MI NIOP

Project PEO(U&W) CSI (Requirements)

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Motion Imagery (MI) Navy Interoperability Profile (NIOP)

[MI NIOP]

Implementation Standards for MI Packaging and Dissemination

RELEASED - Version 1.3.0

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REVISION HISTORY

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0.0.1			Andrew Kirschbaum		4/18/2012	Initial Template Release
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0.1.2	Nov 2012	Headers/ Section 6.3.4	Andrew Kirschbaum			Added headers. Added a change to maintain video quality (DCR 2012-019).
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			Ron Broens **Mike Alcantara**			**format. Wrote / edited Introduction Section 1.0, commented on requirements in Section 3.0**
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1 INTRODUCTION

This NIOP designates the Naval UAS portfolio interoperability management preference in places where there are multiple options mandated in the Department of Defense (DoD) Information Technology (IT) Standards Registry (DISR). The DISR, for instance, contains two standards for MI compression and this NIOP 'designates' ISO/IEC 14496.10 (H.264) as the PEO (U&W) Naval UAS portfolio choice to ensure all programs use at least one common solution. This NIOP also directs image quality to be maintained in order to support the multitude of different mission scenarios in which Naval UAS assets currently participate.

1.1 Purpose

The MI Navy Interoperability Profile (NIOP) delineates current Motion Imagery format, quality, compression, and metadata standards. The purpose of the MI NIOP is to delineate the Motion Imagery format, quality, compression, and metadata implementation requirements between an Unmanned Aircraft (UA) and a Control Segment (CS). The goal is to improve interoperability and the usefulness of MI produced by Naval UAS by implementing the standards consistently across the Naval UAS portfolio.

1.2 Scope

This NIOP provides the implementation requirements focusing on three primary geospatial capabilities which may be supported by a variety of MI sensors: 1) Situational Awareness, 2) Exploitation and, 3) Strike Support.

Finally, this document addresses specific Motion Imagery format, quality, metadata, and compression implementation requirements broken down by Naval UAS FoS Performers.

The scope of the MI NIOP is depicted in Figure 1. At the UA, the MI NIOP requirements are applied after all image processing has been done and immediately before the data stream is put through the last steps of

encryption (if applicable), conversion by a multiplexer (if applicable) and transmission to leave the UA. The MI NIOP implementation requirements are applied to what comes into the Control Segment. The MI NIOP requirements are also applied to the output of a Control Segment if it posts the MI product onto the C4I Segment for other Consumers of UAS products. The MI NIOP is not intended to replace either 1) the systems engineering and requirements definition or 2) systems engineering and integration.

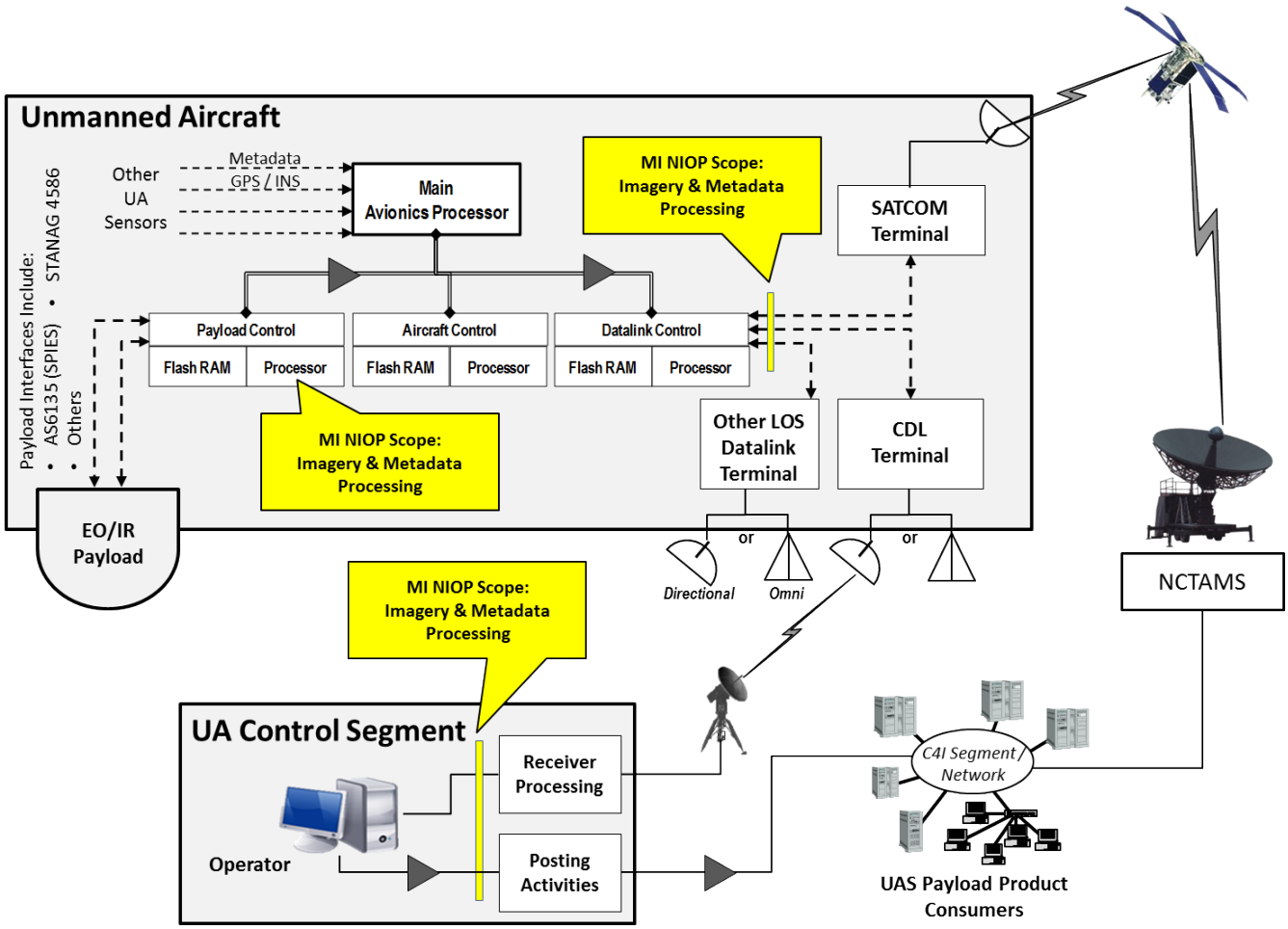

Figure 1: Location of MI Scope

The Standards Discovery presented in Appendix A provides an orientation for understanding the types of applicable Standards (STs) supporting technical requirements for any capability, along with additional guidance provided by Recommended Practices (RPs). Individual Capability Based Requirement Profiles (CBRP), presented in Appendix C, identify relevant STs and RPs for each named capability.

CBRP, presented in Appendix C, identify relevant Standards and RPs for each named capability.

The standards for Motion Imagery payload products, with their associated metadata as specified in this NIOP, provide open and known formats for dissemination of payload products from Unmanned Aircraft and UAS Control Segments. When coupled with standard methods of transport over an interoperable data links and Networks, compliance with these NIOPs will ensure payload products can be disseminated from UA to Control Segments, Control Segments to Consumers on the C4I network, and Consumers can process the products. The operating parameters are adopted from standards within the DISR; their implementation and conformance will maximize Naval UAS payload product dissemination across the joint battle space.

Note:	For the purposes of this document, a Standard is a specification that has been approved by the DoD Information Technology Standards Committee and is listed in the DISR. Software owned and controlled by an outside commercial organization and licensed by the government is a Commercial off the Shelf (COTS) solution. That COTS software may, however, produce DISR standard data formats and streams and implement DISR service interface standards.

The MI NIOP identifies required standards and requirements for Motion Imagery integration to achieve interoperability.

The requirements for Situational Awareness are foundational to Exploitation and Strike Support. As such the following set of SA requirements provides for a uniform implementation of MI products produced by Naval UAS ISR assets. A MI Stream product is composed of a Motion Imagery Elementary Stream, a Metadata Elementary Stream(s), and an optional Audio Elementary Stream packaged within a MPEG-2 Transport Stream container. The requirements for Exploitation are built upon and in addition to those requirements for Situational Awareness. The requirements for Strike Support are built upon and in addition to those requirements for Exploitation. The requirements for Exploitation and Strike Support provide for a uniform implementation of MI products produced by Naval UAS ISR assets.

1.3 Applicability

This edition of the MI NIOP is mandated by PEO (U&W) Naval UAS Interoperability Initiative Memorandum (22 Feb 2013) for PEO (U&W) UAS portfolio programs. Specific Naval UAS Programs and their respective implementation timeframes are specified by the OPNAV N2/N6 Interoperational Capabilities Implementation Agreement.

1.4 Terms of Reference

1.4.1 Naval UAS FoS Interoperational Capabilities Capstone (ICC)

An Interoperational Capability is an architectural modeling object type representing a high-level specification of an enterprise, organization, or Performer's abilities to achieve a desired operational effect under specified standards and conditions through combinations of ways and means to perform a set of activities.

Each Interoperational Capability is comprised of interoperable operations and/or supporting interoperable activities to be executed by PEO (U&W) UAS FoS Performer. Each interoperable activity is composed of specific verbs and actions for a Performer, in accordance with the interoperability business rules. Refer to the ICC document for further definitions of these terms.

Naval UAS FoS **Interoperational Capabilities**	**Naval UAS FoS** **Interoperable Activities**	**Naval UAS FoS** **Performers**
• Exclusive Control Interoperations • Supervised Usage Interoperations (Unmanned Aircraft) • Supervised Usage Interoperations (Payloads) • Supervised Usage Interoperations (Weapons) • Platform Monitor Interoperations • Payload Products for Discoverability Interoperations	• Perform • Support • Manage • Produce • Use • Forward • Post	• Unmanned Aircraft • Control Segment: Native • Control Segment: Non-Native • Control Segment: Disadvantage • C4I Segment • Consumer
Naval UAS FoS **Interoperability Business Rules**		**Naval UAS FoS** **Performer Roles**
• Exclusive Control Acquisition • Exclusive Control Handover • Exclusive Control Override • Supervised Usage		• Acquiring Control Segment • Relinquishing Control Segment • Supervising Control

Authorization • Supervised Usage Pushback • Supervised Usage Relinquish • Supervised Usage Takeback • Platform Disclosure • Platform Discoverability • Airworthiness Interoperations Verification		Segment • Supervised User • Supervised Unmanned Aircraft

1.4.2 MI NIOP Definitions

1.4.2.1 Audio Elementary Stream

An Elementary Stream which contains compressed audio.

1.4.2.2 Control Segment (CS)

For the purpose of this NIOP, the term CS is defined as a node or stand alone system which can receive MI Stream. The CS may be able to command and control the UA or payload. A Control Segment will perform the required Posting activities onto a C4I network for discovery by additional Consumers (Users) of Naval UAS products.

1.4.2.3 Elementary Stream

"A generic term for one of the coded video, coded audio or other coded (i.e. compressed) bit streams in packetized Elementary Stream packets" [as defined in ISO/IEC 13818-1]. In this document, "Motion Imagery" is recommended by the MISB as it connotes "intelligence value" in contrast to the commercial use of the term "video", which may not convey intelligence value.

1.4.2.4 Exploitation

Exploitation necessitates that sufficient metadata be present to support mission analysis processes and to correlate information from multiple intelligence sources. This data may also be compared with other MI studied over time, or used to produce still images that may be fused with yet other images or data for

derived intelligence value. Data collected in Exploitation might also support photogrammetric processes that further improve data accuracy.

1.4.2.5 Full Motion Video (FMV)

"Full Motion Video (FMV) is a term used within the military and intelligence communities. As used, FMV implies a very narrow subset of Motion Imagery; one that assumes geo-spatial metadata, commercial image formats and playback rates. FMV has no formal definition and conveys different meanings to different communities; therefore, the term FMV should not be used in any contractual language." – MISP-2015.1

1.4.2.6 Metadata Elementary Stream

An Elementary Stream which contains Key-Length-Value (KLV) metadata elements.

1.4.2.7 MI Stream

Defined for use within this NIOP, a MI Stream is composed of a Motion Imagery Elementary Stream, a synchronous and/or asynchronous Metadata Elementary Stream(s), and an optional Audio Elementary Stream encapsulated within an MPEG-2 Transport Stream container.

1.4.2.8 Motion Imagery

"Motion Imagery is a sequence of Images, that when viewed (e.g. with a media player) must have the potential for providing informational or intelligence value. This implies the Images composing the Motion Imagery are: (1) generated from sensed data, and (2) related to each other both in time and in space. Some sensed data, such as Visible Light and Infrared, can be used directly to form Images, while others, such as SAR and LIDAR, require a conversion to a viewable Image. To satisfy the time and space relationship the capture time (i.e. the time the Image was taken) of each successive Image must be sequentially in order and the space relationship between each successive Image must have some recognizable visual overlap with the previous Image." -MISP-2015.1

1.4.2.9 Motion Imagery Elementary Stream

An Elementary Stream which contains compressed Motion Imagery.

1.4.2.10 Quality

"Situational Awareness (SA) quality" MI is a product derived from MI, or other sources that is at a bandwidth, compression, resolution, frame rate, and metadata content suitable for distribution over operational networks to field users for the observation of static and dynamic relationship of entities within the field of view of the collection sensor.

"Exploitation quality" MI is a higher quality of Motion Imagery achievable with a deployed system, including metadata, generally at "high" bit-rates delivered by the collection system to be used for Exploitation and analysis by human analysts and automated analysis tools for the production of MI products for distribution to end-users.

"Strike Support quality" MI is the highest quality Motion Imagery achievable by a collection system for the production of precision geo-positioning products for distribution to end-users and automated analysis tools.

1.4.2.11 Situational Awareness

Situational Awareness is the human perception of the elements of the operational environment in the context of forces, space and time, the comprehension of their meaning, and the projection of their status in the near future.

1.4.2.12 Strike Support

Strike Support data is typically expected to be highly precise, often calibrated, and sufficient to provide real-world coordinates to meet the needs of engagement. Strike Support data is heavily tied to weapon selection and objectives, which means that its requirements for accuracy, image spatial/temporal resolution and quality are all derived from the intended targets and the desired targeting engagement.

1.4.2.13 Transcoding

Transcoding is the direct digital-to-digital data conversion of one encoding to another. Transcoding for Motion Imagery includes conversions to change: compression format, image format (transsize), and data rates (transrating)

2 REFERENCE DOCUMENTATION

While every effort has been made to ensure the completeness of this list, users are cautioned that they must meet all specified requirements of documents cited in Sections 3 of this NIOP.

Government Documents

Standard Identifier	Title	Date
MIL-STD 961E	Defense and Program-Unique Specifications Format and Content	2-Apr-08
CJCSI 3900.01C	Position (Point and Area) Reference Procedures	30-Jun-07
CJCSI 6212.01F	Net Ready Key Performance Parameter	21-Mar-12
U.S. DoD IP 1.1:2013	U.S. DoD Interoperability Profile (IP) 1.1 Motion Imagery for Situational Awareness	3-Dec-13
NGA.STND.0017_3.0.1	Community Sensor Model (CSM) Technical Requirements Document (TRD), Version 3.0.1	28-Dec-12
□□NGA.SIG.0002_2.1	Frame Sensor Model Metadata Profile Supporting Precise Geopositioning, Version 2.1	07-Jul-11

Non-Government Documents		
Standard Identifier	**Title**	**Date**
North Atlantic Treaty Organization (NATO) Standardization Agency (NSA)		
STANAG 4586	Standard Interface of Unmanned Aerial Vehicle (UAV) Control System (UCS) for NATO UAV Interoperability, Edition 2, Amendment 2	18-May-11
STANAG 4609, Ed 3	NATO Digital Motion Imagery Format	13-Oct-09
NGA.STND.0040_1.0	National Imagery Interpretability Rating Scale Standard Version 1.0	5-Aug-14
□□Motion Imagery Standards Board (MISB) Documents		
MISP-2015.2	Motion Imagery Standards Profile-2015.2	26-Feb-15
MISB ST 0102.11	Security Metadata Universal and Local Sets for Digital Motion Imagery	23-Oct-14

MISB ST 0107.2	Bit and Byte Order for Metadata in Motion Imagery Files and Streams	27-Feb-14
□□MISB ST 0301.5	MISB Profile for Aerial Surveillance and Photogrammetry Applications (ASPA)	26-Jul-10
□□MISB ST 0403.2	Digital Representation and Source Interface formats for Infrared Motion Imagery mapped into 1280 x 720 format Bit-Serial Digital Interface	27-Feb-14
□□MISB ST 0601.8	MISB UAS Datalink Local Metadata Set (LDS*) ** Data Set is synonymous with Metadata Set*	23-Oct-14
MISB ST 0602.4	Annotation Metadata Set	27-Feb-14
MISB ST 0603.2	Common Time Reference for Digital Motion Imagery Using Coordinated Universal Time (UTC)	27-Feb14
MISB ST 0604.3	Time stamping and Compressed Motion Imagery	27-Feb14
MISB ST 0605.5	Encoding and Inserting Time Stamps and KLV Metadata in Class 0 Motion Imagery	26-Feb15
MISB ST 0607.4	MISB Metadata Registry and Processes	26-Feb-15
MISB ST 0801.5	Photogrammetry Metadata Set for Digital Motion Imagery	27-Feb-14
MISB ST 0805.1	KLV to Cursor-on-Target (CoT) Conversions	27-Feb-14
MISB ST 0806.4	Remote Video Terminal Metadata	27-Feb-14
□□MISB ST 0807.15	MISB Metadata Registry	26-Feb-15
MISB ST 0901.2	Video-National Imagery Interpretability Rating Scale	27-Feb-14
□□MISB ST 0902.4	Motion Imagery Sensor Minimum Metadata Set	23-Oct-14
□□MISB ST 0903.4	Video Moving Target Indicator and Track Metadata	23-Oct-14

□□□MISB ST 1010.1	Generalized Standard Deviation and Correlation Coefficient Metadata	27-Feb-14
MISB ST 1107.1	Metric Geopositioning Metadata Set	27-Feb-14
MISB ST 1201.1	Floating Point to Integer Mapping	27-Feb-14
MISB ST 1202.2	Generalized Transformation Parameters	26-Feb-15
MISB ST 1204.1	Motion Imagery Identification System (MIIS) Core Identifier	24-Oct-13
MISB ST 1402	MPEG-2 Transport of Compressed Motion Imagery and Metadata	27-Feb-14
MISB RP 0701	Common Metadata System-Structure	6-Aug-07
MISB RP 0802.2	H.264/AVC Motion Imagery Coding	27-Feb-14
MISB ST 0808.1	Ancillary Text Metadata Sets	27-Feb14
□□MISB ST 0809.1	KLV Representation of Meteorological Data	27-Feb14
□□MISB RP 0813.1	Integration of Motion Imagery into the STANAG 4559 Data Model	27-Feb14
MISB RP 0904.1	H.264 Bandwidth/Quality/Latency Tradeoffs	27-Feb14
MISB ST 1001.1	Audio Encoding	27-Feb14
□□Institute of Electrical & Electronics Engineers (IEEE)		
IEEE 1003.1:2004	The core of the Single UNIX Specification, Version 3	2004 Edition
□□International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)		
ISO/IEC 13818-1:2013	Information technology -- Generic coding of moving pictures and associated audio information: Systems	2013 Edition
ISO/IEC 13818-2:2013	Information technology -- Generic coding of moving pictures and associated audio information: video	2013 Edition
ISO/IEC 14496-10:2014	Information technology -- Coding of audio-visual objects -- Part 10: Advanced Video Coding	2014 Edition

3 INTERFACE REQUIREMENTS

3.1 System Level Requirements

3.2 Implementation of MI for Situational Awareness (SA)

3.2.1 SA: Unmanned Aircraft Requirements

3.2.1.1 SA: MI Stream

The UA shall encapsulate a MI Stream in accordance with ISO/IEC 13818-1 and MISB ST 1402 as depicted in Figure 2. **[MI-509]**

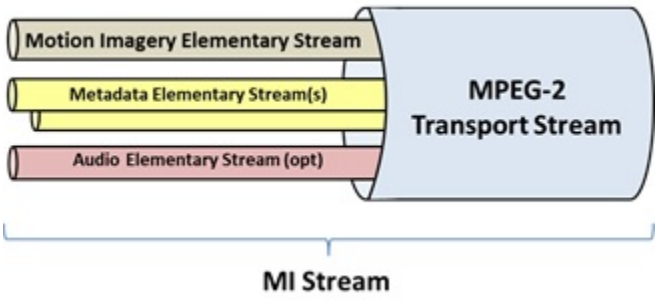

Figure 2: Component Elementary Streams within an MPEG-2 Transport Stream that comprise an MI Stream

A MI Stream shall contain one Motion Imagery Elementary Stream. [MI-5137]

A MI Stream shall contain one of the following as specified in MISB ST 1402: 1) one synchronous Metadata Elementary Stream and one or more asynchronous Metadata Elementary Stream(s); or 2) one synchronous Metadata Elementary Stream; or 3) one or more asynchronous Metadata Elementary Stream(s). [MI-514]

Note:	When security metadata is carried within the MPEG-2 Transport Stream, it shall be inserted into only one of the two metadata carriage methods available: the synchronous Metadata Elementary Stream method or the asynchronous Metadata Elementary

	Stream method in accordance with MISB ST 1402. [MI-515]

Metadata shall have a Precision Time Stamp (as defined in MISB ST 0603) located within 1 second of the Precision Time Stamp of the nearest MI frame within a MI Stream. [MI-517]

A MI Stream may optionally contain one or more Audio Elementary Stream(s). Audio shall be one of the allowed compressed types specified in MISB ST 1001. [MI-519]

3.2.1.2 SA: Network Protocol Output

The UA shall transmit the MI Stream using multicast User Datagram Protocol (UDP/IP). [MI-521]

3.2.1.3 SA: Motion Imagery Quality

The UA shall produce MI with a minimum spatial format of 640x480p. **[MI-524]**

When the UA produces Standard and/or Enhanced Definition formats, the UA shall compress the Motion Imagery using H.264/AVC (as defined in ISO/IEC 14496-10), Constrained Baseline Profile, up to and including H.264/AVC Level 3. **[MI-526]**

When the UA produces 1920x1080p30 or 1280x720p60 format, the Motion Imagery shall be compressed using H.264/AVC (as defined in ISO/IEC 14496-10), Constrained Baseline Profile, up to and including H.264/AVC Level 4.0. [MI-528]

While in flight, the Motion Imagery Elementary Stream frame rate shall have six selectable Motion Imagery Elementary Stream frame rates from 30 FPS down to 5 FPS, including 15 FPS and 10 FPS. [MI-530]

Note:	Frame rates are to be selected by skipping an integer number of frames; for example, for a native rate of 30 FPS, a skip of one frame produces 15 FPS; a skip of two frames produces 10 FPS; a skip of five frames produces 5 FPS, etc.

While in flight, the UA shall have 5 selectable MI Stream data rates ranging from a minimum of 256 Kbps to the maximum bandwidth available. **[MI-533]**

3.2.1.4 SA: Timestamp

The Precision Time Stamp, as defined in MISB ST 0603, inserted on each frame of Motion Imagery shall be accurate within 10 msec. [MI-536]

Note:	MISB RP 0603 defines the timestamp for a Motion Imagery frame as "the start of the actual image capture process, such as the opening of the shutter or start of Charge Coupled Device (CCD) integration." MISB RP 0603 is cited here because this language was removed from ST 0603 and remains a TBD until more accurately specified.

Uncompressed Motion Imagery shall include a Precision Time Stamp in accordance with MISB ST 0605. [MI-5145]

Where a timestamp exists in the uncompressed Motion Imagery, the compressed Motion Imagery shall use the same Precision Time Stamp for the corresponding frame. [MI-541]

When compressed with H.264/AVC, a Motion Imagery Elementary Stream shall include a Precision Time Stamp in accordance with MISB ST 0605. [MI-539]

Compressed Motion Imagery in the UA shall include a Precision Time Stamp as defined in MISB ST 0603 that designates the time of frame capture. [MI-543]

The Precision Time Stamps shall be referenced to UTC time in accordance with MISB ST 0603. [MI -545]

Note:	MISB ST 0603 defines the use of UTC as a common time reference for the correlation of MI frames and metadata.

Where a transcoding process is used, that process shall populate the Motion Imagery Elementary Stream Precision Time Stamps in the processed output MI Stream with the same Precision Time Stamps found in the input MI Stream. [MI-548]

The UA shall associate a Precision Time Stamp with each metadata item within 10 milliseconds of the metadata sample time. [MI-550]

The KLV metadata shall include a Precision Time Stamp in accordance with MISB ST 0603. [MI-552]

Note:	The Precision Time Stamp is used to associate metadata with Motion Imagery frames, which facilitates search and review of time-critical events. Metadata sources such as a flight computer typically operate on a common timing reference with the MI. As a source of metadata, the flight computer provides a Precision Time Stamp for inclusion along with the metadata. Ideally, metadata should be sampled coincident with a frame of MI – in this case the Precision Time Stamp for both the MI and the metadata would be the same. When not possible, it is best to sample metadata in relation to the timing reference (i.e. synchronous), but with some known time offset relative to the MI frame. The mandatory timestamp for both Motion Imagery and metadata is the Precision Time Stamp (see MISB ST 0603). The Precision Time Stamp for Local and Universal Set KLV metadata is an 8-byte unsigned integer that represents the number of microseconds elapsed since midnight (00:00:00), January 1, 1970. This date is known as the UNIX epoch and is discussed in the IEEE POSIX standard – IEEE 1003.1.

3.2.1.5 SA: Metadata

Where a transcoding process is used, the transcoding process shall populate the Metadata Elementary Stream Precision Time Stamps in the processed output MI Stream with the same Precision Time Stamps found in the input MI Stream. [MI-555]

The UA shall avoid annotations that create permanent changes in the Motion Imagery. **[MI-557]**

If overlaid metadata/annotations are not necessary for critical safety or targeting, then the UA shall implement MISB ST 0602 for all annotations. **[MI-559]**

When overlaid metadata is not necessary for critical safety or targeting, the UA shall not create burned-in graphic overlays in MI frames during the transmission process. [MI-2711]

Note:	Some manned and unmanned platform sensors have previously “burned in” the metadata onto the Motion Imagery early in the Motion Imagery production process. Burned in annotations are no longer acceptable.

Note:	Exception: momentary use of burned-in graphics is acceptable in cases where in-stream metadata does not provide the means of representing critical safety and targeting elements.

The UA shall format the KLV metadata in accordance with MISB ST 0107. [MI-564]

Note:	All metadata is represented using big-endian [Most Significant Byte (MSB) first] encoding. Bytes are big-endian bit encoding (MSB first).

The UA shall transmit metadata defined in MISB ST 0902 (a mandatory subset of elements from MISB ST 0601) with a rate of once every 10 seconds. [MI-567]

When metadata elements are sampled at a faster rate than once every 10 seconds, the UA shall transmit the metadata elements at their native sample rate. [MI-569]

Note:	All the metadata elements need not be transmitted in the same packet. It is strongly preferred that values for the metadata transmitted be the original unaltered values.

Where metadata elements in MISB ST 0601 are available to the system, the UA shall include the metadata. [MI-2712]

Note:	For example, if there is a device for detecting icing, the “Icing Detected” value should be included. If there is not such a device, then it can be excluded.

The MI Core Identifier element with MISB ST 0902 shall be in accordance with MISB ST 1204. [MI-575]

The UA shall include a checksum metadata element as the last item in every metadata Local Set in accordance with MISB ST 0902. [MI-578]

Security metadata elements within MISB ST 0902 shall be in accordance with MISB ST 0102. [MI-580]

The UA shall provide Sensor Ellipsoid Height (Tag 75) for all implementations of MISB ST 0902 as well as MISB ST 0601. [MI-2716]

MISB ST 0902 Sensor Ellipsoid Height (Tag 75) shall be provided directly from the system’s Global Positioning System. [MI-646]

The UA shall populate MISB ST 0902 Sensor Ellipsoid Height (Tag 75) in accordance with direction given in CJCSI 3900.01C. [MI-644]

3.2.2 SA: Control Segment

3.2.2.1 SA: MI Stream Receipt

All CSs shall display the content within a MI Stream. [MI-584]

The CS shall display a Motion Imagery Elementary Stream compressed using MPEG-2 in accordance with ISO/IEC 13818-2 at Main Profile at Main Level within a MI Stream. [MI-586]

The CS shall display a Motion Imagery Elementary Stream compressed using H.264/AVC, up to and including Level 4, in accordance with ISO/IEC 14496-10, Constrained Baseline Profile, Main Profile, or High Profile within a MI Stream. [MI-588]

Note:	To maintain interoperability with NATO partners the interlaced and progressive formats of 720x576 50/25 FPS are supported by requirements MI-586 and MI-588. Receivers should be tested for these formats.

Note:	Legacy systems may produce 720x480, interlaced and progressive Motion Imagery at 30/29.97 FPS are supported by requirements MI-586 and MI-588. Receivers should be tested for these formats.

3.2.2.2 SA: Metadata

When receiving a MI Stream containing MISB ST 0601 metadata, the CS shall display all metadata elements contained in MISB ST 0902 at a minimum. [MI-593]

The CS shall have the ability to display MISB ST 0902 security metadata elements. [MI-595]

The CS shall skip any tag or key not recognized as controlled by MISB or SMPTE. [MI-601]

When receiving a MI Stream containing MISB ST 0902 metadata, the CS shall display MISB ST 0902

Sensor Ellipsoid Height (Tag 75). [MI-2718]

When receiving a MI Stream containing audio, the CS shall play the Audio Elementary Stream. [MI-603]

3.2.2.3 SA: Retransmission

The CS shall retransmit the MI Stream using multicast UDP/IP. [MI-606]

The CS shall transmit the MI Stream in the same format as received. [MI-608]

The CS shall transmit the MI Stream at the same quality level as received. [MI-2713]

The CS shall have the ability to simultaneously transmit a minimum of two MI Streams of different data rates. [MI-610]

The CS shall preserve the Metadata Elementary Stream within the MI Stream and retransmit it without data loss. [MI-612]

The CS shall incorporate additional metadata elements added by the CS in the Metadata Elementary Stream of the MI Stream. [MI-2714]

The CS shall export Metadata Elementary Stream elements in the Cursor on Target – Extensible Markup Language (XML) schema format. [MI-614]

When transcoding, the CS shall populate the Motion Imagery Elementary Stream Precision Time Stamps in the processed output MI Stream with the same Precision Time Stamps found in the input Elementary Stream of the MI Stream. [MI-616]

When transcoding, the CS shall populate the Metadata Elementary Stream Precision Time Stamps in the processed output MI Stream with the same Precision Time Stamps found in the input Metadata Elementary Stream of the MI Stream. [MI-618]

When transmitting a MI Stream, the CS shall translate any metadata from the MISB deprecated EG 0104 elements to the MISB ST 0601 elements. [MI-620]

The CS shall store a received MI Stream at the same quality level as received. [MI-622]

3.3 Implementation of MI for Exploitation (EX)

3.3.1 EX: Unmanned Aircraft Requirements

3.3.1.1 EX: Motion Imagery Quality

When compressing 1920x1080p High Definition Motion Imagery, the compression encoder shall produce a selection of spatial formats between, and including 1920x1080p and 640x480p. [MI-627]

When compressing 1280x720p High Definition Motion Imagery, the compression encoder shall produce a selection of spatial formats between, and including 1280x720p and 640x480p. [MI-630]

While supporting Real-Time Operations and Pattern of Life, the UA shall compress Motion Imagery Elementary Stream using H.264/AVC (as defined in ISO/IEC 14496-10), Constrained Baseline Profile, up to and including H.264 Level 4.2. [MI-633]

While supporting Real-Time Operations and Pattern of Life, the Motion Imagery Elementary Stream frame rate shall have selectability from six supported frame rates including the highest supported sensor frame rate down to 5 FPS, including 60 FPS, 30 FPS, 15 FPS and 10 FPS changeable while in flight. [MI-635]

Note:	Frame rates are to be selected by skipping an integer number of frames; for example, for a native rate of 60 FPS, a skip of one frame produces 30 FPS; a skip of two frames produces 20 FPS; a skip of 11 frames produces 5 FPS, etc.

3.3.1.2 EX: Metadata

Metadata shall be inserted into a MI Stream using the Synchronous Metadata Multiplex Method in accordance with MISB ST 1402 [MI-638]

Metadata that corresponds to a specific Motion Imagery frame shall contain the same Precision Time Stamp as the Motion Imagery Elementary Stream Precision Time Stamp. [MI-2715]

UA shall provide all elements of MISB ST 0902 at a minimum interval of once per second. [MI-642]

When precise information is required for the principle point of the frame, the UA shall transmit all Threshold elements of MISB ST 1107. [MI-3180]

When populating Threshold elements of MISB ST 1107, the UAS shall report those elements at a minimum of once per second. [MI-650]

Note:	MISB ST 1107 metadata can become large as compared to MISB ST 0902 so implementations should be cognizant of the potential impacts of reporting MISB ST 1107 at higher rates than once per second. For example, more bits allocated to the Metadata Elementary Stream will cause the quality of the Motion Imagery Elementary Stream to decrease in a constant bit-rate channel.

The UA shall limit timestamp errors of MISB ST 1107 metadata to be within +/- 5ms from the time of validity of the data. [MI-657]

Note:	The time synchronization between metadata elements and Motion Imagery frames has a significant impact on the accuracy of collected data. The accuracy of the timestamps applied to metadata and MI frames establishes the overall time relationship between the two. It should be noted that errors less than +/-5 milliseconds may be necessary to meet accuracy requirements which may be levied on individual sensors.

3.3.2 EX: Control Segment

3.3.2.1 EX: Metadata

When receiving a MI Stream containing MISB ST 0601 and MISB ST 1107 metadata, the CS shall have the ability to display all metadata elements contained in MISB ST 0902 at a minimum. [MI-702]

Note:	Exploitation capabilities may require display of additional metadata useful for desired analyst processes supported by metadata elements in MISB ST 1107, MISB ST 0601 or other MISB metadata sets. The display of these additional elements should be based on end user requirements.

3.4 Implementation of MI for Strike Support (SS)

3.4.1 SS: Unmanned Aircraft Requirements

3.4.1.1 SS: Motion Imagery Quality

Reserved for future use.

3.4.1.2 SS: Metadata

Where elements of MISB ST 0601 are not included in MISB ST 0902, the UA shall transmit the metadata defined in MISB ST 0601 at a minimum rate of once per second. [MI-2720]

The UA shall populate the Threshold and Objective metadata elements defined in MISB ST 1107. [MI-716]

Note:	Strike Support capabilities supported by MI requires knowledge of the actual system position and sensor pointing performance at the instance of data collection. These capabilities require metadata which reports variance and covariance metadata. Systems which seek to meet these Strike Support objectives will need to populate MISB ST 1107 Threshold and Objective metadata elements which define all information necessary to precisely exploit the entire Motion Imagery frame.

When populating Threshold and Objective elements of MISB ST 1107, the UA shall report these elements at a minimum of once per second. [MI-3187]

Note:	MISB ST 1107 metadata can become large as compared to MISB ST 0902 so implementations should be cognizant of the potential impacts of reporting MISB ST 1107 at higher rates than once per second. For example, more bits allocated to the Metadata Elementary Stream will cause the quality of the Motion Imagery Elementary Stream to decrease in a constant bit-rate channel.

3.4.2 SS: Control Segment

Reserved for future use.

4 QUALITY ASSURANCE PROVISIONS

4.1 NIOP Compliance Certification

Reserved for future use

4.2 Verification Methods

Verification of compliance with this profile will be made through the methods of analysis, examination, demonstration, testing, or any combination thereof. The following definitions of these methods have been extracted from MIL-STD-961E.

4.2.1 Analysis

Analysis is an element of verification that uses established technical or mathematical models or simulations, algorithms, charts, graphs, circuit diagrams, or other scientific principles and procedures to provide evidence that stated requirements were met.

4.2.2 Examination

Examination is an element of verification that is generally nondestructive and typically includes the use of sight, hearing, smell, touch, and taste; simple physical manipulation; and mechanical and electrical gauging and measurement.

4.2.3 Demonstration

Demonstration is an element of verification that involves the actual operation of an item to provide evidence that the required functions were accomplished under specific scenarios. The items may be instrumented and performance monitored.

4.2.4 Test

Test is an element of verification in which scientific principles and procedures are applied to determine the properties or functional capabilities of items.

4.2.5 Verification and Traceability Matrix

The matrix maps active NIOP requirements to a Unique Identifier (NUI) by both paragraph number and requirement title.

Table 1: Verification Matrix

Unique ID	Verification Method			
	Analysis	Exam	Demo	Test
509	X			
5137	X			
514	X			
517	X			
519	X			
521			X	
524	X			
526	X			
528	X			
530			X	
533			X	
536	X			
5145			X	
541			X	
539			X	
543	X			
545	X			
548	X			
550	X			

Unique ID	Verification Method			
	Analysis	Exam	Demo	Test
552			X	
555	X			
557	X			
559	X			
2711	X			
564	X			
567	X			
569	X			
2712			X	
575	X			
578	X			
580			X	
2716			X	
646	X			
644	X			
584	X			
586	X			
588	X			
593	X			
595	X			
601			X	

Unique ID	Verification Method			
	Analysis	Exam	Demo	Test
2718			X	
603			X	
606			X	
608	X			
2713	X			
610			X	
612			X	
2714	X			
614	X			
616	X			
618	X			
620	X			
622	X			
627			X	
630			X	
633	X			
635			X	
638	X			
2715	X			
642	X			
3180	X			

Unique ID	Verification Method			
	Analysis	Exam	Demo	Test
650	X			
657	X			
702	X			
2720	X			
716			X	
3187	X			

5 PROGRAM GUIDANCE & EMERGING STANDARDS

5.1 Program Guidance

"Strike Support quality" MI requires the highest quality imagery achievable by a collection system for the production of precision geo-positioning products for distribution to end-users and automated analysis tools. Please see the Classified Annex for Image Quality Details.

Note:	Strike Support may require capture of a still image from the MI. In these cases, requirements for population of the still image metadata into the NITF SENSRB TRE will directly correlate to content requirements for MI population of MISB ST 1107. Implementation requirements for NITF metadata population is provided in Motion Imagery Derived Still Imagery NIOP

6 ACRONYMS, TERMS AND DEFINITIONS

A		
	AVC	Advanced Video Codec
B		

C		
	CDL CDT	Common Data Link Command Data Terminal
	CoT	Cursor on Target
	CS CSCI	Control Segment Computer Software Configuration Items
	CST	Custodian Support Team
D		
	DLI	Data Link Interface
E		
	ED	Enhanced Definition
	EG	Engineering Guideline
	EO	Electro-Optical
F		
	FPS	Frames per Second
G		
H		
	HD	High Definition

	Hz	Hertz
I		
	IA ICWG	Information Assurance Interface Control Working Group
	ID	Identification
	IDD	Interface Definition Document
	IEC	International Electrotechnical Commission
	IP	Internet Protocol or Implementation Profile
	IR	Infrared
	ISO	International Standards Organization
J		
K		
	Kb	Kilo-bits
	KLV	Key Length Value
L		
	LOI	Level of Interaction or Level of Interoperability
M		
	Mbps	Megabits (10^6) per second
	MI	Motion Imagery

	MISB	Motion Imagery Standards Board
	MISP	Motion Imagery Standards Profile
	MPEG	Moving Pictures Experts Group
N		
	NGA	National Geospatial-Intelligence Agency
O		
P		
Q		
R		
	RF	RADIO Frequency
	RP	Recommended Practice
S		
	SA	Situational Awareness
	SD	Standard Definition
	ST	Standard
	STANAG	Standard NATO Agreement
T		

	TBD	To Be Determined or To Be Developed
	TS	MPEG-2 Transport Stream
U		
	UA	Unmanned Aircraft
	UAS	Unmanned Aircraft System
	UDP	Universal Datagram Protocol
V		
	VSM	Vehicle Specific Module
W		
X		
Y		
Z		

APPENDIX-A: STANDARDS DISCOVERY (INFORMATIVE)

The use of standards is complicated by two separate and usually unrelated processes. The first is the simple discovery of the standards applicable to provision the required capabilities. The second is the

selection of the standards during system design and extends to actual implementation during system development. The relationship between those two phases is usually obscured by a list of applicable standards that far exceeds what is actually needed to meet the Threshold or Objective Requirements.

The goal of this NIOP is to enable our acquisition professionals to more readily derive technical requirements from the capability-based requirements, and then determine which standards are needed to meet the requirements.

Note, that while some standards are mandated for use at one place in a given system, they could also be used in other places. While a mandated use is not optional, additional use internally may be. The decision to use a standard in these optional places, then, is based on a program's own engineering assessment.

That boundary is normally at the external system interfaces – a program can and should design for maximum utility internally, but will conform to existing interface requirements externally.

The complete details for the content, format and interface required to transport the data outside of the system environment may only be applied at the Control Segment simply because many items are not known on the Unmanned Aircraft, limited computing power on the Unmanned Aircraft, or constrained bandwidth. However, as one or more of these constraints become relaxed more could be done on the Unmanned Aircraft, if desired. This type of decision belongs to the program.

ISR systems use GEOINT Standards to provide content (both data and metadata), format, encoding, and interface requirements used in design and implementation of a system to satisfy required capabilities. Understanding what each standard defines is an important part of determining their applicability. Standards organizations such as the Motion Imagery Standards Board (MISB), SMPTE, ISO/IEC, SAE, etc. develop multiple document types that help in executing a given standard. The figure below illustrates the differing types of documents produced by standards organizations referenced in this module.

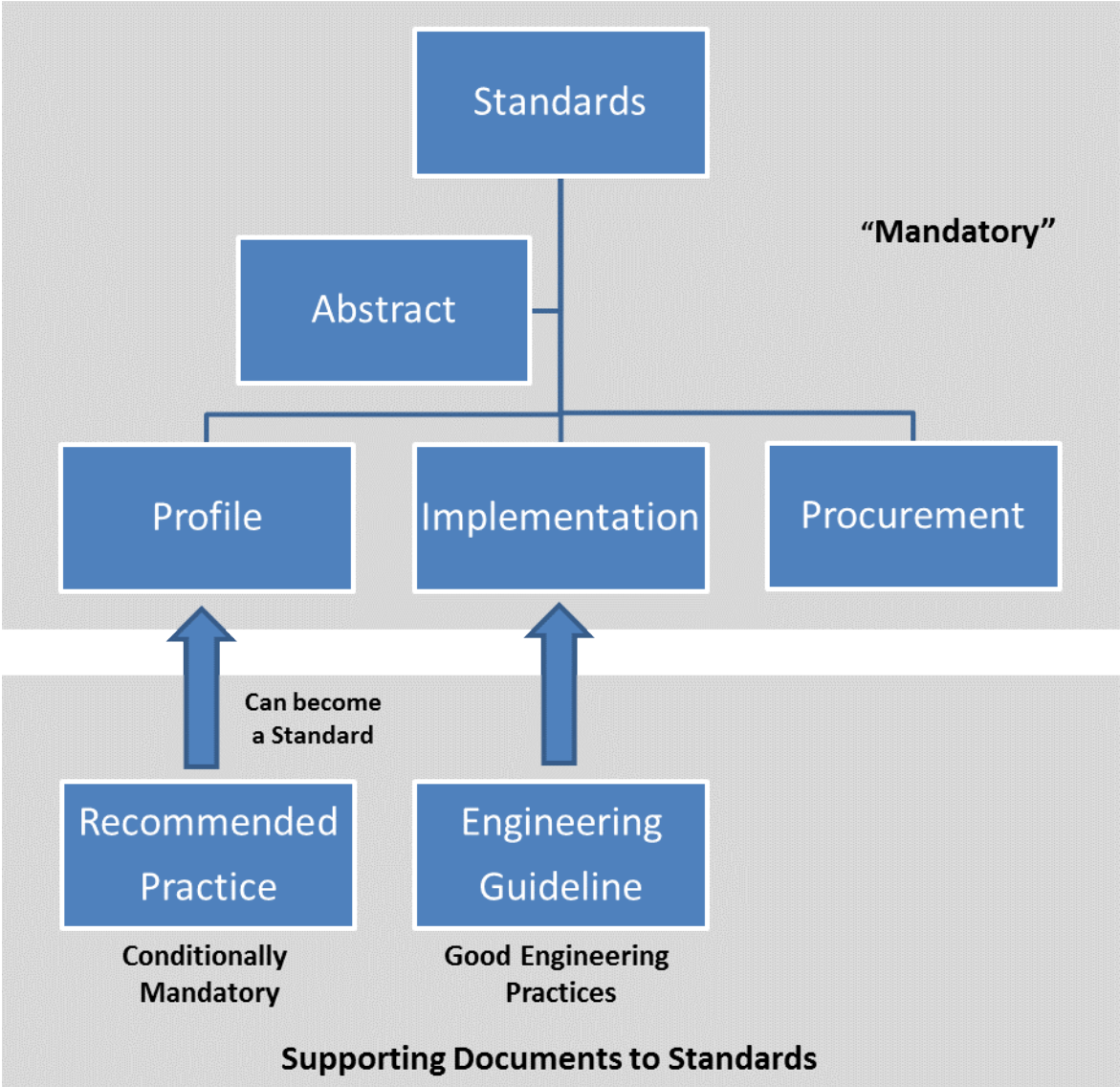

Figure 3: Relationship of STs, RPs and EGs

In addition to a Standard (ST), the Recommended Practice (RP) and Engineering Guideline (EG) are other "standards" documents used by various standards organizations. The MISB uses a RP to provide guidance that facilitates the implementation of a ST. An RP is not required for interoperability, but when used states requirements for its usage. RPs chosen by specific MISB adoption 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. The MISB is phasing out the use of the EG. Documents originally published as EG have either been promoted to a ST or RP based on meeting the appropriate criteria. The EG will not be used in future publications, although some legacy documents continue to carry this designation.

Standards can take various forms; some are very broad providing specifications that cover many possible uses and features of the standard – these are classified as Abstract. Others directly detail how to implement a technology – these are Implementation standards. The following describes these various documents:

Abstract standards constitute an architecture and/or vocabulary and data model that provides critical information to be used in design and implementation. An Abstract standard is not always testable and typically never used in its totality (e.g., the NSG Metadata Foundation (NMF) is the conceptual model for GEOINT and defines more than 400 data elements). Part 1 of the six-part NMF provides the NMF Core. This core identifies the mandatory and commonly used metadata content required for the discovery and exchange of geospatial data. As with all conceptual models, it is agnostic to implementing technology. Implementation specifications address how the conceptual model should be realized for a specific technology. For MI capabilities, the implementation specification is defined by the Motion Imagery Standards Profile (MISP). The MISP mandates that all metadata be encoded via the binary Key Length Value (KLV) specification within MPEG-2 Transport Streams. Furthermore, the MISP mandates a threshold set of metadata that meets the NMF Core requirements for all MI data sets and defines additional metadata profiles to support higher level capabilities such as basic Situational Awareness processes, graphical annotations, rigorous photogrammetric processes, etc. If a program identifies a requirement for a capability that is not supported by an existing metadata profile within the MISP, the program should engage with the MISB to establish a profile for community use.

A profile of a standard can be an extension to an existing developed standard, a subset of specifications extracted from an Abstract standard, or a collection of standards that together meet a particular need. Profiles in this community are specified to meet DoD/IC/NSG unique mission requirements not normally covered by commercial standards. A profile (chosen by specific MISB adoption, and approved by the GEOINT Standards Center of Excellence (GSCOE) 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. This MI Module is a profile because it collects various standards, RPs, and EGs under one umbrella for meeting the requirements of its intended capability areas.

Implementation standards are used directly in design and development of system components producing a testable capability. Usually, use of an Implementation standard will also satisfy the high-level requirements of one or more Abstract standards. If the Implementation standard is thought to conflict with its higher level/less detailed Abstract standard, the developer is urged to report this to the organization standard's owner in the DISR. An Implementation standard may also be developed independently of an existing Abstract standard should such an Abstract standard not exist.

Procurement standards and/or technical specifications will be used to procure hardware or software that shall comply with content of that document. They are often derived from citing specific specifications defined in an Abstract standard (e.g. ISO/IEC 14996-10 (H.264/AVC)) or Implementation standard (e.g., MISB ST 9723 (H.264/AVC) or Recommended Practice (e.g., RP 9720b).

RPs provide a recommended methodology to assemble the hardware and software components into a system. It is unlikely that one program will be able to exactly match how another program has implemented a capability, but new programs should review pertinent RPs for guidance at the very least. Within the MISB construct, RPs can be elevated to standards should their use and need be warranted.

EGs document a recommended implementation or practice that represents good engineering principles and therefore, should be implemented if at all possible. For instance, an EG may provide setup data used

to initialize the hardware and software in a system or perhaps the settings for a procured camera to provide an output stream of the required resolution (e.g., HD 1080p). EGs are generally not policy mandates but can be levied as requirements by programs. Within the MISB construct, there are no future plans for the development of EGs, as this form of document is being phased out.

Example 1: MISB ST 0601 provides an extensive list of the acceptable metadata elements to be used in a MI KLV stream as well as specifying the syntax and semantics for these metadata elements. It is considered Abstract because it does not mandate that all elements shall be used in a given system implementation.

MISB ST 0902, an Implementation standard, references the elements in MISB ST 0601, does provide specific implementation requirements for EO/IR MI used for Situational Awareness, and does mandate that all elements within MISB ST 0902 be used. Similarly MISB ST 1107, a ST document designed to be used in conjunction with MISB ST 0801, provides the KLV metadata and metadata structures for MI required for the photogrammetric processes used in Strike Support.

Example 2: The fundamental commercial standard governing H.264 compression (ISO/IEC 14496-10) is an Abstract standard that is very broadly defined in order to address numerous market uses. While there are many particular specifications this community draws upon from this standard, the MISB has elected to extract specific compression profiles and levels of H.264 to meet community needs. MISB ST 0604, an Implementation standard, extends the use of the H.264 standard by defining video time stamp standards for use in this community. MISB RP 0802 provides guidance for users of H.264 to meet their specific application requirements.

APPENDIX-B: SENSOR MODALITIES & CAPABILITIES

The relationship of current and future MI sensor modalities to intended capabilities and mission objectives is not always clear. The figure below provides a general framework to help Program Managers assess the MI and metadata "goodness" based on matching mission objectives to Situational Awareness, Exploitation and Strike Support.

In The figure below mission objectives that rely on MI support to the Joint Targeting Process, Phase 5, Mission Planning and Execution (JP 3-60) are used as relevant examples. Targeting – in Phase 5 – consists of five steps for deliberate targeting: Find, Fix, Track, Target, and Engage. Dynamic or time-sensitive targeting includes a sixth step: Assess. Often the six steps are referred to as F2T2EA (Find, Fix, Track, Target, Engage, Assess). The figure below lists example activities or mission objectives along with a relative measure of metadata and MI support for the three capabilities discussed here.

Data Characteristics	Joint Targeting Support (Mission Planning and Execution – F2T2EA)		
	Situational Awareness	**Exploitation**	**Strike Support**
	Find: • Detection	Find: • Intelligence Collection / Analytics • Identify	
	Fix: • Focus / Sensor(s) attention	Fix • Locate / Location Maintenance	Fix: • Locate for CSW, precision weapons
	Track: • Human Perception ISR • Comprehend meaning / Project future status	Track: • Investigative ISR • Maintain awareness / pattern of life	
	Target: • Confirm area clearance	Target: • Risk assessment / collateral damage assessment • Decision for method of engagement	Target: • Collateral damage assessment • Weaponeering
	Assess: • Real-time understanding • Re-attack recommendations	Assess: • Report detailed results • BDI • Specific re-attack recommendations	
Metadata	*Low* → *High* Required Data/Metadata and Knowledge of Metadata Accuracy		
MI / FMV			
Spatial Resolution	320x240 – 640x480 pixels	640x480 – 1920x1080 pixels	640x480 – 1920x1080 pixels
Temporal Frame Rate	5 – 30 frames per second	5 – 60 frames per second	5 – 30 frames per second
Image Quality	low – nominal	nominal – high	nominal – high

Figure 4: Mission Objectives, and Relative Measure of Metadata

It should be noted that the boundaries between the activities for Situational Awareness, Exploitation and Strike Support are soft, and a Program Manager will have to carefully think through and plan for the scale and complexities of the mission objectives being addressed. Situational Awareness is described in the Motion Imagery Standards Profile (MISP 6.4) as follows:

1. Situational Awareness is the human perception of the elements of the operational environment in the context of forces, space and time, the comprehension of their meaning, and the projection of their status in the near future.
2. A Situational Awareness Product is a concise, transportable summary of the state of friendly and enemy elements conveyed through information such as sill imagery, MI, or other data that can contribute to the development of Situational Awareness either locally or at some distant node.

Situational Awareness information is generally data delivered to a forward location in real-time where the communications channel bandwidth tends to be limited. The metadata needed is that of location and presence of self and others within the immediate battle space. The MI data can vary from below Standard Definition video to Standard Definition video with frame rates as low as 5 frames-per-second; image quality is often "what you can get" but tradeoffs in spatial and temporal resolution can increase the image quality to a needed level.

Exploitation, necessitates that sufficient metadata be present to support mission analysis processes and to correlate information from multiple intelligence sources. This data may also be compared with other MI studied over time, or used to produce still images that may be fused with yet other images or data for derived intelligence value. Data collected in Exploitation might also support photogrammetric processes that further improve data accuracy. The MI requirements to support Exploitation generally demand high spatial resolution and sufficient frame rate for the task; for example such requirements can be met with high definition video. Image quality is a key factor in Exploitation, and given that the channel bandwidth from point of collection to the analyst is often a limiting factor, tradeoffs in spatial resolution and frame rate to achieve the needed image quality may be needed based on a specific task.

Strike Support data is typically expected to be highly precise, often calibrated, and sufficient to provide real-world coordinates to meet the needs of engagement. Strike Support data is heavily tied to weapon selection and objectives, which means that its requirements for accuracy, image spatial/temporal resolution and quality are all derived from the intended targets and the desired targeting engagement.

Since there are no Department of Navy (DoN) parameters that define suitability of metadata and MI baselines for any of these capabilities, this document provides a set of Threshold requirements that define a baseline required to support each capability, and can be used as-is or expanded as appropriate by the Program Manager. The standards foundational to this profile can be found in the DISR, and are herein separated into two categories for ease in distinction: 1) Abstract standards define the topic of discussion, including provision of vocabularies for both data and metadata; and 2) Implementation standards define implementable and testable specifications to be used in system design and development. The Implementation standards are further grouped by purpose as: Compression, File/Transport, Timing and Synchronization, and Metadata.

APPENDIX-C: CAPABILITY BASED REQUIREMENT PROFILES (INFORMATIVE)

Capability Based Requirement Profiles (CBRP) are described with the appropriate standards to support Situational Awareness, Exploitation, and Strike Support capabilities using EO/IR MI sensors. They are presented together because of the hierarchical nature of their contents: Situational Awareness (SA) requirements provide the baseline for the trio; Exploitation adds additional requirements to SA; and Strike Support adds more requirements to Exploitation.

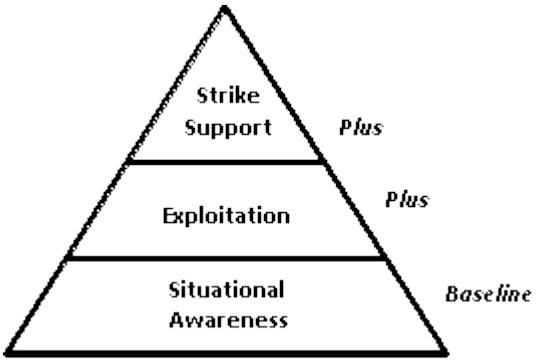

Figure 5: Hierarchical Nature of Capabilities

A program manager begins by selecting a Sensor Modality set based on the requirements for dissemination. Those requirements drive the choice of ST or RP relevant to their design and implementation process. Simply adding these selections to the program's Standards View-1 (StdV-1) does not satisfy the requirements. They are to be used in the design process, inserted in the system in the appropriate locations, and included in program testing and the Net Ready Key Performance Parameter (NR-KPP) Measures of Effectiveness (MOEs) and Measures of Performance (MOPs).

The tables below present the STs and RPs relevant to EO/IR MI for Situational Awareness, Exploitation and Strike Support, in their place of relevance within the system . The tables build on one another where the standards for Situational Awareness are needed to support Exploitation and Strike Support, and where the standards for Exploitation are needed to support Strike Support. Most of the cited documents are governed by the MISB and can be found in the MISP and on the MISB web site **www.gwg.nga.mil/misb/**.

Table 2: EO/IR MI CBRP for Situational Awareness

Standards Required for SA and Foundational to All Capabilities				
SA Standards	**Compression**	**File / Transport**	**Timing / Synch**	**Metadata**
Abstract Standards	**H.264/AVC** ISO/IEC 14996-10	**KLV in SMPTE 291** SMPTE ST 291-1 **MPEG-2 TS**	**Time Reference & Synchronization** ST 0603	**Content Description** ST 0607 **Metadata Dictionary** ST 0807 **KLV Data Encoding** MISP-2015

		ISO/IEC 13818-1		**Annotation Set** ST 0602 **CMS: Structure** RP 0701 **MISB Registry** ST 0607 **UAS Local Set** ST 0601 **Security Set** ST 0102
Implementation/ Procurement Standards (All mandatory unless listed as Mandatory if capability is implemented)	**Motion Imagery** **H.264/AVC Encoding** MISP-2015 (SD/ED) ST 0404 (IR) **Audio Encoding** ST 1001	**MPEG-2 TS** ST 1402 **STANAG 4559 Model** ST 0813 **Interface Formats for IR** ST 0403 (IR)	**Common Time Reference** ST 0603 **Time Stamping (uncompressed MI)** ST 0605 **Time Stamping (compressed MI)** ST 0604	**Bit/Byte Order** ST 0107 **Minimum Metadata Set** ST 0902 **MI Identification** ST 1204 **Mandatory if capability implemented** **Floating/Integer Mapping** ST 1201 **Ancillary Text** ST 0808 **RVT Local Set** ST 0806 **Metrological** ST 0809 **Cursor on Target** ST 0805
Recommended Practices	**H264/AVC Coding** RP 0802 **BW/Quality/ Latency** RP 0904			**Common Metadata System** RP 0701

Additional Guidance	**Points of Interoperability** MISP-2015 Examples: 640x480p≤30 FPS H.264 Level 3 Data Rate 1.5 - 5 Mb/s 640x480p≤15 FPS H.264 Level 2.2 Data Rate 0.768-1.5 Mb/s			

Table 3: EO/IR MI CBRP for Exploitation

Exploitation: Additional Standards Required Above SA				
Exploitation Standards	**Compression**	**File / Transport**	**Timing / Synch**	**Metadata**
Abstract Standards				
Implementation / Procurement Standar	**H.264/AVC** MSIP-2015	**ASPA** ST 0301	**Time Stamps (HD Uncompressed MI)** ST 0605	**VMTI LDS** ST 0903 **Mandatory if Capability Implemented Photogrammetry** ST 0801

ds **(All mandatory unless listed as Mandatory if capability is implemented)**				
□□Additional Guidance	**Points of Interoperability** **MSIP-2015** Examples: 1920x1080p ≤30 FPS H.264 Level 4.1 Data Rate 5 - 10 Mb/s 1280 x720p≤60 FPS H.264 Level 3.2 Data Rate 5 - 10 Mb/s			

Table 4: EO/IR MI CBRP for Strike Support

Strike Support: Additional Standards Required Above Exploitation				
Exploitation Standards	**Compression**	**File / Transport**	**Timing / Synch**	**Metadata**

Abstract Standards				
Implementation / Procurement Standards **(All mandatory unless listed as Mandatory if capability is implemented)**	**H.264/AVC** MISP-2015			**Photogrammetry** ST 0801
Additional Guidance	**Points of Interoperability** MISP-2015 <u>Examples:</u> 1920x1080p ≤30 FPS H.264 Level 4.1 Data Rate 5 - 10 Mb/s 1280x720p ≤30 FPS H.264 Level 3.2 Data Rate 1.5 – 5 Mb/s			