

NITFS/J2K Interactions

Bandwidth Compression Symposium

Arnold, MO

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Topics

- Role of Image Formats
- Formats Using JPEG
- Functionality Added to Legacy JPEG by the NITFS Format
- Role of NITFS Format with JPEG 2000
- NITFS File Header & JPEG 2000
- NITFS Image Subheader & JPEG 2000

Role of Image Formats

- To provide additional information about the image data:
 - Image presentation properties such as:
 - Tonescale
 - Colourspace
 - Image attribution (metadata) such as:
 - Intellectual property rights
 - Sensor characteristics
 - Geospatial information
 - Multi-image/graphic/text/etc. composition

Formats Using JPEG

- Legacy JPEG
 - NITF2.0 and NITF2.1
 - JFIF
 - SPIFF
 - TIFF
 - Others
- JPEG 2000
 - JP2
 - NITF2.1
 - Others

Functionality Added to Legacy JPEG by the NITFS Format

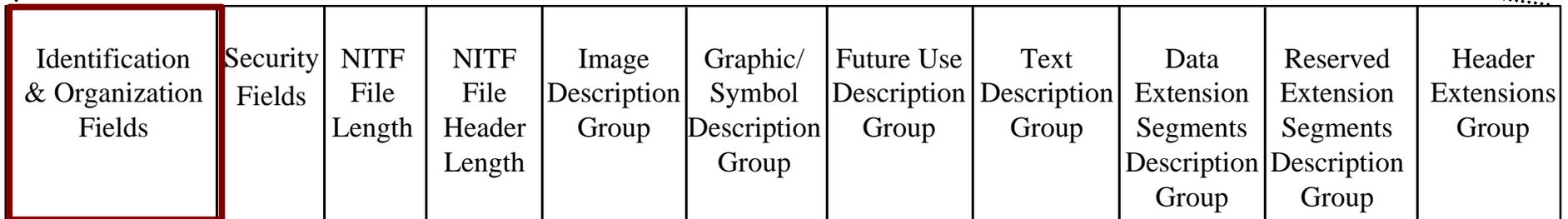
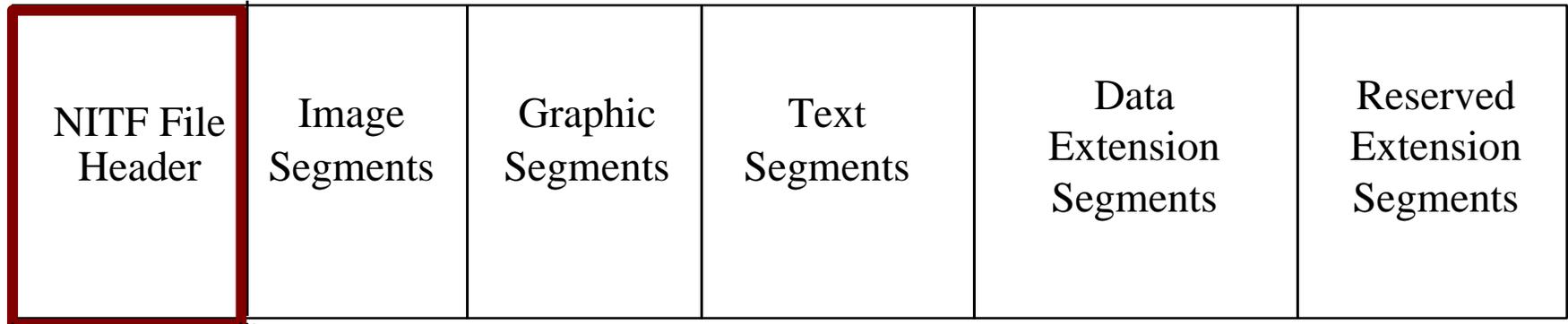
- Color designation for components (bands)
- Use of Color Transform Functions
- Sample Value Remapping and LUTs
- Image Blocking / Tiling
- Component Interleaving Modes
- Indexed access into large image files
- Vacant Block / Tile Masking
- Error Management
- Reduced Resolutions

Role of NITFS Format With JPEG 2000

- Image Rendering (Image/Pixel Structure)
- Basic/common image/pixel attributes
- Multi-image/graphic/etc. composition
- Parameters and Attribution, for example:
 - Discovery and Retrieval
 - Security
 - Geospatial Attributes
 - Exploitation Support Data

NITF FILE STRUCTURE

NITF 2.1 & NSIF 1.0



NITF File Header

- **Identification and Organization Fields**
 - FHDR NITF
 - FVER 02.10
 - **CLEVEL** **03, 05, 06, 07, 09**
 - STYPE BF01
 - OSTAID Originating Station Identifier
 - FDT File Data and Time
 - FTITLE File Title
 - FBKGC File Background Color
 - ONAME Originator's Name
 - OPHONE Originator's Phone Number

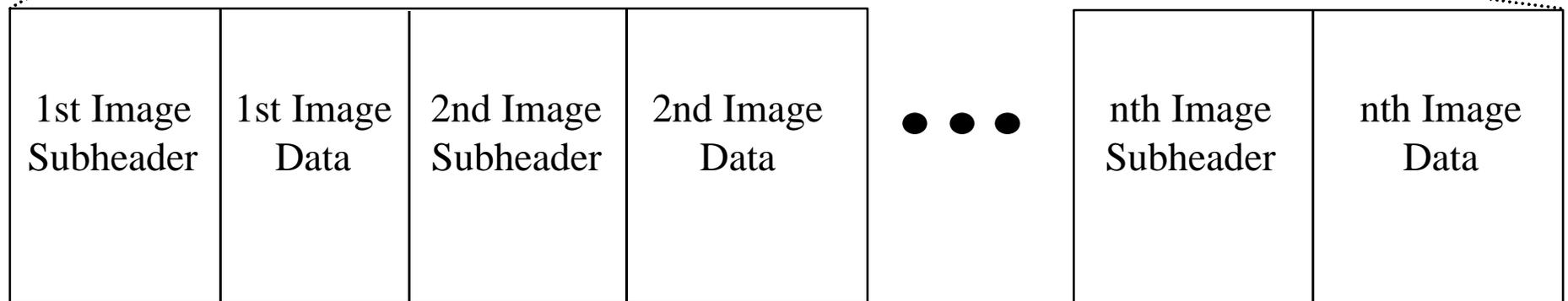
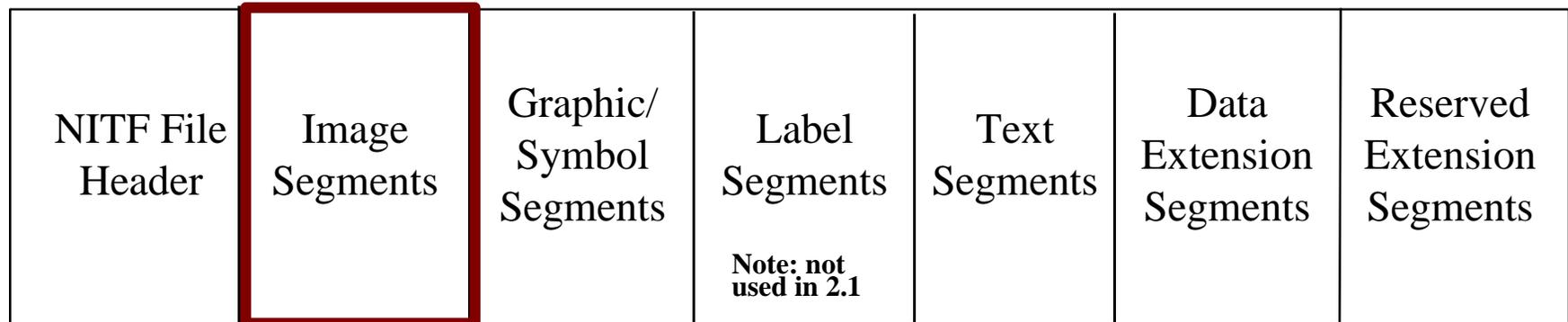
J2K & CLEVELs

- Same CLEVEL constraints as currently defined in Mil-Std-2500B, Table A-10 for:
 - Common Coordinate System (CCS) Extents
 - Maximum File Sizes
 - Image Segment Row x Column Sizes
 - Image Blocking
 - Number of Bands in an Image Segment
 - Number of Image Segments Per File
 - Number of Graphic, Text, & Extension Segments per File

J2K & CLEVELS (cont.)

- J2K attributes common across CLEVELS:
 - Lossless compression (numerically reversible)
 - Lossy compression (numerically irreversible)
 - Binary, Integer, and Signed Integer (PVTYPES)
 - 01 - 37 bits-per-pixel (per component/band)
 - With and Without LUTs (LUTs with lossless case only)
 - IREPs: MONO, RGB/LUT, RGB, and MULTI, plus two new IREPS: J2KICT and J2KRCT
 - IMODE = B (interleave by block/tile) default for all J2K code stream progression options.
 - IC = C8, M8 (M8 with lossless transparent pixel mask)

NITF IMAGE SEGMENT FILE STRUCTURE



NITF IMAGE SEGMENT FILE STRUCTURE (CONT'D)

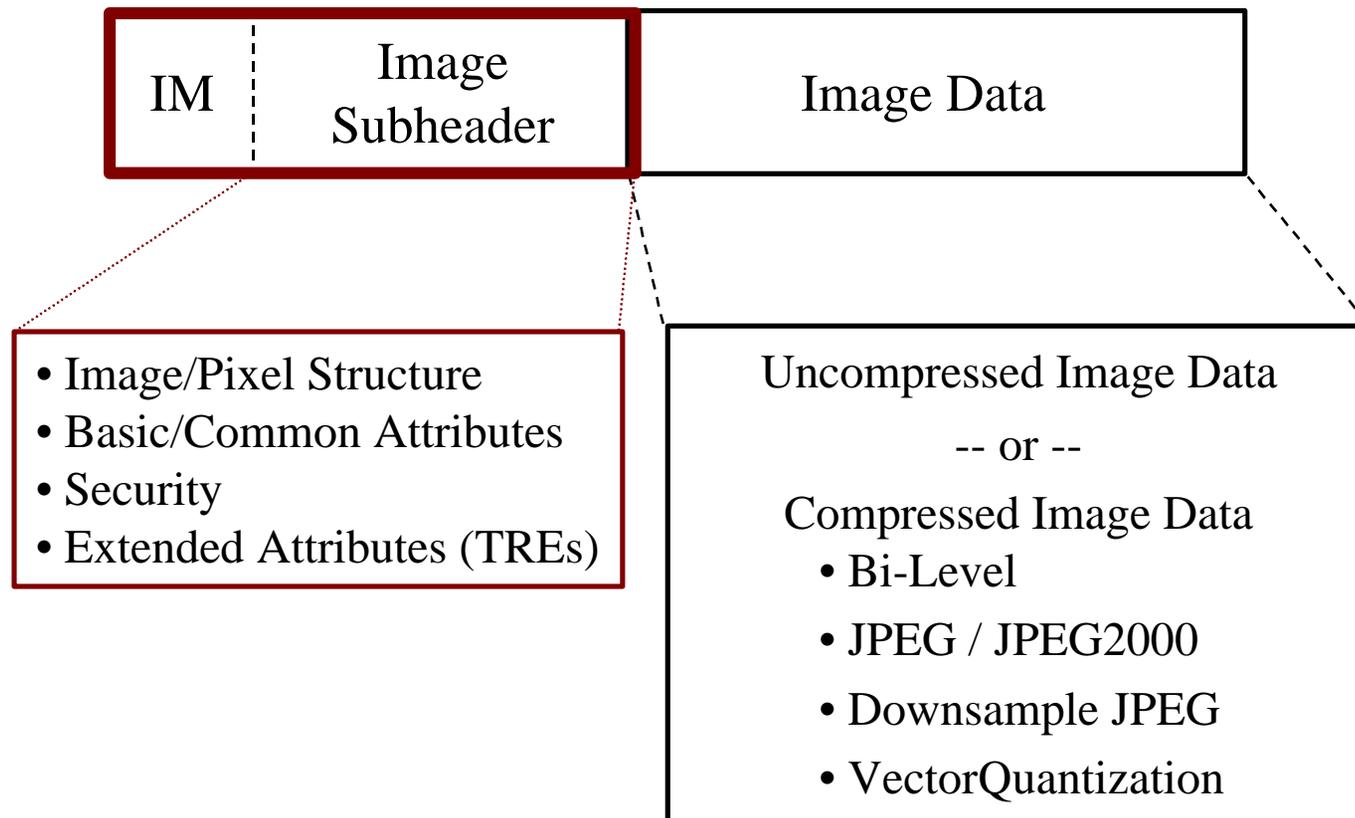


Image Subheader Fields

- IM
- IID1
- IDATIM
- TGTID
- IID2
- Security Fields
- ENCRYP
- ISORCE
- **NROWS / NCOLS**
- **PVTYPE**
- **IREP / IREP BANDnn**
- ICAT / ISUBCATnn
- **ABPP / NBPP**
- PJUST
- ICORDS / IGEOLO
- NICOM / ICOMn
- **IC / COMRAT**
- **NBANDS / XBANDS**
- IFCn / IMFLTn
- **NLUTSn / NELUT / LUTDnm**
- ISYNC
- IMODE
- NBPR / NBPC
- NPPBH / NPPBV
- IDLVL / IALVL
- ILOC
- IMAG
- UDID / IXSHD

NROWS/NCOLS

- **Proposed J2K Guidance:**

Correlate these values with the J2K SIZ markers for the component (s) with the greatest H/V resolution (least grid separation) available in the compressed code stream:

Set NROWS = $[Ysiz/YRsiz] - [YOsiz/YRsiz]$

Set NCOLS = $[Xsiz/XRsiz] - [XOsiz/XRsiz]$

Note: XRsiz and YRsiz values are those from the component(s) with the smallest value of Rsiz. Round up fractions to nearest integer value.

PVTYPE

- **Proposed J2K Guidance:**

Select the applicable PVTYPE code value based on the pixel value type of the image prior to compression, i.e. the pixel value type that can be obtained by decompressing the image data. Derived from J2K marker, Ssiz.

B	1 bit-per-pixel (binary) Integer
INT	2-37 bits-per-pixel Integer
SI	2-37 bits-per-pixel Signed Integer

IREP/IREPBAND_n

- **Proposed J2K Guidance:**

Select the applicable IREP code value based on the image representation of the image data within the J2K code stream. (MONO, RGB/LUT, RGB, MULTI)
(Additional 'colour' IREPs of J2KICT and J2KRCT)

The sequence of IREPBAND_n designations shall correlate with the J2K sequence of component numbers. (M, R, G, B, LU)
(Additional values: Y0, Y1, Y2 for new colour IREPs)

ABPP/NBPP

- **Proposed J2K Guidance:**

Correlate these values with the J2K SIZ marker for precision ($Ssizi^i$). Populate the fields with the largest bit-depth of all the components in the J2K code stream.

For J2K, NBPP and ABPP are set to the same value.

IC

- **Proposed J2K Guidance.**

Use code C8 to designate the image data is compressed using J2K (no mask tables).

Limited use of mask tables, IC code M8:

- Block mask records are not needed because J2K handles empty blocks internally and the TLM marker provides a byte offset index to blocks/tiles.
- Transparent Pixel code designation only makes sense for Lossless (reversible) compression.
- Transparent pixel mask record byte offset index records must correlate with the TLM marker.

COMRAT

- **Proposed J2K Guidance.**

Populate the COMRAT field with the approximate number of bits-per-pixel-per-band for the compressed image.

Precede the value with:

- N for numerically lossless
- V for lossy, but visually lossless
- L for lossy

Use a floating decimal point representation, e.g. N.nn, Nn.n, Nnnn, V.nn, Vn.n, Vnnn, etc.

NBANDS/XBANDS

- **Proposed J2K Guidance:**

Correlate this value with the J2K SIZ marker for number of components available in the compressed code stream as included in the Image Segment data field:

$$\text{NBANDS/XBANDS} = \text{Csiz}$$

IFC_n / IMFLT_n

- **Proposed J2K Guidance:**

Not used with J2K compression.

Set IFC_n = N.

Populate IMFLT_n with BCS spaces.

NLUTS / NELUT_n / LUT_{nm}

- **Proposed J2K Guidance:**

LUTs may only be used with lossless (reversible) J2K compression options.

ISYNC

- **Proposed J2K Guidance:**
Not used with J2K compression.
Set ISYNC = 0.

IMODE

- **Proposed J2K Guidance:**
Set IMODE = B for all instances of J2K compressed data progressions.

(B = Interleaved by Block/Tile)

NBPR / NBPC

- **Proposed J2K Guidance:**

Populate with the number of J2K tiles in the row (X) and column (Y) directions of the J2K code stream.

NPPBH / NPPBV

- **Proposed J2K Guidance:**

Populate with the block/tile size of the J2K reference grid for the image: XTsiz, YTsiz.

A typical block/tile size is 1024 x 1024.

When an image is large enough to warrant more than one block/tile, block/tile sizes smaller than 1024 x 1024 should be avoided since this will adversely impact the efficiency of compression.

ILOC

- **Proposed J2K Guidance:**

Populate the ILOC field relative to the row/column offset location in the NITF Common Coordinate System (CCS) of the first pixel of the first row of the image, i.e. the pixel pointed to by (XOsiz, YOsiz).

NOTE: The ILOC (row,col) offset values are relative to the origin of the object to which the image segment is attached.

IMAG

- **Proposed J2K Guidance:**

Populate this field with the value corresponding to the highest resolution available in the compressed image code stream relative to the original source image.

NOTE: Proper population of the IMAG field is critical to associating pixel row/column indices within the context of the image support data. When chipping, also use ICHIPB TRE.

UDID/IXSHD

- **Proposed J2K Guidance:**

Populate/update the new J2KLRA TRE.

The J2KLRA TRE provides information about the original source image:

- Number of wavelet levels
- Number of layers & target bit-rate for each layer
- Number of bands

And, if the original source image has been parsed, the number of levels, layers and bands remaining in the parsed image.