NOTICE OF CHANGE

NOT MEASUREMENT SENSITIVE

MIL-STD-188-198A
NOTICE 3
1 March 2001

DEPARTMENT OF DEFENSE
INTERFACE STANDARD

JOINT PHOTOGRAPHIC EXPERTS GROUP (JPEG) IMAGE COMPRESSION FOR THE NATIONAL IMAGERY TRANSMISSION FORMAT STANDARD

TO ALL HOLDERS OF MIL-STD-188-198A:

1. THE FOLLOWING PAGES OF MIL-STD-188-198A HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
Cover	14 March 1997	Cover	reprinted without change
ii	14 March 1997	ii - Of Notice 2	1 March 2001
vi	14 March 1997	vi - Of Notice 2	1 March 2001
1	12 October 1994	1 - Of Notice 1	1 March 2001
3	12 October 1994	3 - Of Notice 1	1 March 2001
51	12 October 1994	51 - Of Notice 1	1 March 2001
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53	15 December 1993	53	1 March 2001
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57	15 December 1993	57	reprinted without change
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59	12 October 1994	59 - Of Notice 1	reprinted without change
60	14 March 1997	60 - Of Notice 1	1 March 2001
60a	new page	not applicable	1 March 2001
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61b	14 March 1997	61b - Of Notice 2	1 March 2001
61c	14 March 1997	61c – Of Notice 2	1 March 2001
DD 1426	14 March 1997	DD 1426	1 March 2001

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-188-198A will verify that the page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military standard is completely revised or canceled.

Custodians:
Army – SC
Navy – OM
Air force –90
MISC – DC4

Preparing Activity:
NIMA - MP
(Project TCSS 0055)

NOT MEASUREMENT SENSITIVE

MIL-STD-188-198A
15 December 1992

SUPERSEDING
MIL-STD-188-198
18 June 1993

DEPARTMENT OF DEFENSE
INTERFACE STANDARD

JOINT PHOTOGRAPHIC EXPERTS GROUP (JPEG) IMAGE COMPRESSION
FOR THE
NATIONAL IMAGERY TRANSMISSION FORMAT STANDARD

AMSC N/A **AREA TCSS**

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FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for formatting digital imagery and imagery-related products and exchanging them among members of the Intelligence Community (IC), as defined by Executive Order 12333, and other departments and agencies of the United States Government, as governed by Memoranda of Agreement (MOA) with those departments and agencies.

2. The National Imagery Transmission Format Standard Technical Board (NTB) developed this standard based upon currently available technical information.

3. The Department of Defense (DOD) and other members of the IC are committed to interoperability of systems used for formatting, transmitting, receiving, and processing imagery and imagery-related information. This standard describes the Joint Photographic Experts Group (JPEG) compression algorithm and establishes its application within the NITFS.

4. Beneficial comments (recommendations, additions, deletions) and other pertinent data which may be of use in improving this document should be addressed to the National Imagery and Mapping Agency (NIMA), 12310 Sunrise Valley, Reston II Building, Mailstop P24, Reston, VA 20191-3449 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

5. Portions of this document were reproduced from the Draft CCITT Recommendation T.81 (1992) with prior authorization from the copyright holder, International Telecommunications Union (ITU). DOD takes sole responsibility for the selection of portions from the ITU document for reproduction, with subsequent additions or changes, which should not be attributed to the ITU. In 1994, Draft CCITT Recommendation T.81(1992) became the final international standards, ITU-T T.81(1994) and ISO/IEC 10918-1:1994.

CONTENTS

SUPERSEDES PAGE vi OF MIL-STD-188-198A, NOTICE 2.

1. SCOPE

1.1 Scope. This standard establishes the requirements to be met by systems complying with NITFS when image data are compressed using the JPEG image compression algorithm as described in DIS 10918-1, *Digital Compression and Coding of Continuous-tone Still Images*.

1.2 Content. This standard provides technical detail of the NITFS compression algorithm designated by the code C3 in the Image Compression field of the National Imagery Transmission Format (NITF) file image subheader, JPEG, for both eight- and 12-bit gray scale imagery and 24-bit color imagery. It also provides the required default quantization tables for use in Secondary Imagery Dissemination Systems (SIDS) complying with NITFS.

1.3 Applicability. This standard is applicable to the Intelligence Community and the Department of Defense. It is mandatory for all Secondary Imagery Dissemination Systems in accordance with the memorandum by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence ASD(C^3I) Subject: National Imagery Transmission Format Standard (NITFS), 12 August 1991. This standard shall be implemented in accordance with the National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan (N-0105/98) and MIL-HDBK-1300. New equipment and systems, those undergoing major modification, or those capable of rehabilitation shall conform to this standard.

1.4 Tailoring task, method, or requirement specifications. The minimum compliance requirements for implementation of this compression algorithm are defined in NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan (N-0105/98).

1.5 Types of operation. This standard establishes the requirements for the communication or storage for interchange of image data in compressed form. Each type of operation defined by this standard consists of three parts:

a. The compressed data interchange format (which defines the image data field of the NITF file format).

b. The encoder.

c. The decoder.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplements thereto, cited in the solicitation.

STANDARDS

FEDERAL

FED-STD-1037B	-	Telecommunications: Glossary of Telecommunication Terms, 3 June 1991.

MILITARY

MIL-STD-2500	-	National Imagery Transmission Format (NITF) for the National Imagery Transmission Format Standard (NITFS).

HANDBOOKS

MIL-HDBK-1300	-	National Imagery Transmission Format Standard (NITFS).

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building #4, Section D, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation.

NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan (N-0105/98)	-	NITFS Certification Test and Evaluation Program Plan

(Copies of NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan (N-0105/98) may be obtained from DISA/JIEO/JITC/TCBD, Fort Huachuca, AZ 85613-7020.)

5.2.3.3.2.1 Multiple block image data format (IMODE=B or P). The top level of figure 20 specifies that the JPEG compressed data is contained in the Image Data Field of the NITF file. The second level of figure 20 specifies that this multiple block image format shall begin with the compressed data for the first image block and shall be followed by the compressed data for each image block, one after the other, left to right, top to bottom. The third level of figure 20 specifies that each compressed block shall begin with an SOI marker, shall contain one frame, and shall end with an EOI marker. The format below this level is identical to the single block case previously described in 5.2.3.3.1.

5.2.3.3.2.2 Multiple block image data format (IMODE=S). The use of this IMODE requires that the image contain multiple blocks and multiple bands, otherwise IMODE shall be set to B or P. The top level of figure 21 specifies that the JPEG compressed data is contained in the Image Data Field of the NITF file. The second level of figure 21 specifies that this multiple block image format shall begin with the compressed data for the first image band and shall be followed by the compressed data for each image band, one after the other, first to last. The third level of figure 21 specifies that each compressed image band shall consist of the compressed data (for that band) for each image block, one after the other, left to right, top to bottom. The fourth level of figure 21 specifies that each compressed block shall begin with an SOI marker, shall contain one frame, and shall end with an EOI marker. The format below this level is identical to the single block case previously described in 5.2.3.3.1 with each frame containing only one scan that contains the compressed data from only one band.

5.2.3.3.3 JPEG Multispectral compressed format. Multispectral image data may be compressed as either IMODE B or S. Consideration must be given to the number of components each IMODE will allow and how to identify these components in the Frame and Scan headers.

5.2.3.3.3.1 Multispectral compressed format (IMODE=B). The JPEG format has a limit of 255 components when compressing multi component imagery with IMODE=B, for both single block and multiple block cases. Components shall be identified by the values placed in the “component number” and matching “Scan component selector” fields. This value shall start at zero (0x00) and increase monotonically to 254 (0xFE). These fields are contained in the Frame header and Scan header. Their format is shown in tables IV and VI respectively.

5.2.3.3.3.2 Multispectral compressed format (IMODE=S). The JPEG format has no upper limit with regard to the number of components that can be compressed with IMODE=S. Components shall be identified by the values placed in the “component number” and matching “Scan component selector” fields. NITF implementations may identify compressed components with any number (0x00 through 0xFF). Implementations may also number compressed components in any order, as long as the order of the compressed components matches the order of the components found in the source image. Implementations may also identify components using the same identification number. For example, all of the compressed components could be identified with the number 0x01. Despite the free use of the component identification fields, implementations are strongly encouraged to monotonically number the compressed components, starting with 0x00. If the number of components exceeds 256, the identification value should roll over to 0x00 and start the sequence again.

5.2.3.3.4 Frame header. The frame header specifies the source image characteristics, the components in the frame, the sampling factors for each component, and selects the quantization table to be used with each component. The format is shown in table IV with variable fields specified in table V for the different image types.

TABLE IV. Frame header.

Offset	Field Value	Field Name	length (bytes)	comments	
0	see table V	SOF_n	2	Start of frame. SOF_0 is used for "Baseline DCT sequential" mode when P=8. When P=12, SOF_1 must be used for "Extended DCT sequential, Huffman coding". Essentially, Baseline requires: sequential DCT, P=8; Huffman coding; 8-bit quantization tables; and no more than two sets of Huffman tables. Extended sequential allows: P=12,16-bit quantization tables, and up to four sets of Huffman tables.	
2	see table V	L_f	2	Length of parameters = $(8+3N_f)$	
4	see table V	P	1	Sample precision, 8 or 12, (see SOF_n note)	
5	1-65535	Y	2	Number of lines (note 0 is not allowed)	
7	1-65535	X	2	Number of samples per line	
9	see table V	N_f	1	Number of components per frame, 1 to 255	
10	0	C_1	1	Component number = 0 (R or Y)	
11	see table V	H_1V_1	1	Horizontal & vertical sampling factors	
12	see table V	TQ_1	1	Quantization table selector	
13	1	C_2	1	Component number = 1 (G or Cb)	if $N_f = 3$
14	see table V	H_2V_2	1	Horizontal & vertical sampling factors	if $N_f = 3$
15	see table V	TQ_2	1	Quantization table selector	if $N_f = 3$
16	2	C_3	1	Component number = 2 (B or Cr)	if $N_f = 3$
17	see table V	H_3V_3	1	Horizontal & vertical sampling factors	if $N_f = 3$
18	see table V	TQ_3	1	Quantization table selector	if $N_f = 3$

TABLE V. Variable frame header fields.

Field Name	8-bit gray scale	12-bit gray scale	RGB color	YCbCr601 color	Multispectral
SOF_a	0xFFC0 (SOF_0)	0xFFC1 (SOF_1)	0xFFC0 (SOF_0)	0xFFC0 (SOF_0)	0xFFC0 or 0xFFC1
L_f	11	11	17	17	8 + 3 N_f
P	8	12	8	8	8 for SOFa = 0xFFC0, 12 for SOFa= 0xFFC1
N_f	1	1	3	3	Up to 255 bands
C_1	0	0	0 (R)	0 (Y)	0
H_1V_1	0 x 11 (no subsampling)	0 x 11 (no subsampling)	0 x 11 (no subsampling)	0x11 (no subsampling), or 0x21(Cb, Cr subsampled horiz), or 0x12 (Cb, Cr subsampled vert)., or 0x22 (Cb, Cr subsampled horizontally & vertically)	0x11 (no subsampling)
TQ_1	0	0	0	0	0 to 3
C_2			1 (G)	1 (Cb)	1
H_2V_2			0 x 11	0 x 11	0x11
TQ_2			1	1	0 to 3
C_3			2 (B)	2 (Cr)	2
H_3V_3			0 x 11	0 x 11	0x11
TQ_3			2	1	0 to 3
. . .					. . .
C_{Nf}					N_f
$H_{Nf}V_{Nf}$					0x11
TQ_{Nf}					0 to 3

5.2.3.3.5 Scan header. The scan header specifies which component(s) are contained in the scan and selects the entropy coding tables to be used with each component. The format is shown in table VI with variable fields specified in table VII for the different types.

TABLE VI. Scan header.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFDA	SOS	2	Start of scan.
2	see table VII	L_s	2	Length of parameters = $(6+2N_s)$.
4	see table VII	N_s	1	Number of components in scan, 1 or 3.
5	0	Cs_1	1	Scan component selector (R or Y).
6	see table VII	Td_1Ta_1	1	(DC, AC) entropy table selectors.
7	1	Cs_2	1	Scan component selector (G or Cb).
8	see table VII	Td_2Ta_2	1	(DC, AC) entropy table selectors.
9	2	Cs_3	1	Scan component selector (B or Cr).
10	see table VII	Td_3Ta_3	1	(DC, AC) entropy table selectors.
7 or 11	0	S_s	1	Start of spectral selection = 0 (NA sequential DCT).
8 or 12	63	S_e	1	End of spectral selection = 63 (NA sequential DCT).
9 or 13	0x00	A_hA_1	1	Successive approximation bit positions (NA).

TABLE VII. Variable scan header fields.

Field Name	**8-bit gray scale**	**12-bit gray scale**	**YCbCr601 color**	**RGB color (interleaved)**	**RGB color (Scan 1 - 3)**	**8-bit MS (Scan 1 - N_f)**	**12-bit MS (Scan 1 - N_f)**
L_s	8	8	12	12	8	8	12
N_s	1	1	3	3	1	1	1
Cs_1	0	0	0 (Y)	0 (R)	0 (R), 1 (G), 2 (B)	0 (band 1), 1 (band 2), . . . $\mathbf{N}_f - 1$(Band $\mathbf{N}_f$)	0 (band 1), 1 (band 2), . . . $\mathbf{N}_f - 1$(Band $\mathbf{N}_f$)
Td_1Ta_1	0x00	0x00	0x00	0x00 or 0x11	0x00 or 0x11	0x00 or 0x11	0x00 or 0x11 or 0x22 or 0x33
Cs_2			1 (Cb)	1 (G)			
Td_2Ta_2			0x11	0x00 or 0x11			
Cs_3			2 (Cr)	2 (B)			
Td_3Ta_3			0x11	0x00 or 0x11			

5.2.3.3.6 Table-specification and miscellaneous marker segments. At the places indicated [tables/misc.] on figures 19, 20, and 21 any of the table-specification segments or miscellaneous marker segments specified in 5.2.3.3.5.1 - 5.2.3.3.5.5 may be present in any order and with no limit on the number of segments. If any table specifications occur in the compressed image data, they shall replace any defaults or previous specifications, and shall be used whenever the tables are required in the remaining scans in the frame. If a table specification occurs more than once for a given table in the compressed image data, each specification shall replace the previous specification.

5.2.3.3.6.1 Quantization table-specification. The quantization table segment format is shown in table VIII with variable fields specified in table IX for the different image types. Note Consecutive tables can appear under separate Quant Table headers. Ie Three tables, three 0xFFC4 markers. For example, it is possible to specify the two tables used for YCbCr601 DCT compression with one or two DQT marker segments as shown in table IX.

TABLE VIII. Quantization table specification.

Offset	**Field Value**	**Field Name**	**length (bytes)**	**comments**	
0	0xFFDB	DQT	2	Define quantization table marker.	
2	see table IX	L_q	2	Length of parameters.	
4	see table IX	P_qT_q	1	Quantization table element precision P_q specifies the precision of the Q_k values in table $\#T_q$. P_q value 0 indicates 8-bit Q_k values; value 1 indicates 16-bit Q_k values. P_q shall be zero for 8-bit sample precision P.	first table
5	see table IX	Q_k	64 or 128	Quantization table elements (64) in zig-zag order.	first table
	see table IX	P_qT_q	1	Quantization table element precision.	last table
	see table IX	Q_k	64 or 128	Quantization table elements (64) in zig-zag order.	last table

TABLE IX. Variable DQT segment fields.

Field Name	**8/12-bit gray scale** (8-bit tables)	**12-bit gray scale** (16-bit tables)	**YCbCr601 color** (2 tables)	**YCbCr601 color** (1 table)	**RGB color** (3 tables)	**RGB color** (1 table)	**MS 8 – bit** (1-4 tables)	**MS 12 – bit** (1-4 tables)	
L_q	67	131	132	67	197	67	2 + 65* $(T_{qn}+1)$	2 + 129* $(T_{qn}+1)$	
P_qT_q	0x00	0x10	0x00	0x00 or 0x01	0x00	0x00 or 0x01 or 0x02	0x00	0x10	first table
Q_k	1-255	1-65535	1-255	1-255	1-255	1-255	1-255	1-65535	
P_qT_q			0x01		0x01		0x01	0x11	second table
Q_k			1-255		1-255		1-255	1-65535	
P_qT_q					0x02		0x02	0x12	third table
Q_k					1-255		1-255	1-65535	
P_qT_q							0x03	0x13	fourth table
Q_k							1-255	1-65535	

5.2.3.3.6.2 Huffman table-specification. The Huffman table segment format is shown in table X with variable fields specified in table XI for the different image types. Note that there may be one or more Huffman tables specified per marker segment. For example, it is possible to specify the two tables used for YCbCr601 DCT compression with one or two DHT marker segments as shown in table XI.

TABLE X. Huffman table specification.

Offset	Field Value	Field Name	Length (bytes)	comments	
0	0xFFC4	DHT	2	Define Huffman table marker.	
2	see table XI	L_h	2	Length of parameters.	
4	see table XI	T_cT_h	1	T_c: Table class; 0=DC table; 1=AC table. T_h: Huffman table identifier (0-1 for baseline).	first table
5	0-255	L_i	16	Number of codes of each length (BITS array).	first table
21	0-255	$V_{i,j}$	see table XI	Symbols (HUFFVAL array).	first table
	see table XI	T_cT_h	1	T_c: Table class; 0=DC table; 1=AC table. T_h: Huffman table identifier (0-1 for baseline).	last table
	0-255	L_i	16	Number of codes of each length (BITS array).	last table
	0-255	$V_{i,j}$	see table XI	Symbols (HUFFVAL array).	last table

TABLE XI. Variable DHT fields.

Field Name	Gray scale (1 DC/AC table)	YCbCr601 color or RGB Color (1 DC/AC table)	MS (1 DC/AC table)	YCbCr601 Color (2 DC/AC tables)	RGB color (2 DC/AC tables)	MS (Up to 4 DC/AC tables)	
L_h	210 (8-bit) 278(12-bit)	210	210 (8-bit) 278(12-bit)	418	418	Up to 1106	
T_cT_h	0x00	0x00	0x00	0x00	0x00	0x00	DC table
# of $V_{i,j}$	12 (8-bit) 16 (12-bit)	12	12 (8-bit) 16 (12-bit)	12	12	16 (12-bit)	
T_cT_h	0x10	0x10	0x10	0x10	0x10	0x10	AC table
# of $V_{i,j}$	162 (8-bit) 226 (12-bit)	162	162 (8-bit) 226 (12-bit)	162	162	226 (12-bit)	
T_cT_h				0x01	0x01	0x01	DC table
# of $V_{i,j}$				12	12	16	
T_cT_h				0x11	0x11	0x11	AC table
# of $V_{i,j}$				162	162	226	

5.2.3.3.6.3 Restart interval definition. The restart interval definition segment format is shown in table XII. NITF requires that the restart interval be no more than the number of MCUs in a block-row.

TABLE XII. Restart interval definition.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFDD	DRI	2	Define restart interval marker.
2	4	L_r	2	Length of parameters.
4	1-65535	R_i	2	Number of MCU in restart interval.

5.2.3.3.6.4 Comment segment. Use of the comment segment is optional for generators and may be ignored by interpreters. The segment structure is shown in table XIII.

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TABLE XIII. Comment segment.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFFE	COM	2	Comment marker.
2	2-65535	L_c	2	Segment length (2+length of comment).
4	0-255	Cm_1-$Cm_{L_c\text{-}2}$	L_c-2	Comment bytes.

5.2.3.3.6.5 Application data segment. JPEG defines an application data segment with the general structure in table XIV. Sixteen different application marker codes are defined: APP_0 - APP_f with corresponding values 0xFFE0 - 0xFFEF.

TABLE XIV. Application data segment.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFE0 - 0xFFEF	APP_n	2	Application data marker: APP_0 - APP_F.
2	2-65535	L_p	2	Segment length (2+length of application data).
4	0-255	AP_1-$AP_{L_p\text{-}2}$	L_p-2	Application data bytes.

5.2.3.3.6.5.1 NITF APP_6 application data segment. NITF requires the use of an APP_6 application data segment. Optional APP_7 directory segments can also be used. No other application data segments shall be present in the compressed data. The NITF APP_6 application data segment shall immediately follow the first SOI marker in the Image Data Field. The NITF APP_6 application data segment contains information which is needed by an interpreter but not supported by the ISO/CCITT JPEG format. Most of this information is also present in some fields of the NITF image subheader (COMRAT, IREPBAND, NBPP, etc.). The format for APP_6 is shown in table XV.

TABLE XV. NITF APP_6 application data segment.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFE6	APP_6	2	NITF application data marker.
2	25	L_p	2	Segment length (2+length of application data).
4	0x4E49 0x5446 0x00	Identifier	5	Zero terminated string: "NITF".
9	0x0200	Version	2	Version number. The most significant byte is used for major revisions, the least significant byte for minor revisions. Version 2.00 is the current revision level.
11	0x42, 0x50 or 0x53	IMODE	1	Image format. Three values are defined at this time. 'B' - IMODE=B 'P' - IMODE=P 'S' - IMODE=S
12	1-9999	H	2	Number of image blocks per row.
14	1-9999	V	2	Number of image blocks per column.
16	0-1	Image Color	1	Original image color representation. Three values are defined at this time. 0 - monochrome 1 – RGB 3 - multispectral
17	1-16	Image Bits	1	Original image sample precision.
18	0-99	Image Class	1	Image data class (0-99). 0x00 - General Purpose 0x01 - VIS 0x02 - IR 0x03 - SAR 0x04 – Downsample JPEG
19	1-29	JPEG Process	1	JPEG coding process. The values for this field are defined to be consistent with ISO 10918-2. Three values are defined at this time. 1 - baseline sequential DCT, Huffman coding, 8-bit sample precision 4 - extended sequential DCT, Huffman coding, 12-bit sample precision 14 - sequential lossless

TABLE XV. NITF APP_6 application data segment - Continued.

20	0-5	Quality	1	Image quantization tables used. Quality levels are 0 – 5. The value 0 shall be used when custom tables are present. Explanation of the optimized tables can be found in Table A-1 and NIMA document N0106-97. Note: With NITF 2.0, default tables were allowed and 0 indicated no defaults, all quantization tables embedded. Since all tables are embedded in NITF2.1, 0 now indicates custom generated tables embedded.

TABLE XV. NITF APP_6 application data segment - Continued.

Offset	Field Value	Field Name	Length (bytes)	comments
21	0 to 3	Stream Color	1	Compressed color representation. Four values are defined at this time. 0 – monochrome 1 – RGB 2 - YCbCr601 3 - multispectral
22	8 or 12	Stream Bits	1	Compressed image sample precision.
23	1	Horizontal Filtering	1	This field specifies the filtering used in the horizontal direction prior to subsampling the chrominance samples. One value is defined at this time. 1 - Centered samples, [1/2, 1/2] filter
24	1	Vertical Filtering	1	This field specifies the filtering used in the vertical direction prior to subsampling the chrominance samples. One value is defined at this time. 1 - Centered samples, [1/2, 1/2] filter
25	0	Flags	2	Reserved for future use.

5.2.3.3.6.5.2 NITF APP_7 directory segments. The NITF APP_7 directory segments are used to provide random access to the variable length compressed data segments. APP_7 segments contain a directory of offset information for a series of scans or restart intervals depending on the directory type. In all cases, offsets are measured from the beginning of the Image Data Field in the NITF file to the beginning of the element. The number of entries depends on the directory type and is the number of (restart intervals per scan) or (scans per block) for directory types: 'R' and 'S', respectively. The format for APP_7 is shown in table XVI where all integers are stored in big endian format. The number of directory entries can be very large for restart interval directories. In these cases it is possible for a directory to exceed the, approximately 64 kbyte, segment limitation fixed by the 2 byte L_p field at offset 2 in any JPEG application data segment. Since each element requires 4 bytes in the directory, this translates to a maximum of 16,382 entries. When a logical directory contains more that 16,382 elements, they must be split between more that one physical directory. In this case, multiple APP_7 directory segments must follow each other with no other intervening data and they must be of the same directory type (restart interval). Each additional APP_7 directory contains those elements, in the same order, that would have been present in the directory had there been no size limitation.

TABLE XVI. NITF APP_7 directory segments.

Offset	Field Value	Field Name	Length (bytes)	comments
0	0xFFE7	APP_7	2	NITF directory segment marker.
2	4N+5	L_p	2	Segment length (2+length of application data).
4	0x52, 0x53	Directory Type	1	Directory type. Two values are defined at this time. 'R' - Restart Interval Directory 'S' - Scan Directory
5		N	2	Number of directory entries. Note 0 is not allowed. Maximum value of N (16,382) maximizes L_p at 65533.
7		1st Offset	4	Offset to first element in this directory. (restart interval, scan).
11		2nd Offset	4	Offset to second element in this directory.
4N+3		Last Offset	4	Offset to last element in this directory.

5.2.3.3.6.5.3 NITF APP6/(Extension NITF0001) image block minimum value. The NITF APP6 application data segment with an ID string "NITF0001.A" contains the minimum value for each scan of an original uncompressed image block before any preprocessing or compression steps are performed. The ID string follows the form NITFxxxx.V, where xxxx is the extension number and V is the version number. The extension number is 0001 and the current version identifier is A.

This application segment also stores the image block index values which specify the relative image block row and image block column position of the frame assigned during the original image operation for Fast Access Format (FAF) based imaging operations. The index values are 1 based, with the first FAF block of the original imaging operation at position (1,1).
NOTE: The scope of the row/column block index is not limited to the contents of a specific NITF file. For purposes of this application data segment, the first block placed in a NITF file does not necessarily have index (1,1). A NITF file may only contain a portion of the image blocks resulting from an original imaging operation. For example, multiple NITF files may be used to store the blocks from an imaging operation to keep file sizes manageable for a particular system. User applications may allow selected blocks to be extracted (chipped) and passed on in a new NITF file. In general, such applications should retain the original row/column index value to retain the context of the row/column where the block was located in the original imaging operation. The option to retain index values or reinitialize the first block in the NITF file to index (1,1) is therefore application specific.

When the NITF tag for the amplitude re-mapping process is used, (IOMAPA), the minimum values stored in APP6/(Extension NITF0001) are utilized by the amplitude re-mapping process described in Appendix D of N-0106-97 (Bandwidth Compression Standards and Guidelines Document). When the NITF amplitude re-mapping tag is used, an APP6/(Extension NITF0001) application data segment must exist for each image block or frame compressed with the 12-bit JPEG algorithm. When using the 12-bit JPEG DCTextended sequential transmission mode with monochrome imagery, the NScan field shall be fixed at 1.

Table XVII contains the format for the APP6/(Extension NITF0001) segment.

TABLE XVII. NITF JPEG AAP6/(Extension NITF0001) segment format for image block minimum values.

Offset	Field Value	Field Name	Length	Comments
0	OxFFE6	APP6	2	NITF APP Data Marker
2	Variable	Lp	2	Seg Length (See Note 4)
4	0x4E435446 0x30303031 0x2E41 0x00	ID_STRING	11	Null terminated ID string used to identify the APP6 tag as the minimum pixel amplitude storage extension "NITF0001.A"
15	Generated (see note 1)	Image Block Row No.	4	(See Note 3)
19	Generated (see note 1)	Image Block Col No.	4	(See Note 3)
23	Generated (see note 2)	NScan	2	Number of Scans per Frame
25	Generated (see note 2)	Min_Value_1	2	Min. value of Scan #1 in Image Block
. . .	. . .	. . .	. . .	. . .
C	Generated (see note 2)	Min-Value_NScan	2	Min. value of Scan #Nscan in Image Block
C	0x0000 (see note 5)	Flags	2	Reserved for Future Use

Notes:
1) Value is 4 byte unsigned binary integer representation
2) Value is 2 byte unsigned binary integer representation

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3) Image block index relative to the transmitted image. The top left image block is indexed (row, column) - > (1,1)
4) Length Lp = 25 + (2*NScan)
5) The offset label of C is used for the conditional offsets dependent on the value of the NScan field.

Figures 22 and 23 show the location of the APP6/(Extension NITF0001) application data segments relative to other NITF components.5.2.3.3.6.5.4 NITF APP6/(Extension NITF0002) Forward Error Correction (FEC) code. The NITF APP6/(Extension NITF0002) application data segment with an ID string "NITF0002.A" contains the FEC (Forward Error Correction) codes which are used to protect the NITF/JPEG header and misc. table data from bit errors. The ID string follows the form NITFxxxx.V, where xxxx is the extension number and V is the version number. The extension number is 0002 and the current version identifier is A.

The FEC codes are applied to:

a. NITF/JPEG Frame Header and Misc. Tables
b. NITF/JPEG Scan Header and Misc. Tables

Two different forms of the APP6/(Extension NITF0002) application data segment shall be used for each image block, one for the frame overhead data and one for the scan overhead data. The two forms are conditional based on the value of the APP6/(Extension NITF0002) Mode_Type field which discriminates the frame and scan forms of the extension. The frame mode version of the tag is placed in the tag region before the Start of Frame marker code, and the scan version of the tag falls in the tag area preceding each Start of Scan marker in an image block.

The two forms are very similar with the exception of the values contained in the Mode_Type field and the 8 byte ASCII formatted SYNC Code inserted before the Reed-Solomon FEC bytes.

The placement of the APP6/(Extension NITF0002) application segments is shown in figures 24 and 25.

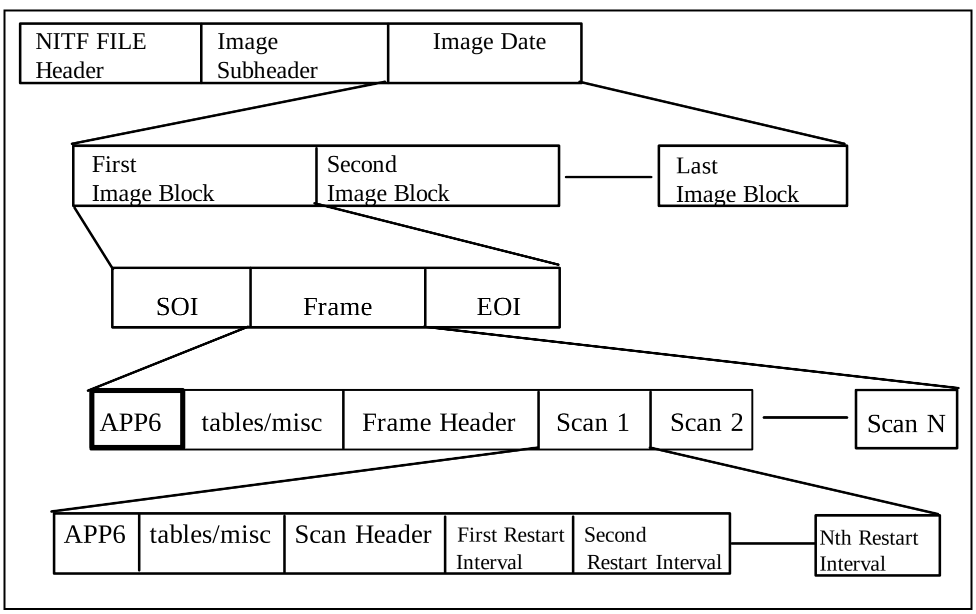

FIGURE 24. NITF 12 bit JPEG/DCT multiple block file structure with FEC (TRANSMISSION MODE = B or P).

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
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