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NGA STANDARDIZATION DOCUMENT

NATIONAL IMAGERY TRANSMISSION FORMAT VERSION 2.1

Implementation Profile

for

Tactical Hyperspectral Imagery (HSI) Systems

Specification of the data content, structure and metadata
for tactical HSI data products

(2011-07-27)

Version 1.0

NATIONAL CENTER FOR GEOSPATIAL INTELLIGENCE STANDARDS

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CHANGE LOG

Date	Version	Description	DR/CA	Developer
27 JUL 2011	1.0	Initial publication of NITF2.1 IP.		

TBR/TBD LOG

Date	Description	Developer	Date Addressed
19 JUL 2011	Table 4.1.27-2 JPEG 2000 Target Bit Rate Layers have not been optimized for Hyperspectral Products		

IMPORTANT NOTICE

A hardcopy of this document may not be the version currently in effect. The current version is available at the following web-address: https://nsgreg.nga.mil. The current version can always be verified on the web prior to using this document.

REFERENCES

The reference documents listed in this section consist of existing standards, guidelines, and handbooks published by various organizations of the United States government, the North Atlantic Treaty Organization (NATO), international standards bodies, non-governmental technical organizations, and, in some cases, private and public corporations.

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 by this implementation profile document, whether or not they are listed here. At the time of publication, the editions indicated in the following tables were valid. All documents are subject to revision and users of this profile document should investigate recent editions and change notices of the documents listed below.

DEPARTMENT OF DEFENSE STANDARDS	
MIL-STD-2500C	DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, 01 May 2006
MIL-STD-188-198A(4)	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with Notice 1, 12 October 1994; Notice 2, 14 March 1997; Notice 3, 1 March 2001; and Notice 4, 31 March 2004

FEDERAL INFORMATION PROCESSING STANDARDS	
FIPS PUB 10-4	Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions, Apr 1995 NOTE: Effort is underway to transition from use of FIPS10-4 country codes to those of ISO 3166-1.

NATO STANDARDIZATION AGREEMENTS	
STANAG 4545	Standardization Agreement 4545, NATO Secondary Imagery Format (NSIF), Edition 1, Amendment 1, 14 April 2000, with Errata Sheet dated 1 May 2007 NOTE: Edition 2 is in the final stages of being ratified to replace Edition 1. Edition 2 adopts ISO/IEC BIIF Profile - NSIF01.01.

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY PUBLICATIONS	
STDI-0002-1	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS) Version 4.0, 1 August 2011
STDI-0005	Implementation Practices of the National Imagery Transmission Format Standard (IPON) Version 1.0, 1 August 2007
STDI-0006	National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD), 23 July 2008.
TR 8350.2	Department of Defense World Geodetic System 1984, Third edition, 04 Jul 1997 with Amendment 1 (03 Jan 2000) and Amendment 2 (23 Jun 2004)
N-0105/98	National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan, 25 Aug 1998
N0106-97	National Imagery Transmission Format Standard Bandwidth Compression Standards and Guidelines Document, 25 Aug 1998
NGA.IP.0001_1.0	Implementation Profile for Tagged Image File Format (TIFF) and Geographic Tagged Image File Format (GeoTIFF), Version 1.0, 2008-11-18
NGA.STND.0012_2.0	National System for Geospatial Intelligence Metadata Foundation (NMF) - Part 1: Conceptual Schema Profile, Version 2.0

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION	
ISO 3166-1	Codes for the representation of names of countries and their subdivisions – Part 1: Country codes
ISO/IEC 12087-5:1998 w/Corrigenda 1&2	Information technology – Computer graphics and image processing – Image processing and interchange (IPI) – Functional specification – Part 5: Basic image interchange format (BIIF), 01 Dec 1998
ISO/IEC 15444-1:2004 w/Cor1:2007/2:2008 & Amd1:2006/2:2009	Information Technology - JPEG 2000 image coding system: Core coding system, Edition 2, 2004-09-23; Cor 1:2007, Edition 1, 2007-07-10; Cor 2:2008 Clarification on determination of maximum file size, Edition1, 2008-04-07; Amd 1:2006 Profiles for digital cinema applications, Edition 1, 2006-01-09; Amd 2:2009 Extended profiles for cinema and video production and archival applications, Edition 1, 2009-12-0
ISO/IEC BPJ2K01.10	Information technology – Computer graphics and image processing – registered graphical item – Class: BIIF Profile – BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10)
ISO/IEC BIIF PROFILE NSIF01.01	Information technology – Computer Graphics and Image Processing – Registered Graphical Item, Class: BIIF Profile – NATO Secondary Imagery Format Version 01.01. June 2008

INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS STANDARDS	
IEEE 754	IEEE Standard for binary floating-point arithmetic

COMMERCIAL STANDARDS	
ESRI	ESRI Shapefile Technical Description, An ESRI White Paper – July 1998, Environmental Systems Research Institute, Inc., 380 New York St., Redlands, CA 92373-8100
GeoTIFF	GeoTIFF Format Specification, GeoTIFF Revision 1.0, Specification Version: 1.8.2, December 28, 2000 (http://www.remotesensing.org/geotiff/spec/geotiffhome.html)
TIFF 6.0	TIFF™ Revision 6.0 Specification, Final – June 3, 1992. Adobe Developers Association, Adobe Systems Incorporated, 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900 (http://partners.adobe.com/public/developer/en/tiff/TIFF6.pdf)
JFIF	JPEG File Interchange Format Version 1.02, September 1, 1992. C-Cube Microsystems, 1778 McCarthy Blvd., Milpitas, CA 95035 (eric@c3.pla.ca.us)

ACRONYMS

The Acronyms used in this document are defined as follows:

BCS-A	Basic Character Set – Alphanumeric
BCS-N	Basic Character Set –Numeric
DES	Data Extension Segment
ECS-A	Extended Character Set – Alphanumeric
FTITLE	File Title
HDR	File Header
IP	Implementation Profile
IID1	Image Identifer 1
IID2	Image Identifier 2
JPEG	Joint Photographic Experts Group
IM	IMage
IS	IMage Segment
LWIR	Long-Wavelength InfraRed
MWIR	Mid-Wavelength InfraRed
NESR	Noise Equivalent Spectral Radiance
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NSG	National System for Geospatial-Intelligence
RSM	Replacement Sensor Model
RSM*	The set of RSM TREs
SWIR	Short-Wavelength InfraRed
TII	Tactical Image Identifier
TRE	Tagged Record Extension
VNIR	Visible and Near-InfraRed

Additional acronyms may be found in the following reference documents:

- *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard;* Section 3.1
- *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS);* Appendix A
- *STDI-0005, Implementation Practices of the National Imagery Transmission Format Standard (IPON);* Appendix A
- *STDI-0006, National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD);* Section 5

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1.0 Introduction

This Implementation Profile (IP) describes the National Imagery Transmission Format (NITF) 2.1 image file formats and metadata profiles for the various products generated by tactical, i.e., airborne, hyperspectral remote sensing systems and their ground processing elements.

Tactical Hypersepctral Imagery (HSI) datasets that comply with this Implementation Profile (IP) will be suitable for ingest, processing, exploitation, and dissemination by the National System for Geospatial Intelligence (NSG).

1.1 Purpose

This IP details the preferred application of the National Imagery Transmission Format Standard (NITFS) to tactical HSI systems delivering data to the NSG. As a result, tactical HSI datasets will be interoperable with the tools, techniques, and segments of the NSG, ensuring efficient, low-cost integration seamless workflow for NSG end-users.

1.2 Scope

The current scope of this IP is to support the design, development, and implementation of NITF2.1-compliant datasets (products) produced by HSI remote sensing systems. This IP identifies both the standards, and the standards application guidance, needed to produce dataset content compatible with the NSG architecture tailored to the capabilities and operational requirements of the system. Adherence to the provisions of this ICD promotes consistency of dataset content among different remote sensing systems. This IP addresses the application of foundation standards to enable an HSI data product to contain the following types of information:

- HSI sensor radiance measurements filtered by spectral band (HSI cube)
- NSG foundational metadata for description, security and discovery of HSI products
- Image (cube) to ground position correlation and error management
- Radiometric and quality characteristics of the HSI pixel values
- Parameters to support non-literal exploitation of HSI data content
- Pixel processing history

This IP is restricted to primary exploitable, hyperspectral imagery with the following characteristics:

1. Collected from an airborne platform
2. Simultaneously or near simultaneously acquired bands
3. Each band has the same spatio-temporal extent
4. Each band has the same number of pixels in the row and column dimensions
5. Each supporting image segment has the same coverage extent as the hyperspectral image segment.

In order to accommodate a broad range of tactical HSI systems, this Implementation Profile is broken into three pieces

1. Primary Document
2. Addendum A: Unclassified systems tailoring matrix
3. Addendum B: Classified systems tailoring matrix

2.0 General Requirements

This IP describes the format and metadata value ranges used in the formation of NITF2.1 Hyperspectral imagery datasets. Hyperspectral datasets provided in the NITF2.1 product file formats defined herein are readily accessible via the current architecture of the NSG. Additional image segments, Tagged Record Extensions, and Data Extension Segments are permitted.

Data producers should have their output data capability tested/certified for conformance with the base standards, the provisions of the profile, and the provisions of the sensor-specific addendum. They need to demonstrate all variations of output as driven by the collection modality supported by the system. Implementers of this profile should use the National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan (N-0105/98) as a reference.

2.1 Dataset Content

Table 2.1-1 defines the content of the airborne HSI dataset.

Table 2.1-1: Airborne HSI dataset

Segment	Type	Description	Obligation
QUICK_LOOK	IS	A single-band monochromatic or three-band 'color' visualization image derived from the HSI image segment. This is an overview representation of the HSI data.	Required
HYPERSPECT	IS	A three-dimensional grid (cube) of spectral measurement values (pixels); the collected HSI data.	Required
PIX_LATLON	IS	A two-dimensional location grid of latitude and longitude values identifying the horizontal position of the HSI pixels.	Required
PIX_HEIGHT	IS	A two-dimensional grid of height values. Used in conjunction with the PIX_LATLON segment to identify the vertical position of the HSI pixels.	Optional
BADPIXMAP	IS	Pixel quality information on a pixel-by-pixel basis to enable human imagery analysts and automated exploitation software know the degree to which individual pixel values are valid for exploitation.	Required
NESR_DATA	IS	A grid of values representing the root-mean-square (RMS) noise of each spectral measurement expressed in unit of radiance.	See Addendum for obligation and associated details
CSSHPA	DES	The contents of the shapefile describes the footprint of the image, as it exists on the ground, with as much fidelity as possible given the 1000-vertex limit.	Optional
TRE_OVERFLOW	DES	A NITF Data Extension Segment (DES) designated to contain TRE overflow.	TRE overflow condition in HYPERSPECT image segment.

2.2 Dataset Structure

The generalized structure of the NITF2.1 files defined in this IP take the form of a single NITF Header (HDR) followed by one or more NITF Image Segments (IMs) and ending with none, one, or more NITF Data Extension Segments (DESs). Figure 2.2-1 provides a high-level picture of this general file structure.

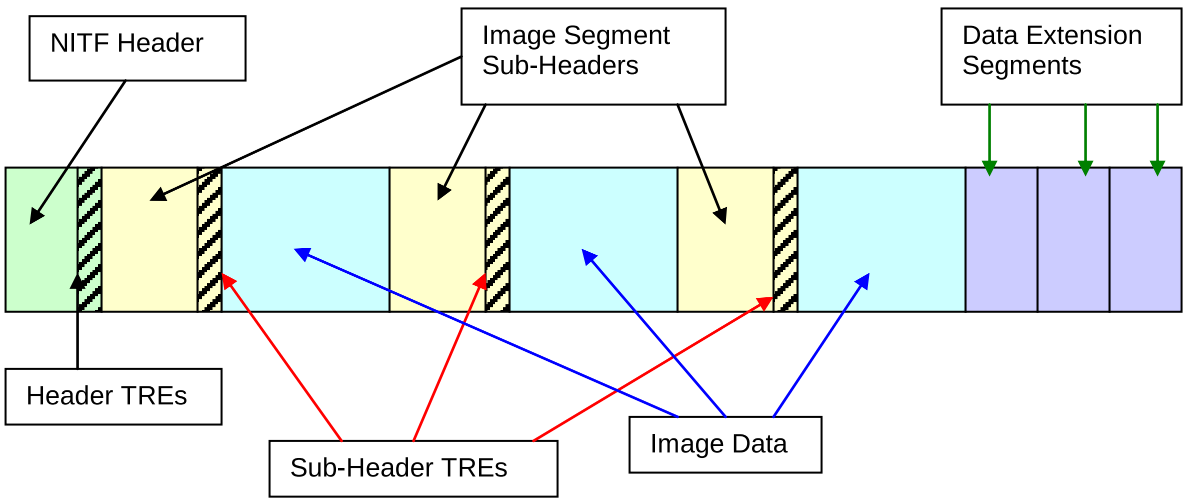

Figure 2.2-1: General NITF2.1 File Structure

The current version of this IP does not make use of Graphic Segments, Text Segments, or Reserved Extension Segments, though this does not preclude the use of these NITF structures in future versions of this standard.

See the individual Hyperspectral (section 3.0) product description sections for discussion of the specific types and numbers of NITF structures used for a given product dataset. All relevant Tagged Record Extensions (TRE) are discussed generally in the individual dataset descriptions in section 3.0, as well as specifically in section 4.0. This does not preclude use of additional TRE not discussed within this IP.

Acceptable file naming extensions for use with these Hyperspectral NITF2.1 datasets include, but are not limited to, the following values: “.ntf”, “.nitf”, “.ntf21”, “.nitf21”, “.NTF”, “.NITF”, “.NTF21”, and “.NITF21”. A lack of file extension is also permitted.

A more detailed view of the specific structure for the NITF2.1 files defined in this IP is provided in Figure 2.2-2, which includes an overview for the allocation of TREs throughout the file structure. The figure identifies those file segments that are always required (R), those that are optional (O), and those that are conditional (C) when producing an HSI NITF file per the provisions of this IP. The conditions for which segments marked as ‘(C)’ are included in an NITF file are described later in section 3.0.

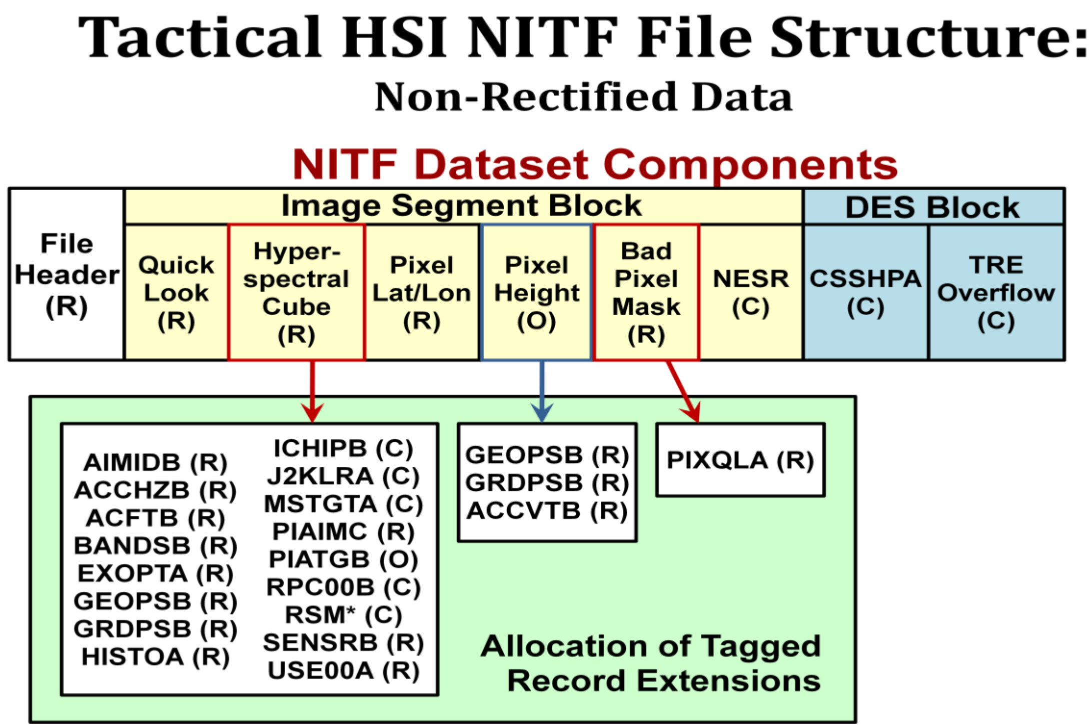

Figure 2.2-2: Tactical HSI NITF File Structure: Non-Rectified Data

The principal component for an HSI NITF file is the Hyperspectral Image Segment (HYPERSPECT). Figure 2.2-3 provides an overview of the TRE allocation for the HSI image segment and an indication of the functional purpose of the TREs selected for use with the Hyperspectral Image Segment. TRE functionality includes data content description, discovery, radiometry, processing history and geo-positioning information. Details for the content of the Hyperspectral image segment are provided in section 3.1.3.

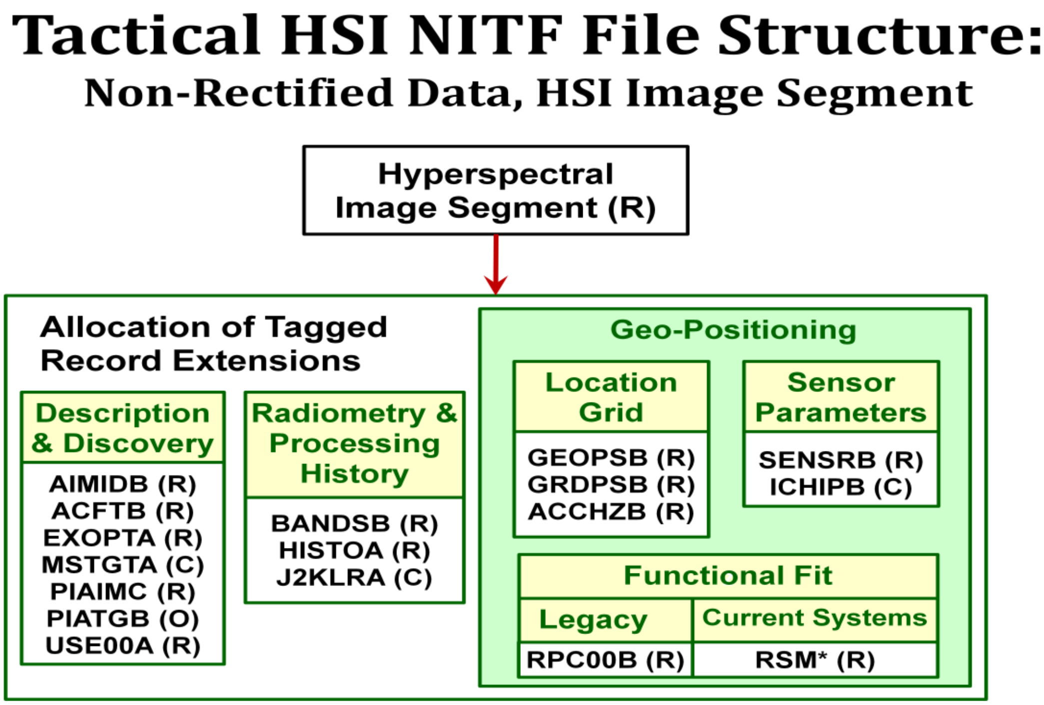

Figure 2.2-3: Tactical HSI NITF File Structure: Non-Rectified Data, HSI Image Segment

2.3 Tactical Image Identifier

Table 2.3-1 defines the Tactical Image Identifier (TII) definitions to be used with the various NITF2.1-formatted Hyperspectral data products. The TII is used as the convention for the naming of the actual NITF2.1 file, as well as the value placed into the NITF2.1 Header field, FTITLE, and the NITF2.1 Image Segment Subheader field, IID2. This 40-character file identifier is used for cataloging and discovery purposes within the NSG architecture.

For additional information refer to *STDI-0005*, *Implementation Practices of the National Imagery Transmission Format Standard (IPON).*

2.4 NITF Security Fields Description

This NITF2.1 profile for HSI products requires compliant NITFS Security Fields as defined in MIL-STD-2500C and existing security marking polices in effect at the time of file creation or modification. Table 2.4-1 provides the specific implementation of the NITF2.1 Security Fields for use with HSI datasets.

2.5 Sensor Parameters for Non-Literal Exploitation

The National Geospatial-Intelligence Agency (NGA) in collaboration with the Department of Defense (DoD) components, the Intelligence Community (IC), industry, and academia have worked together to identify, define, and standardize the essential sensor parameters required to support robust non-literal exploitation and, in turn, integrated exploitation. Non-literal exploitation is the analysis of measurable, quantifiable, repeatable data collected by remotely-located sensors to produce information of intelligence value that cannot be interpreted by the human eye and cognitive system.

Sensor parameters for non-literal exploitation can be categorized as 'dynamic' and 'static' parameters. Dynamic parameters are specific to each sensed image, while 'static' parameters vary less frequently, or not at all. Appendix D lists the 'static' spectro-radiometric sensor parameters that each sensor developer shall separately provide to their customers in addition to parameters contained in NITF files. See sensor-specific addendum for details.

2.6 Spatial and Temporal Extents

This NITF2.1 profile for HSI products requires that all metadata and supporting image segments cover the full extent of the main HYPERSPECT image segment. This does not necessarily mean that the other image segments have the same dimensions, but they should be compatible in coverage. However, all unprojected image segments should be referenced to the upper left corner of the upper left pixel of the HYPERSPECT segment, which is treated as the origin of a left-handed common image coordinate system (MIL-STD-2500C, section 5.4.2.1). In the case of temporal metadata that are not directly tied to the image or projected map spaces associated with the HYPERSPECT segment (e.g., time-stamped SENSRB data), it is required that those metadata cover the entire temporal extent of the imaging event and, if possible, a small buffer on either side.

Table 2.3-1: Tactical Image Identifiers for Hyperspectral Datasets

Tactical Image Identifiers for Hyperspectral Datasets.					
IID2 Bytes	**Subfield Name**	**Subfield Description**	**Data Type**	**Value Range**	**Type**
1-7	ACQUISITION_ DATE	**Acquisition Date**. This is the image collection date and **not** the start of mission date or aircraft takeoff date. Note: This is the same date (different format) as recorded in the Image Subheader IDATIM field	BCS-A	DDMMMYY (for all products)	R
8-9	PROGRAM_ CODE	**Program Code**. Assigned by Operations (e.g., CAOC). This value is the same as the first 2 characters of the Mission ID. 1st char is numeric and 2nd char is alphabetic -OR- 1st char is alphabetic and 2nd char is numeric	BCS-A	0-9, A-Z (uppercase)	R
10-11	SORTIE_NO	**Sortie Number**. Assigned by Operations. Last two characters of sortie number of the month.	BCS-A	0-9, A-Z (uppercase)	R
12-16	SCNUM	**Scene Number**. Identifies the current scene, and is determined from the mission plan, except for ad hoc “re-tasking” or “immediate scenes”. Scene numbers do not have to be sequential, only unique. See paragraph J.3.3 of the IPON (STDI-0005) for further details.	BCS-N	00000-99999	R
17-18	PRODUCER_ CODE	**DoD/DIA Producer Code**. Uniquely defines a producer per site. Site designation.	BCS-A	AA-ZZ (uppercase)	R
19-24	PRODUCT_NO	**Product Number**. “Producer-defined” product ID number which uniquely defines each product produced by a given producer. This could be a simple one-up product sequence number.	BCS-A	0-9, A-Z (uppercase)	R
25-26	PROJECT_ CODE	**Project Code**. Two-character NGA assigned project code.	BCS-A	AA-ZZ (uppercase)	R
27-29	REPLAY	**Replay Indicator**. Indicates whether the data was reprocessed or retransmitted. See paragraph J.3.1 of the IPON (STDI-0005) for additional discussion. 000: original C01: DCGS-I Look Composite C02: DCGS-I Volume Composite G01-G99: Reprocessed Image T01-T99: Retransmitted Image	BCS-A	000, C01, C02, G01-G99, T01-T99 (uppercase)	R

Tactical Image Identifiers for Hyperspectral Datasets.					
IID2 Bytes	**Subfield Name**	**Subfield Description**	**Data Type**	**Value Range**	**Type**
30-32	PRODUCER _SN	**Producer Serial Number**. Defines a unique instance of the primary image producer (e.g., processor). Note: Represented as either a decimal or a hexadecimal value.	BCS-A	000-FFF (No spaces allowed) (uppercase)	R
33-40	PRODUCTION _DATIM	**Production Date and Time**. Eight-character (hex) production date/time (GMT represented in hexadecimal as elapsed time in seconds since midnight Jan 1, 1970. Note: This date & time should be equivalent to, or within 5 seconds of the NITF2.1 header field, FDT, and the PIAPRx field, PRODUCRTIME, (format is different). Any transaction, change, modification, and/or editing of the image segment (subheader and/or pixels) requires updating characters 33-40 of the Tactical Image ID (PRODUCTION_DATIM) to reflect the date/time of the processing action. Anytime a processor edits & resaves a NITFS IM segment that has the new Tactical Image ID, it must update the subfield for PRODUCTION_DATIM (bytes 33-40). If the image segment is resaved unmodified ("as is") or as part of another NITF file (e.g., accumulated into a volume in a NITF file with MITOCA), then the PRODUCTION_DATIM subfield does not need to be updated. See paragraph J.3.2 of the IPON (STDI-0005) for reduced resolution data sets (Rsets).	BCS-A	00000000-FFFFFFFF (hexadecimal value of seconds from midnight Jan 1, 1970; a.k.a. UNIX time) Note: Alpha-characters shall be upper-case.	R

Table 2.4-1: NITF2.1 Security Fields for HSI Products

NITF2.1 Security Fields for HSI Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
xSCLAS	**File Part Security Classification**. This field shall contain a valid value representing the classification level of the entire file.	1	ECS-A	T, S, C, R, or U *For fields xSCLAS through xSCTLN, consult current security guidelines and directives at the time of production to determine proper markings.*	N/A	R
xSCLSY	**File Part Security Classification System**. This field shall contain valid values indicating the national or multinational security system used to classify the file. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fsclsy.html for register of codes added via the NTB registration process.*	2	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCODE	**File Part Codewords**. This field shall contain a valid indicator of the security compartments associated with the file.	11	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCTLH	**File Part Control and Handling**. This field shall contain valid additional security control and/or handling instructions (caveats) associated with the file. *Note: See http://jitc.fhu.disa.mil/nitf/reg_fields.html and STDI-0005 IPON for info on CH code value handling.*	2	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSREL	**File Part Releasing Instructions**. This field shall contain a valid list of country and/or multilateral entity codes to which countries and/or multilateral entities the file is authorized for release.	20	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSDCTP	**File Part Declassification Type**. This field shall contain a valid indicator of the type of security declassification or downgrading instructions that apply to the file.	2	ECS-A	DD, DE, GD, GE, O, X (Default is ECS spaces (0x20))	N/A	<R>
xSDCDT	**File Part Declassification Date**. This field shall indicate the date on which a file is to be declassified if the value in File Declassification Type is DD.	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	UTC	<R>

NITF2.1 Security Fields for HSI Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
xSDCXM	**File Part Declassification Exemption**. This field shall indicate the reason the file is exempt from automatic declassification if the value in File Declassification Type is X. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fsdcxm.html for register of codes added via the NTB registration process.*	4	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSDG	**File Part Downgrade**. This field shall indicate the classification level to which a file is to be downgraded if the values in File Declassification Type are GD or GE.	1	ECS-A	S, C, R (Default is ECS spaces (0x20))	N/A	<R>
xSDGDT	**File Part Downgrade Date**. This field shall indicate the date on which a file is to be downgraded if the value in the File Declassification Type is GD.	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	Date	<R>
xSCLTX	**File Part Classification Text**. This field shall be used to provide additional information about file classification to include identification of a declassification or downgrading event if the values in File Declassification Type are DE or GE. It may also be used to identify multiple classification sources and/or any other special handling rules.	43	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCATP	**File Part Classification Authority Type**. This field shall indicate the type of authority used to classify the file. Valid values are O (original classification authority), D (derivative from a single source), and M (derivative from multiple sources	1	ECS-A	O, D, M (Default is ECS spaces (0x20))	N/A	<R>

NITF2.1 Security Fields for HSI Products.						
FIELD NAME	DESCRIPTION	SIZE	DATA TYPE	VALUE RANGE	UNITS	TYPE
xSCAUT	**File Part Classification Authority**. This field shall identify the classification authority for the file dependent upon the value in FSCATP. Values are user defined free text which should contain the following information: original classification authority name and position or personal identifier if the value in FSCATP is O; title of the document or security classification guide used to classify the file if the value in FSCATP is D; and Derive-Multiple if the file classification was derived from multiple sources and the value of the FSCATP field is M. In the latter case, the file originator will maintain a record of the sources used in accordance with existing security directives. One of the multiple sources may also be identified in File Classification Text if desired.	40	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCRSN	**File Part Classification Reason**. This field shall contain values indicating the reason for classifying the file. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fscrsn.html for register of codes added via the NTB registration process.*	1	ECS-A	A to H, M, N (Default is ECS spaces (0x20))	N/A	<R>
xSRDT	**File Part Security Source Date**. This field shall indicate the date of the source used to derive the classification of the file. In the case of multiple sources, the date of the most recent source shall be used. Format	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	UTC	<R>
xSCTLN	**File Part Security Control Number**. This field shall contain a valid security control number associated with the file. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s).	15	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>

3.0 Hyperspectral NITF2.1 Requirements

3.1 Hyperspectral Product Definition Profiles

The following conventions shall be followed in terms of metadata population. For metadata formatted as "Basic Character Set – Alphanumeric" (BCS-A), the values provided in Tables 3.1.1-1 thru 4.1.17-1 are post-pended with BCS-A spaces (0x20) to the full byte size of the field. Likewise, for metadata formatted as "Extended Character Set – Alphanumeric" (ECS-A) the values provided in Tables 3.1.1-1 thru 4.1.17-1 are post-pended with ECS-A spaces (0x20) to the full byte size of the field. In contrast, for metadata formatted as "Basic Character Set –Numeric" (BCS-N), the values provided in Tables 3.1.1-1 thru 4.1.17-1 are pre-pended with leading BCS-N zeros (0x30) to the full byte size of the field.

Metadata fields in Tables 3.1.1-1 thru 4.1.17-1 having a TYPE designator of "R" are considered to be required fields that must be present in the NITF2.1 dataset. Additionally, fields having this TYPE designation must also be populated with valid data. If the TYPE designator is given as "<R>", then the required field may be populated with a default value of all BCS-A spaces (0x20), regardless of any other directions given in the VALUE RANGE section of the table. The presence of a field having a TYPE designator of "C" is conditional on a value(s) in other metadata fields. If present in the file, then metadata fields of TYPE "C" must contain valid data. A TYPE designator of "<C>" also allows the conditional field to be populated with all BCS-A spaces (0x20) as appropriate.

3.1.1 Hyperspectral Product NITF2.1 Header Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Header as defined in MIL-STD-2500C. Table 3.1.1-1 provides the specific implementation of a NITF2.1 Header for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C*, *DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard*.

Table 3.1.1-1: NITF2.1 Header Fields for Hyperspectral Products

NITF2.1 Header Fields for Hyperspectral Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
FHDR	**File Profile Name**. This field shall contain the BCS-A character string uniquely denoting that the file is formatted using NITF.	4	BCS-A	NITF	N/A	R
FVER	**File Version**. This field shall contain a BSC-A character string uniquely denoting the version.	5	BCS-A	02.10	N/A	R
CLEVEL	**Complexity Level**. This field shall contain the complexity level required to interpret fully all components of the file. Valid entries are assigned in accordance with complexity levels established in Table A-10 of MIL-STD-2500C.	2	BCS-N	03, 05, 06, 07, or 09 (generate as appropriate)	N/A	R
STYPE	**Standard Type**. Standard type or capability. The character string BF01 indicates that this file is formatted using ISO/IEC IS 12087-5.	4	BCS-A	BF01	N/A	R
OSTAID	**Originating Station ID**. This field shall contain the identification code or name of the originating organization, system, station, or product. It shall not be filled with BCS spaces (0x20).	10	BCS-A	alphanumeric	N/A	R
FDT	**File Date and Time**. This field shall contain the time (UTC) (Zulu) of the file's origination.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
FTITLE	**File Title**. This field shall contain the title of the file.	80	ECS-A	alphanumeric, see addendum	N/A	R
FSCLAS Through FSCTLN	**For Security Fields FSCLAS through FSCTLN, refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
FSCOP	**File Copy Number**. This field shall contain the copy number of the file.	5	BCS-N	00000	N/A	R
FSCPYS	**File Number of Copies**. This field shall contain the total number of copies of the file.	5	BCS-N	00000	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
FBKGC	**File Background Color**. This field shall contain the three color components of the file background color in the order Red, Green, Blue. Where (0x00, 0x00, 0x00)=black; (0xFF, 0xFF, 0xFF)=white.	3	Unsigned Binary Integer	0x00 0x00 0x00	N/A	R
ONAME	**Originator's Name**. This field shall contain a valid name for the operator who originated the file.	24	ECS-A	Default is all ECS spaces (0x20)	N/A	<R>

NITF2.1 Header Fields for Hyperspectral Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
OPHONE	**Originator's Phone Number**. This field shall contain a valid phone number for the operator who originated the file.	18	ECS-A	Default is all ECS spaces (0x20)	N/A	<R>
FL	**File Length**. This field shall contain the length in bytes of the entire file including all headers, subheaders, and data. Note: The largest file is limited to 999999999998 (10^{12}-2) bytes.	12	BCS-N	000000000388 to 999999999998, see addendum	Bytes	R
HL	**NITF File Header Length**. This field shall contain a valid length in bytes of the NITF file header.	6	BCS-N	000388 to 999999	Bytes	R
NUMI	**Number of Image Segments**. This field shall contain the number of separate image segments included in the file.	3	BCS-N	001 to 999	N/A	R
Start of Number of Image Segments Loop; If NUMI ≠ 000, then Loop runs from 1 to NUMI.						
LISHn	**Length of nth Image Subheader**. This field shall contain a valid length in bytes for the nth image subheader, where n is the number of the IS counting from the first IS (n=001) in order of the image segment's appearance in the file.	6	BCS-N	000439 to 999998	Bytes	C
LIn	**Length of nth Image Segment**. This field shall contain a valid length in bytes of the nth IS data, where n is the number of the IS counting from the first IS (n=001) in order of the IS appearance in the file.	10	BCS-N	0000000001 to 9999999998	Bytes	C
End of Number of Image Segments Loop.						
NUMS	**Number of Graphic Segments**. This field shall contain the number of separate graphic segments included in the file.	3	BCS-N	000	N/A	R
NUMX	**Reserved for Future Use**. This field is reserved for future use and shall be filled with BCS zeros (0x30).	3	BCS-N	000	N/A	R
NUMT	**Number of Text Segments**. This field shall contain the number of separate text segment(s) included in the file.	3	BCS-N	000	N/A	R
NUMDES	**Number of Data Extension Segments**. This field shall contain the number of separate DES included in the file.	3	BCS-N	000 to 999	N/A	R
Start of Number of Data Extension Segments Loop; If NUMDES ≠ 000, then Loop runs from 1 to NUMDES.						
LDSHn	**Length of nth Data Extension Segment Subheader**. This field shall contain a valid length in bytes for the nth DES subheader, where n is the number of the DES counting from the first DES (n=001) in order of the DES's appearance in the file.	4	BCS-N	0200 to 9998	Bytes	C

NITF2.1 Header Fields for Hyperspectral Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LDn	**Length of nth Data Extension Segment**. This field shall contain a valid length in bytes of the data in the nth DES, where n is the number of the DES counting from the first DES (n=001) in order of the DES's appearance in the file.	9	BCS-N	000000001 to 999999998	Bytes	C
End of Number of Data Extension Segments Loop.						
NUMRES	**Number of Reserved Extension Segments**. This field shall contain the number of separate RES included in the file.	3	BCS-N	000	N/A	R
UDHDL	**User Defined Header Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the UDHD.	5	BCS-N	00000	Bytes	R
XHDL	**Extended Header Data Length**. A value of BCS zeros (0x30) shall represent that noTRE are included in the XHD. If TRE exist, the field shall contain the sum of the length of all the TRE appearing in the XHD field plus 3 bytes (length of XHDLOFL field).	5	BCS-N	00000, 00003 to 99999	Bytes	R
If XHDL = 00000, then the following fields are omitted.						
XHDLOFL	**Extended Header Data Overflow**. This field shall contain BCS zeros (0x30) if the TRE in XHD do not overflow into a DES. This field shall be omitted if the field XHDL contains BCS zeros (0x30).	3	BCS-N	000 Omit (if XHDL is all BCS zeros (0x30))	Bytes	C
XHD	**Extended Header Data**. If present, this field shall contain TRE approved and under configuration management of the GWG/NTB. The length of this field shall be the length specified by the field XHDL minus 3 bytes. This field shall be omitted if the XHDL field contains BCS zeros (0x30).	††	Various	TREs Note: While this IP does not identify use of specific TREs in the file header, it does not preclude the use of additional TREs. Omit (if XHDL is all BCS zeros (0x30) or if XHDL is 00003)	N/A	C
End of XHDL conditional.						

†† A value as specified in the XHDL field minus 3 (in bytes)

3.1.2 Hyperspectral Product NITF2.1 Quick-Look Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.2-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard*.

Inclusion of a Quick-Look image segment within an HSI dataset (NITF file) is required. It may consist of a single-band monochromatic image, or a three-band 'color' visualization image, derived from the HSI image segment. A single-band Quick-Look image is recommended for visualizing Long-wavelength infrared (LWIR) and Mid-wavelength infrared (MWIR) source images. A three-band 'color' visualization image is recommended for Visible and near-infrared (VNIR) and Short-wavelength infrared (SWIR) source images. The Quick-Look image resolution may be the same as the HSI image from which it is derived, or may be a reduced resolution, but shall have a maximum size of 1024 pixels in the largest row/column dimension to maintain scale to the HSI cube. The Quick-Look image is intended for simple visualization of the HSI coverage, not for exploitation and should be derived from the HSI image. Consequently, no TREs are included within the image sub header for this image segment.

Table 3.1.2-1: NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	QUICK_LOOK	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	TII (see Table 2.3-1)	N/A	R
ISCLAS through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image.	42	ECS-A	Populate with the value from the HYPERSPECT IS from which this IS was derived.	N/A	R
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 00001024	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 00001024	pixels	R
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image.	3	BCS-A	INT	N/A	R

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image.	8	BCS-A	MONO for single band image. RGB for three band image.	N/A	R
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. This field is used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	VIS	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression.	2	BCS-N	08	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	D for Decimal Degrees (A BCS space is acceptable if IGEOLO values are not available at time of image formation)	N/A	<R>
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field, when present, shall contain an approximate geographic location suffficient to support general user appreciation for the image location (e.g., cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.)	60	BCS-A	±dd.ddd±ddd.ddd (four times) where: ±dd.ddd equals latitude ±ddd.ddd equals longitude + represents northern/eastern hemisphere, - represents southern/western hemisphere) Omit (if ICORDS = a BCS space character (0x20))	deg	C
End of ICORDS conditional.						

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 to 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Alphanumeric Omit (if NICOM = 0 (0x30))	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed. C8 for ISO standard compression JPEG 2000. The definition of the compression scheme associated with code C8 is found in ISO/IEC BPJ2K01.10.	2	BCS-A	NC, C8	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. This field is omitted if the value in IC is NC. If the value of IC is C8, then this field shall be present and contain a value representing the nominal compression rate (numbers of bits-per-pixel-per-band) of the compressed image.	4	BCS-A	Omit (for IC=NC) For C8, See the ISO/IEC BPJ2K01.10 for guidance in populating this field.	N/A	C
End of IC conditional.						
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image.	1	BCS-N	1 (Recommended for LWIR & MWIR) -or- 3 (Recommended for VNIR & SWIR)	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	omit	N/A	C

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**nth Band Representation**. This field shall contain a valid indicator of the processing required to display the nth band of the image with regard to the general image type as recorded in the IREP field. For IREP=MONO, use M for a monochrome representation of the band. For IREP=RGB, use R, G, B respectively for a Red, Green, Blue representation of the respective bands.	2	BCS-A	M (single band case) - or - R, G, B (three band case)	N/A	<R>
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. For ICAT=VIS, populate with all BCS spaces.	6	BCS-A	All BCS spaces (0x20)	N/A	<R>
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B and P. The interpretation of IMODE is dependent on whether the image is JPEG2000 compressed (IC = C8), or uncompressed (IC = NC). The value B indicates band interleaved by block. The value P indicates band interleaved by pixel within each block.	1	BCS-A	B (for single band case, uncompressed) P (for three band case, uncompressed) B (for single and three band cases when JPEG2000 compressed.)	N/A	R

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024 or dimensions of image if less	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024 or dimensions of image if less	pixels	R
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	08	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C.	3	BCS-N	001 - 999 Selected to be highest IDLVL value used in the NITF file.	N/A	R

NITF2.1 Quick-Look Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field.	5	BCS-N	00000	bytes	R
IXSHDL	**Image Extended Subheader Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the IXSHD field. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field).	5	BCS-N	00000	bytes	R

3.1.3 Hyperspectral Product NITF2.1 Hyperspectral Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.3-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard*.

Inclusion of a Hyperspectral image segment within an HSI dataset (NITF file) is mandatory. The Hyperspectral image segment consists of a three-dimensional grid of spectral measurement values (the HSI cube data) in two spatial and one spectral dimension.

Spatially the HSI cube shall be represented as a geo-referenceable grid. Grid rows and columns of the cube with pixel values in their 'as-sampled' collection orientation for which a sensor model-based transformation can be used to convert grid coordinate values to coordinate values of a geographic coordinate reference system.

The HSI cube pixel values represent at sensor radiance the results of various types/levels of image processing:

Table 3.1.3-1: NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters “IM” to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	HYPERSPECT	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	TII (see Table 2.3-1)	N/A	R
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	1	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image. If the source of the data is classified, then the description shall be preceded by the classification, including codeword(s).	42	ECS-A	Alphanumeric Populate with meaningful value to describe the source of the HSI data.	N/A	R
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image. Valid entries are INT for integer; and R for real. The data bits of INT values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. The data bits of R values shall be represented according to IEEE 32 or 64-bit floating point representation (IEEE 754).	3	BCS-A	INT (Case when data is scaled; BANDSB TRE shall contain the Scale Factor and Offset Factor.) R (Case when data is unscaled)	N/A	R
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image. Valid representation indicators are MULTI for multi-band imagery and NODISPLY for an image not intended for display. This field is used in conjunction with the IREPBANDn field to interpret the processing required to display each band in the image.	8	BCS-A	MULTI	N/A	R
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. Valid indicator is HS for hyper-spectral. This field is used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	HS	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression.	2	BCS-N	08 to 32	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	D for Decimal Degrees (A BCS space is acceptable if IGEOLO values are not available at time of image formation)	N/A	<R>

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field, when present, shall contain an approximate geographic location suffficient to support general user appreciation for the image location (e.g., cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.)	60	BCS-A	±dd.ddd±ddd.ddd (four times) where: ±dd.ddd equals latitude ±ddd.ddd equals longitude + represents northern/eastern hemisphere, - represents southern/western hemisphere) Omit (if ICORDS = a BCS space character (0x20))	deg	C
End of ICORDS conditional.						
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 to 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Alphanumeric Omit (if NICOM = 0 (0x30))	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed. C8 for ISO standard compression JPEG 2000. The definition of the compression scheme associated with code C8 is found in ISO/IEC BPJ2K01.10.	2	BCS-A	NC, C8 For PVTYPE “R”, JPEG 2000 compression shall not be used. For PVTYPE “INT”, when JPEG2000 compressed, use numerically lossless mode only.	N/A	R

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. This field is omitted if the value in IC is NC. If the value of IC is C8, then this field shall be present and contain a value representing the nominal compression rate (numbers of bits-per-pixel-per-band) of the compressed image. Note: For JPEG 2000 compression, the bit-rate stored in COMRAT may not contain the required precision. The J2KLRA TRE and the JPEG 2000 codestream itself should be interrogated to find the true bit-rate values.	4	BCS-A	Omit (for IC=NC) Nxxy (for IC=C8) Numerically Lossless compression, where the bit-rate is given as xx.y and the decimal point is implied.	N/A	C
End of IC conditional.						
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image. The value is BCS zero (0x30) for multiple band images or matrices with greater than 9 bands.	1	BCS-N	0	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image.	5	BCS-N	00010-99999	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**n^{th} Band Representation**. This field shall contain a valid indicator of the processing required to display the n^{th} band of the image with regard to the general image type as recorded in the IREP field. The valid values when IREP contains MULTI are M, R, G, B, and BCS spaces (0x20). Use M for a monochrome representation of the band. Use R, G, B respectively for a Red, Green, Blue representation of the respective bands. When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired.	2	BCS-A	R, G, B, M, BCS spaces It is recommended that 3 of the bands have the IREPBANDn fields populated with R, G, and B. For consistency, spectral images cannot have more than one band each marked as R, G, or B.	N/A	<R>

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. For ICAT=HS, ISUBCATn contains the band's wavelength in nanometers.	6	BCS-A	Band wavelength in nanometers	N/A	<R>
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B, P, and R. The interpretation of IMODE is dependent on whether the image is JPEG2000 compressed (IC = C8), or uncompressed (IC = NC). The value B indicates band interleaved by block. The value P indicates band interleaved by pixel within each block. The value R indicates band interleaved by row within each block.	1	BCS-A	B, P, or R for uncompressed data. B only for JPEG 2000 compressed data.	N/A	R
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	DESCRIPTION	SIZE	DATA TYPE	VALUE RANGE	UNITS	TYPE
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024, or image dimension if less	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024 or image dimension if less	pixels	R
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	08, 16, 32	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C.	3	BCS-N	001 – 999 Selected to be a lower IDLVL value than that used for a QUICK_LOOK image segment.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field. If one or more TRE exists, then the field shall contain the sum of the length of all the TRE field plus 3 bytes (length of UDOFL field).	5	BCS-N	00000 00003-99999	bytes	R
If UDIDL = 00000, then the following fields are omitted.						
UDOFL	**User Defined Image Sub-header Overflow**. If present, this field shall contain BCS zeros (0x30). This field shall be omitted if the field UDIDL contains BCS zeros (0x30).	3	BCS-N	000 Omit (if UDIDL is all BCS zeros (0x30))	bytes	C
UDID	**User-Defined Image Sub-header Data** If present, this field shall contain TRE approved and under configuration management of the GWG/NTB. The length of this field shall be the length specified by the UDIDL field minus 3 bytes. This field shall be omitted if the UDIDL field contains BCS zeros (0x30).	†	User-Defined	TREs See section 4.0 for allowed TREs. Omit (if UDIDL is all BCS zeros (0x30) or if UDIDL is 00003)	N/A	C
End of UDIDL conditional.						
IXSHDL	**Image Extended Subheader Data Length**. The field shall contain the sum of the lengths of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field). If one or more TRE are too long to fit in the IXSHD field and the UDID field, they shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00003-99999	bytes	R

NITF2.1 Hyperspectral Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
If IXSHDL = 00000, then the following fields are omitted.						
IXSOFL	**Image Extended Subheader Overflow**. This field shall contain BCS zeros (0x30) if the TRE in IXSHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow.	3	BCS-N	000 to 999	bytes	C
IXSHD	**Image Extended Subheader Data**. This field shall contain TRE approved and under configuration management of the GWG/NTB. The length of this field shall be the length given by IXSHDL minus 3 bytes.	††	Various	TREs See section 4.0 for allowed TREs.	N/A	C
End of IXSHDL conditional.						

† A value as specified in the UDIDL field minus 3 (in bytes)
†† A value as specified in the IXSHDL field minus 3 (in bytes)

3.1.4 Hyperspectral Product NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.4-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard* and *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix P, Geospatial Support Data Extensions (GEOSDE).

Non-rectified image and height data can be accurately geo-referenced using a location grid reference image segment. This involves associating a grid of horizontal spatial location information with the image and/or height data for which the horizontal spatial information applies. The Pixel Latitude / Longitude image segment (PIX_LATLON) serves as the grid reference image segment for Hyperspectral data sets.

Inclusion of a PIX_LATLON image segment within an HSI dataset (NITF file) is required. The PIX_LATLON image segment contains a two-dimensional location grid of latitude and longitude values identifying the horizontal position for the center of each pixel in the HYPERSPECT image segment.

The PIX_LATLON image segment also provides the horizontal position for each height value contained in the PIX_HEIGHT image segment, when the PIX_HEIGHT image segment is present in the dataset.

Table 3.1.4-1: NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	PIX_LATLON	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	TII (see Table 2.3-1) Use same TII as appears in the HYPERSPECT IID2 field.	N/A	<R>
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image.	42	ECS-A	Populate with the value from the HYPERSPECT IS from which this IS was derived.	N/A	R
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image.	3	BCS-A	R	N/A	R

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image.	8	BCS-A	NODISPLY	N/A	R
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. This field is used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	LOCG	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of “significant bits” for the value in each band of each pixel without compression.	2	BCS-N	64	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	D	N/A	<R>
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field, when present, shall contain an approximate geographic location suffficient to support general user appreciation for the image location (e.g., cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.)	60	BCS-A	±dd.ddd±ddd.ddd (four times) where: ±dd.ddd equals latitude ±ddd.ddd equals longitude + represents northern/eastern hemisphere, - represents southern/western hemisphere)	deg	C
End of ICORDS conditional.						
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 - 9	N/A	R

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Alphanumeric Omit (if NICOM = 0 (0x30))	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed.	2	BCS-A	NC	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. This field is omitted if the value in IC is NC.	4	BCS-A	Omit	N/A	C
End of IC conditional.						
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image.	1	BCS-N	2	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	omit	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**n^{th} Band Representation**. This field shall contain a valid indicator of the processing required to display the n^{th} band of the image with regard to the general image type as recorded in the IREP field. When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired.	2	BCS-A	All BCS spaces (0x20)	N/A	<R>

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. For location grids (ICAT=LOGC), the number of bands is strictly equal to 2; consequently, there are only 2 fields, the ISUBCAT1 field and the ISUBCAT2 field. Use GGX and GGY with the geographic X representing the longitude band and Y representing the latitude band.	6	BCS-A	ISUBCAT1=GGX ISUBCAT2= GGY	N/A	R
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. The value P indicates band interleaved by pixel within each block.	1	BCS-A	P	N/A	R
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024, or image dimension if less	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024 or image dimension if less	pixels	R
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	64	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C. The image or graphic segment in the file having the minimum display level shall have attachment level 0 (IALVL=000).	3	BCS-N	001 – 999 Selected to be a lower IDLVL value than that used for the HYPERSPECT image segment.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R

NITF2.1 Pixel Latitude / Longitude Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field.	5	BCS-N	00000	bytes	R
IXSHDL	**Image Extended Subheader Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the IXSHDL field.	5	BCS-N	00000	bytes	R

3.1.5 Hyperspectral Product NITF2.1 Pixel Height Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.5-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard* and *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix P, Geospatial Support Data Extensions (GEOSDE).

Inclusion of a Pixel Height image segment (PIX_HEIGHT) within Hyperspectral datasets is optional. The PIX_HEIGHT image segment is a two-dimensional grid of height values. It is used in conjunction with the PIX_LATLON image segment to identify the three-dimensional position of the pixels in the HYPERSPECT image segment.

Non-rectified image and height data can be accurately geo-referenced using a location grid reference image segment. This involves associating a grid of horizontal spatial location information with the image and/or height data for which the horizontal spatial information applies. The Pixel Latitude / Longitude image segment (PIX_LATLON) serves as the grid reference image segment for Hyperspectral data sets. The PIX_LATLON image segment provides the horizontal position for each height value contained in the PIX_HEIGHT image segment.

Table 3.1.5-1: NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	PIX_HEIGHT	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	Tactical ID (see Table 2.3-1) Use same TII as appears in the HYPERSPECT IID2 field.	N/A	<R>
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image.	42	ECS-A	Populate with the value from the HYPERSPECT IS from which this IS was derived, or DTED, SRTM, GTOPO, and HRE	N/A	R
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image.	3	BCS-A	R	N/A	R

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image.	8	BCS-A	NODISPLY	N/A	R
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. This field is used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	DTEM	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of “significant bits” for the value in each band of each pixel without compression.	2	BCS-N	64	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	D	N/A	<R>
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field shall contain an approximate geographic location suffficient to support general user appreciation for the image location (e.g., cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.)	60	BCS-A	±dd.ddd±ddd.ddd (four times) where: ±dd.ddd equals latitude ±ddd.ddd equals longitude + represents northern/eastern hemisphere, - represents southern/western hemisphere)	deg	C
End of ICORDS conditional.						
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 - 9	N/A	R

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Omit (if NICOM = 0 (0x30)),	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed.	2	BCS-A	NC	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. This field is omitted if the value in IC is NC.	4	BCS-A	Omit	N/A	C
End of IC conditional.						
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image.	1	BCS-N	1	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	omit	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**nth Band Representation**. This field shall contain a valid indicator of the processing required to display the nth band of the image with regard to the general image type as recorded in the IREP field. When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired.	2	BCS-A	All BCS spaces (0x20)	N/A	<R>
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. Standard values for Digital Terrain Elevation Models (ICAT = DTEM) are units of length from DIGEST Part 3 – 7.	6	BCS-A	M (code for Meters)	N/A	R

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IFCn	**n^{th} Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**n^{th} Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the n^{th} Image Band**. This field shall contain the number of LUTs associated with the n^{th} band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. The value B indicates band interleaved by block.	1	BCS-A	B	N/A	R
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024, or image dimension if less	pixels	R

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024, or image dimension if less	pixels	R
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	64	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C.	3	BCS-N	001 – 999 Selected to be a lower IDLVL value than that used for the HYPERSPECT image segment.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R

NITF2.1 Pixel Height Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field.	5	BCS-N	00000	bytes	R
IXSHDL	**Image Extended Subheader Data Length**. The field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field).	5	BCS-N	00003-99999	bytes	R
If IXSHDL = 00000, then the following fields are omitted.						
IXSOFL	**Image Extended Subheader Overflow**. This field shall contain BCS zeros (0x30) since none of the TRE in IXSHD overflow into a DES.	3	BCS-N	000	bytes	C
IXSHD	**Image Extended Subheader Data**. This field shall contain TRE approved and under configuration management of the GWG/NTB. The length of this field shall be the length given by IXSHDL minus 3 bytes.	††	Various	GEOPSB TRE GRDPSB TRE ACCVTB TRE (optional) See section 4.0 for allowed TREs.	N/A	C
End of IXSHDL conditional.						

†† A value as specified in the IXSHDL field minus 3 (in bytes)

3.1.6 Hyperspectral Product NITF2.1 Bad Pixel Map Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.6-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C*, *DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard* and *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix AA, Pixel Quality (PIXQLA) Tagged Record Extension.

Inclusion of the Bad Pixel Map image segment (BADPIXMAP) within Hyperspectral datasets is required. The BADPIXMAP image segment contains pixel quality information that enables human imagery analysts and automated exploitation software to know the degree to which individual pixel values are valid for exploitation. Pixel value encodings in the BADPIXMAP image segment denote specific pixel quality conditions, thus forming (or allowing the formation of) an array of per-pixel values indicating the quality condition of each pixel in the HYPERSPECT image segment.

Table 3.1.6-1: NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters “IM” to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	BADPIXMAP	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	TII (see Table 2.3-1) Use same TII as appears in the HYPERSPECT IID2 field.	N/A	<R>
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30).	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image.	42	ECS-A	Populate with the value from the HYPERSPECT IS from which this IS was derived.	N/A	<R>
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image.	3	BCS-A	B, INT	N/A	R
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image.	8	BCS-A	NODISPLY	N/A	R

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. This field is used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	PIXQUAL	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression.	2	BCS-N	01 (PVTYPE=B) 02 to 16 (PVTYPE=INT)	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	BCS-A space	N/A	<R>
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 - 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Alphanumeric Omit (if NICOM = 0 (0x30)),	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed. C8 for ISO standard compression JPEG 2000. The definition of the compression scheme associated with code C8 is found in ISO/IEC BPJ2K01.10.	2	BCS-A	NC	N/A	R

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image. The value is BCS zero (0x30) for multiple band images or matrices with greater than 9 bands. If all of the bits are the same for all bands, then NBANDS=1, otherwise NBANDS equals zero and populate XBANDS appropriately.	1	BCS-N	0 or 1	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	00010-99999	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**nth Band Representation**. This field shall contain a valid indicator of the processing required to display the nth band of the image with regard to the general image type as recorded in the IREP field. When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired.	2	BCS-A	BCS-A spaces	N/A	<R>
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. For ICAT=PIXQUAL, ISUBCATn contains the corresponding band's wavelength in nanometers (multi-band case), or BCS spaces (single band case).	6	BCS-A	For NBANDS=1: All BCS spaces (0x20) For NBANDS=0 and XBANDS>=10: Identical values as appear in the HYPERSPECT segment	N/A	<R>
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B, P, and R. The interpretation of IMODE is dependent on whether the image is JPEG2000 compressed (IC = C8), or uncompressed (IC = NC). The value B indicates band interleaved by block. The value P indicates band interleaved by pixel within each block. The value R indicates band interleaved by row within each block.	1	BCS-A	For NBANDS=1: B For NBANDS=0 and XBANDS>=10: Identical value as appears in the HYPERSPECT segment	N/A	R
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024, or image dimension if less	pixels	R

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024, or image dimension if less	pixels	R
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	01,08, 16	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C.	3	BCS-N	001 – 999 Selected to be a lower IDLVL value than that used for the HYPERSPECT image segment.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R

NITF2.1 Bad Pixel Map Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field.	5	BCS-N	00000	bytes	R
IXSHDL	**Image Extended Subheader Data Length**. The field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field).	5	BCS-N	00003-99999	bytes	R
If IXSHDL = 00000, then the following fields are omitted.						
IXSOFL	**Image Extended Subheader Overflow**. This field shall contain BCS zeros (0x30) since none of the TRE in IXSHD overflow into a DES	3	BCS-N	000	bytes	C
IXSHD	**Image Extended Subheader Data**. This field shall contain TRE approved and under configuration management of the GWG/NTB. The length of this field shall be the length given by IXSHDL minus 3 bytes.	††	Various	PIXQLA TRE See section 4.0 for allowed TREs.	N/A	C
End of IXSHDL conditional.						

†† A value as specified in the IXSHDL field minus 3 (in bytes)

3.1.7 Hyperspectral Product NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.1.7-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with these types of Hyperspectral datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard*.

See Addendum for obligation and associated details for inclusion of the Noise Equivalent Spectral Radiance (NESR) image segment (NESR_DATA) with Hyperspectral data sets. The NESR_DATA image segment consists of a grid (cube) of values representing the root-mean-square (RMS) noise of each spectral measurement, expressed in unit of radiance.

The row (NROWS), column (NCOLS), and band (NBANDS/XBANDS) dimensions of the NESR_DATA image segment are directly associated with the dimensions of the HYPERSPECT image segment. The number of bands (NBANDS/XBANDS) for the NESR_DATA image segment is exactly the same as the associated HYPERSPECT image segment. However, there are three cases permitted for NROWS and NCOLS values in the NESR_DATA image segment.

a. The NROWS and NCOLS values are the same for both the NESR_DATA and HYPERSPECT image segments.

b. NROWS=1, and NCOLS is the same as the associated HYPERSPECT image segment. The NESR_DATA image segment consists of an [NCOLS x 1 x NBANDS/XBANDS] array applicable to all rows of the image.

c. NCOLS =1, and NROWS is the same as the associated HYPERSPECT image segment. The NESR_DATA image segment consists of an [1 x NROWS x NBANDS/XBANDS] array applicable to all columns of the image.

Note: For some sensors, the NESR values are constant for a given dimension of the associated image resulting in repetitive duplication of NESR values in the NESR_DATA image segment when using case ‘a’. E.g., the same row of quality values is repeated in the NESR_DATA image segment for every row of pixel values in the associated HYPERSPECT image segment. The unnecessary duplication of pixel NESR information can be avoided by allowing the NROWS/NCOLS of the NESR_DATA image segment to differ from that of the associated HYPERSPECT image segment using case ‘b’ or case ‘c’.

Table 3.1.7-1: NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image.	10	BCS-A	NESR_DATA	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Default is all BCS spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image.	80	ECS-A	TII (see Table 2.3-1) Use same TII as appears in the HYPERSPECT IID2 field.	N/A	<R>
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30.	1	BCS-N	0 (for not encrypted)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image.	42	ECS-A	Populate with the value from the HYPERSPECT IS from which this IS was derived.	N/A	<R>
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image.	8	BCS-N	00000001 to 99999999	pixels	R
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image.	3	BCS-A	R	N/A	R

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image.	8	BCS-A	NODISPLY	N/A	R
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. This field should be used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	MATR	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression.	2	BCS-N	32, 64	bits	R
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO).	1	BCS-A	BCS-A space	N/A	<R>
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 - 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The fields ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block.	80	ECS-A	Alphanumeric Omit (if NICOM = 0 (0x30)),	N/A	C
End of Image Comments Loop.						
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. NC to represent the image is not compressed.	2	BCS-A	NC	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. This field is omitted if the value in IC is NC.	4	BCS-A	Omit	N/A	C

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
End of IC conditional.						
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image. The value is BCS zero (0x30) for multiple band images or matrices with greater than 9 bands.	1	BCS-N	0 - 9	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	00010-99999	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**nth Band Representation**. This field shall contain a valid indicator of the processing required to display the nth band of the image with regard to the general image type as recorded in the IREP field. When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired.	2	BCS-A	All BCS spaces (0x20)	N/A	<R>
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image.	6	BCS-A	All BCS spaces (0x20)	N/A	<R>
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None).	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All BCS spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B.	1	BCS-N	0	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B, P, and R. The interpretation of IMODE is dependent on whether the image is JPEG2000 compressed (IC = C8), or uncompressed (IC = NC). The value B indicates band interleaved by block. The value P indicates band interleaved by pixel within each block. The value R indicates band interleaved by row within each block.	1	BCS-A	B, P, R	N/A	R
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is “0001”, setting the NPPBH value to “0000” designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024, or image dimension if less	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is “0001”, setting the NPPBV value to “0000” designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024, or image dimension if less	pixels	R

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. If IC=C8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	32, 64	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C.	3	BCS-N	001 – 999 Selected to be a lower IDLVL value than that used for the HYPERSPECT image segment.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C.	3	BCS-N	000	N/A	R
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 I.e., ROW=00000 COL=00000	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. The default value is 1.0, indicating no magnification or reduction.	4	BCS-A	1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field.	5	BCS-N	00000	bytes	R

NITF2.1 Noise Equivalent Spectral Radiance (NESR) Image Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IXSHDL	**Image Extended Subheader Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the IXSHD field. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field).	5	BCS-N	00000	bytes	R

3.1.8 Hyperspectral Product NITF2.1 CSSHPA Data Extension Segment Subheader Description

This NITF2.1 profile for Hyperspectral products requires a compliant NITFS Data Extension Segment Subheader as defined in MIL-STD-2500C. Table 3.1.8-1 provides the specific implementation of a NITF2.1 Data Extension Segment Subheader for use with these types of Hyperspectral datasets. The contents of the shapefile shall describe the footprint of the image, as it exists on the ground, with as much fidelity as possible given the 1000-vertex limit.

For additional information refer to *STDI-0006*, *National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD)*.

Table 3.1.8-1: NITF2.1 CSSHPA Data Extension Segment Subheader Fields for Hyperspectral Products

NITF2.1 CSSHPA Data Extension Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
DE	**File Part Type**. This field shall contain the characters “DE” to identify the subheader as a data extension.	2	BCS-A	DE	N/A	R
DESID	**Unique DES Type Identifier**. This field shall contain a valid alphanumeric identifier properly registered with the ISMC.	25	BCS-A	CSSHPA DES	N/A	R
DESVER	**Version of the Data Definition**. This field shall contain the alphanumeric version number of the use of the tag. The version number is assigned as part of the registration process.	2	BCS-N	01	N/A	R
DECLAS Through DECTLN	**For Security Fields DECLAS through DECTLN refer to Section 2.4 for details.**	167	ECS-A	See paragraph 2.4 and Table 2.4-1.	N/A	R
DESSHL	**DES User-defined Subheader Length**. This field shall contain the number of bytes in the DES User-Defined Subheader Fields.	4	BCS-N	0062 or 0080	N/A	R
DES User-Defined Subheader Fields.						
SHAPE_USE	**Shapefile Use**.	25	ECS-A	IMAGE_SHAPE (padded with BCS space characters)	N/A	R

NITF2.1 CSSHPA Data Extension Segment Subheader Fields for Hyperspectral Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
SHAPE_CLASS	**Shapefile Class**. Type of shapes contained within this Shapefile.	10	BCS-N	POLYGON (padded with BCS space characters)	N/A	R
SHAPE1_NAME	**Shapefile 1 Name**. Name of first file in the Shapefile.	3	BCS-A	SHP, SHX, or DBF	N/A	R
SHAPE1_START	**Shapefile 1 Start Offset**. Start location in bytes of the first file, expressed as an offset in the DES User-Defined Data.	6	BCS-N	000000 to 999999	N/A	R
SHAPE2_NAME	**Shapefile 2 Name**. Name of second file in the Shapefile.	3	BCS-A	SHP, SHX, or DBF	N/A	R
SHAPE2_START	**Shapefile 2 Start Offset**. Start location in bytes of the second file, expressed as an offset in the DES User-Defined Data.	6	BCS-N	000000 to 999999	N/A	R
SHAPE3_NAME	**Shapefile 3 Name**. Name of third file in the Shapefile.	3	BCS-A	SHP, SHX, or DBF	N/A	R
SHAPE3_START	**Shapefile 3 Start Offset**. Start location in bytes of the third file, expressed as an offset in the DES User-Defined Data	6	BCS-N	000000 to 999999	N/A	R
DES User-Defined Data.						
User-defined data shall consist of the three files which together comprise the description of an ESRI Shapefile (described in the ESRI Shapefile Technical Description)						

4.0 Product Tagged Record Extension Definitions

The NITF2.1 profiles for Hyperspectral data products use some or all of the following Tagged Record Extensions (TRE):

<u>TRE Present in the NITF2.1 Header</u>

- None

<u>TRE Present in the NITF2.1 Quick-Look Subheader</u>

- None

<u>TRE Present in the NITF2.1 Hyperspectral Subheader or its TRE_OVERFLOW DES</u>

- As listed in Table 4.0-1

Table 4.0-1: TREs for Hyperspectral Image Segment

Functional Categories		Applicability	TRE	Obligation
Dataset Description and Discovery These TREs provide a variety of modular data records containing data elements that are populated to describe the collected HSI data. Richness of description promotes discoverability and selection of datasets applicable for desired use.		Always	AIMIDB	Required
		Always	ACFTB	Required
		Always	EXOPTA	Required
		Always	MSTGTA	Required when targets are present in image tasking order.
		Always	PIAIMC	Required
		When targets are identified in the image	PIATGB	Optional
		Always	USE00A	Required
Positioning These TREs enable four methods for associating ground coordinates with image coordinates. The sensor parameters method is always required. One of the functional fit methods is always required, but both can be included (see Appendix C for details). Location grid is always	**Sensor Parameters**	Always	SENSRB	Required
	Functional Fit - Legacy	RPC when fit tolerance supports usage. See Appendix C.	RPC00B	Required when RSM is not available
	Functional Fit - Objective	RSM when fit tolerance supports usage. See Appendix C.	RSMIDA	Required
		See Appendix C	RSMPIA	Required when number of RSMPCA > 1

required. See descriptions of PIX_LATLON and PIX_HEIGHT image segments in sections 3.1.4 and 3.1.5, respectively.		See Appendix C	RSMPCA	Required when number of RSMGGA = 0
		See Appendix C	RSMDCA	Conditional when direct error covariance data are available
		See Appendix C	RSMAPA	Conditional when adjustments are available
		See Appendix C	RSMECA	Conditional when indirect error covariance data are available
		See Appendix C	RSMGIA	Required when number of RSMGGA > 1
		See Appendix C	RSMGGA	Required when number of RSMPCA = 0
	Location Grid	Always	GEOPSB	Required
			GRDPSB	Required
			ACCHZB	Required
Radiometry and Pixel Processing History The BANDSB TRE enables radiometric calibration and exploitation of the hyperspectral data and is always required. The HISTOA TRE communicates the processing history of the hyperspectral data and is always required. The J2KLRA is only required if JPEG2000 compression is used on the hyperspectral data prior to its storage in the NITF file.			BANDSB	Required
			HISTOA	Required
			J2KLRA	When JPEG 2000 compression is applied to the data

<u>TRE Present in the NITF2.1 Pixel Latitude / Longitude Subheader</u>

- None

<u>TRE Present in the NITF2.1 Pixel Height Subheader</u>

- GEOPSB – Geo Positioning Information
- GRDPSB – Grid Reference Data
- ACCVTB – Vertical Accuracy

<u>TRE Present in the NITF2.1 Bad Pixel Map Subheader</u>

- PIXQLA

<u>TRE Present in the NITF2.1 Noise Equivalent Spectral Radiance Subheader</u>

- None

The metadata population conventions discussed in section 3.0 shall be followed in section 4.0 as well.

Additionally, users of Hyperspectral datasets should reference the TRE definition tables provided herein, to determine which metadata fields, if any, in a given TRE are populated with format- and range-compliant fill data (uncorrelated metadata fields), and which metadata fields are populated with real, scene-correlated data. This is indicated in the TRE definition tables given below, by a flag value of either U (for uncorrelated metadata) or R (for real, correlated, metadata), in the table column headed “Corr. Flag”. Care must be taken that like field values across header, subheaders and TREs are mutually consistent and do not contradict each other.

4.1 Common Tagged Record Extensions

The following Tagged Record Extensions (TRE) may be found in Hyperspectral datasets. Some of the TRE defined here are required for a given dataset while other TRE are merely optional. Certain TRE, such as the J2KLRA TRE, are required only conditionally, based on the processing applied to the imagery data (e.g., use of JPEG 2000 compression) or collection requirements (e.g., target definitions). TRE that are presented as being optional, as opposed to conditional, may not be present in a given Hyperspectral dataset, their use is entirely up to the processing element forming the NITF2.1 dataset.

4.1.1 ACCHZB TRE for Hyperspectral Products

The Horizontal Accuracy support data extension (ACCHZB) is contained in the HYPERSPECT image segment user-defined or extended subheader data sections of the NITF2.1 Subheader. The ACCHZB TRE conveys the horizontal accuracy of the PIX_LATLON location grid values associated with the HYPERSPECT image.

This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.1-1 provides the field descriptions and metadata population requirements for ACCHZB TRE used with Hyperspectral datasets. This TRE is required for all such datasets.

For additional information refer to*STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix P, Geospatial Support Data Extension (GEOSDE).

Table 4.1.1-1: ACCHZB TRE Fields for Hyperspectral Products

ACCHZB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ACCHZB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00017 to 99985	bytes	R	R
NUM_ACHZ	**Number of Horizontal Accuracy Regions**. This field shall contain the number of horizontal accuracy regions to follow. The maximum number of positional accuracy regions is limited to 99.	2	BCS-N	positive integer 01 to 99	N/A	R	R
Repeat for each NUM_ACHZ.							
UNIAAHn	**Unit of Measure for AAHn**. This field shall contain the units for AAHn or BCS Spaces if the absolute horizontal accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	R	<R>
AAHn	**Absolute Horizontal Accuracy**. This field is omitted when UNIAAHn contains BCS Spaces. Otherwise, this field shall contain the absolute horizontal accuracy for the nth region of positional accuracy.	5	BCS-N	positive integer 00000 to 99999	N/A	R	C
UNIAPHn	**Unit of Measure for APHn**. This field shall contain the units for APHn or BCS Spaces if the point-to-point horizontal accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	R	<R>
APHn	**Point-to-Point Horizontal Accuracy**. This field is omitted when UNIAPHn contains BCS Spaces. Otherwise, this field shall contain the point-to-point (relative) horizontal accuracy for the nth region of positional accuracy.	5	BCS-N	00000 to 99999	N/A	R	C

ACCHZB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
NUM_PTSn	**Number of Points in Bounding Polygon**. This field defines the number of points (coordinate pairs) that are used to define the bounding polygon of the nth region of horizontal accuracy. Coordinate values shall refer to the coordinate system and units defined in GEOPS (and possibly in PRJPS). First and last points shall be the same. If the accuracy information applies to the entire Image Segment (the value of NUM_ACHZ is 1 and the ACCPO extension is not present), then this field does not apply and will contain 000.	3	BCS-N	positive integer 004 to 999 or 000	N/A	R	R
Repeat for each NUM_PTSn.							
LONnm	**Longitude/Easting**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the easting (when the value of GEOPS.UNI is M) or longitude (otherwise) of the mth point.	15	BCS-N		N/A	R	C
LATnm	**Latitude/Northing**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the northing (when the value of GEOPS.UNI is M) or latitude (otherwise) of the mth point.	15	BCS-N		N/A	R	C
…..End of Repeat for each NUM_PTSn							
…..End of Repeat for each NUM_ACHZ.							

4.1.2 ACCVTB TRE for Hyperspectral Products

The Vertical Accuracy support data extension (ACCVTB) is contained in the PIX_HEIGHT image segment extended subheader data section of the NITF2.1 Subheader.

Table 4.1.2-1 provides the field descriptions and metadata population requirements for ACCVTB TRE used with Hyperspectral datasets. This TRE is requiredwhen using the PIX_HEIGHT image segment.

For additional information refer to*STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix P, Geospatial Support Data Extensions (GEOSDE).

Table 4.1.2-1: ACCVTB TRE Fields for Hyperspectral Products

ACCVTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ACCHZB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00017 to 99985	bytes	R	R
NUM_ACVT	**Number of Vertical Accuracy Regions**. This field shall contain the number of vertical accuracy regions to follow. The maximum number of positional accuracy regions is limited to 99.	2	BCS-N	positive integer 01 to 99	N/A	R	R
Repeat for each NUM_ACVT.							
UNIAAVn	**Unit of Measure for AAVn**. This field shall contain the units for AAVn or BCS Spaces if the absolute vertical accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	R	<R>
AAVn	**Absolute Vertical Accuracy**. This field is omitted when UNIAAVn contains BCS Spaces. Otherwise, this field shall contain the absolute vertical accuracy for the nth region of positional accuracy.	5	BCS-N	00000 to 99999	N/A	R	C
UNIAPVn	**Unit of Measure for APVn**. This field shall contain the units for APVn or BCS Spaces if the point-to-point vertical accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	R	<R>

ACCVTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
APVn	**Point-to-Point Vertical Accuracy**. This field is omitted when UNIAPVn contains BCS Spaces. Otherwise, this field shall contain the point-to-point (relative) vertical accuracy for the nth region of positional accuracy.	5	BCS-N	00000 to 99999	N/A	R	C
NUM_PTSn	**Number of Points in Bounding Polygon**. This field defines the number of points (coordinate pairs) that are used to define the bounding polygon of the nth region of vertical accuracy. Coordinate values shall refer to the coordinate system and units defined in GEOPS (and possibly in PRJPS). First and last points shall be the same. If the accuracy information applies to the entire Image Segment (the value of NUM_ACVT is 1 and the ACCPO extension is not present), then this field does not apply and will contain 000.	3	BCS-N	positive integer 004 to 999 or 000	N/A	R	R
Repeat for each NUM_PTSn.							
LONnm	**Longitude/Easting**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the easting (when the value of GEOPS.UNI is M) or longitude (otherwise) of the mth point.	15	BCS-N		N/A	R	C
LATnm	**Latitude/Northing**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the northing (when the value of GEOPS.UNI is M) or latitude (otherwise) of the mth point.	15	BCS-N		N/A	R	C
…..End of Repeat for each NUM_PTSn							
…..End of Repeat for each NUM_ACVT.							

4.1.3 ACFTB TRE for Hyperspectral Products

The Aircraft Information airborne support data extension (ACFTB) is contained in the image extended subheader data section of the NITF2.1 Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.3-1 provides the field descriptions and metadata population requirements for ACFTB TRE used with Airborne Hyperspectral datasets. This TRE is required for all such datasets.

The ACFTB TRE is shown as required in STDI-0002-1 Table E-1 for Airborne Hyperspectral Imagery.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.3-1: ACFTB TRE Fields for Hyperspectral Products

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ACFTB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00207	bytes	R	R
AC_MSN_ID	**Aircraft Mission Identification**. This field contains the name of the mission. If the mission name is not available, then this field shall be populated with the value NOT AVAILABLE followed by 7 BCS spaces.	20	BCS-A	generate Default is NOT AVAILABLE followed by 7 BCS spaces (0x20)	N/A	R	R
AC_TAIL_NO	**Aircraft Tail Number**. This field records the tail number of the aircraft flying the mission.	10	BCS-A	generate Default is BCS spaces (0x20)	N/A	R	<R>
AC_TO	**Aircraft Take-Off Date and Time**. This field records the date and time that the aircraft took-off to fly the mission. The date and time are referenced to UTC.	12	BCS-A	CCYYMMDDhhmm where, CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), and mm is the minute (00-59). Note: Leap seconds are not used in this definition. Default is BCS spaces (0x20)	UTC	R	<R>

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SENSOR_ID_ TYPE	**Sensor Identification Type**. This field identifies which sensor type produced the image. For EO-IR Imagery: ccff where, cc indicates the sensor category: IH (high altitude / long-rage IR) IM (medium altitude IR) IL (low altitude IR) MH (multi-spectral high altitude / long-range) MM (multi-spectral medium altitude) ML (multi-spectral low altitude) VH (visible high altitude / long-range) VM (visible medium altitiude) VL (visible low altitude) VF (video frame) And ff indicates the sensor format: FR (frame) LS (line scan) PB (pushbroom) PS (panning scan) Note: The contents of several fields below depend upon the value of this field.	4	BCS-A		N/A	R	R
SENSOR_ID	**Sensor ID**. This field identifies the specific sensor that produced the image. *See http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx for register of codes maintained via the NTB registration process.* Note: The contents of several fields below depend upon the value of this field.	6	BCS-A	*Values registered with the NTB.*	N/A	R	R

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SCENE_SOURCE	**Scene Source**. This field indicates the origin of the request for the current scene. A scene is a single image or a collection of images providing contiguous coverage of an area of interest. 0 = Pre-Planned 1 to 9 are system specific. *See http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx for register of codes maintained via the NTB registration process.*	1	BCS-A	0-9 or a BCS space (0x20) Default is a BCS space (0x20) *Values registered with the NTB.*	N/A	R	<R>
SCNUM	**Scene Number**. This field identifies the current scene, and is determined from the mission plan; except for immediate scenes, where it may have the value 000000, the scenes are numbered from 000001 to 999999. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.	6	BCS-N	000000-999999 (in general)	N/A	R	R
PDATE	**Processing Date**. For EO and IR systems, this field records the date that the image file was produced. For SAR systems, this field records the date that the raw data was converted to imagery. The date changes at midnight UTC.	8	BCS-N	CCYYMMDD (where CC is the century, YY is the year, MM is the month (01-12), and DD is the day of the month (01-31)).	UTC	R	R
IMHOSTNO	**Immediate Scene Host**. Together with the Immediate Scene Request ID field below, this field denotes the scene that the immediate scene was initiated from and can be used to renumber the scene. For example, if the immediate scene was initiated from scene number 000123 and this is the third request from that scene, then the scene number field will be 000000, the immediate scene host field will contain 000123 and the immediate scene request ID will contain 000003. Only non-zero for immediate scenes.	6	BCS-N	000000, 000001-999999 (in general)	N/A	R	R

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IMREQID	**Immediate Scene Request ID**. This field provides the number of the current immediate scene taken from the original scene number recorded in the Immediate Scene Host field above.	5	BCS-N	00000, 00001-99999 (in general)	N/A	R	R
MPLAN	**Mission Plan Mode**. This field defines the current sensor-specific SENSOR_TYPE / SENSOR_ID collection mode. *See http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx for register of codes maintained via the NTB registration process.*	3	BCN-N	001-999 (in general) *Values registered with the NTB.*	N/A	R	R
Note: Where the image extends along an extended path, as with SAR Search modes and EO-IR Wide Area Search modes, the entry and exit locations are the specified latitude, longitude, and elevation above mean sea level (MSL) of the planned entry and exit points on the centerline of the area contained within the NITF Image Segment. Where the image is confined to the area about a single reference point, as with Spot modes and Point Target modes, the entry fields contain the specified reference point latitude/longitude/elevation, and the exit fields are filled with BCS spaces. The location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and ten-thousandths of seconds (0000 to 9999) of latitude, with X=N for north and S for south, and dddmmss.ssssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and ten-thousandths of seconds (0000 to 9999) of longitude, with Y=E for east or W for west. The format ±dd.dddddddd indicates degrees of latitude (north is positive), and ±ddd.dddddddd represents degrees of longitude (east is positive).							
ENTLOC	**Entry Location**. For imagery extending along an extended path, such as with SAR Search modes or EO-IR Wide Area Search (WAS) modes, this field provides the latitude and longitude of the entry location for the collection of the image scene. For imagery collected around a single reference point, as with Spot or Point Target collection modes, this field provides the latitude and longitude of the specified reference point.	25	BCS-A	ddmmss.ssssXdddmmss.ssssY, ±dd.dddddddd±ddd.dddddddd or all BCS spaces if not known (in general) Default is BCS spaces (0x20)	degrees	R	<R>

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
LOC_ACCY	**Location Accuracy**. This field defines the 90% probable circular error in the ENTLOC and EXITLOC positions. For unknown CE90 values use 000000 or 000.00.	6	BCS-A	000.01-999.99, 000000, or 000.00	feet	R	R
ENTELV	**Entry Elevation**. This field identifies the imaging operation entry point ground elevation above mean sea level (MSL).	6	BCS-A	-01000 to +30000 Default is BCS spaces (0x20)	feet or meters	R	<R>
ELV_UNIT	**Unit of Elevation**. This field defines the units of the entry and exit altitudes.	1	BCS-A	f or m Default is a BSC space (0x20)	N/A	R	<R>
EXITLOC	**Exit Location**. For imagery extending along an extended path, such as with SAR Search modes or EO-IR Wide Area Search (WAS) modes, this field provides the latitude and longitude of the exit location for the collection of the image scene. For imagery collected around a single reference point, as with Spot or Point Target collection modes, this field is filled with BCS spaces (0x20).	25	BCS-A	ddmmss.ssssXdddmmss.ssssY, ±dd.dddddddd±ddd.dddddddd or all BCS spaces if not known (in general) Default is BCS spaces (0x20)	degrees	R	<R>
EXITELV	**Exit Elevation**. This field identifies the imaging operation exit point ground elevation above mean sea level (MSL).	6	BCS-A	-01000 to +30000 Default is BCS spaces (0x20)	feet or meters	R	<R>

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TMAP	**True Map Angle**. This field provides the true map angle as defined below: SAR Systems: In Search modes, the true map angle is the angle between the ground projection of the line of sight from the aircraft and the scene centerline. In Spot modes, the true map angle is the angle, measured at the central reference point, between the ground projection of the line of sight from the aircraft and a line parallel to the aircraft's desired track heading. EO-IR Systems: The true map angle is defined in the NED coordinate system with origin at the aircraft (aircraft local NED), as the angle between the scene entry line of sight and the instantaneous aircraft track-heading vector. The aircraft track-heading vector is obtained by rotating the north unit-vector of the aircraft local NED coordinate system in the aircraft local NE plane through the aircraft track-heading angle. The true map angle is measured in the slanted plane containing the scene entry line of sight and the aircraft track-heading vector. This angle is always positive.	7	BCS-A	000.000-180.000 Default is BCS spaces (0x20)	degrees	R	<R>
ROW_SPACING	**Row Spacing**. This field contains the row spacing measured at the center of the image. The row spacing is defined as the distance in the image plane between corresponding pixels of adjacent rows measured in feet or meters, or as the angular center-to-center distance (pitch) between corresponding pixels of adjacent rows measured in micro-radians. If the spacing (or associated units) is unknown, then the default value, 0000000, shall be entered.	7	BCS-N	00.0000-99.9999 (for distance given in feet or meters) 0000.00-9999.99 (for distance given in µ-radians) 0000000 (if unknown distance or units) Default is 0000000	meters, feet, or µ-radi-ans	R	R

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ROW_SPACING_UNITS	**Units of Row Spacing**. This field provides the units in which the row spacing is measured.	1	BCS-A	f, m, r, or u (where f=feet, m=meters, r=µ-radians, and u=unknown units)	N/A	R	R
COL_SPACING	**Column Spacing**. This field contains the column spacing measured at the center of the image. The column spacing is defined as the distance in the image plane between adjacent pixels within a row measured in feet or meters, or as the angular center-to-center distance (pitch) between adjacent pixels within a row measured in micro-radians. If the actual spacing (or associated units) is unknown, the default value of 0000000 shall be entered.	7	BCS-N	00.0000-99.9999 (for distance given in feet or meters) 0000.00-9999.99 (for distance given in µ-radians) 0000000 (if unknown distance or units) Default is 0000000	meters, feet, or µ-radians	R	R
COL_SPACING_UNITS	**Units of Column Spacing**. This field provides the units in which the column spacing is measured.	1	BCS-A	f, m, r, or u (where f =feet, m=meters, r=µ-radians, and u=unknown units)	N/A	R	R
FOCAL_LENGTH	**Sensor Focal Length**. This field contains the effective distance from the optical lens to sensor element(s), used when either the ROW_SPACING_ UNITS or COL_SPACING_UNITS fields indicates µ-radians. A value of 999.99 indicates that the focal length is not available or not applicable to this sensor.	6	BCS-N	000.01-899.99, 999.99	cm	R	R
SENSERIAL	**Sensor Vendor's Serial Number**. This field records the serial number of the line replaceable unit (LRU) containing EO-IR imaging electronics or SAR Receiver/Exciter involved in creating the imagery contained in this file.	6	BCS-A	000001-999999 Default is BCS spaces (0x20)	N/A	R	<R>
ABSWVER	**Airborne Software Version**. This field records the airborne software version (vvvv) and revision (rr) numbers.	7	BCS-A	vvvv.rr Default is BCS spaces (0x20)	N/A	R	<R>

ACFTB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CAL_DATE	**Calibration Date**. This field provides the date that the sensor was last calibrated. CCYY is the century and year, MM is the month (01-12), and DD is the day of the month (01-31).	8	BCS-A	CCYYMMDD Default is BCS spaces (0x20)	UTC	R	<R>
PATCH_TOT	**Patch Total**. This field provides the total number of Patches contained in the imaging operation. Generally, this will also be consistent with the number of PATCH and/or CMETAA extensions contained in an imaging operation. For EO-IR imagery this field shall hold a value of 0000. Note: 0000 indicates no PATCH extensions present.	4	BCS-N	For SAR: Spot: 0000-0001 Search: 0000-9999 For EO-IR: All modes: 0000	N/A	R	R
MTI_TOT	**MTI Total**. This field provides the total number of MTIRP extensions contained in this file. Each MTIRP identifies 1 to 999 moving targets. For EO-IR imagery this field shall hold a value of 000.	3	BCS-N	For SAR: 000-999 For EO-IR: 000	N/A	R	R

4.1.4 AIMIDB TRE for Hyperspectral Products

The Airborne Image Identification airborne support data extension (AIMIDB) is contained in the image extended subheader data section of the NITF2.1 Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.4-1 provides the field descriptions and metadata population requirements for AIMIDB TRE used with Airborne Hyperspectral datasets. This TRE is required for all such datasets.

The AIMIDB TRE is shown as required in STDI-0002-1 Table E-1 for Airborne Hyperspectral Imagery. The AIMIDB TRE also contains metadata indicating the Mission Number and Country Code, which may be useful for image search and discovery.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.4-1: AIMIDB TRE Fields for Hyperspectral Products

AIMIDB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	AIMIDB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00089	bytes	R	R
ACQUISITION_ DATE	**Acquisition Date and Time**. This field shall contain the date and time, referenced to UTC, of the collection in the format CCYYMMDDhhmmss, in which CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), mm is the minute (00-59), and ss is the second (00-59). Field is equivalent to the IDATIM field in the Image Segment Subheader.	14	BCS-N	CCYYMMDDhhmmss	UTC	R	R
MISSION_NO	**Mission Number**. This field records the four-character descriptor of the mission, which has the form PPNN, where PP is the DIA Project Code (range is AA to ZZ) or U0 if the Project Code is unknown, and NN is an assigned two-digit identifier, for example, the last digits of FLIGHT_NO. UNKN shall be used if no specific descriptor is known.	4	BCS-A	PPNN, U0NN, UNKN (in general)	N/A	R	R
MISSION_IDENTI FICATION	**Name of the Mission**. This field records the Air Tasking Order Mission Number, if available, followed by BCS spaces. The value, NOT AVAIL. (two words separated by a BCS space and having a trailing period), shall be used if the mission name is unavailable.	10	BCS-A	Air Tasking Order Mission Number followed by BCS spaces (0x20) -or- NOT AVAIL. (in general)	N/A	R	R

AIMIDB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FLIGHT_NO	**Flight Number**. This field identifies a particular flight with a flight number in the range 01 to 09. Flight 01 shall be the first flight of the day, flight 02 the second, etc. In order to ensure uniqueness in the image ID, if the aircraft mission extends across midnight UTC, the flight number shall be 0x (where x is in the range 0 to 9) on images acquired before midnight UTC and Ax on images acquired after midnight UTC; for extended missions Bx, …, Zx shall designate images acquired on subsequent days. The value 00 indicates the flight number is unavailable.	2	BCS-A	00, 01 to 09, A1 to A9, B1 to B9, …, Z1 to Z9 (in general)	N/A	R	R
OP_NUM	**Image Operation Number**. This field identifies the image operation number. This value is reset to 001 at the start of each flight and incremented by 1 for each distinct imaging operation. Additionally, the number is reset to 001 following operation number 999. A value of 000 indicates the airborne system does not number imaging operations. For imagery derived from video systems this field contains the frame number within the ACQUISITION_DATE time.	3	BCS-N	000, 001-999 (in general)	N/A	R	R
CURRENT_ SEGMENT	**Current Segment ID**. This field identifies which segment (piece) of an imaging operation contains this image. AA is the first segment; AB is the second segment, etc. This field shall contain AA if the image is not segmented (i.e., consists of a single segment).	2	BCS-A	AA-ZZ	N/A	R	R

AIMIDB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
REPRO_NUM	**Reprocess Number**. This field identifies whether the image is in its original processing state, or if it has been reprocessed or enhanced. For SAR imagery this field indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A value of 00 in this field indicates that the data is an originally processed image; a value of 01 indicates the first reprocess/enhancement, etc. For visible and infrared imagery this field shall contain 00 to indicate no reprocessing or enhancement.	2	BCS-N	00-99 (in general)	N/A	R	R
REPLAY	**Replay**. This field indicates whether the data was reprocessed to overcome initial processing failures, or retransmitted to overcome transmission errors. A 000 in this field indicates that the data is an originally processed and transmitted image, a value in the ranges of G01 to G99 or P01 to P99 indicates the data is reprocessed, and a value in the range T01 to T99 indicates it was retransmitted.	3	BCS-A	000, G01 to G99, P01 to P99, or T01 to T99 (in general) Default is BCS spaces (0x20)	N/A	R	<R>
RESERVED_001	**Reserved Field 001**. Reserved field for future use.	1	BCS-A	A BCS space (0x20)	N/A	R	R
START_TILE_ COLUMN	**Starting Tile Column Number**. For tiled (blocked) sub-images, this field records the number of the first tile within the CURRENT_SEGMENT, relative to tiling at the start of the imaging operation. Tiles are rectangular arrays of pixels (dimensionally defined by the NITF image subheader NPPBH and NPPBV fields) that subdivide an image. For un-tiled (single block) images this field shall contain 001.	3	BCS-N	001-099 (in general)	N/A	R	R

AIMIDB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
START_TILE_ROW	**Starting Tile Row Number**. For tiled (blocked) sub-images, this field records the number of the first tile within the CURRENT_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall be 00001.	5	BCS-N	00001-99999 (in general)	N/A	R	R
END_SEGMENT	**Ending Segment**. This field contains the ending segment ID of the imaging operation. This field shall contain AA if the image is not segmented (i.e., consists of a single segment). During an extended imaging operation the end segment may not be known or predictable before it is collected; the value 00 (numeric zeros) shall indicate that the ending segment of the operation is unknown.	2	BCS-A	00, AA-ZZ (in general)	N/A	R	R
END_TILE_COLUMN	**Ending Tile Column Number**. For tiled (blocked) sub-images, this field records the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall contain 001.	3	BCS-N	001-099 (in general)	N/A	R	R
END_TILE_ROW	**Ending Tile Row Number**. For tiled (blocked) sub-images, this field records the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall contain 00001.	5	BCS-N	00001-99999 (in general)	N/A	R	R
COUNTRY	**Country Code**. This field contains the two-letter code (digraph) defining the country for the reference point of the image. Standard codes may be found in FIPS PUB 10-4.	2	BCS-A	AA to ZZ Default is BSC spaces (0x20)	N/A	R	<R>
RESERVED_002	**Reserved Field 002**. Reserved field for future use.	4	BCS-A	4 BCS spaces (0x20)	N/A	R	R

AIMIDB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
LOCATION	**Location**. This field contains the location of the natural reference point of the sensor, which provides a rough indication of geographic coverage. The format ddmmX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X=N or S for North or South, and dddmmY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y=E or W for east or west, respectively. For SAR imagery the reference point is normally the center of the first image block. For EO-IR imagery the reference point for framing sensors is the center of the frame; for continuous sensors, it is the center of the first row of the image. Note: Because the location is only reported to one arc-minute, it may be more than a half-mile in error, and not actually represent any point within the boundary of the image. BCS spaces indicate that the location is unavailable.	11	BCS-A	ddmmXdddmmY Default is BCS spaces (0x20)	degrees	R	<R>
RESERVED_003	**Reserved Field 003**. Reserved field for future use.	13	BCS-A	13 BCS spaces (0x20)	N/A	R	R

4.1.5 BANDSB TRE for Hyperspectral Products

The multispectral / Hyperspectral Band Parameters support extension (BANDSB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.5-1 provides the field descriptions and metadata population requirements for BANDSB TRE used with used with Hyperspectral datasets. The use of this TRE is required for all such datasets. Multiple BANDSB extensions may be placed within one Image Segment Subheader when the amount of parametric data exceeds the maximum allowed of a single BANDSB extension or implementers wish to segregate certain parameters in their own extension.

The BANDSB TRE contains metadata indicating the Row Ground Sample Distance (GSD) and the Column GSD, which may be useful for image search and discovery. The BANDSB TRE also contains parametric data relaateed to Hyperspectral imagery.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.5-1: BANDSB TRE Fields for Hyperspectral Products

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	BANDSB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00000 to 99985	bytes	R	R
COUNT	**Number of Bands** comprising the data cube.	5	BCS-N	00001 to 09999	N/A	R	R
RADIOMETRIC QUANTITY	**Data Representation.** Field describes the data held in the image data area of the associated image segment. For exploitation ready datasets the data is expected as at-sensor radiance.	24	BCS-A	RADIANCE	N/A	R	R
RADIOMETRIC QUANTITY UNIT	**Data Representation Unit.** Field indicates the unit of measure for the data held in the image data field of the associated image segment. Spectral Radiance: S = μW cm-2 sr-1 μm-1	1	BCS-A	S		R	R
SCALE FACTOR	**Cube Scale Factor *(M)*** Multiplicative factor that has been applied to all bands of the data cube, after any individual band adjustments or scaling and before data was stored in the image data of the Image Segment.	4	IEEE-754 32bit Float	Default value for this field is the IEEE-754 representation for “+1.00 “, which is 0x3F800000.	N/A	R	R
ADDITIVE FACTOR	**Cube Additive Factor *(A)*** Constant added to all bands of the data cube and after multiplicative factor was applied. Stored value = A + Mx	4	IEEE-754 32 bit Float	Default value for this field is the IEEE-754 representation for “+0.00 “, which is 0x00000000.		R	R
ROW_GSD	**Row Ground Sample Distance.** Nominal Row Spacing, or spacing between rows, measured pixel center to pixel center. Distance in the data cube plane between corresponding pixels of adjacent rows measured in meters.	7	BCS-N	000.001 to 9999.99, “-------“ (String of minus signs, 0x2D. Minus signs indicate this parameter was unknown at file creation time.)	meters	R	R
ROW_GSD_UNIT	**Units of Row Ground Sample Distance.** M=meter	1	BCS-A	M		R	R

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
COL_GSD	**Column Ground Sample Distance.** Nominal column spacing, spacing between columns, measured pixel center to pixel center. Distance in the data cube plane between adjacent pixels within a row measured in meters;	7	BCS-N	000.001 to 9999.99 "-------" (String of minus signs, 0x2D. Minus signs indicate this parameter was unknown at file creation time.)	meters	R	R
COL_GSD_UNITS	**Unit of Column Ground Sample Distance.** M=meter	1	BCS-A	M		R	
SPT_RESP_ROW	**Spatial Response Function across Rows.** Nominal pixel/detector size measured perpendicular to data row.	7	BCS-N	000.001 to 9999.99, "-------" (String of minus signs, 0x2D. Minus signs indicate this parameter was unknown at file creation time.)	meters or μradians	R	R
SPT_RESP_UNIT_ROW	**Units of Row Spatial Response.** Units for the previous field SPT_RESP_ ROW. M=meter, R=μradians	1	BCS-A	M or R		R	<R>
SPT_RESP COL	**Spatial Response Function across Columns.** Nominal Pixel/detector size measured perpendicular to data column.	7	BCS-N	000.001 to 9999.99, "-------" (String of minus signs, 0x2D. Minus signs indicate this parameter was unknown at file creation time.)	meters or μradians	R	R
SPT_RESP_UNIT_COL	**Units of Row Spatial Response.** Units for the previous field SPT_RESP_ COL. M=meter, R=μradians	1	BCS-A	M or R		R	<R>
DATA_FLD_1	Field reserved for future use	48	Unsigned Integer	0x00 – 0xFF		R	<R>

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	DESCRIPTION	SIZE	DATA TYPE	VALUE RANGE	UNITS	CORR. FLAG	TYPE
EXISTENCE_ MASK	**Bit-wise Existence Mask Field.** 32 flags represented by the bits of this 4 byte (32 bit) field. (b31, b30, b29, b28 ….. b2, b1, b0) A bit set to zero signals that a conditional field is not present in this extension. A bit set to the value one indicates the inclusion of the conditional field. b31 signals the RADIOMETRIC ADJUSTMENT SURFACE and ATMOSPHERIC ADJUSTMENT ALTITUDE fields. b30 signals the DIAMETER field. b29 signals the DATA_FLD_2 field. b28 flags the BANDIDn field. b27 signals the BAD_BANDn field. b26 signals the NIIRSn field. b25 signals the FOCAL_LENn field. b24 signals the CWAVE and WAVE_LENGTH_UNIT fields. b23 signals the FWHM and WAVE_LENGTH_UNIT fields. b22 signals the FWHM_UNC and WAVE_LENGTH_UNIT field. b21 signals the NOM_WAVEn and WAVE_LENGTH_UNIT fields. b20 signals the NOM_WAVE_UNCn field and WAVE_LENGTH_UNIT fields. b19 signals the LBOUNDn, UBOUNDn and WAVE_LENGTH_UNIT fields. b18 signals the SCALE FACTORn, and ADDITIVE FACTORn fields. b17 signals the START_TIMEn.	4	Unsigned Integer	0x00000001 to 0xFFFFFFC1	N/A	R	R

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
EXISTENCE_ MASK (continued)	b16 signals the INT_ TIMEn field. b15 signals the CALDRK and CALIBRATION SENSITIVITYn fields. b14 signals the ROW_GSDn and ROW_GSD_UNITSn, COL_GSDn, COL_GSD_UNITSn fields. b13 signals the ROW_GSD_UNCn and COL_GSD_UNCn fields. (If b13 is set to 1 then b14 must be set.) b12 signals the BKNOISEn and SCNNOISEn fields. b11 signals the SPT_RESP_FUNCTION_ROWn, SPT_RESP_UNIT_ROWn, SPT_RESP_FUNCTION_COLn, SPT_RESP_UNIT_COLn fields. b10 signals the SPT_RESP UNC_ROWn and SPT_RESP UNC_COLn fields. (If b10 is set to 1 then b11 must be set.) b9 signals the DATA_FLD_3n field. b8 signals the DATA_FLD_4n field. b7 signals the DATA_FLD_5n field. b6 signals the DATA_FLD_6n field. b5 = 0 (Not used, but present) b4 = 0 (Not used, but present) b3 = 0 (Not used, but present) b2 = 0 (Not used, but present) b1 = 0 (Not used, but present) b0 = signals the NUM_AUX_B and NUM_AUX_C fields.						
RADIOMETRIC ADJUSTMENT SURFACE	**Adjustment Surface.** The presence of this field indicates that radiometric adjustments have been done to the associated image data cube. This field will contain a value indicating at what surface radiometric adjustment has been done. Values are user-defined, clear text. Data is assumed to be at-sensor or aperture radiance.	24	BCS-A	APERTURE		R	R

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ATMOSPHERIC ADJUSTMENT ALTITUDE	**Adjustment Altitude Above WGS84 Ellipsoid.** This field contains a valid value when the Radiometric Adjustment Surface field indicates 'within atmosphere', otherwise a NAN (not a number) value, as described in ANSI/IEEE-754-1985.	4	IEEE-754 32bit Float	Real (4 Byte IEEE-754 Floating representation)	meters	R	C
DIAMETER	**Diameter of the lens.**	7	BCS-N	00.01 to 8999.99	cm	R	C
DATA_FLD_2	Reserved for future use	32	Unsigned Integer	0x00 – 0xFF		R	C
WAVE_ LENGTH_UNIT	**Wave Length Units.** Unit of measure for subsequent wavelength fields. U = µm = micrometers W = Wavenumber, cm-1 If any of following fields are present in the extension according to the Bit-wise Existence Mask Field, [FOCAL_LENn, CWAVEn, FWHMn, NOM_WAVEn, NOM_WAVE_UNCn, LBOUNDn, UBOUNDn], then the WAVE_LENGTH_UNIT field must be present.	1	BCS-A	U, W		R	R
The following fields repeat once for each Image Band identified in the COUNT field. …… The presence of any of these fields is signaled by the bit values in the EXISTENCE_MASK. Parameters are organized in band sequential mode; parameters values for band1, followed by parameters values for band2 , followed by parameters values for band3 through bandn.							
BANDIDn	**Band n Identifier.** A unique identifier that represents the nth band of the associated data cube.	50	BCS-A	User-defined		R	C
BAD_BANDn	**Bad Band Flag.** Numeric field that signals the validity of the nth band of the associated data cube. 0 = Invalid, bad, suspect or corrupted data in the nth band. 1 = nth band contains valid data.	1	BCS-N	0,1 (0x30, 0x31)		R	C
NIIRSn	**NIIRS Value.** MS/HS NIIRS rating for the nth band.	3	BCS-N	0.1 – 9.9		R	C

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FOCAL_LENn	**Band n Focal Length.** Focal length of the detector or optics for the nth band of the associated data cube.	5	BCS-N	00001 – 99999	mm	R	C
CWAVEn	**Band n Center Response Wavelength.** Wavelength or wave number at the center of a detector's band profile. This field shall only be used in conjunction with symmetrical; i.e., guassian band profiles.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
FWHMn	**Band n Width.** The wavelength difference between the upper and lower bounds at the 50% (-3dB) points of the sensor spectral response.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	R
FWHM_UNCn	**Band Width Uncertainty.** Uncertainty in wavelength measure in the FWHMn field.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
NOM_WAVEn	**Band n Nominal Wavelength.** For asymmetric band profile distributions, this will be the median wavelength of which equal amounts of energy are captured above and below this nominal wavelength.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
NOM_WAVE_ UNCn	**Uncertainty in band wavelength** measure in the NOM_WAVEn field.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
LBOUNDn	**Band n Lower Wavelength Bound.** The wavelength for the nth band at the lower 50% (-3dB) point of the sensor spectral response.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
UBOUNDn	**Band n Upper Wavelength Bound.** The wavelength for the nth band at the higher 50% (-3dB) point of the sensor spectral response.	7	BCS-N	0.00001 to 10000.0	µm or cm-1	R	C
SCALE FACTORn	**Individual Scale Factor (m_n).** Multiplicative factor applied to nth band of the data cube before it was stored in the image data area of the associated image segment.	4	IEEE-754 32bit Float	Real (4 Byte IEEE- 754 floating representation)		R	C

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ADDITIVE FACTORn	**Individual Additive Factor (a_n).** Constant added to nth band of the data cube before it was stored in the image data area of the associated image segment and after multiplicative factor was applied. Stored value = m_n x + a_n	4	IEEE-754 32bit Float	Real (4 Byte IEEE- 754 floating representation)		R	C
START_TIMEn	**Start Time.** The starting time and date that the nth band was collected, expressed in UTC, Zulu time zone. If portions of this date and time are unknown, implementers shall place a dash (0x2D) in place of the unknown portions of the Start_ Time.	16	BCS-N	YYMMDDhhmmss.sss		R	C
INT_ TIMEn	**Integration Time.** Total number of milliseconds the nth band was collected.	6	BCS-N	000001 to 999999	ms	R	C
CALDRKn	**Band n Calibration (Dark).** The calibrated receive power level for the nth band that corresponds to a pixel value of 0.	6	BCS-N	.00000 to 999999 (Floating demical point permitted)	μW/ (cm2-sr-μm)	R	C
CALIBRATION SENSITIVITYn	**Band n Calibration (Increment).** The mean change in power level for the nth band that corresponds to an increase of 1 in pixel value.	5	BCS-N	.0000 to 99999 (Floating demical point permitted)	μW/ (cm2-sr-μm)	R	C
ROW_GSDn	**Band n Spatial Response Interval by Row.** nth band Row Spacing, spacing between rows of the nth band. Distance in the nth data cube plane between corresponding pixels of adjacent rows measured in meters, pixel center to pixel center; or Angular center-to-center distance (pitch), of the nth band, between corresponding pixels of adjacent rows measured in micro-radians (μ-radians).	7	BCS-N	0000.00 to 9999.99	meters or μradians	R	C
ROW_GSD_ UNCn	**Band n Spatial Response Interval Uncertainty Row.** Uncertainty in ROW_GSDn, Spacing between pixels of adjacent rows.	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ROW_GSD_UNITn	**Unit of Row Spacing.** Units for the previous two fields ROW_GSDn and ROW_GSD_UNCn. M=meter, R=μradians	1	BCS-A	M or R		R	C
COL_GSDn	**Band n Spatial Response Interval by Column.** Column Spacing, spacing between columns, of the nth band. Distance in the nth image plane between corresponding pixels of adjacent columns measured in meters pixel center to pixel center; or Angular center-to-center distance (pitch), of the nth band, between corresponding pixels of adjacent columns measured in micro-radians (μ-radians).	7	BCS-N	0000.01 to 9999.99	meters or μradians	R	C
COL_GSD_UNCn	**Band n Spatial Response Interval Uncertainty Column.** Uncertainty in COL_GSDn, Spacing between pixels of adjacent columns.	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C
COL_GSD_UNITn	**Unit of Column Spacing.** Units for the previous two fields COL_GSDn and COL_GSD_UNCn. M=meter, R=μradians	1	BCS-A	M or R		R	C
BKNOISEn	**Band n Background Noise.** Measure of noise level of collection system with shutter closed.	5	BCS-N	.0000 to 99999 (Floating demical point permitted)	μW/(cm^2-sr-μm)	R	C
SCNNOISEn	**Band n Scene Noise.** Noise equivalent target of the scene. Noise level for a Signal to Noise Ratio of 1.	5	BCS-N	.0000 to 99999 (Floating demical point permitted)	μW/(cm^2-sr-μm)	R	C
SPT_RESP_FUNCTION_ROWn	**Band n Spatial Response Function across Rows.** Pixel/detector coverage measured at FWHM perpendicular to data rows. This is referred to as the instantaneous field of view (IFOV) for the across row direction.	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C
SPT_RESP UNC_ROWn	**Band n Spatial Response Function Uncertainty.** Uncertainty in SPT_RESP_FUNCTION_ROWn	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SPT_RESP_UNIT_ROW	**Unit of Row Spatial Response.** Units for the previous two fields SPT_RESP_FUNCTION_ROWn and SPT_RESP UNC_ROWn M=meter, R=μradians	1	BCS-A	M or R		R	C
SPT_RESP_ FUNCTION_COLn	**Band n Spatial Response Function across Columns.** Pixel/detector coverage measured at FWHM perpendicular to data columns. This is referred to as the instantaneous field of view (IFOV) for the across column direction.	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C
SPT_RESP UNC_COLn	**Band n Spatial Response Function Uncertainty.** Uncertainty in SPT_RESP_FUNCTION_COLn	7	BCS-N	000.001 to 9999.99	meters or μradians	R	C
SPT_RESP_UNIT_COL	**Unit of Column Spatial Response.** Units for the previous two fields SPT_RESP_FUNCTION_COLn and SPT_RESP UNC_COLn. M=meter, R=μradians	1	BCS-A	M or R		R	C
DATA_FLD_3n	Field reserved for future use.	16	Unsigned Integer	0x00 – 0xFF		R	C
DATA_FLD_4n	Field reserved for future use.	24	Unsigned Integer	0x00 – 0xFF		R	C
DATA_FLD_5n	Field reserved for future use.	32	Unsigned Integer	0x00 – 0xFF		R	C
DATA_FLD_6n	Field reserved for future use.	48	Unsigned Integer	0x00 – 0xFF		R	C
…. End of the repeating fields of this Extension.							
NUM_AUX_B	**Number of Auxiliary Band Level Parameters(m).** These parameters have values specified for each band held in the image product.	2	BCS-N	00 to 99		R	C
NUM_AUX_C	**Number of Auxiliary Cube Level Parameters(k).** These parameters values are specified once for the entire image data cube.	2	BCS-N	00 to 99		R	C

BANDSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Repeat for each NUM_AUX_B.							
BAPFm	**Band Auxiliary Parameter Value Format.** APNmn, APRmn and APAmn fields are required when BAPFm value is respectively I, R and A.	1	BCS-A	A = ASCII I = Integer R = Real (4 Byte IEEE-754 Floating representation)		R	C
UBAPm	**Unit of Band Auxiliary Parameter**	7	BCS-A	DIGEST Edition 2.1, Part 3-7		R	C
Repeat for each COUNT (i.e., Number of Bands)							
APNmn	**Auxiliary Parameter Integer Value**	10	BCS-N	User-defined		R	C
OR							
APRmn	**Auxiliary Parameter Real Value**	4	IEEE-754 32bit Float	Real		R	C
OR							
APAmn	**Auxiliary Parameter Char String Value**	20	BCS-A	User-defined		R	C
…..End of Repeat for each COUNT							
…..End of Repeat for each NUM_AUX_B.							
Repeat for each NUM_AUX_C.							
CAPFk	**Cube Auxiliary Parameter Value Format.** APNk, APRk and APAk fields are required when CAPFk value is respectively I, R and A.	1	BCS-A	A = ASCII I = Integer R = Real (4 Byte IEEE-754 Floating representation)		R	C
UCAPk	**Unit of Cube Auxiliary Parameter**	7	BCS-A	DIGEST Edition 2.1, Part 3-7		R	C
APNk	**Auxiliary Parameter Integer Value**	10	BCS-N	User-defined		R	C
OR							
APRk	**Auxiliary Parameter Real Value**	4	IEEE-754 32bit Float	Real		R	C
OR							
APAk	**Auxiliary Parameter Char String Value**	20	BCS-A	User-defined		R	C
…..End of Repeat for each NUM_AUX_C.							

4.1.6 EXOPTA TRE for Hyperspectral Products

The Exploitation Usability Optical Information support extension (EXOPTA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.6-1 provides the field descriptions and metadata population requirements for EXOPTA TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets.

The EXOPTA TRE contains metadata indicating the Mean Ground Sample Distance (GSD), Sun Elevation, and Sun Azimuth, which may be useful for image search and discovery.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.6-1: EXOPTA TRE Fields for Hyperspectral Products

EXOPTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	EXOPTA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00107	bytes	R	R
ANGLE_TO_NORTH	**Angle to True North**. Angle, measured clockwise, from the first-row vector (pointing from the first column to the last) to a vector pointing to True North.	3	BCS-N	000 to 359	degrees	R	<R>
MEAN_GSD	**Mean Ground Sample Distance**. The geometric mean of the cross and along scan center-to-center distance between contiguous ground samples. Accuracy = ±10% Note: Systems requiring an extended range shall insert a default value of "000.0" for this field and utilize the PIAMC tag.	5	BCS-N	000.0 to 999.9	inches	R	<R>
(reserved-001)		1	BCS-N	1		R	R
DYNAMIC_RANGE	**Dynamic Range** of image pixels.	5	BCS-N	00000 to 65535		R	<R>
(reserved-002)		7		7 BCS spaces		R	R
OBL_ANG	**Obliquity Angle**. Angle between the local NED horizontal and the optical axis of the image.	5	BCS-N	00.00 to 90.00	degrees	R	<R>
ROLL_ANG	**Roll Angle** of the platform body.	6	BCS-N	±90.00	degrees	R	<R>
PRIME_ID	**Primary Target ID**	12		alphanumeric		R	<R>
PRIME_BE	**Primary Target BE / OSUFFIX** (target designator)	15		alphanumeric		R	<R>
(reserved-003)		5		5 BCS spaces		R	R

EXOPTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
N_SEC	**Number Of Secondary Targets in Image**. Determines the number of SECTG extension present in the image subheader.	3	BCS-N	000 to 250		R	R
(reserved-004)		2		2 BCS spaces		R	R
(reserved-005)		7	BCS-N	0000001		R	R
N_SEG	**Number of Segments**. Segments are separate imagery pieces within an imaging operation.	3	BCS-N	001 to 999		R	R
MAX_LP_SEG	**Maximum Number of Lines Per Segment**. Includes overlap lines.	6	BCS-N	000001 to 199999		R	<R>
(reserved-006)		12		12 BCS spaces		R	R
SUN_EL	**Sun Elevation**. Angle in degrees, measured from the target plane at intersection of the optical line of sight with the earth's surface at the time of the first image line (NITF row 1). 999.9 indicates data is not available.	5	BCS-N	±90.0, 999.9	degrees	R	R
SUN_AZ	**Sun Azimuth**. Angle in degrees, from True North clockwise (as viewed from space) at the time of the first image line. 999.9 indicates data is not available.	5	BCS-N	000.0 to 359.9, 999.9	degrees	R	R

4.1.7 GEOPSB TRE for Hyperspectral Products

The Geo Positioning Information support extension (GEOPSB) is contained in HYPERSPECT and PIX_HEIGHT image segment user-definded or extended subheader data sections of the NITF2.1 Image Segment Subheader. The GEOPSB TRE defines the absolute coordinate system to the HYPERSPECT and PIX_HEIGHT (when present) data are geo-referenced using the PIX_LATLON image segment.

This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.7-1 provides the field descriptions and metadata population requirements for GEOPSB TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*, Appendix P, Geospatial Support Data Extensions (GEOSDE).

Table 4.1.7-1: GEOPSB TRE Fields for Hyperspectral Products

GEOPSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	GEOPSB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00443	bytes	R	R
TYP	**Coordinate System Type**. This field shall contain the type of coordinate system to which the Image Segment refers. Valid values are GEO for a geographic coordinate system (longitude & latitude), MAP for a cartographic (grid) coordinate system (easting & northing) and DIG for a geographic or cartographic coordinate system registered through location grids or registration points. See clause D1.2.2 for details. The default value is MAP.	3	BCS-A	DIG		R	R
UNI	**Coordinate Units**. This field shall contain the units of measure to which the Image Segment refers. Valid values are SEC (Decimal seconds of arc), DEG (Decimal degrees) and M (Metres). The value must be consistent with the coordinate system type. SEC and DEG are not allowed when the coordinate system type is MAP. M is not allowed when the coordinate system type is GEO. The PRJPS extension is expected when the value is M. The default value is M.	3	BCS-A	DEG		R	R

GEOPSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
DAG	**Geodetic Datum Name**. This field shall contain the name of the geodetic datum to which the Image Segment refers. The default value is World Geodetic System 1984.	80	BCS-A	World Geodetic System 1984 See DIGEST Edition 2.1, Part 3-6		R	R
DCD	**Geodetic Datum Code**. This field shall contain the code of the geodetic datum to which the Image Segment refers. The default value is WGE.	4	BCS-A	WGE See DIGEST Edition 2.1, Part 3-6		R	R
ELL	**Ellipsoid Name**. This field shall contain the name of the ellipsoid to which the Image Segment refers. The default value is World Geodetic System 1984.	80	BCS-A	World Geodetic System 1984 See DIGEST Edition 2.1, Part 3-6		R	R
ELC	**Ellipsoid Code**. This field shall contain the code of the ellipsoid to which the Image Segment refers. The default value is WE.	3	BCS-A	WE See DIGEST Edition 2.1, Part 3-6		R	R
DVR	**Vertical Datum Reference**. This field shall contain the name of the vertical datum reference to which the Image Segment refers, or BCS Spaces if no elevation value appears in the Image Segment. The default name is Geodetic.	80	BCS-A	Geodetic See DIGEST Edition 2.1, Part 3-6		R	<R>
VDCDVR	**Code (Category) of Vertical Reference**. This field shall contain the code (or category) of the vertical reference to which the Image Segment refers, or BCS Spaces if no elevation value appears in the Image Segment. The default code is GEOD.	4	BCS-A	GEOD See DIGEST Edition 2.1, Part 3-6		R	<R>

GEOPSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SDA	**Sounding Datum Name**. This field shall contain the name of the sounding datum to which the Image Segment refers, or BCS Spaces if no sounding appears in the Image Segment. The default value is Mean Sea.	80	BCS-A	All BCS spaces See DIGEST Edition 2.1, Part 3-6		R	<R>
VDCSDA	**Code for Sounding Datum**. This field shall contain the code of the sounding datum to which the Image Segment refers, or BCS Spaces if no sounding appears in the Image Segment. The default valid code is MSL.	4	BCS-A	All BCS spaces See DIGEST Edition 2.1, Part 3-6		R	<R>
ZOR	**Z values False Origin**. This field shall contain the elevation and depth false origin for Z values to which the Image Segment refers. The default value is 000000000000000, which implies that there is no projection false Z origin.	15	BCS-N	**000000000000000**		R	R
GRD	**Grid Code**. This field shall contain the identification code of the grid system to which the Image Segment refers, or BCS Spaces. The default value is BCS Spaces.	3	BCS-A	All BCS spaces See DIGEST Edition 2.1, Part 3-6		R	<R>
GRN	**Grid Description**. If the GRD Field value is not BCS Spaces, this field can contain a text description of the grid system. The default value is BCS Spaces.	80	BCS-A	All BCS spaces		R	<R>
ZNA	**Grid Zone number**. This field shall contain the zone number when the GRD Field contains a significant grid code and the corresponding grid system comprises more than one zone. Defaulted to 0000 otherwise.	4	BCS-N	0000 See DIGEST Edition 2.1, Part 3-6		R	R

4.1.8 GRDPSB TRE for Hyperspectral Products

When the image, matrix, or raster data is not rectified, the geographic location of each pixel may be derived from a location grid (PIX_LATLON image segment) computed for a given elevation. A Grid Reference Data GRDPSB TRE is placed in the Image Subheader of the HYPERSPEC image segment and in the PIX_HEIGHT image segment (when present). The coordinates expressed in the location grid (PIX_LATLON) refer to the absolute coordinate system defined in the GEOPSB TRE. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.8-1 provides the field descriptions and metadata population requirements for GRDPSB TRE used with Hyperspectral datasets. The use of this TRE is required whenever the PIX_LATLON or PIX_HEIGHT segments are present in such datasets.

For additional information refer to *STANAG 7074*, *Digital Geographic Information Exchange Standard (DIGEST), Part 2 Annex D*.

Table 4.1.8-1: GRDPSB TRE Fields for Hyperspectral Products

GRDPSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier.** The last character identifies the version of the TRE.	6	BCS-A	GRDPSB	N/A		R
CEL	**Length of Data to Follow.** The CEL Field value shall be equal to: 2 + NUM_GRDS ∗ 66	5	BCS-N	00068	bytes		R
NUM_GRDS	**Number of Location Grids.** This field defines the number of location grids described in the GRDPS extension. Usually, only one or two grids are needed.	2	BCS-N Positive Integer	01	grids		R
. . . . Start for each location grid							
ZVLn	**Location Grid Elevation.** This field shall contain the elevation (Meters) to which the nth location grid has been computed, or BCS Spaces if this elevation is not useful (a single grid is provided, for example). The default value is BCS Spaces.	10	BCS-N	+000000.00	meters		<R>
BADn	**Location Grid ID.** This field shall contain the identification of the Image Segment (IID1 Field) which contains the nth location grid data.	10	BCS-A	PIX_LATLON	N/A		R
LODn	**Data density in columns.** This field shall contain the interval (measured in image pixels) between two consecutive elements of the nth location grid (in columns). Positive (decimal or integer) values are required.	12	BCS-N	000000000001	pixels		R
LADn	**Data density in rows.** This field shall contain the interval (measured in image pixels) between two consecutive elements of the nth location grid (in rows). Positive (decimal or integer) values are required.	12	BCS-N	000000000001	pixels		R
LSOn	**Origin in columns.** This field shall contain the column number of the origin of the nth location grid.	11	BCS-N Positive Integer	00000000000	column		R

GRDPSB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
PSOn	**Origin in rows.** This field shall contain the row number of the origin of the nth location grid.	11	BCS-N Positive Integer	00000000000	row		R
. . . . End for each location grid							

4.1.9 HISTOA TRE for Hyperspectral Products

The Softcopy History tagged record extension (HISTOA) is contained in the image extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.9-1 provides the field descriptions and metadata population requirements for the HISTOA TRE used with Hyperspectral datasets. This TRE is required for all such datasets.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

The HISTOA TRE describes previous pixel processing actions and the current state of the image pixels within the HYPERSPECT image segment. For the purposes of this profile, the focus is on recording the state of the image pixels when the data is first formed into the NITF file structure. The objective is to describe the pixel processing actions (e.g., format conversions, data compression/expansion, data enhancement processing, etc.) that pixel values underwent prior to NITF formulation; and the pixel processing actions that occurred in conjunction with the NITF formulation processing event.

For a given data production system, the product specification normally dictates the HISTOA TRE features to be implemented, within the bounds of the TRE specification. The expectation is that few, if any, variations in the production characteristics will result in a simple, straight forward "cookie cutter" approach for populating the data element fields in the HISTOA TRE for the initial NITF formulation event.

Table 4.1.9-1: HISTOA TRE Fields for Hyperspectral Products

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	HISTOA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00115 to 83512	bytes	R	R
SYSTYPE	**System Type**. This field shall contain the name of the sensor from which the original image was collected. The code in the SYSTYPE field shall be left justified and the remainder of the field filled with BCS spaces (0x20) to a full 20 characters. *NOTE:* *See http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx for register of codes added via the NTB registration process.*	20	BCS-A	alphanumeric Value as registered with the NTB. Use same value as registered for ACFTB:SENSOR_ID field.	N/A	R	R
PC	**Prior Compression**. This field shall contain an alphanumeric string that indicates if bandwidth compression/expansion was applied to the image prior to NITF image creation. This field should be used in conjunction with the PE field to determine the state of the image prior to NITF formation. The valid field codes for the PC field are 4 byte character strings. The first two characters indicate the type of compression. The next two characters indicate either the bit-rate or the quality level. The types of compression are indicated by codes listed in STDI-0002-1, Appendix L, and as listed at: http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx (continued next page)	12	BCS-A	generate If no compression / expansion applied: NONE00000000 If application of compression / expansion is unknown: UNKC00000000 Other codes from STDI-0002-1 or the NTB register as applicable.	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
PC (continued)	The entire PC field is 12 bytes long to allow for the concatenation of up to three compression algorithms. Consecutive 4-byte character strings shall indicate the application of two or three compression algorithms in succession. If only one compression algorithm is applied then the last eight characters are zeros. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown compression (UNKC) shall be used. Examples of valid codes for the PC field are shown below. The DP43DC130000 code indicates that a concatenation of the 4.3 DPCM and the 1.3 DCT compression and expansion was applied to the image prior to its NITF formation. The NONE00000000 code indicates that no compression was applied to the image prior to its NITF formation. The UNKC00000000 code indicates that prior compression processing history is unknown.						

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
PE	**<u>Prior Enhancements</u>**. This field shall contain an alphanumeric string that indicates if any enhancements were applied to the image prior to NITF image creation. This field should be used in conjunction with the PC field to determine the state of the image prior to NITF formation. The valid field codes for the PC field are given below: EH08 – Enhanced 8 bpp from IDEX EH11 – Enhanced 11 bpp from IDEX UE08 – 8 bpp with DRA but no enhancements from IDEX UE11 – Unenhanced 11 bpp from IDEX DGHC – Digitized Hardcopy UNKP – Unknown Processing NONE – No prior processing The first four codes explicitly define the types of ODS (Output Data Server) products that are available for NITF formation. Additional codes may be added for airborne systems. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown processing (UNKP) shall be used.	4	BCS-A	alphanumeric Typically: NONE --or— UNKP Additional codes as registered with the NTB. http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx	N/A	R	R
REMAP_FLAG	**<u>System Specific Remap</u>**. This field shall indicate whether or not a system specific remap has been applied to the image. The valid field codes are 0-9, and a BCS space (0x20), but 2-9 are reserved for future use. A value of 0 means that no system specific remap has been applied. A value of 1 means that system specific remap has been applied to the image. For commercial and airborne imagery, this field does not apply at this time and should be filled with a BCS space. Values 2-9 are reserved for future use and shall not be used at this time.	1	BCS-A	BCS space (0x20)	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
LUTID	**Data Mapping ID from the ESD**. This field shall contain the DMID (Data Mapping ID). See section L.4.1 of STDI-0002-1. The valid field codes are 07, 08, and 12-64. A value of 07 or 08 indicates that the image is PEDF (Piecewise Extended Density Format). A value between 12 and 64 indicates that the image is a Linlog formatted image. A value of 00 indicates that neither Linlog nor PEDF is used for this image. Numbers between 01 and 06, 09, 10, and 11 are reserved and should not be used at this time. There are no valid DMID values greater than 64. NITF users can use this field to help determine what type of processing should be applied to the image.	2	BCS-N	00	N/A	R	R
NEVENTS	**Number of Processing Events**. This field shall contain the number of processing events associated with the image. The tag is designed to record up to 99 separate processing events. The valid field codes are 01 to 99. The processing events are listed in chronological order, starting with the first event and ending with the most recent processing event. At a minimum, the first processing event shall be the processing immediately following the generation of the NITF formatted image; however, if practical, the originator of the NITF image can create the HISTOA TRE earlier – with the creation of the NITF formatted image. In that instance, the first processing event would be the creation of the NITF formatted image. Each successive processing event is to record what transformations have been applied to the image, once the image has been processed and saved.	2	BCS-N	01 to 99 The first recorded processing event shall be for the creation of the NITF formatted image.	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Processing Event Loop, where nn = 01 to NEVENTS.							
PDATEnn	**Processing Date and Time**. This field shall contain the date and time (UTC) on which this processing event occurred. This field can be used in conjunction with the FDT field in the NITF file header to determine if the History Tag has been updated each time the image was processed and saved. If the PDATE field and the FDT field are identical, then the History Tag has been properly updated. If the fields are not identical, then the History Tag has not been properly updated and the data may not be accurate or timely.	14	BCS-N	CCYYMMDDhhmmss	UTC	R	R
PSITEnn	**Processing Site**. This field shall contain the name of the site or segment that performed the processing event. This 10-character alphanumeric field is free form text. Examples of PSITE entries are FOS, JWAC, or CENTCOM.	10	BCS-A	alphanumeric	N/A	R	R
PASnn	**Softcopy Processing Application**. This field shall contain the processing application software used to perform the processing steps cited in the event (e.g., IDEX, VITEC, or DIEPS). The version number of the application would also be helpful to include in this field.	10	BCS-A	alphanumeric	N/A	R	R
NIPCOMnn	**Number of Image Processing Comments**. This field shall contain the valid number of image processing comments for this processing event. The valid field codes are 0 to 9.	1	BCS-N	1 to 9	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Image Processing Comment Loop, where m = 1 to NIPCOMnn. Note: This loop structure is conditional on NIPCOMnn > 0.							
IPCOMnn	**nth Image Processing Comment**. This field shall contain the nth line of comment text, based on the value of the NIPCOM field. The fields IPCOM1 to IPCOMn shall contain free form alphanumeric text. They are intended for use as a single comment block and shall be used that way. This comment field shall be used to clarify or indicate special processing not accounted for in the Processing Event fields. Reasons for populating this field would be to indicate alternate processing for multi-spectral imagery, to indicate the order of S/C processing steps contained within a single processing event, or to inform downstream users of potential problems with the image.	80	BCS-A	For the first processing event, provide a brief summary description for the processing history of the data prior to placing the data in NITF. Include a URL for a detailed description of the processing history and associated processing and data characterization parameters not recorded elsewhere in the dataset file (e.g., system-specific static parameters). See system-specific addendum for further guidance.	N/A	R	C
End of Image Processing Comment Loop.							
IBPPnn	**Input Bit Depth (Actual)**. This field shall contain the number of significant bits for each pixel before the processing functions denoted in the processing event have been performed and before compression. This type of pixel depth description is consistent with the ABPP field within the NITF image subheader. For example, if an 11-bpp word is stored in 16 bits, this field would contain 11 and the NBPP field in the NITF image subheader would contain 16. The valid IBPP field codes are 01 to 64, indicating 1 to 64 bpp.	2	BCS-N	01 to 64	bits per pixel	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IPVTYPEnn	**Input Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value of each pixel before the processing functions denoted in the processing event have been performed and before compression. Valid entries are INT for integer, SI for 2's complement signed integer, and R for real.	3	BCS-A	alphanumeric INT, SI, R	N/A	R	R
INBWCnn	**Input Bandwidth Compression**. This field shall indicate the type of bandwidth compression or expansion that has been applied to the image prior to any enhancements desired in the processing event. The valid field codes to describe each type of compression are 5 byte character strings. The first two characters indicate the type of compression. The next two characters indicate either the bit rate or the quality level. The last character indicates if the process is compression or an expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by codes listed in STDI-0002-1, Appendix L and as listed at: http://jitc.fhu.disa.mil/cgi/nitf/tag_reg/trefields.aspx The entire INBWC field is 10 bytes long to allow for the concatenation of up to two compression algorithms. Two consecutive 5-byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining five characters are zeros. The NONE000000 code indicates that the input image to the NITF formation process was uncompressed.	10	BCS-A		N/A	R	R
DISP_FLAGnn	**Display-Ready Flag**. This field shall indicate if the image is "Display Ready". The DISP_FLAG field applies only to systems that do not inherently produce displayable imagery. A value of BCS space (0x20) means that the image is inherently displayable.	1	BCS-A	BCS space (0x20)	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ROT_FLAGnn	**Image Rotation**. This field shall indicate if the image has been rotated. The valid field codes are 0 and 1. A value of 0 means that the image has not been rotated. A value of 1 means that the image has been rotated. If this field is equal to 1, then the ROT_ANGLE field must be filled with the angle of rotation.	1	BCS-N	0	N/A	R	R
The presence of field ROT_ANGLEnn is conditional upon ROT_FLAGnn = 1.							
ROT_ANGLEnn	**Angle of Rotation**. This field shall contain the angle in degrees that the image has been rotated, where a positive angle denotes clockwise rotation. The valid field codes are 000.0000 to 359.9999. This field is conditional on the ROT_FLAG field being equal to 1. If the rotation has included an interpolation, then the interpolation method shall be described in the comment sections.	8	BCS-N	000.0000 to 359.9999 Omit this conditional field	degrees	R	C
ASYM_FLAGnn	**Asymmetric Correction**. This field shall indicate if asymmetric correction has been applied to the image. This processing step only applies to certain types of imagery. The valid field codes are 0 and 1, and a BCS space (0x20). A value of 0 means that asymmetric correction has not yet been applied to the image. A value of 1 means that asymmetric correction has been applied to the image. A value of BCS space (0x20) means that imagery did not need correcting. If this field is equal to 1, then the ZOOMROW and ZOOMCOL fields must be filled with the magnification levels in the row (line) and column (element) directions, respectively.	1	BCS-A	0, 1, or BCS space (0x20)	N/A	R	R
The presence of fields ZOOMROWnn and ZOOMCOLnn are conditional upon ASYM_FLAGnn = 1.							
ZOOMROWnn	**Magnification in Line (Row) Direction**. This field shall contain the level of magnification that was applied to the image in the line (row) direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.	7	BCS-N	00.0000 to 99.9999	N/A	R	C

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZOOMCOLnn	**Magnification in Element (Column) Direction**. This field shall contain the level of magnification that was applied to the image in the element (column) direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.	7	BCS-N	00.0000 to 99.9999	N/A	R	C
PROJ_FLAGnn	**Image Projection**. This field shall indicate if the image has been projected from the collection geometry into another geometry that is more suitable for display. The valid field codes are 0 and 1. A value of 0 means that no geometric transformation has been applied to the image, meaning it is probably still in the collection geometry. A value of 1 means that the image has been projected into another geometry. If this field is equal to 1, then a description of the projection or rectification shall be given in the comment section.	1	BCS-N	0	N/A	R	R
SHARP_FLAGnn	**Sharpening**. This field shall indicate if the image has been passed through a sharpening operation. The valid field codes are 0 and 1. A value of 0 means that no sharpening has been applied to the image. A value of 1 means that sharpening has been applied to the image. If this field is equal to 1, then the SHARPFAM and SHARPMEM fields must be filled with the appropriate numbers. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the sharpening kernel database.	1	BCS-N	0 or 1	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
The presence of fields SHARPFAMnn and SHARPMEMnn are conditional upon SHARP_FLAGnn = 1.							
SHARPFAMnn	**Sharpening Family Number**. This field shall contain the number of the sharpening family, if a sharpening operation was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the SHARP_FLAG field. Although the IDEX sharpening family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the sharpening kernel is not part of the existing group of families and members, a value of -1 shall be placed in the field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the sharpening kernel database.	2	BCS-N	-1, 00 to 99 (in general)	N/A	R	C
SHARPMEMnn	**Sharpening Member Number**. This field shall contain the number of the sharpening member, if a sharpening operation was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the SHARP_FLAG field. If the sharpening kernel is not part of the existing group of families and members, then a value of -1 shall be placed in the field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the sharpening kernel database.	2	BCS-N	-1, 00 to 99 (in general)	N/A	R	C
MAG_FLAGnn	**Symmetrical Magnification**. This field shall indicate if the image has been symmetrically (same amount in each direction) magnified during this processing step. The valid field codes are 0 and 1. A value of zero means that the image was not magnified. A value of 1 means that the image has been magnified. If this field is equal to 1, then the MAG_LEVEL field shall be filled with the level of magnification.	1	BCS-N	0 or 1	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
The presence of field MAG_LEVELnn is conditional upon MAG_FLAGnn = 1.							
MAG_LEVELnn	**Level of Relative Magnification**. This field shall contain the level of symmetrical magnification that has been applied to the image relative to the input image at this processing step. For example, a value of 02.0000 would indicate a 2X magnification relative to the input image. The valid field codes are 00.0000 to 99.9999. This field is conditional on the MAG_FLAG field. A value greater than 1 shall indicate that the image was magnified to a size larger than its previous size and a value less than 1 shall indicate the image size was decreased. The method of magnification shall be described in the comment section.	7	BCS-N	00.0000 to 99.9999 (in general)	N/A	R	C
DRA_FLAGnn	**Dynamic Range Adjustment (DRA)**. This field shall indicate if a Dynamic Range Adjustment (DRA) has been applied to the image. DRA is an affine transformation of the image pixel values of the form Y = DRA_MULT*(X-DRA_SUB), where X is the input pixel value, DRA_SUB is the DRA subtractor, DRA_MULT is the DRA multiplier, and Y is the output pixel value. The DRA is said to be spatially invariant when the DRA subtractor and DRA multiplier do not depend on pixel position. If the DRA subtractor and DRA multiplier do depend on pixel position, then the DRA is said to be spatially variant. The valid field codes are 0, 1, and 2. A value of 0 means that a DRA has not been applied to the image. A value of 1 means that a spatially invariant DRA has been applied to the image. In this case, the DRA_SUB and DRA_MULT fields shall be filled with the appropriate codes. A value of 2 means that a spatially variant DRA has been applied to the image. In cases where DRA_FLAG equals 0 or 2, the DRA_SUB and DRA_MULT fields shall not be filled.	1	BCS-N	0, 1, or 2	N/A	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
The presence of fields DRA_MULTnn and DRA_SUBnn are conditional upon DRA_FLAGnn = 1.							
DRA_MULTnn	**DRA Multiplier**. This field shall contain the multiplier value of the DRA. The valid field codes are 000.000 to 999.999. This field is conditional on the DRA_FLAG field being equal to 1.	7	BCS-N	000.000 to 999.999 (in general)	N/A	R	C
DRA_SUBnn	**DRA Subtractor**. This field shall contain the subtractor value of the DRA. The valid field codes are -9999 to +9999. This field is conditional on the DRA_FLAG field being equal to 1.	5	BCS-N	-9999 to +9999 (in general)	N/A	R	C
TTC_FLAGnn	**Tonal Transfer Curve (TTC)**. This field shall indicate if a TTC (Tonal Transfer Curve) has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a TTC has not been applied to the image. A value of 1 means that a TTC has been applied to the image. If a TTC has been applied, then the TTCFAM and TTCNUM fields shall be filled with the appropriate codes. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the TTC database.	1	BCS-N	0 or 1	N/A	R	R
The presence of fields TTCFAMnn and TTCMEMnn are conditional upon TTC_FLAGnn = 1.							
TTCFAMnn	**TTC Family Number**. This field shall contain the number of the TTC family, if a TTC was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the TTC_FLAG field. Although the IDEX TTC family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the TTC is not part of the existing group of families and members, then a value of -1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the TTC database.	2	BCS-N	-1, 00 to 99 (in general)	N/A	R	C

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TTCMEMnn	**TTC Member Number**. This field shall contain the number of the TTC member, if a TTC was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the TTC_FLAG field. If the TTC is not part of the existing group of families and members, then a value of -1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph L.5 of STDI-0002-1 for a more complete description of the TTC database.	2	BCS-N	-1, 00 to 99 (in general)	N/A	R	C
DEVLUT_FLAGnn	**Device LUT**. This field shall indicate if the device compensation LUT has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a device LUT has not been applied to the image. A value of 1 means that a device LUT has been applied to the image. The nature of the LUT may be specified in the comment section and should include the device for which the LUT is applied. If the device is not known, then an appropriate method for describing the LUT shall be given.	1	BCS-N	0 or 1	N/A	R	R
OBPPnn	**Output Bit Depth (Actual)**. This field shall contain the number of significant bits for each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. For example, if an 8 bpp image is mapped into Display-Ready space using the proper 8 to 11 bpp transformation (see section L.4 of STDI-0002-1), then the IBPP field would contain 08 and the OBPP field would contain 11. The OBPP field shall contain the actual number of data bits, not the word length; for example, if an 11-bpp pixel were stored in 16 bits, this field would contain 11. The valid OBPP field codes are 01 to 64, indicating 1 to 64 bpp. In many cases, this field will match the IBPP field.	2	BCS-N	01 to 64	bits per pixel	R	R

HISTOA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
OPVTYPEnn	**Output Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value of each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. Valid entries are INT for integer and R for real. The data bits of INT values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. INT data types shall be limited to 16 bits. R values shall be represented according to the IEEE 32-bit floating-point representation (IEEE 754).	3	BCS-A	alphanumeric (in general) INT, R	N/A	R	R
OUTBWCnn	**Output Bandwidth Compression**. This field shall indicate the type of bandwidth compression or expansion that has been applied to the image after any enhancements denoted in the processing event. The valid field codes to describe each type of compression are 5-byte character strings. The first two characters indicate the type of compression. The next two characters indicate either the bit rate of the quality level. The last character indicates if the process is compression or expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by the same codes used in the INBWC field and can be found in the field description for INBWC. The entire OUTBWC field is 10 bytes long to allow for the concatenation of up to 2 compression algorithms. Two consecutive 5 byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining 5 characters are zero.	10	BCS-A	alphanumeric	N/A	R	R
End of Processing Event Loop.							

4.1.10 ICHIPB TRE for Hyperspectral Products

The Image Chip tagged record extension (ICHIPB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.10-1 provides the field descriptions and metadata population requirements for ICHIPB TRE used with Hyperspectral datasets when chipped. This TRE is required for all such datasets, and is only used with the HYPERSPECT image segment.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.10-1: ICHIPB TRE Fields for Hyperspectral Products

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ICHIPB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00224	bytes	R	R
XFRM_FLAG	**Non-linear Transformation Flag**. If the image is non-dewarped, field is 00. For all others, flag is 01 with zero fill in the remaining fields.	2	BCS-N	00 (for non-dewarped case, data provided) 01 (for dewarped case, no data provided)	N/A	R	R
Note: If XFRM_FLAG = 01, then all remaining fields are populated with zero-fill to their full extent.							
SCALE_FACTOR	**Scale Factor Relative to R0**. This provides a mechanism to reference back to the full image if product is not at R0. To determine product RRDS value: if 0001.00000 then R0; 0002.00000 then R1; if 0004.00000 then R2; if 0008.00000 then R3; if 0016.00000 then R4; if 0032.00000 then R5; if 0064.00000 then R6; if 0128.00000 then R7. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	10	BCS-N	0000.00001 to 9999.99999 (reciprocal of display magnification) 0000000000 (if XFRM_FLAG = 01)	N/A	R	R
ANAMRPH_CORR	**Anamorphic Correction Indicator**. If no anamorphic correction has been applied, then this field shall contain 00. If anamorphic correction has been applied, then this field shall contain 01. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	2	BCS-N	00 (no anamorphic correction) 01 (anamorphic correction) 00 (if XFRM_FLAG = 01)	N/A	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SCANBLK_NUM	**Scan Block Number (Index)**. This field contains the scan block number from which the product was chipped, if applicable; otherwise 00. When chipping from imagery that has multiple scan blocks, the scan block from which the chip was extracted shall be identified. The value in this field permits identification and selection of the scan block specific SDEs from the entire complement of SDEs in the original image file. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	2	BCS-N	00, 01 to 99 (in general; 00 indicates that Scan Block Number is not applicable) 00 (if XFRM_FLAG = 01)	N/A	R	R
OP_ROW_11	**Output Product Row Number Component of Grid Point Index (1,1) for Intelligent Data**. This field shall contain the chipped output product's row number component for grid point index (1,1) for intelligent data. Typically, this value is 00000000.500. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general; typically this value is 00000000.500 for Grid Point Index (1,1)) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
OP_COL_11	**Output Product Column Number Component of Grid Point Index (1,1) for Intelligent Data**. This field shall contain the chipped output product's column number component for grid point index (1,1) for intelligent data. Typically, this value is 00000000.500. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general; typically this value is 00000000.500 for Grid Point Index (1,1)) 000000000000 (if XFRM_FLAG = 01)	samples	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
OP_ROW_12	**Output Product Row Number Component of Grid Point Index (1,2) for Intelligent Data**. This field shall contain the chipped output product's row number component for grid point index (1,2) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
OP_COL_12	**Output Product Column Number Component of Grid Point Index (1,2) for Intelligent Data**. This field shall contain the chipped output product's column number component for grid point index (1,2) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R
OP_ROW_21	**Output Product Row Number Component of Grid Point Index (2,1) for Intelligent Data**. This field shall contain the chipped output product's row number component for grid point index (2,1) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
OP_COL_21	**Output Product Column Number Component of Grid Point Index (2,1) for Intelligent Data**. This field shall contain the chipped output product's column number component for grid point index (2,1) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R
OP_ROW_22	**Output Product Row Number Component of Grid Point Index (2,2) for Intelligent Data**. This field shall contain the chipped output product's row number component for grid point index (2,2) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
OP_COL_22	**Output Product Column Number Component of Grid Point Index (2,2) for Intelligent Data**. This field shall contain the chipped output product's column number component for grid point index (2,2) for intelligent data. For a better definition of the proper implementation of ICHIPB see STDI-0002-1 Appendix B. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FI_ROW_11	**Grid Point (1,1), Row Number in Full Image Coordinate System**. This field shall contain the grid point (1,1) row number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
FI_COL_11	**Grid Point (1,1), Column Number in Full Image Coordinate System**. This field shall contain the grid point (1,1) column number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R
FI_ROW_12	**Grid Point (1,2), Row Number in Full Image Coordinate System**. This field shall contain the grid point (1,2) row number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FI_COL_12	**Grid Point (1,2), Column Number in Full Image Coordinate System**. This field shall contain the grid point (1,2) column number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R
FI_ROW_21	**Grid Point (2,1), Row Number in Full Image Coordinate System**. This field shall contain the grid point (2,1) row number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
FI_COL_21	**Grid Point (2,1), Column Number in Full Image Coordinate System**. This field shall contain the grid point (2,1) column number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FI_ROW_22	**Grid Point (2,2), Row Number in Full Image Coordinate System**. This field shall contain the grid point (2,2) row number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	lines	R	R
FI_COL_22	**Grid Point (2,2), Column Number in Full Image Coordinate System**. This field shall contain the grid point (2,2) column number in the full image coordinate system. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	12	BCS-N	00000000.000 to 99999999.999 (in general) 000000000000 (if XFRM_FLAG = 01)	samples	R	R

ICHIPB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FI_ROW	**Full Image Number of Rows**. This field shall contain the number of pixel rows in the original full image for which the coverage of the SDEs is applicable. When known by the chipping application, this field is to be populated with the maximum row value for the coverage to which the support data (SDE) applies. The default value of 00000000 shall be interpreted to mean the total coverage area of the SDE applies, but the maximum number of rows is unknown. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	8	BCS-N	00000000, 00000002 to 99999999 (in general; 00000000 indicates that total coverage applies though it is unknown) 00000000 (if XFRM_FLAG = 01)	lines	R	R
FI_COL	**Full Image Number of Columns**. This field shall contain the number of pixel columns in the original full image for which the coverage of the SDEs is applicable. When known by the chipping application, this field is to be populated with the maximum column value for the coverage to which the support data (SDE) applies. The default value of 00000000 shall be interpreted to mean the total coverage area of the SDE applies, but the maximum number of columns is unknown. For images with multiple scan blocks, the “full image” value refers to the extent of the single scan block from which the chip was extracted. Note: If XFRM_FLAG is 01, then this field shall be zero-filled.	8	BCS-N	00000000, 00000002 to 99999999 (in general; 00000000 indicates that total coverage applies though it is unknown) 00000000 (if XFRM_FLAG = 01)	samples	R	R

4.1.11 MSTGTA TRE for Hyperspectral Products

The Mission Target Information support extension (MSTGTA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.11-1 provides the field descriptions and metadata population requirements for MSTGTA TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets as indicated in Table 4.0-1.

For additional information refer to *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.11-1: MSTGTA TRE Fields for Hyperspectral Products

MSTGTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	MSTGTA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00101	bytes	R	R
TGT_NUM	**Pre-Planned Target Number**. This field shall contain the number assigned to each pre-planned target, initialized at 00001. Recorded in the mission target support data block and the mission catalog support data block to associate the two groups of information. The same number may be assigned to multiple mission catalogs support blocks. Each mission target block shall have a unique number. 00000 = TRE is empty.	5	BCS-N	00000, 00001 to 99999	N/A	R	R
TGT_ID	**Designator of Target**. This field records the twelve-character target designator.	12	BCS-A	alphanumeric (in general) Default is all BCS spaces (0x20)	N/A	R	<R>
TGT_BE	**Basic Encyclopedia ID/OSUFFIX**. This field records the ten-character BE number of the target followed by the five-character OSUFFIX for the target.	15	BCS-A	BBBBBBBBBBOOOOO, BBBBBBBBBB (where BCS space-fill is used for the OSUFFIX if it is unknown) Default is all BCS spaces (0x20)	N/A	R	<R>
TGT_PRI	**Pre-Planned Target Priority**. This field records the pre-planned priority of the target. 001 = top priority 002 = second priority, etc.	3	BCS-A	001 to 999 Default is all BCS spaces (0x20)	N/A	R	<R>
TGT_REQ	**Target Requester**. This field identifies the authority requesting the targets to be imaged.	12	BCS-A	alphanumeric (in general) Default is all BCS spaces (0x20)	N/A	R	<R>

MSTGTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TGT_LTIOV	**Latest Time Information of Value**. This field shall contain the date and time, referenced to UTC, at which the information, contained in this file, loses all value and should be discarded. The date and time is in the format CCYYMMDDhhmm where CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), and mm is the minute (00 to59).	12	BCS-A	CCYYMMDDhhmm Default is all BCS spaces (0x20)	UTC	R	<R>
TGT_TYPE	**Pre-Planned Target Type**. This field identifies the type of pre-planned target. 0 = point 1 = strip 2 = area 3 to 9 = reserved	1	BCS-A	0 to 9 (in general) Default is all BCS spaces (0x20)	N/A	R	<R>
TGT_COLL	**Pre-Planned Collection Technique**. This field identifies the pre-planned collection technique. 0 = vertical 1 = forward oblique 2 = right oblique 3 = left oblique 4 = best possible 5 to 9 = reserved	1	BCS-N	0 to 9 (in general)	N/A	R	R

MSTGTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TGT_CAT	**Target Functional Category Code from DIAM-65-3-1**. This field contains the five-character numeric code that classifies the function performed by a facility. The data code is based on an initial breakdown of targets into nine major groups, identified by the first digit: 1 = Raw Materials 2 = Basic Processing 3 = Basic Equipment Production 4 = Basic Services, Research, Utilities 5 = End Products (civilian) 6 = End Products (military) 7 = Places, Population, Gov't 8 = Air & Missile Facilities 9 = Military Troop Facilities Each successive numeric character, reading from left to right, extends or delineates the definition further.	5	BCS-A	10000 to 99999 Default is all BCS spaces (0x20)	N/A	R	<R>
TGT_UTC	**Planned Time at Target**. This field shall record the planned time at target in UTC. The format is hhmmssZ where, hh = hours (00-23), mm = minutes (00-59), ss = seconds (00-59), and Z = the UTC time zone.	7	BCS-A	hhmmssZ Default is all BCS spaces (0x20)	UTC	R	<R>
TGT_ELEV	**Target Elevation Above MSL**. This field shall contain the planned elevation of the target above Mean Sea Level (MSL) for point targets. For strip and area targets, this field shall contain the average elevation of the target area above MSL. The value is recorded in either feet or meters, as specified by TGT_ELEV_UNIT.	6	BCS-A	-01000 to +30000 Default is all BCS spaces (0x20)	feet or meters	R	<R>
TGT_ELEV_UNIT	**Unit of Target Elevation**. This field contains the units of the elevation value recorded in TGT_ELEV. f = feet m = meters	1	BCS-A	f or m Default is a BCS space (0x20)	N/A	R	<R>

MSTGTA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TGT_LOC	**Target Location**. This field shall contain the planned latitude/longitude of the portion of the target corresponding to the point where the elevation was measured or the point associated with the average elevation for strip or area targets. Location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X=N for north and S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y=E for east and W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).	21	BCS-A	ddmmss.ssXdddmmss.ssY, ±dd.dddddd±ddd.dddddd	degrees	R	R

4.1.12 PIAIMC TRE for Hyperspectral Products

The Profile for Imagery Access Image support extension (PIAIMC) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.12-1 provides the field descriptions and metadata population requirements for PIAIMC TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets as indicated in Table 4.0-1.

The PIAIMC TRE contains metadata indicating the Percentage of Cloud Cover and Mean Ground Sample Distance (GSD), which may be useful for image search and discovery.

For additional information refer to *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.12-1: PIAIMC TRE Fields for Hyperspectral Products

PIAIMC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	PIAIMC	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00362	bytes	R	R
CLOUDCVR	**Cloud Cover**. Indicates the percentage of the image that is obscured by cloud. A value of 999 indicates an unknown condition.	3	BCS-N	000 to 100, 999		R	O
SRP	**Standard Radiometric Product**. Indicates whether or not standard radiometric product data is available.	1	BCS-A	Y, N		R	O
SENSMODE	**Sensor Mode**. Identifies the sensor mode used in capturing the image.	12	BCS-A	WHISKBROOM, PUSHBROOM, FRAMING, SPOT, SWATH, TBD		R	O
SENSNAME	**Sensor Name**. Identifies the name of the sensor used in capturing the image.	18	BCS-A	USIGS DM, SENSOR - TYPE Name		R	O
SOURCE	**Source**. Indicates where the image came from (e.g., magazine, trade show, etc.).	255	BCS-A	alphanumeric		R	O
COMGEN	**Compression Generation**. Counts the number of lossy compressions done by the archive.	2	BCS-N	00 to 99		R	O
SUBQUAL	**Subjective Quality**. Indicates a subjective rating of the quality of the image.	1	BCS-A	P-Poor, G - Good, E - Excellent, F- Fair		R	O
PIAMSNNUM	**PIA Mission Number**. Indicates the mission number assigned to the reconnaissance mission.	7	BCS-A	EARS 1.1, page 4-28		R	O
CAMSPECS	**Camera Specs**. Specifies the brand name of the camera used, and the focal length of the lens.	32	BCS-A	Alphanumeric		R	O

PIAIMC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
PROJID	**Project ID Code**. Identifies collection platform project identifier code.	2	BCS-A	EARS 1.1, Appendix 9		R	O
GENERATION	**Generation**. Specifies the number of image generations of the product. The number (0) is reserved for the original product.	1	BCS-A	0 to 9		R	O
ESD	**Exploitation Support Data**. Indicates whether or not Exploitation Support Data is available and contained within the product data.	1	BCS-A	Y, N		R	O
OTHERCOND	**Other Conditions**. Indicates other conditions that affect the imagery over the target.	2	BCS-A	EARS 1.1, page 4 to 28		R	O
MEAN GSD	**MEANGSD**. The geometric mean of the across and along scan center-to-center distance between contiguous ground samples.	7	BCS-A	00000.0 to 99999.9, accuracy=10%	inches	R	O
IDATUM	**Image Datum**. Identifies the mathematical representation of the earth used to geocorrect/or to rectify the image. (Identifies the Datum associated with IGEOLO.)	3	BCS-A	Horizontal_Reference_ Datum_Code (refer to DDDS element		R	O
IELLIP	**Image Ellipsoid**. Identifies the mathematical representation of the earth used to geocorrect/or to rectify the image. (Identifies the Ellipsoid associated with IGEOLO.)	3	BCS-A	DIGEST Edition 2.1, Part 3, table 8-1		R	O
PREPROC	**Image Processing Level Code**. Identifies the level of radiometric and geometric processing applied to the product by the commercial vendor.	2	BCS-A	USIGS DM, IMAGEDATASET Processing Level Code		R	O
IPROJ	**Image Projection System**. Identifies the 2D-map projection used by commercial vendors to geocorrect/or to rectify the image.	2	BCS-A	DIGEST Edition 2.1, Part 3, table 6-1		R	O

PIAIMC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SATTRACK	**Satellite Track**. Identifies location of an image acquired by LANDSAT or SPOT (only) along the satellite path.	8	BCS-A	Minimum values: PATH(J)=0001 ROW(K)=0001 Maximum values: PATH(J)=9999 ROW(K)=9999 Recorded as PATH/ROW=00010001 to 99999999		R	O

4.1.13 PIATGB TRE for Hyperspectral Products

The Profile for Imagery Access Target support extension (PIATGB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.13-1 provides the field descriptions and metadata population requirements for PIATGB TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets as indicated in Table 4.0-1.

The PIATGB TRE contains metadata indicating the Country Code, which may be useful for image search and discovery.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.13-1: PIATGB TRE Fields for Hyperspectral Products

PIATGB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	PIATGB	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00117	bytes	R	R
TGTUTM	**Target UTM**. Identifies the Universal Transverse Mercator (UTM) grid coordinates that equate to the geographic coordinates of the target element.	15	BCS-A	XXXNNnnnnnnnnnn		R	O
PIATGAID	**Target Identification**. Identifies a point or area target (DSA, LOC or BAS).	15	BCS-A	6 character Area Target ID, 10 Character BE, or 15 character BE + suffix		R	O
PIACTRY	**Country Code**. Identifies the country in which the geographic coordinates of the target element reside.	2	BCS-A	FIPS 10-4		R	O
PIACAT	**Category Code**. Classifies a target element by its product or the type of activity in which it can engage.	5	BCS-A	DIAM 65-3-1		R	O
TGTGEO	**Target Geographic Coordinates**. Specifies a point target's geographic location in latitude and longitude.	15	BCS-A	ddmmssXdddmmssY		R	O
DATUM	**Target Coordinate Datum**. Identifies the datum of the map used to derive the target coordinates (UTM or GEO).	3	BCS-A	In accordance with Appendix B, Attachment 10, XI-DBDD-08 93 Aug 93		R	O
TGTNAME	**Target Name**. Identifies the official name of the target element based on the MIIDS/IDB name.	38	BCS-A	alphanumeric target names		R	O
PERCOVER	**Percentage of Coverage**. Percentage of the target covered by the image.	3	BCS-A	000 to 100		R	O

PIATGB TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TGTLAT	**Target Latitude**. Specifies a point target's geographic location in latitude (in decimal degrees).	10	BCS-A	+dd.dddddd - where "+" is northern hemisphere and "-" is southern hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be BCS spaces.	degrees	R	O
TGTLON	**Target Longitude**. Specifies a point target's geographic location in longitude (in decimal degrees).	11	BCS-A	+ddd.dddddd - where "+" is eastern hemisphere and "-" is western hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be BCS spaces.	degrees	R	O

4.1.14 PIXQLA TRE for Hyperspectral Products

The Pixel Quality TRE (PIXQLA) is contained in the BADPIXMAP image extended data section of the NITF2.1 Image Segment Subheader. Table 4.1.14-1 provides the field descriptions and metadata population requirements for PIXQLA TRE used with Hyperspectral datasets described in this profile.

The BADPIXMAP image segment and its PIXQLA TRE provides a means to include pixel quality information on a pixel-by-pixel basis in imagery datasets so that human imagery analysts and automated exploitation software know the degree to which individual pixel values are valid for exploitation.

For additional information refer to *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.14-1: PIXQLA TRE Fields for Hyperspectral Products

PIXQLA TRE Fields for Hyperspectral Products							
Field Name	**Description**	**Size**	**Data Type**	**Value Range**	**Units**	**Accuracy**	**Use**
CETAG	**Unique Extension Type Identifier:** Unique TRE identifier.	6	BCS-A	PIXQLA	N/A	Exact	R
CEL	**Length of User-Defined Data:** Length in bytes of data contained in subsequent fields. The TRE's length is 11 plus the value given in the CEL field.	5	BCS-N	00094 - 99985 Implementation dependent	Bytes	Exact	R
NUMAIS	**Number of Associated Image Segments:** This field designates the number of IS(s) associated with the PQS. If NUMAIS = ALL, then the PQS is associated with all IS(s) in the NITF dataset except those with ICAT = PIXQUAL. If NUMAIS = ALL, the conditional field(s) AISDLVL is (are) omitted from this TRE. Otherwise, NUMAIS is a number between 001 and 998 and is no more than the actual number of non-pixel-quality IS(s) in the dataset.	3	BCS-A	001	Count	Exact	R
Start of Associated Image Segment Loop, which runs from n =001 to NUMAIS. Loop is omitted if NUMAIS = "ALL"							
AISDLVLn	**Associated Image Segment Display Level:** This field identifies the Image Display LeVel (IDLVL) of each IS associated with the PQS. AISDLVLn values must correspond to IDLVL values of ISs included in the same dataset. The field is repeated NUMAIS times.	3	BCS-N	001 to 999 Populate with the IDLVL value for the HYPERSPECT image segment within the dataset.	N/A	Exact	C
End of Associated Image Segment Loop							

PIXQLA TRE Fields for Hyperspectral Products							
Field Name	**Description**	**Size**	**Data Type**	**Value Range**	**Units**	**Accuracy**	**Use**
NPIXQUAL	**Number of Pixel Quality Conditions:** This field designates the number of pixel quality conditions represented by the per-pixel values in the PQS. This value is exactly equal to the number of bits used to encode pixel quality. The first bit location is the least significant bit. Since each bit may be either on (set to 1) or off (set to zero), data providers need only a single bit to encode pixel conditions that are exact opposites of each other, such as "Good" and "Bad". Data providers should avoid using different bits to encode pixel conditions that are exact opposites of each other.	4	BCS-N	0001 to 0016 The value shall be no greater than the ABPP field value in the PQS subheader.	Count	Exact	R
PQ_BIT_VALUE	**Pixel Quality Bit Value:** This field identifies the bit value used (the value of the nth bit in PQ_CONDITIONn) for all pixel quality conditions when the designated condition is present.	1	BCS-A	1	N/A	Exact	R
Start of Pixel Condition Loop, which runs from Bit Location n = 0001 (least significant bit) to NPIXQUAL (most significant bit)							
PQ_CONDITIONn	**Pixel Quality Condition:** This field identifies the pixel quality condition in the associated IS when the n^{th} bit of the corresponding pixel in the PQS is set to the value PQ_BIT_VALUE.	40	BCS-A	Alphanumeric character string. Table 4.1.15-2 provides names and definitions for some of the more common pixel quality condition pairs. See the NITF Register for additional condition pairs that may have been established since this profile was published.	N/A	Exact	R
End of Pixel Condition Loop							

Table 4.1.14-2: Common Pixel Quality Condition Pairs

Common Pixel Quality Condition Pairs*		
#	**Condition**	**Definition**
1	Bad	The pixel measured value has little-to-no validity and should not be included in exploitation tasks. Does not indicate why the pixel is bad. If the pixel is not flagged as bad, then the pixel measured value may be exploited with confidence, regardless of any other quality condition(s) specified for this pixel.
2	FPA #, e.g., “FPA 2”	Indicates that the n^{th} focal plane array (FPA) made the pixel measurement. Used for sensors that create an image by amalgamating measurements from several FPAs.
3	Interpolated	Indicates that the pixel value has been estimated from nearby measurements, rather than independently measured.
4	Averaged	Indicates that the measured pixel value is an average of more than one pixel value, rather than a single value.
5	Saturated	Detector measurement reached its maximum possible value. Actual value of the physical phenomenon may be significantly higher than the measured value.
6	Dead	The detector no longer operates. The measured pixel value is usually zero or at the noise level.
7	Noisy	The detector exhibits greater variance than considered normal.
8	Vignetted	Reduction of an image's brightness or saturation at the periphery compared to the image center.
*Additional values as registered with the NITFS Technical Board (NTB). See http://jitc.fhu.disa.mil/nitf/reg_fields.html		

4.1.15 RPC00B TRE for Hyperspectral Products

The Rapid Positioning Capability support extension (RPC00B) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.15-1 provides the field descriptions and metadata population requirements for RPC00B TRE used with Hyperspectral datasets. The use of this TRE is required for all such datasets as indicated in Table 4.0-1.

The RPC00B TRE contains metadata contain polynomial coefficients which define the physical relationship between image coordinates and ground coordinates.

For additional information refer to *STDI-0002-1*, *The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS)*.

Table 4.1.15-1: RPC00B TRE Fields for Hyperspectral Products

RPC00B TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RPC00B	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	01041	bytes	R	R
SUCCESS	**Success Flag**. This field designates the successful completion of the RPC model.	1	BCS-N	1	N/A	R	R
ERR_BIAS	**Error – Bias**. This field records the 68% non-time-varying error estimate, assuming correlated images.	7	BCS-N	0000.00 to 9999.99	meters	R	R
ERR_RAND	**Error – Random**. This field records the 68% time-varying error estimate, assuming uncorrelated images.	7	BCS-N	0000.00 to 9999.99	meters	R	R
LINE_OFF	**Line Offset**. This field contains the offset used to normalize the values along the line-axis.	6	BCS-N	000000 to 999999	lines	R	R
SAMP_OFF	**Sample Offset**. This field contains the offset used to normalize the values along the sample-axis.	5	BCS-N	00000 to 99999	samples	R	R
LAT_OFF	**Latitude Offset**. This field contains the offset used to normalize the range of latitude values covered by the RPC model.	8	BCS-N	±90.0000	degrees	R	R
LONG_OFF	**Longitude Offset**. This field contains the offset used to normalize the range of longitude values covered by the RPC model.	9	BCS-N	±180.0000	degrees	R	R
HEIGHT_OFF	**Height Offset**. This field contains the offset used to normalize the range of height values included in the RPC model.	5	BCS-N	±9999	meters	R	R

RPC00B TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
LINE_SCALE	**Line Scale Factor**. This field contains the scale factor used to normalize the values along the line-axis.	6	BCS-N	000001 to 999999	lines	R	R
SAMP_SCALE	**Sample Scale Factor**. This field contains the scale factor used to normalize the values along the sample-axis.	5	BCS-N	00001 to 99999	samples	R	R
LAT_SCALE	**Latitude Scale Factor**. This field contains the scale factor used to normalize the range of latitude values covered by the RPC model.	8	BCS-N	±90.0000 (cannot be ±00.0000)	degrees	R	R
LONG_SCALE	**Longitude Scale Factor**. This field contains the scale factor used to normalize the range of longitude values covered by the RPC model.	9	BCS-N	±180.0000 (cannot be ±000.0000)	degrees	R	R
HEIGHT_SCALE	**Height Scale Factor**. This field contains the scale factor used to normalize the range of height values included in the RPC model.	5	BCS-N	±9999 (cannot be ±0000)	meters	R	R
Start of Loop for LINE_NUM_COEFF_nn, where nn = 01 to 20.							
LINE_NUM_COEFF_nn	**Line Numerator Coefficients**. This field contains the nnth coefficient for the polynomial in the Numerator of the r_n equation (see STDI-0002-1).	12	BCS-A	±9.999999E±9	N/A	R	R
End of Loop for LINE_NUM_COEFF_nn.							
Start of Loop for LINE_DEN_COEFF_nn, where nn = 01 to 20.							
LINE_DEN_COEFF_nn	**Line Denominator Coefficients**. This field contains the nnth coefficient for the polynomial in the Denominator of the r_n equation (see STDI-0002-1).	12	BCS-A	±9.999999E±9	N/A	R	R
End of Loop for LINE_DEN_COEFF_nn.							

RPC00B TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Loop for SAMP_NUM_COEFF_nn, where nn = 01 to 20.							
SAMP_NUM_COEFF_nn	**Sample Numerator Coefficients**. This field contains the nnth coefficient for the polynomial in the Numerator of the c_n equation (see STDI-0002-1).	12	BCS-A	±9.999999E±9	N/A	R	R
End of Loop for SAMP_NUM_COEFF_nn.							
Start of Loop for SAMP_DEN_COEFF_nn, where nn = 01 to 20.							
SAMP_DEN_COEFF_nn	**Sample Denominator Coefficients**. This field contains the nnth coefficient for the polynomial in the Denominator of the c_n equation (see STDI-0002-1).	12	BCS-A	±9.999999E±9	N/A	R	R
End of Loop for SAMP_DEN_COEFF_nn.							

4.1.16 RSMIDA TRE for Hyperspectral Products

The Replacement Sensor Model Identification support data extension (RSMIDA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.16-1 provides the field descriptions and metadata population requirements for the RSM RSMIDA TRE.

For additional information refer to the document, *Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.16-1: RSMIDA TRE Fields for Hyperspectral Products

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMIDA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	01628	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, resampling, or other such image to image transformations. The image identifier is left justified with trailing BCS spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all BCS spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
ISID	**Image Sequence Identifier**. This field contains a character string that uniquely identifies an image sequence acquired by a single sensor. The associated image is a member of this image sequence.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SID	**Sensor Identifier**. This field contains a character string that uniquely identifies the sensor used to acquire the associated image.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
STID	**Sensor Type Identifier**. This field contains a character string that uniquely identifies the sensor capabilities available in the sensor used to acquire the associated image. The sensor type identifier includes identification of sensor make and model. Any two sensors that have the same features and capabilities will have the same sensor type.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
YEAR	**Year of Image Acquisition**. This field identifies the UTC year the image was taken.	4	BCS-A	0000 to 9999 (in general; in practice range is 1960 to present) All BCS spaces if unavailable. Default is all BCS spaces (0x20)	years	R	<R>
MONTH	**Month of Image Acquisition**. This field identifies the UTC month of the year that the image was taken.	2	BCS-A	01 to 12 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	months	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
DAY	**Day of Image Acquisition**. This field identifies the UTC day of the month that the image was taken.	2	BCS-A	01 to 31 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	days	R	<R>
HOUR	**Hour of Image Acquisition**. This field identifies the UTC hour of the day that the image was taken.	2	BCS-A	00 to 23 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	hours	R	<R>
MINUTE	**Minute of Image Acquisition**. This field identifies the UTC minute of the hour that the image was taken.	2	BCS-A	00 to 59 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	minutes	R	<R>
SECOND	**Second of Image Acquisition**. This field identifies the UTC number of seconds past the minute that image acquisition occurred for the row 0, column 0 in the original full image. *Note that the range exceeds 60 seconds due to a possible UTC leap second.	9	BCS-A	00.000000 to 60.999999* All BCS spaces if unavailable. Default is all BCS spaces (0x20)	seconds	R	<R>
NRG	**Number of Rows Acquired Simultaneously**. This field contains the number of rows that are acquired simultaneously (in a single group).	8	BCS-N	00000001 to 99999999 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	N/A	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
NCG	**Number of Columns Acquired Simultaneously**. This field contains the number of columns that are acquired simultaneously (in a single group).	8	BCS-N	00000001 to 99999999 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	N/A	R	<R>
TRG	**Time Between Adjacent Row Groups**. This field contains the time period that elapses between a row group and the next higher group of rows. Allowed to have a negative value to accommodate an image inadvertently “inserted” in “backwards” time order.	21	BCS-A	±9.99999999999999E±99 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	seconds	R	<R>
TCG	**Time Between Adjacent Column Groups**. This field contains the time period that elapses between a column group and the next higher group of columns. Allowed to have a negative value to accommodate an image inadvertently “inserted” in “backwards” time order.	21	BCS-A	±9.99999999999999E±99 All BCS spaces if unavailable. Default is all BCS spaces (0x20)	seconds	R	<R>
End of Image Information; Start of Ground Information.							

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GRNDD	**Ground Domain Form**. An arbitrary ground point is specified with coordinates *X*, *Y*, and *Z*. This field specifies the corresponding coordinate system as either Geodetic (G or H) or Rectangular (R). If Geodetic, *X*, *Y*, and *Z*, correspond to longitude, latitude, and height above the ellipsoid, respectively. Longitude is specified east of the prime meridian, and latitude is specified north of the equator. Units for *X*, *Y*, and *Z*, are radians, radians, and meters, respectively. The range for *Y* is (-pi/2 to pi/2). The range for *X* is (-pi to pi) when GRNDD=G, and (0 to 2pi) when GRNDD=H. The latter is specified when the RSM ground domain contains a longitude value near pi radians. If Rectangular, *X*, *Y*, and *Z* correspond to a coordinate system that is defined as an offset from and rotation about the WGS 84 Rectangular coordinate system. The field GRNDD specifies the applicable coordinate system for all ground points referenced in all RSM TREs for this image, unless specifically stated otherwise for a particular TRE.	1	BCS-A	G, H, R	N/A	R	R
XUOR	**Rectangular Coordinate Origin (XUOR)**. This field provides the WGS 84 *X* coordinate of the origin of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H)	meters	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
YOUR	**Rectangular Coordinate Origin (YUOR)**. This field provides the WGS 84 *Y* coordinate of the origin of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H)	meters	R	<R>
ZUOR	**Rectangular Coordinate Origin (ZUOR)**. This field provides the WGS 84 *Z* coordinate of the origin of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H)	meters	R	<R>
XUXR	**Rectangular Coordinate Unit Vector (XUXR)**. This field provides the WGS 84 *X* component of the unit vector defining the *X*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
XUYR	**Rectangular Coordinate Unit Vector (XUYR)**. This field provides the WGS 84 *X* component of the unit vector defining the *Y*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
XUZR	**Rectangular Coordinate Unit Vector (XUZR)**. This field provides the WGS 84 *X* component of the unit vector defining the *Z*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
YUXR	**<u>Rectangular Coordinate Unit Vector (YUXR)</u>**. This field provides the WGS 84 *Y* component of the unit vector defining the *X*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
YUYR	**<u>Rectangular Coordinate Unit Vector (YUYR)</u>**. This field provides the WGS 84 *Y* component of the unit vector defining the *Y*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
YUZR	**<u>Rectangular Coordinate Unit Vector (YUZR)</u>**. This field provides the WGS 84 *Y* component of the unit vector defining the *Z*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
ZUXR	**<u>Rectangular Coordinate Unit Vector (ZUXR)</u>**. This field provides the WGS 84 *Z* component of the unit vector defining the *X*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZUYR	**Rectangular Coordinate Unit Vector (ZUYR)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Y*-axis of the Rectangular coordinate system.	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
ZUZR	**Rectangular Coordinate Unit Vector (ZUZR)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Z*-axis of the Rectangular coordinate system	21	BCS-A	±9.99999999999999E±99 (if GRNDD = R) All BCS spaces (if GRNDD = G or H) Value consistent with fields XUXR through ZUZR forming an orthogonal matrix	N/A	R	<R>
End of Ground Information; Start of Vertex Information.							
V1X	**Vertex 1 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V1 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V1Y	**Vertex 1 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V1 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V1Z	**Vertex 1 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V1 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V2X	**Vertex 2 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V2 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
V2Y	**Vertex 2 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V2 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V2Z	**Vertex 2 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V2 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V3X	**Vertex 3 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V3 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V3Y	**Vertex 3 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V3 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V3Z	**Vertex 3 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V3 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V4X	**Vertex 4 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V4 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V4Y	**Vertex 4 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V4 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V4Z	**Vertex 4 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V4 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
V5X	**Vertex 5 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V5 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V5Y	**Vertex 5 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V5 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V5Z	**Vertex 5 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V5 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V6X	**Vertex 6 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V6 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V6Y	**Vertex 6 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V6 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V6Z	**Vertex 6 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V6 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V7X	**Vertex 7 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V7 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V7Y	**Vertex 7 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V7 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
V7Z	**Vertex 7 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V7 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
V8X	**Vertex 8 – X Coordinate of the RSM Ground Domain**. This field provides the value of the *x* coordinate of vertex V8 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V8Y	**Vertex 8 – Y Coordinate of the RSM Ground Domain**. This field provides the value of the *y* coordinate of vertex V8 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	radians or meters		R
V8Z	**Vertex 8 – Z Coordinate of the RSM Ground Domain**. This field provides the value of the *z* coordinate of vertex V8 of the RSM ground domain.	21	BCS-A	±9.99999999999999E±99	meters		R
End of Vertex Information; Start of Reference Point and Illumination Model.							
GRPX	**Ground Reference Point X**. This field provides the x-coordinate of the Ground Reference Point. The Ground Reference Point is optional. If not supplied, this field and the next two fields have values of all BCS spaces.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters		<R>
GRPY	**Ground Reference Point Y**. This field provides the y-coordinate of the Ground Reference Point.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters		<R>
GRPZ	**Ground Reference Point Z**. This field provides the z-coordinate of the Ground Reference Point.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	meters		<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FULLR	**Number of Rows in Full Image**. This field contains the number of image rows covered by the original full image. This is ancillary information and not required for RSM implementation.	8	BCS-A	00000001 to 99999999, or all BCS spaces if unavailable Default is all BCS spaces (0x20)	pixels		<R>
FULLC	**Number of Columns in Full Image**. This field contains the number of image columns covered by the original full image. This is ancillary information and not required for RSM implementation.	8	BCS-A	00000001 to 99999999, or all BCS spaces if unavailable Default is all BCS spaces (0x20)	pixels		<R>
MINR	**Minimum Row**. This field provides the minimum row value of the RSM image domain relative to original full image.	8	BCS-N	00000000 to 99999999	pixels		R
MAXR	**Maximum Row**. This field provides the maximum row value of the RSM image domain relative to original full image.	8	BCS-N	00000000 to 99999999	pixels		R
MINC	**Minimum Column**. This field provides the minimum column value of the RSM image domain relative to original full image.	8	BCS-N	00000000 to 99999999	pixels		R
MAXC	**Maximum Column**. This field provides the maximum column value of the RSM image domain relative to original full image.	8	BCS-N	00000000 to 99999999	pixels		R

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IE0	**Illumination Elevation Angle/Grazing Angle Constant Coefficient**. This field provides the approximate angle from the local tangent plane coordinate system's horizontal ground plane to the primary source of scene illumination for image position (0, 0). The elevation angle is defined to be in the range (-pi/2 to pi/2) radians. The illumination direction model is optional. If not supplied, this field and the next 11 fields have values of all BCS spaces.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians		<R>
IER	**Illumination Elevation Angle/Grazing Angle Coefficient per Row**. This field provides the approximate elevation angle change per image row.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel		<R>
IEC	**Illumination Elevation Angle/Grazing Angle Coefficient per Column**. This field provides the approximate elevation angle change per image column.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel		<R>
IERR	**Illumination Elevation Angle/Grazing Angle Coefficient per Row Squared**. This field provides the approximate elevation angle change per image row squared.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>
IERC	**Illumination Elevation Angle/Grazing Angle Coefficient per Row-Column**. This field provides the approximate elevation angle change per image row-column.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IECC	**Illumination Elevation Angle/Grazing Angle Coefficient per Column Squared**. This field provides the approximate elevation angle change per image column squared.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>
IA0	**Illumination Azimuth Angle Constant Coefficient**. This field provides the approximate angle clockwise from true north to the primary source of scene illumination (in the local tangent plane coordinate system's horizontal ground plane) for image position (0, 0). The azimuth angle is typically in the range (0 to 2pi) radians. However, it can exceed this range to ensure continuity of the azimuth angle over the RSM image domain when the azimuth is near 2pi radians. The user should check the azimuth value (polynomial output) and add +/- 2pi if necessary to place into the range (0 to 2pi).	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians		<R>
IAR	**Illumination Azimuth Angle Coefficient per Row**. This field provides the approximate azimuth angle change per image row.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel		<R>
IAC	**Illumination Azimuth Angle Coefficient per Column**. This field provides the approximate azimuth angle change per image column.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel		<R>
IARR	**Illumination Azimuth Angle Coefficient per Row Squared**. This field provides the approximate azimuth angle change per image row squared.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IARC	**Illumination Azimuth Angle Coefficient per Row-Column**. This field provides the approximate azimuth angle change per image row-column.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>
IACC	**Illumination Azimuth Angle Coefficient per Column Squared**. This field provides the approximate azimuth angle change per image column squared.	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians per pixel squared		<R>
End of Reference Point and Illumination Model; Start of Space Vehicle Information.							
SPX	**Sensor X-Position**. This field provides the sensor position x-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters		<R>
SVX	**Sensor X-Velocity**. This field provides the sensor velocity x-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second		<R>
SAX	**Sensor X-Acceleration**. This field provides the sensor acceleration xcoordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second squared		<R>
SPY	**Sensor Y-Position**. This field provides the sensor position y-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters		<R>

RSMIDA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
SVY	**Sensor Y-Velocity**. This field provides the sensor velocity y-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second		<R>
SAY	**Sensor Y-Acceleration**. This field provides the sensor acceleration ycoordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second squared		<R>
SPZ	**Sensor Z-Position**. This field provides the sensor position z-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters		<R>
SVZ	**Sensor Z-Velocity**. This field provides the sensor velocity z-coordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second		<R>
SAZ	**Sensor Z-Acceleration**. This field provides the sensor acceleration zcoordinate value at reference time t_0 .	21	BCS-A	±9.99999999999999E±99 (population is optional) Default is all BCS spaces (0x20)	radians or meters per second squared		<R>

4.1.17 RSMPIA TRE for Hyperspectral Products

The Replacement Sensor Model Polynomial identification support data extension (RSMPIA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.17-1 provides the field descriptions and metadata population requirements for the RSM RSMPIA TRE.

For additional information refer to the document*, Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.17-1: RSMPIA TRE Fields for Hyperspectral Products

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMPIA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00591	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing BCS spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all BCS spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
R0	**Low Order Polynomial Constant Coefficient for Row**. This field provides the constant term used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels	R	R

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RX	**Low Order Polynomial Coefficient of X for Row**. This field provides the coefficient of *x* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *x* units (radians or meters)	R	R
RY	**Low Order Polynomial Coefficient of Y for Row**. This field provides the coefficient of *y* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *y* units (radians or meters)	R	R
RZ	**Low Order Polynomial Coefficient of Z for Row**. This field provides the coefficient of *z* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *z* units (meters)	R	R
RXX	**Low Order Polynomial Coefficient of XX for Row**. This field provides the coefficient of *xx* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xx* units (radians squared or meters squared)	R	R
RXY	**Low Order Polynomial Coefficient of XY for Row**. This field provides the coefficient of *xy* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xy* units (radians squared or meters squared)	R	R
RXZ	**Low Order Polynomial Coefficient of XZ for Row**. This field provides the coefficient of *xz* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xz* units ((radians)(meters) or meters squared)	R	R

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RYY	**Low Order Polynomial Coefficient of YY for Row**. This field provides the coefficient of *yy* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *yy* units (radians squared or meters squared)	R	R
RYZ	**Low Order Polynomial Coefficient of YZ for Row**. This field provides the coefficient of *yz* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *yz* units ((radians)(meters) or meters squared)	R	R
RZZ	**Low Order Polynomial Coefficient of ZZ for Row**. This field provides the coefficient of *zz* used in the approximate image row position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *zz* units (meters squared)	R	R
C0	**Low Order Polynomial Constant Coefficient for Column**. This field provides the constant term used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels	R	R
CX	**Low Order Polynomial Coefficient of X for Column**. This field provides the coefficient of *x* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *x* units (radians or meters)	R	R
CY	**Low Order Polynomial Coefficient of Y for Column**. This field provides the coefficient of *y* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *y* units (radians or meters)	R	R
CZ	**Low Order Polynomial Coefficient of Z for Column**. This field provides the coefficient of *z* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *z* units (meters)	R	R

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CXX	**Low Order Polynomial Coefficient of XX for Column**. This field provides the coefficient of *xx* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xx* units (radians squared or meters squared)	R	R
CXY	**Low Order Polynomial Coefficient of XY for Column**. This field provides the coefficient of *xy* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xy* units (radians squared or meters squared)	R	R
CXZ	**Low Order Polynomial Coefficient of XZ for Column**. This field provides the coefficient of *xz* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *xz* units ((radians)(meters) or meters squared)	R	R
CYY	**Low Order Polynomial Coefficient of YY for Column**. This field provides the coefficient of *yy* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *yy* units (radians squared or meters squared)	R	R
CYZ	**Low Order Polynomial Coefficient of YZ for Column**. This field provides the coefficient of *yz* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *yz* units ((radians)(meters) or meters squared)	R	R
CZZ	**Low Order Polynomial Coefficient of ZZ for Column**. This field provides the coefficient of *zz* used in the approximate image column position low order polynomial.	21	BCS-A	±9.99999999999999E±99	pixels per *zz* units (meters squared)	R	R

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RNIS	**Row Number of Image Sections**. This field identifies the number of sections the RSM image domain is divided into along the row direction for representation of the ground-to-image relationship.	3	BCS-N	001 to 256	N/A	R	R
CNIS	**Column Number of Image Sections**. This field identifies the number of sections the RSM image domain is divided into along the column direction for representation of the ground to-image relationship.	3	BCS-N	001 to 256	N/A	R	R
TNIS	**Total Number of Image Sections**. This field contains the total number of rectangular sections the RSM image domain is divided into for representation of the ground-to-image relationship. The value in this field is the product of the values in the RNIS and CNIS fields. Thus, the value of the field TNIS, with a maximum of 256, places constraints on the values of the fields RNIS and CNIS. This number represents the total number of RSMPCA TREs.	3	BCS-N	001 to 256	N/A	R	R
RSSIZ	**Section Size in Rows**. This field contains the number of rows contained in a single section. Note that its value is represented as a positive noninteger because it equals the number of rows in the RSM image domain divided by the number of sections in the row direction, not necessarily an integer value.	21	BCS-A	+9.99999999999999E+99 Positive value	pixels	R	R

RSMPIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CSSIZ	**Section Size in Columns**. This field contains the number of columns contained in a single section. Note that its value is represented as a positive non-integer because it equals the number of columns in the RSM image domain divided by the number of sections in the column direction, not necessarily an integer value.	21	BCS-A	+9.99999999999999E+99 Positive value	pixels	R	R

4.1.18 RSMPCA TRE for Hyperspectral Products

The Replacement Sensor Model Polynomial Coefficients support data extension (RSMPCA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.18-1 provides the field descriptions and metadata population requirements for the RSM RSMPCA TRE.

For additional information refer to the document, *Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.18-1: RSMPCA TRE Fields for Hyperspectral Products

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMPCA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00486 to 18546	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing BCS spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all BCS spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
RSN	**Row Section Number**. This field contains the image row section number that the following polynomial coefficients apply to.	3	BCS-N	001 to 256	N/A	R	R
CSN	**Column Section Number**. This field contains the image column section number that the following polynomial coefficients apply to.	3	BCS-N	001 to 256	N/A	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RFEP	**Row Fitting Error**. This field contains the rms fit error estimate applicable to the row rational polynomial relative to the original sensor model's ground-toimage function. The value of RFEP assumes that an RSM ground-to-image (correction) grid is not employed, if available. The value of RFEP is nonnegative.	21	BCS-A	±9.99999999999999E±99 (population optional) Default is all BCS spaces (0x20)	pixels	R	<R>
CFEP	**Column Fitting Error**. This field contains the rms fit error estimate applicable to the column rational polynomial relative to the original sensor model's ground-toimage function. The value of CFEP assumes that an RSM ground-to-image (correction) grid is not employed, if available. The value of CFEP is nonnegative.	21	BCS-A	±9.99999999999999E±99 (population optional) Default is all BCS spaces (0x20)	pixels	R	<R>
RNRMO	**Row Normalization Offset**. This field contains the offset used in the defining relationship between un-normalized and normalized image row coordinates *r* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	pixels	R	R
CNRMO	**Column Normalization Offset**. This field contains the offset used in the defining relationship between un-normalized and normalized image column coordinates *c* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	pixels	R	R
XNRMO	**X Normalization Offset**. This field contains the offset used in the defining relationship between un-normalized and normalized ground coordinates *x* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	radians or meters	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
YNRMO	**Y Normalization Offset**. This field contains the offset used in the defining relationship between un-normalized and normalized ground coordinates *y* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	radians or meters	R	R
ZNRMO	**Z Normalization Offset**. This field contains the offset used in the defining relationship between un-normalized and normalized ground coordinates *z* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	meters	R	R
RNRMSF	**Row Normalization Scale Factor**. This field contains the scale factor used in the defining relationship between unnormalized and normalized image row coordinates *r* for the ground-to-image rational polynomial	21	BCS-A	±9.99999999999999E±99	pixels	R	R
CNRMSF	**Column Normalization Scale Factor**. This field contains the scale factor used in the defining relationship between unnormalized and normalized image column coordinates *c* for the ground-toimage rational polynomial	21	BCS-A	±9.99999999999999E±99	pixels	R	R
XNRMSF	**X Normalization Scale Factor**. This field contains the scale factor used in the defining relationship between unnormalized and normalized ground coordinates *x* for the ground-to-image rational polynomial.	21	BCS-A	±9.99999999999999E±99	radians or meters	R	R
YNRMSF	**Y Normalization Scale Factor**. This field contains the scale factor used in the defining relationship between unnormalized and normalized ground coordinates *y* for the ground-to-image rational polynomial	21	BCS-A	±9.99999999999999E±99	radians or meters	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZNRMSF	**Z Normalization Scale Factor**. This field contains the scale factor used in the defining relationship between unnormalized and normalized ground coordinates *z* for the ground-to-image rational polynomial	21	BCS-A	±9.99999999999999E±99	meters	R	R
RNPWRX	**Row Numerator Polynomial Maximum Power of X**. This field contains the maximum power of normalized *x* coordinate used in the image section's row numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R
RNPWRY	**Row Numerator Polynomial Maximum Power of Y**. This field contains the maximum power of normalized *y* coordinate used in the image section's row numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R
RNPWRZ	**Row Numerator Polynomial Maximum Power of Z**. This field contains the maximum power of normalized *z* coordinate used in the image section's row numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R
RNTRMS	**Row Numerator Polynomial Number of Polynomial Terms**. This field contains the number of terms (coefficients) in the image section's row numerator polynomial. The value of this field is the same as: $(RNPWRX + 1) * (RNPWRY + 1) * (RNPWRZ + 1)$.	3	BCS-N	001 to 216	N/A	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Loop for Each Row Numerator Polynomial Term; Loop Runs From 1 to RNTRMS.							
RNPCF	**Polynomial Coefficient**. This field contains one coefficient of the image section's row numerator polynomial. The (*RNPWRX* + 1)∗(*RNPWRY* + 1)∗(*RNPWRZ* + 1) total number of field entries are ordered in concert with the following polynomial form (or summation order): $\sum_{k=0}^{RNPWRZ} \sum_{j=0}^{RNPWRY} \sum_{i=0}^{RNPWRX} a_{ijk} x^i y^j z^k$ where *x* is the normalized *x* ground coordinate, *y* is the normalized *y* ground coordinate, and *z* is the normalized *z* ground coordinate. The first RNPCF field entry corresponds to *a*000, the second to *a*100, and so on.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End of Row Numerator Polynomial Term Loop.							
RDPWRX	**Row Denominator Polynomial Maximum Power of X**. This field contains the maximum power of normalized *x* coordinate used in the image section's row denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R
RDPWRY	**Row Denominator Polynomial Maximum Power of Y**. This field contains the maximum power of normalized *y* coordinate used in the image section's row denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R
RDPWRZ	**Row Denominator Polynomial Maximum Power of Z**. This field contains the maximum power of normalized *z* coordinate used in the image section's row denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RDTRMS	**Row Denominator Polynomial Number of Polynomial Terms**. This field contains the number of terms (coefficients) in the image section's row denominator polynomial. The value of this field should be the same as $(RDPWRX + 1) * (RDPWRY + 1) * (RDPWRZ + 1)$.	3	BCS-N	001 to 216	N/A	R	R
Start of Loop for Each Row Denominator Polynomial Term; Loop Runs From 1 to RDTRMS.							
RDPCF	**Polynomial Coefficient**. This field contains one coefficient of the image section's row denominator polynomial. The $(RDPWRX + 1)*(RDPWRY + 1)*(RDPWRZ + 1)$. total number of field entries are ordered in concert with the following polynomial form (or summation order): $$\sum_{k=0}^{RDPWRZ} \sum_{j=0}^{RDPWRY} \sum_{i=0}^{RDPWRX} b_{ijk}\, x^i\, y^j\, z^k$$ where x is the normalized x ground coordinate, y is the normalized y ground coordinate, and z is the normalized z ground coordinate. The first RDPCF field entry corresponds to $b000$, the second to $b100$, and so on.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End of Row Denominator Polynomial Term Loop.							
CNPWRX	**Column Numerator Polynomial Maximum Power of X**. This field contains the maximum power of normalized x coordinate used in the image section's column numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R
CNPWRY	**Column Numerator Polynomial Maximum Power of Y**. This field contains the maximum power of normalized y coordinate used in the image section's column numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CNPWRZ	**Column Numerator Polynomial Maximum Power of Z**. This field contains the maximum power of normalized *z* coordinate used in the image section's column numerator polynomial.	1	BCS-N	0 to 5	N/A	R	R
CNTRMS	**Column Numerator Polynomial Number of Polynomial Terms**. This field contains the number of terms (coefficients) in the image section's column numerator polynomial. The value of this field should be the same as $(CNPWRX + 1) * (CNPWRY + 1) * (CNPWRZ + 1)$.	3	BCS-N	001 to 216	N/A	R	R
Start of Loop for Each Column Numerator Polynomial Term; Loop Runs From 1 to CNTRMS.							
CNPCF	**Polynomial Coefficient**. This field contains one coefficient of the image section's column numerator polynomial. The $(CNPWRX + 1)*(CNPWRY + 1)*(CNPWRZ + 1)$ total number of field entries are ordered in concert with the following polynomial form (or summation order): $\sum_{k=0}^{CNPWRZ} \sum_{j=0}^{CNPWRY} \sum_{i=0}^{CNPWRX} c_{ijk}\, x^i y^j z^k$ where *x* is the normalized *x* ground coordinate, *y* is the normalized *y* ground coordinate, and *z* is the normalized *z* ground coordinate. The first CNPCF field entry corresponds to $c000$, the second to $c100$, and so on.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End of Column Numerator Polynomial Term Loop.							

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CDPWRX	**Column Denominator Polynomial Maximum Power of X**. This field contains the maximum power of normalized *x* coordinate used in the image section's column denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R
CDPWRY	**Column Denominator Polynomial Maximum Power of Y**. This field contains the maximum power of normalized *y* coordinate used in the image section's column denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R
CDPWRZ	**Column Denominator Polynomial Maximum Power of Z**. This field contains the maximum power of normalized *z* coordinate used in the image section's column denominator polynomial.	1	BCS-N	0 to 5	N/A	R	R
CDTRMS	**Column Denominator Polynomial Number of Polynomial Terms**. This field contains the number of terms (coefficients) in the image section's column denominator polynomial. The value of this field should be the same as $(CDPWRX + 1) * (CDPWRY + 1) * (CDPWRZ + 1)$.	3	BCS-N	001 to 216	N/A	R	R

RSMPCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Loop for Each Column Denominator Polynomial Term; Loop Runs From 1 to CDTRMS.							
CDPCF	**Polynomial Coefficient**. This field contains one coefficient of the image section's column denominator polynomial. The (*CDPWRX* + 1)∗(*CDPWRY* + 1)∗(*CDPWRZ* + 1) total number of field entries are ordered in concert with the following polynomial form (or summation order): $\sum_{k=0}^{CDPWRZ} \sum_{j=0}^{CDPWRY} \sum_{i=0}^{CDPWRX} d_{ijk}\, x^i\, y^j\, z^k$ where *x* is the normalized *x* ground coordinate, *y* is the normalized *y* ground coordinate, and *z* is the normalized *z* ground coordinate. The first CDPCF field entry corresponds to *d*000, the second to *d*100, and so on.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End of Column Denominator Polynomial Term Loop.							

4.1.19 RSMDCA TRE for Hyperspectral Products

The Replacement Sensor Model Direct Error Covariance support data extension (RSMDCA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.19-1 provides the field descriptions and metadata population requirements for the RSM RSMDCA TRE.

For additional information refer to the document, *Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.19-1: RSMDCA TRE Fields for Hyperspectral Products

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMDCA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00597 to 99988	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing BCS spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all BCS spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
TID	**Triangulation ID**. This field contains an identifier that is unique to the most recent process after RSM support data generation that led to the adjustments and/or error covariance in this RSM support data edition. The field value is all BCS spaces if there has been no such process.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
NPAR	**Number of Parameters**. This field contains the number of (active) RSM adjustable parameters of the associated image. It is the row and the column dimensions of the image's error covariance.	2	BCS-N	01 to 36	N/A	R	R
NIMGE	**Number of Images**. This field contains the number of images corresponding to the RSM direct error covariance. The fields NIMGE and NPART are constrained such that (NIMGE)(82)+(0.5)(NPART+1)(NPART)(21) is less than 99495 bytes. Thus, for example, if there are 6 RSM adjustable parameters per image, there could be up to 16 images represented by the direct error covariance, i.e., NIMGE=16 and NPART=96.	3	BCS-N	001 to 999	N/A	R	R
NPART	**Total Number of Parameters**. This field contains the number of (active) RSM adjustable parameters associated with all of the images. It is both the row and column dimensions of the direct error covariance.	5	BCS-N	00001 to 99999	N/A	R	R
Start of Loop for each Image; Loop runs from 1 to NIMGE.							
IID1	**Image Identifier**. This field contains the original full image identification corresponding to an image associated with the RSM direct error covariance. Identifications are listed in order of their corresponding image's "placement" in the RSM direct error covariance.	80	BCS-A	alphanumeric (in general) Default is all BCS spaces (0x20)	N/A	R	<R>
NPARI	**Number of Parameters**. This field contains the number of active RSM adjustable parameters associated with the image.	2	BCS-N	01 to 36	N/A	R	R
End of Image Loop.							

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of Local Coordinate System Definition for RSM Adjustable Parameters for image.							
XUOL	**Local Coordinate Origin (XUOR)**. This field provides the WGS 84 *X* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
YUOL	**Local Coordinate Origin (YUOL)**. This field provides the WGS 84 *Y* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
ZUOL	**Local Coordinate Origin (ZUOL)**. This field provides the WGS 84 *Z* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
XUXL	**Local Coordinate Unit Vector (XUXL)**. This field provides the WGS 84 *X* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
XUYL	**Local Coordinate Unit Vector (XUYL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
XUZL	**Local Coordinate Unit Vector (XUZL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
YUXL	**Local Coordinate Unit Vector (YUXL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
YUYL	**Local Coordinate Unit Vector (YUYL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
YUZL	**Local Coordinate Unit Vector (YUZL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
ZUXL	**Local Coordinate Unit Vector (ZUXL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
ZUYL	**Local Coordinate Unit Vector (ZUYL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZUZL	**Local Coordinate Unit Vector (ZUZL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
RSM Adjustable Parameter-Error Covariance Correspondence							
"Image-space" Adjustable Parameters							
IR0	**Image Row Constant Index**. This field provides the value of the index into the associated image's error covariance for the RSM adjustable parameter: constant offset adjustment of the image row position. A value of all BCS spaces for the field specifies that this adjustable parameter is not active (not used). For example, if the value of the field is 3, this particular adjustable parameter corresponds to row 3 and column 3 of the associated image's error covariance. In particular, the (3, 3) element of the error covariance corresponds to the adjustable parameter's variance of error. In general, the RSM direct error covariance corresponds to the RSM adjustable parameters associated with multiple images. If *m* images precede the associated image in the RSM direct error covariance, and if their total number of active adjustable parameters equals *k*, then the value of the field IRO plus *k* equals the index into the direct RSM error covariance for this particular adjustable parameter for the associated image. The fields IIDI and NPARI of this TRE provide the information required to determine image order and number of active adjustable parameters for all images associated with the RSM direct error covariance. The	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
	following 35 fields provide the same type of information as the IRO field, but each is associated with a different RSM adjustable parameter. All of the adjustable parameters reference Local (rectangular) ground coordinates *x*, *y*, and *z*. Note that the field IRO and following 19 fields are associated with RSM “image space” adjustable parameters, and the next 16 fields are associated with RSM “ground space” adjustable parameters. Together, they are the elements of the RSM Adjustable Parameter Choice Set.						
IRX	**Image Row X Index**. The image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRY	**Image Row Y Index**. The image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRZ	**Image Row Z Index**. The image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRXX	**Image Row X^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point x^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IRXY	**Image Row XY Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xy* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRXZ	**Image Row XZ Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xz* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRYY	**Image Row Y^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point y^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRYZ	**Image Row YZ Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *yz* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IRZZ	**Image Row Z^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point z^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IC0	**Image Column Constant Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ICX	**Image Column X Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICY	**Image Column Y Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICZ	**Image Column Z Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICXX	**Image Column X^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point x^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICXY	**Image Column XY Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xy* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
IXXZ	**Image Column XZ Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xz* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ICYY	**Image Column Y^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point y^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICYZ	**Image Column YZ Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *yz* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
ICZZ	**Image Column Z^2 Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point z^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
"Ground-space" Adjustable Parameters							
GXO	**Ground X Constant Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GYO	**Ground X Constant Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GZO	**Ground X Constant Index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GXR	**Ground Rotation X**. The Image error covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *x*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GYR	**Ground Rotation Y**. The Image error covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *x*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GZR	**Ground Rotation Z**. The Image error covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *x*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GS	**Ground Scale**. The Image error covariance index associated with the following RSM Adjustable Parameter: the multiplicative ground point scale factor.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GXX	**Ground X Adjustment Proportional to X index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GXY	**Ground X Adjustment Proportional to Y index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GXZ	**Ground X Adjustment Proportional to Z index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GYX	**Ground Y Adjustment Proportional to X index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>

RSMDCA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GYY	**Ground Y Adjustment Proportional to Y index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the ground point *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GYZ	**Ground Y Adjustment Proportional to Z index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GZX	**Ground Z Adjustment Proportional to X index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GZY	**Ground Z Adjustment Proportional to Y index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
GZZ	**Ground Z Adjustment Proportional to Z index**. The Image error covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<R>
Error Covariance Data							
Begin loop for each Direct Error Covariance element; Loop runs from 1 to (1/2 (NPART+1)(NPART)) entries.							
DERCOV	**Direct Error Covariance Element**. This field contains an element of the RSM Direct Error Covariance. The elements correspond to the upper triangular portion of the error covariance. They are in row major order.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End of Polynomial Coefficients.							

4.1.20 RSMAPA TRE for Hyperspectral Products

The Replacement Sensor Model Adjustable Parameters support data extension (RSMAPA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.20-1 provides the field descriptions and metadata population requirements for the RSM RSMAPA TRE.

For additional information refer to the document*, Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.20-1: RSMAPA TRE Fields for Hyperspectral Products

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	DESCRIPTION	SIZE	DATA TYPE	VALUE RANGE	UNITS	CORR. FLAG	TYPE
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMAPA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00486 to 18546	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
TID	**Triangulation ID**. This field contains an identifier that is unique to the most recent process after RSM support data generation that led to the adjustments and/or error covariance in this RSM support data edition. The field value is all spaces if there has been no such process.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
NPAR	**Number of Parameters**. This field contains the number of (active) RSM adjustable parameters (dimension of RSM Adjustment Vector) of the associated image	2	BCS-N	01 to 36	N/A	R	<R>
Start of Local Coordinate System Definition for RSM Adjustable Parameters for the image.							
XUOL	**Local Coordinate Origin (XUOR)**. This field provides the WGS 84 *X* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
YUOL	**Local Coordinate Origin (YUOR)**. This field provides the WGS 84 *Y* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
ZUOL	**Local Coordinate Origin (ZUOR)**. This field provides the WGS 84 *Z* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	R
XUXL	**Local Coordinate Unit Vector (XUXL)**. This field provides the WGS 84 *X* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
XUYL	**Local Coordinate Unit Vector (XUYL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
XUZL	**Local Coordinate Unit Vector (XUZL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
YUXL	**Local Coordinate Unit Vector (YUXL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
YUYL	**Local Coordinate Unit Vector (YUYL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
YUZL	**Local Coordinate Unit Vector (YUZL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
ZUXL	**Local Coordinate Unit Vector (ZUXL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZUYL	**Local Coordinate Unit Vector (ZUYL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
ZUZL	**Local Coordinate Unit Vector (ZUZL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	R
End of Local Coordinate System Definition for RSM Adjustable Parameters for the image.							

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of "Image-space" Adjustable Parameters.							
IRO	**Image Row Constant Index**. This field provides the value of the index into the associated image's RSM Adjustment Vector for the RSM adjustable parameter: the constant offset adjustment of the image row position. A value of all spaces for the field specifies that this adjustable parameter is not active (not used). For example, if IRO=3, the third element of the associated image's RSM Adjustment Vector corresponds to the adjustable parameter: constant offset adjustment of the image row position. The following 35 fields provide the same type of information as the IRO field, but each is associated with a different RSM adjustable parameter. All of the adjustable parameters reference Local (rectangular) ground coordinates *x*, *y*, and *z*. Note that the field IRO and following 19 fields are associated with RSM "image space" adjustable parameters, and the next 16 fields are associated with RSM "ground space" adjustable parameters. Together, they are the elements of the RSM Adjustable Parameter Choice Set.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRX	**Image Row X Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *x* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRY	**Image Row Y Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *y* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IRZ	**Image Row Z Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *z* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRXX	**Image Row X^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point x^2 position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRXY	**Image Row XY Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *xy* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRXZ	**Image Row XZ Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *xz* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRYY	**Image Row Y^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point y^2 position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IRYZ	**Image Row YZ Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *yz* position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IRZZ	**Image Row Z^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point z^2 position applied to the image row position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
IC0	**Image Column Constant Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the constant offset adjustment of the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICX	**Image Column X Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *x* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICY	**Image Column Y Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *y* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICZ	**Image Column Z Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *z* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICXX	**Image Column X^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point x^2 position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ICXY	**Image Column XY Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *xy* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICXZ	**Image Column XZ Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *xz* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICYY	**Image Column Y^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point y^2 position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICYZ	**Image Column YZ Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *yz* position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
ICZZ	**Image Column Z^2 Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point z^2 position applied to the image column position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
End of "Image-space" Adjustable Parameters.							
Start of "Ground-space" Adjustable Parameters							
GXO	**Ground X Constant Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the constant offset adjustment of the ground *x* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GYO	**Ground Y Constant Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the constant offset adjustment of the ground *y* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GZO	**Ground Z Constant Index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the constant offset adjustment of the ground *z* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GXR	**Ground Rotation X**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the small angle ground point rotation about the *x*-axis.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GYR	**Ground Rotation Y**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the small angle ground point rotation about the *y*-axis.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GZR	**Ground Rotation Z**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the small angle ground point rotation about the *z*-axis.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GS	**Ground Scale**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the multiplicative ground point scale factor.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GXX	**Ground X Adjustment Proportional to X index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *x* position applied to the ground point *x* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GXY	**Ground X Adjustment Proportional to Y index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *y* position applied to the ground point *x* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GXZ	**Ground X Adjustment Proportional to Z index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *z* position applied to the ground point *x* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GYX	**Ground Y Adjustment Proportional to X index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *x* position applied to the ground point *y* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GYY	**Ground Y Adjustment Proportional to Y index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *y* position applied to the ground point *y* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GYZ	**Ground Y Adjustment Proportional to Z index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point z*x* position applied to the ground point *y* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GZX	**Ground Z Adjustment Proportional to X index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *x* position applied to the ground point *z* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>

RSMAPA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GZY	**Ground Z Adjustment Proportional to Y index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *y* position applied to the ground point *z* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
GZZ	**Ground Z Adjustment Proportional to Z index**. The RSM Adjustment Vector index associated with the following RSM adjustable parameter: the coefficient for ground point *z* position applied to the ground point *z* position.	2	BCS-A	01 to 36 all spaces if not used (adjustable parameter not active)	N/A	R	<R>
End of “Ground-space” Adjustable Parameters							
Adjustable Parameters Data							
Begin loop for each RSM Adjustment Vector component (active adjustable parameter) for the associated image (NPAR entries)							
PARVAL	**Component Value**. This field contains the value contained in the next component of the RSM Adjustable Parameter Vector.	21	BCS-A	±9.99999999999999E±99	N/A	R	R
End loop for each RSM Adjustment Vector component (active adjustable parameter) for the associated image (NPAR entries)							

4.1.21 RSMECA TRE for Hyperspectral Products

The Replacement Sensor Model Indirect Error Covariance support data extension (RSMECA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.21-1 provides the field descriptions and metadata population requirements for the RSM RSMECA TRE.

For additional information refer to the document, *Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.21-1: RSMECA TRE Fields for Hyperspectral Products

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMECA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00354 to 42864	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
TID	**Triangulation ID**. This field contains an identifier that is unique to the most recent process after RSM support data generation that led to the adjustments and/or error covariance in this RSM support data edition. The field value is all spaces if there has been no such process.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
INCLIC	**Include Indirect Error Covariance Flag**. If the value of this field is Y, the indirect error covariance information is included in this TRE.	1	BCS-A	Y, N	N/A	R	R
INCLUC	***Include Unmodeled Error Covariance Flag***. If the value of this field is Y, the unmodeled error covariance information is included in this TRE.	1	BCS-A	Y, N	N/A	R	R
If (INCLIC=Y) then include the following fields:							
NPAR	**Number of RSM Adjustable Parameters**. This field contains the number of (active) RSM adjustable parameters of the associated image. It is the dimension of both the row and the column dimensions of the (mapped) RSM image error covariance. The maximum allowed number of RSM adjustable parameters is 36.	2	BCS-N	01 to 36	N/A	R	C
NPARO	**Number of Original Adjustable Parameters**. This field contains the number of original adjustable parameters of the associated image. It is both the row and column dimensions of the (unmapped) original image error covariance. The maximum allowed number of original adjustable parameters is 36.	2	BCS-N	01 to 36	N/A	R	C
IGN	**Number of Independent Subgroups**. This field contains the number of independent adjustable parameter (error) subgroups associated with the original adjustable parameters of the associated image.	2	BCS-N	01 to 36	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CVDATE	**Version Date of the Original Image Error Covariance**. Date representing the version of the error model applicable to the original image error covariance. If populated, and two images are from the same sequence of images from the same sensor, and if the values of CVDATE are different in the two RSMECA TREs, all original adjustable parameter (errors) are assumed uncorrelated between the images.	8	BCS-A	YYYYMMDD Default is all BCS spaces (0x20)	N/A	R	<C>
Local Coordinate System Definition for RSM Adjustable Parameters for the associated image.							
XUOL	**Local Coordinate Origin (XUOL)**. This field provides the WGS 84 *X* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	C
YUOL	**Local Coordinate Origin (YUOL)**. This field provides the WGS 84 *Y* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	C
ZUOL	**Local Coordinate Origin (ZUOL)**. This field provides the WGS 84 *Z* coordinate of the origin of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	±9.99999999999999E±99	meters	R	C
XUXL	**Local Coordinate Unit Vector (XUXL)**. This field provides the WGS 84 *X* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
XUYL	**Local Coordinate Unit Vector (XUYL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
XUZL	**Local Coordinate Unit Vector (XUZL)**. This field provides the WGS 84 *X* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
YUXL	**Local Coordinate Unit Vector (YUXL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
YUYL	**Local Coordinate Unit Vector (YUYL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
YUZL	**Local Coordinate Unit Vector (YUZL)**. This field provides the WGS 84 *Y* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ZUXL	**Local Coordinate Unit Vector (ZUXL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *X*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
ZUYL	**Local Coordinate Unit Vector (ZUYL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Y*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C
ZUZL	**Local Coordinate Unit Vector (ZUZL)**. This field provides the WGS 84 *Z* component of the unit vector defining the *Z*-axis of the Local (rectangular) coordinate system. This coordinate system is part of the RSM adjustable parameters definition for the image.	21	BCS-A	+9.99999999999999E+99 Value consistent with fields XUXL through ZUZL forming an orthogonal matrix	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
RSM Adjustable Parameter-Error Covariance Correspondence							
IR0	**<u>Image Row Constant Index</u>**. This field provides the value of the index into the RSM error crosscovariance for the RSM adjustable parameter: constant offset adjustment of the image row position. A value of all spaces for the field specifies that this adjustable parameter is not active (not used). The RSM error cross-covariance C_{Rij} is applicable to the errors in the active RSM adjustable parameters at the time of pixel *i* and the errors in the active RSM adjustable parameters at the time of pixel *j*. For example, if the value of the field is 3, this particular adjustable parameter corresponds to row 3 and column 3 of the RSM error cross-covariance. In particular, when the two pixels (times) are the same, the (3, 3) element corresponds to the adjustable parameter's variance of error at the time of pixel *i*. The following 35 fields provide the same type of information as the IRO field, but each is associated with a different RSM adjustable parameter. All of the adjustable parameters reference Local (rectangular) ground coordinates *x*, *y*, and *z*. Note that the field IRO and following 19 fields are associated with "image space" adjustable parameters, and the next 16 fields are associated with "ground space" adjustable parameters. Together, they are the elements of the RSM Adjustable Parameter Choice Set.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IRX	**Image Row X Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRY	**Image Row Y Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRZ	**Image Row Z Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRXX	**Image Row X^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point x^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRXY	**Image Row XY Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xy* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRXZ	**Image Row XZ Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xz* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
IRYY	**Image Row Y^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point y^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRYZ	**Image Row YZ Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *yz* position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IRZZ	**Image Row Z^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point z^2 position applied to the image row position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
IC0	**Image Column Constant Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICX	**Image Column X Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICY	**Image Column Y Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ICZ	**Image Column Z Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICXX	**Image Column X^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point z^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICXY	**Image Column XY Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xy* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICXZ	**Image Column XZ Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *xz* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICYY	**Image Column Y^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point y^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
ICYZ	**Image Column YZ Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *yz* position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
ICZZ	**Image Column Z^2 Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point z^2 position applied to the image column position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
"Ground-space" Adjustable Parameters							
GXO	**Ground X Constant Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GYO	**Ground Y Constant Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground y position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GZO	**Ground Z Constant Index**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the constant offset adjustment of the ground *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GXR	**Ground Rotation X**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *x*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GYR	**Ground Rotation Y**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *y*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GZR	**Ground Rotation Z**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the small angle ground point rotation about the *z*-axis.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GS	**Ground Scale**. The RSM error cross-covariance index associated with the following RSM Adjustable Parameter: the multiplicative ground point scale factor.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GXX	**Ground X Adjustment Proportional to X Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GXY	**Ground X Adjustment Proportional to Y Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GXZ	**Ground X Adjustment Proportional to Z Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GYX	**Ground Y Adjustment Proportional to X Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *x* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GYY	**Ground Y Adjustment Proportional to Y Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GYZ	**Ground Y Adjustment Proportional to Z Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *y* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GZX	**Ground Z Adjustment Proportional to X Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *x* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GZY	**Ground Z Adjustment Proportional to Y Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *y* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
GZZ	**Ground Z Adjustment Proportional to Z Index**. The RSM error crosscovariance index associated with the following RSM Adjustable Parameter: the coefficient for ground point *z* position applied to the ground point *z* position.	2	BCS-A	01 to 36 All BCS spaces (0x20) (if not used; not active)	N/A	R	<C>
Error Covariance Data							
Begin loop for each Original Adjustable Parameter Independent Error Subgroup; Loop runs from 1 to IGN entries.							
NUMOPG	**Number of Original Adjustable Parameters in Subgroup**. This field contains the number of contiguous original adjustable parameters in this independent error subgroup. (Independent error subgroups are contiguous as well.)	2	BCS-N	01 to 36 Sum of IGN entries of NUMOPG must equal NPAR	N/A	R	C
Begin loop for each element of the original image error covariance for this independent error subgroup; Loop runs from 1 to (1/2 (NUMOPG+1)(NUMOPG) entries.							
ERRCVG	**Original Error Covariance Element**. This field contains an original adjustable parameter error covariance element corresponding to the independent error subgroup. The elements correspond to the upper triangular portion of the error covariance. They are in row major order.	21	BCS-A	±9.99999999999999E±99 Collectively, the ERRCVG values for the subgroup must correspond to a positive definite error covariance matrix	N/A	R	C
End loop for each element of the original image error covariance for this independent error subgroup.							

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
TCDF	**Time Correlation Domain Flag**. This field defines the type of original adjustable parameter error, and hence, the corresponding correlation function domain, for this independent error subgroup. If this field is 0, the time correlation applies to all time intervals, both within and between images. The associated errors in the original adjustable parameters are “image element errors”. If this field is 1, the time correlation applies to time intervals between images only. Time correlation for time intervals within an image is defined 100% positively correlated. The associated errors in the original adjustable parameters are “image errors”. If this field is 2, the time correlation applies to time intervals within an image only. Time correlation for time intervals between images is defined as zero. The associated errors in the original adjustable parameters are “restricted image element errors”.	1	BCS-N	0, 1, or 2	N/A	R	C
NCSEG	**Number of Correlation Segments**. This field contains the number of piece-wise linear correlation segments that make up the correlation function for this independent error subgroup.	1	BCS-N	2 to 9	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Begin loop for each Correlation Segment; Loop runs from 1 to NCSEG entries.							
CORSEG	**Segment Correlation Value**. This field contains the correlation value applicable at the beginning of the segment. Note that the value is defined as one for the first segment (correlation segment=1), and defined as zero for the last segment (correlation segment=NCSEG). It is a nonnegative number for all segments, decreasing in value from one segment to the next.	21	BCS-A	±9.99999999999999E±99 Greater than or equal to zero and less than or equal to one. Value consistent with a nonnegative, convex, piecewise linear correlation function defined by NCSEG entries of CORSEG and TAUSEG	N/A	R	C
TAUSEG	**Segment Tau Value**. This field contains the correlation time (tau) applicable at the beginning of the segment. Note that the value is defined as zero for the first segment (correlation segment=1). It is a positive number for all other segments, increasing in value from one segment to the next. Note that the values of the fields CORSEG and TAUSEG for all the segments are further constrained such that the corresponding piece-wise linear correlation function is convex (nonpositive and increasing slope from one segment to the next). Also, the last segment is defined equal to zero for all tau greater than the last segment's TAUSEG value.	21	BCS-A	±9.99999999999999E±99 Non-negative value. Value consistent with a nonnegative, convex, piecewise linear correlation function defined by NCSEG entries of CORSEG and TAUSEG	N/A	R	C
End of loop for each Correlation Segment.							
End of loop for each Original Adjustable Parameter Independent Error Subgroup.							

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Begin loop for Mapping Matrix Elements; Loop runs from 1 to ((NPAR)(NPARO)) entries.							
MAP	**Mapping Matrix Element**. This field contains the value of the next mapping matrix element, stored in row major order. The mapping matrix is used to map the associated image's original error covariance to RSM error covariance. The mapping matrix has NPAR rows and NPARO columns.	21	BCS-A	±9.99999999999999E±99	N/A	R	C
End of loop for Mapping Matrix Elements.							
End of conditional "If INCLIC=Y".							
If (INCLUC=Y) then include the following fields:							
Unmodeled Error Covariance data							
URR	**Unmodeled Row Variance**. This field provides the variance of unmodeled error represented as an image row error.	21	BCS-A	±9.99999999999999E±99 Non-negative value	N/A	R	C
URC	**Unmodeled Row-Column Variance**. This field provides the covariance between the unmodeled error represented as an image row error and unmodeled error represented as an image column error.	21	BCS-A	±9.99999999999999E±99 Collectively, URR, URC, and UCC values must correspond to a positive semi-definite (2x2) error covariance matrix	N/A	R	C
UCC	**Unmodeled Column Variance**. This field provides the variance of unmodeled error represented as an image column error.	21	BCS-A	±9.99999999999999E±99 Non-negative value	N/A	R	C
UNCSR	**Number of Correlation Segments for Independent Variable Row Distance**. This field contains the number of piece-wise linearcorrelation segments that make up the correlation function for unmodeled error with independent variable image row distance.	1	BCS-N	2 to 9	N/A	R	C

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Begin loop for each Correlation Segment; Loop runs from 1 to UNCSR entries.							
UCORSR	**Segment Correlation Value**. This field contains the correlation value applicable at the beginning of the segment. Note that the value is defined as one for the first segment (correlation segment=1), and defined as zero for the last segment (correlation segment=UNCSR). It is a nonnegative number for all segments, decreasing in value from one segment to the next.	21	BCS-A	±9.99999999999999E±99 Greater than or equal to zero and less than or equal to one. Value consistent with a nonnegative, convex, piecewise linear correlation function defined by UNCSR entries of field UCORSR and field UTAUSR	N/A	R	C
UTAUSR	**Segment Tau Value**. This field contains the correlation row distance (tau) applicable at the beginning of the segment. Note that the value is defined as zero for the first segment (correlation segment=1). It is a positive number for all other segments, increasing in value from one segment to the next. Note that the values of the fields UCORSR and UTAUSR for all the segments are further constrained such that the corresponding piecewise linear correlation function is convex (non-negative and increasing slope from one segment to the next). Also, the last segment is defined equal to zero for all tau greater than the last segment's UTAUSR value.	21	BCS-A	±9.99999999999999E±99 Non-negative value Value consistent with a nonnegative, convex, piecewise linear correlation function defined by UNCSR entries of field UCORSR and field UTAUSR	N/A	R	C
End of loop for Correlation Segments.							
UNCSC	**Number of Correlation Segments for Independent Variable Column Distance**. This field contains the number of piece-wise linear correlation segments that make up the correlation function for unmodeled error with independent variable image column distance.	1	BCS-N	2 to 9	N/A	R	C
Begin loop for each Correlation Segment; Loop runs from 1 to UNCSC entries.							

RSMECA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
UCORSC	**Segment Correlation Value**. This field contains the correlation value applicable at the beginning of the segment. Note that the value is defined as one for the first segment (correlation segment=1), and defined as zero for the last segment (correlation segment=UNCSC). It is a nonnegative number for all segments, decreasing in value from one segment to the next.	21	BCS-A	±9.99999999999999E±99 Greater than or equal to zero and less than or equal to one. Value consistent with a nonnegative, convex, piecewise linear correlation function defined by UNCSC entries of field UCORSC and field UTAUSC	N/A	R	C
UTAUSC	**Segment Tau Value**. This field contains the correlation column distance (tau) applicable at the beginning of the segment. Note that the value is defined as zero for the first segment (correlation segment=1). It is a positive number for all other segments, increasing in value from one segment to the next. Note that the values of the fields UCORSC and UTAUSC for all the segments are further constrained such that the corresponding piecewise linear correlation function is convex (non-negative and increasing slope from one segment to the next). Also, the last segment correlation is defined equal to zero for all tau greater than the last segment's UTAUSC value.	21	BCS-A	±9.99999999999999E±99 Non-negative value. Value consistent with a nonnegative, convex, piecewise linear correlation function defined by UNCSC entries of field UCORSC and field UTAUSC	N/A	R	C
End of loop for Correlation Segments.							
End of conditional "If INCLUC=Y".							

4.1.22 RSMGIA TRE for Hyperspectral Products

The Replacement Sensor Model Ground-to-image Grid Identification support data extension (RSMGIA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.22-1 provides the field descriptions and metadata population requirements for the RSM RSMGIA TRE.

For additional information refer to the document*, Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.22-1: RSMGIA TRE Fields for Hyperspectral Products

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMGIA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00486 to 18546	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
GR0	**Low Order Polynomial Constant Coefficient for Row**. This field provides the constant term used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels	R	R

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GRX	**Low Order Polynomial Coefficient of X for Row**. This field provides the coefficient of *x* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *x* units (radians or meters)	R	R
GRY	**Low Order Polynomial Coefficient of Y for Row**. This field provides the coefficient of *y* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *y* units (radians or meters)	R	R
GRZ	**Low Order Polynomial Coefficient of Z for Row**. This field provides the coefficient of *z* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *z* units (radians or meters)	R	R
GRXX	**Low Order Polynomial Coefficient of XX for Row**. This field provides the coefficient of *xx* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xx* units (radians or meters squared)	R	R
GRXY	**Low Order Polynomial Coefficient of XY for Row**. This field provides the coefficient of *xy* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xy* units (radians or meters squared)	R	R

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GRXZ	**Low Order Polynomial Coefficient of XZ for Row**. This field provides the coefficient of *xz* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xz* units (radians or meters squared)	R	R
GRYY	**Low Order Polynomial Coefficient of YY for Row**. This field provides the coefficient of *yy* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *yy* units (radians or meters squared)	R	R
GRYZ	**Low Order Polynomial Coefficient of YZ for Row**. This field provides the coefficient of *yz* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *yz* units (radians or meters squared)	R	R
GRZZ	**Low Order Polynomial Coefficient of ZZ for Row**. This field provides the coefficient of *zz* used in the approximate image row position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *zz* units (radians or meters squared)	R	R
GC0	**Low Order Polynomial Constant Coefficient for Column**. This field provides the constant term used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels	R	R

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GCX	**Low Order Polynomial Coefficient of X for Column**. This field provides the coefficient of *x* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *x* units (radians or meters)	R	R
GCY	**Low Order Polynomial Coefficient of Y for Column**. This field provides the coefficient of *y* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *y* units (radians or meters)	R	R
GCZ	**Low Order Polynomial Coefficient of Z for Column**. This field provides the coefficient of *z* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *z* units (radians or meters)	R	R
GCXX	**Low Order Polynomial Coefficient of XX for Column**. This field provides the coefficient of *xx* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xx* units (radians or meters squared)	R	R
GCXY	**Low Order Polynomial Coefficient of XY for Column**. This field provides the coefficient of *xy* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xy* units (radians or meters squared)	R	R

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GCXZ	**Low Order Polynomial Coefficient of XZ for Column**. This field provides the coefficient of *xz* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *xz* units (radians or meters squared)	R	R
GCYY	**Low Order Polynomial Coefficient of YY for Column**. This field provides the coefficient of *yy* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *yy* units (radians or meters squared)	R	R
GCYZ	**Low Order Polynomial Coefficient of YZ for Column**. This field provides the coefficient of *yz* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *yz* units (radians or meters squared)	R	R
GCZZ	**Low Order Polynomial Coefficient of ZZ for Column**. This field provides the coefficient of *zz* used in the approximate image column position low order polynomial.	21	BCS-A	+9.99999999999999E+99	pixels per *zz* units (radians or meters squared)	R	R
GRNIS	**Row Number of Image Sections**. This field identifies the number of sections the RSM image domain is divided into along the row direction for representation of the ground-toimage relationship.	3	BCS-N	001 to 256	N/A	R	R

RSMGIA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GCNIS	**Column Number of Image Sections**. This field identifies the number of sections the RSM image domain is divided into along the column direction for representation of the ground-to-image relationship.	3	BCS-N	001 to 256	N/A	R	R
GTNIS	**Total Number of Image Sections**. This field contains the total number of rectangular sections the RSM image domain is divided into for representation of the ground-toimage relationship. The value in this field is the product of the values in the GRNIS and GCNIS fields. Thus, the value of the field GTNIS, with a maximum of 256, places constraints on the values of the fields GRNIS and GCNIS. This number represents the total number of RSMGGA TREs.	3	BCS-N	001 to 256	N/A	R	R
GRSSIZ	**Section Size in Rows**. This field contains the number of rows contained in a single section. Note that its value is represented as a positive non-integer because it equals the number of rows in the RSM image domain divided by the number of sections in the row direction, not necessarily and integer value.	21	BCS-A	+9.99999999999999E+99 Positive value	pixels	R	R
GCSSIZ	**Section Size in Columns**. This field contains the number of columns contained in a single section. Note that its value is represented as a positive non-integer because it equals the number of columns in the RSM image domain divided by the number of sections in the column direction, not necessarily and integer value.	21	BCS-A	+9.99999999999999E+99 Positive value	pixels	R	R

4.1.23 RSMGGA TRE for Hyperspectral Products

The Replacement Sensor Model Ground-to-image Grid support data extension (RSMGGA) for the Replacement Sensor Model (RSM) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment subheader. Table 4.1.23-1 provides the field descriptions and metadata population requirements for the RSM RSMGGA TRE.

For additional information refer to the document, *Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1*.

Table 4.1.23-1: RSMGGA TRE Fields for Hyperspectral Products

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	RSMGGA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00390 to 99988	bytes	R	R
IID	**Image Identifier**. This field contains a character string that uniquely identifies the original full image that corresponds to the associated image. This is not to be confused with the identification of an image derived by filtering, chipping, re-sampling, or other such image to image transformations. The image identifier is left justified with trailing spaces.	80	BCS-A	Tactical ID (see Table 2.3-1) Default is all spaces (0x20)	N/A	R	<R>
EDITION	**RSM Image Support Data Edition**. This field contains a character string that uniquely identifies the RSM support data for the associated original full image. It is to consist of an identifier of up to 20 characters for the processor that generated the RSM support data, to which is appended up to 20 characters that are unique to that processor.	40	BCS-A	alphanumeric (in general; population is optional) Default is all BCS spaces (0x20)	N/A	R	<R>
GGRSN	**Ground-to-image Grid Row Section Number**. This field contains the image row section number that the following ground-to-image grid applies to	3	BCS-N	001 to 256	N/A	R	R

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
GGCSN	**Ground-to-image Grid Column Section Number**. This field contains the image column section number that the following ground-to-image grid applies to	3	BCS-N	001 to 256	N/A	R	R
GGRFEP	**Ground-to-image Grid Row Fitting Error**. This field contains the rms fit error estimate applicable to the row ground-to-image grid relative to the original sensor model's ground-toimage function. The value of GGRFEP assumes that an RSM ground-to-image polynomial is also employed, if available. When a ground-to-image polynomial is available, the ground-to-image grid represents corrections to the polynomial, and field GGRFEP represents the rms error of the combined polynomial and grid evaluation.	21	BCS-A	+9.99999999999999E+99 Non-negative value Population optional Default is all spaces	pixels	R	<R>
GGCFEP	**Ground-to-image Grid Column Fitting Error**. This field contains the rms fit error estimate applicable to the column ground-to-image grid relative to the original sensor model's groundto-image function. The value of GGCFEP assumes that an RSM ground-to-image polynomial is also employed, if available. When a ground-to-image polynomial is available, the ground-to-image grid represents corrections to the polynomial, and field GGCFEP represents the rms error of the combined polynomial and grid evaluation.	21	BCS-A	+9.99999999999999E+99 Non-negative value Population optional Default is all spaces	pixels	R	<R>

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
INTORD	**Ground-to-image Grid Interpolation Order**. This field specifies the recommended interpolation order to be used in determining row and column image coordinates from the ground-to-image grid. The fitting error statistics provided in fields GGRFEP and GGCFEP above are based on assumed use of the recommended interpolation order. Field GGRFEP and GGCFEP should only be populated if field INTORD is populated. The recommended order specified in INTORD is either 0, 1, 2, or 3. These values correspond to nearest neighbor, separable tri-linear Lagrange, separable tri-quadratic Lagrange, and separable tri-cubic Lagrange interpolations, respectively.	1	BCS-A	0,1,2,3 Population optional Default is all spaces	N/A	R	<R>
Grid plane and grid point position data							
NPLN	**Number of Grid Planes**. This field contains the total number of grid planes.	3	BCS-N	002-999	N/A	R	R
DELTAZ	**Delta Z Between Grid Planes**. This field contains the constant delta *z* between grid planes.	21	BCS-A	+9.99999999999999E+99 Positive value	meters	R	R
DELTAX	**Delta X Between Grid Points**. This field contains the constant delta *x* between points in a grid plane. This value is the same for all grid planes	21	BCS-A	+9.99999999999999E+99 Positive value	Radians or meters	R	R
DELTAY	**Delta Y Between Grid Points**. This field contains the constant delta *y* between points in a grid plane. This value is the same for all grid planes.	21	BCS-A	+9.99999999999999E+99 Positive value	Radians or meters	R	R
ZPLN1	**Z Value of Plane 1**. This field contains the constant *z* value of the first plane. All other planes have greater *z* values. Within a given grid plane, all points have a common *z* -coordinate value.	21	BCS-A	+9.99999999999999E+99	meters	R	R

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
XIPLN1	**X Value of Initial Point in Plane 1**. This field contains the value of the *x* -coordinate of the first grid point in the first grid plane.	21	BCS-A	+9.99999999999999E+99	Radians or meters	R	R
YIPLN1	**Y Value of Initial Point in Plane 1**. This field contains the value of the *y* -coordinate of the first grid point in the first grid plane.	21	BCS-A	+9.99999999999999E+99	Radians or meters	R	R
REFROW	**Reference Image Row Coordinate Value**. This field contains the reference image row coordinate value across all grid points across all grid planes. This value is within the RSM image domain and with respect to the original full image.	9	BCS-N	-99999999 to +99999999	pixels	R	R
REFCOL	**Reference Image Column Coordinate Value**. This field contains the reference image column coordinate value across all grid points across all grid planes. This value is within the RSM image domain and with respect to the original full image.	9	BCS-N	-99999999 to +99999999	pixels	R	R
TNUMRD	**Total Number of Image Row Coordinate Digits**. The value of this field specifies the total number of digits used in field RCOORD to specify the image row coordinate value relative to the value of REFROW.	2	BCS-N	3 - 11	N/A	R	R
TNUMCD	**Total Number of Image Column Coordinate Digits**. The value of this field specifies the total number of digits used in field CCOORD to specify the image column coordinate value relative to the value of REFCOL.	2	BCS-N	3 - 11	N/A	R	R
FNUMRD	**Number of Image Row Coordinate Fractional Digits**. The value of this field specifies the number of fractional digits used in field RCOORD to specify the image row coordinate value relative to the value of REFROW.	1	BCS-N	1-3	N/A	R	R

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
FNUMCD	**Number of Image Column Coordinate Fractional Digits**. The value of this field specifies the number of fractional digits used in field CCOORD to specify the image row coordinate value relative to the value of REFCOL.	1	BCS-N	1-3	N/A	R	R
Begin repeat for grid plane 2 through the total number of grid planes (NPLN-1 entries)							
IXO	**Initial Grid Points X Offset**. This field contains the offset of this grid plane's initial grid point's *x* -coordinate value relative to the first grid plane's initial grid point's *x* -coordinate value, expressed as a signed integer multiple of delta *x*.	4	BCS-N	+999	N/A	R	R
IYO	**Initial Grid Points Y Offset**. . This field contains the offset of this grid plane's initial grid point's *y*-coordinate value relative to the first grid plane's initial grid point's *y*-coordinate value, expressed as a signed integer multiple of delta *y*.	4	BCS-N	+999	N/A	R	R
End repeat for grid plane 2 through the total number of grid planes (NPLN-1 entries)							
Begin repeat for each grid plane (NPLN entries)							
NXPTS	**Number of Grid Points in the X Direction**. This field contains the total number of grid points in the *x* direction in this grid plane. For this grid plane, the *x* -coordinate of each grid point is equal to the initial grid point's *x* -coordinate plus a nonnegative multiple of delta *x*.	3	BCS-N	002 to 999	N/A	R	R
NYPTS	**Number of Grid Points in the Y Direction**. This field contains the total number of grid points in the *y* direction in this grid plane. For this grid plane, the *y* -coordinate of each grid point is equal to the initial grid point's *y* -coordinate plus a nonnegative multiple of delta *y*.	3	BCS-N	002 to 999	N/A	R	R

RSMGGA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Begin repeat for each grid point ((NXPTS)(NYPTS) entries)							
RCOORD	**<u>Grid Point's Row Coordinate</u>**. This field contains the value of the image row coordinate for the current grid point, expressed as a non-negative offset from field REFROW. Grid points are stored in matrix row major order. The first matrix element corresponds to this grid's initial grid point. A matrix row corresponds to a constant *x* –coordinate value. A matrix column corresponds to a constant *y* –coordinate value.	3 – 11, per field TNUMRD	BCS-A	000 - 999 to 00000000000 – 99999999999, per field TNUMRD. If a valid row coordinate value is unavailable, the field contains all spaces (3-11 spaces per field TNUMRD).	0.1, 0.01, or 0.001 pixels, per field FNUMRD	R	<R>
CCOORD	**<u>Grid Point's Column Coordinate</u>**. This field contains the value of the image column coordinate for the current grid point, expressed as a non-negative offset from field REFCOL. Grid points are stored in matrix row major order. The first matrix element corresponds to this grid's initial grid point. A matrix row corresponds to a constant *x* – coordinate value. A matrix column corresponds to a constant *y* – coordinate value.	3 – 11, per field TNUMRD	BCS-A	000 - 999 to 00000000000 – 99999999999, per field TNUMCD. If a valid column coordinate value is unavailable, the field contains all spaces (3-11 spaces per field TNUMCD).	0.1, 0.01, or 0.001 pixels, per field FNUMCD	R	<R>
End repeat for each grid point ((NXPTS)(NYPTS) entries)							
End repeat for each grid plane (NPLN entries)							

4.1.24 SENSRB TRE for Hyperspectral Products

The General Electro-Optical (Visible, Infrared, Multi- and Hyperspectral) Sensor Parameters Tagged Record Extension (SENSRB) is contained in the image extended subheader data section of the NITF 2.1 Image Segment Subheader. The field descriptions and metadata population requirements for SENSRB are provided in *STDI-0002-1, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS), Appendix Z*. SENSRB supersedes SENSRA and is required for all Hyperspectral datasets.

While SENSRB does contain many of the same fields as SENSRA for legacy purposes, it is significantly more robust with respect to the storage of vital sensor calibration and geopositioning metadata. Its modular, flexible, and standardized framework ensures that core photogrammetric tasks can be performed on the associated image both quickly and reliably. SENSRB must be populated with enough information to successfully instantiate a rigorous geopositioning model for the sensor type associated with the image (see Frame Sensor Model Metadata Profile Supporting Precise Geopositioning, Version 1.0 and NGA.SIG.0003_1.0 for examples). Appendix A to this document provides a more detailed explanation of the minimum population requirement as well as suggested implementations for various sensor types and image collection scenarios.

A SENSRB TRE makes available fifteen data “modules” as illustrated below in Figure 4.1.24-1. Data modules are bundles of associated data fields; data fields are byte allotments for prescribed field values. Two data modules are mandatory for any and all instantiations of SENSRB. The others are conditional or optional depending on prescribed requirements. Conditional and optional modules contain a mandatory flag field indicating the presence, and sometimes quantity, of the associated data fields. Either a “Y” or a non-zero value in a flag field indicates that the module’s data fields are present (the module “exists”). Conversely, if a module’s flag field is populated with an “N” or a zero value, no data fields are present for that module (the module “does not exist”). The intention is to allow the SENSRB implementer to tailor a metadata population plan to the sensor system and imagery product being characterized by this TRE.

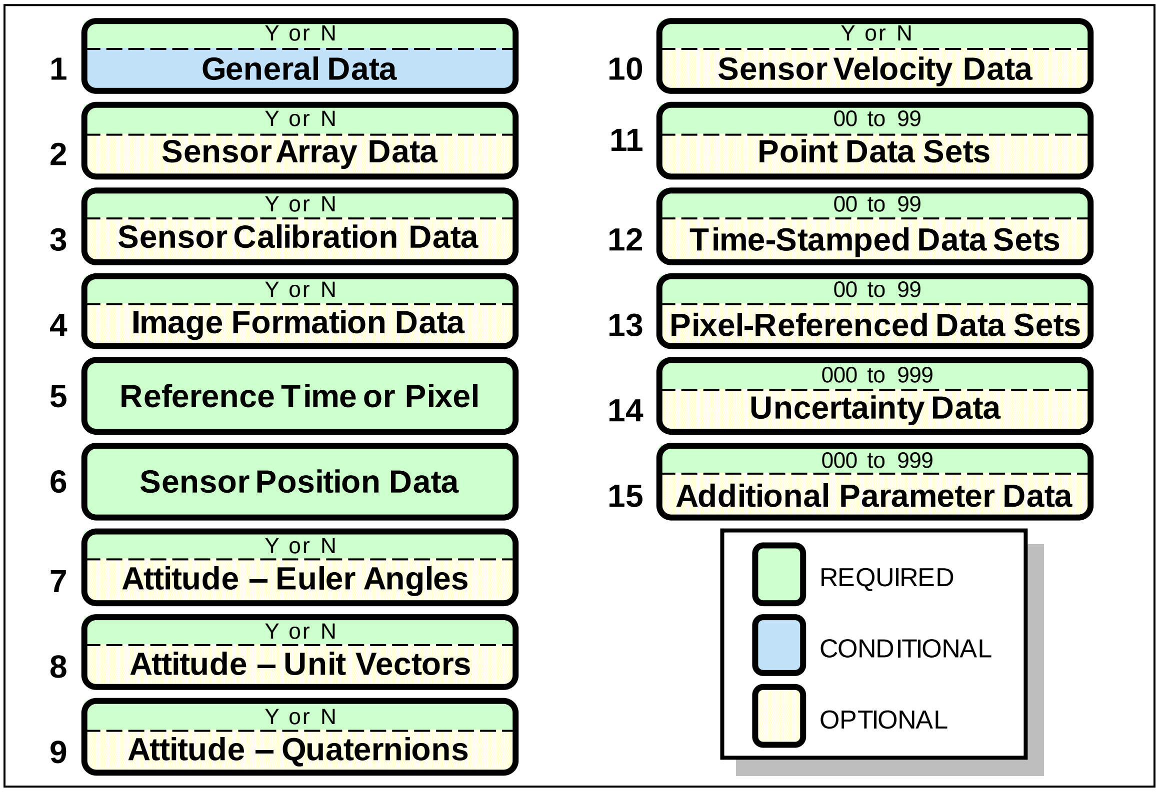

Figure 4.1.24-1: Schematic View of SENSRB Modules

Note: Labels such as “Y or N” and “00 to 99” denote required flag fields, which indicate the existence of subsequent data fields in conditional or optional modules.

The presence of data fields within a module (the module’s “existence”) depends on the data’s availability and applicability but is also determined by one of three hierarchical requirements:

- Mandatory existence (required)—modules have no flag field and their data fields are required for each and every SENSRB instantiation. (Modules 5 and 6).
- Specification-required existence (conditional)—module’s data fields are required only for the first (or sole) SENSRB instantiation associated with each image segment. (Module 1).
- Application-required existence (optional)—modules’ data fields must exist to facilitate certain exploitation applications. (Modules 2-4 and 7-15).

Table 4.1.24-1: SENSRB TRE Fields for Hyperspectral Products

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
	CETAG	**Controlled Extension Name.** Unique tagged record extension type identifier	-	SENSRB	6	BCS-A	R
	CEL	**Total Length of CEDATA.** Number of bytes of data present for fields 01 to 15d. That is the length of this controlled extension minus the eleven bytes allotted for CETAG (6 bytes) and CEL (5 bytes); refer to *MIL-STD-2500C*, section 5.8.1 for guidance.	bytes	90 *to* 99985	5	BCS-NPI	R
01	GENERAL_DATA	**General Data Flag.** Flag field indicating the presence of general data. This module provides identifying information for the associated NITF image segment and sets reference systems for subsequent module parameters. 'Y' in this field indicates the presence of the Fields 01a to 01r; 'N' omits their presence. The value of this field must be 'Y' for the first instance of SENSRB associated with each NITF image segment. See Z.5.1 General Data Module for additional guidance regarding these fields.	*flag*	Y *or* N	1	BCS-A	R
01a	SENSOR	**Sensor Registered Name or Model.** Identifies the common name for the payload sensor that collected the image segment. The twenty-five character name must be unique, explicit, and registered with the NTB.[c] For sensor payloads made up of multiple of sensors, SENSOR_URI (index 01b), DETECTION (index 02a), METHOD (04a), and MODE (04b) fields allow for further characterization of the imagery source.	-	*see NTB registry for approved values.[c]*	25	BCS-A	C
01b	SENSOR_URI	**Sensor Uniform Resource Identifier.** This optional field allows a unique identifier specific to the collecting sensor. This field supports serial numbers or, preferably, Uniform Resource Identifiers (URI)—which can facilitate access to more detailed sensor information, such as geometric or radiometric calibration data, via the internet. The 32-character field supports Internet Protocol v6. See Z.5.1.1 Sensor and Platform Identification and Characterization.	-	*user defined*	32	BCS-A	[C]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
01c	PLATFORM	**Platform Common Name.** Identifies the platform type upon which the sensor is operating. The twenty-five character name must be unique, explicit, and registered with the NTB.[c]	-	*see NTB registry for approved values.[c]*	25	BCS-A	C
01d	PLATFORM_URI	**Platform Uniform Resource Identifier.** This optional field allows a unique platform identification, especially for non-aircraft platforms where ACFTB TRE AC_TAIL_NO does not apply. The thirty-two byte field accommodates a Uniform Resource Identifiers (URI), which can facilitate access to more detailed platform information via Internet Protocol v6. See Z.5.1.1 Sensor and Platform Identification and Characterization.	-	*user defined*	32	BCS-A	[C]
01e	OPERATION_ DOMAIN	**Operational Domain.** Specifies the platform's domain of operation during the collection—providing some indication of the imagery perspective.	-	*see NTB registry for approved values.[c]*	10	BCS-A	C
01f	CONTENT_LEVEL	**Content Level.** Quantifies the level of SENSRB data content to enhance data discovery; see Z.5.1.2 Application-Required Content Level for examples. This single value allows users to imply and/or infer if imagery will meet certain exploitation requirements and discover data with a specific content level.	-	0 *to* 9	1	BCS-NPI	C
01g	GEODETIC_ SYSTEM	**Geodetic Reference System.** Specifies the geodetic system to which the geocoordinates in this TRE are referenced. The default is WGS84 for the World Geodetic System—1984.[c] (See Z.4.6.1 Geospatial Coordinate Systems.)	-	*see NTB registry for approved values.[c]*	5	BCS-A	C
01h	GEODETIC_TYPE	**Geodetic Coordinate Type.** Specifies the coordinate system used to report the sensor location and the reference system for attitudes and velocities. The two allowed field values are: G (Geographic/Geodetic) and C (geocentric Cartesian); see also Z.4.6.1 Geospatial Coordinate Systems. The local geographic coordinate frame shall be North-East-Down (NED).	-	G *or* C	1	BCS-A	C

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
01i	ELEVATION_ DATUM	**Elevation and Altitude Datum.** Specifies the reference datum from which elevations and altitudes will be reported. The three allowed field values are: HAE (height above ellipsoid), MSL (height above mean sea level), and AGL (height above ground level). HAE is *strongly* encouraged; see Z.4.6.1 Geospatial Coordinate Systems.	-	HAE, MSL, *or* AGL	3	BCS-A	C
01j	LENGTH_UNIT	**Length Unit System.** Specifies the unit system used for the spatial parameters within this TRE. The two allowed field values are: SI (International System of Units) and EE (English Engineering Unit System). SI is encouraged. (See Z.4.4.1 Linear Units.)	-	SI *or* EE	2	BCS-A	C
01k	ANGULAR_UNIT	**Angle Unit Type.** Specifies the angular units used for the angular parameters within this TRE (unless explicitly overridden by the UNITS column). The three allowed field values are: DEG (degrees), RAD (radians), or SMC (semi-circles). DEG is encouraged. (See Z.4.4.2 Angular Units.)	-	DEG, RAD, *or* SMC	3	BCS-A	C
01l	START_DATE	**Imaging Start Date.** Date at the start of the NITF image segment collection, formatted as YYYYMMDD and referenced to UTC. (See Z.4.2 Times and Dates.)	*date*	*see description*	8	BCS-NI	C
01m	START_TIME	**Imaging Start Time.** The number of UTC seconds into the day, specified in START_DATE (index 01l), when the first photon contacted the detector for the first collected pixel stored in the NITF image segment. The day starts at the UTC zero seconds (0.000000000 s) and ends just before the start of the next day (86399.99999999 s). The value may be equal to END_TIME for imagery sensors modeled as instantaneous collectors. (See Z.4.2 Times and Dates.)	s	0 *to* 86399.99999999	14	BCS-N	C
01n	END_DATE	**Imaging End Date.** Date at the end of the NITF image segment collection, formatted as YYYYMMDD and referenced to UTC. Must be the same as the imaging start date (or after—for imagery collections extending into a subsequent day). (See Z.4.2 Times and Dates.)	*date*	*see description*	8	BCS-NI	C

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
01o	END_TIME	**Imaging End Time.** The number of UTC seconds into the day, specified in END_DATE (index 01n), when the *last* photon contacted the detector for the *last* collected pixel stored in the NITF image segment. See START_TIME (index 01m) for more guidance. (See also Z.4.2 Times and Dates.) END_DATE and END_TIME may be equal to START_DATE and START_TIME, respectively, for imagery collections modeled as instantaneously collected.	s	0 *to* 86399.99999999	14	BCS-N	C
01p	GENERATION_ COUNT	**Generation Count.** The number of times the data contained in this TRE has been resected or adjusted. Zero (00) shall represent that the data is the original NITF form, which might have undergone manipulations reflected in Module 4. If subsequent modifications are made to this metadata through resection or adjustments, this count will be incremented accordingly. (See Z.5.1.5 Image Parameter Post-Collection Adjustments.)	*count*	00 *to* 99	2	BCS-NPI	C
01q	GENERATION_ DATE	**Generation Date.** The date when the current resection or adjustment was made, formatted as YYYYMMDD. This value is ignored if generation count is zero but must be non-default filled if generation count is greater than zero. (See Z.4.2 Times and Dates.)	*date*	*see description*	8	BCS-NI	[C]
01r	GENERATION_ TIME	**Generation Time.** The UTC time of day when the current resection or adjustment was made, formatted as HHMMSS.sss (See Z.5.1.5 Image Parameter Post-Collection Adjustments for specific instructions regarding this field's precision). This value is ignored if generation count is zero but must be non-default filled if generation count is greater than zero.	-	000000.000 *to* 235959.999	10	BCS-N	[C]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
02	SENSOR_ARRAY_DATA	**Sensor Array Data Flag.** Flag field indicating the presence of data describing the sensor array. This module provides information regarding the image collection hardware and process, as is often needed for geopositioning. 'Y' in this field indicates the presence of the Fields 02a to 02i; 'N' omits their presence. Units depend on the values for LENGTH_UNIT (index 01j) and ANGULAR_UNIT (index 01k). See Z.5.2 Sensor Array Data Module [TBD01] for additional guidance regarding these fields.	*flag*	Y *or* N	1	BCS-A	R
02a	DETECTION	**Detection Type.** Specifies the detection spectrum of the sensor array.	-	*see NTB registry for approved values.[c]*	20	BCS-A	C
02b	ROW_DETECTORS	**Number of Detectors Used in Row and Column.** The number of detectors used in the "instantaneous" collection process as counted in the row- and column-aligned dimensions. This number shall correspond with the row and column physical dimensions of the used sensor array (ROW_METRIC and COLUMN_METRIC, indices 02d and 02e)	-	000001 *to* 99999999	8	BCS-NPI	C
02c	COLUMN_DETECTORS						
02d	ROW_METRIC	**Row and Column Physical Dimension.** The physical length of the sensor array used in the "instantaneous" collection process as measured along the row- and column-aligned dimensions.[e] These dimensions shall correspond with the number of detectors used (ROW_DETECTORS and COLUMN_DETECTORS, indices 02b and 02c).	cm or in	0.000001 *to* 99999999	8	BCS-N	[C][d]
02e	COLUMN_METRIC						
02f	FOCAL_LENGTH	**Best Known Focal Length.** The best known value of the effective focal length.[e] If the sensor's focal length varies with band, provide a nominal value and use the BANDSB TRE to provide the per-band focal lengths.	cm or in	0.000001 *to* 99999999	8	BCS-N	[C][d]
02g	ROW_FOV	**Field of View along Sensor Array Row and Column.** The angle measuring the effective field-of-view projected onto the sensor array center row and column (i.e., Sensor Horizontal Field of View and Sensor Vertical Field of View, respectively—*not* the half-angle FOV).[e]	deg, rad, or sc	0 *to* 270 deg 0 to 3/2π rad 0 to 3/2 sc	8	BCS-N	[C][d]
02h	COLUMN_FOV						

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
02i	CALIBRATED	**Focal Length Calibration Flag.** Indicates if the provided focal length and/or fields of view are based on a geometric calibration process. 'Y' in this field will indicate that the focal length and/or the fields of view with the detector metrics are based on a geometric calibration. 'N' in this field will indicate that they are not.	*flag*	Y *or* N	1	BCS-A	C
03	SENSOR_ CALIBRATION_ DATA	**Sensor Calibration Data Flag.** Flag field indicating the presence of geometric sensor calibration parameters. This module provides sensor geometric calibration values and coefficients to facilitate precision geopositioning. 'Y' in this field indicates the presence of the Fields 03a to 03l; 'N' omits their presence. Additional definitions and implementation guidance for these parameters are provided in Z.5.3 Sensor Calibration Data Module.	*flag*	Y *or* N	1	BCS-A	R
03a	CALIBRATION_ UNIT	**Calibration Unit System.** Identifies the unit system used for the subsequent calibration parameters. If 'mm', then the parameters are referenced to millimeters. If 'px', then the parameters are referenced in pixel units.	-	mm *or* px	2	BCS-A	C
03b	PRINCIPAL_POINT _OFFSET_X	**Principal Point Offset in *x*-direction (x_0) and *y*-direction (y_0).** The number of row-aligned and column-aligned units (±) from the center of the image where the optical axis of the sensor intersects the effective sensor array;[e] see Z.5.3.2 Principal Point Offset. Positive values are in the direction of the positive X_I axis and positive Y_I axis; see Z.4.6.5 Image Coordinate System.	mm or pixels	0 *to* ±99999999	9	BCS-N	[C]
03c	PRINCIPAL_POINT _OFFSET_Y						

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
03d	RADIAL_ DISTORT_1	**First, Second, and Third Radial Distortion Coefficient (k_1, k_2, k_3)**. These values are defined in Z.5.3.3 Radial Distortion.[e]	mm^{-2} or $pixels^{-2}$	0 *to* ±9.9999e+99	12	BCS-A[f]	[C]
03e	RADIAL_ DISTORT_2		mm^{-4} or $pixels^{-4}$				
03f	RADIAL_ DISTORT_3		mm^{-6} or $pixels^{-6}$				
03g	RADIAL_ DISTORT_LIMIT	**Limit of Radial Distortion Fit.** The maximum valid radial distance (from the principal point) for the application of the polynomial distortion correction given in Z.5.3.3 Radial Distortion.	mm or pixels	0 *to* ±99999999	9	BCS-N	[C]
03h	DECENT_ DISTORT_1	**First and Second Decentering Distortion Coefficient (p_1, p_2).** These values are defined in Z.5.3.4 Additional Distortions.[e]	mm^{-1} or $pixels^{-1}$	0 *to* ±9.9999e+99	12	BCS-A[f]	[C]
03i	DECENT_ DISTORT_2						
03j	AFFINITY_ DISTORT_1	**First and Second Affinity Distortion Coefficient (b_1, b_2).** These values are defined in Z.5.3.4 Additional Distortions.[e]	-	0 *to* ±9.9999e+99	12	BCS-A[f]	[C]
03k	AFFINITY_ DISTORT_2						
03l	CALIBRATION_ DATE	**Calibration Report Date**. Date when the calibration values above, indices 03a to 03k, were computed. (See Z.5.3.6 Calibration Notes.) Field shall be formatted as YYYYMMDD.	*date*	*see description*	8	BCS-NI	[C]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
04	IMAGE_ FORMATION_ DATA	**Image Formation Data Flag.** Flag field indicating the presence of parameters describing the image formation process. This module provides information regarding how the image array (which may be equal to the recorded NITF array) was formed from the sensor array. This data is typically needed for geopositioning. 'Y' in this field indicates the presence of the Fields 04a to 04k; 'N' omits the presence of Fields 04a to 04s. See Z.5.4 Image Formation Data Module [TBD02] for additional guidance regarding the definitions and implementation of these fields.	*flag*	Y *or* N	1	BCS-A	R
04a	METHOD	**Imaging Method.** Specifies the method the sensor utilized to collect the image data.	-	*see NTB registry for approved values.[c]*	15	BCS-A	C
04b	MODE	**Imaging Mode.** A registered numeric code indicating the actual mode used by the sensor to collect or detect the image data. This may differ from the *planned* mode given in ACFTB's MPLAN. The three digit codes, and their meaning, are to be registered with the NTB[c].	-	*see NTB registry for approved values[c]*	3	BCS-A	C
04c	ROW_COUNT	**Row and Column Count.** The number of rows and columns in the initial image array. One or both of these values will differ from the numbers of detectors used in rows and columns (indices 02b and 02c) with scanning sensors or if some sub- or super-sampling process is performed as part of the image formation. These values shall be equal to ISH NROWS and NCOLS in cases where the initial image array is recorded directly as the NITF image segment. In cases where the initial image array is modified prior to NITF generation, these values may differ from those in ISH NROWS and NCOLS. Difference between image subheader fields and these fields may indicate scaling, rotation, skewing, etc.	pixel	1 *to* 99999999	8	BCS-NPI	C
04d	COLUMN_COUNT						

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
04e	ROW_SET	**Row and Column Detection Set.** The number of rows and columns collected simultaneously to form the image array. These fields are applicable to all intended sensors. For instantaneous framing sensors, these values shall be equal to positive row and column counts (indices 04c and 04d). For a single-line pushbroom (as an example), one field shall have a meaningful value (equal to the row or column count) and the other shall be one. These values shall pertain to the NITF image segment (stored pixel data), where negative column set indicates column aggregation right to left and negative row set indicates row aggregation bottom to top when pixel data is displayed.	pixel	1 *to* ±9999999	8	BCS-NI	C
04f	COLUMN_SET						
04g	ROW_RATE	**Row and Column Detection Rate.** The duration in time to collect a single or simultaneous set of rows (ROW_SET) and columns (COLUMN_SET) when forming the image array. *These fields are applicable to all intended sensors*. For framing sensors, these values shall be zeros. For pushbroom sensors, one field (in the direction of the scanning) shall have a meaningful value and the other shall have zeros	s	0 *to* 99.9999999	10	BCS-N	C
04h	COLUMN_RATE						
04i	FIRST_PIXEL_ ROW	**Row and Column of First Collected Pixel.** The row and column of the NITF array (image segment) containing the first collected pixel or line set of the image array. *These fields are applicable to all intended sensors* to relate the image array to the NITF image segment. For framing sensors, these values shall be top left (00000001, 000000001) of the displayed image array unless rotated for NITF processing. For pushbroom, one field shall have a meaningful value (typically either one or the row or column count) and the other shall be zeros.	pixel	0 *to* 99999999	8	BCS-NPI	C
04j	FIRST_PIXEL_ COLUMN						
04k	TRANSFORM_ PARAMS	**Number of Image Transform Parameters Provided.** This flag field indicates the number of subsequent fields (indices 04l to 04s) that are present; “0” omits the presence of these fields. See Z.5.4.5 Image Transformation Parameters for additional information.	*count*	0 *to* 8	1	BCS-NPI	C

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
04l	TRANSFORM_ PARAM_1	**Image Transform Parameters ($h_1, h_2, h_3, h_4, h_5, h_6, h_7, h_8$).** These parameters are defined in Z.5.4.5 Image Transformation Parameters [TBD02]. They provide the elements of the transformation matrix between the image coordinates associated with the metadata in this TRE and those corresponding to the NITF image segment's data array. If the metadata values in this TRE correspond with the NITF-stored image array, these parameters would be the elements of an identity matrix. A Transform Parameter must be provided if its number is less than or equal to IMAGE_TRANSFORM_PARAM_COUNT. Otherwise the parameter is not provided. A meaningful value for each provided parameter is required. See section Z.5.7 for additional information.	-	0 *to* ±9999999e±99	12	BCS-A[e]	C
04m	TRANSFORM_ PARAM_2						
04n	TRANSFORM_ PARAM_3						
04o	TRANSFORM_ PARAM_4						
04p	TRANSFORM_ PARAM_5						
04q	TRANSFORM_ PARAM_6						
04r	TRANSFORM_ PARAM_7						
04s	TRANSFORM_ PARAM_8						
REFERENCE TIME/PIXEL		Either Reference Time or Reference Pixel of Applicability must be provided in each and every instantiation of the SENSRB TRE. It specifies the time or pixel location to which the dynamic parameters apply. If both reference methods are provided, the reference pixel location will take precedence over the reference time. See Z.5.5 Reference Time or Pixel Module for additional guidance regarding the implementation of these fields.					
05a	REFERENCE_ TIME	**Reference Time of Applicability.** This is the time for which the values in the TRE are to be applied. The value is in seconds before (negative) or after (positive) START_TIME. A zero value places the reference time at the imaging start time, such as would be the case for sensors modeled with instantaneous collections—where START_TIME equals END_TIME. This field shall not be defaulted if either REFERENCE_PIXEL_ROW or REFERENCE_PIXEL_ COLUMN (index 05b or 05c) is defaulted.	s	0 *to* ±99999.99999	12	BCS-N	[R]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
05b	REFERENCE_ ROW	**Reference Pixel Row and Column of Applicability.** Reference row and column pixel index relative to the NITF image segment at which the field values in this TRE apply. The pixel indices shall refer to the original NITF image segment associated with this TRE (see Z.4.5 Array Types). Pixel indexing is per the standard NITF raster order—column indices increasing to the right and row indices increasing downward from the viewer's perspective; see Z.4.6.4 Image Array Common Coordinate System. These fields shall not be defaulted if REFERENCE_TIME (index 05a) is defaulted.	pixel	0 *to* ±99999999	8	BCS-NI	[R]
05c	REFERENCE_ COLUMN						
SENSOR POSITION DATA		These fields, from which the sensor location can be determined, must be included in each and every instantiation of the SENSRB TRE. Additional guidance regarding these fields is provided in Z.5.6 Sensor Position Data Module.					
06a	LATITUDE_OR_X	**Sensor or Platform Latitude, Longitude, and Altitude or ECEF X, Y, Z Position.** These values provide the platform or sensor geolocation;[e] see Z.5.6 Sensor Position Data Module. They shall reflect the geodetic type specified in GEODETIC_TYPE (index 01h). If geodetic coordinates are used, the latitude and longitude shall be in degrees and between 0 to ±90 and 0 to ±180, respectively. The altitude will be relative to the datum specified by ELEVATION_DATUM (index 01i). Its units are specified by LENGTH_UNIT (index 01j) and can be any numeric value (positive or negative) fitting within the field size. If geocentric coordinates are used, the X_E, Y_E, and Z_E coordinates shall reflect the units specified in LENGTH_ UNIT (index 01j). Z.4.6.1.2 Geocentric Coordinate System provides reasonable limits on these geocentric Cartesian coordinate values.	deg *or* m *or* ft	*see description*	11	BCS-N	R
06b	LONGITUDE_OR_Y		deg *or* m *or* ft	*see description*	12	BCS-N	R
06c	ALTITUDE_OR_Z		m *or* ft	*see description*	11	BCS-N	R

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
06d	SENSOR_X_ OFFSET	**<u>Sensor X, Y, and Z Position Offset Relative to Platform Coordinate System</u>.** The location of the sensor perspective center relative to the above-reported position;[e] measured respectively in the *platform's* X, Y, and Z direction. See Z.5.6 Sensor Position Data Module for further clarification. These values shall reflect the units specified in LENGTH_UNIT (index 01j).	m *or* ft	0 *to* ±9999	8	BCS-N	R
06e	SENSOR_Y_ OFFSET						
06f	SENSOR_Z_ OFFSET						
07	ATTITUDE_ EULER_ANGLES	**<u>Attitude Euler Angle Flag</u>.** Flag field indicating the combined presence of platform and sensor Euler angle values. This module provides platform and sensor attitude measurements in terms of their respective Euler angles. The sensor attitude, as provided either by this module or by Modules 8 or 9, is typically required for geopositioning. If provided, the parameter values in Modules 8 and 9 take precedence over Module 7. 'Y' in this field indicates the presence of the Fields 07a to 07h; 'N' omits their presence. The units depend on the value of ANGULAR_UNIT (index 01k). Additional definitions and implementation guidance for these fields are provided in Z.5.7 Euler Angles Module.	*flag*	Y *or* N	1	BCS-A	R
07a	SENSOR_ANGLE_ MODEL	**<u>Type of Sensor Angle Rotations</u>.** Specifies the Euler angle model using a coded value. Typically the model type will depend on the sensor's mounting and/or pointing gimbal layout. The definitions for the types of sensor angle rotations are provided in Z.5.7.3.1 Sensor Angle Model [TBR].	-	1, 2, *or* 3	1	BCS-NPI	C
07b	SENSOR_ANGLE_ 1	**<u>First, Second, and Third Sensor Rotation Angles</u>.** Rotations[e] to the sensor coordinate system from the platform or local-level coordinate system. The rotation definitions are given in Z.5.7.3 Sensor Euler Angles. The definitions depend on SENSOR_ANGLE_MODEL (index 07a) and PLATFORM_RELATIVE (index 07e); see Z.5.7.3. Sensor Euler Angles. All three fields shall be populated with meaningful values when this module is present.	deg, rad, or sc	0 *to* ±180 deg	10	BCS-N	C
07c	SENSOR_ANGLE_2			0 *to* ±90 deg	9	BCS-N	C
07d	SENSOR_ANGLE_3			0 *to* ±180 deg	10	BCS-N	C

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
07e	PLATFORM_ RELATIVE	**Sensor Angles Relative to Platform Flag.** If this flag is set to 'Y', the above sensor angles are relative to the platform coordinate system (see Z.5.7.3 Sensor Euler Angles); otherwise, the above angles are relative to the time-relevant, sensor-local NED coordinate system, regardless of the GEODETIC_TYPE (index 01h).	*flag*	Y *or* N	1	BCS-A	C
07f	PLATFORM_ HEADING	**Platform Heading, Pitch, and Roll Angle.** These three Euler angles[e] define the attitude of the platform coordinate system; see Z.5.7.2 Platform Euler Angles. They are relative to the time-relevant, platform/sensor-local NED, regardless of the GEODETIC_TYPE (index 01h). Meaningful values for these three angles are required if PLATFORM_RELATIVE (index 07f) is set to 'Y'; otherwise, these angles may be default filled.	deg, rad, or sc	0 *to* 360 deg	9	BCS-N	[C]
07g	PLATFORM_PITCH			0 *to* ±90 deg	9	BCS-N	[C]
07h	PLATFORM_ROLL			0 *to* ±180 deg	10	BCS-N	[C]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
08	ATTITUDE_ UNIT_VECTORS	**Attitude Unit Vector Flag**. Flag field indicating the presence of image coordinate system's unit vectors components. This module provides the image coordinate system direction cosines relative to the sensor-local NED or the ECEF coordinate system. The sensor attitude, as provided either by this module or by Modules 7 or 9, is typically required for geopositioning. The parameter values in this module take precedence over those in Modules 7 and 9. 'Y' in this field indicates the presence of the Fields 08a to 08i; 'N' omits their presence. See Z.5.8 Unit Vectors Module for additional information regarding these fields.	*flag*	Y *or* N	1	BCS-A	R
08a	ICX_NORTH_OR_X	**Image Coordinate (IC) System X, Y, and Z Axes Attitude Unit Vectors Relative to NED or ECEF Coordinate Frame**. The coordinates of the image coordinate system-aligned unit vectors (or equivalently the image coordinate system's direction cosines). These component values are relative to either the sensor-local NED or the ECEF coordinate system, as specified by GEODETIC_TYPE (index 01h). All fields shall be populated with meaningful values when this module is present. The uncertainties[e] associated with these values are reported in Module 14 (Uncertainty Data) using a unique method as described in Z.5.14.5 Attitude Unit Vector Uncertainties.	-	0 *to* ±1	10	BCS-N	C
08b	ICX_EAST_OR_Y						
08c	ICX_DOWN_OR_Z						
08d	ICY_NORTH_OR_X						
08e	ICY_EAST_OR_Y						
08f	ICY_DOWN_OR_Z						
08g	ICZ_NORTH_OR_X						
08h	ICZ_EAST_OR_Y						
08i	ICZ_DOWN_OR_Z						

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
09	ATTITUDE_ QUATERNION	**Attitude Quaternion Flag**. Flag field indicating the presence of a sensor attitude quaternion. This module provides the sensor attitude using a quaternion relative to the sensor-local NED or the ECEF coordinate system. The sensor attitude, as provided either by this module or by Modules 7 or 9, is typically required for geopositioning. The parameter values in this module take precedence over those in Module 7, but those in Module 8 take precedence over these. 'Y' in this field indicates the presence of the Fields 09a to 09d; 'N' omits their presence. See Z.5.9 Quaternions Module for additional information regarding these fields.	*flag*	Y *or* N	1	BCS-A	R
09a	ATTITUDE_Q1	**Attitude Quaternion Vector Components**. Three vector elements of a normalized quaternion[e] defining the conceptual sensor attitude relative to either the sensor-local NED or the ECEF coordinate system, as specified by GEODETIC_ TYPE (index 01h).	-	0 *to* ±1	10	BCS-N	C
09b	ATTITUDE_Q2						
09c	ATTITUDE_Q3						
10	SENSOR_ VELOCITY_ DATA	**Sensor Velocity Data Flag**. Flag field indicating the presence of sensor velocity data. This module provides the sensor velocity components relative to the sensor-local NED or the ECEF coordinate system, as may be useful with a pushbroom or whiskbroom sensor. 'Y' in this field indicates the presence of the Fields 10a to 10c; 'N' omits their presence. See Z.5.10 Sensor Velocity Module for additional information regarding these fields.	*flag*	Y *or* N	1	BCS-A	R
10a	VELOCITY_ NORTH_OR_X	**Sensor North, East, and Down Velocity Vectors**. The velocity vector components of the sensor's velocity vector.[e] The velocity components are relative to either the sensor-local NED or the ECEF coordinate system, as specified by GEODETIC_TYPE (index 01h). Units are specified by LENGTH_UNIT (index 01j).	m/s or ft/s	0 *to* ±99999	9	BCS-N	C
10b	VELOCITY_ EAST_OR_Y						
10c	VELOCITY_ DOWN_OR_Z						

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
11	POINT_SET_DATA	**<u>Polygon or Point Set Count Flag</u>.** Flag field indicating the number of points-of-interest sets associated with the NITF image segment. This module provides point sets (a set of one or more points such as polygon vertices) to identify or bound features within the image and provides geometric information associated with those points. '00' in this field omits the presence of Fields 11a to 11h. A non-zero value defines the number of point sets included in the TRE; see Z.4.7 Looping Fields Concept. See Z.5.11 Point DataSets Module for additional information regarding these fields.	*count*	00 *to* 99	2	BCS-NPI	R
11a	POINT_SET_TYPE_MM	**<u>Type of M^{th} Point Set</u>.** The type of point of interest set. This field identifies the type of feature being identified or bound by the m^{th} point set. This field requires NTB registration, current values are:[c] Image Center Ground Points Image Footprint Ground Area Note: Image Center and Image Footprint are used once per NITF image segment.	-	*see NTB registry for approved values.[c]*	25	BCS-A	L
11b	POINT_COUNT_MM	**<u>Number of Points in M^{th} Set</u>.** The number of points used to identify or bound the m^{th} feature identified by POINT_SET_TYPE_MM (index 11a.*m*). For each occurrence of fields 11a and 11b, fields 11c through 11h occur POINT_COUNT_MM (index 11b.*m*) times.	*count*	001 *to* 999	3	BCS-NPI	L
11c 11d	P_ROW_NNN P_COLUMN_NNN	**<u>Row and Column Location for N^{th} Point</u>.** The NITF-stored array coordinates for the n^{th} point in the m^{th} point set.	pixel	0 *to* 99999999	8	BCS-NPI	L

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
11e	P_LATITUDE_ NNN	**Latitude, Longitude, Elevation, and Range for Nth Point.** The estimated geographic coordinates and elevation, as well as measured range (line-of-sight distance from sensor to point), for the n^{th} point in the m^{th} point set.[e] The geographic coordinates of the imaged feature or region will be provided using the latitude and longitude, *regardless* of the value specified in GEODETIC_ TYPE (index 01h). The elevation will be relative to the datum specified by ELEVATION_ DATUM (index 01i). Fields needing data that is unavailable should be default filled.	deg	0 *to* ±90	10	BCS-N	[L]
11f	P_LONGITUDE_ NNN		deg	0 *to* ±180	11	BCS-N	[L]
11g	P_ELEVATION_ NNN		m or ft	*see note* g	6	BCS-N	[L]
11h	P_RANGE_ NNN		m or ft	0 to 99999999	8	BCS-N	[L]
12	TIME_STAMPED_ DATA_SETS	**Time Stamp Count Flag.** Flag field indicating the number of dynamic parameters recorded with time-stamps in this TRE. This module associates parameter values directly to multiple specific reference times. '00' in this field omits the presence of Fields 12a to 12d. A non-zero value defines the number of time-stamped parameters present in the module; see Z.4.7 Looping Fields Concept. The presence of this module indicates the values stored in the index-referenced fields prior to this module shall be nominal, average, or approximate values per the entire image segment. See Z.5.12 Time-Stamped Data Module for additional guidance and possible exception.	*count*	00 *to* 99	2	BCS-NPI	R
12a	TIME_STAMP_ TYPE_MM	**Index of the Mth Time-Stamped Parameter.** The m^{th} time-stamped parameter's index value. Indexing is limited to reasonably applicable fields (dynamic parameters) in the value range.	*index*	06a *to* 10c	3	BCS-A	L
12b	TIME_STAMP_ COUNT_MM	**Number of Occurrences of the Mth Parameter.** The number of time stamps for which this parameter's value is recorded. This field determines the number of times the two fields below (12c and 12d) repeat to record the time stamps and values of the m^{th} indexed parameter.	*count*	1 *to* 9999	4	BCS-NPI	L

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
12c	TIME_STAMP_ TIME_NNNN	**The Nth Instance of a Time-Stamp Time.** The reference time in seconds relative to START_ TIME (index 01m) associated with the subsequent value of the m^{th} parameter. Negative times are possible, if the parameter is measured before the imaging start time.	s	0 *to* ±99999.99999	12	BCS-N	L
12d	TIME_STAMP_ VALUE_NNNN	**The Nth Instance of the Mth Time-Stamped Parameter's Value.** The parameter value at the time-stamp time above (TIME_STAMP_TIME_NNNN, index 12c.*m.n*).	*see note* h *below*				L
13	PIXEL_ REFERENCED_ DATA_SETS	**Pixel Reference Count Flag.** Flag field indicating the number of dynamic parameters recorded with references to pixel indices. This module associates parameter values directly to multiple NITF image segment locations. '00' in this field omits the presence of Fields 13a to 13e. A non-zero value defines the number of pixel-referenced parameters present in the module; see Z.4.7 Looping Fields Concept. The presence of this module indicates the values stored in the index-referenced fields prior to this module shall be nominal, average, or approximate values per the entire image segment. See Z.5.13 Pixel-Referenced Data Module for additional guidance and possible exception.	*count*	00 *to* 99	2	BCS-NPI	R
13a	PIXEL_REFERENCE _TYPE_MM	**Index of the Mth Pixel-Referenced Parameter.** The m^{th} pixel-referenced parameter's index value. Indexing is limited to reasonably applicable fields (dynamic parameters) in the range.	*index*	06a *to* 10c	3	BCS-A	L
13b	PIXEL_REFERENCE _COUNT_MM	**Number of Occurrences of the Mth Parameter.** The number of pixel reference locations for which this parameter's value is recorded. This field determines the number of times the three fields (13c, 13d, 13d) repeat to record the pixel locations and values of the m^{th} parameter.	*count*	1 *to* 9999	4	BCS-NPI	L

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
13c	PIXEL_REFERENCE_ROW_NNNN	**The Nth Instance of a Reference Pixel Row and Column Index.** The row and column index for the reference pixel associated with the subsequent value of the m^{th} parameter. The center row or center column index shall be used, respectively, when the parameter is only column- or row-varying. Each set of pixel coordinates pertains to the NITF-stored image segment.	pixel	0 *to* ±99999999	8	BCS-NI	L
13d	PIXEL_REFERENCE_COLUMN_NNNN						
13e	PIXEL_REFERENCE_VALUE_NNNN	**The Nth Instance of the Mth Pixel-Referenced Parameter's Value.** The parameter value associated with the reference pixel location defined above (indices 13c.*m*.*n* and 13d.*m*.*n*).	*see note* h *below*				L

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
14	UNCERTAINTY_ DATA	**Uncertainty Data Flag.** Flag field indicating the number of uncertainty-related values in the module. This module provides estimated standard deviations or correlation coefficients for select parameters. '000' in this field omits the presence of Fields 14a to 14c. A non-zero value defines the number of data sets (parameter index pairs and uncertainty values) found in this module; see Z.4.7 Looping Fields Concept. When provided, parameter uncertainties can be projected or propagated into the object space as geoposition uncertainty estimates. These estimated geoposition uncertainties are required for a number of applications. See Z.5.14 Uncertainty Data Module for additional guidance regarding these fields.	*count*	000 *to* 999	3	BCS-NPI	R
14a	UNCERTAINTY_ FIRST_TYPE_NNN	**First Index of Parameter with Reported Uncertainty or Correlation.** The first index for the n^{th} parameter pair to which the subsequent (n^{th}) uncertainty estimate or correlation coefficient (UNCERTAINTY_VALUE_NNN, index 14c.*n)* pertains. Indexing is limited to reasonably applicable fields in the value range (spatial or temporal parameters with potential uncertainties). Indices for looping-conditional fields can be followed by up to seven digits with a decimal point separator. The digits before the separator identify the m^{th} parameter (outer loop), and the digits after the separator identify the n^{th} instance (inner loop) of that m^{th} parameter. See Z.4.7.2 Looping Field Indexing for additional clarification.	*index*	*any appropriate index between* 02a *to* 15d	11	BCS-A	L
14b	UNCERTAINTY_ SECOND_TYPE_ NNN	**Second Index of Parameter with Reported Uncertainty.** The second index for the n^{th} parameter pair to which the subsequent uncertainty estimate or correlation coefficient pertains. Shall be either default filled or identical to the first index to indicate that the subsequent value (index 14c.*n*) is a standard deviation. Must be an appropriate index, different from the first index, to indicate that the subsequent value is a correlation coefficient (relating the two indexed parameters). See UNCERTAINTY_FIRST_TYPE_NNN (index 14a) above for additional guidance.	*index*	*any appropriate index between* 02a *to* 15d	11	BCS-A	[L]

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
14c	UNCERTAINTY_ VALUE_NNN	**Uncertainty or Correlation Value.** The uncertainty estimate or correlation coefficient associated with the previously-identified-parameters' value(s). If the n^{th} UNCERTAINTY_SECOND_ TYPE_NNN (index 14b.*n*) is defaulted or is identical to the n^{th} UNCERTAINTY_FIRST_TYPE_ NNN (index 14a.*n*), this n^{th} value shall be the standard deviation (1σ) estimate for the indexed parameter. If two different indices appear in the two index fields (14a.*n* and 14b.*n*), then the value is a correlation coefficient relating those two indexed parameters.	*see note* i *below*	*for standard deviations:* 0 *to* 9.99999e99 *for correlation coefficients:* -1 *to* +1	10	BCS-A[f]	L
15	ADDITIONAL_ PARAMETER_ DATA	**Additional Parameter Flag.** Flag field indicating the number of additional parameters in the module. This module allows for the registration of new data fields to accommodate requirements not already met by SENSRB. '000' in this field omits the presence of Fields 15a to 15d. A non-zero value defines the number of parameter sets (parameter name, size, count, and value(s)) found in this module; see Z.4.7 Looping Fields Concept. See Z.5.15 Additional Parameter Data Module for additional guidance regarding these fields.	*count*	000 *to* 999	3	BCS-NPI	R
15a	PARAMETER_ NAME_MMM	**Additional Parameter Name.** Name of the m^{th} additional parameter. This name must be unique, explicit, and registered with the NTB.[c] Registration will ensure uniqueness to avoid ambiguity and will document the parameter definition and utility for community awareness and future TRE developments.	-	*see NTB registry for approved values.*[c]	25	BCS-A	L
15b	PARAMETER_ SIZE_MMM	**Additional Parameter Field Size.** The size of the m^{th} additional parameter value field. This user-specified size allows for parameters of variable sizes. This size shall apply to all instantiations of PARAMETER_VALUE_NNNN associated with the m^{th} additional parameter.	bytes	1 *to* 999	3	BCS-NPI	L

SENSRB TRE Fields for Hyperspectral Products							
INDEX	**FIELD**	**FIELD NAME & DESCRIPTION**	**UNITS**	**VALUE RANGE**	**BYTE SIZE**	**CHAR[a] SET**	**TYPE[b]**
15c	PARAMETER_ COUNT_MMM	**<u>Number of Occurrences of the Additional Parameter</u>.** The number of times the m^{th} parameter is recorded herein. This field determines the number of times the field below (PARAMETER_VALUE_NNNN, index 15d) is repeated for the m^{th} additional parameter.	*count*	1 *to* 9999	4	BCS-NPI	L
15d	PARAMETER_ VALUE_NNNN	**<u>Additional Parameter Value</u>.** The value for the n^{th} instantiation of the m^{th} additional parameter.	*See note j below*				L

[a] BCS-A: Basic Character Set–Alpha, BCS-N: Basic Character Set–Numeric, BCS-NI: Basic Character Set–Numeric Integer, BCS-NPI: Basic Character Set–Numeric Positive Integer.
[b] R: Required, C: Conditional, L: Looping-conditional, [ ]: BCS hyphens allowed for entire field.
[c] For instruction on how to review the current NTB registry and for guidance regarding the registration of additional values, see Z.4.1 NTB-Registered Field Values.
[d] At least two of the three sets of data (ROW/COLUMN_METRIC—indices 02d and 02e, FOCAL_LENGTH—index 02f, and ROW/COLUMN_FOV—indices 02g and 02h) must contain meaningful values (not be default filled) to provide the photogrammetric data typically required for geopositioning. (See Z.5.2.3 Focal Length and Field of View.)
[e] Uncertainties associated with these values should be provided in Module 14 (Uncertainty Data); see Z.5.14 Uncertainty Data Module.
[f] This field value must be numerical and can be formatted as exponential or floating decimal, see Z.4.3 Numerical Expressions.
[g] Any reasonable value accommodated by the field size can be used for the feature elevation. Earth-surface elevations would fall between -500 to +9000 m (-1500 to 30,000 ft).
[h] The units, range, size, and character set permitted for this value are specified as they are for the m^{th} indexed parameter identified by index 12a.*m* or 13a.*m*.
[i] Standard deviations will have the same units as the indexed parameter; see Z.5.14.4 Geodetic Coordinate Uncertainties for the exceptions to this rule. Correlation coefficients are unitless.
[j] The value's units, range, and character set will be established for each additional parameter as part of the NTB registration process. The size (byte allotment) for this parameter is as specified by PARAMETER_SIZE_MMM (index 15b.*m*)

4.1.25 STDIDC TRE for Hyperspectral Products

The Standard ID support extension (STDIDC) is contained in the image extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.25-1 provides the field descriptions and metadata population requirements for the STDIDC TRE used with Satellite Hyperspectral datasets. This TRE is required for all such datasets.

For additional information refer to *STDI-0006*, *National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD)*.

Table 4.1.25-1: STDIDC TRE Fields for Hyperspectral Products

STDIDC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	STDIDC	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00089	bytes	R	R
ACQUISITION_ DATE	**Acquisition Date**. This field shall contain the date of the collection mission (date of aircraft takeoff) in the format YYYYMMDDHHMMSS, in which YYYY is the year, MM is the month (01 to 12), DD is the day of the month (01 to 31), HH is the hour (0 to 23), MM is the minute (0 to 59) and SS (00 to 59) is the second (00 to 59). The date changes at midnight UTC. This field is equivalent to the IDATIM field in the image subheader.	14	BCS-N	YYYYMMDDHHMMSS		R	R
MISSION	**Mission Identification**. Fourteen character descriptor of the vehicle. For satellite, identifies the specific vehicle as source of image data. For aerial, identifies the scanner. For the list of registered values, see http://jitc.fhu.disa.mil/nitf/tag_reg/stdidc/mission.htm.	14	BCS-A	alphanumeric Valid values as per list maintained by JITC		R	R

STDIDC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
PASS	**Pass Number**. A number in the range 01 to 99 shall identify each pass or flight per day. In order to ensure uniqueness in the image id, if the satellite or aerial mission extends across midnight UTC, the pass number shall be 01 through 99 on images acquired before midnight UTC and Ax on images acquired after midnight UTC; for extended missions Bx, … Zx shall designate images acquired on subsequent days (where x is in the range of 0 to 9).	2	BCS-A	alphanumeric 01 to 99, A1 to A9 B1 to B9 … Z1 to Z9		R	R
OP_NUM	**Image Operation Number**. Imaging operations numbers shall increase within each Imaging System pass. A value of “000” indicates that the system does not number imaging operations. For video systems, this field will contain the frame number within the acquisition date and time.	3	BCS-N	000 to 999		R	R
START_SEGMENT	**Start Segment ID**. Identifies images as separate pieces (segments) within an imaging operation. AA is first segment; AB is second segment, etc.	2	BCS-A	AA to ZZ		R	R
REPRO_NUM	**Reprocess Number**. This field indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A "00" in this field indicates that the data is an originally processed image, “01” indicates the first reprocess/enhancement, etc.	2	BCS-N	00 to 99		R	R

STDIDC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
REPLAY_REGEN	**Replay** (remapping) imagery mode shall provide the capability to alter the digital processing of previously recorded digital imagery. Regen regeneration imagery mode provides the capability to produce an image identical to the image that was produced in initial process. The images are used as replacements for images damaged during production. A "000" in this field indicates that the data is an originally processed image.	3	BCS-A	alphanumeric		R	R
BLANK_FILL	Blank Fill	1	BCS-A	BCS space (0x20) or _		R	<R>
START_COLUMN	**Starting Column Block**. For tiled (blocked) sub-images, the starting column block is defined as the offset, in blocks, of the first block in the crossscan direction relative to start of the original reference image tiling.	3	BCS-N	001 to 999		R	R
START_ROW	**Starting Row Block**. For tiled (blocked) sub-images, the starting row block is defined as the offset, in blocks, of the first block in the alongscan direction relative to start of the original reference image tiling.	5	BCS-N	00001 to 99999		R	R
END_SEGMENT	**Ending Segment ID** of this file.	2	BCS-A	AA to ZZ		R	R
END_COLUMN	**Ending Column Block**. For tiled (blocked) sub-images, the ending column block is defined as the offset, in blocks, of the last block of the image in the cross-scan direction relative to start of the original reference image tiling.	3	BCS-N	001 to 999		R	R
END_ROW	**Ending Row Block**. For tiled (blocked) sub-images, the ending row block is defined as the offset, in blocks, of the last block in the alongscan direction relative to start of the original reference image tiling.	5	BCS-N	00001 to 99999		R	R

STDIDC TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
COUNTRY	**Country Code**. Two letter code defining the country for the reference point of the image. Standard codes may be found in FIPS PUB 10-4.	2	BCS-A	AA to ZZ		R	<R>
WAC	**World Aeronautical Chart**. 4 number World Aeronautical Chart for the reference point of the image segment. World Aeronautical Chart grids the earth into regions with a 4 number ID.	4	BCS-N	0001 to 1866		R	<R>
LOCATION	**Location**. The natural reference point of the sensor; provides a rough indication of geographic coverage. The format DDMMX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X = N or S for north or south, and DDMMY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y = E or W for east or west, respectively. For SAR imagery, the reference point is normally the center of the first image block. For EO-IR imagery, the reference point for framing sensors is the center of the frame; for continuous sensors, it is the center of the first line.	11	BCS-A	DDMMXDDDMMY		R	R
	reserved	5	BCS-A	spaces			<R>
	reserved	8	BCS-A	spaces			<R>

4.1.26 USE00A TRE for Hyperspectral Products

The Exploitation Usability support extension (USE00A) is contained in the image extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.26-1 provides the field descriptions and metadata population requirements for the USE00A TRE used with Hyperspectral datasets. This TRE is required for all such datasets

The USE00A TRE contains metadata indicating the Mean Ground Sample Distance (GSD), Sun Elevation, and Sun Azimuth, which may be useful for image search and discovery.

For additional information refer to *STDI-0006*, *National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD)*.

Table 4.1.26-1: USE00A TRE Fields for Hyperspectral Products

USE00A TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	USE00A	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00107	bytes	R	R
ANGLE_TO_NORTH	**Angle to North**. Angle, measured clockwise from first row vector (pointing from the first column to the last) to a vector pointing to True North.	3	BCS-N	000 to 359	degrees	R	R
MEAN_GSD	**Mean Ground Sample Distance**. The geometric mean of the cross and along scan center-to- center distance between contiguous ground samples. Accuracy = +10% Note: Systems requiring an extended range shall insert a default value of "000.0" for this field and utilize the PIAMC tag.	5	BCS-N	000.0 to 999.9	inches	R	R
	reserved	1	BCS-A	space		R	<R>
DYNAMIC_RANGE	**Dynamic Range**. Dynamic range of pixels in image.	5	BCS-A	00000 to 99999		R	<R>
	reserved	3	BCS-A	spaces		R	<R>
	reserved	1	BCS-A	space		R	<R>
	reserved	3	BCS-A	spaces		R	<R>
OBL_ANG	**Obliquity Angle**.	5	BCS-A	00.00 to 90.00	degrees	R	<R>
ROLL_ANG	**Roll Angle**.	6	BCS-A	-90.00 to +90.00	degrees	R	<R>
	reserved	12	BCS-A	spaces		R	<R>
	reserved	15	BCS-A	spaces		R	<R>
	reserved	4	BCS-A	spaces		R	<R>

USE00A TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
	reserved	1	BCS-A	space		R	<R>
	reserved	3	BCS-A	spaces		R	<R>
	reserved	1	BCS-A	space		R	<R>
	reserved	1	BCS-A	space		R	<R>
N_REF	**Number of Reference Lines**. Number of reference lines in the image. For each reference line, there will be a REFLNA extension in the NITF file.	2	BCS-N	00 to 99		R	R
REV_NUM	**Revolution Number**. The revolution number in effect at the northernmost point of orbit.	5	BCS-N	00001 to 99999		R	R
N_SEG	**Number of Segments**.	3	BCS-N	001 to 999		R	R
MAX_LP_SEG	**Maximum Lines Per Segment**. Maximum number of lines per segment, including overlap lines. The maximum number of lines per segment depends upon the aggregation mode of the collector.	6	BCS-A	000001 to 999999		R	<R>
	reserved	6	BCS-A	spaces		R	R
	reserved	6	BCS-A	spaces		R	R
SUN_EL	**Sun Elevation**. In degrees measured from the target plane at intersection of the optical line of sight with the earth's surface at the time of the first image line. Default value, if data is not available, is 999.9.	5	BCS-N	-90.0 to +90.0, or 999.9	degrees	R	R
SUN_AZ	**Sun Azimuth**. In degrees measured from true North clockwise (as viewed from space) at the time of the first image line. Default value, if data is not available, is 999.9.	5	BCS-N	000.0 to 359.0, or 999.9	degrees	R	R

4.1.27 J2KLRA TRE for Hyperspectral Products

The JPEG 2000 Layer Target Bit Rates tagged record extension (J2KLRA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.27-1 provides the field descriptions and metadata population requirements for J2KLRA TRE used with Hyperspectral datasets. This TRE is required for all such datasets that make use of JPEG 2000 compression.

Table 4.1.27-2 provides the target bit rate values for each Quality Layer in the JPEG 2000 compressed codestream.

The target bit rate values provided in this table has not been optimized for Hyperspectral imaging systems. As such, these values are to be considered as TBR.

The J2KLRA TRE is required for JPEG 2000 Compressed Imagery.

For additional information refer to *BPJ2K01.00*, *BIIF Profile for JPEG 2000*.

Table 4.1.27-1: J2KLRA TRE Fields for Hyperspectral Products

J2KLRA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	J2KLRA	N/A	R	R
CEL	**Length of Entire Tagged Record**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00023 to 00261	bytes	R	R
ORIG	**Original Compressed Data**. This field shall indicate the encoding profile used during the compression of the JPEG 2000 codestream and whether the codestream has been parsed or not. Codestream parsing can be accomplished in resolution level, quality layer, spatial extent (spatial chipping), and/or component (spectral band). The conditional fields (NLEVELS_I, NLAYERS_I, and NBANDS_I) are present if this field indicates a parsed codestream. Note: If a codestream has been transcoded from one profile to another (e.g., NPJE to EPJE), then the ORIG field shall be updated for use with the transcoded codestream to reflect the encoding profile now in effect. Note: Community may soon add definitions for values 4 and 5. See NTB site for information concerning “Airborne-Preferred Profile for JPEG 2000 Encoding (APJE)”.	1	BCS-N	0 (for original NPJE comp.) 1 (for parsed NPJE comp.) 2 (for original EPJE comp.) 3 (for parsed EPJE comp.) 4 to 7 (reserved for future use) 8 (for original other comp.) 9 (for parsed other comp.) Note: For this IP, values will generally be 0 or 2.	N/A	R	R

J2KLRA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Original compressed image information (the first JPEG 2000 compression).							
NLEVELS_O	**Number of Wavelet Levels in Original Image**. This field shall indicate the number of wavelet decomposition levels provided in the original image codestream. Note that the number of Reduced Resolution Dataset (RRDS) images contained in a codestream is equal to one plus the number of decomposition levels recorded in this field.	2	BCS-N	00 to 99 (in general)	N/A	R	R
NBANDS_O	**Number of Bands in Original Image**. This field shall indicate the number of bands (components) in the original image codestream.	5	BCS-N	00001 to 16384 (in general)	N/A	R	R
NLAYERS_O	**Number of Layers in Original Image**. This field shall indicate the number of layers in the original image codestream.	3	BCS-N	001 to 020 (in general)	N/A	R	R
Start of layer target bit rate information loop. Field repeats for n = 0 to NLAYERS_O-1 times.							
LAYER_IDn	**n^{th} Layer ID Number**. This field indicates the index number of the layer target bit rate being described. Layers are numbered from 0 to NLAYERS_O-1. 0 is the layer with the lowest bit rate.	3	BCS-N	000 to 019 (in general)	N/A	R	R
BITRATEn	**n^{th} Bit Rate**. This field shall indicate the accumulated bit rate target associated with this and associated lower layers. This is defined in bits per pixel per band (bpppb). It may happen that the bit rate was not achieved due to data characteristics. Note for JPEG 2000 numerically lossless quality, the bit rate for the final layer is an expected value based on past performance. If there is not a target bit rate, report the achieved bit rate.	9	BCS-A**	00.000000 to 38.000000* See Table 4.1.13-2 for listings of actual Layer Target Bit Rates to be used.	bpppb	R	R
End of layer target bit rate information loop.							

J2KLRA TRE Fields for Hyperspectral Products							
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**CORR. FLAG**	**TYPE**
Start of conditional fields for parsed datasets (ORIG = 1, 3, 5, or 9). Note: 5 added as a choice based on APJE profile being discussed by NTB (see NTB site).							
NLEVELS_I	**Number of Wavelet Levels in This Image**. This field shall indicate the number of wavelet decomposition levels included in this image codestream as defined in the JPEG 2000 codestream COD marker (see ISO/IEC 15444-1:2004).	2	BCS-N	00 to 99 (in general)	N/A	R	C
NBANDS_I	**Number of Bands in This Image**. This field shall indicate the number of bands in this image as defined in the JPEG 2000 codestream SIZ marker (see ISO/IEC 15444-1:2004).	5	BCS-N	00001 to 16384 (in general)	N/A	R	C
NLAYERS_I	**Number of Layers in This Image**. This field shall indicate the number of layers in this image as defined in the JPEG 2000 codestream COD marker (see ISO/IEC 15444-1:2004).	3	BCS-N	001 to 020 (in general)	N/A	R	C

*The component sample precision is limited by the number of guard bits, quantization, growth of coefficients at each decomposition level, and the number of coding passes that can be signaled. Not all combinations of coding styles will allow the coding of 38 bit samples per band (see BPJ2K01.00).
** The official definition of the J2KLRA TRE has the BITRATEn field format listed as BCS-A (see BPJ2K01.00).

Table 4.1.27-2: JPEG 2000 Target Bit Rate Layers

Quality Layer	Visually Lossless Compression (9-7I)	Numerically Lossless Compression (5-3R)
0	**0.03125** bpppb	**0.03125** bpppb
1	**0.0625** bpppb	**0.0625** bpppb
2	**0.125** bpppb	**0.125** bpppb
3	**0.25** bpppb	**0.25** bpppb
4	**0.5** bpppb	**0.5** bpppb
5	**0.6** bpppb	**0.6** bpppb
6	**0.7** bpppb	**0.7** bpppb
7	**0.8** bpppb	**0.8** bpppb
8	**0.9** bpppb	**0.9** bpppb
9	**1.0** bpppb	**1.0** bpppb
10	**1.1** bpppb	**1.1** bpppb
11	**1.2** bpppb	**1.2** bpppb
12	**1.3** bpppb	**1.3** bpppb
13	**1.5** bpppb	**1.5** bpppb
14	**1.7** bpppb	**1.7** bpppb
15	**2.0** bpppb	**2.0** bpppb
16	**2.3** bpppb	**2.3** bpppb
17	**2.8** bpppb	**2.8** bpppb
18	**3.5** bpppb	**3.5** bpppb
19		**all remaining bits**

Appendix A -- SENSRB Population Requirements for Hyperspectral Imaging Systems

A-1 Background

The goal of this appendix is to describe the threshold and objective metadata population requirements for SENSRB, as it relates to geopositioning for tactical hyperspectral imaging (HSI) systems. It is designed to offer clear implementation guidance to both program managers and data providers by encouraging the use of standardized rigorous geopositioning models and establishing a common geopositioning quality reference system: The Metric Level. The intricacies of SENSRB are not discussed here, as the Tagged Record Extension (TRE) description itself involves more than ninety pages of documentation. The reader should consult Appendix Z in STDI-0002-1 for more detailed information.

A-2 Threshold Photogrammetric Requirements

As mentioned in section 4.1.24, SENSRB must be populated with enough information to successfully instantiate a rigorous geopositioning model for the sensor type associated with the image. The threshold of "enough" is defined in this context to mean that there must be sufficient information to construct a basic line of sight (LOS) vector for each image pixel, referred to by photogrammetrists as an imaging ray. The amount and nature of the information required to meet this threshold standard varies by sensor type. The three most common types of electro-optical sensors used in tactical HSI systems are frame, pushbroom, and whiskbroom. NGA has developed and released two guidance documents that provide detailed information on how to construct rigorous geopositioning models-including basic imaging rays-for these sensor types:

- Frame Sensor Model Metadata Profile Supporting Precise Geopositioning (FSMMG), Version 1.0, 13 June 2007
- Pushbroom/Whiskbroom Sensor Model Metadata Profile Supporting Precise Geopositioning (NGA.SIG.0003_1.0), Version 1.0, 21 July 2009

The above guidance documents also include discussions on objective information requirements such as sensor calibration and uncertainty characterization. Providing calibration items like principal point offsets and radial lens distortion terms will generally improve the accuracy of an imaging ray and the ground coordinates that result from intersecting it with a terrain source (e.g., fixed height plane or DEM) or one or more additional rays from other images. Providing uncertainty characterization, usually in the form of covariance matrices, enables you to express how well you understand the inherent accuracy of the sensor and, by extension, any ground coordinates generated from the sensor model. While communicating uncertainty is not an absolute requirement for basic geopositioning, some applications (e.g., targeting) require that standard confidence metrics derived from uncertainty information (LE90 and CE90) accompany generated ground coordinates.

It should be noted that, at this time, adjustable parameters are not supported by SENSRB in a standardized way, so it is recommended that any adjustments be applied prior to storing affected values in SENSRB. Use the Generation (count, date, and time) elements to distinguish when subsequent modifications are made to SENSRB through resection or adjustments.

A-3 SENSRB Population Requirements

SENSRB includes the concept of a Content Level, which is a general way to communicate the overall suitability of included sensor information to support various geopositioning tasks. The levels range from 0 (basic) to 9 (exquisite). At the low end, SENSRB behaves in a similar fashion to SENSRA, but with slightly better floating point precision for angular values; this allows it to support general situational awareness activities, but not much else. At the high end, SENSRB can fully support precision targeting activities. The SENSRB specification breaks down the required modules for each Content Level, which can be found in Table A-3-1:

Table A-3-1: SENSRB Content Levels

Adapted from Table Z-2, STDI-0002-1, Appendix Z, pp. 53. Fields marked with "R" are required; those marked with "C" are conditional.

	Content Level Value									
SENSRB Content (Applicable Module)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Image Temporal Data (1 & 5)	R	R	R	R	R	R	R	R	R	R
Sensor Position Data (6)	R	R	R	R	R	R	R	R	R	R
Sensor Array & Image Formation Data (2 & 4)			R	R	R	R	R	R	R	R
Sensor or Image Attitude Data (7, 8, or 9)					R	R	R	R	R	R
Metadata Synchronization (12 or 13)*					C	C	C	C	C	C
Sensor Velocity Data (10)*					C	C	C	C	C	C
Uncertainties (14)							R	R	R	R
Sensor Calibration Data (3)									R	R
Image Geospatial Data (11)		R		R		R		R		R
*Modules 10 and (12 or 13) are required for Content Level 4 and higher, but only for multiple frame, pushbroom, or whiskbroom imaging methods										

Content Level 4 is the first one that contains enough information to construct a basic imaging ray, so it serves as the foundation for a reference system that will be used from this point forward to describe an overall geopositioning quality scale (Metric Level). It should be noted that for time-dependent imaging systems which require the use of Module 12 or 13, sensor position and attitude values must be provided at a sufficiently high rate to properly represent changes in their values throughout the image scan.

The reader should be aware that "metric" within the context of this document does not equate to "accurate geopositioning." It is defined here as the ability to accurately express the nature and amount of uncertainty present in a system. So, for example, a sensor with poor geopositioning performance, but excellent uncertainty characterization, is considered to be metric. Conversely, a sensor with excellent geopositioning performance, but no uncertainty information, is not metric.

The Metric Level reference system is designed to establish a common baseline for conversations between program managers and data providers with respect to a given sensor's threshold and objective geopositioning requirements and how they translate into an acceptable implementation of SENSRB. The reference system consists of six levels, which map directly to Content Levels 4 through 9 (Table A-3-2):

Table A-3-2: The Metric Levels and associated exploitation capabilities
as derived from the SENSRB Content Levels.

Metric Level	SENSRB Content Level	Exploitation Capability
0	4	Basic Geopositioning, Without Ground Control
1	5	Basic Geopositioning, With Ground Control
2	6	Enhanced Geopositioning, Without Ground Control
3	7	Enhanced Geopositioning, With Ground Control
4	8	Calibrated Geopositioning, Without Ground Control
5	9	Calibrated Geopositioning, With Ground Control

There are three categories related to exploitation capability: Basic, Enhanced, and Calibrated. Each of these comes with two options that revolve around the presence or absence of ground control information. Module 11 will be used to store ground control information in the form of one or more truth points that convey location as a [longitude, latitude, height] coordinate triplet. "Ground Points" will be used as the identifier in the POINT_SET_TYPE field for this point set. As one moves up the scale from 0 to 5, there is a trade-off between ease of implementation and ease of exploitation with respect to precision geopositioning. At the two highest levels, there is a significant burden on the data provider, but this may be appropriate—given a specific sensor's purpose. It should also be noted that if Modules 3, 11, or 14 are included, they must be populated with meaningful values. *Including them and filling their fields with null values (e.g., 0.0) does not meet the population requirement.*

Given that "metric" is defined as the ability to accurately convey system uncertainty, it may seem odd to the reader that the Metric Level system begins with SENSRB Content Level 4 instead of 6, where uncertainty information is required. Content Level 4 represents the foundation of the reference system because basic geopositioning can take place, but there is no uncertainty information present. It has the designation of "0" for this reason. Content Level 5 enables some level of uncertainty characterization due to its inclusion of ground control information. For example, this information can be used as part of an analytical process to "back out" a basic set of covariance estimates for one or more sensor parameters, or to describe at a general level how "off" the sensor model's generated coordinates are from truth.

A-4 Image Footprint Population Requirement

Separate from any ground control information that is included with SENSRB, a three-dimensional footprint outline of the image must be included via a Module 11 polygon point set identified as “Image Footprint” in the POINT_SET_TYPE field. A three-dimensional image footprint is required in order to provide the user with a minimal set of height data that are relevant to the HYPERSPECT image segment (section 3.1.3), in the event that a PIX_HEIGHT image segment (section 3.1.5) is not present. Each point (vertex) should consist of a [longitude,latitude,height] coordinate triplet. The vertices should match those used in CSSHPA (section 3.1.8) to describe the image footprint, with the addition of height information in the case of SENSRB. In both cases, at least four, but no more than one thousand points can be used to describe the footprint. Ideally, the heights will be derived from the intersection of a set of image LOS vectors with an independent terrain source (e.g., DEM), but they can be associated with the intersection of the vectors with a fixed height plane, if necessary. In the fixed height plane case, it is recommended that the selected height value represent a reasonable approximation of the center of the actual height range covered by the footprint of the image.

Appendix B -- NMF Description of HSI NITF2.1 File

B-1 Introduction

Metadata is information which describes the characteristics of a data resource. In general, metadata represents the 'who, what, when, where, why and how' of the described resource. In order for a geospatial data resource to be discovered, assessed for its fitness of use, retrieved, and then exchanged, it must have associated metadata that complies with certain DoD/IC and international standards that mandate the structure and content of metadata for geospatial information. The diverse metadata requirements within these various standards that are appropriate for compliance in the NSG have been brought together under a single umbrella reference standard for ease of use in the NSG, the National System for Geospatial Intelligence Metadata Foundation (NMF) – Part 1: Conceptual Schema Profile. The NMF defines the *conceptual* schema profile for specifying geospatial metadata in and for the NSG.

B-1.1 Purpose

This appendix specifies the means for creating an NMF-compliant description of NITF2.1-formatted Hyper-Spectral Imagery (HSI) products generated by imagery sensor systems and their ground processing elements.

B-1.2 Scope

The scope of this appendix is to support the development and implementation of NMF-based metadata for NITF2.1-compliant HSI products. This appendix is focused on creating NMF-compliant descriptions of HSI data collected via tactical airborne sensors. Like the NMF, this specification is *conceptual* in nature. The NMF companion document, NSG Metadata Implementation Specification (NMIS), defines the methods for *encoding* geospatial metadata in the NSG.

This profile does not address the NMF-based description of HSI datasets that have been edited, reprocessed, enhanced, supplemented or otherwise modified by downstream processes (e.g., image library, dissemination, screening, workstation and similar processes that may modify, augment and re-save the content of HSI NITF2.1 files).

B-1.3 References

MIL-STD-2500C: National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 01 May 2006 (Normative reference) (http://www.gwg.nga.mil/ntb/baseline/docs/2500c/index.html)

STDI-0002-1: The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), v4, 1 August 2011 (Normative reference)

(http://www.gwg.nga.mil/ntb/baseline/docs/stdi0002/index.html)

- Appendix E, Airborne Support Data Extensions (ASDE)
    - AIMIDB
    - ACFTA
- Appendix L, HISTOA Extension
- Appendix Y, Joint Photographic Experts Group 2000 (J2K) Extension
- Appendix Z, SENSRB Tagged Record Extension

NGA.STND.0012_2.0: National System for Geospatial Intelligence Metadata Foundation (NMF) - Part 1: Conceptual Schema Profile, Version 2.0 (Normative reference)
(https://nsgreg.nga.mil/)

NGA.STND.0018_1.0: National System for Geospatial Intelligence Metadata Implementation Specification (NMIS) - Part 2: XML Exchange Schema, Version 2.0.0 (Informative reference)
(https://nsgreg.nga.mil/)

NGA.SIG.nnnn_1.0: Guideline for Populating NITF2.1 Security Group Fields (DRAFT)
(https://nsgreg.nga.mil/)

B-2 Requirements

For purposes of this specification, each HSI NITF2.1 file is considered to be a separate resource that can be described per the NMF conceptual schema. The NMF description shall be recorded in an NMF-based metadata file using an authorized encoding (see NMIS). Content of the NMF-based metadata file is derived from information available within the HSI NITF2.1 file and from known (a priori) information available to the process used to create the metadata file (e.g., information about the metadata file itself and its originator that is not available within the resource being described).

Table B-2-1 specifies the source of content for creating an NMF-based description of an HSI NITF2.1-formatted file (resource).

Table B-2-1: NMF Description of HSI NITF2.1 Files

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Resource Title name by which the cited resource is known	Mandatory	MD_Metadata.identificationInfo.MD_Identification.citation.CI_Citation.title	Value is extracted from the FH:FTITLE field of the NITF2.1 file.
Resource Date date for the cited resource	Mandatory	MD_Metadata.identificationInfo.MD_Identification.citation.CI_Citation.date.CI_Date CI_Date.date CI_Date.dateType The allowed authoritative dateType namespace is: "http://metadata.dod.mil/mdr/ns/GSIP/codelist/DateTypeCode"	Value is derived from the date recorded in the FH:FDT field of the NITF2.1 file (converted to indication of year, year-month, or year-month-day, as specified by ISO 8601). Include event used for the resource date. For initial creation of NITF2.1 files, the value is: "http://metadata.dod.mil/mdr/ns/GSIP/codelist/DateTypeCode#creation"
Resource Abstract brief narrative summary of the content of the resource(s)	Mandatory	MD_Metadata.identificationInfo.MD_Identification.abstract	For HSI still imagery, this narrative summary can be derived from information contained within the NITF2.1 file structure as follows: "This resource (NITF2.1 file) contains hyper-spectral imagery and associated data obtained from the following source: <IM:SOURCE>. The NITF file is composed of <IM:NUMI> Image Segments with the following Image Identifiers: < IM:IID1$_{001}$//IM:IID2$_{001}$, IM:IID1$_{002}$//IM:IID2$_{002}$, …. IM:IID1$_{nnn}$//IM:IID2$_{nnn}$>"

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Metadata Point Of Contact party responsible for the metadata information	Mandatory	MD_Metadata.contact.CI_ResponsibleParty CI_ResponsibleParty.organisationName CI_ResponsibleParty.role (Use Class/CI_RoleCode <<CodeList>>) The allowed authoritative CI_RoleCode code list namespace is: *http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode*	Identify the organization responsible for creating the NMF-based metadata file. For initial creation of metadata files, the role value is: *"http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode#creator"*
Metadata Date Stamp date that the metadata was created	Mandatory	MD_Metadata.dateStamp Express date in form YYYY-MM-DD as specified by ISO 8601.	Value is the date of creation for the NMF-based metadata file.
Resource Language language(s) used within the dataset	Mandatory	MD_Metadata.identificationInfo.MD_DataIdentification.language The allowed authoritative 'languageCode' namespace is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso639-2"	Value is the locale parameter 'languageCode' representing the language used within the NITF2.1 file based on a priori knowledge of the party that created the NITF2.1 file. When a priori knowledge of the resource language is not available, use the value: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso639-2#eng"
Resource Topic Category main theme(s) of the dataset	Mandatory	MD_Metadata.identificationInfo.MD_DataIdentification.topicCategory (Class/MD_TopicCategoryCode<<Enumeration>>) Described in NMF Ver 2.0, paragraph 5.2.3.1	Use the value: "imageryBaseMapsEarthCover"

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Geographic Location geographical extent of the resource, either a bounding box or an identifier	Mandatory	MD_Metadata.identificationInfo.MD_DataIdentification.extent.EX_Extent.geographicElement.EX_GeographicBoundingBox OR EX_GeographicDescription Use: EX_GeographicDescription to express the country code. (Recommended practice is to include CountryCodes for those countries partially or completely covered by the extent of the resource.) Additionally, for coverage data (e.g., imagery and gridded data) not yet rectified to a ground coordinate system, use: EX_BoundingPolygon.polygon (Class/GM_Object) to express the boundary enclosing the coverage of the resource, expressed as the closed set of (x,y) coordinates of the polygon (last point replicates first point).	Derive Country Code and Bounding Polygon content from information available in the NITF2.1 file based on the following priorities: 1- TRE:SENSRB 2- IM:ICORDS and IM:IGEOLO 3- FH:TGTID Note 1: May require transformation of coordinate representation used in the NITF2.1 file. Note 2: For NITF2.1 files with multiple image segments, the bounding polygon represents the extent of the coverage for all of the still image segments. The allowed authoritative CountryCode namespaces are: “http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso3166-1/digraph” “http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso3166-1/trigraph” “http://metadata.dod.mil/mdr/ns/GPAS/codelist/fips10-4/digraph”
Security Classification name of the handling restrictions on the resource	Mandatory	MD_IdentificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.classification	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Security Classification System name of the classification system	Mandatory	MD_IdentificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.ownerProducer	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Resource Identifier alphanumeric value identifying an instance in the namespace	Mandatory	MD_Metadata.identificationInfo.MD_Identification.citation.CI_Citation.identifier.MD_Identifier MD_Identifier.code MD_Identifier.authority - CI_Citation.title - CI_Citation.date - CI_Date.date - CI_Date.dateType Example for ‘authority’ citation: CI_Citation.title: “Site Alpha Image Library” CI_Date.date: “2000-01-01” CI_Date.dateType: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/DateTypeCode#creation”	Values associated with this element are those needed to uniquely identify the specific NITF2.1 file within the context of the file storage system. For example, the file name, a URL for the file, a URN for the file, the product identifier use by the library or archiving system, or similar identifiers. The set of elements used to express the ‘Resource Identifier’ may be repeated to record alias identifiers used in separate namespaces. For example, to record the filename used by the originator and to record the product identifier assigned by a repository (library). Example values for MD_Identifier.code: “filename.ntf” “Urn:uuid:e9129b4b-ea21-4531-9a1c-471565521c21”

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Resource Originator party who created the resource	Mandatory	MD_Metadata.identificationInfo.MD_Identification.pointOfContact.CI_ResponsibleParty CI_ResponsibleParty.organisationName CI_ResponsibleParty.role (Use Class/CI_RoleCode <<CodeList>>) The allowed authoritative CI_RoleCode code list namespace is: "*http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode"*	The CI_ResponsibleParty.organisationName value is extracted or derived from the IM:ISORCE field of the image segment(s). For NITF2.1 files with multiple image segments, repeat the set of 'CI_ResponsibleParty' elements for every image segment containing a different IM:ISORCE value. The CI_ResponsibleParty.role value is: "*http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode#originator"*
Resource Point Of Contact party who can be contacted for acquiring knowledge about or acquisition of the resource	Mandatory	MD_Metadata.identificationInfo.MD_Identification.pointOfContact.CI_ResponsibleParty CI_ResponsibleParty.organisationName CI_ResponsibleParty.role (Use Class/CI_RoleCode <<CodeList>>) The allowed authoritative CI_RoleCode code list namespace is: *http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode*	The CI_ResponsibleParty.organisationName value is extracted from the FH:OSTAID field of the file header. The CI_ResponsibleParty.role value is: "*http://metadata.dod.mil/mdr/ns/GSIP/codelist/RoleCode#pointOfContact"*

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Keyword topic of the content of the resource Specified by a controlled-vocabulary code or by keywords. Best practice is to choose keywords from controlled vocabularies NOTE: IC Core definition	Conditional / Required for DoD and IC organizations/ communities	MD_Metadata.identificationInfo.MD_Identification.descriptiveKeywords.MD_Keywords.keyword MD_Keywords.keyword MD_Keywords. thesaurusName - CI_Citation.title - CI_Citation.date - CI_Date.date - CI_Date.dateType MD_Keywords.type (Class / MD_KeywordTypeCode <<CodeList>>) Use the KeywordTypeCode to group a set of similar keywords. The allowed authoritative KeywordTypeCode namespace is: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/KeywordTypeCode”	When the Basic Encyclopedia (BE) and/or facility OSUFFIX subfields of the FH:TGTID field are populated with other than space characters, extract these values into Keyword elements. Additional keywords may be added at the discretion of the party/organization responsible for creating the NMF-based metadata file.
Hierarchy Level scope to which the metadata applies (NSG derived requirement)	Mandatory	MD_Metadata.hierarchyLevel (Class / MD_ScopeCode <<CodeList>>) The allowed authoritative namespace is: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/ScopeCode”	Use value: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/ScopeCode#dataset”
Hierarchy Level Name name of the hierarchy levels for which the metadata is provided (NSG derived requirement)	Mandatory	MD_Metadata.hierarchyLevelName (Class / NMF_ScopeAmplificationCode) The allowed authoritative namespace is: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/ScopeAmplificationCode”	Use value: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/ScopeAmplificationCode#collection”

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Metadata Standard Name name of the metadata standard (including profile name) used (NSG derived requirement)	Mandatory	MD_Metadata.metadataStandardName The allowed authoritative namespace is: "http://metadata.ces.mil/mdr/ns/GSIP/codelist/MetadataStandardNameCode"	Use value: "http://metadata.ces.mil/mdr/ns/GSIP/codelist/MetadataStandardNameCode/#nsgMetadataFoundation"
Metadata Standard Version version (profile) of the metadata standard used (NSG derived requirement)	Mandatory	MD_Metadata.metadataStandardVersion	Use value: "2.0"
Resource Character Set full name of the character coding standard used for the dataset	Mandatory	MD_Metadata.identificationInfo.MD_DataIdentification.characterSet MD_DataIdentification.characterSet (Class / MD_CharacterSetCode <<CodeList>> The allowed authoritative namespace is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/ianaCharset"	Identify the locale parameter 'characterSetCode' used when creating the NITF2.1 file. For NITF2.1, the value is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/ianaCharset#UTF-8"
Temporal Extent information about the temporal extent of the resource	Conditional / Required when applicable Note: Applicable for HSI still imagery.	MD_Metadata.identificationInfo.MD_DataIdentification.extent.EX_Extent.temporalElement.EX_TemporalExtent EX_TemporalExtent.extent (Class / TM_Primitive) TM_Instant.position.DateTime TM_Period.begin.DateTime TM_Period.end.DateTime Expressed as year-month-day and time of day in a form as specified by ISO 8601. (e.g., YYYY-MM-DDThh:mm:ss.sssZ)	For NITF2.1 files with a single Image Segment, derive the content (TM_Instant) from information available in the NITF2.1 file based on the following priorities: 1- TRE:SENSRB 2- IM:IDATIME For NITF2.1 files with multiple Image Segments with HSI data collected at different times, record the time period (TM_Period) covered by the content of the resource (NITF2.1 file).

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Metadata Language language used for documenting metadata	Conditional / Required when not defined by the encoding	MD_Metadata.locale.PT_Locale PT_Locale.languageCode (Class / LanguageCode <<CodeList>>) The allowed authoritative namespace is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso639-2"	Identify the locale parameter 'languageCode' used when creating the NMF-based metadata file. An example value is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/iso639-2#eng"
Online Resource information about on-line sources from which the dataset, can be obtained	Conditional / Required if "geographic location" and "temporal extent" not documented	MD_Metadata.identificationInfo.MD_Identification.r esourceFormat.MD_Format.formatDistributor.MD_ Distributor.distributorTransferOptions.MD_DigitalTransferOptions.onLine.CI_OnlineResource CI_OnlineResource.description CI_OnlineResource.linkage CI_OnlineResource.name	Optional since 'geographic location' and 'temporal extent' are otherwise documented in the NMF-based metadata file. Inclusion of this information is at the discretion of the party/organization responsible for creating the NMF-based metadata file.
Metadata Character Set full name of the character coding standard used for the metadata set	Optional	MD_Metadata.locale.PT_Locale PT_Locale.CharacterSetCode (Class / MD_CharacterSetCode <<CodeList>>) The allowed authoritative namespace is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/ianaCharset"	Identify the locale parameter 'characterSetCode' used when creating the NMF-based metadata file. An example value is: "http://metadata.dod.mil/mdr/ns/GPAS/codelist/ianaCharset#UTF-8"

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Spatial Representation Type method used to spatially represent geographic information	Optional	MD_Metadata.identificationInfo.MD_DataIdentification.spatialRepresentationType Use: Class / MD_SpatialRepresentationTypeCode<<CodeList>> The allowed authoritative namespace is: "http://metadata.dod.mil/mdr/ns/GSIP/codelist/SpatialRepresentationTypeCode"	Identify the method used to represent geospatial information in the resource using the SpatialRepresentationTypeCode. For still imagery, the value is: "http://metadata.dod.mil/mdr/ns/GSIP/codelist/SpatialRepresentationTypeCode#grid"
Distribution Format provides a description of the format of the data to be distributed	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceFormat.MD_Format MD_Format.name MD_Format.version	For files distributed in NITF2.1 format, the values for the format elements are: MD_Format.name: "NITF" MD_Format.version: "2.1"
Lineage information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage	Optional	MD_Metadata.dataQualityInfo.DQ_DataQuality.lineage.LI_Lineage.statement	Identify the resource from which the still image(s) was derived. Extract the value from the <fields> shown below. Additional lineage information may be added (e.g., from a priori known information). LI_Lineage.statement: Hyper-Spectral Imagery (HSI) collected by the <SENSRB:PLATFORM> platform using the <SENSRB:SENSOR> sensor. The still imagery was processed into NITF form by the <HISTOA: PSITEnn > version <HISTOA:PASnn> processing system.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Reference System description of the spatial and temporal reference systems used in the dataset	Conditional / Required if the resource includes coordinates	MD_Metadata.referenceSystemInfo.MD_ReferenceSystem.referenceSystemIdentifier.RS_Identifier RS_Identifier.code RS_Identifier.codeSpace The allowed authoritative codespace for spatial reference systems is: "http://metadata.ces.mil/mdr/ns/GSIP/crs" The allowed authoritative codespace for temporal reference systems is: "TBD"	Identify the spatial reference system for the resource. An example code value is: "WGS84E_2D" Identify the temporal reference system for the resource. An example value is: TBD
Resource Spatial Resolution factor which provides a general understanding of the density of spatial data in the dataset	Optional	MD_Metadata.identificationInfo.MD_DataIdentification.spatialResolution.MD_Resolution MD_Resolution.distance (Class / Distance)	Identify the nominal ground sample distance between pixels. An example distance value is: "5.0 Meters"
Metadata File Identifier unique identifier for this metadata file	Optional	MD_Metadata.fileIdentifier	Identify the file for this metadata file. Example values: "filename.xml" "Urn:uuid:e9129b4b-ea21-4531-9a1c-471565521c21"

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Vertical Extent extent information including the vertical extent of the dataset	Optional	MD_Metadata.identificationInfo.MD_DataIdentification.extent.EX_Extent.verticalElement.EX_VerticalExtent EX_VerticalExtent.minimumValue (Real/Real) EX_VerticalExtent.maximumValue (Real/Real) EX_VerticalExtent.verticalCRS (Class / SC_CRS)	Inclusion of this information is at the discretion of the party/organization responsible for creating the NMF-based metadata file. Identify the lowest and highest vertical extents. The preferred value for verticalCRS is: “http://metadata.dod.mil/mdr/ns/GSIP/crs/EGM96_H”
Rights information about rights held in or over a resource Rights are the constraints applied to assure the protection of privacy or intellectual property, and any special restrictions, limitations or warnings on using a shared resource. This element should be a positive statement as to whether or not such constraints apply NOTE: IC Core definition	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.MD_LegalConstraints MD_LegalConstraints.accessConstraints (Class / MD_RestrictionCode <<CodeList>>) MD_LegalConstraints.useConstraints (Class / MD_RestrictionCode <<CodeList>>) The allowed authoritative namespace is: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode”	Include when legal constraints are applicable to the NITF2.1 file. Example values: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode#usPrivacyAct” “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode#intellectualPropertyRights” “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode#copyright” “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode#none” “http://metadata.dod.mil/mdr/ns/GSIP/codelist/RestrictionCode#license”

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Relation reference to a related resource Recommended best practice is to identify the referenced resource by means of a label or number conforming to a formal identification system. NOTE: IC Core definition	Optional	MD_Metadata.identificationInfo.MD_Identification.aggregationInfo.MD_AggregateInformation aggregateDataSetName (Class / CI_Citation <<DataType>>) associationType (Class / DS_AssociationTypeCode <<CodeList>>) relatedDirection (Valid values are “inbound,” “outbound,” and “bidirectional.”) The allowed authoritative namespace for DS_AssociationTypeCode) is: “http://metadata.dod.mil/mdr/ns/GSIP/codelist/ResourceAssociationTypeCode”	Inclusion of this information is at the discretion of the party/organization responsible for creating the NMF-based metadata file. For example, the ‘Relation’ element may be used to associate the NITF2.1 file as a member of a named aggregation of files associated with a common purpose, event, campaign, duration, or similar relationship. Example association type codes: “aggregation” “crossReference” “membership” “stereoMate”
Classification Reason The basis for an original classification decision	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.NMF_ICISM.classificationReason	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Classified By identity, by name or personal identifier, and position title of the original classification authority for a resource	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.classifiedBy	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Date Of Exempted Source specific year, month, and day of publication or release of a source document, or the most recent source document, that was itself marked with a declassification constraint. This element is always used in conjunction with the Type Of Exempted Source element	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.dateOfExemptedSource	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Declassification Date specific year, month, and day upon which the information shall be automatically declassified if not properly exempted from automatic declassification	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.declassDate	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Declassification Event description of an event upon which the information shall be automatically declassified if not properly exempted from automatic declassification	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.declassEvent	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Declassification Exception single indicator describing an exemption to the nominal 25-year point for automatic declassification. This element is used in conjunction with the Declassification Date or Declassification Event	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.declassException	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Derivatively Classified By identity, by name or personal identifier, of the derivative classification authority	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.derivativelyClassifiedBy	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Derived From citation of the authoritative source or reference to multiple sources of the classification markings used in a classified resource	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.derivedFrom	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Dissemination Controls one or more indicators identifying the expansion or limitation on the distribution of information	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.disseminationControls	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
FGI Source Open one or more indicators identifying information which qualifies as foreign government information for which the source(s) of the information is not concealed	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.fgiSourceOpen	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
FGI Source Protected single indicator that information qualifies as foreign government information for which the source(s) of the information must be concealed	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.fgiSourceProtected	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Non-Intelligence Community Markings one or more indicators of the expansion or limitation on the distribution of an information resource or portion within the domain of information originating from non-intelligence components	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.nonIntelligenceCommunityMarkings	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Releasable To one or more indicators identifying the country or countries and/or international organization(s) to which classified information may be released based on the determination of an originator in accordance with established foreign disclosure procedures. This element is used in conjunction with the Dissemination Controls element.	Conditional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.releaseableTo	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
Special Access Program Identifier one or more indicators identifying the defense or intelligence programs for which special access is required	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.sarProgramIdentifier	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.
SCI Controls one or more indicators identifying sensitive compartmented information control system(s).	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.sciControls	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Core Resource Metadata	Obligation	ISO 19115 Mapping	HSI Product Source of Content
Type Of Exempted Source declassification marking of a source document that causes the current, derivative document to be exempted from automatic declassification. This element is always used in conjunction with the Date Of Exempted Source element	Optional	MD_Metadata.identificationInfo.MD_Identification.resourceConstraints.NMF_SecurityConstraints.capcoMarkings.ISM_SecurityAttributeGroup.typeOfExemptedSource	Value is extracted from the NITF2.1 security group data element fields as applicable. See NGA document, Guideline for Populating NITF2.1 Security Group Fields, for description of NITF security group field relationships with NMF use of the IC.ADD for information security marking metadata.

Appendix C -- Functional Fit Model Implementation Guidance

C-1 Introduction

This NITF implementation profile allows both Rational Polynomial Coefficients (RPCs) and all flavors of Replacement Sensor Model (RSM) to be associated with the HYPERSPECT image segment, but knowing which one to use, and when, is not always readily apparent. The goal of this appendix is to provide straightforward implementation guidance for vendors and program managers.

C-2 Implementation Guidance

Determining which functional fit model to implement begins with answering one question: Will the model be used for tasks other than general situational awareness? In other words, as the program manager, do you have the expectation that end users should be able to perform mensuration, registration, orthorectification, single/multi-point positioning, and/or targeting tasks with the replacement model? If the answer is no, you can probably get away with RPCs, regardless of sensor type, as long as the RPC00B tag's ERR_BIAS and ERR_RAND fields reflect the level of uncertainty associated with the polynomials (see section C-3). For basic sensors like frame cameras and spaceborne pushbroom systems, RPCs may be more than sufficient for the photogrammetric tasks outlined above, but it is not likely to be the case for more dynamic sensors. For those systems, the vendor will probably have to implement a solution based on RSM. If the reader is unfamiliar with the RSM paradigm, please consult the documents listed in section C-5. Figure C-2-1 contains a decision flowchart, the contents of which are discussed below, that should help both program managers and vendors choose the most appropriate course of action based on established geopositioning requirements.

The key driver with respect to appropriate functional fit model choice, assuming that there is a desire for something more than general situational awareness, is its ability to reproduce the results of the rigorous math model it is based on to within an acceptable error tolerance. For pratical purposes, the threshold level of acceptability is the standard human visual point selection/mensuration error: 0.5 pixels. In other words, an appropriate model is one that can do at least as well as a human when it comes to picking the same point in an image, given multiple attempts to do so. The objective level of acceptability is one third of that error, or 0.17 pixels.

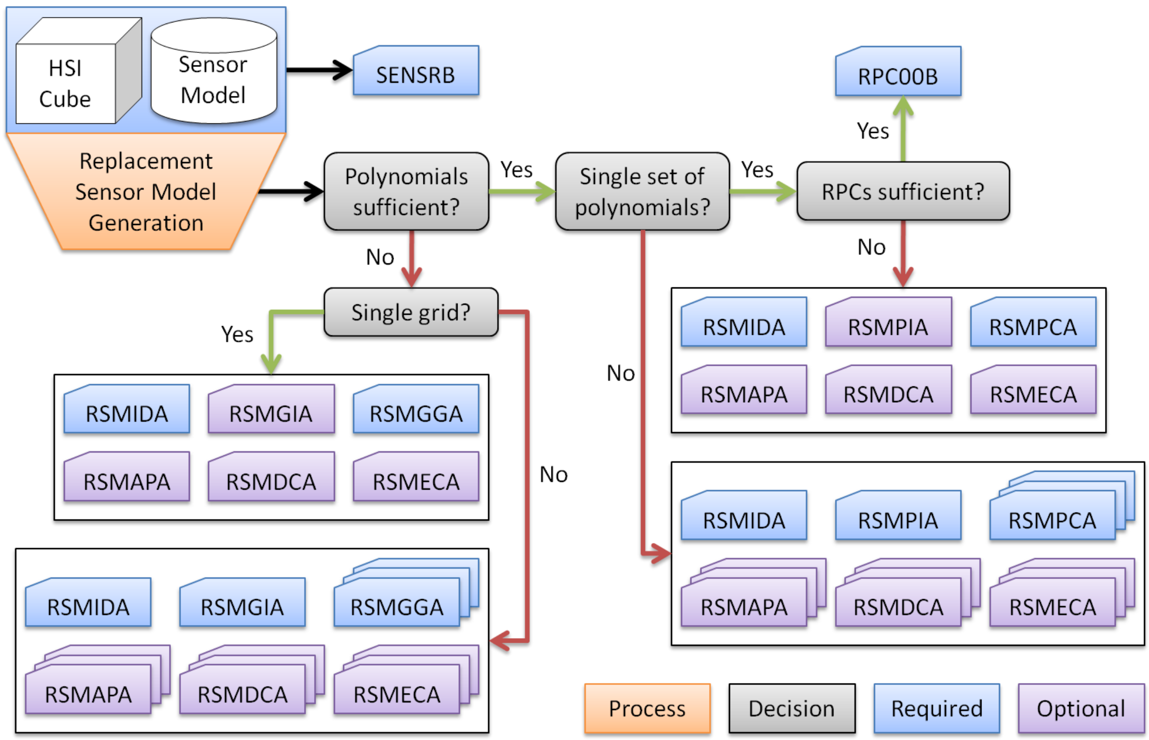

Figure C-2-1: Functional fit model decision flowchart, including required and optional and tags

How is the functional fit model error determined? Once the model is built using a regularly spaced grid of image points or ground points (this depends on if you are using polynomials or a grid approach), a similar or larger number of regularly spaced points that were not included in the model generation process, referred to as check points, are run through both the rigorous model and the functional fit model. If the maximum and root mean squared (RMS) errors do not fall below the range defined by the threshold and objective levels of acceptability, and also do not meet the accuracy requirements as outlined by the program manager, another type of model must be used.

When attempting to find the right model to use, it is suggested that you start with RPCs to see if they will work. They are currently the most widely supported type of functional fit model. If they do not work, try a single set of RSM polynomials. Switching to the more flexible RSM polynomial framework is sometimes all that is needed. If one set of RSM polynomials does not work, try breaking up the image into sections (virtually) and generating separate sets of polynomials for each one. If the multi-section polynomial approach does not work, try one or more grids. Grids are viewed as the method of last resort, as they are often the most difficult type of replacement model to implement and to use. It should be noted that you can mix and match the polynomial and grid versions of RSM across different sections of your image, but for the sake of guidance simplicity, that approach is not discussed here. Please refer to the documents in section C-5 for more information. Note: If RPCs do work, you can also include an RSM implementation in order to convey more robust error and model adjustment information (see C-3 below).

In the case of an extremely dynamic sensor, no replacement model may work. The end user will have to rely on the contents of SENSRB instead (see Appendix A).

C-3 Parameters and Tags for Error Estimation and Model Adjustment

While both RPCs and RSM can be implemented without providing adjustable parameter and error information, it is strongly recommended that appropriate values be provided in order to support the photogrammetric tasks outlined at the beginning of section C-2. In the case of RPCs, error information can be provided only via the ERR_BIAS and ERR_RAND fields. These two fields should always contain meaningful non-zero values. The RSM paradigm includes a full suite of adjustable parameter (RSMAPA) and error estimation (RSMDCA, RSMECA) tags. It should be noted that if more than one polynomial set or grid is used, adjustable parameter and error estimation tags should be provided for each one.

C-4 MSP, RSM, and CSM

For vendors with access to government-furnished software, the Mensuration Services Program (MSP) includes C++ libraries that can automatically generate text versions of RSM tags for a given image. However, there are two caveats. First, MSP relies on the Community Sensor Model (CSM) paradigm for all of its geopositioning tasks. In order for a vendor to take advantage of MSP for a particular sensor, a CSM must exist for that sensor. For more information on CSM, please refer to the relevant documents in section C-5. Second, MSP generates and uses what is known as the “X” version of RSM (e.g., an RSMDCX tag is produced instead of RSMDCA), which is a yet-to-be-approved variant of the standard that includes refinements in several areas. For the purposes of this document, both the “A” and “X” versions of RSM are acceptable, but only the “A” version is currently supported by COTS image exploitation software packages.

C-5 References

RSM Specification (Draft)
https://www.gwg.nga.mil/protected/ntb/coordinationitems/RSM_delivery_23Jul04.pdf

RSM Appendix A, Grid Interpolation (Draft)
https://www.gwg.nga.mil/protected/ntb/coordinationitems/RSMAppA_23Jul04.pdf

RSM Appendix B, RSM Partial Derivatives (Draft)
https://www.gwg.nga.mil/protected/ntb/coordinationitems/RSMAppB_23Jul04.pdf

RSM Appendix C, RSM White Paper (Draft)
https://www.gwg.nga.mil/protected/ntb/coordinationitems/RSMAppC_23Jul04.pdf

Proposed Updates to RSM TREs (Draft)
https://www.gwg.nga.mil/protected/ntb/coordinationitems/RSM_unlimitedDist.pdf

Community Sensor Model (CSM) Technical Requirements Document (TRD) Version 3.0
http://www.gwg.nga.mil/documents/csmwg/documents/CSM_TRD_Version_3.0__15_November_2010.pdf

CSM TRD Appendix C: API
http://www.gwg.nga.mil/documents/csmwg/documents/CSM_TRD_Appendix_C_API_Version_3.0__15_November_2010.pdf

NOTE: The URLs provided above were current at time of publication. Users of this IP may also consult the NSG Standards Registry at the following web-address: https://nsgreg.nga.mil.

Appendix D -- Static Sensor Characterization Data for Imagery

Static Sensor Characterization Data for Imagery			
Data Type	**Description**	**Data Sources**	**Comments**
Counts to EASR Conversion Factors and associated Error (Covariance Matrix)	The parameters and methods required to convert pixel counts (in Digital Numbers) to Entrance Aperture Spectral Radiance (in power per unit area per unit projected solid angle per wavelength) for all exploitable products. Constants such as gains and offsets may be data set dependent. The methodology for this computation is expected to be the same for all data collected by a specific sensor. This description should include static and dynamic calibration parameters and/or calculations. Covariance matrices for errors in the quantities associated with the counts-to-radiance conversion should also be provided.	If the bands are given in radiometric units, BANDSB should have the unit defined. If the data are processed by the vendor out of radiometric quantities, documentation from vendor will be necessary to describe the counts to radiance conversion.	Radiance conversion methods and error models should include any known effects of variation across the focal plane. Standard deviation for each pixel should account for errors from calibration, including as applicable any special effects such as ghosting, cross-talk, etc. Covariance between pixels should characterize non-uniformity across the array, and should include any special effects such as stray light correction, spectral banding, etc.
Radiometric Modulation Transfer Function Compensation (RMTFC)	Convolution kernel for each band of the sensor, used to compensate for MTF effects on small targets without degrading the radiometric fidelity of the data.	Vendor documentation required.	For current systems this parameter may not be necessary, but future systems could be designed to make use of this.
Optics MTF			
Cross Scan and Along Scan System MTF (measured total system MTF)	For each sensor band, two 1D MTFs conjugate to the line spread functions measured against along-scan and cross-scan line targets.	Vendor documentation required.	MTFs should include any known effects of variation across the focal plane.
System Point Spread Functions (PSF)	For each sensor band, a 2D PSF over the full spatial response range. The PSF data should be sampled at a higher resolution than the sensor captures so that it can be used for subpixel analysis. Optimally, a high resolution PSF and a measured PSF would be used for validation.	Vendor documentation required.	PSF should include any known effects of variation across the focal plane.

Static Sensor Characterization Data for Imagery			
Data Type	**Description**	**Data Sources**	**Comments**
2D Enhanced PSF	a> 8x oversampled PSF obtained by measurements using point source targets. b> Full PSF without assuming symmetry		
1D Systematic Error Correction (SEC) factors			
1D Systematic Error Correction (SEC) uncertainties			
2D Systematic Error Correction (SEC) factors Function of target size	For each sensor band, correction factors for errors in the radiances calculated based on application of the RMTFC. These correction factors may be target-size dependent.	Vendor documentation required.	For current systems this parameter may not be necessary, but future systems could be designed to make use of this.
2D Systematic Error Correction (SEC) Uncertainties	For each sensor band, the residual errors for SEC corrections.	Vendor documentation required.	For current systems this parameter may not be necessary, but future systems could be designed to make use of this.
Residual System Bias Correction Factors	Gain and offset factors to compensate for any known system-induced radiometric bias		
Residual System Uncertainty			
Spectral Banding for Adjacent Chips	Difference in sensor response due to a specified spectral source, for adjacent chips (can be computed from RSRs for all chips)		Can be computed from RSRs for all chips and a specified spectrum.
Spectral Uniformity	Maximum difference in sensor response due to a specified spectral source, for all chips (can be computed from RSRs for all chips)		Can be computed from RSRs for all chips and a specified spectrum.
Noise Equivalent Delta Reflectance	The change in target reflectance that produces a sensor response equal to the noise level (inversely proportional to sensor signal-to-noise ratio) - may depend on sensor mode, band, and viewing and illumination geometries		

Static Sensor Characterization Data for Imagery			
Data Type	**Description**	**Data Sources**	**Comments**
Stray Light Model/Compensation	For each sensor band, a complete characterization of the spatial distribution of stray light and the effects on the measured radiance and pixel intensity. Methods for compensating for stray light should also be provided, including a method for estimating post-compensation uncertainty.	This is only available through the vendor. As an engineering endeavor, the vendor should characterize the stray light using pre-launch modeling adjusted with post-launch characterization. These effects may have been corrected for in pre-processing of exploitable products, in which case only modeling of the residual errors is needed.	Stray light modeling should include direct stray illumination, ghosting, scattered light, etc.
Ghosting Parameters for each spectral band, for array center and ends	Modeling parameters for ghosting (internal reflections of light onto the sensor)		
Radiometric Accuracy	Both absolute and relative radiometric accuracy. Need full system radiometric accuracy - full radiometric environment included		
Calibration Irradiance for each chip in each spectral band			
Optics Spectral Transmission	The optical spectral transmission - system spectral response, post thermal-vac (as built).		
Optics Obstruction for each spectral band			
Irradiance Variation Across the Array	Modeling parameters for variation in sensor response to focal plane irradiance (e.g., due to vignetting, if applicable)		
Relative Spectral Response (RSR) for each chip in each sensor band (including filters and detector)			
Optical distortion	Description of characterized optical distortion of the sensor	Derived model through ray tracing and on-ground measurements. Vendor documentation required.	

Static Sensor Characterization Data for Imagery			
Data Type	**Description**	**Data Sources**	**Comments**
Focal plane description	Description of the detector layout of the sensor	Vendor documentation describing the actual focal plane and the ground processing used to generate the synthetic array.	
Sensor stability	Documentation of the short and long term temporal variances exhibited by and in each band of the sensor, to include temporal thermal variations as a function of exposure to heat sources or lack thereof (e.g., satellite in an out of umbra or an aircraft in orbit)	Vendor documentation describing thermal instability is required.	

Appendix E -- Recommendations for Supporting chipping of HSI image segment and ancillary data

E-1 Background

This appendix provides general guidance for user and application software tools and similar facilities when performing chipping of the main hyperspectral image segment, HYPERSPECT. In order to maintain the utility of the hyperspectral data for full exploitation purposes, chipping operations should appropriately maintain the associated metadata and ancillary image segments contained within the NITF file, noting that the ancillary image segments may not have the same spatial (row/column) dimensions as the HYPERSPECT image segment. When choosing to chip content of an HSI NITF file based on this implementation plan, the chipping is to be performed from the perspective of the HYPERSPECT image segment, and not one of the supporting image segments (see section 2.6 for more detailed information on spatial and temporal requirements). The resulting chipped data is written to another NITF file.

E-2 Chipping Recommendations

When chipping the HYPERSPECT image segment, the ICHIPB TRE should be written to the chipped image segment. Inclusion of the ICHIPB TRE in the HYPERSPECT image segment allows the exploitation software to then relate the spatial dimensions of the chipped image segment to the associated image segments and thus allow the software to extract the appropriate information. Those image segments that can be chipped using established methodology provided by the NITF standard should be chipped accordingly, including updating any relevant TREs.

For instance, the PIX_LATLON and PIX_HEIGHT image segments have the same spatial dimensions (i.e., NROWS and NCOLS) and thus can be spatially chipped to correspond with spatial dimensions of the HYPERSPECT image segment. The BADPIXMAP image segment utilizes the PIXQLA TRE which requires the image segment to maintain corresponding spatial dimensions as the primary image segment (i.e., HYPERSPECT), thus this image segment should be chipped accordingly to preserve the relationships described in STDI-0002-1 Appendix AA PIXQLA TRE definition. For the associated image segments documented in this Implementation Profile, Table E-2-1 indicates how these image segments should be chipped.

There are some metadata fields and TREs that must be modified appropriately. These details are described in Table E-2-2.

Table E-2-1: Chipping Guidance Overview

Segment / DES	Dimensions	Chipping Guidance
HYPERSPECT	NCOL x NROW x NBANDS	The key image segment used to drive the chipping process. For example, new dimensions are NC x NR x NBANDS
QUICK_LOOK	Covers the same spatial area, but may be at a reduced resolution and possibly rotated.	Chip to cover same geographic coverage as the HYPERSPECT chip.
PIX_LATLON	NCOL x NROW x 2	NC x NR x 2
PIX_HEIGHT	NCOL x NROW x 1	NC x NR x 1
BADPIXMAP	NCOL x 1 x NBANDS NCOL x 1 x 1 NCOL x NROW x 1 NCOL x NROW x NBANDS	NC x 1 x NBANDS NC x 1 x 1 NC x NR x 1 NC x NR x NBANDS
NESR_DATA	NCOL x 1 x NBANDS	NCOL x 1 x NBANDS Do not chip the content. Retain original image segment.
CSSHPA DES	Covers geographic area of HYPERSPECT	Do not edit the content. Retain original segment.

Table E-2-2: HSI Chipping Guidance Details

HSI Chipping Guidance Details		
Segment	**Description**	**Chipping Recommendation**
File Header	This is the file header of the HSI dataset.	The following header fields need to be addressed when chipping internal segments: • CLEVEL* • FDT • FTITLE • ONAME • OPHONE • FL • Image length fields* • Image sub-header length fields**

<table>
<tr><th colspan="3">HSI Chipping Guidance Details</th></tr>
<tr><th>Segment</th><th>Description</th><th>Chipping Recommendation</th></tr>
<tr><td>Quick-Look Image</td><td>A single-band monochromatic or three-band 'color' visualization image derived from the HSI image segment. This is an overview representation of the HSI data cube and shall have a maximum size of 1024 pixels in the largest dimension to maintain scale to HSI cube.</td><td>Generate a new Quick-look IS from the ‘chipped’ HYPERSPECT.

When chipping other image segments within the product, this Quick-Look Image segment is regenerated based on the HSI cube chip geographic extent, maintaining the 1024 pixel limitation in the largest dimension, resulting in more resolution and a better quality overview.

The following sub-header fields may need to be addressed based on dimensions of chip of Hyperspectral Image segment and most likely, the intermittent overview will be 1024x1024:
• IID2
• NROWS
• NCOLS
• IGEOLO
• NPPBH
• NPPBV</td></tr>
</table>

HSI Chipping Guidance Details		
Segment	**Description**	**Chipping Recommendation**
Hyperspectral Image	A three-dimensional grid (cube) of spectral measurements in pixel values, the collected HSI data.	This is the 'key' chip segment, and other segments being chipped must relate directly to the pixels and bands contained in this segment. The following sub-header fields and TREs need to be addressed based on chip of this segment: • IID2 • NROWS • NCOLS • IGEOLO • NBPR • NBPC • NPPBH • NPPBV • IXSHDL • IXSHD • ICHIPB** added • GRDPSB updated • ACCHZB updated • SENSRB updated ** When chipping and adding an ICHIPB TRE, the output Row and Column fields will reflect the pixels of the area of interest that was chipped out and their relationship to full image as identified in full image Row and Column fields. SENSRB Module 11 should be updated to account for changes in the footprint
Pixel Latitude/ Longitude Image	A two-dimensional location grid of latitude and longitude values identifying the horizontal position of the HSI pixels.	The following sub-header fields and TREs need to be addressed based on chip of this segment: • IID2 • NROWS • NCOLS • IGEOLO • NBPR • NBPC • NPPBH • NPPBV

HSI Chipping Guidance Details		
Segment	**Description**	**Chipping Recommendation**
Pixel Height Image	This is a two-dimensional grid of height values, used in conjunction with the PIX_LATLON segment to identify the vertical position of the HSI pixels.	The following sub-header fields and TREs need to be addressed based on chip of this segment: • IID2 • NROWS • NCOLS • IGEOLO • NBPR • NBPC • NPPBH • NPPBV • GRDPSB updated • ACCVTB updated
Bad Pixel Map Image	Pixel quality information on a pixel-by-pixel or detector basis to enable human imagery analysts and automated exploitation software know the degree to which individual pixel values or detectors are valid for exploitation.	This segment should be chipped to preserve its pixel space relationship with the HYPERSPECT image segment in accordance with STDI-0002-1 Appendix AA PIXQLA. The following sub-header fields and TREs need to be addressed based on chip of this segment: • IID2 • NROWS • NCOLS • NBPR • NBPC • NPPBH • NPPBV • PIXQLA (retained)
Noise Equivalent Spectral Radiance (NESR) Image	This is a grid of values representing the root-mean-square (RMS) noise of each spectral measurement expressed in unit of radiance.	This image segment should be retained 'as is' and not chipped.
CSSHPA DES	The Shapefile describe the footprint of the image, as it exists on the ground.	The CSSHPA DES should be retained. The foot print information for the chipped image segment will be contained in IGEOLO of the HYPERSPECT image segment.
TRE_OVERFLOW DES	A NITF Data Extension Segment (DES) designed to contain TRE overflow.	The TRE_OVERFLOW DES should be included in the file as needed to support TREs associated with the HYPERSPECT image segment.