SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS6135

Issued 2012-12

Interface Standard, Airborne EO/IR Systems, Data

RATIONALE

This document was created to standardize the data interface between aircraft and EO/IR sensors. This activity was initiated at the request of the U.S. Navy in 2009.

PREFACE

AS6135, Interface Standard, Airborne EO/IR Systems, Data, is a standard that defines the data interface between aircraft (manned and unmanned) and onboard EO/IR Systems. Its purpose is to promote platform to sensor system interface standardization by providing substantial, but not 100% commonality, interoperability, and interchangeability[1].

This document was prepared by the AS-1C3 Electro-Optic/Infrared Mission Avionics Data Exchange (MADE) Task Group, under the jurisdiction of the AS-1C Subcommittee, Avionic Subsystems, of the SAE AS-1 Committee, Platform Systems and System Integration.

[1] See also Appendix A1

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1. SCOPE

This standard defines the data interfaces between a host aircraft ("platform") and an Electro-Optic/Infrared (EO/IR) sensor. These data interfaces cover various types of data including: imagery, metadata, command, status, and responses (CSR), geospatial postion, time, test and maintenance, and hand-controller. This standard does not cover mechanical or electrical interfaces.

1.1 Relationship Between Aircraft/Sensor Interfaces and SAE Standards

Figure 1 shows the relationship between the various interfaces and the various SAE standards. AS6129 (electrical) covers connectors, power, conductors, fiber optics, and some aspects of data transport. AS6135 (data) covers data (e.g., imagery, metadata, as well as CSR). AS6135 overlaps AS6129 in the area of protocols for data transport. AS6135 and AS6129 are closely bound together because building a system based on these standards is dependent on the requirements from both standards. Also, requirements put in one standard can impact the options for updating the other standard.

NOTE: Regarding Figure 1, SAE is drafting a standard (AS6165) to cover maintenance and test which will overlap both AS6129 and AS6135. SAE is also drafting a standard (AS6169) which will cover the mechanical interface. AS6169 will overlap AS6129 with regard to connectors.

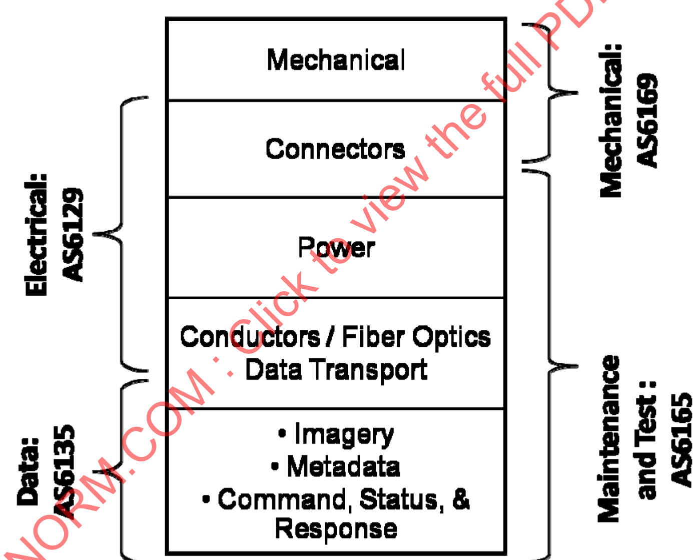

FIGURE 1 - RELATED SAE STANDARDS

1.2 Purpose

The intent of this standard is to enhance interoperability, commonality, and interchangeability among equipment provided by various EO/IR suppliers and avionic systems. Adoption of this standard will improve procurement flexibility for acquisition, system integrators, and platform providers. Relevant platforms include fixed wing, rotary wing, UAS (except for micro-UAS), and lighter than air vehicles. The approach adopted to accomplish these intents includes utilizing the same interface standards used elsewhere in the end-to-end system. This standard is also intended to encourage the move away from sensors that use interlaced acquisition, transport and/or format, as well as analog interfaces.

The data interface is designed to facilitate the:

a. Interconnection between EO/IR sensor systems and the avionics systems hosted by the platform

b. Exchange of data and metadata between sensor systems and sensor data processors

c. Maintenance and test of EO/IR systems

1.3 Application

This standard applies to all platforms and EO/IR sensors that interface with each other. AS6135 addressess turreted EO/IR sensor systems. Future revisions of AS6135 may address other EO/IR sensor systems such as pods. AS6135 covers sensors and platforms presently in concept development stages, future platforms, and sensor developments, and upgrades to legacy platforms. This standard is intended for use by procuring agencies and as a general guideline for industry.

2. REFERENCES

2.1 Applicable Documents

The documents listed in this section are cited in Sections 3 and 4 of this standard. This section does not include documents cited in other sections of this standard, or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in Sections 3 and 4 of this standard, whether or not they are listed here.

The following publications form a part of this document to the extent specified herein. When specified herein, the specified revision level of a document shall be used. Otherwise, the latest revision level of the specified document is implied.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS6129 Interface Standard, Airborne EO/IR Systems, Electrical

2.1.2 Government Documents

ICD-GPS-060B GPS User Equipment (Phase III) Interface Control Document for the Precise Time and Time Interval (PTTI) Interface. 12 February 2002

MIL-STD-2500C National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard (NITF 2.1), 2006-05

MISB EG 0802.1 H.264/AVC Coding and Multiplexing, 2010-09

MISB MISP 6.2 Motion Imagery Standards Board (MISB), Motion Imagery Standard Profile (MISP), 2011-6

MISB RP 0403.1 Bit-Serial Digital Interface for Infrared Motion Imagery, 2010-02

MISB STD 9701 Standard Definition Digital Motion Imagery, Compression Systems (MISP)

MISB STD 0102.9 Security Metadata Universal and Local Sets for Digital Motion Imagery, 2010-09

MISB STD 0601.4 UAS Datalink Local Metadata Set, 2010-3

MISB STD 0603.1 Common Time Reference for Digital Motion Imagery Using Coordinated Universal Time (UTC), Jun 2011

MISB STD 0604.2 Time Stamping and Transport of Compressed Motion Imagery and Metadata, 2011-06

MISB STD 0605.3 Inserting Time Stamps and Metadata in High Definition Uncompressed Video, 2011-06

MISB STD 0807.8	MISB KLV Metadata Dictionary, 2011-10
MISB STD 0902.1	Motion Imagery Sensor Minimum Metadata Set, 2010-06
NAVSTAR ICD GPS 060 -B	GPS User Equipment (Phase III) Interface Control Document for the Precise Time and Time Interval (PTTI) Interface. 2002-02
NTB STDI-0002 v 4.0	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF) 2011-08
STANAG 4586 Ed 2, amendment 2	STANDARD INTERFACES OF UAV CONTROL SYSTEM (UCS) FOR NATO UAV INTEROPERABILITY, Ed. 2, amendment 2
U.S. Army PM ICD 2.1.1	U.S. Army Unmanned Aircraft Systems (UAS) Project Office Private Messages Interface Control Document (ICD) Version 2.1.1 2011-09

2.1.3 Industry Documents

ANSI/TIA/EIA-422-B	Electrical Characteristics of Balanced Voltage Differential Interface Circuits (RS-422)
IEEE-1588-2008	Precision Clock Synchronization Protocol for Networked Measurement and Control Systems. Precision Timed Protocol (PTP/IEEE 1588)
IEEE-802.3ab	Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4 Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T
IEEE-802.3ae	Media Access Control (MAC) Parameters, Physical Layers, and Management Parameters for 10 Gb/s Operation
ISO/IEC 13818-1:2007	Information technology - Generic coding of moving pictures and associated audio information, Part 1: Systems
ISO/IEC 14496-10:2009	Information Technology - Coding of audio-visual objects Part 10: Advanced video coding
ISO/IEC 15444-1:2004	Information Technology - JPEG 2000 image coding system: Core coding system
ITU-T Rec. H.264	Advanced Video Coding for Generic Audio Visual Services 2009-03. (ISO/IEC 14496-10:2009)
RFC 768	User Datagram Protocol, 1980-08
RFC 791	Internet Protocol, 1981-09 (*Updated by RFC 1349*)
RFC 792	Internet Control Message Protocol (ICMP)
RFC 959	File Transfer Protocol (FTP)
RFC 2460	Internet Protocol v6 (IPv6), 1998-12 (*updated by RFC 5095, RFC 5722, RFC 5871, RFC 6437*)
RFC 2818	HTTP Over Transport Layer Security (TLS)
RFC 3376	Internet Group Management Protocol (IGMP), Version 3
RFC 4251	The Secure Shell (SSH) Protocol Architecture

SMPTE RP 214:2002	Packing KLV Encoded Metadata and Data Essence into SMPTE 291 Ancillary Data Packets (Archived 2007).[2]
SMPTE ST 12-1:2008	Television - Time and Control Code
SMPTE ST 12-2:2008	Television - Transmission of Time Code in the Ancillary Data Space
SMPTE ST 125:1995	Television - Component Video Signal 4:2:2 - Bit-Parallel Digital Interface
SMPTE ST 259:2008	Television - SDTV Digital Signal/Data - Serial Digital Interface
SMPTE ST 274:2008	Television - 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates
SMPTE ST 291:1998	SMPTE 291-1998: Ancillary Data Packet and Space Formatting
SMPTE ST 292-0:2011	SMPTE Bit-Serial Interfaces at 1.5 Gb/s - Roadmap for the 292 Document Suite
SMPTE ST 292-1:2011	1.5 Gb/s Signal/Data Serial Interface
SMPTE ST 293:2003	Television - 720 x 483 Active Line at 59.94-Hz Progressive Scan Production - Digital Representation
SMPTE ST 296:2010	Television - 1280 x 720 Progressive Image Sample Structure - Analog and Digital Representation and Analog Interface
SMPTE ST 297:2006	Television - Serial Digital Fiber Transmission System for SMPTE 259,SMPTE 344,SMPTE 292 and SMPTE 424Signals
SMPTE ST 349:2001	Television - Transport of Alternate Source Image Formats through SMPTE 292 (Archived 2006)
SMPTE ST 424:2006	Television - 3 Gb/s Signal/Data Serial Interface
SMPTE ST 425-0:2011	SMPTE Bit-Serial Interfaces at 3 Gb/s - Roadmap for the 425 Document
SMPTE ST 425-1:2011	Source Image Format and Ancillary Data Mapping for the 3 Gb/s Serial Interface
SMPTE ST 435-1:2009	10 Gb/s Serial Signal/Data Interface - Part 1: Basic Stream Distribution
SMPTE ST 435-2:2009	10 Gb/s Serial Signal/Data Interface - Part 2: 10.692 Gb/s Stream - Basic Stream Data Mapping
SMPTE ST 435-3:2009	10 Gb/s Serial Signal/Data Interface - Part 3: 10.692 Gb/s Optical Fiber Interface
SMPTE ST 2048-0:2011	SMPTE ROADMAP 2048 x 1080 and 4096 x 2160 Digital Cinematography Production Image Formats FS/709 - Roadmap for the 2048 Document Suite
SMPTE ST 2048-1:2011	2048 x 1080 and 4096 x 2160 Digital Cinematography Production Image Formats FS/709
SMPTE ST 2048-2:2011	2048 x 1080 Digital Cinematography Production Image FS/709 Formatting for Serial Digital Interface
WGS84	World Geodetic System 1984

[2] http://store.smpte.org/product-p/rp%200214-2002.htm

2.2 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.3 Definitions

COMMAND, STATUS, AND RESPONSE INTERFACE: Defines the data elements and message sets passed between the host platform and the sensor used to control the operation of the sensor. This interface may also be used to check sensor operation. The protocol for passing these messages is handled in co-ordination with the AS6129. AS6129 also covers the requirements for conductors/fiber optics. The following types of information are passed through the Command, Status, and Response Interface:

a. COMMANDS: The set of all digital instructions transmitted to the EO/IR sensor from the controller which directs its operation. These instructions come from an operator, from the aircraft, or from a pre-programmed set of instructions. These commands, for example, instruct the EO/IR sensor where to point, and which features to utilize in gathering images, such as: slew left; turn on stabilization; lock onto a geo-location; change magnification to X; display black as hot versus white hot; turn on image fusion; etc.

b. STATUS: Digital information returned from the EO/IR sensor back to the operator, aircraft, or recorder which provides feedback on sensor operation and other indications of its condition. Examples of this information include: magnification level, azimuth and elevation, stabilization setting, output scale setting for thermal sensors, heading, etc. Another example is the Built-In Test (BIT) information which might occur periodically, in response to a command, or only if a fault or warning is detected. Status information can overlap with metadata. Status can include non-embedded Imagery metadata, Geospatial Position and Time, Hand Controller, and/or Maintenance data

c. RESPONSES: Digital information returned from the EO/IR sensor back to the operator, aircraft, in reply or reaction to a command. Responses are a sub-set of Status. For example, if the command is to turn on stabilization, the response could be “stabilization is on”.

COMMONALITY: A shared feature or attribute. Or a shared set of features or attributes.[3]

ELECTRONICS CONTROL UNIT (ECU): An electronic unit logically between the platform and the sensor, typically inside the aircraft, which is part of the sensor system, but external to the turret.

ELECTRO-OPTIC/INFRARED (EO/IR) SENSOR: A sensor which generates images based on a specific region of the electromagnetic spectrum (UV, Visible, Near-Infrared (NIR), Short Wave Infrared (SWIR), Mid-Wave Infrared (MWIR) and/or Long Wave Infrared (LWIR). It can be either the imager itself (e.g., a night vision camera) or a turret (gimbal) or pod which includes the imager. The turret or pod may also contain lasers operating in the EO/IR spectrum

EO/IR SENSOR POD: An aerodynamically shaped fixed housing containing an EO/IR Sensor external to the aircraft, typically mounted on a pylon.

EO/IR SENSOR TURRET: A motorized gimbaled mount for one or more EO/IR Sensors permitting rotation about one or more axes. This rotation allows the sensors to be pointed relatively independent of the platform on which it is mounted.

FRAME: A single image from a sensor.

[3] Derived from definition in: the American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company, updated in 2009. Published by Houghton Mifflin Company. All rights reserved.

GEOSPATIAL POSITION DATA: Data in reference to translational and rotational position, velocity, and acceleration, etc. of the aircraft and current time. Characteristics of the data include (1) Minimum rate data to be provided, (2) Data latency, (3) Maximum time stamp error (if data latency cannot be met), (4) Data format to be reported in WGS 84 Height Above Ellipsoid (HAE).

IMAGE:

1. A visible impression obtained by a camera, telescope, microscope, or other device, or displayed on a computer or video screen.[4]

2. An optical counterpart or appearance of an object, as is produced by reflection from a mirror, refraction by a lens, or the passage of luminous rays through a small aperture and their reception on a surface.[5]

IMAGE COMPRESSION: Compression is the encoding of information while reducing the bandwidth or bits required. Image Compression is the compression of an image for storage or transmission.[6]

a. TRUE LOSSLESS IMAGE COMPRESSION: A form of image compression where the decompressed image is numerically identical to the source image.

b. VISUALLY LOSSLESS IMAGE COMPRESSION: A form of image compression where there is no subjective loss of image quality.

c. LOSSY IMAGE COMPRESSION: A form of image compression wherein there may be loss in subjective image fidelity.

IMAGE FORMAT: The horizontal and vertical pixel densities and the temporal update rate. May also denote how an image or image sequence is packaged, stored and transported. This includes compression methods such as H.264, formats such as NITF, and interface standards such as SMPTE ST 292-1.

INTERCHANGEABILITY: A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance[7].

INTEROPERABILITY: The ability of two or more systems or components to exchange information and to use the information that has been exchanged.[8]

METADATA: Data about the Imagery. Examples include:

a. The time the image was generated.

b. The location of and information about the platform, e.g., latitude, longitude, altitude, pitch, roll, and heading of the platform.

[4] (http://oxforddictionaries.com/definition/image?q=image)visited 4/10/2012
[5] http://dictionary.reference.com/browse/image visited 4/1/2011
[6] http://www.thefreedictionary.com/image+compression
[7] Federal Standard 1037C, Telecommunications: Glossary of Telecommunication Terms. http://www.its.bldrdoc.gov/fs-1037/fs-1037c.htm Visited on March 22, 2011.
[8] IEEE Glossary

c. Information about the sensor, e.g., azimuth and elevation of the gimbal, the zoom level.

d. Information about the target at the time the image(s) were taken, e.g., latitude and longitude.

Metadata can be incorporated into the image file and/or be sent in parallel.

MOTION IMAGERY: A sequential or continuous stream of images, utilizing MISB formats, that enable observation of the dynamic behavior of objects within the scene.

STILL IMAGERY: One or more individual images that use the NITF format.

TRANSPORT: A mechanism to move, carry, convey or transfer data and/or electrical/optical signals from one place to another

VIDEO: A type of Motion Imagery, typically at frame rates used in television broadcasting. The word “video” has also been used to include non-television formats such as those found in the consumer internet community.

2.4 Acronyms

Table 1 shows the list of Acronyms.

TABLE 1 - ACRONYMS

Acronym	Description
1000BaseT	1000 Megabits per Second, Baseband, Twisted Pair
aka	Also Known As
ANSI	American National Standards Institute
AS	Aerospace Standard (e.g., SAE AS6135)
AS-1	Aircraft Systems & Systems Integration group (SAE)
AVC	Advanced Video Coding
BIT	Built-In-Test
C&S	Command and Status
CSR	Command, Status, and Response
CSRM	Command, Status, and Response Message
DISR	DoD Information Technology Standards and Profile Registry
DHCP	Dynamic Host Configuration Protocol
DLI	Data Link Interface
ECU	Electronics Control Unit
ECUSI	Electronics Control Unit – Sensor Interface
EG	Engineering Guidance
EIA	Electronic Industry Association
EO/IR	Electro-Optic Infrared
FPS	Frames Per Second
FTP	File Transfer Protocol
Gb/s	Gigabits per second
GEOINT	Geospatial Intelligence
GIG	Global Information Grid

TABLE 1 - ACRONYMS (CONTINUED)

Acronym	Description
GPS	Global Positioning System
GWG	Geospatial Intelligence Working Group (NGA)
HAE	Height Above Ellipsoid
HTTP	Hypertext Transfer Protocol (world wide web protocol)
HTTPS	Hypertext Transfer Protocol Secure
IAW	In Accordance With
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IEC	International Electro-Technical Commission
IEEE	Institute of Electronics and Electrical Engineers
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IR	Infrared
ISO	International Organization for Standardization
ISR	Intelligence Surveillance Reconnaissance
ISR TF	Intelligence Surveillance Reconnaissance Task Force
ITU-T	International Telecommunications Union's Standardization Sector
JPEG	Joint Photographic Experts Group
KLV	Key, Length, Value
LWIR	Long Wave Infrared
MAC	Media Access Control
Mbps	Mega-bits per second
MIL	Military
MISB	Motion Imagery Standards Board (NGA GWG)
MISP	Motion Imagery Standard Profile
MPEG	Moving Picture Experts Group
MWIR	Mid-Wave Infrared
NATO	North Atlantic Treaty Organization
NGA	National Geospatial-Intelligence Agency
NIAT	NGA Interoperability Action Team
NIOP	Navy InterOperability Profile
NIR	Near-Infrared
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard

TABLE 1 - ACRONYMS (CONTINUED)

Acronym	Description
NTB	NITFS Technical Board (NGA GWG)
PEO	Program Executive Office(r)
PM	Private Message(s)
PM	Project Manager
PM ICD	Private Message Interface Control Document
PM UAS	Project Manager Unmanned Aircraft Systems
PPS	Pulse Per Second
PS	Per Second
PSI	Platform - Sensor Interface
PTP	Precision Time Protocol
QOS	Quality of Service
RFC	Request for Comment (IETF)
RP	Recommended Practice
RS	Recommended Standard (EIA)
SDI	Serial Digital Interface
SMPTE	Society of Motion Picture and TV Engineers
SSH	Secure Shell
ST	Standard
STANAG	Standardization Agreement (NATO)
STD	Standard
SWIR	Short Wave Infrared
TAI	Temps Atomique International (International Atomic Time)
TCP	Transmission Control Protocol
TIA	Telecommunications Industry Association
TLS	Transport Layer Security
TRE	Tagged Record Extension
TTE	Time Triggered Ethernet
UAS	Unmanned Aircraft System
UAV	Unmanned Air Vehicle
UDP	User Datagram Protocol
UCS	UAV Control Systems
UTC	Coordinated Universal Time
UV	Ultra-Violet
VANC	Vertical ANCillary data space
VOIP	Voice Over Internet Protocol
WGS	World Geodetic System
XON/XOFF	Transmitter On and Transmitter Off

3. GENERAL REQUIREMENTS

3.1 Platform/Sensor Data Interface[9]

Figure 2 shows the data flows between the aircraft and the sensor. AS6135 covers the platform to sensor interface for both manned and unmanned aircraft. This standard does not cover the interface to off-platform control and imagery users, nor on-platform transport and processing. However, the requirements for those interfaces and processes directly impact the interface and details in AS6135 plus implementation and vice versa. AS6135 leverages the standards utilized by those off-platform interfaces and processes, as well as the standards utilized by on-platform transport and processing. In Figure 2, the dashed line (blue) represents the interface between the sensor and the aircraft, which is the interface covered by this standard. The dotted line (red) represents the interface between the aircraft and systems outside of the aircraft (other than the EO/IR sensor), for example a ground control station. The dotted line (red) interface is not covered by this standard. However, AS6135 leverages the standards that do define that interface(s) further downstream.

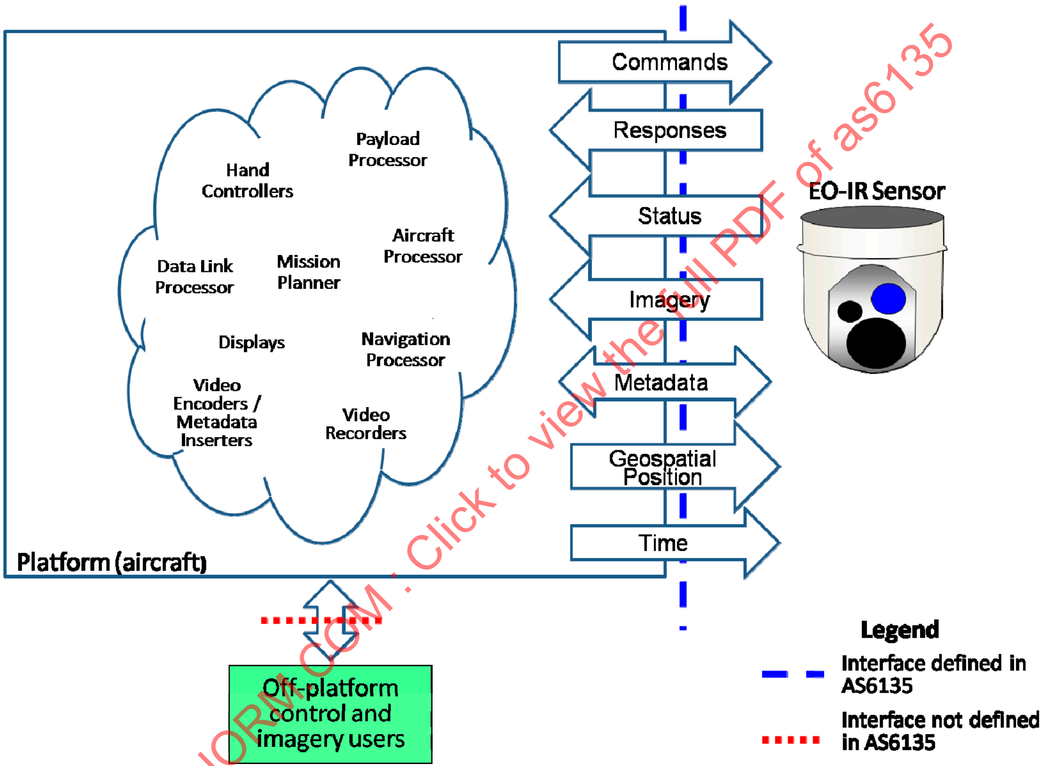

FIGURE 2 - DATA FLOWS

AS6135 can support a variety of platform to sensor interfacing configurations, as depicted in Figures 3a, 3b, 4a, and 4b. Figures 3a and 4a show the case where there is an Electronics Control Unit (ECU), while Figures 3b and 4b show the case where there is no ECU. Figures 3a and 3b show a configuration without an on-board hand-controller, while Figures 4a and 4b show a configuration with an on-board hand-controller. The interface between the host platform processor(s) and the sensor is called the Platform Sensor Interface (PSI). If the sensor has an ECU, then the PSI shall be located at the ECU. If the sensor does not have an ECU, then the PSI shall be located at the sensor. Either way, the PSI has been standardized to be identical. If the sensor has an ECU, then the ECU to Sensor Interface (ECUSI) shall be considered part of the sensor system; AS6135 is NOT standardizing the ECUSI. AS6135 shall be applied at the PSI. Both the platform and the sensor shall comply with AS6135 at the PSI. Unless otherwise specified all requirements shall apply to both the platform and the sensor.

[9] See also Appendices A1 and A2

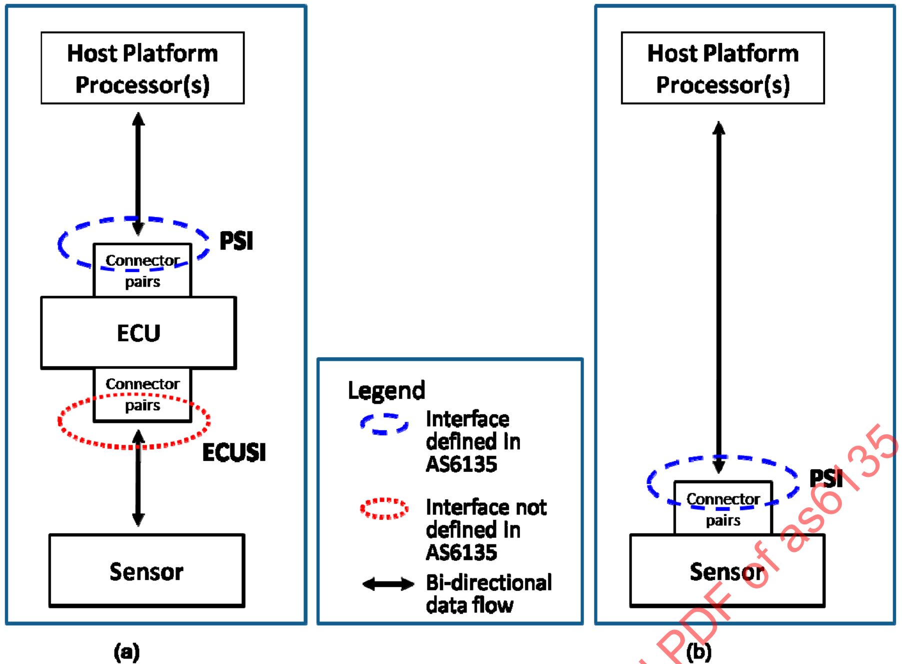

FIGURE 3 - LOCATION OF INTERFACES (A) WITH ECU (B) WITHOUT ECU

NOTE: Related standards such as AS6129, Interface Standard, Airborne EO/IR Systems, Electrical, might involve the ECUSI.

Figures 3a and 3b are applicable to both manned and unmanned platforms. In the case of an unmanned aircraft, the commands are generated autonomously on-board and/or are generated off-platform and then transferred to the sensor by the platform. Figures 4a and 4b, show the possible addition of an optional on-board hand-controller. The hand-controller can interface to either the host platform processor(s) or to the PSI. AS6135 specifies the interface at the PSI regardless of whether or not the data goes via the host platform processor(s). Although the same approach can be used for the interface between the hand controller and the host platform processors, AS6135 does not define this interface. As in Figures 3a and 3b, Figure 4a shows a sensor with an ECU while Figure 4b shows a sensor without an ECU.

In terms of CSR, there are two approaches to interfacing an optional on-board hand-controller to the PSI: (1) use the same STANAG 4586 and Private Messages (PM) used between the host platform processor(s) and the sensor at the PSI and/or (2) lower level commands. Some platforms use the first approach, some the second approach. The first approach can add latency due to converting the formating and in overhead due to the message wrapper, but gains in terms of commonality, interoperability, and some interchangeability. The second approach uses “lower level” messages. These messages are typically positions of each of the axes on the hand-controller and the positions of switches when their position or state changes. AS6135, specifies the first approach. AS6135 currently provides limited specification of the low level hand controller interface.

NOTE: AS6135 may include the second approach in future versions.

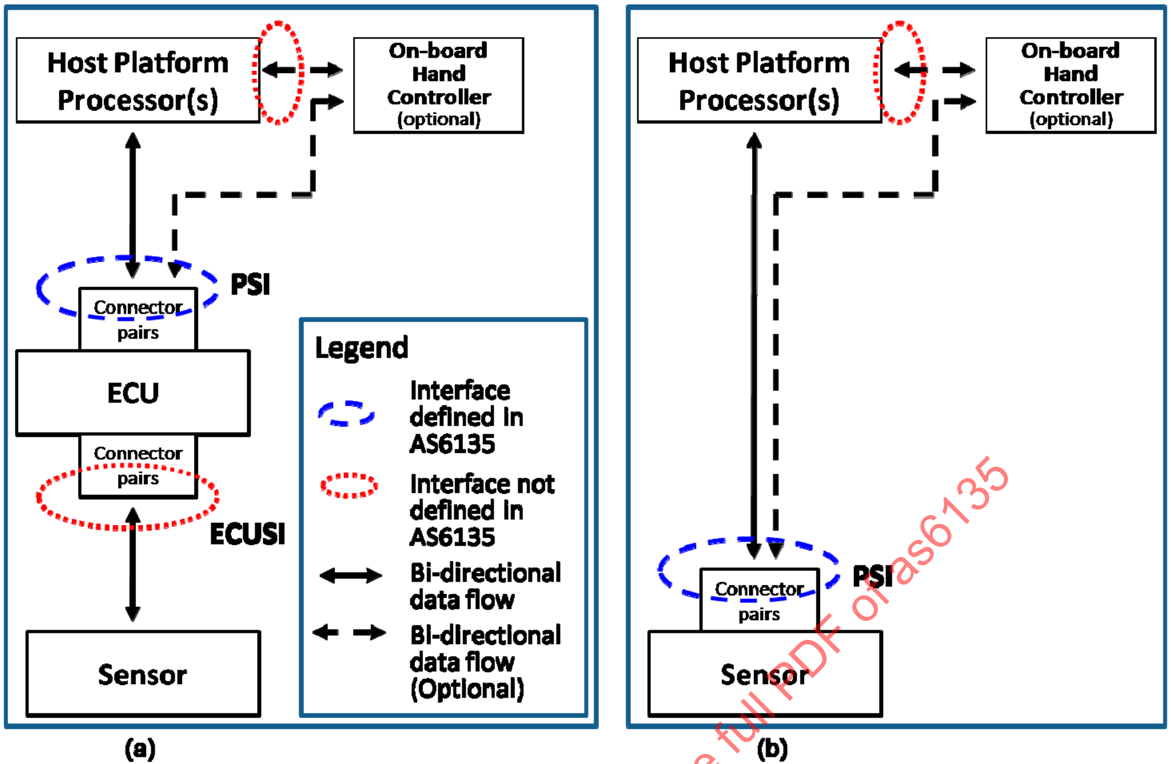

FIGURE 4 - LOCATIONS OF INTERFACES ASSUMING A HAND-CONTROLLER AND (A) AN ECU, (B) NO ECU

4. DETAILED REQUIREMENTS[10]

The data interface includes Imagery, CSR, geospatial position, and hand controller. The types of data being passed at the interface are shown in Table 2. AS6135 defines the format and content (e.g., messages) as well as transport, but not the cabling which is specified in AS6129.

TABLE 2 - DATA TYPES

Imagery	• Uncompressed motion imagery and associated embedded metadata • Compressed motion imagery and associated embedded metadata • Uncompressed and compressed still imagery and associated embedded metadata
Command, Status, and Response (CSR)	• Command - Control and configuration messages sent to the sensor • Response - Replies to commands, sent from the sensor • Status - Non-embedded imagery metadata, geospatial position data, hand controller, and/or maintenance data
Geospatial Position	Translational and rotational position, velocity, and acceleration, etc. of the aircraft and the time when these values were measured (i.e., time stamp).
Hand-Controller	The hand controller is a device allowing the human operator to control the sensor via physical movement of the operator's body (e.g., hand or head). The hand controller interface to the sensor can be used by a human, but it can also be used by the platform's processors to control the sensor.

[10] See also Appendix A3.

4.1 Imagery and Metadata[11]

There are three types of imagery described in these subsections: uncompressed motion imagery, compressed motion imagery and still imagery (compressed and uncompressed are considered together). These are the imagery outputs from the EO/IR sensor system. For the purposes of this standard, no official definitions are made to differentiate between still and motion imagery. The categories are divided only by the methods of data transport used.

4.1.1 Uncompressed Motion Imagery

Uncompressed Motion Imagery is motion imagery data from the sensor that has not been through an image compression process. Section 4.1.1.1, Uncompressed Motion Imagery Protocol and Image Format, below describes the protocol for carrying uncompressed motion imagery as well as the associated image formats (e.g., width, height, color depth, etc.) of the imagery that is being carried.

4.1.1.1 Uncompressed Motion Imagery Protocol and Image Format[12]

The standards for transport and image formats listed in Table 3 shall be used in accordance with the active image dimensions of the sensor. Smaller image sizes shall be accommodated by centering the image in the next larger standard image format. Only progressive formats shall be supported; interlaced image formats shall not be used.

High bit depth (greater than 10-bits per pixel) IR motion imagery can be carried over the SMPTE transports shown in Table 3 using the method described in MISB RP 0403.

Table 3 references standards that specify transmissions at 1.5 Gb/s and 3.0 Gb/s. Regarding interoperability, most receivers can handle both rates and related formats automatically. Sensors can output at either rate. Platforms shall be capable of receiving at both rates.

TABLE 3 - UNCOMPRESSED MOTION IMAGERY FORMATS

Active Image Size (HxV)	Frame Rate (fps)	Image Format	Video Over Copper Transport	Video Over Fiber Transport
720 x 480	60, 59.94	SMPTE ST 293 / SMPTE ST 349	SMPTE ST 292	SMPTE ST 297
720 x 576	50	SMPTE ST 293 / SMPTE ST 349	SMPTE ST 292	SMPTE ST 297
1280x720	60, 59.94, 50	SMPTE ST 296	SMPTE ST 292	SMPTE ST 297
1920x1080	30, 29.27, 25	SMPTE ST 274	SMPTE ST 292	SMPTE ST 297
1920x1080	60, 59.94, 50	SMPTE ST 274	SMPTE ST 424 / 425 Mapping	SMPTE ST 297

[11] See also Appendix A4
[12] See also Appendix A5

4.1.2 Compressed Motion Imagery

Compressed Motion Imagery is a reduced bandwidth representation of uncompressed motion imagery. Bandwidth is reduced by applying a standards' compliant video compression algorithm as defined in the following subsections. Imagery compression can be true lossless, visually lossless, or lossy. The following sections discuss how to compress, transport, and the allowable formats of the motion imagery.

4.1.2.1 Compressed Motion Imagery Protocol[13]

Compressed Motion Imagery shall be carried using MPEG-2 Transport Stream (ISO/IEC 13818-1) and in accordance with MISB STD 0604 over UDP (RFC-768) over IP (RFC-791, RFC-2460) as defined under MISB STD 9701.

4.1.2.2 Compressed Motion Imagery Data and Image Format

If the sensor is capable of performing image compression, then it shall implement the "ISO/IEC 14496-10 (MPEG-4 Part 10)" video compression standard also known as "ITU-T Recommendation H.264". The sensor may also implement the MPEG-2 video compression standard. No other video compression standards shall be used by the sensor.

The platform shall support both MPEG-4 Part 10 and MPEG-2 video compression standards. Motion Imagery compression parameters, including selection of compression standard, shall be set by the platform using CSRMs via the CSR Interface.

NOTE: Regarding the platform supporting both MPEG-4 Part 10 and MPEG-2, there is information in the data stream that defines which type of compression is being used, so a receiver can tell which one it is receiving and choose the appropriate decoder."

NOTE: MISB EG 0802 provides guidance for the use of H.264 to enhance interoperability of the compressed data streams.

NOTE: The compressed motion imagery may represent any image size from the full sensor image size down to an image size of 16x16 pixels. The reduced image size may be the result of scaling or cropping (see MISB EG 0904 for guidance). In addition, the compressed motion imagery may represent any frame rate.

Motion Imagery compression parameters shall be set via Command, Status, and Response Messages (CSRMs) via the CSR Interface.

4.1.3 Still Imagery

Still Imagery is one or more images, typically slower than one frame per second or not of the same location or target.

4.1.3.1 Still Imagery Protocol[14]

Still Image files, as defined in 4.1.3.2, shall be transferred from the sensor over Ethernet using the FTP protocol as defined in IETF RFC 959. The files shall be sent in Binary (TYPE[15]) mode using the Stream (MODE[16]) transfers.

The sensor shall implement the client interface and shall send (STOR[17]) files to the server either periodically (i.e., at a certain rate) or on command. The sensor shall provide a filename for each file, and shall have the capability to change the current directory (CWD[18]).

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[13] See also Appendix A6
[14] See also appendix A7
[15] FTP command meaning "set transfer type", e.g., ASCII vs binary
[16] FTP command meaning "set transfer mode"
[17] FTP command meaning "store a file on the remote host"
[18] FTP command meaning "Change Working Directory"

The sensor shall be able to log in (USER[19], PASS[20]) to the FTP server using either username/password or anonymous login as required by the server. The sensor shall use passive (PASV[21]) mode in order to simplify operation through a Firewall.

The platform shall be able to set FTP Server Address, Snapshot Trigger, and Snapshot Rate. This functionality shall be configured and commanded using CSRMs via the CSR interface.

4.1.3.2 Still Imagery Data and Image Format

Still imagery data shall be formatted into NITF files as defined in MIL-STD-2500C. Image data in the NITF file may be uncompressed, or compressed using the JPEG2000 compression algorithm.

NOTE: The still imagery may represent any image size from the full sensor image size down to an image size of 16x16 pixels. The reduced image size may be the result of scaling or cropping (see MIL-STD-2500C).

Still imagery data and image format parameters, e.g., compression, shall be set via CSRMs via the CSR Interface.

4.1.4 Metadata

Metadata is data about the imagery and is associated with specific imagery. It tells the user of the imagery when and where the imagery was taken as well as details about the platform and sensor which generated it. Metadata supports exploitation of the imagery. Metadata can be used for feedback and status for an operator who is controlling the platform and sensor.

Metadata consists of multiple variables. Some metadata variables have fixed values (or at least unchanging during a single flight), while others are updated at a variety of rates, some of which are not constant. Each frame of imagery must be associated with the metadata appropriate for the time of image acquisition. For example, for light sensitive sensors, the time is the start of exposure. Altitude is data about the height of the aircraft as a function of time. The altitude of the aircraft at the time a particular frame of imagery was acquired is also metadata.

Data that is generated by the sensor and inserted into metadata field(s) shall be inserted as metadata by and at the sensor. Data which is generated by the platform can be inserted as metadata either at the platform or sent to the sensor and inserted there. Data which is generated by the platform and is inserted into metadata fields by the sensor shall be sent via CSRM.

NOTE: Some data used to populate metadata fields is generated further downstream, i.e., off of the platform.

4.1.4.1 Motion Imagery Metadata Format and Transport

Motion imagery metadata shall be encoded using Key-Length-Value (KLV) as defined in SMPTE ST 336, Data Encoding Protocol Using Key-Length-Value.

Metadata and video frame time stamps accompanying uncompressed motion imagery shall be inserted into the motion imagery stream according to MISB STD 0605 and MISB STD 0603. This requires the use of SMPTE ST 291 and SMPTE RP 214 for inserting KLV encoded metadata (including the KLV encoded video frame precision time stamp) into the Vertical ANCillary data space (VANC) of the SMPTE transport protocol. It also requires the use of SMPTE ST 291 and SMPTE ST 12-1 and ST 12-2 for inserting a time stamp in each video frame.

Metadata and video frame time stamps accompanying compressed motion imagery shall be inserted into the motion imagery stream according to MISB STD 0603 and MISB STD 0604.

[19] FTP command meaning "send username"
[20] FTP command meaning "send password"
[21] FTP command meaning "enter Passive mode"

4.1.4.2 Motion Imagery Metadata Content

All metadata elements shall be in the MISB STD 0807 metadata dictionary and/or the SMPTE metadata dictionary SMPTE RP 210.

NOTE: MISB 0807 is preferred over SMPTE RP 210

NOTE: Although the Motion Imagery Sensor Minimum Metadata Set, specified by MISB STD 0902, is required for ultimate distribution, some elements can be inserted at a later point in the distribution chain, for example in the aircraft or even on the ground rather than at the sensor.

The sensor shall produce a metadata stream with the video that encodes the MISB STD 0601 UAS Datalink Local Metadata Set. The following metadata tags within MISB STD 0601 shall be populated by the sensor:

a. Tag 11: Image Source Sensor

b. Tag 16: Sensor Horizontal Field of View

c. Tag 17: Sensor Vertical Field of View

d. Tag 18: Sensor Relative Azimuth Angle

e. Tag 19: Sensor Relative Elevation Angle

f. Tag 20: Sensor Relative Roll Angle

In addition, the sensor may include any other metadata available to it.

4.1.4.3 Still Imagery Metadata Format and Content

Still imagery metadata shall be contained in the NITF file header, NITF sub-header, and Tagged Record Extensions (TRE) with associated data extensions (tags) for corresponding Image Segment(s) per MIL-STD-2500C and STDI-0002.

NOTE: A valid NITF file requires additional metadata which is not included in the set required by AS6135. It may either be added by the sensor or at another point before the imagery leaves the platform. Refer to MIL-STD-2500C and STDI-0002 for the full list of required metadata fields.

The sensor shall populate, at a minimum, all of the metadata fields listed in Table 4 or all of the metadata fields listed in Table 5.

NOTE: The only difference between the tables is the use of SENSRA TRE versus SENSRB TRE. Table 4 uses SENSRA TRE while Table 5 uses SENSRB TRE. SENSRB is a newer standard and is intended to provide greater flexibility. SENSRA and SENSRB are not incompatible. Systems could have one or the other, or even both. Most systems currently use SENSRA, but the desire is to move to SENSRB.

TABLE 4 - REQUIRED STILL IMAGERY METADATA FIELDS SET A

NITF 2.1 FIELD	Field Description	Required
NITF Header		
FDT	File Date and Time	x
Image Subheader		
IID1	Image Identifier 1	x
IDATIM	Image Date and Time	x
ISORCE	Image Source	x
NROWS	Number of Significant Rows in Image	x
NCOLS	Number of Significant Columns in Image	x
IREP	Image Representation	x
ICAT	Image Category	x
ABPP	Actual Bits-Per-Pixel Per Band	x
IC	Image Compression	x
NBANDS	Number of Bands	x
TRE ACTFB		
ROW_SPACING	Image Pixel Row Spacing	x
COL_SPACING	Image Pixel Column Spacing	x
FOCAL_LENGTH	Sensor Focal Length	x
TRE SENSRA		
REF_ROW	Reference Row	x
REF_COL	Reference Column	x
SENSOR_MODEL	Sensor Model	x
SENSOR_LOC	Sensor Location	x
SENSOR_ALT_SOURCE	Sensor Altitude Source	x
SENSOR_ALT	Sensor Altitude	x
SENSOR_ALT_UNIT	Sensor Altitude Unit	x
SENSOR_PITCH	Sensor Pitch Angle	x
SENSOR_ROLL	Sensor Roll Angle	x
SENSOR_YAW	Sensor Yaw Angle	x

TABLE 5 - REQUIRED STILL IMAGERY METADATA FIELDS SET B

NITF 2.1 FIELD	Field Description	Required
NITF Header		
FDT	File Date and Time	x
Image Sub-header		
IID1	Image Identifier 1	x
IDATIM	Image Date and Time	x
ISORCE	Image Source	x
NROWS	Number of Significant Rows in Image	x
NCOLS	Number of Significant Columns in Image	x
IREP	Image Representation	x
ICAT	Image Category	x
ABPP	Actual Bits-Per-Pixel Per Band	x
IC	Image Compression	x
NBANDS	Number of Bands	x
TRE ACFTB		
ROW_SPACING	Image Pixel Row Spacing	x
COL_SPACING	Image Pixel Column Spacing	x
FOCAL_LENGTH	Sensor Focal Length	x
TRE SENSRB		
01a - SENSOR	Sensor Registered Name or Model	x
01l - START_DATE	Imaging Start Date	x
01m - START_TIME	Imaging Start Time	x
02a - DETECTION	Detection Type	x
02b - ROW_DETECTORS	Number of Detectors Used in Row	x
02c - COLUMN_DETECTORS	Number of Detectors Used in Column	x
02f - FOCAL_LENGTH	Best Known Focal Length	x
02g - ROW_FOV	Field of View along Sensor Array Row	x
02h - COLUMN_FOV	Field of View along Sensor Array Column	x
05a - REFERENCE_TIME	Reference Time of Applicability	**x OR 5b/5c**
05b - REFERENCE_ROW	Reference Pixel Row and Column of Applicability	**x OR 5a**
05c - REFERENCE_COLUMN		**x OR 5a**
07b - SENSOR_ANGLE_1	First, Second, and Third Sensor Rotation Angles	x
07c - SENSOR_ANGLE_2		x
07d - SENSOR_ANGLE_3		x

NOTE: A valid NITF file requires additional metadata which is not included in the set required by AS6135. It may either be added by the sensor or at another point before the imagery leaves the platform. Refer to MIL-STD-2500C and STDI-0002 for the full list of required metadata fields.

4.2 Communications Interfaces

4.2.1 RS-422 Serial Interface Characteristics[22]

When RS-422 interfaces are provided, they shall implement asynchronous serial communications. Each RS-422 port shall be configured independently and shall have the characteristics as shown in Table 6:

TABLE 6 - RS-422 SERIAL INTERFACE CHARACTERISTICS

Variable	Allowable values
Transfer speed (bits per second)	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity Bits	None, Even, Odd
Data Bits	8
Stop Bits	1, 2
Flow Control	None, XON/XOFF

4.2.2 Ethernet Interfaces

Unless specified elsewhere in this standard, the Ethernet interfaces shall comply with the requirements of these subsections. Ethernet may be provided using a copper interface or a fiber interface as described below. The choice of copper or fiber or both will be as required by the procuring agency.

4.2.2.1 Copper Ethernet Interface

The copper Ethernet interface shall comply with IEEE-802.3ab which is commonly known as 1000Base-T. The interface shall support auto-detection and auto-negotiation. The platform shall properly interface with a sensor operating at 10, 100, or 1000 Mbps in Half or Full Duplex mode. The sensor can choose 10, 100, or 1000 Mbps in Half or Full Duplex mode as long as it is complies with IEEE-802.3ab

4.2.2.2 Fiber Ethernet Interface

The fiber Ethernet interface shall comply with IEEE-802.3ae which is commonly known as 10G Base-SR.

4.2.2.3 Addressing and Protocols

The Ethernet interface shall support both IPv4 and IPv6 addressing. The sensor shall support both DHCP and static IP address assignment.

The sensor shall support the ICMPv4/ICMPv6[23] Echo Request and Echo Reply messages (PING).

The platform shall send to the sensor only multicast message traffic from multicast groups that the sensor has joined. One method to meet this requirement is for the platform to support IGMP[24] for multicast routing.

The platform shall support, and the sensor may use HTTPS[25], SSH[26], FTP[27], IEEE-1588, compressed video over unicast or multicast UDP/IP and STANAG-4586 DLI messages over multicast UDP/IP.

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[22] See also Appendix A6
[23] ICMP – RFC-792 Internet Control Message Protocol
[24] IGMP – RFC-3376 Internet Group Management Protocol, Version 3
[25] HTTPS – RFC-2818 HTTP Over TLS
[26] SSH – RFC-4251 The Secure Shell (SSH) Protocol Architecture
[27] FTP – RFC-959 File Transfer Protocol (FTP)

4.3 Command, Status, and Response Messages (CSRM)

Commands are issued to the sensor by the platform via messages. The sensor responds via messages to those commands. The sensor also sends status messages to the platform either periodically or based on condition or other special circumstances. The Interface for CSRM is referred to as the CSR Interface. The CSR Interface is part of the Ethernet Interface provided in AS6129. The Ethernet Interface carries still imagery and compressed motion imagery as well as CSRM.

4.3.1 CSRM Protocol[28]

Sensors shall send and receive CSRM using multicast UDP over IP over Ethernet.

4.3.2 CSRM Data Format and Content[29]

CSRM shall use the Data Link Interface (DLI) message formats defined in STANAG 4586.

CSRM may use "Public" and/or "Private" messages. All CSRM Public messages shall be defined in STANAG 4586. STANAG 4586 also allows for Private Messages (PM). Various organizations maintain standardized, non-proprietary repositories of "Private" Messages" (PM). All CSRM Private Messages shall be defined in standardized, non-proprietary PM repository(ies) accepted by the procuring agency.

NOTE: As an example, the U.S. Army PM ICD would be one PM repository that may be used if this document is accessible to the platform and sensor manufacturers. Where a manufacturer for either the platform or the sensor requires a message to control the sensor that is not covered by other documents to which they have access, then they would have to either request the STANAG 4586 custodian to add the new message to the STANAG, or to request the maintainers of the PM repository(ies) to add a message to their document.

NOTE: STANAG 4586 is publicly available.

4.4 Hand Controller

Hand controllers can be located on the platform or off-platform.

The on-board hand controller interface is shown in Figures 4a and 4b. AS6135 does not define the interface between an on-board hand controller and the host platform's processor(s). AS6135 does define the interface between an on-board hand controller and the EO/IR sensor if it is directly interfaced.

If there are one or more on-board hand-controllers interfaced to the sensor, it/they shall be interfaced via CSRM via Ethernet or it/they shall be interfaced via low level messages via RS-422.

On-board hand-controllers can be interfaced via CSRM via Ethernet, in the same manner as anything else that commands the sensor, in which case the messages shall comply with 4.3 Command, Status, and Response Messages (CSRM). Alternatively, an RS-422 asynchronous serial interface can be used for the implementation of a low level on-board hand controller interface. The protocol, format, and data content for this low level hand controller interface are not defined within this standard, regardless this interface shall comply with 4.2.1, RS-422 Serial Interface Characteristics.

NOTE: The protocol, format, and data content for the low level hand controller interface might be defined in a future version of AS6135.

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[28] See also Appendix A8
[29] See also Appendix A9

NOTE: The RS-422 low level hand controller interface is for human control of the sensor, not for aircraft control of the sensor. The RS-422 low level hand controller is not an alternative to 4.3, Command, Status, and Response Messages (CSRM).

Off-board hand controllers shall be interfaced to the Sensor via CSRM and shall comply with 4.3, Command, Status, and Response Messages (CSRM).

4.5 Geospatial Position[30]

The geospatial position data provides information about the aircraft position and orientation as a function of time. This data is sent from the aircraft to the EO/IR system to aid in pointing, target reporting, transfer alignment and/or metadata generation. Sensor data is sent back to the aircraft as metadata or status data.

One of the following two methods of providing geospatial position information to the sensor shall be used: the first method uses a GPS receiver internal to the EO/IR system and the second method uses a GPS receiver external to the EO/IR system.

NOTE: The GPS receiver processes the signals. The GPS antenna is not necessarily co-located with the GPS receiver. The section below refers to the location of the GPS receiver.

4.5.1 Internal GPS Receiver

If a GPS receiver is present inside the EO/IR system, it may be used to provide geospatial position information that will be used for generating metadata and for processing commands such as pointing. This internal GPS receiver may also be used to provide time information as described in 4.6.1.

4.5.2 External Geospatial Position Information

If the sensor is receiving geospatial position information from the platform, regardless of whether the sensor also contains a GPS receiver, then 4.5.2.1 and 4.5.2.2 shall apply.

4.5.2.1 Geospatial Position Protocol

Geospatial Position messages shall be received using multicast UDP over IP over Ethernet.

4.5.2.2 Geospatial Position Messages and Data Format

Geospatial position messages shall use the Data Link Interface (DLI) message formats defined in STANAG 4586.

All geospatial position messages may use “Public” or “Private” messages. All geospatial position Public messages shall be defined in STANAG 4586. STANAG 4586 also allows for Private Messages. Various organizations maintain standardized, non-proprietary repositories of “Private” Messages. All geospatial position Private Messages (PM) shall be defined in standardized, non-proprietary PM repository(ies) accepted by the procuring agency.

NOTE: As an example, the U.S. Army PM ICD would be one PM repository that may be used if this document is accessible to the platform and sensor manufacturers. Where a manufacturer for either the platform or the sensor requires a message to control the sensor that is not covered by other documents to which they have access, then they would have to either request the STANAG 4586 custodian to add the new message to the STANAG, or to request the maintainers of the PM repositories to add a message to their document.

NOTE: STANAG 4586 is publicly available.

[30] See also Appendix A10

Below is the recommended minimum set of variables to be passed from the platform to the sensor via Platform Geospatial Data messages:

a. Time stamp

b. Platform position (Latitude, Longitude, Altitude)

c. Platform X, Y, Z velocity

d. Platform X, Y, Z acceleration

e. Platform heading (true and/or magnetic), pitch and roll

f. Platform heading, pitch, and roll velocity

g. Platform heading, pitch, and roll acceleration

h. Errors in (some/all) the above

i. Sensor Position Offsets (position of the sensor relative to the location for which aircraft values above are reported)

j. Aircraft Track

4.6 Time Stamping and Time Synchronization

Video frames and metadata packets shall be time stamped as defined in MISB standards STD 0601.5, STD 0603.1, STD 0604.2 and STD 0605.3. These standards require a time resolution of 1 µs. Time stamps shall have an accuracy of 10 µs or better.

In order to maintain the accuracy of time stamps, two methods of time synchronization are provided. The first method uses an internal GPS receiver while the second method uses an external time source.

4.6.1 Internal GPS Receiver

If an internal GPS receiver is present, it may be used to provide time synchronization to maintain the accuracy of the time stamp. This internal GPS receiver may also be used to provide geospatial position information as described in 4.5.1.

NOTE: GPS time information must be converted to UTC time in order to be used for time stamping video frames and metadata. See MISB STD 0603.1 for conversion information.

4.6.2 External Time Source

If the sensor is receiving time information from the platform, regardless of whether the sensor also contains a GPS receiver, then this time information shall be distributed to the sensor using one or both of two methods: (1) a CSRM Time message sent via Ethernet and/or (2) using the IEEE-1588 protocol.

4.6.2.1 CSRM Time Message and Clock Synchronization

If the time information is distributed using the CSRM Time message, then the platform shall also transmit and the sensor shall also receive a 1 PPS signal. The Time message shall be in accordance with the requirements for CSRM. The platform shall send and the sensor shall accept the periodic CSRM Time message via Ethernet. The CSRM Time message shall contain the coarse time (seconds since 0:0:0:0 1/1/1970) corresponding to the previous 1PPS pulse. Typically, the sensor will synchronize an internal clock to the 1 PPS signal in order to generate the fine time which is the number of microseconds elapsed in the current second. Together, the coarse and fine time shall be used to generate the time stamps.

NOTE: The CSRM Time message corresponds to the pulse which was just received as opposed to being in advance of the pulse.

4.6.2.2 External IEEE 1588 protocol

If the time information is distributed via IEEE 1588 protocol, then the sensor shall contain an IEEE-1588 Ordinary Clock which shall synchronize to an external IEEE-1588 Master Clock as defined by the protocol. The internal Ordinary Clock shall be used to generate the time stamps.

NOTE: IEEE-1588 time information (which is transmitted in TAI format) must be converted to UTC time in order to be used for time stamping video frames and metadata.

5. NOTES

5.1 A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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APPENDIX A - DISCUSSION, NOTES, AND RATIONALE

NOTE: This Appendix is for explanation and is not part of the requirements of the standard.

A.1 CONTEXT (REFERS TO PREFACE AND 3.1, PLATFORM/SENSOR DATA INTERFACE)

AS-1C3, the data task group within SAE Avionic Subsystems Committee, drafted AS6135 and had as its goal standardizing the interface between platforms and EO/IR sensors. Three characteristics are included in measuring the standardization: commonality, interoperability, and interchangeability. Consensus appeared to be that it would not be feasible to have 100% of all three at a reasonable cost in a reasonably short time-frame. Thus AS6135 represents a trade-off between what is ideal and what is realistic.

AS-1C3's goal was: lots of commonality, lots (but perhaps slightly less) interoperability, and some interchangeability. Currently, procuring a sensor for a new platform or a totally different sensor for a major upgrade requires handling a mostly custom interface. That interface is often not only unique, but proprietary. AS-1C3 is trying to make that interface much less custom, and open, including, non-proprietary. Replacing an existing sensor with a different sensor, but with an identical interface with no changes required on the part of the platform manufacturer/systems integrator, would be the ideal and that would be complete interchangeability. The interchangeability is in terms of the interface, various functions inside the sensor, for example the zoom might be different. "Limited" or "some" interchangeability, means that you can change the sensors with much less pain than today. For example, most of the messages would be the same, the connectors and cabling would be the same (covered by AS6129), the video formats would be the same, the communications (e.g., Ethernet) would be the same, etc.

AS6135 represents a balance between standardization and flexibility while respecting some legacy systems. AS6135 is geared towards future systems and major upgrades, not legacy systems. Complete standardization would result in either a very constrained system resulting in major costs, and major objections, or a system capable of handling a large number of possibilities (e.g., having translators for different formats, and multiple transport approaches) resulting in extra costs and requiring the physical connections to have many more conductors which adds weight and cost. AS-1C3 tried to limit the options. Although there are options in AS6135, the authors tried to keep it to a reasonable number. The authors tried to balance legacy sensors and platforms with anticipated future applications while providing a migration path.

Figure A1 shows the overall view of where an EO/IR Sensor fits into the end-to-end system. AS6135 only addresses the interface between the platform and the sensor. However, this standard is leveraging other available standards being used at other points in the larger end-to-end system and hence it's important that the writers and users of this standard understand this larger picture. Leveraging available standards makes it easier for the writers and implementers of this standard. For example, if STANAG 4586 and the standardized Private Messages (PM) (U.S. Army Program Manager PM ICD or other Service's equivalent) are used at the Platform/EO/IR Sensor interface (PSI), then those messages can be generated at any point in the end-to-end system and carried through the system without translation. STANAG 4586 and PM are already required downstream of the sensor. If the platform already has to understand these messages, then why convert it to a proprietary interface inside the aircraft? This approach makes it easier to change out a sensor either for different missions, or in an upgrade to get improved capabilities. If the imagery is generated In Accordance With (IAW) MISP 6.2 and NITF 2.1, then it is universally understood and interoperable, and it does not need conversion to different formats through the end-to-end system which can degrade the quality of the imagery as well as adding extra costs to handle conversions.

This standard attempted to use other standards instead of inventing something new and to utilize common practice where feasible in order to increase acceptance and minimize changes required to implement this standard. In particular leveraging MISB and NTB standards, as well as STANAG 4586, plus the standardized Private Messages allows the changes required to have an interoperable platform cover most of the changes required to implement AS6135.

Imagery needs to be compliant by the time it enters the Global Information Grid (GIG). Metadata associated with the imagery can be generated in the sensor, in the platform, or on the ground. In theory the metadata could be entered just prior to the imagery entering the GIG, however, our approach is to have the metadata be entered as early as feasible.

This Task Group is attempting to push standards as far upstream (i.e., into the sensor) as practical and beneficial.