# Session D3:
# HD-SDI KLV Metadata: A Game-Changing Tool

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## New Concerns

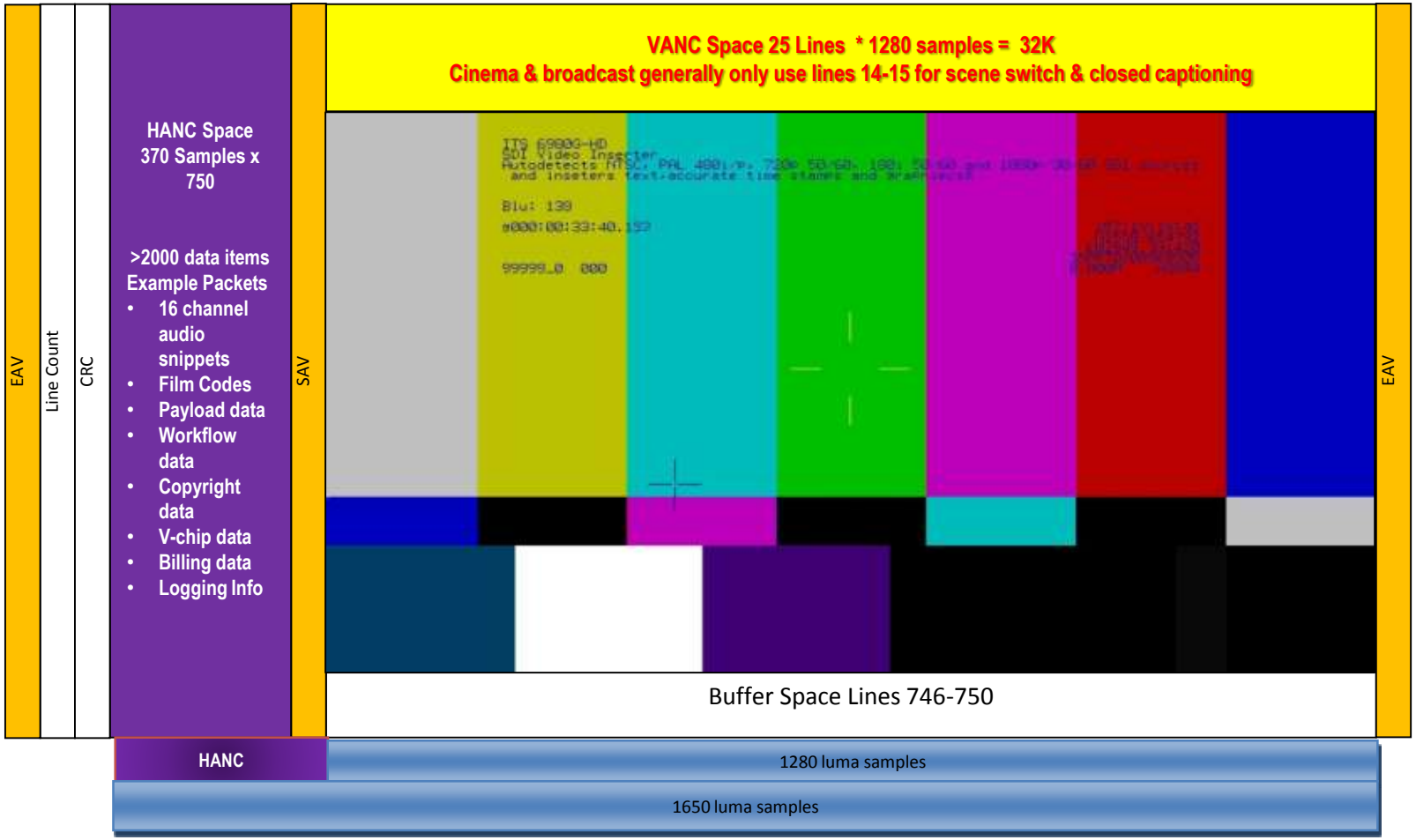
- Resolution is a more complex subject
- More formats
- High transport data rates
- Large volumes of data for archive
- Alias artifacts in images

## Benefits

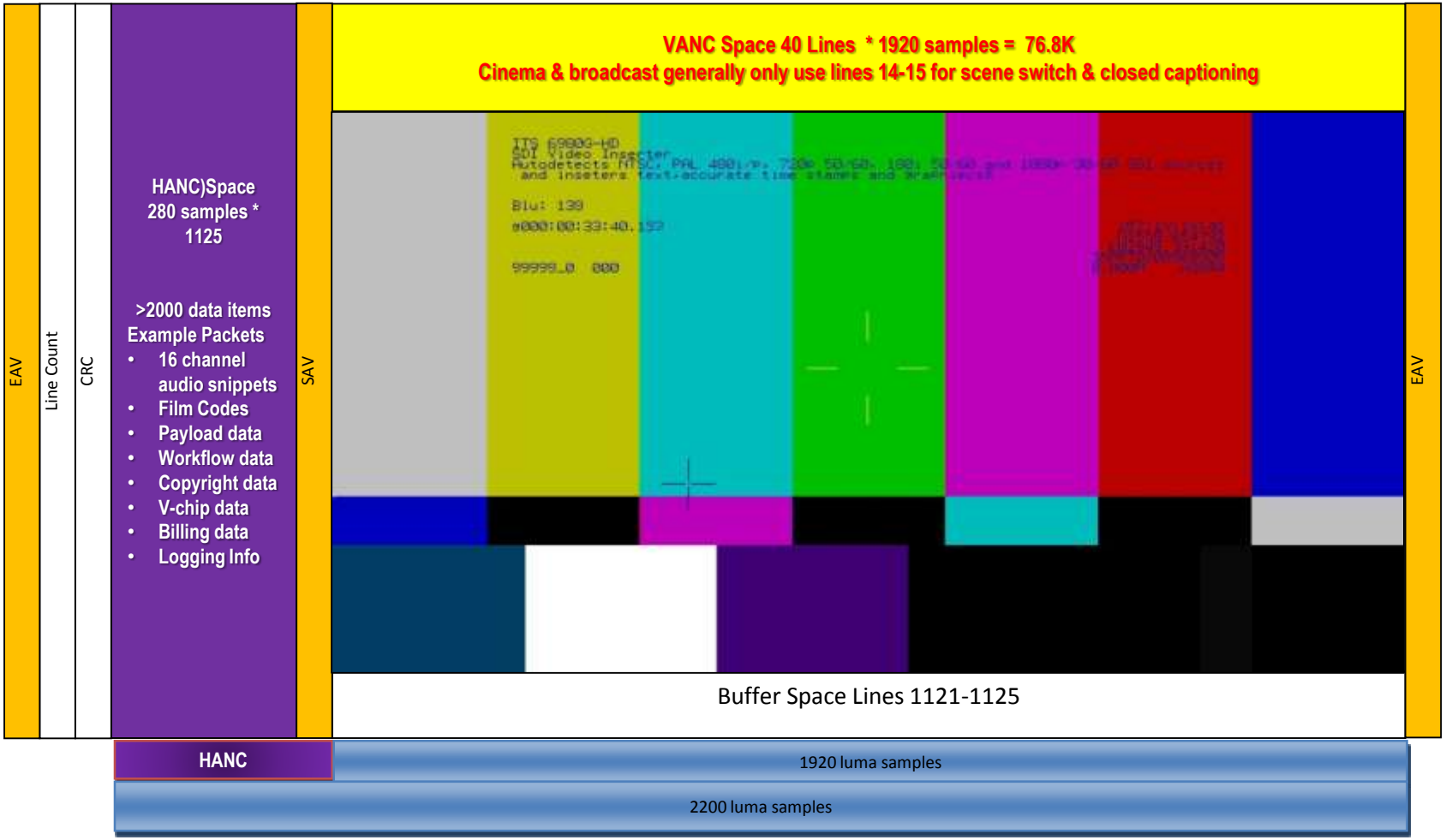
- Order of magnitude improvement in imagery
- Wider color gamut
- Recording and reproduction can be identical to raw video
- Single Frames approach snap shot quality
- Metadata space built in to the SMPTE frames

# Metadata Spaces are Designed into HD

- 720 Frame Parameters



- 1080 Frame Parameters



## Uses of Horizontal Ancillary (HANC) space

- HANC space used by broadcast & Cinema
  - As many as 3000 data types could be present
    - Audio (AES); 16 Channels
    - Payload (format, frame rate, etc.)
    - Advertisers, FCC logging, etc.

## Uses of Vertical Ancillary (VANC) Space

- VANC space is not used much by broadcast
  - Line 14 is scene switch point
  - Closed Captioning (mostly line 15)
- GOV uses it
  - MISB has >900 data types defined
  - All are KLV type 02
- Anyone can use the KLV Structure
  - Form valid SMPTE 291M packet
  - Insert desired data
  - Detect Packet
  - Extract Data

## Many Metadata Types Defined by SMPTE

- Dictionary
  - Example Keys
    - 16 Channels of sound bytes, source data, airing time, editing workflow
    - SMPTE time code
    - SAP, film codes… on and on
  - Data content
  - Format
- Metadata Elements Dictionary

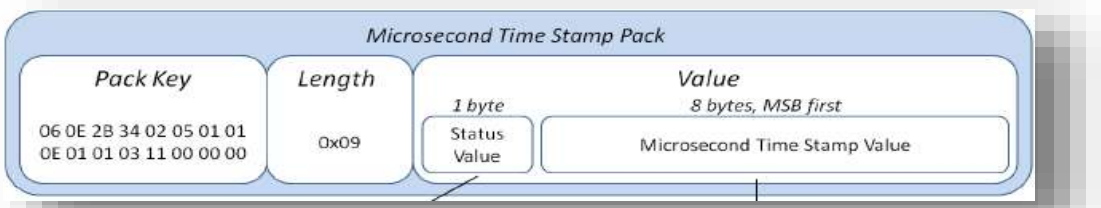
| Universal Label (KEY) | Metadata Element Name | Metadata Element Definition |
|---|---|---|
| 06.0E.2B.34.01.01.01.01.00.00.00.00.00.00.00.00 | ELEMENTS | Register of individual Metadata Elements |
| 06.0E.2B.34.01.01.01.01.01.00.00.00.00.00.00.00 | IDENTIFIERS AND LOCATORS | Class 1 metadata is reserved for abstract Identifiers and Locators |
| 06.0E.2B.34.01.01.01.01.01.01.00.00.00.00.00.00 | Globally Unique Identifiers | Unique identifiers and locators |
| 06.0A.2B.34.01.01.01.01.01.01.01.00.00.00.00.00 | UMID Video | Unique Material Identifier for video essence. Note: This is a 12-byte SMPTE label. |
| 06.0A.2B.34.01.01.01.01.01.01.10.00.00.00.00.00 | UMID Video | Unique Material Identifier for video essence. Note: This is a 12-byte SMPTE label. |
| 06.0A.2B.34.01.01.01.01.01.01.11.00.00.00.00.00 | UMID Video | Unique Material Identifier for video essence. Note: This is a 12-byte SMPTE label. |
| 06.0A.2B.34.01.01.01.01.01.01.12.00.00.00.00.00 | UMID Video | Unique Material Identifier for video essence. Note: This is a 12-byte SMPTE label. |
| 06.0A.2B.34.01.01.01.01.01.01.20.00.00.00.00.00 | UMID Video | Unique Material Identifier for video essence. Note: This is a 12-byte SMPTE label. |

## MISB used the type 02 KLV SMPTE structure

- > 900 register keys
  - MISB Standard 0807 lists the registered private keys
    http://www.gwg.nga.mil/misb/stdpubs.html
  - All MISB keys are 6.0E.2B.34.xx.xx.xx.xx.0E.0y.xx.xx.xx.xx.xx.xx
    Y=01 or 02 or 03
  - Most Derived for UAV uses
  - Structured to result in continuous pulse streams for PCM systems

## Microsecond Time Stamp

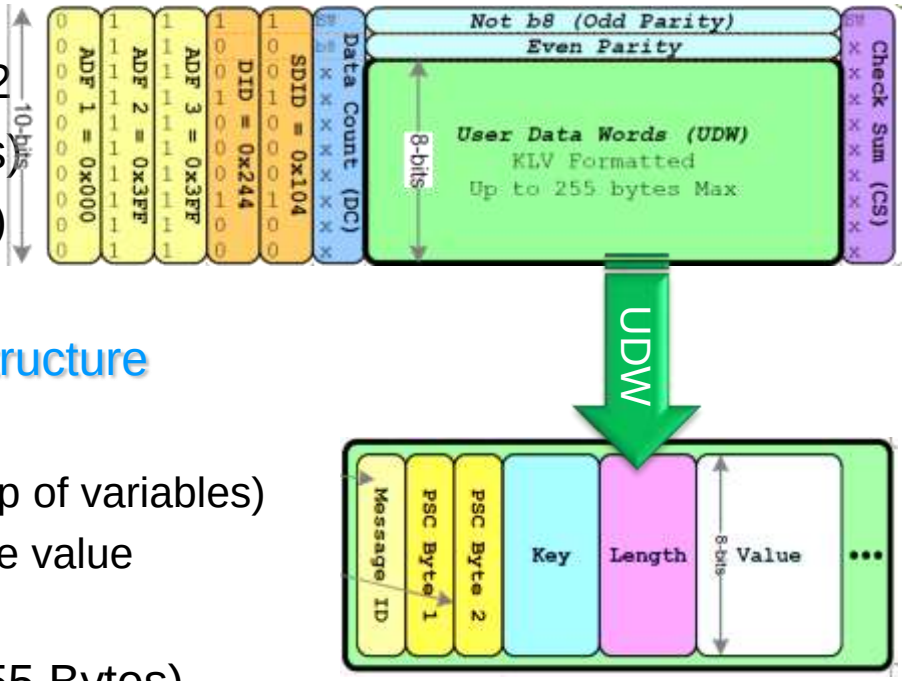
- Found in SMPTE RP210, and MISB 0807
- Key = 06.0E.2B.34.02.05.01.01.0E.01.01.03.11.00.00.00
- Must be start on 1st sample after SAV of Line 9




- Status Value = 1 Byte; Locked/unlocked source, valid, etc.
- Time Value = 8 Bytes; UNIX Epoch > µsec since Jan 1, 1970

## KLV VANC Pack is a SMPTE Structure

- SMPTE Standard 291M type 02
- Wrappers (ADF signature bytes)
- Type identifiers (DID and SSID)
- Length (DC)




## MISB uses the Type 02 KLV SMPTE Structure

- Key, Length Value
  - Key = data type identifier (group of variables)
  - Length = number of bytes of the value
  - Value = data itself
- Size of KLV = Data Count (1-255 Bytes)
  - Message ID (1 byte)
  - Program Segment Counter (2 bytes)
  - Key (16 bytes)
  - Length (1 byte)
  - Value ( L number of bytes); any data

## Non-Registered Keys –Custom Uses

- Special purpose designs
  - Fuse your data sampled at the frame rate to each image
- Must conform to SMPTE 291M Type 02 structure
- Can pass through all commercial equipment without harm

## Using equipment capable of recognizing customs keys can:

- Pass unobstructed, unaltered imagery while carrying image relevant data
- Extract previously inserted custom key data
  - Overlay
  - Output customer data to files

## Design a Key

- Create a key number (16 byte;32 HEX digits)

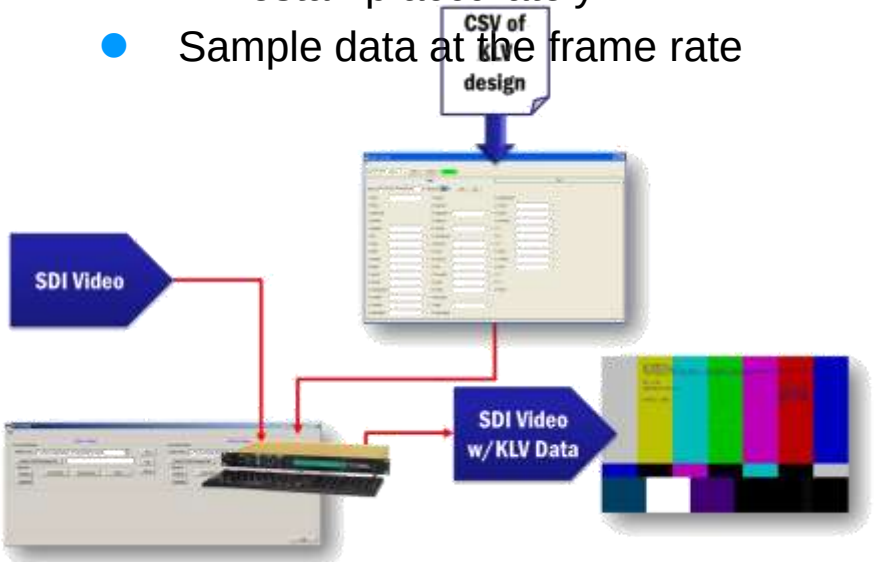

- Name Fields
- Select a data type
  - Signed/unsigned integers
  - Scaled singed/unsigned integers
  - Single and Double Precision Floating Point Numbers
  - ASCII strings
  - Binary blocks of data
- Locate data items and allocate space
  - Offset byte and number of bytes
- Define Scale & Decimal Point locatio
  - 3 bytes unsigned = 16,777,216 full-scale, scaled to 360 yields a resolution of $21*10^{-6}$
  - Specify 1,2 or 3 decimal places!

| Field Ref Name | Field Number | Start Byte | Pad | Format | Input LEN | Len Range |
|---|---|---|---|---|---|---|
| Test ID | 1 | 1 | 0 | ASCII | 10 | 1-234 |
| DAS Time | 2 | 11 | 0 | Binary | 8 | 1-225 |
| Geodetic Datum | 3 | 19 | 0 | Binary | 1 | 1-217 |
| Run Number | 4 | 20 | 0 | Binary | 1 | 1-216 |
| Classification | 5 | 21 | 0 | ASCII | 10 | 1-215 |
| Temp | 6 | 31 | 0 | UI-MAX | 2 | 1-4 |
| Pressure | 7 | 33 | 0 | UI-MAX | 2 | 1-4 |

| Field Ref Name | Field Number | Start Byte | Pad Before This Byte | Format | Input LEN | Len Range | Full Scale Value | Decimal Places | Display Model |
|---|---|---|---|---|---|---|---|---|---|
| Focus setting | 27 | 87 | 0 | UI-MAX | 2 | 1-4 | 1024 | 0 | 1024. |
| azimuth | 28 | 89 | 0 | UI-MAX | 3 | 1-4 | 360 | 8 | 359.99997854 |
| elevation | 29 | 93 | 1 | SI-MAX | 3 | 1-4 | 180 | 8 | +/-179.99997854 |

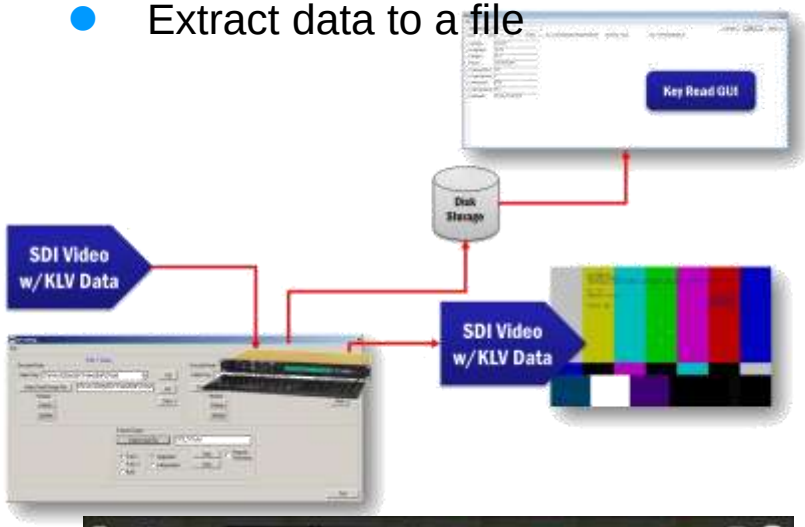
## Insert into the HD video stream at the source

- Timestamp accurately
- Sample data at the frame rate




## See and Extract from HD video stream at the Destination

- Overlay some or all data
- Extract data to a file




## Record unobstructed/unaltered video

- Playback with or without overlay
- Playback and Extract data to a file
- Playback as SMPTE 2022-6 File over Et

# VANC KLV Metadata Check List

## KLV packs in SDI are a game changer

- KLV Packs can
  - Transport data
  - Move cipher blocks
  - Enable recording of clean video
  - Maintain alignment of imagery and data

## Video Encoders/Decoders Must Preserve VANC end-to-end

## SDI Recorders must

- Preserve VANC  at record time
- Restore VANC at playback time

## Video Archiving must preserve VANC

- SMPTE 2022-6 can support this capability

## ITS software toolkit

- Create KLV
- Insert your data
- Monitor your data
- Display your data
- Test your KLV design