



**DIGITAL VIDEO ENCODING WITH METADATA  
&  
SDKs and HARDWARE DECODERS**

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## Summary

This document outlines SightLine's encoding capabilities and library support of motion imagery standards for streaming video and metadata. It also includes a list of known working software and hardware decoders.

## Supported Video Encoding Algorithms

SightLine has implemented the following algorithms. Each is different and offers alternative compression options for encoding, distributing, and capturing network video. Outbound adjustable options include bit rate changes and I-Frames to support low bandwidth or higher bandwidth settings for broadcast quality applications. Constant bit rate is being employed for all outbound streams.

**MJPEG** – video compression format where each video frame or interlaced field of a digital video sequence is compressed separately as a JPEG image. Client support includes web browsers such as Safari, Google Chrome, and Mozilla Firefox. While you get better overall image quality it normally requires much more bandwidth.

**MPEG4** – video compression standard implemented to provide lower latency encoding. Higher output frame rates can be achieved as the algorithm compresses data content at a higher rate (payload of data is larger than H.264). Reduced bandwidth requirements, output frame rates and overall lower latency, yet low robustness in the event of packet loss.

**H.264** – base and high profile encoding utilizing part 10 compression techniques. It is a block-oriented motion-compensation-based video compression standard. We have two supported options for this algorithm, one that processes Standard Definition video and the other High Definition digital video. This encoding option has become the industry standard providing excellent quality video with low bandwidth requirements.

Supported Resolutions			
SLA-1500 & SLA-3000		Standard Definition	
CODEC	Camera/Video Format	PAL (25fps)	NTSC (30fps)
MJPEG	Analog	720x525	640x480
MPEG4	Analog	720x525	640x480
H.264	Analog	720x525	640x480
SLA-1500		High Definition	
MPEG4	Digital	960x720	1280x720
H.264	Digital	960x720	1280x720
SLA-3000		High Definition	
CODEC	Camera/Video Format		
MJPEG	Digital	960x720, 1280x720, 1440x1080, 1920x1080	
H.264	Digital	960x720, 1280x720, 1440x1080, 1920x1080	

## Supported Networking Protocols

SightLine boards support sending outbound streams via UDP. TCP and UDP protocols operate at the transport layer, where UDP is the more prevalent protocol used for streaming video.

**TCP** – connection based reliable, ordered, and error checking delivery stream, yet it is this order checking that significantly impacts delivery of video. This is very apparent when frames are dropped.

**UDP** – a connectionless datagram service that emphasizes reduced latency over reliability, and is designed to support the delivery of streaming video. Dropped frames do not impact the video's consistency and sequencing.

**RTP** – designed for transfer of streaming data. Supports multiple destinations through multicasting and provides detection of out of sequence data. It is used in conjunction with UDP and helps sequencing.

## Network Session Protocols

**RTSP** – used to initiate and control streaming video and media sessions. Commonly used for establishing remote video streaming sessions that traverse firewalls. Ports which form a session are negotiated. It is used in tandem with RTP protocol to provide content to clients.

**Client Support** – Most media players including, Windows Media Player, QuickTime, and VLC support RTSP and can be used to play SLA's video streams.

## MISB Compliance

SightLine has developed all motion imagery streams in accordance with the MISB standards. Current MISB documentation can be found on their [website](#). Motion imagery describes a video stream that contains video and metadata encapsulated within an [MPEG2 Transport Stream](#). The video is stream is encoded as H.264 and the metadata is [KLV](#). Both are encapsulated within the MPEG2 Transport Stream as a separate elementary streams. Sightline adheres to the following MISB guidelines: 0102.10, 0601.7, 0603.2, 0604.3, and 0903.3.

## Supported Libraries and SDKs

SightLine has developed a software decoder using the open source product FFmpeg. This tool is a multimedia framework able to decode and play digital video. It is a cross-platform solution that compiles (and runs on) Linux, Microsoft Windows, and others.

SightLine offers a video decoder sample application using this FFmpeg library. Additionally, our engineering control application (SLA-PANEL Plus) utilizes this same decoder for receiving and processing network streamed video. Both of these are available on our website from our [Software Download](#) page.

Other video decoder SDKs include:

- **Tungsten – 2D3 Sensing developed toolkit**  
This tool provides the essentials for building encoding and decoding solutions that are MISB compliant. Offer complimentary supporting products for the collection, distributing, and

managing of motion imagery data. Number of seats/clients based licensing model with scheduled monthly maintenance.

- **[GV2F Video](#) – Par Government video framework kit**  
Commercial FMV software library for developers that require MPEG2 w/KLV, H.264 & MJPEG video support readily integrated within their core geospatial product offerings.
- **[GStreamer](#) – Open source multimedia framework**  
Free tool for developing encoding and decoding applications. Supports simple playback, streaming both video and audio, as well as cross-platform support.

## Decoding Hardware

Here are a number of known hardware decoders that can process our video stream:

- **[Delta Digital Video](#) – offer rugged Mil-Spec encoders and decoders (MISB Compliant)**  
Solid hardware and good integration options make this a great choice for larger platforms.
- **[Haivison](#) – offer video streaming solutions for encoding, recording, decoding (MISB compliant)**  
Solid hardware and good integration options make this a great choice for larger platforms.
- **[VBrick](#) – offer video encoding, decoding and management**  
Larger company/campus video distribution model with great software for managing and archiving streams.

## Test Software

Software used to test receiving/decoding our video stream:

- **[SLA-PANEL Plus](#) – MISB compliant client for processing motion imagery**  
Great example of a low latency example of using the FFmpeg library decoder.
- **[GV3.0](#) – MISB compliant client for processing motion imagery**  
Excellent tool for viewing KLV metadata and buffered video is a great feature.
- **[VLC](#) – Video client for decoding video streams**  
Very good addition to the above applications for just viewing video.

**Note:** The VLC application is listed here as a test tool only. This media player by default is configured with a large playback buffer when receiving a network stream. This buffer introduces a very significant lag in the 'on-screen-display' side of decoding vs. the actual encoding. For latency measurements of our encoders, please refer to EAN-PerformanceLatency.pdf.

## Streaming and Snapshot

SightLine's snapshot function supports output to the following formats: PNG and JPG. For JPG snapshots there is also support of [EXIF metadata](#). This data is stored/embedded in the file's header section and can be parsed/extracted after capture. This includes data values for location, GPS time, and/or geographic information.

Additionally, the SLA-1500 allows snapshot exports of 16-bit raw camera data. This requires digital pixel output with full resolution (14 or 16-bits). This is the PNG option and it also includes a header with metadata (but not called EXIF which is jpg specific).

With HD inputs, the snapshot can be the entire HD frame, even if video streaming is a smaller frame size.

Output destinations of the snapshots can be made to an SD card (local/onboard slot) or to a remote FTP server over a network connection. These can be either single snaps or a sequence of snapshots at a set interval.

Additionally, you can capture the live video stream to the local SD card or to a remote file on a host PC.

## Digital Radio Support

We have tested streaming video and serial communications over a number of IP based RF radio systems. All of the network based radios we have tested supported our video and serial communications. Specifically, we have tested and are compatible with the following radios:

[Microhard Systems](#) – Nano Digital Data Link (IPnDDL) radio support for both Ethernet and Serial communications. Additionally, this radio can be tightly integrated on board your surveillance platform or vehicle with our SLA-1500 video processor and the [SLA-1500-RAB](#) board.

[Persistent Systems](#) – Wave Relay MPU5 radio and their MANET architecture software. These radios are currently in wearable camera surveillance systems used by civilian and military personnel.

[L3 Communications](#) – Bandit is a miniature dual-band transceiver. Both L and S-bands are supported and it provides AES encryption. It has standard network interfaces and a built-in router and is used on many unmanned systems.

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