks (spaces).

Example of Releasing Instructions: **USA DEU**

4.1.6 Declassification Date

Whether a date or a code indicating the category of exemption from declassification, this metadata element is always the last field in the classification marking string for classified information. The Declassification Date appears in two areas, the Classification Line, and in the lower right section of the first page of a file or document:

Examples of Declassification Date field: **20130801**
X1

4.1.7 Classified By

This metadata element identifies the name and type of authority used to classify the file. The metadata element is free text and can contain either the original classification authority name and position or personal identifier, or the title of the document or security classification guide used to classify the material.

Example of Classified By field: **MGEN John Doe, Dir XLM**

4.1.8 Classification Reason

This metadata element contains the free text reason for classification or a citation from a document (see below).

Example of Classification Reason: **Par 1.5(a)**

4.1.9 Derived From

This metadata element contains that derivative information relating to a file or document and is free text. The metadata element is not needed if the "Classified by" authority has Original Classification Authority.

Example of Derived From: **Program XYZ Security and Classification Guide**

4.1.10 Classification or Marking System

This metadata element identifies the classification or marking system used in this Security Metadata Set. The entry shall be a free text field. This metadata element is not needed if the US CAPCO classification and marking system is used.

Example of Classification or Marking System: **XYZ Marking System**

4.1.11 Object Country Coding Method

This metadata element identifies the coding method for the Object Country Code (Par.4.1.12) metadata. The Object Country Coding Method may use FIPS 10-4 two-letter, or

four-letter alphabetic country codes or ISO-3166 two-letter, three-letter, or numeric codes for countries, or some other designated coding method. A free text method may also be used. This metadata element is not needed if the default FIPS 10-4 two-letter code is used.

Examples of Country Coding Method: **ISO-3166 Two Letter**
Free Text

4.1.12 Object Country Code

This metadata element contains a value identifying the country that is the object of the essence or metadata to which the Security Metadata Set is linked. Multiple countries may be shown separated by a semi-colon. The default method of coding is the FIPS 10-4 two-letter code.

Example of a Subject Country: AL;HU (Example of default FIPS 10-4 codes for Albania and Hungary)

4.1.13 Comments

This metadata element allows for security related comments and format changes that may be necessary In the future. This field is in addition to those required by CAPCO and is optional.

4.2 Security Metadata Universal Set

The individual metadata elements that comprise information needed to identify the security classification of MPEG-2 streams and other metadata are defined as SMPTE KLV metadata elements in SMPTE RP210-2000 (Draft submitted). The Security Metadata Universal Set 16-byte Universal Label Key shall be: 06 0E 2B 34 02 01 01 01 02 08 02 00 00 00 00 00[1]. Required security and linking information shall be contained entirely within a Security Metadata Set that conforms to SMPTE 336M KLV encoding rules. The Security Metadata Set shall be a compliant Universal Set as determined by the metadata originator. While it is possible that Security metadata could be expressed as a Global Set, a pack or even as a label, the decision was made to use the Universal Set to reduce ambiguity or chances for misinterpretation.

4.3 Security Metadata Set Application in MPEG-2 Streams

It is imperative that Security Metadata Sets be correctly associated with the information, which they describe by always containing a link to some essence or other metadata. The following metadata elements shall be used to associate Security Metadata Sets with essence (video, audio, data) or other metadata within MPEG-2 TS or PS, which may contain multiple ES material.

4.3.1 Metadata Links within MPEG-2 Streams

Any KLV metadata that conforms to SMPTE 336M (whether individual metadata, sets, or packs) may be linked to MPEG-2 ES within TS or PS using the following unique MPEG-2 stream identifiers:

Unique Material Identifier (UMID)

If used, the 32-byte UMID defined by SMPTE 330M shall be used to identify the essence to which security metadata is linked.

Stream ID In MPEG-2 Program Streams the 8-bit stream_id specifies the type and number of the Elementary Stream. In MPEG-2 Transport Streams the stream_id may be set

[1] All Set UL Keys (Designators) are tentative and may be changed as the SMPTE Sets Dictionary is developed.

by the user to any valid value which correctly describes the Elementary Stream type. (ISO/IEC 13818-1, par 2.4.3.7 and Table 2-18.) The stream_id shall be the Value for the Stream ID metadata element.

Transport Stream ID When multiple Transport Streams are present in a network environment the 16-bit transport_stream_id uniquely identifies a specific Transport Stream from any other Transport Stream to remove any ambiguity. Its value is defined by the originator. (ISO/IEC 13818-1, par 2.4.4.5.) The transport_stream_id shall be the Value for the Transport Stream ID.

Universal Label Key ID The 16-byte Universal Label Key for the element, set or pack to which the Security Metadata Set is linked shall be the Value of the Universal Label Key ID.

4.3.2 Linking Security Metadata to MPEG-2 Streams

To indicate the security classification of individual MPEG-2 streams the appropriate link metadata elements shall be contained within a Security Metadata Set as follows:

Elementary Streams– Use of stand-alone ES formats is discouraged for the reasons cited in the MISB RP, *Use of MPEG-2 Systems Streams in Digital Motion Imagery Systems* (DRAFT). However, each Elementary Stream within a Transport Stream or Program Stream shall be associated with a valid Metadata Security Set by containing the one or more UMID or Stream ID metadata elements for the streams to which they apply. If the same Metadata Security Set applies to multiple Elementary Streams then the Metadata Security Set shall contain each of the UMIDs or Stream IDs separately in the Set.

Transport Streams – Each Transport Stream shall be associated with a valid Metadata Security Set by containing the UMID or Transport Stream ID metadata element for that Transport Stream. The Security Metadata Set for the Transport Stream shall convey all the security information for the highest classification Elementary Stream or metadata contained in the Transport Stream.

Program Streams – The UMID shall be used for directly linking Security metadata to identified Program Streams in their entirety. The Security Metadata Set for the Program Stream shall convey all the security information for the highest classification Transport Stream, Elementary Stream or metadata contained in the Program Stream.

4.3.3 Linking Security Metadata to Other Metadata

When a single metadata element is associated with a Security Metadata Set the Security Metadata Set shall contain Universal Label Key ID whose Value is the 16-byte Universal label Key for the single metadata element.

When some but not all metadata elements within a set or pack must be linked to a Security Metadata Set the Security Metadata Set shall contain each individual Universal Label Key ID for the metadata to which it is linked.

When all metadata in a set or pack is associated with a Security Metadata Set then the set or pack shall contain the Security Metadata Set with a Universal Label Key ID whose value is the Universal Label Key for the set or pack. If all metadata in an Elementary Stream is associated with the same Security Metadata Set then the two shall be associated using the method in 3.3.3 above for Elementary Streams.

4.3.4 Security Metadata Without Links

Security Metadata Sets that do not contain a Stream ID link or a Transport Stream ID link to MPEG-2 streams or a Universal Label Key ID link to other metadata are non-compliant and prohibited. The presence of a stand-alone Security Metadata Set without links is ambiguous and presents a potential security hazard.

4.3.5 Classification of Metadata Security Sets

Every effort shall be made to keep the contents (values) within a Security Metadata Set Unclassified. When one or more elements in a Security Metadata Set must be classified they must be linked to another (or the same) Security Metadata Set by a Universal Label Key ID for the classified element(s).

If an entire Security Metadata Set must be classified it shall be linked to another (or the same) Security Metadata Set by the Universal Label Key ID for itself.

4.3.6 Security Metadata Set Repetition Rate

Security Metadata Sets shall be repeated at regular, short intervals such as every 5, 10, 15, 30, or 60 seconds. The maximum repetition interval shall be 60 seconds. Applications that produce very short motion imagery clips or segments of a few seconds in duration may need to repeat Security Metadata Sets as often as every frame.

4.3.7 Unclassified Essence and Metadata

When essence and/or metadata are unclassified the Security Metadata Set shall consist of the value "UNCLASSIFIED//" for Security Classification. Other entries in the Set that limit or clarify the classification are optional.

4.3.8 Partial Security Metadata Sets

For some classifications (e.g. unclassified, collateral), or other circumstances, not all metadata elements in Par. 4.1 may be required. It is the responsibility of the originator and their cognizant security office to ensure that all appropriate security entries are used.

4.3.9 Absence of Security Metadata Sets in MPEG-2 Streams

The absence of one or more Security Metadata Sets cannot and shall not be construed as rendering an MPEG-2 stream or metadata as Unclassified. The proper insertion of Security Metadata Sets into MPEG-2 streams and the extraction of Security information is the responsibility of system developers. It is the responsibility of bitstream originators and system developers to incorporate continual checks for Security Metadata Sets in their applications.

4.4 Summary of Security Metadata Set Elements

Metadata elements allowed in a Security Metadata Universal Sets are summarized in Table 1.

06 0E 2B 34 01 01 01 03 02 08 02 01 00 00 00 00	Security Classification
06 0E 2B 34 01 01 01 03 07 01 20 01 02 07 00 00	Classifying Country and Releasing Instructions Country Coding Method
06 0E 2B 34 01 01 01 03 07 01 20 01 02 08 00 00	Classifying Country
06 0E 2B 34 01 01 01 03 02 08 02 02 00 00 00 00	Caveats
06 0E 2B 34 01 01 01 03 07 01 20 01 02 09 00 00	Release Instructions
06 0E 2B 34 01 01 01 03 02 08 02 03 00 00 00 00	Classified By
06 0E 2B 34 01 01 01 03 02 08 02 04 00 00 00 00	Classification Reason
06 0E 2B 34 01 01 01 03 02 08 02 05 00 00 00 00	Declassification
06 0E 2B 34 01 01 01 03 02 08 02 06 00 00 00 00	Derived From
06 0E 2B 34 01 01 01 03 02 08 02 08 00 00 00 00	Classification or Marking System
06 0E 2B 34 01 01 01 03 07 01 20 01 02 06 00 00	Object Country Coding Method
06 0E 2B 34 01 01 01 03 07 01 20 01 02 01 01 00	Object Country Code
06 0E 2B 34 01 01 01 03 02 08 02 07 00 00 00 00	Classification Comment
06 0E 2B 34 01 01 01 01 01 01 01 XY 00 00 00 00	UMID Video
06 0E 2B 34 01 01 01 01 01 01 02 XY 00 00 00 00	UMID Audio
06 0E 2B 34 01 01 01 01 01 01 03 XY 00 00 00 00	UMID Data
06 0E 2B 34 01 01 01 01 01 01 04 XY 00 00 00 00	UMID System
06 0E 2B 34 01 01 01 03 01 03 04 02 00 00 00 00	Stream ID
06 0E 2B 34 01 01 01 03 01 03 04 03 00 00 00 00	Transport Stream ID
06 0E 2B 34 01 01 01 03 01 03 06 01 00 00 00 00	Item Designator ID (16 byte)

Table 1 - Security Metadata Set Elements

4.5 Security Metadata Set Mapped to STANAG 4545

When a single frame is extracted from an MPEG-2 Video Elementary Stream and is converted into an NSIF image and the associated KLV metadata is used to populate the Exploitation Support Data (ESD) the linked Security Metadata Sets shall be compared to determine the highest and/or most restrictive Security Metadata Set and apply that set according to the mapping shown in Table 2.

Metadata Security Set Element	STANAG 4545 Field Name(s)	STANAG 4545 (ed.1, amd.1) Reference
Security Classification	FSCLAS (File Security Classification)	page C-1-1
Classifying Country and Releasing Instructions Country Code Method	Not applicable	
Classifying Country	FSCLAS (File Security Classification)	page C-1-1
Caveats	FSCODE (File Codewords) and FSCTLH (File Control and Handling)	page C-1-2
Releasing Instructions	FSREL (File Releasing Instructions)	page C-1-2
Declassification Date	FSDCTP (File Declassification Type) and FSDCDT (File Declassification Date)	page C-1-2
Classified By	FSCATP (File Classification Authority Type) and FSCAUT (File Classification Authority)	page C-1-3
Classification Reason	FSCRSN (File Classification Reason)	Page C-1-4
Derived From	FSCATP (File Classification Authority Type) and FSCAUT (File Classification Authority) and FSSRDT (File Security Source Date)	Pages C-1-3 and C-1-4
Classification or Marking System	Not applicable	
Object Country Code Method	Not applicable	
Object Country Code	TBD	
Comments	Not applicable	
UMID (Video Essence)	Not applicable	
UMID (Audio Essence)	Not applicable	
UMID (Data Essence)	Not applicable	
UMID (System)	Not applicable	
Stream ID	Not applicable	
Transport Stream ID	Not applicable	
Universal Label Key ID	Not applicable	

Table 2 - Mapping of Security Metadata Set Elements into STANAG 4545 Security Fields

Annex A (Informative) – Security Metadata Set Elements

06	0E	2B	34	01	01	01	03	02	08	02	01	00	00	00	00	Security Classification	Marking of the security level or other description of the classification of information
06	0E	2B	34	01	01	01	03	07	01	20	01	02	07	00	00	Classifying Country and Releasing Instructions Country Code Method	The coding method used to identify the Non-US classifying country and countries in the releasing instructions
06	0E	2B	34	01	01	01	03	07	01	20	01	02	08	00	00	Classifying Country	ISO 3166 code of non-US country setting the security classification
06	0E	2B	34	01	01	01	03	02	08	02	02	00	00	00	00	Caveats	Marking of security exceptions or restrictions on the security classification
06	0E	2B	34	01	01	01	03	07	01	20	01	02	09	00	00	Releasing Instructions	ISO 3166 code of countries to which classified information is releasable
06	0E	2B	34	01	01	01	03	02	08	02	03	00	00	00	00	Classified By	Original classification authority name and position or personal identifier; the title of the document or security classification guide used to classify the information
06	0E	2B	34	01	01	01	03	02	08	02	04	00	00	00	00	Classification Reason	Narrative text explaining the reason for assigning the classification
06	0E	2B	34	01	01	01	03	02	08	02	05	00	00	00	00	Declassification	Date for automatic declassification or the code indicating exemption from automatic declassification
06	0E	2B	34	01	01	01	03	02	08	02	06	00	00	00	00	Derived From	Narrative text indicating the source document or authority for derivative declassification
06	0E	2B	34	01	01	01	03	02	08	02	08	00	00	00	00	Classification and Marking System	Classification and marking system used in the Set
06	0E	2B	34	01	01	01	03	07	01	20	01	02	06	00	00	Object Country Code Method	The coding method used to identify the object country code
06	0E	2B	34	01	01	01	03	07	01	20	01	02	01	01	00	Object Country Code	The country code or text that represents the country depicted in the essence.
06	0E	2B	34	01	01	01	03	02	08	02	07	00	00	00	00	Classification Comment	Narrative text further explaining the classification assignment
06	0E	2B	34	01	01	01	01	01	01	01	XY	00	00	00	00	UMID Video	Unique Material Identifier for video essence. Note – the UMID has a 12 byte SMPTE label. XY defines the Material/Instance number creation and/or usage methods.
06	0E	2B	34	01	01	01	01	01	01	02	XY	00	00	00	00	UMID Audio	Unique Material Identifier for audio essence. Note – the UMID has a 12 byte SMPTE label. XY defines the Material/Instance number creation and/or usage methods.
06	0E	2B	34	01	01	01	01	01	01	03	XY	00	00	00	00	UMID Data	Unique Material Identifier for data essence. Note – the UMID has a 12 byte SMPTE label. XY defines the Material/Instance number creation and/or usage methods.
06	0E	2B	34	01	01	01	01	01	01	04	XY	00	00	00	00	UMID System	Unique Material Identifier for other material including grouped picture, audio or data essence. Note – the UMID has a 12 byte SMPTE label. XY defines the Material/Instance number creation and/or usage methods.
06	0E	2B	34	01	01	01	03	01	03	04	02	00	00	00	00	Stream ID	Organizationally given identifier that is the steam_id in ISO/IEC 13818-1 (MPEG-2 Systems)
06	0E	2B	34	01	01	01	03	01	03	04	03	00	00	00	00	Transport Stream ID	Organizationally given identifier that is the transport_stream_id in ISO/IEC 13818-1 (MPEG-2 Systems)
06	0E	2B	34	01	01	01	03	01	03	06	01	00	00	00	00	Item Designator ID (16 byte)	Organizationally given identifier that is the 16-byte Item Designator (SMPTE 336M) for any data or metadata that uses the SMPTE Universal Label

ACQUISITION GUIDANCE

Standards

The term STANDARD mandates binding technical implementation policy, and as such, should be identified in Government procurement actions as a mandatory compliance item in order for vendor offerings to be accepted by the Government.

For point of clarification, in commercial practice the majority of identified standards (notably those from SMPTE) are considered to be "voluntary" standards, where equipment manufacturers and users are free to choose to comply or to not comply with the standard. Standards, as represented in this AEDP are not considered voluntary for NATO Community users and systems. They are mandatory up to the level defined in this AEDP (Annex A section 3-3).

Profiles

The term PROFILE documents an extension to a STANDARD developed or specified to meet NATO unique mission requirements not normally covered by commercial standards. PROFILES mandate binding technical implementation policy, and as such, should be identified in Government procurement actions as a mandatory compliance item in order for vendor offerings to be accepted by the Government.

Recommended Practices/Engineering Guidelines

The term RECOMMENDED PRACTICE documents a recommended implementation or practice that further clarifies the implementation of a STANDARD or PROFILE in order to insure interoperability across NATO systems. Recommended Practices should be considered to be a technical implementation policy, and as such, may be identified in Government procurement actions as a mandatory compliance item in order for vendor offerings to be accepted by the Government. Engineering Guidelines represent good engineering principals and therefore, should be implemented if at all possible.

Emerging Standards

The term emerging standard identifies a preliminary version of an anticipated and or emerging STANDARD, PROFILE, RECOMMENDED PRACTICE or Engineering Guideline where the primary initial parameters are outlined and understood but additional coordination or engineering analysis is required. At the time of formal adoption, the emerging standard will become a standard, profile, recommended practice, or engineering guideline. Until formally adopted there is no requirement to implement any portion of any STUDY item.

COMPLIANCE TEST & CERTIFICATION

1. Introduction.

1.1 Purpose. This Annex establishes Compliance Test and Certification activities necessary for achieving and sustaining STANAG 4609 compliance of MI implementations intended for use within NATO. This Compliance Test and Certification Guidance identifies the MI Compliance Test and Certification policies, roles and responsibilities, and provides MI test guidance within the Global NATO Intelligence, Surveillance, and Reconnaissance (ISR) Interoperability Architecture (NIIA) Allied Engineering Documentation Publication (AEDP) structure.

1.1.1 STANAG 4609 Compliance Testing Goals. The overall goal of STANAG 4609 compliance testing as identified in this Annex is to verify the degree to which an MI system is compliant with STANAG 4609. Additional benefits expected from STANAG 4609 compliance testing are as follows:

1. Verify syntactical correctness and unambiguous interpretation of STANAG 4609 to ensure high quality MI documentation.
2. Ensure MI systems satisfy the information exchange requirements specified in STANAG 4609.
3. Ensure NATO-owned and national information systems implement the MI standard correctly and consistently.
4. Determine whether or not deviations from STANAG 4609 exist and certify systems that implement the standard correctly.
5. Establish a basis for enhanced confidence of interoperability within the NATO MI community.

1.1.2 Test Guidance Basis. This Guidance is established under the NATO Common Interoperability Standards (NCIS) Testing Concept and the NIIA AEDP structure. This Guidance will allow developers, system designers, system managers, and budget planners to plan and perform MI testing. The MI Custodian is responsible for coordinating the use of national and NATO testing facilities in accordance with this Guidance.

1.2 Scope. This document applies to all systems defined as meeting the MI standard. This document encompasses the following MI Compliance Test and Certification information:

1. Testing authorities
2. Testing responsibilities
3. Funding test services
4. Defining test criteria
5. Compliance test planning, execution, and reporting

1.2.1 Test Guidance Organization. This document is organized in the following sections:

Section 1. Introduction
Section 2. Test Criteria
Section 3. Test Execution
Section 4. Quality Assurance Requirements
Section 5. Reporting Procedures
Section 6. Test Facilities
Appendix 1. Specification Template for Motion Imagery Systems to Meet Motion Imagery System Requirements

1.3 Background.

As stated in the NATO Policy for Command, Control, and Communications (C3) Interoperability, "there is a NATO requirement that automated data systems, whether NATO or nationally owned, used by the forces of NATO, be interoperable; the extent of the interoperability between specific systems is to be determined and agreed according to the information exchange requirements of cooperating forces."

The NATO Interoperability Management Plan (NIMP) provides the overall NATO strategy for the improvement of interoperability of information systems in support of C3. The strategy calls for the development of NCIS and their implementation on the interfaces of NATO-owned and national information systems that have requirements to interoperate in NATO operations. The NIMP establishes the NATO Interoperability Framework Testing Infrastructure (NIFTI) to coordinate the testing of NCIS standards. The NIMP also establishes the 5-year Rolling Interoperability Program (RIP). The NIFTI program provides input to the RIP on the status of Interoperability Milestones. This enables NATO to assess the "State-of-Interoperability" for NATO and national systems. The MI Custodian will provide feedback to NIFTI and the RIP.

1.4 References. Referenced documents for this Annex are contained in Applicable or Referenced Documents Section on page 3 of this AEDP.

1.5 Applicability. To ensure STANAG 4609 quality and its successful implementation in MI systems, the Compliance Test and Certification guidance is applicable to tests performed during MI development, configuration management, implementation, and operational use. Nations, Major NATO Commands (MNCs), and NATO organizations responsible for the development, configuration management and implementation of MI are to conduct testing in accordance with this Plan. This Plan will be effective upon approval by all owning body authorities.

Within the NCIS Testing Concept document, statements are made about the level of commitment of nations, MNCs, NATO organizations, and industries to adhere to testing implementations utilizing NCIS standards. The principal commitments in the use of this test program are summarized below:

1. STANAG 4609 MI Compliance Testing is mandatory for MNCs, NATO organizations, and Host Nations employing MI in NATO-owned information systems utilized in NATO operations.
2. In addition to the MI Compliance Testing identified here additional Interoperability Testing within the NATO Interoperability Framework is highly recommended for nations employing the MI in national information systems utilized in NATO operations.
3. MI Compliance Testing is encouraged for nations implementing MI systems even when intended for national use only.
4. Industries that develop commercial-off-the-shelf (COTS) systems implementing MI are recommended to submit their products for testing under the provisions of this Compliance Test and Certification Guidance. NATO and nations that acquire COTS to use in their information systems should insist on standards compliant products.

1.6 Authority. The following bodies have the responsibility for participating in the MI Test Program.

1.6.1 NATO Air Force Armaments Group (NAFAG) Joint ISR Capabilities Group (JISRCG). The JISRCG has the responsibility for the development and configuration management of STANAG 4609. Joint ISR Capabilities Group oversees the process whereby imagery systems achieve and sustain MI compliance through the MI Test Program. Joint ISR Capabilities Group appoints the STANAG 4609 Custodian who will in turn manage the Configuration and Testing of the MI STANAG. The Joint ISR Capabilities Group MI Custodian will review and approve test procedures for the MI Test Facilities.

1.6.2 MI Custodian. The Joint ISR Capabilities Group MI Custodian is the delegated NATO authority for the management oversight of the MI Test Program. The testing of the standard is embedded in the development and configuration management procedures that are the responsibility of the MI Custodian. Because of the close relationship of configuration management and testing, the Custodian will be responsible for the day-to-day oversight of the MI Compliance Test and Certification activities, and has responsibility for maintaining configuration control of the MI STANAG.

1.6.3 NATO C3 BOARD (NC3B) Interoperability Sub-Committee (ISC). The NC3B (ISC) has the overall responsibility for NATO interoperability of C3 systems. The NC3B (ISC) will coordinate the activities of the MI Test Program within the NATO Interoperability Framework Testing Infrastructure.

1.7 MI Test Policies and Procedures.

1.7.1 Test Policies. The Testing Policies for Joint ISR Capabilities Group STANAGs identified in the NATO ISR Interoperability Architecture (NIIA) are contained in AEDP-2, Part II.

1.7.2 Test Procedures. Each MI Test Facility will maintain its particular test procedures available upon request as part of the test coordination. A test procedure will be provided to the MI Custodian for review.

1.7.3 Test Program Responsibilities.

1.7.3.1 Test Coordination. The MI Owning Body or Vendor will coordinate directly with the MI Test Facility for test support. The MI Test Facility will provide availability schedule for tests and retests.

1.7.3.2 Test Schedules. The MI Test Facilities will maintain test schedules and provide current scheduling information to the MI Custodian.

1.7.3.3 Master Schedule. The MI Custodian will maintain a master test schedule and demonstration/exercise schedule.

1.7.3.4 Certified MI Systems. The MI Custodian will maintain a Certified MI System registry.

1.7.4 Test Program Resources.

1.7.4.1 MI Test Facilities. The MI Custodian will maintain a registry of accredited MI Test Facilities. The registry will include point of contact information, locations, and associated costs.

2. Test Criteria MI systems or subsystems will be tested in accordance with the test criteria documented herein. Although different testing facilities may be authorized to certify compliance and may use different test procedures and protocols, all facilities will use this common set of test criteria. Each facility will generate the necessary test procedures and the STANAG 4609 Custodian will approve the test procedures as part of the accreditation of the facility to perform STANAG compliance testing.

2.1 Compliance with AEDP-2, Volume II, Annex B. The testing program in this document complies with the policy contained in the Joint ISR Capabilities Group directions contained in AEDP-2, Volume 2, Annex B. The policies and procedures defined therein are applicable to this test and certification program. However, minor deviations from the general guidance in AEDP-2 may be identified, and under such circumstances, the guidance provided herein takes precedence. All deviations will be approved by the Chairman of the Intelligence Surveillance and Reconnaissance Integration Working Group (ISRIWG) and Joint ISR Capabilities Group as provided in AEDP-2.

2.2 Overall Test Philosophy. This program is intended to ensure that systems implementing STANAG 4609 will, in fact, be interoperable once deployed in coalition operations. While the testing program is intended to be comprehensive relative to STANAG 4609 interface requirements, it will not include testing of the applications required to properly exploit and disseminate the information.

2.2.1 Basic Test Concept. The testing concept embodied by this test program requires that all required features of the MI exchange operate properly and that no optional features cause system/application failure or rejection. The test criteria will cover tests that examine each requirement in the STANAG. Eleven mandatory test matrices are included in Appendix 1 to Annex D, Tables D-1-1 through D-1-11. One optional criterion is included in Appendix 1 to Annex D. Any system that fails one or more of the tests within stated functional level of compliance will not be certified under the provisions of this program. However, since the purpose of the test and certification program is to ensure interoperability of systems in coalition operations, every effort will be made to provide the vendor an opportunity to fix the problems during testing and bring the system or subsystem into compliance. If corrections or fixes are made, the certification facility will repeat the entire test sequence and the system or subsystem will be required to pass all tests to ensure that fixes have not caused additional problems that could result in system or subsystem test failure.

2.2.2 Functional Compliance Certification. A key element of the test program is the use of mandatory levels of compliance. Compliance states that the system under test must meet all requirements outlined in STANAG 4609, as applicable to the unit under test. Failure of any applicable tests will preclude awarding the compliance certification. There are eleven mandatory functional levels of compliance that all ground stations must support. The optional levels in Appendix 1 to Annex D, section 2 are included to reflect the MI future requirements roadmap addressed in this document and are based on developing advanced user requirements, application considerations, and upper level MI standards.

2.3 Classification of Tests. Requirements associated with STANAG 4609 compliance and interoperability are detailed in Tables D-1 and in Appendix 1 to Annex D, Tables D-1-1 through D-1-11. If specific testing requirements are not annotated within the criteria section the requirement has been consolidated within the appropriate testing requirement matrix in Tables D-1-1 to D-1-11, Appendix 1 to Annex D. The Owning Body will confirm that a specification requirement has been met through a satisfactory completion of internal (contractor) and external (customer) design and document reviews. Such reviews will establish a high degree of confidence that the requirement has been properly interpreted and implemented, and been applied according to the methods, practices, and standards required by STANAG 4609. Some requirements are

directly related to a specific validation test. Other requirements are difficult and expensive to test and validate. The following identifies which requirements correspond to a direct test, and which requirements are better validated through design analysis. The method of verification required for each test category is described below:

2.3.1 Inspection (I) is verification that a specification requirement has been met by observation of overt characteristics (such as mechanical orientation, presence of a feature, or color) or by simple measurement of a physical property (such as length or weight).

2.3.2 Test (T) is verification that a specification has been met by means of quantitative measurement with standard or specialized external test equipment under the required operating conditions.

2.3.3 Demonstration (D) is verification that a specification requirement has been met by satisfactory demonstration of the required function when operating with a STANAG 4609-certified system or subsystem, or by observation of a higher-level test.

2.3.4 Analysis (A) is verification that a specification requirement has been met by analyzing the contributing subsystem tolerances, ranges, or limits followed by the allocation of such components among the subsystem in such a manner that the overall specification is assured. Analysis may be derived from equations, charts, graphs, and/or test data.

2.3.5 Not Applicable (N) means that no verifiable requirement exists. Tests are not applicable to this paragraph.

Table D-1 Testing Requirements Matrix.

Legend: I – Inspect **T** – Test **D** – Demonstration **A** – Analysis **N** – Not Applicable

STANAG Paragraph	Requirement	I	T	D	A	N
C 1.1	Standard Definition Digital Motion Imagery Sampling Structure		X			
C 1.2	Analog Video Migration					X
C 1.3	Progressively Scanned Enhanced Definition Digital Motion Imagery		X			
C 1.4	High Definition Television Systems		X			
C 1.5	Digital Motion Imagery, Uncompressed Baseband Signal Transport and Processing		X			
C 2.1	Digital Motion Imagery, Compression Systems		X			
C 2.2	Advanced Digital Motion Imagery Compression Systems		Ed 2			Ed 1
C 2.3	Use of MPEG-2 System Streams for Streaming		X			
C 2.4	Compressed High Definition Advanced Television (ATV) and Associated Motion Imagery Systems		X			
C 2.5	Motion Imagery Still Frames		X			
C 3.1	Motion Imagery Metadata Dictionary Structure		X			
C 3.2	Data Encoding using Key-Length Value		X			
C 3.3	Metadata Dictionary			X		
C 3.4	Imbedded Time Reference for Motion Imagery Systems		X			
C 3.5	Time Code Embedding		X			
C 3.6	Time Reference Synchronization		X			
C 3.7, 5.1	Timing Reconciliation Universal Metadata Set for Motion Imagery					X
C 3.8	Packing KLV Packets into SMPTE 291 Ancillary Data Packets		X			
C 3.9	Packing KLV Packets into MPEG-2 Systems Streams		X			
C 3.10	Bit and Byte Order for Metadata in Motion Imagery Files and Streams		X			
C 3.11	Use of Closed Captioning for Core Metadata Legacy Analog Video Encoding					X
C 4.1	Use of MPEG-2 System Streams in Files		X			
C 4.2	Advanced File Formats		Ed 2			Ed 1
C 5.1 (3.7)	Timing Reconciliation Universal Metadata Set for Digital Motion Imagery					X

3. Test Criteria

3.1 Part One: Sampling Structures.

3.1.1 Test Objective. To determine if a motion imagery system properly encodes, decodes, interoperates between encode and decode function, successfully transfers motion imagery data as required at specified performance levels as defined in STANAG 4609.

3.1.1.1 Conformance Points. Conformance Points establish normative parts of Motion Imagery standards. A conformance point is a specification of a particular Profile, at a certain Level, at which conformance may be tested.

3.1.2 Required Documentation and Software. The documents, software, and pretest procedures listed in 3.1.2.1 are required for performing the MIS Compliance Test and Certification.

3.1.2.1 Documents.

a. STANAG 4609
b. Owning Body Test Requirements Document (if applicable)
c. MIS Test Requirements Document
d. MIS Test Facility Test Plan and Procedures

3.1.2.2 Software. The Owning Body or Vendor will be provided test data to be decoded by the MIS prior to the test. The test data will consist of files of various file sizes and allow testing up to the minimum level required for the MIS Compliance Test and Certification.

3.1.3 Spatial Definition Requirement. The MIS will conform to the requirements of the associated level of spatial definition as specified in STANAG 4609.

3.1.3.1 Criteria. Spatial Definition Requirements are detailed in Appendix 1, Annex D. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (T)

3.1.4 Standard Definition Digital Motion Imagery Sampling Structure Requirement. The sampling structure of digital motion imagery will comply with requirements of Component (4:2:2) Digital video as defined in Paragraphs 1.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.4.1 Criteria.

a. Component (4:2:2) Digital Video will be used for sampling structure for Baseband (uncompressed) standard definition motion imagery signals, 8 bits per component (Y, Cb, Cr) will be supported per requirements of ITU-R BT.601-5. (T)
b. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.5 Analog Video Migration Requirement. The Analog Video Migration path from analog to digital video will comply with requirements of ITU-R BT.601-5 Component (4:2:2) digital sampling structure as defined in paragraph 1.2 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

a. All new digital Baseband motion imagery systems production sampling structures will conform to ITU-R BT.601-5 Component (4:2:2) sampling structures.
b. Motion imagery systems serving unique mission requirements with legacy analog video waveforms should convert such analog video waveforms to ITU-R BT.601-5

Component (4:2:2) sampling structures as soon as possible in the signal processing chain, with no processing node backwards conversions to analog wave forms allowed.

3.1.5.1 Criteria.

a. All NATO Motion Imagery productions systems will demonstrate the capability to read and create digital production sampling structures. (T)

b. Systems will comply with requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.6 Progressively Scanned Enhanced Definition Digital Motion Imagery Requirement. The Progressively Scanned Enhanced Definition Digital Motion Imagery will comply with standards in accordance with paragraph 1.3, Annex C to STANAG 4609, NATO Digital Motion Imagery Standards. For progressively scanned digital imagery, ITU-R BT.1358 will define the sampling structure. Once Motion Imagery has been originated or converted to digital format it must remain in its digital format.

3.1.6.1 Criteria.

a. Operating parameters for 720 to 960 line progressive scan motion imagery systems will be defined by ITU-R BT.1358. (T)

b. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.7 High Definition Television Systems Requirement. High Definition Television Systems will comply with standards in accordance with paragraph 1.4, Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.7.1 Criteria. SMPTE Standard 296M-2001 will define the NATO STANDARD motion imagery sampling structure for progressively scanned digital high definition systems based on 720 vertical scanning lines. Progressively scanned digital high definition systems based on 720 vertical scanning lines are defined by SMPTE Standard 296M-2001. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (T), (See appropriate matrix).

NOTE: Progressively scanned digital high definition systems defined by SMPTE Standard 296M-2001 will not use the parallel connector interfaced defined by SMPTE 296M-2001. Progressively scanned digital high definition systems based on 1080 vertical scanning lines are defined by SMPTE Standard 274M-1998.

3.1.8 Digital Motion Imagery, Uncompressed Baseband Signal Transport and Processing Requirement. Uncompressed Baseband Signal Transport and Processing will comply with standards as defined in paragraph 1.5 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards (see Appendix 1 to Annex D).

3.1.8.1 Criteria. Baseband signal transport and processing standards are dependent upon the definition or fineness of detail which can be portrayed in the vertical axis of the video. These dependent requirements are outlined below:

a. SMPTE 259M Level C (4:2:2) standard definition is the standard for uncompressed Baseband signal transport and processing for standard definition digital motion imagery, audio, and metadata origination. If baseband format interchange is required for standard definition, SMPTE 259M, Level C (4:2:2) standard definition (270Mb/s Serial Digital Interface (SDI)) will be the standard for uncompressed Baseband signal transport and processing for standard definition digital motion imagery, audio and metadata origination, system interface, production/analysis center processing and

manipulation. Standard definition systems have nominal interlaced vertical resolution of 480 to 576 scanning lines. The uncompressed standard definition baseband signal transport use a SDI interface. (T)

b. SMPTE 349M is the standard for uncompressed Baseband signal transport and processing for enhanced definition digital motion imagery, audio and metadata origination. If baseband format interchange is required for Enhanced Definition, SMPTE 349M is the standard for uncompressed baseband signal transport and processing for Enhanced Definition digital motion imagery, audio and metadata origination, system interface, production/analysis center processing and manipulation. Progressively scanned digital enhanced definition systems based on 480 to 576 vertical scanning lines are be defined by SMPTE Standard 292M. The uncompressed enhanced definition baseband signal transport use an HDSDI, Fibre Channel or Gigabit Ethernet interface. (T)

c. SMPTE 292M is the standard for uncompressed Baseband signal transport and processing for high definition digital motion imagery, audio and metadata origination. If baseband format interchange is required for High Definition, SMPTE 292M (1.5 Gb/s Bit-Serial Interface) is the standard for uncompressed baseband signal transport and processing for high definition digital motion imagery, audio and metadata origination, system interface, production/analysis center processing and manipulation. Progressively scanned digital high definition systems based on a nominal 720-1080 vertical scanning lines is defined by SMPTE Standard 296M-2001. (T)

d. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.9 Digital Motion Imagery, Compression Systems Requirement. Digital Motion Imagery, Compression Systems will comply with standards as defined in paragraph 2.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.9.1 Criteria. If motion imagery compression is required, ISO/IEC 13818 – 1,2,3,4 (commonly known as MPEG-2) or ITU Rec. H.264 will be the standard for all standard definition, enhanced definition, and high definition compressed motion imagery.

a. For standard definition motion imagery, MPEG-2 Main Profile @ Main Level (MP @ ML) or H.264 L3.0 will be the standard definition motion imagery compression profile.(T)

b. For enhanced definition and high definition motion imagery, MPEG-2 Main Profile @ High Level (MP @ HL) or H.264L4.0 will be the enhanced definition and high definition motion imagery compression profile for NATO origination, acquisition, production, manipulation, exploitation, distribution, archiving and end-user motion imagery product distribution. (T)

c. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.10 Advanced Digital Motion Imagery Compression Systems Requirement. Advanced Digital Motion Imagery Compression Systems will comply with standards as defined in paragraph 2.2 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.11 Use of MPEG-2 System Streams Requirement. The use of MPEG-2 Transport Streams will comply with standards as defined in paragraph 2.3 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

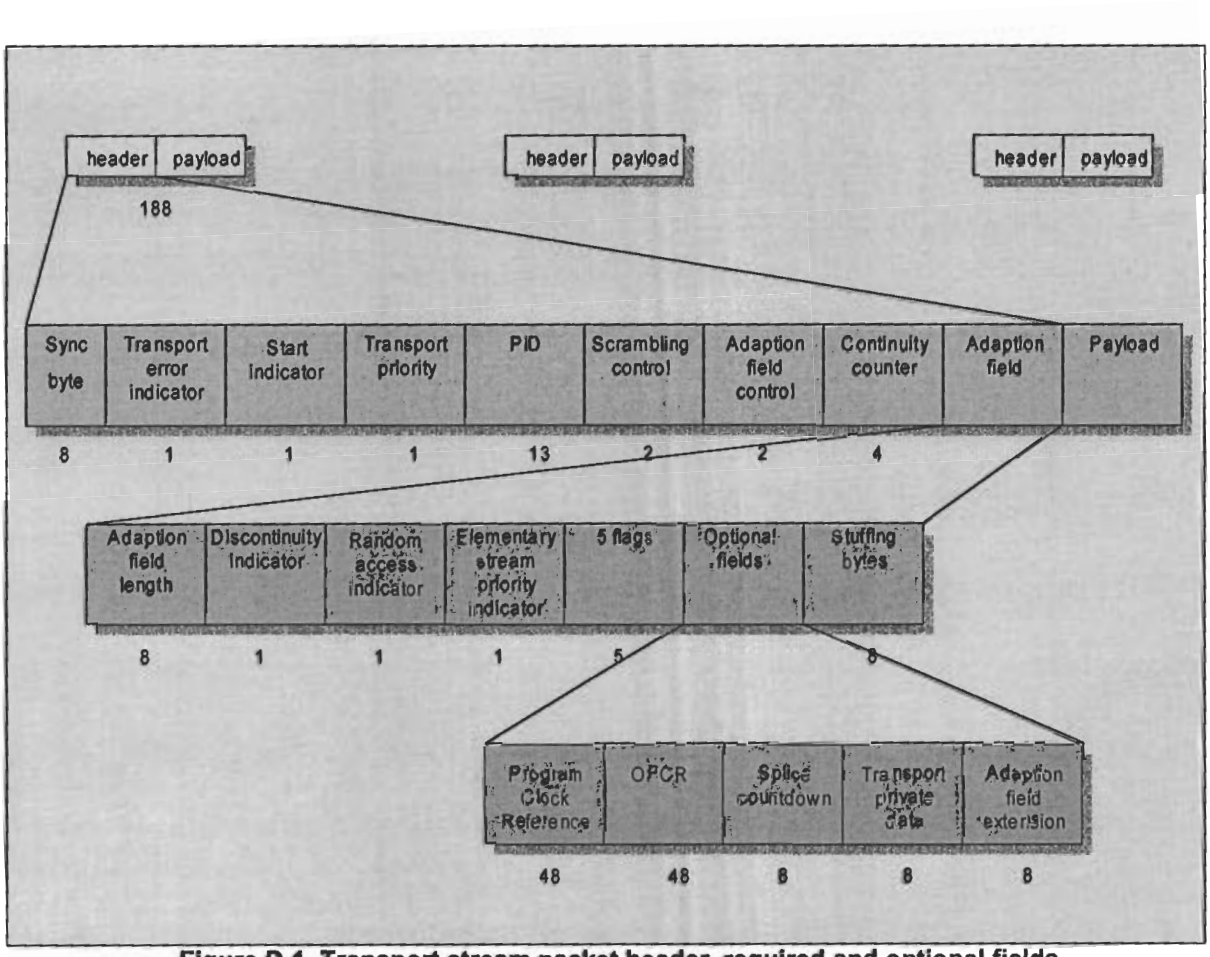


Figure D-1 Transport stream packet header, required and optional fields.

3.1.11.1 Criteria. For streaming applications, MPEG-2 Transport Streams (TS) (see Figure D-1) will be used for NATO applications. All TS header, Packetized Elementary Stream (PES) header and table data meet appropriate standards. The transport stream header will be compliant to the following specifications:

a. Data packets will be 188 bytes long. (T)

b. Each TS packet will start with the correct 47H sync byte, and the correct reserved bits will be inserted in the correct locations in a 42-bit PCR value. (T)

c. TS Packet has 4 byte header which includes a packet identification code (PID). The PID will be correct. (T)

d. The Sequence number will be correct for PID. (T)

e. Additional control information needed (i.e., adaption field) beyond the payload data will be correctly formatted. (T)

f. If used, the decode time stamp will be accurate. (T)

g. The Program Map Table (PMT) will contain all the PIDs for each of the elementary streams. (T)

h. A transport stream's Program Association Table (PAT), which is always located in PID 0, will contain a listing of which PIDs contain the PMTs.

i. If various programs are multiplexed with a PAT, the PAT will indicate PID = 0. (T)

j. Data will be compared in the various tables to determine that there is no conflicting data. This includes comparing the required MPEG-2 tables to the DVB SI or ATSC PSIP tables, as well as checking the consistency among the tables required by each system.

k. Gold standard MPEG-2 files will play back without breaking, having distortion, artifacts, or other detriments impacting quality. (T)

l. The frequency of occurrence and time between PSI/SI/PSIP tables will meet the appropriate standards. (T)

m. Presentation Time Stamp and Data Time Stamp values will be within the allowable range with respect to each other and the associated Program Clock Reference (PCR) values. (T)

n. The accuracy of MPEG-2 PCR values will be checked to insure they are no more than 500 ns different from the true value for the TS. (T)

o. The PIDs in a transport stream will be consistent with those presented in the transport stream's PAT. As programs begin and end, a transport stream's PIDs will change and the encoder transmitting a stream must update the stream's PAT on a regular basis, nominally at least once every 0.5 s. (T)

p. Transport rate will be computed and verified. (T)

q. Data integrity in entire transport stream will be verified. (T)

r. PSI streams (PID 0, PID 1, and PMT PIDs), audio elementary streams, and video elementary streams will be compliant with the Transport Stream System Target Decoder (T-STD) model and will be verified. (T)

s. PCR jitter analysis will be performed and verified to not exceed specifications. Jitter and wander in received data timing information and in baseband video resulting from the timing information will be identified. (T)

t. The PCR and PTS coding frequency will be within specification. (T)

u. Time stamps (PTS and DTS) for audio and video access units will be within specifications. (T)

v. Any System Target Decoder buffer violations will be identified. (T)

w. Content accuracy of PSI tables (PAT, PMT, and CAT) will be verified. (T)

x. Decoder will be able to decode every syntactically correct bitstream for every standard/profile as specified in Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.12 Compressed High Definition Advanced Television (ATV) and Associated Motion Imagery Systems Requirement. Compressed High Definition Advanced Television (ATV) and Associated Motion will comply with standards as defined in paragraph 2.4 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.12.1 Criteria. All NATO high definition advanced television and motion imagery systems must be able to decode, process and display all of the diverse sampling structures and temporal rates within the MPEG-2 high level profiles, where the systems may either display the received signal in its native format or the signals may be re-formatted to the highest common progressive format supported by the system. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

a. NATO high definition advanced television and motion imagery origination, acquisition, production, manipulation and processing systems must generate at least one of the following sampling format and associated temporal rates:

(1) 1280 x 720, frame rates 60p, 50p, 30p, 25p, 24p, aspect ratio 16:9. (T)

(2) 1920 x 1080, frame rates 30p, 25p, 24p, aspect ratio 16:9. (T)

(3) Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

b. For enhanced and standard definition applications origination, acquisition, production, manipulation, and or processing system must generate at least one of the following sampling format and its associated temporal rates:

(1) 720 x 576, frame rates 50p, 25p, 25i, 24p; 16:9 and 4:3 Aspect Ratios (T)

(2) 720 x 480 (483), frame rates 60p, 60p/1.001, 30p, 30p/1.001, 30i, 30i/1.001, 24p, 24p/1.001; 16:9 and 4:3 Aspect Ratios (T)

(3) 640 x 480, frame rates 60p, 60p/1.001, 30p, 30p/1.001, 24p, 24p/1.001; 4:3 Aspect Ratios (T)

(4) Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.13 Motion Imagery Still Frames Requirement. The Motion Imagery Still Frames will comply with standards as defined in paragraph 2.5 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.13.1 Criteria.

1. STANAG 4545 NATO Still Image Format (NSIF 1.0) will be the NATO standard for digital still images that have been extracted from motion imagery sequences. (Note: Once an image has been captured for individual still image processing, exploitation and dissemination; the image is no longer considered to be motion imagery and is not subject to STANAG 4609 image standards). (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.14 Motion Imagery Metadata Dictionary Structure Requirement. The Motion Imagery Metadata Dictionary Structure will comply with standards as defined in paragraph 3.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

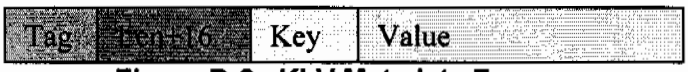


Figure D-2 - KLV Metadata Frames

3.1.14.1 Criteria.

1. SMPTE 335M-2001, Metadata Dictionary Structure, (Figure D-2) is the NATO standard for the interchange and structure definition of metadata dictionaries used by digital motion imagery systems and products. (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.15 Data Encoding using Key-Length Value Requirement. The Data Encoding using Key-Length Value will comply with standards as defined in paragraph 3.2 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.15.1 Criteria.

1. SMPTE 336M-2001, Data Encoding Protocol Using Key-Length-Value (KLV), is the NATO standard protocol for encoding data essence and metadata into motion imagery streams, files, etc. Universal sets are mandated for NATO use. (N)
2. The record structure of entries in the dictionary are defined by SMPTE 335M. For each entry, the dictionary includes the following:

a. Key: The SMPTE UL for the item, including the dictionary version number at the time this item was introduced. (T)
b. Name: A plain text name, not necessarily suitable for machine processing. (T)
c. Symbol: A name that conforms to relevant computer language syntax restrictions (such as XML or other popular languages). (T)
d. Description: For human understanding. (T)
e. Defining Document: A reference to the document that precisely defines the meaning of this item, or to an authoritative source for such information. (T)
f. Type Specification: A textual description of the type; Universal Labels (UL) for types are being added as links into the forthcoming SMPTE Types Registry. (T)
g. Value Length and Range restrictions. (T)
h. Node/Leaf: If the entry is a node or a leaf in the naming tree. (T)

3. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.16 Metadata Dictionary Requirement. The Metadata Dictionary will comply with standards as defined in paragraph 3.3 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.16.1 Criteria.

1. SMPTE RP210.3-2001, SMPTE Metadata Dictionary Content, is the NATO standard for the identification of metadata elements encoded in digital motion imagery products. (N)
2. Each Metadata element is listed by name, with a definition of what it is, its data type, length, reference to existing standards where appropriate and a unique 16 byte key, of which the first eight bytes identify the dictionary and version where the metadata element first appeared. (T)
3. The second eight bytes identify the particular metadata element. (T)
4. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.17 Imbedded Time Reference for Motion Imagery Systems Requirement. The Imbedded Time Reference for Motion Imagery Systems will comply with standards as defined in paragraph 3.4 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.17.1 Criteria. The following guidelines will be followed in regard to imbedded time references:

1. SMPTE 12M-1999, will be the NATO standard for time annotation and imbedded time references for motion imagery systems. (T)
2. SMPTE 309M will be the NATO standard for precision time and date imbedding into SMPTE 12M time code data streams. (T)
3. Within SMPTE 309M, NATO users will use the Modified Julian Data (MJD) date encoding format and Universal Coordinated Time (UTC) as the time zone format. (T)
4. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.18 Time Code Embedding Requirement. Time Code Embedding will comply with standards as defined in paragraph 3.5 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.18.1 Criteria. If KLV Metadata is not available, and traditional time code is used for date/time information, the following standards will apply:

1. Digital Vertical Interval Time Code (D-VITC) will be imbedded on digital video line 9 of all ITU-R BT.601-5 Component (4:2:2) and bit-serial interface systems. (T)
2. Users may implement local time code for internal processing (such as in tape recorders) provided D-VITC is always forwarded to the next processing element on digital video line 9. (T)
3. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.19 Time Reference Synchronization Requirement. Time Reference Synchronization will comply with standards as defined in paragraph 3.6 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.19.1 Criteria.

1. Universal coordinated time (UTC) clock signals will be used as the universal time reference for NATO SMPTE 12M time code systems. (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.20 Timing Reconciliation Universal Metadata Set for Motion Imagery Requirement. The Timing Reconciliation Universal Metadata Set for Motion Imagery will comply with standards as defined in paragraph 3.7 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.20.1 Criteria.

1. If motion imagery applications depend on accurate error free timing or a degree of certainty between metadata captured and video/audio essence captured timing, then time reconciliation is required. This timing reconciliation metadata set will be used to correct the original capture time of metadata with a user defined time stamp typically associated with the capture time of the digital motion imagery or audio essence. (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.21 Packing KLV Packets into SMPTE 291 Ancillary Data Packets Requirement. Methods to pack KLV Packets into SMPTE 291 Ancillary Data Packets will comply with standards as defined in paragraph 3.8 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.21.1 Criteria.

1. If a serial digital interface is used, SMPTE RP 214-2002, "Packing KLV Encoded Metadata and Data Essence into SMPTE 291M Ancillary Data Packets" is the NATO standard for the encoding of metadata elements into Serial Digital Interface (SDI) SMPTE 291M ancillary data packets. (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.22 Packing KLV Packets into MPEG-2 Systems Streams Requirement. Methods to pack KLV Packets into MPEG-2 Systems Streams will comply with standards as defined in paragraph 3.9 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.22.1 Criteria.

1. KLV metadata in both the Transport Stream and Program Stream must be identified by the registered format identifier 0x4B4C5641 ("KLVA"). (T)
2. If MPEG-2 is used with nonsynchronized metadata, SMPTE RP 217-2001, Nonsynchronized mapping of KLV Packets into MPEG-2 System Streams, is the NATO standard for the non-synchronous encoding of metadata elements into MPEG-2 Systems Streams. (T)
3. If MPEG-2 is uses with Synchronized metadata, ISO/IEC 13818-1"2000/FPDAM1 is mandated for the synchronous encoding of metadata for exchange of motion imagery and metadata files for collaboration of production work in progress among analysts; storage of work in progress for access by multiple users; and permanent archive of all contributions to a finished work. (T)
4. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.23 Bit and Byte Order for Metadata in Motion Imagery Files and Streams Requirement. The Bit and Byte Order for Metadata in Motion Imagery Files and Streams will comply with standards as defined in paragraph 3.10 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.23.1 Criteria.

1. KLV metadata in NATO motion imagery systems will use Big-Endian in Byte order and Big-Endian in Bit order. (T)
2. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.24 Use of Closed Captioning for Core Metadata Legacy Analog Video Encoding Requirement. The Use of Closed Captioning for Core Metadata Legacy Analog Video Encoding will comply with standards as defined in paragraph 3.11 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.24.1 Criteria.

1. EIA-608 Data Services will be the NATO standard for legacy system analog video vertical interval metadata encoding using video line 21. (D)
2. Systems will comply with requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.25 Use of MPEG-2 System Streams Requirement. The use of MPEG-2 System Streams will comply with standards as defined in paragraph 4.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.25.1 Criteria.

1. MPEG-2 Transport or Program Streams may be used for NATO applications. (T)
2. All NATO systems will be able to receive and decode both Transport and Program Stream files. (D)
3. Systems will comply with testing requirements as specified in applicable Tables D-1-1 to D-1-11, Appendix 1 to Annex D. (See appropriate matrix).

3.1.26 Advanced File Formats Requirement. The use of Advanced File Formats will comply with standards as defined in paragraph 4.2 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.27 Timing Reconciliation Universal Metadata Set for Digital Motion Imagery Requirement. The Timing Reconciliation Universal Metadata Set for Digital Motion Imagery will comply with standards as defined in paragraph 5.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards.

3.1.27.1 Criteria.

1. Timing reconciliation metadata Set for Digital Motion Imagery is not required if the application using the metadata does not depend on the amount of timing error between metadata capture and file essence capture. (N)
2. If required the time stamp metadata element will be used to link accurate capture time of metadata to other metadata or essence files as outlined in paragraph 5.1 in Annex C to STANAG 4609, NATO Digital Motion Imagery Standards. (N)

4. Quality Assurance Requirements

4.1 Quality Assurance Provisions. The Quality Assurance (QA) provisions are an integral part of the program needed to assist the MI custodian in ensuring high standards are maintained throughout the system life cycle process, from documentation to system certification. QA consists of but is not limited to:

1. Editorial document reviews to ensure clear, concise communication.
2. Validating the STANAG.
3. Validating test set operation/calibration and test procedures prior to testing.
4. Independent test result assessments.

5. Reporting Procedures

5.1 Certification Letters and Test Summaries. The MI Test Facility will provide a Compliance Certification Letter with test summary to the MI Custodian and Owning Body or Vendor if the MI system complies with STANAG 4609. The test summary will include the following:

1. System Title
2. Proponent
3. Program Manager
4. Testers
5. System Under Test Description
6. Test Network Description
7. System Configuration
8. Modes of Operation
9. Testing Limitations
10. Required Standards and Conformance
11. Summary providing:
    a. Number of trials passed
    b. Number of trials failed
    c. Total number of trials

5.2 Certification Recommendation to Custodian. The MI Test Facility will provide an Assessment Letter with test summary to the Owning Body or Vendor if the system does not comply with STANAG 4609 or when reporting demonstrations results. Compliance Certification Letters and Assessment Letters will be maintained with the MI Custodian, placed on the MI web site, and placed in the MI Test Facility registry.

5.3 Appeals to Custodian. The Owning Body or vendor may appeal to the MI Custodian for complaints involving test facility schedule conflicts, test procedures, or test results. Test result complaints need to be filed within 30 calendar days after issuance of the Assessment Letter by the MI Test Facility. The Owning Body or vendor will appeal to the MI Custodian in writing.

6. Test Facilities. A MI Test Facility encompasses the hardware and software (MI Test Set), and personnel needed to provide a MI Compliance Test capability. The MI Custodian will accredit MI Test Facilities. A MI Test Facility should be accessible to any NATO body that wishes to make use of the compliance testing service. MI Test Facilities should have portable test equipment to provide maximum flexibility to the using test customer.

6.1 MI Test Set. The MI Test Set will be capable of testing MI as specified in STANAG 4609 and will be tested and validated as part of the MI Test Facility accreditation.

6.2 Accreditation of MI Test Facilities.

6.2.1 Formal Request for MI Test Facility Accreditation. The NATO Body sponsoring the proposed MI Test Facility will submit a formal accreditation request to the MI Custodian. An approved checklist detailing the required system hardware, software, test equipment, and test procedures will be completed and attached. The request will state the preferred test location and at least three-accreditation test dates.

6.2.2 MI Test Facility/Set Accreditation. The MI Custodian will accredit all MI Test Facilities. A validated MI Test Set will be used to certify the MI Test Facility's compliance to STANAG 4609, the MI Test Requirements Document, and to test the interface as required in the approved procedure. Initially, a specified MI Test Set will be used to accredit MI Test Facilities; once accredited, the MI Test Facility can be used under the direction of the Custodian to accredit other MI Test Facilities.

The specified MI Test Set will be tested with several MI systems to ensure it accurately tests and evaluates MI systems for compliance to STANAG 4609 and the MI Test Requirements Document. The MI Custodian will certify the specified MI Test Set based on successful test assessments and reports.

6.3.3 Accredited MI Test Facility Maintenance. The MI Test Facility will report all successful MI system compliance tests to the MI Custodian within 30 calendar days of test completion. The report will include, as a minimum, the items listed in paragraph 5 in this annex. The MI Test Facility will submit an annual report summarizing test activities and a statement that required test equipment has been calibrated. The MI Test Facility will implement hardware and software changes as directed by the MI Custodian to accommodate program and possible STANAG changes. Modifications and changes are addressed in paragraph 6.3.4.

6.3.4 Modifying an Accredited MI Test Facility. The Accredited MI Test Facility will notify the MI Custodian of planned or required modifications to the test facility. The notification will include the reason for modifying the test facility and what hardware and software is being modified or replaced. The MI Custodian will determine if the MI Test Facility needs to be reaccredited.

SPECIFICATION TEMPLATE FOR MOTION IMAGERY SYSTEMS TO MEET MOTION IMAGERY SYSTEM REQUIREMENTS

1. SCOPE.

1.1 Introduction. Introduce and define the MIS compliance levels characteristics and state the minimum levels required for the specification.

2. Recommended Minimum Capabilities Details. Minimum performance capabilities of the motion imagery systems are described in AEDP-8 paragraph 3-3, Critical Interfaces for Interoperability and are outlined below in tables D-1-1 through D-1-23.

3. MXF Capabilities. Verify that when implemented MXF applications will recognize MPEG-2 transport stream with KLV.

Table D-1-1; Testing Requirements Matrix Level 10M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 10M			X		
Common Description	High Definition (HDTV)/Processing					X
Spatial Definition	High	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Medium	X				
Applicable Standard	SMPTE 296M-2001		X			
	Progressive modes of SMPTE 274M		X			
	Progressive modes of SMPTE 295M		X			
	MPEG-2 MP@HL		X			
Nominal Horizontal Resolution	1280-1920		X			
Nominal Vertical Resolution	720p –1080p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	10:1		X			
Nominal Payload Data Rate	80Mb/s		X			
Data Rate Range	34 – 100 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	HD SDI (SMPTE 292M)					X
	E3					X
	T3					X
	OC-12					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
E3=34.368 Mb/s
Mb/s= Megabits per second
OC-12 = 622 Mb/s
SDI = Serial Digital Interface
FPS = Frames Per Second
MPEG = Motion Picture Experts Group
SMPTE = Society of Motion Television and Motion Picture Engineers
T3 = 44.736 Mb/s
HDTV = High Definition Television
MP@HL=MainProfile@HighLevel

Table D-1-2; Testing Requirements Matrix Level 10H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 10H			X		
Common Description	High Definition (HDTV)/Processing					X
Spatial Definition	High	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Medium	X				
Applicable Standard	SMPTE 296M-2001		X			
	Progressive modes of SMPTE 274M		X			
	Progressive modes of SMPTE 295M		X			
	H.264 MP@L41 (8b)		X			
	H.264 HP@L41 (8b)		X			
	H.264 Hi10P@L41 (10b)		X			
Nominal Horizontal Resolution	1280-1920		X			
Nominal Vertical Resolution	720p –1080p		X			
Nominal Bit Depth	8 or 10		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	20:1		X			
Nominal Payload Data Rate	40Mb/s		X			
Data Rate Range	17 – 50 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	T3					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
E3=34.368 Mb/s FPS = Frames Per Second HDTV = High Definition Television
Mb/s= Megabits per second OC-12 = 622 Mb/s p = Progressive Scan
SMPTE = Society of Motion Television and Motion Picture Engineers
SDI = Serial Digital Interface T3 = 44.736 Mb/s

Table D-1-3; Testing Requirements Matrix Level 9M

Description	Requirement	Inspect	Test	Demonstrate	Analysis	Not Applicable
System Level	Level 9M		X			
Common Description	High Definition (HDTV)/Distribution					X
Spatial Definition	High	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Low	X				
Applicable Standard	SMPTE 296M-2001		X			
	Progressive modes of SMPTE 274M		X			
	Progressive modes of SMPTE 295M		X			
	MPEG-2 MP@HL		X			
Nominal Horizontal Resolution	1280-1920		X			
Nominal Vertical Resolution	720p –1080p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	45:1		X			
Nominal Payload Data Rate	19.4Mb/s		X			
Data Rate Range	10 – 44.7 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	STANAG 7085					X
	Half to Full E3					X
	Half to Full T3					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
E3=34.368 Mb/s
FPS = Frames Per Second
HDTV = High Definition Television
Mb/s= Megabits per second
MPEG = Motion Picture Experts Group
MP@HL=MainProfile@HighLevel
SMPTE = Society of Motion Television and Motion Picture Engineers
T3 = 44.736 Mb/s

Table D-1-4; Testing Requirements Matrix Level 9H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 9H		X			
Common Description	High Definition (HDTV)/Distribution					X
Spatial Definition	High	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Low	X				
Applicable Standard	SMPTE 296M-2001		X			
	Progressive modes of SMPTE 274M		X			
	Progressive modes of SMPTE 295M		X			
	H.264 MP@L3.2(720)		X			
	H.264 MP@L4.0		X			
	H.264 HP@L4.0		X			
Nominal Horizontal Resolution	1280-1920		X			
Nominal Vertical Resolution	720p –1080p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	80:1		X			
Nominal Payload Data Rate	10 Mb/s		X			
Data Rate Range	5 – 20 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	7085					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
E3=34.368 Mb/s
FPS = Frames Per Second
HDTV = High Definition Television
Mb/s= Megabits per second
p = Progressive Scan
SMPTE = Society of Motion Television and Motion Picture Engineers
T3 = 44.736 Mb/s

Table D-1-5; Testing Requirements Matrix Level 8						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 8		X			
Common Description	Enhanced Definition (ED)/Acquisition					X
Spatial Definition	Enhanced	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	High	X				
Applicable Standard	ITU-R BT.1358		X			
	SMPTE 294M-2001		X			
Nominal Horizontal Resolution	640-960		X			
Nominal Vertical Resolution	480p – 576p		X			
Nominal Bit Depth	8 or 10		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	Zero		X			
Nominal Payload Data Rate	360Mb/s		X			
Data Rate Range	135 – 540 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	SDI (SMPTE 259M)					X
	OC-12					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
FPS = Frames Per Second
Mb/s= Megabits per second
OC-12 = 622 Mb/s
SMPTE = Society of Motion Television and Motion Picture Engineers
SDI = Serial Digital Interface
ITU = International Telecommunications Union
MPEG = Motion Picture Experts Group
p = Progressive Scan

Table D-1-6; Testing Requirements Matrix Level 7M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 7M		X			
Common Description	Enhanced Definition (ED)/Processing/Archiving					X
Spatial Definition	Enhanced	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Medium	X				
Applicable Standard	ITU-R BT.1358		X			
	SMPTE 294M-2001		X			
	MPEG-2 MP@HL		X			
Nominal Horizontal Resolution	640-960		X			
Nominal Vertical Resolution	480p –576p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	10:1		X			
Nominal Payload Data Rate	25Mb/s		X			
Data Rate Range	10 – 50 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	T3					X
	E3					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode E3=34.368 Mb/s E3 = 34.368 Mb/ FPS = Frames Per Second
ITU = International Telecommunications Union Mb/s= Megabits per second
MPEG = Motion Picture Experts Group MP@HL=MainProfile@HighLevel p = Progressive Scan
SMPTE = Society of Motion Television and Motion Picture Engineers T3 = 44.736 Mb/s

Table D-1-7; Testing Requirements Matrix Level 7H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 7H		X			
Common Description	Enhanced Definition (ED)/Processing/Archiving					X
Spatial Definition	Enhanced	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Medium	X				
Applicable Standard	ITU-R BT.1358		X			
	SMPTE 294M-2001		X			
	H.264 MP@L3 (L3.1 > 30 FPS)		X			
Nominal Horizontal Resolution	640-960		X			
Nominal Vertical Resolution	480p –576p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	20:1		X			
Nominal Payload Data Rate	12 Mb/s		X			
Data Rate Range	5 – 14 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	T3					X
	E3					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode E3=34.368 Mb/s E3 = 34.368 Mb/s FPS = Frames Per Second
ITU = International Telecommunications Union Mb/s= Megabits per second p = Progressive Scan
SMPTE = Society of Motion Television and Motion Picture Engineers T3 = 44.736 Mb/s

Table D-1-8; Testing Requirements Matrix Level 6M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 6M		X			
Common Description	Enhanced Definition (ED)/Distribution					X
Spatial Definition	Enhanced	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Low	X				
Applicable Standard	ITU-R BT.1358		X			
	SMPTE 294M-2001		X			
	MPEG-2 MP@HL		X			
Nominal Horizontal Resolution	640-960		X			
Nominal Vertical Resolution	480p –576p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	45:1		X			
Nominal Payload Data Rate	5.5Mb/s		X			
Data Rate Range	3 – 15 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	GBS					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode FPS = Frames Per Second GBS = Global Broadcast System
ITU = International Telecommunication Union Mb/s= Megabits per second
MPEG = Motion Picture Experts Group MP@HL=MainProfile@HighLevel p = Progressive Scan
SMPTE = Society of Motion Television and Motion Picture Engineers

Table D-1-9; Testing Requirements Matrix Level 6H

Description	Requirement	Inspect	Test	Demonstrate	Analysis	Not Applicable
System Level	Level 6H		X			
Common Description	Enhanced Definition (ED)/Distribution					X
Spatial Definition	Enhanced	X				
Temporal Definition	Medium – High	X				
Generation Resiliency	Low	X				
Applicable Standard	ITU-R BT.1358		X			
	SMPTE 294M-2001		X			
	H.264 MP@L3 (L3.1 > 30 FPS)		X			
Nominal Horizontal Resolution	640-960		X			
Nominal Vertical Resolution	480p –576p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	80:1		X			
Nominal Payload Data Rate	3 Mb/s		X			
Data Rate Range	2 – 8 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	GBS					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
ITU = International Telecommunication Union
SMPTE = Society of Motion Television and Motion Picture Engineers
FPS = Frames Per Second
Mb/s= Megabits per second
GBS = Global Broadcast System
p = Progressive Scan
SDI = Serial Digital Interface

Table D-1-10; Testing Requirements Matrix Level 5						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 5		X			
Common Description	Standard Definition (SD)/Acquisition					X
Spatial Definition	Standard	X				
Temporal Definition	Standard	X				
Generation Resiliency	High	X				
Applicable Standard	ITU 601		X			
	SMPTE 259M (4:2:2)		X			
Nominal Horizontal Resolution	720		X			
Nominal Vertical Resolution	480i –576i		X			
Nominal Bit Depth	8 or 10		X			
Frame Rates	24 – 60 FPS		X			
Nominal Compression Ratio	Zero to 2.5:1		X			
Nominal Payload Data Rate	270Mb/s		X			
Data Rate Range	270 – 360 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	SDI					X
	OC-12					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
FPS = Frames Per Second i = Interlaced Scan
ITU = International Telecommunication Union Mb/s= Megabits per second MPEG = Motion Picture Experts Group
OC-12 = 622 Mb/s SDI = Serial Digital Interface
SMPTE = Society of Motion Television and Motion Picture Engineers

Table D-1-11; Testing Requirements Matrix Level 4M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 4M		X			
Common Description	Standard Definition (SD)/Processing/Archiving					X
Spatial Definition	Standard	X				
Temporal Definition	Standard	X				
Generation Resiliency	Medium	X				
Applicable Standard	MPEG-2 MP@ML		X			
Nominal Horizontal Resolution	720		X			
Nominal Vertical Resolution	480i –576i		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	5.5:1 – 10:1		X			
Nominal Payload Data Rate	15 Mb/s		X			
Data Rate Range	15 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	Half to Full T3					X
	Half to Full E3					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
i = Interlaced Scan
MPEG = Motion Picture Experts Group
SDI = Serial Digital Interface
E3=34.368 Mb/s
Mb/s= Megabits per second
MP@ML=MainProfile@MainLevel
TCDL = Tactical Common Data Link
FPS = Frames Per Second
T3 = 44.736 Mb/s

Table D-1-12; Testing Requirements Matrix Level 4H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 4H		X			
Common Description	Standard Definition (SD)/Processing/Archiving					X
Spatial Definition	Standard	X				
Temporal Definition	Standard	X				
Generation Resiliency	Medium	X				
Applicable Standard	H.264 MP@L3		X			
Nominal Horizontal Resolution	720		X			
Nominal Vertical Resolution	480i –576i		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	5.5:1 – 20:1		X			
Nominal Payload Data Rate	10 Mb/s		X			
Data Rate Range	10 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	Half to Full T3					X
	Half to Full E3					X
	ATM					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
i = Interlaced Scan
T3 = 44.736 Mb/s
E3=34.368 Mb/s
Mb/s= Megabits per second
FPS = Frames Per Second
SDI = Serial Digital Interface

Table D-1-13; Testing Requirements Matrix Level 3M

Description	Requirement	Inspect	Test	Demonstrate	Analysis	Not Applicable
System Level	Level 3M		X			
Common Description	Standard Definition (SD)/Distribution					X
Spatial Definition	Standard	X				
Temporal Definition	Standard	X				
Generation Resiliency	Low	X				
Applicable Standard	MPEG-2 MP@ML		X			
Nominal Horizontal Resolution	720		X			
Nominal Vertical Resolution	480i –576i		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	28:1		X			
Nominal Payload Data Rate	6 Mb/s		X			
Data Rate Range	3.8 – 10 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	GBS					X
	T2/E2					X
	ATM					X
	DVD					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
FPS = Frames Per Second
Mb/s= Megabits per second
MP@ML=MainProfile@MainLevel
DVD = Digital Video Disk
GBS = Global Broadcast System
MPEG = Motion Picture Experts Group
T2 = 6.312 Mb/s
E2=8.448 Mb/s
I = Interlaced Scan

Table D-1-14; Testing Requirements Matrix Level 3H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 3H		X			
Common Description	Standard Definition (SD)/Distribution					X
Spatial Definition	Standard	X				
Temporal Definition	Standard	X				
Generation Resiliency	Low	X				
Applicable Standard	H.264 MP@L3		X			
Nominal Horizontal Resolution	720		X			
Nominal Vertical Resolution	480i –576i		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	56:1		X			
Nominal Payload Data Rate	3 Mb/s		X			
Data Rate Range	1.5 – 5 Mb/s		X			
Candidate Transport Channels (Nominal Rates)	GBS					X
	T2/E2					X
	ATM					X
	DVD					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
ATM = Asynchronous Transfer Mode
DVD = Digital Video Disk
E2=8.448 Mb/s
FPS = Frames Per Second
GBS = Global Broadcast System
I = Interlaced Scan
Mb/s= Megabits per second
MPEG = Motion Picture Experts Group
T2 = 6.312 Mb/s

Table D-1-15; Testing Requirements Matrix Level 2.2H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L2.2H		X			
Common Description	Low – Medium /Distribution					X
Spatial Definition	Medium	X				
Temporal Definition	Medium	X				
Generation Resiliency	Low	X				
Applicable Standard	H.264 L2.2		X			
Nominal Horizontal Resolution	640 – 720		X			
Nominal Vertical Resolution	480 – 576		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	110:1		X			
Nominal Payload Data Rate	1.5 Mb/s		X			
Data Rate Range	1,024 to 1,500 kb/s		X			
Candidate Transport Channels (Nominal Rates)	T1/E1					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
E1= 2.048 Mb/s FPS = Frames Per Second Kb/s= Kilobits per second
Mb/s= Megabits per second MPEG = Motion Picture Experts Group T1 = 1.544 Mb/s

Table D-1-16; Testing Requirements Matrix Level 2.1M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L2.1M		X			
Common Description	Low/Distribution					X
Spatial Definition	Low – Medium	X				
Temporal Definition	Medium	X				
Generation Resiliency	Low	X				
Applicable Standard	MPEG-2 MP@ML		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	480 – 576		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	110:1		X			
Nominal Payload Data Rate	1.5 Mb/s		X			
Data Rate Range	1024 to 1,500 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	T1/E1					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
E1= 2.048 Mb/s
Mb/s= Megabits per second
MPEG = Motion Picture Experts Group
FPS = Frames Per Second
MP@ML=MainProfile@MainLevel
T1 = 1.544 Mb/s
Kb/s= Kilobits per second

Table D-1-17; Testing Requirements Matrix Level 2.1H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L2.1H		X			
Common Description	Low/Distribution					X
Spatial Definition	Low – Medium	X				
Temporal Definition	Medium	X				
Generation Resiliency	Low	X				
Applicable Standard	H.264 L2.2		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	480 – 576		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	165:1		X			
Nominal Payload Data Rate	1.0 Mb/s		X			
Data Rate Range	768 to 1,024 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	T1/E1					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			
Legend: E1= 2.048 Mb/s Mb/s= Megabits per second		FPS = Frames Per Second MPEG = Motion Picture Experts Group		Kb/s= Kilobits per second T1 = 1.544 Mb/s		

Table D-1-18; Testing Requirements Matrix Level 2.0M						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L2.0M		X			
Common Description	Low/Distribution					X
Spatial Definition	Low	X				
Temporal Definition	Medium	X				
Generation Resiliency	Very Low	X				
Applicable Standard	MPEG-1		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	240 – 288p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	165:1		X			
Nominal Payload Data Rate	1 Mb/s		X			
Data Rate Range	768 to 1,024 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	T1/E1					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
E1= 2.048 Mb/s
Mb/s= Megabits per second
T1 = 1.544 Mb/s
FPS = Frames Per Second
MPEG = Motion Picture Experts Group
Kb/s= Kilobits per second
p = Progressive Scan

Table D-1-19; Testing Requirements Matrix Level 1.3H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L1.3H		X			
Common Description	Very Low/Distribution					X
Spatial Definition	Low	X				
Temporal Definition	Medium	X				
Generation Resiliency	Very Low	X				
Applicable Standard	H.264 L1.3		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	240 – 288p		X			
Nominal Bit Depth	8		X			
Frame Rates	24 – 30 FPS		X			
Nominal Compression Ratio	430:1		X			
Nominal Payload Data Rate	384 Kb/s		X			
Data Rate Range	384 to 768 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	Partial T1					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
FPS = Frames Per Second Kb/s= Kilobits per second p = Progressive Scan
RSTP = Real Time Streaming Protocol RTP = Real Time Transport Protocol T1 = 1.544 Mb/s

Table D-1-20; Testing Requirements Matrix Level 1.2H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L1.2H		X			
Common Description	Very Low/Distribution					X
Spatial Definition	Low	X				
Temporal Definition	Low-Medium	X				
Generation Resiliency	Very Low	X				
Applicable Standard	H.264 L1.2		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	240 – 288p		X			
Nominal Bit Depth	8		X			
Frame Rates	Typical 12 – 15 FPS		X			
Nominal Compression Ratio	650:1		X			
Nominal Payload Data Rate	256 Kb/s		X			
Data Rate Range	192 to 384 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	RTP/RSTP					X
	Wireless					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			
Legend: FPS = Frames Per Second RSTP = Real Time Streaming Protocol		Kb/s= Kilobits per second RTP = Real Time Transport Protocol		p = Progressive Scan T1 = 1.544 Mb/s		

Table D-1-21; Testing Requirements Matrix Level 1.1H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	L1.1H		X			
Common Description	Very Low/Distribution					X
Spatial Definition	Low	X				
Temporal Definition	Low	X				
Generation Resiliency	Very Low	X				
Applicable Standard	H.264 L1.1		X			
Nominal Horizontal Resolution	320 – 352		X			
Nominal Vertical Resolution	240 – 288p		X			
Nominal Bit Depth	8		X			
Frame Rates	Typical 6 – 7 FPS		X			
Nominal Compression Ratio	1300:1		X			
Nominal Payload Data Rate	128 Kb/s		X			
Data Rate Range	56 to 192 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	RTP/RSTP					X
	Wireless					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			
Legend: FPS = Frames Per Second RSTP = Real Time Streaming Protocol		Kb/s= Kilobits per second RTP = Real Time Transport Protocol		p = Progressive Scan T1 = 1.544 Mb/s		

Table D-1-22; Testing Requirements Matrix Level 1.0H						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 1.0H		X			
Common Description	Very Low/Distribution					X
Spatial Definition	Very Low	X				
Temporal Definition	Low/Medium	X				
Generation Resiliency	Lowest	X				
Applicable Standard	H.264 L1.0		X			
Nominal Horizontal Resolution	160 – 176		X			
Nominal Vertical Resolution	120 – 144p		X			
Nominal Bit Depth	8		X			
Frame Rates	Typical 12 – 15 FPS		X			
Nominal Compression Ratio	5200:1		X			
Nominal Payload Data Rate	32 Kb/s		X			
Data Rate Range	< 56 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	RTP/RSTP					X
	Wireless					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
FPS = Frames Per Second
RSTP = Real Time Streaming Protocol
Kb/s= Kilobits per second
RTP = Real Time Transport Protocol
p = Progressive Scan
T1 = 1.544 Mb/s

Table D-1-23; Testing Requirements Matrix Level 0						
Description	**Requirement**	**Inspect**	**Test**	**Demonstrate**	**Analysis**	**Not Applicable**
System Level	Level 0		X			
Common Description	Very Low Temporal Motion Imagery/Distribution					X
Spatial Definition	High	X				
Temporal Definition	Very Low	X				
Generation Resiliency	Variable	X				
Applicable Standard	NSIF or future multi-media format		X			
Nominal Horizontal Resolution	720-1920		X			
Nominal Vertical Resolution	480 –1080		X			
Nominal Bit Depth	8 or 10 or 12		X			
Frame Rates	Still – 2 FPS		X			
Nominal Compression Ratio	10:1		X			
Nominal Payload Data Rate	256 Kb/s		X			
Data Rate Range	56 – 512 Kb/s		X			
Candidate Transport Channels (Nominal Rates)	Non Real Time POTS					X
	ISDN					X
Key Length Value (KLV) metadata	KLV metadata is present		X			
	KLV metadata complies with KLV standards		X			

Legend:
FPS = Frames Per Second
Mb/s = Megabits per second
ISDN = 56 Kilobits per second over 64 Kilobits per second
POTS = Plain Old Telephone System

ANNEX E
AEDP-8
(Edition 2)

CONFIGURATION MANAGEMENT PLAN

1. Purpose. The purpose of this Annex is to provide the framework for the management of STANAG 4609 and all associated documents.

1.1 Related Documents.

1.1.1 Included Documents. Documents included in this configuration management structure are as follows:

1. STANAG 4609
2. AEDP-8 Implementation Guide
3. Others as designated by the STANAG 4609 Custodian

1.1.2 Other Referenced Documents.
AAP-3 Procedures for the Development, Preparation, Production, and the Updating of NATO Standardization Agreements (STANAGs) and Allied Publications (APs)

2. Scope. This document provides the framework for configuration management of STANAG 4609 and all associated documents. The participating NATO member nations define their respective levels of participation and all NATO member nations have equal opportunity to have their respective positions voiced in the STANAG 4609 community. Decisions made within this framework are subject to final approval of NATO NAFAG Joint ISR Capabilities Group (formerly Air Group IV), in order to ensure the proper placement of STANAG 4609 within the overall NATO Imagery Interoperability Architecture (NIIA). Overall, the configuration management structure is consistent with the NATO guidelines defined in AAP-3, *Procedures for the Development, Preparation, Production, and the Updating of NATO Standardization Agreements (STANAGs) and Allied Publications (APs)*. The key element of the configuration management process is the management of requests for change by individual nations.

3. STANAG Management Organization.

3.1 General.

3.1.1 NATO Nation Responsibility. Each NATO member nation is responsible for funding its own participation. Although each NATO member nation can assign representatives to the STANAG activities defined herein, any assigned representatives are expected to be active participants.

3.1.2 Participation Requirements. Should the STANAG 4609 Custodian be unable to properly execute business due to repeated lack of participation at the meetings, the Custodian shall report the lack of participation to Joint ISR Capabilities Group and shall request the Joint ISR Capabilities Group representative of the respective nation(s) to either withdraw from STANAG 4609 participation or appoint a new STANAG 4609 representative who will be able to fully participate.

3.2 Custodian/Chairman. The STANAG 4609 Custodian also serves as the chairman of all meetings of the configuration management functions. The Custodian is responsible for all STANAG 4609 activity. Specific duties include, but are not limited to the following tasks:

1. Tracks changes and provides "official" copy for promulgation
2. Reports to Joint ISR Capabilities Group on status
3. Chairs STANAG 4609 Custodial Support Team (CST) meetings
4. Directs activity of STANAG 4609 Administrative Support Team (AST)

3.2.1 Tasking and Reporting Responsibility. The Custodian is the only individual to receive tasking from and report to Joint ISR Capabilities Group on STANAG 4609. This authority can be delegated to other members of the STANAG 4609 community, but responsibility for the tasking and reporting resides with the Custodian.

3.3 STANAG 4609 Custodial Support Team (4609 CST). The Custodial Support Team decides on the changes to be made to STANAG 4609.

3.3.1 STANAG 4609 Representatives. The respective Joint ISR Capabilities Group Representative appoints representatives to the 4609 CST. Each NATO member nation can appoint a representative to the 4609 CST by providing the name, organization, address, telephone and facsimile numbers, and electronic mail address of their 4609 CST member to the STANAG 4609 Custodian. (The STANAG 4609 Custodian will document the members of the 4609 CST and provide the information to the Joint ISR Capabilities Group Secretary for recording in the Joint ISR Capabilities Group decision sheet.) The national representative to the 4609 CST can be from government or industry as chosen by the Joint ISR Capabilities Group representative. The national representative to the 4609 CST is the official spokesman for all participants from that nation.

3.3.2 National Representative's Responsibilities. Each national representative shall define procedures for establishing the respective national position on proposed changes. These procedures can use whatever process is appropriate to that nation, but ultimately the national representative will voice the official national position to the 4609 CST.

3.3.3 National Representative's Delegation Authority. The authority of the national representative can be delegated to another individual from that nation in absence of the national representative. The delegation shall be in writing to the Custodian/chairman prior to the start of the meeting at which the delegation of authority is effective. The substitute representative shall have all authority and responsibility of the regular representative.

3.3.4 Other Participation. Other individuals from nations with representatives may participate at discretion of national representatives or the Custodian/chairman. The participants can be additional government personnel or contractor personnel. The intent of having additional personnel participate is to provide technical, operational, or procedural expertise that may not be resident with the representatives and to allow participation by those who are developing systems using STANAG 4609.

3.3.5 Other Interested Parties. Individuals from non-NATO nations may participate in 4609 CST meetings only at the request of the Custodian, and only to explain/defend changes proposed by the individual or a non-NATO nation.

3.4 STANAG 4609 Administrative Support Team (4609 AST). The STANAG 4609 Administrative Support Team provides the necessary planning and maintenance activities to manage STANAG 4609.

3.4.1 4609 AST Member Selection. The members of the 4609 AST are selected by the Custodian. Members are selected based on tasking, resources, and remain members of the 4609 AST at the discretion of the Custodian.

3.4.2 4609 AST Member Functions. The members of the 4609 AST will perform the following functions.

1. Prepare for meetings by identifying locations and dates for the meetings, preparing announcements, coordinating security clearances, providing guidance to meeting hosts, and preparing presentation materials and handouts.
2. Presentation of recommended changes during the meetings.
3. Track recommended changes submitted through 4609 CST channels.
4. Prepare minutes of all meetings.
5. Prepare revisions for distribution to Joint ISR Capabilities Group secretary and members.
6. Perform the configuration management STANAG 4609, including maintaining the current version of document.
7. Disseminate all proposed changes to the 4609 CST as they are received and logged.

3.5 Joint ISR Capabilities Group WEB Page. The Joint ISR Capabilities Group Secretary is responsible for maintaining the configuration management of the Joint ISR Capabilities Group web page on which STANAG 4609 is posted.
The Secretary will update the postings for past and upcoming meetings based on information provided by the Custodian. Once changes to STANAG 4609 are approved, the Secretary will post the revision to the Joint ISR Capabilities Group web page within 45 days of the meeting, unless other arrangements are agreed during the Joint ISR Capabilities Group meeting. The Secretary will maintain a list of the national representatives to the 4609 CST on the web page, based on the nominations made during the Joint ISR Capabilities Group meetings as documented in the Joint ISR Capabilities Group meeting decision sheets.

3.6 Special Teams. The Custodian shall have the authority to convene special teams to examine major technical issues that are beyond the scope of routine change proposal activity. Technical issues of this type can include major changes to the format or development of future strategies for advanced motion imagery systems. The Custodian can chair the special team or select another member of the MI community to chair the special team and report on its progress. The members of the team will be appointed by the Custodian based on recommendations from the national representatives. The Custodian will identify any special teams, including the members, tasking, planned schedule, and expected products, to Joint ISR Capabilities Group.

4.0 Change Identification.

4.1 Change Request Procedure. All representatives can submit change requests that change the content or structure of STANAG 4609. Other personnel requesting changes shall submit their requests through the respective national representatives. For persons from NATO nations without formal representatives on the 4609 CST, the change requests shall be submitted through their respective Joint ISR Capabilities Group representative.

4.1.1 Submission of Changes from non-NATO Nations. Individuals from non-NATO nations may submit change proposals directly to the Custodian. In addition to the information contained in the Standardization Document Change Proposal (SDCP) form (Appendix 1), the submission shall include a cover letter which clearly identifies the name, title, organization, and contact information of the submitter, as well as a statement as to whether the submission is in response to a national government requirement. If the change supports a national government requirement, the requirement should be identified, and an endorsement included which is signed by an appropriate government representative. In all cases, the submitter should be prepared to attend the 4609 CST meeting to explain and/or defend the proposed change.

4.2 Change Request Format. All change requests shall use a standard format, either by completing the form in Appendix A or electronic mail containing the same information and order as the form. The paper form can be submitted either through the mail or by telefax. The change request is submitted to the appropriate national representative, who then endorses the change and forwards it to the Custodian. The Custodian provides the change request to the 4609 AST for logging and dissemination for discussion and review.

4.3 Class of Changes. All change requests shall identify the proposed change as either Class I (amendments of substance) or Class II (editorial amendments). Class I changes modify the functionality of standard (requires s/w change to comply). This includes changes to the order of fields, changes to the allowed or required values for a field, or additions/deletions of fields or approved values. Class I changes are those identified as changes of substance in paragraph 214.2. of AAP-3(G). Class II changes are for administrative or editorial revisions or to clarify the usage of the STANAG. These changes are those identified as editorial amendments in paragraph 214.3 of AAP-3(G).

5. Configuration Management. Configuration Management, as defined in AAP-3(G), defines the top-level process. It specifies that once changes are produced, they should be forwarded to the NATO Standardization Agency (NSA). AAP-3(G) does not specify the process within the sponsoring agency or for the Custodian to use in recording proposed changes and managing the change approval process. The primary purpose of this plan is to specify the process to be used by the STANAG 4609 Custodian.

The STANAG 4609 Configuration Management will be conducted on a cyclic basis. The process is shown in Figure E-1. Changes can be submitted at any time, but will be reviewed by the 4609 CST on a quarterly basis as required. Presentations to Joint ISR Capabilities Group will be performed on a semiannual basis to coincide with the Joint ISR Capabilities Group meetings.

5.1 Routine Business Activities. These activities can be performed at any time by the appropriate personnel.

5.1.1 Change Requests. Change requests are submitted by any interested individual or organization to the respective national representative using the form included in Appendix 1. A list of national representatives will be maintained by the Joint ISR Capabilities Group Secretary and included on the web page.

5.1.1.1 National Representative's Authority for Change Requests. The national representatives have disapproval authority over any proposed change from their respective nation prior to submission to the Custodian. If approved, the national representative endorses the change request and forwards the change request to the Custodian.

5.1.1.2 Direct Submission by non-NATO Nations. Change request submissions from individuals in non-NATO nations are submitted directly to the Custodian. The Custodian shall review the submissions and approve for 4609 CST consideration those proposals that have potential benefit to the NATO community. Rejected proposals are returned to the submitter with the reasons for rejection.

5.1.2 Change Request Routing. The Custodian provides the change request to the 4609 AST for logging into the configuration management system. At the direction of the Custodian, proposed changes can be disseminated by the 4609 AST at any time for review.

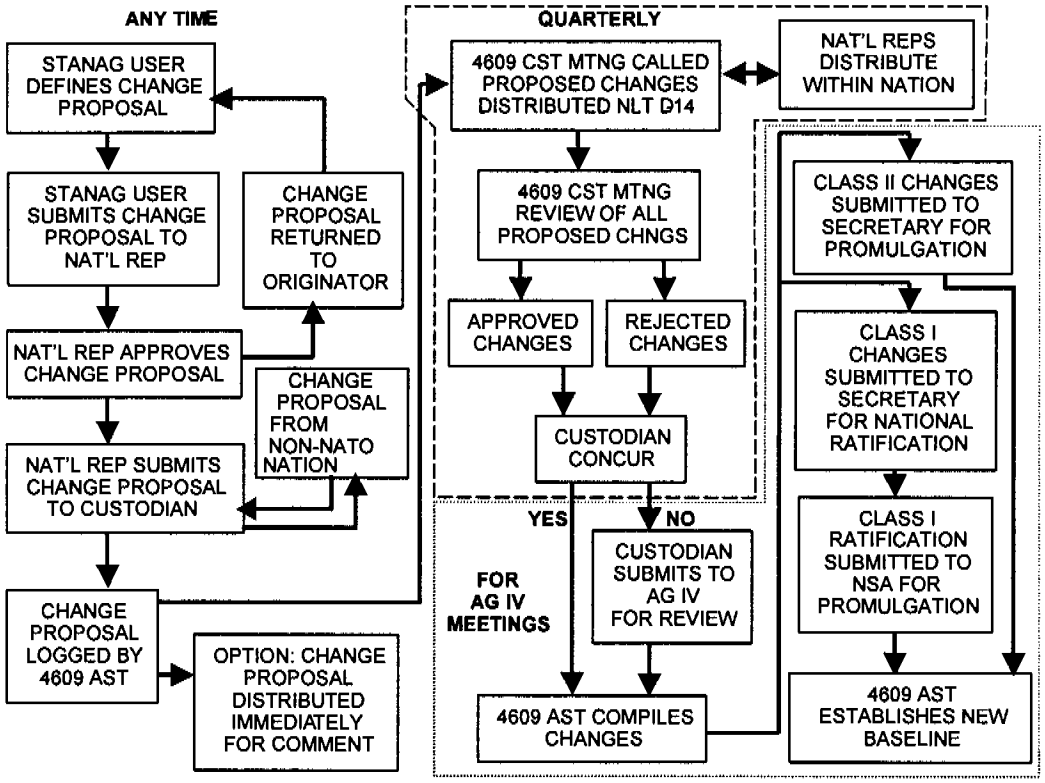


FIGURE E-1; CM PROCESS FLOW

5.2 Quarterly 4609 CST Meetings. The 4609 CST shall meet quarterly unless there are no outstanding change proposals. The Custodian will formally call the meeting based on the arrangements established by the 4609 AST.

5.2.1 Procedure for Proposed Changes. Proposed changes are compiled and distributed to all national representatives no less than fourteen days prior to the meeting. The format of the change compilation is shown in Appendix 1. National representatives then distribute the proposed changes to other interested individuals from the respective nation. National representatives and others are directed to establish impact of the proposed changes. The respective national positions are determined by procedures established by each nation. If a nation is unable to attend a 4609 CST meeting, the nation may submit written comments to the Custodian prior to the 4609 CST meeting. The comments will be provided to all attendees for consideration during deliberations.

5.2.2 Discussion of Change Proposals. During the 4609 CST meeting, each proposed change is discussed. Change proposals are discussed under direction of the Custodian. Change proposals can be deferred pending additional investigation/review, for which the Custodian assigns responsibility for addition study/review, or changes can be voted independently or in groups at discretion of Custodian.

5.2.2.1 Voting on Change Proposals. Only the national representatives vote on final configuration decisions. Class I changes require unanimous consent of national representatives (or designated alternates) in attendance and voting. Class II changes require a majority vote of national representatives in attendance and voting. Ties are decided by the Custodian.

5.2.2.2 Custodian's Options and Approval Authority. The Custodian can defer the decisions of the national representatives for Joint ISR Capabilities Group review, request additional discussion and review by the national representatives, or approve them immediately. Approved decisions are incorporated into the STANAG by the 4609 AST. When deemed necessary by the Custodian, unapproved decisions are presented to Joint ISR Capabilities Group for final decision. Those changes approved by the Custodian or ratified by Joint ISR Capabilities Group are incorporated into the STANAG by the 4609 AST.

5.3 Joint ISR Capabilities Group Meetings. At the Joint ISR Capabilities Group meetings, two topics are presented along with the general status of the STANAG 4609 activities. The Custodian can present any change proposals approved or rejected by the 4609 CST for which the Custodian disagreed. Joint ISR Capabilities Group makes the final decisions on those items presented for which the Custodian disagreed with the 4609 CST national representatives. The 4609 AST then incorporates the revisions as directed by Joint ISR Capabilities Group.

In addition, the Custodian presents to Joint ISR Capabilities Group completed amendments to the STANAG along with a summary of the changes for ratification. Revisions with Class I changes are then submitted to the Joint ISR Capabilities Group Secretary to formally present the modifications to the nations for ratification. Revisions with only Class II changes are considered ratified with Joint ISR Capabilities Group approval. Regardless of the ratification process used, after ratification, the Secretary

posts the revised STANAG to the Joint ISR Capabilities Group web page and submits it to the Chairman of the MAS for promulgation.

6.0 Meeting Procedures.

6.1 Language. All meetings will be conducted in English. Those nations requiring the materials in different languages are responsible for translating the materials. Attendees to the meetings should be proficient enough in English to contribute to the meeting in English.

6.2 Meeting Advance Notice. All meetings will be announced with a minimum of 60 days notice.

6.3 Quorum. The quorum for approving changes for submission to Joint ISR Capabilities Group is 2 nations formally represented by approved representatives or their alternates.

6.4 Meeting Minutes. Minutes of all formal meetings will be distributed within 14 days of the completion of the meeting. The minutes will include a record to document approved and disapproved changes, identify the status of all outstanding changes, and identify issues to be taken forward to Joint ISR Capabilities Group.

6.5 Memorandum of Resolution. If, because of disagreement between the Custodian and the majority of national representatives, items are taken forward to Joint ISR Capabilities Group for a final decision, the Custodian and 4609 AST will prepare a memorandum for record, distributed to all national representatives, which will identify results of Joint ISR Capabilities Group discussions/decisions, and provide status of all changes. This memorandum will be disseminated to the national representatives within 14 days of Joint ISR Capabilities Group meeting.

APPLICATION NOTES

Basic Predator KLV Metadata

Scope

This Engineering Guideline (EG) documents the basic Predator UAV (Unmanned Aerial Vehicle) metadata to be encoded into a standard SMPTE KLV Universal Metadata Set. This EG provides direction on the creation of a standard metadata set for reliable exchange of Predator closed caption (CC) data among digital motion imagery systems.

The scope of this EG is strictly limited to metadata that originates as closed caption metadata in analog video from the Predator UAV. Analog video and closed caption metadata are legacy systems that may continue to be used during the transition to all-digital sensors and information infrastructures. This EG facilitates that transition only and does not constitute an approved end-system implementation.

References

EG 0104.5, *Predator UAV Basic Universal Metadata Set* , MISB, 14 December 2006

SMPTE 336M-2001, *Data Encoding Protocol Using Key-Length-Value*

SMPTE 335M-2001, *Metadata Dictionary Structure*

SMPTE RP210.7-2003, *Metadata Dictionary*

Core Video Metadata Profile, Version 1.0, Video Working Group, 14 March 1997
"Predator Closed Caption ESD System", NIMA-MIPO Memorandum for Record U-001-01/ATTM, 25 February 2001 (Attached as Annex B)

Introduction

As motion imagery systems begin to migrate to all-digital architectures there are still some systems that will be in transition and require the consistent preservation of some analog system characteristics. One such element in transition is analog closed caption metadata from the Predator UAV. Analog closed caption has been successful as a means of carrying important UAV geospatial and mission metadata with video imagery. During the transition from this low data rate method of metadata carriage to more reliable and higher capacity embedded digital metadata it is important to preserve the general contents of the original Core Video Metadata Profile upon which the Predator UAV closed caption system was based. This metadata consists of the "raw" unprocessed metadata obtained directly from the Predator UAV platform or ground station before the signal has entered the processing and exploitation chain.
This EG identifies a way to encode, as a minimum, the original, source-derived, analog closed caption metadata from the Predator UAV and some computed information into a standard KLV digital metadata set. This standardized method of capturing the minimum Predator UAV metadata will help interoperability during motion imagery systems transition. All metadata shall be represented using big-endian (most significant byte – MSB - first) encoding. Bytes shall be big-endian bit encoding (most significant bit – msb - first).

Predator UAV Basic Universal Metadata Set

This section defines a metadata set that originates from or uses information from Predator analog closed caption metadata. The Predator UAV Basic Universal Metadata Set is the KLV metadata form of the original analog closed caption metadata.

All Predator UAV Basic Universal Metadata Sets shall be SMPTE 336M KLV compliant Universal Sets as determined by the metadata originator. (While it is possible that Predator metadata could be expressed as a Global Set, a Pack or even as a Label, the decision was made to use the Universal Set to reduce ambiguity or chances for misinterpretation.)

It is the responsibility of implementers to evaluate the format of the Predator CC metadata to determine if format changes or recalculations are needed before mapping to KLV fields. NOTE: A direct entry-for-entry mapping from CC to KLV cannot be assumed and all CC source fields shown may not be present.

Predator UAV Basic Universal Metadata Set

The Predator UAV Basic Universal Metadata Set shall conform to the syntax and format of the Universal Metadata Set specified in SMPTE 336M-2001.

The Predator UAV Basic Universal Metadata Set shall consist of the metadata elements and Timing Reconciliation and Security Sets listed in Table 1 and shall have the 16-byte designator of 06 0E 2B 34 02 01 01 01 0E 01 01 02 01 01 00 00. Table 2 contains information on the mapping or calculation that may be required to create a KLV metadata element.

Each Predator UAV Basic Universal Metadata Set shall contain as a minimum a timestamp obtained either from the Predator closed caption input or defined by the originator of the metadata set at the time of encoding. The originator-defined timestamp shall come from a constantly increasing reference source to allow users to determine accurate time intervals.

Predator Image Geoposition Corner Metadata

The Predator Corner Latitude/Longitude metadata shall consist of the elements shown in Table 1 which are mapped or calculated from original Predator analog closed caption metadata.

Corner coordinates are numbered as follows to conform to NITF numbering convention for single image frame corner coordinates:

Point 1 – upper left corner,

Point 2 – upper right corner,

Point 3 – lower right corner,

Point 4 – lower left corner.

Corners not corresponding to geographic locations, i.e. above the horizon, shall not be included.

Timing Reconciliation Metadata Set

This Recommended Practice (RP) defines a timing reconciliation metadata set to correct (reconcile) the original capture time of metadata with a User Defined Time Stamp usually associated with the capture time of the digital motion imagery or audio essence. Timing reconciliation metadata is not required if the application using the metadata does not depend on the amount of timing error or uncertainty between the metadata capture and the video or audio essence capture.

The time of metadata insertion into an encoded essence stream, file, or frame can be different from the time of its initial capture or sampling by as much as several seconds. In addition, the capture time of the metadata may be different from the capture time of the essence. As a result, the stream, file, or frame time stamp associated with an element or set (or pack) of metadata will be incorrect. When an application requires more precise information about the time of metadata capture this RP shall be used to convey the metadata capture time as a metadata set that is linked to another set or pack of metadata or to an individual metadata element. All metadata shall be represented using big-endian (most significant byte – MSB - first) encoding. Bytes shall be big-endian bit encoding (most significant bit – msb - first).

Timing Reconciliation Metadata for Digital Motion Imagery

The following time stamp metadata element shall be used to link accurate capture time of metadata to other metadata or essence as described in this section:

07 02 01 01 01 05 01 00 User Defined Time Stamp – Microseconds since 1970 (msb first)

Timing Reconciliation Metadata Inside Metadata Sets or Packs

The User Defined Time Stamp metadata element alone may be placed within a metadata set or pack when it unambiguously applies to each and every element of metadata within the set or pack. Its presence in the metadata set or pack shall be the only indication that it is the creation or capture date and time for the contents of that entire set or pack and, if used, it shall always be the first element of metadata within the applicable set or pack. When only a Timing Bias Correction is present in the set it shall be applied to the time to which it is linked or to the time in the set to which it is linked. When both a User Defined Time and Timing Bias Correction are present in the set the Time Bias Correction shall be applied to the User Defined Time in the set.

Timing Reconciliation Universal Metadata Set Linked to Other Metadata

The User Defined Time Stamp and a Timing Bias Correction (if needed) may be linked selectively to individual metadata elements or to metadata sets, packs or labels using the Timing Reconciliation Metadata Set (detailed in Table 1).

16-byte Set Designator[1]	Metadata Set or Element Name
Universal Set	
06 0E 2B 34 02 01 01 01 07 02 01 03 01 00 00 00	**Timing Reconciliation Metadata Set**
06 0E 2B 34 01 01 01 04 07 02 01 01 01 05 01 00	User Defined Time Stamp – Microseconds since 1970 (msb first)
06 0E 2B 34 01 01 01 04 03 01 03 03 03 01 00 00	Timing Bias Correction (microseconds – msb first)
06 0E 2B 34 01 01 01 03 03 01 03 03 04 00 00 00	Description of Timing Bias Correction
06 0E 2B 34 01 01 01 03 01 03 02 00 00 00 00 00	Item Designator ID

Table 1 – Timing reconciliation metadata set

When a single metadata element is linked to a Timing Reconciliation Universal Metadata Set the Timing Reconciliation Universal Metadata Set shall contain an Item Designator ID whose Value is the 16-byte Universal Label Key for the single metadata element to which it is linked. The Timing Reconciliation Universal Metadata Set shall always preceed the metadata element to which it is linked. Figure 1 is an informative example of a Timing Reconciliation Universal Metadata Set linked to one metadata element.

When some but not all metadata elements within a set or pack must be linked to a Timing Reconciliation Universal Metadata Set the Timing Reconciliation Universal Metadata Set shall contain one individual Item Designator ID for each metadata element to which it is linked. The Timing Reconciliation Universal Metadata Set shall always preceed all of the elements of the metadata set or pack to which it is linked.

When all metadata elements within a set or pack are linked to a Timing Reconciliation Universal Metadata Set and use of the method in 4.1 above may be ambiguous, the Timing Reconciliation Universal Metadata Set shall contain one individual Item Designator ID for the metadata set or pack to which it is linked. The Timing Reconciliation Universal Metadata Set shall always preceed the metadata set or pack to which it is linked.

Timing Reconciliation Universal Metadata Set Placement in Streams

When a Timing Reconciliation Universal Metadata Set is used within an MPEG-2 stream it the metadata linked to it shall always appear in each "I" frame. This does not preclude it also being used in "P" and /or "B" frames but its use in each "I" frame is mandatory.

[1] All Set UL Designators are tentative and may be changed as the SMPTE Sets Registry is developed.

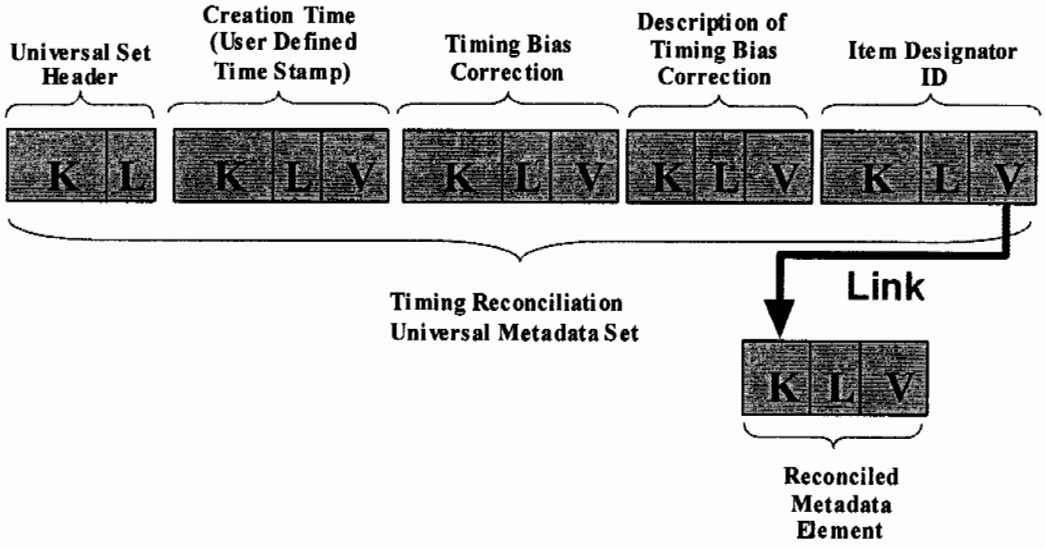


Figure 1 - Example of a Timing Reconciliation Universal Metadata Set Linked to a Metadata Element

16-byte Metadata Label or 16-byte Set Designator	Metadata Element or Set Name	Core Video Metadata Profile Name	Name in NIMA-MIPO Memo
06 0E 2B 34 01 01 01 01 07 01 02 01 03 02 00 00	Frame Center Latitude	FRAME CENTER LATITUDE	Target Latitude
06 0E 2B 34 01 01 01 01 07 01 02 01 03 04 00 00	Frame Center Longitude	FRAME CENTER LONGITUDE	Target Longitude
06 0E 2B 34 01 01 01 0A 07 01 02 01 03 16 00 00	Frame Center Elevation	(not defined)	(not defined)
06 0E 2B 34 01 01 01 01 07 01 01 01 00 00 00 00	Image Coordinate System	IMAGE COORDINATE SYSTEM	Image Coordinate System
06 0E 2B 34 01 01 01 01 07 01 09 02 01 00 00 00	Target Width	(not defined)	Target Width
06 0E 2B 34 01 01 01 01 07 02 01 02 01 01 00 00	Start Date Time - UTC	VIDEO TIME STAMP	Date of Collection/ Time of Collection
06 0E 2B 34 01 01 01 01 07 02 01 02 07 01 00 00	Event Start Date Time – UTC	MISSION START TIME	Date of Mission Start/ Time of Mission Start
06 0E 2B 34 01 01 01 04 07 02 01 01 01 05 00 00	User Defined Time Stamp (microseconds since 1970) (msb)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 07 01 00	Corner Latitude Point 1 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 08 01 00	Corner Latitude Point 2 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 09 01 00	Corner Latitude Point 3 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0A 01 00	Corner Latitude Point 4 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0B 01 00	Corner Longitude Point 1 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0C 01 00	Corner Longitude Point 2 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0D 01 00	Corner Longitude Point 3 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0E 0100	Corner Longitude Point 4 (Decimal Degrees)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 07 00 00	Corner Latitude Point 1 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 08 00 00	Corner Latitude Point 2 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 09 00 00	Corner Latitude Point 3 (Whole Seconds)	(not defined)	(not defined)

16-byte Metadata Label or 16-byte Set Designator	Metadata Element or Set Name	Core Video Metadata Profile Name	Name in NIMA-MIPO Memo
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0A 00 00	Corner Latitude Point 4 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0B 00 00	Corner Longitude Point 1 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0C 00 00	Corner Longitude Point 2 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0D 00 00	Corner Longitude Point 3 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0E 00 00	Corner Longitude Point 4 (Whole Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 04 07 01 02 01 03 07 02 00	Corner Latitude Point 1 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 04 07 01 02 01 03 08 02 00	Corner Latitude Point 2 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 04 07 01 02 01 03 09 02 00	Corner Latitude Point 3 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 04 07 01 02 01 03 0A 02 00	Corner Latitude Point 4 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0B 02 00	Corner Longitude Point 1 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0C 02 00	Corner Longitude Point 2 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0D 02 00	Corner Longitude Point 3 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 03 07 01 02 01 03 0E 02 00	Corner Longitude Point 4 (Hundredths of Seconds)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 01 07 01 08 01 01 00 00 00	Slant Range	SLANT RANGE	Slant Range
06 0E 2B 34 01 01 01 01 07 01 10 01 01 00 00 00	Sensor Roll Angle	(not defined)	Sensor roll angle*
06 0E 2B 34 01 01 01 01 07 01 10 01 02 00 00 00	Angle to North	ANGLE TO NORTH	Sensor Pointing Azimuth
06 0E 2B 34 01 01 01 01 07 01 10 01 03 00 00 00	Obliquity Angle	OBLIQUITY ANGLE	Sensor Elevation Angle
06 0E 2B 34 01 01 01 07 07 01 10 01 04 00 00 00	Platform Roll Angle	(not defined)	Aircraft roll angle
06 0E 2B 34 01 01 01 07 07 01 10 01 05 00 00 00	Platform Pitch Angle	(not defined)	Aircraft pitch angle
06 0E 2B 34 01 01 01 07 07 01 10 01 06 00 00 00	Platform Heading Angle	(not defined)	Aircraft heading angle
06 0E 2B 34 01 01 01 02 04 20 02 01 01 08 00 00	Field of View (Horizontal)	FIELD OF VIEW	Field of View
06 0E 2B 34 01 01 01 02 04 20 02 01 01 0A 01 00	Field of View (Vertical)	(not defined)	(not defined)
06 0E 2B 34 01 01 01 01 07 01 02 01 02 02 00 00	Device Altitude	SENSOR ALTITUDE	Sensor Altitude
06 0E 2B 34 01 01 01 03 07 01 02 01 02 04 02 00	Device Latitude	SENSOR LATITUDE	Sensor Latitude
06 0E 2B 34 01 01 01 03 07 01 02 01 02 06 02 00	Device Longitude	SENSOR LONGITUDE	Sensor Longitude

16-byte Metadata Label or 16-byte Set Designator	Metadata Element or Set Name	Core Video Metadata Profile Name	Name in NIMA-MIPO Memo
06 0E 2B 34 01 01 01 01 04 20 01 02 01 01 00 00	Image Source Device	SENSOR NAME	Sensor Name
06 0E 2B 34 01 01 01 01 01 05 05 00 00 00 00 00	Episode Number	MISSION NUMBER	Mission Number
06 0E 2B 34 01 01 01 01 01 01 20 01 00 00 00 00	Device Designation	PROJECT ID CODE	Project ID Code
06 0E 2B 34 02 01 01 01 07 02 01 03 01 00 00 00	Timing Reconciliation Metadata Set	(not defined)	(not defined)

Table 1 – Predator UAV Universal Basic Metadata Set Contents

* Planned addition to Predator analog closed caption metadata

TO (Y) Metadata Element or Set Name	Method of Translation	FROM (X) Name in NIMA-MIPO Memo
Frame Center Latitude	No changes needed. (Y=X)	Target Latitude
Frame Center Longitude	No changes needed. (Y=X)	Target Longitude
Image Coordinate System	0: Geodetic WGS84; 1: Geocentric WGS84; 2: None	Image Coordinate System
Target Width	(Convert from Feet to Meters) Y=X*0.304801	Target Width
Start Date Time – UTC	Convert to ISO8601:2000 date and time format	Date of Collection/ Time of Collection
Event Start Date Time – UTC	Convert to ISO8601:2000 date and time format	Date of Mission Start/ Time of Mission Start
User Defined Time Stamp (microseconds since 1970)	Time at which ESD is received. May be synchronized with Date/Time of Collection.	(not defined)
Corner Latitude Point 1	Computed from other metadata.	(not defined)
Corner Latitude Point 2	Computed from other metadata.	(not defined)
Corner Latitude Point 3	Computed from other metadata.	(not defined)
Corner Latitude Point 4	Computed from other metadata.	(not defined)
Corner Longitude Point 1	Computed from other metadata.	(not defined)
Corner Longitude Point 2	Computed from other metadata.	(not defined)
Corner Longitude Point 3	Computed from other metadata.	(not defined)
Corner Longitude Point 4	Computed from other metadata.	(not defined)
Slant Range	(Convert from Nautical Miles to Meters) Y=X*1852	Slant Range
Sensor Roll Angle	No changes needed. (Y=X)	Sensor roll angle *
Angle to North	(Convert from "angle relative to sensor boresight vector" to "first row of image" – Assuming boresight vector is perpendicular to top row of image) Y=X+90 (subtract 360 if needed)	Sensor Pointing Azimuth
Obliquity Angle	(Compute the "inverse of the Sensor Depression Angle?") Y=180-X	Sensor Depression Angle
Platform Roll Angle	No changes needed. (Y=X)	Aircraft roll angle
Platform Pitch Angle	No changes needed. (Y=X)	Aircraft pitch angle
Platform Heading Angle	No changes needed. (Y=X)	Aircraft heading angle
Field of View (Horizontal)	No changes needed. (Y=X)	Field of View
Device Altitude	(Convert from Feet to Meters) Y=X*0.304801	Sensor Altitude
Device Latitude	No changes needed. (Y=X)	Sensor Latitude
Device Longitude	No changes needed. (Y=X)	Sensor Longitude
Image Source Device	(Convert from Integer to String) 0=EO Nose, 1=EO Zoom, 2=EO Spotter 3=IR Mitsubishi PtSi Model 500 4=IR Mitsubishi PtSi Model 600 5=IR InSb Amber Model TBD	Sensor Name
Episode Number	No changes needed. (Y=X)	Mission Number
Device Designation	No changes needed. (Y=X)	Project ID Code

Table 2 – Conversion From Predator Closed Caption To Predator Uav Universal Basic Metadata Set

* Planned addition to Predator analog closed caption metadata.

Memo

To: Executive Office for Cruise Missiles and UAVs, JPO for MAE-UAV
Subject: Checkout Reference Data for the Predator ESD System
From: Pete Wiedemann
Date: 10 March 1998

U-001-01/ATTM 25 February 2001

MEMORANDUM FOR RECORD

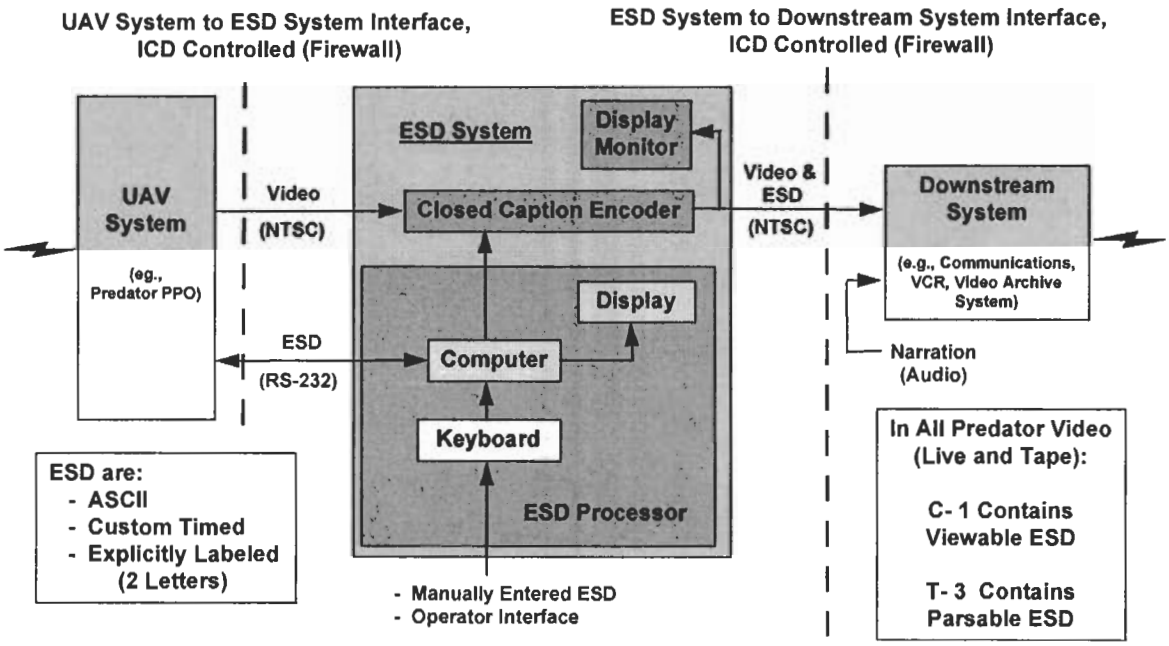
SUBJECT: Predator Closed Caption ESD System

1. The Motion Imagery Program Office requires for interoperability that systems, which receive Predator closed caption Exploitation Support Data, conform to the attached memorandum.

STEPHEN W. LONG
Program Manager, MIPO

Enclosure
Memo from Pete Wiedemann, Subject: Checkout Reference Data for the Predator ESD System

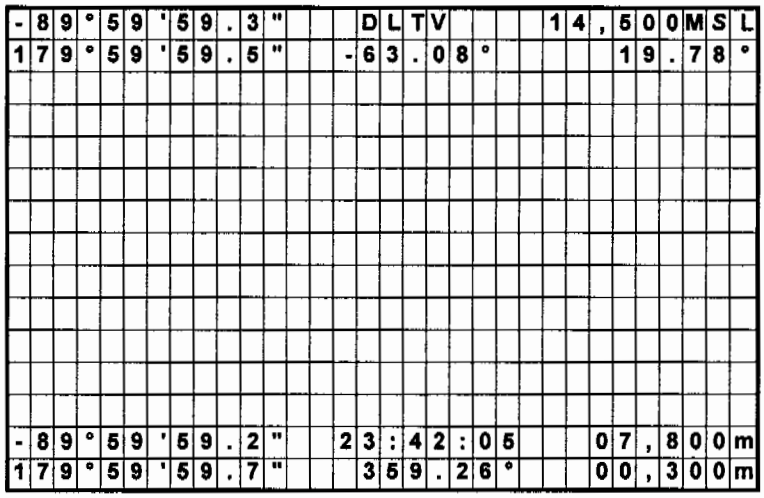
Predator ESD System, Block Diagram



VIEWABLE ESD, SCREEN LOCATION LAYOUT

Vehicle Latitude	Sensor ID	Vehicle Altitude
Vehicle Longitude	Sensor Elevation Angle	Sensor FoV Angle
Image Center Latitude	Time/Date(Alternating)	Slant Range
Image Center Longitude	Sensor Azimuth	Gnd.Dist.AtImageBase

Viewable ESD, Data Format Layout, showing Time of Day



Viewable ESD, Data Format Layout, showing Date

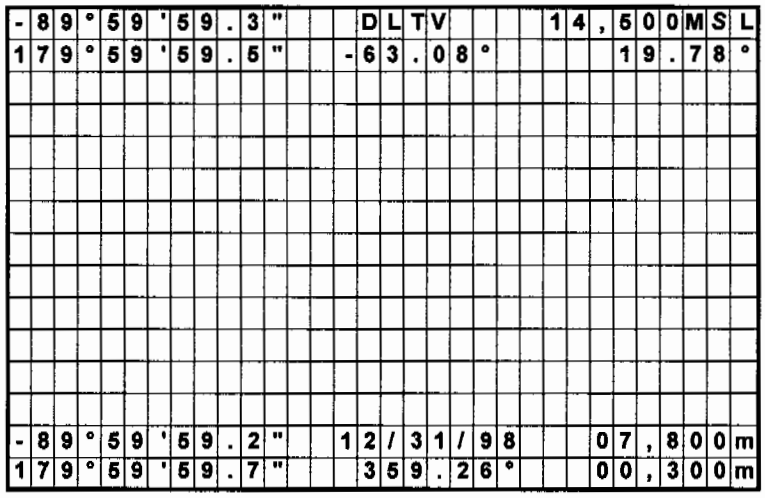


Table of Viewable and Parsable ESD (starts on next page)

DATA ITEM	DG	UNITS	RANGE	FORMAT	EXAMPLES
Target Latitude[1]	Ta	Deg/Min/Sec/ Tenths	+/- 0-90.0	PDDMMSST P: Sign (+ or -) D: Degrees digit M: Minutes digit S: Seconds digit T: Tenths	+89°59'59.9" => Ta+8959599 –34°26"37.5" => Ta–3426375
Target Longitude[2]	To	Deg/Min/Sec/ Tenths	+/- 0-180.0	PDDDMMSST P: Sign (+ or -) D: Degrees digit M: Minutes digit S: Seconds digit T: Tenths	+179°59'59.9" => To+17959599 –117°00'00.0" => To–11700000 – 5°05'17.0" => To–00505170
Target Width[3]	Tw	Meters	0-99,999	N N: from 1 to 5 digits	8,123 m => Tw8123 523 m => Tw523
Slant Range	Sr	Meters	0-99,999	N N: from 1 to 5 digits	99,999 m => Sr99999 523 m => Sr523
Sensor Pointing Azimuth[4]	Sp	Degrees	0-359.00	DDD.HH D: Degrees digit H: Hundredths digit	359.58° => Sp359.58 23.00° => Sp23.00
Sensor Elevation Angle[5]	Se	Degrees	+/- 0-180.00	PDDD.HH P: Sign (+ or -) D: Degrees digit H: Hundredths digit	+179.33° => Se+179.33 – 5.10° => Se-5.10
Field of View[6]	Fv	Degrees	0-180.00	DDD.HH D: Degrees digit H: Hundredths digit	179.33° => Fv179.33 0.41° => Fv0.41
Sensor Altitude	Sl	Feet MSL	+/- 0-99,999	PN P: Sign (+ or -) N: from 1 to 5 digits	+24,999 MSL => Sl+24999 – 1,023 MSL => Sl-1023

Sensor Latitude[1]	Sa	Deg/Min/Sec/ Tenths	+/- 0-90.0	PDDMMSST P: Sign (+ or -) D: Degrees digit M: Minutes digit S: Seconds digit T: Tenths digit	+85°59'59.7" => Sa+8959597 – 5°00'00.0" => Sa-0500000
Sensor Longitude[2]	So	Deg/Min/Sec/ Tenths	+/- 0-180.0	PDDDMMSST P: Sign (+ or -) D: Degrees digit M: Minutes digit S: Seconds digit T: Tenths digit	+179°59'59.7" => So+17959597 – 5°00'00.0" => So-00500000
Sensor Name	Sn	Name Code	0-5	0: EO Nose 1: EO Zoom (DLTV) 2: EO Spotter 3: IR Mitsubishi PtSi Model 500 4: IR Mitsubishi PtSi Model 600 5: IR InSb Amber Model TBD	DLTV => Sn1
Image Coordinate System	Ic	Coordinate Code	0-2	0: Geodetic WGS 84 1: Geocentric WGS 84 2: None	(not viewable) => Ic1
Date of Collection	Cd	Date		CCYYMMDD CC=Century YY=Year MM=Month DD=Day	05/23/98 => Cd19970523
Time of Collection	Ct	Time	0-235959	HHMMSS HH=Hour MM=Minute SS=Seconds	17:23:06 => Ct172306 03:06:27 => Ct030627

Mission Number	Mn	Number	1-9999999	N N: from 1 to 7 digits	(not viewable) => Mn3324
Mission Start Date	Md	Date		CCYYMMDD CC=Century YY=Year MM=Month, DD=Day	(not viewable) => Md19970423
Mission Start Time	Mt	Time	0-235959	HHMMSS HH=Hour MM=Minute SS=Seconds	(not viewable) => Mt212456 (not viewable) => Mt050802
Security Classification	Cl	Classification Code	U/R/C/S/T	U: Unclassified O: Sensitive (FOUO) R: Restricted C: Confidential S: Secret T: TopSecret	(not viewable) => Cl<esc>C (not viewable) => Cl<esc>S [Correction: *Some software versions report '0' for Unclassified and '1' for Restricted.*]
Project ID Code[7]	Pc	Number	0-99	N N: from 1 to 2 digits	(not viewable) => Pc25
ESD ICD Version	Iv	Count	0-999	N N: from 1 to 3 digits	(not viewable) => Iv5

Notes:

1) A plus sign (+) indicates North Latitude. All Latitude coordinates use WGS84.
2) A minus sign (-) indicates East Longitude. [Correction: *A minus sign (-) indicates West Longitude.*] All Longitude coordinates use WGS84.
3) At center of image.
4) Relative to true North.
5) Relative to Planetary Tangent at Nadir. 0 is Horizon, –90 is Straight down (nadir). [Correction: *+90 is straight down (nadir)*]
6) Horizontal, across baseline of image, projected onto the terrain (flat terrain model at DTED or other best available elevation data). [Correction: *Software versions prior to 1.6 report Vertical Field of View.*]
7) The Project ID of the Collection Platform (e.g., Predator, Outrider, Pioneer, etc.).

GLOSSARY

(ACRONYMS AND DEFINITIONS)

AAF	Advanced Authoring Format
AEDP	Allied Engineering Documentation Publication
AF	Air Force
AF DCGS	Air Force Distributed Common Ground System
ANSI/NCITS	American National Standards Institute / National Committee for Information Technology Standards
AP	Allied Publication
Bandwidth	Bandwidth is the difference between the highest and lowest frequency a channel can conduct, measured in MHz. Also used to describe the rated throughput capacity of a given network medium or protocol.
BER	1.Bit Error Rate, 2. Basic Encoding Rules
bps	Bits Per Second
Broadband (Serial)	Analog data transmission. Signal flow is unidirectional. Using amplifiers to regenerate signals
Buffer	An amount of memory that temporarily stores data to help compensate for differences in the transfer rate from one device to another.
Byte	Eight bits; historically, one word of data
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
Certification	Comprehensive evaluation of the technical and non-technical features of an automated information system and other safeguards, made in support of the accreditation process, to establish the extent to which a particular design and implementation meets a set of specified requirements
CIP	Common Imagery Processor
CL	Compliance Level
CM	Configuration Management
COE	Common Operating Environment
CONOPS	Concept Of Operations
CONUS	Continental United States
Compression	Compression is the reduction in size of data in order to save space or transmission time. For data transmission, compression can be performed on just the data content or on the entire transmission unit (including *header* data) depending on a number of factors.
COTS	Commercial Off The Shelf
CPU	Central Processing Unit
CST	Custodial Support Team
Declassification	A decision process supported by procedures which allows unrestricted release of a data storage element
DoD	Department of Defense
DVD	Digital Versatile Disk
EIA	Electronics Industry Association
ELT	Electronic Light Table
Encryption	Encryption is the conversion of data into a form, called a ciphertext, that

	cannot be easily understood by unauthorized people
EO	Electro-Optical
FTP	File Transfer Protocol - An application protocol, part of the TCP/IP protocol stack, used for transferring files between network nodes. FTP is defined in RFC 959
GB	Gigabytes
Gbps	Giga bits per second
GFI	Government Furnished Information
GUI	Graphical User Interface - A user environment that uses pictorial as well as textual representations of the input and output of applications and the hierarchical or other data structure in which information is stored. Conventions such as buttons, icons, and windows are typical, and many actions are performed using a pointing decide (such as a mouse). Microsoft Windows and the Apple Macintosh are prominent examples of platforms utilizing GUIs
IEEE	Institute of Electrical and Electronic Engineers
IESS	Imagery Exploitation Support System
IMINT	Imagery Intelligence
INFOSEC	Information Security
INT	Intelligence
Interoperability	Interoperability testing is the process of assessing the ability of a system to exchange usable electronic information with systems of other services or nations as specified in its requirements documents. Specialized test tools are used to monitor performance of products to determine if the proper actions and reactions are produced. A system is certified as interoperable at the completion of successful interoperability testing
IOC	Initial Operational Capability
IP	Internet Protocol - A network-layer protocol in the TCP/IP stack offering a connectionless internetwork service. IP provides features for addressing, type-of-service specification, fragmentation and reassembly, and security. Defined in RFC 791. IPv4 (Internet Protocol version 4) is a connectionless, best-effort packet switching protocol
IPL	Image Product Library
IR	Infrared
ISDN	Integrated Services Digital Network. A telephone service designed to carry both voice and data information.
ISO/IEC	International Organization for Standardization / International Electro-technical Commission
ISR	Intelligence, Surveillance, and Reconnaissance
IU	Interface Unit
JITC	Joint Interoperability Test Command
JITF	Joint Integration Test Facility
KB	Kilobytes
Kbps	Kilobits per second
KLV	Key, Length, Value; see SMPTE 336

LAN	Local Area Network - A high-speed, low-error data network covering a relatively small geographic area (up to a few thousand meters). LAN standards specify cabling and signaling at the physical and data link layers of the OSI reference model
LSB	Least Significant Byte
MASINT	Measurement and Signature Intelligence
MB	Megabytes
Mbps	Megabits per second
MPEG	Moving Picture Experts Group
MSB	Most Significant Byte
MSI	Multi-Spectral Imagery
MTI	Moving Target Indicator
MXF	Material Exchange Format; see SMPTE 377
NADSI	NATO Advanced Data Storage Interface
NAFAG	NATO Air Force Armaments Group
NATO	North Atlantic Treaty Organization
NED	NATO Effective Date
NB	Narrow-Band
NCIS	NATO Common Interoperability Standards
NIIA	NATO ISR Interoperability Architecture
NIFTI	NATO Interoperability Framework Testing Infrastructure
NIL	National Image Library
NIMA	National Imagery and Mapping Agency
NIMP	NATO Interoperability Management Plan
NITF	National Imagery Transmission Format
NITFS	NITF Standard
NL	NIMA Library
NLT	No Later Than
NRT	Near-Real Time
NSA	NATO Standardization Agency
NSIF	NATO Secondary Imagery Format
NSILI	NATO Standard ISR Library Interface
NTM	National Technical Means
NTSC	National Television Standards Committee
PAL	Phase Alternating Line
Plug and Play	Plug and Play technology offers automatic settings for hardware in computer. The term signifies plugging the device, for example Network Card and then automatically plays or run the computer without manual configuration by users
S-VHS	Super VHS
SAR	Synthetic Aperture Radar
SIGINT	Signals Intelligence
SIPRNET	Secret Internet Protocol Router Network
SMPTE	Society of Motion Picture and Television Engineers
SONET	Synchronous Optical Network
STANAG	Standardization Agreement (NATO)
T&E	Test and Evaluation
TBD	To Be Determined
TBR	To Be Resolved

TCDL	Tactical Common Data Link
TCP	Transmission Control Protocol,. One of the TCP/IP protocol suites designed to ensure reliable data transfer
TERABYTE	1,000 Gigabytes (10 raised to the 12th power)
TIA	Telecommunications Industry Association
TPED	Tasking, Processing, Exploitation, and Dissemination
UAV	Uninhabited Aerial Vehicle
Validation	Validation testing is the process of ensuring: 1) proper requirements coverage by the proposed standards or specifications and 2) correct standards or specifications are available as the basis for developing products. In the context of validation, correct standards would be those demonstrated to be self-consistent, complete and feasible. Validation testing consists of two general phases: static analysis which satisfies item 1) above and dynamic analysis which satisfies item 2) above
Vendor	The manufacturer/developer/retailer responsible for producing or marketing a System, subsystem, or product
VHF	Very High Frequency
VHS	Video Helical Scan (1/2 inch recording format)
VQ	Vector Quantization
VTC	Video Teleconferencing
WAN	Wide Area Network A data communications network that serves users across a broad geographic area and often uses transmission devices provided by common carriers. Frame Relay, SMDS, and X.25 are examples of WANs WB Wide-Band
WWW	World Wide Web. Multimedia hypertext-based system that uses HTML (Hypertext Markup Language) to provide access to services and information
XML	Extensible Markup Language