National Imagery and Mapping Agency

The Compendium of Controlled Extensions (CE)

for the

National Imagery Transmission Format (NITF)

VERSION 2.1

16 November 2000

FORWARD

1. The National Imagery Transmission Format Standard (NITFS) is the suite of standards for formatting digital imagery and imagery-related products and exchanging them among the Department of Defense (DOD), other Intelligence Community (IC) members, and other United States (US) Government departments and agencies. Resulting from a collaborative US Government and industry effort, it is the common standard used to exchange and store files composed of images, symbols, text, and associated data.

2. This Controlled Extension (CE) compendium provides the approved CE specifications to be used with the National Imagery Transmission Format (NITF) versions 2.0 (NITF2.0) or 2.1 (NITF2.1). This compendium is an unclassified companion to STDI-0001, *National Support Data Extensions (SDE) (Version 1. 3) for the National Imagery Transmission Format Standard (NITFS)*, 2 October 1998. The documents do not overlap or conflict. SDE implementation requirements are defined in N0105-98, NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, 25 August 1998.

3. The NITFS Technical Board (NTB) and its Format (FWG), Bandwidth Compression (BCWG), and Communications (CWG) Working Groups develop, coordinate, review, and plan for NITFS. It is a consensus-based government/industry forum that responds to the Geospatial and Imagery Standards Management Committees (GSMC and ISMC). The GSMC and ISMC manage geospatial and imagery standards for the DOD and IC encompassed by the US Imagery and Geospatial Information System (USIGS).

4. Changes to this compendium are controlled by the NTB and the National Imagery and Mapping Agency (NIMA) Configuration Control Board (NCCB). Beneficial comments and data that can be used to improve this document should be addressed to National Imagery and Mapping Agency, Attn: NIMA Customer Support/COD, Mail Stop P-38, 12310 Sunrise Valley Drive, Reston VA 20191-3449.

FORWARD

EFFECTIVE PAGE LOG

PAGES	DATE	PAGES	DATE
i – vi	16 November 2000	117 – 150	4 March 1999
1 – 53	4 March 1999	151 – 222	16 November 2000
54 – 116	16 November 2000		

To Be Determined (TBD), To Be Resolved (TBR) Log

PAGE	TBD/TBR	DESCRIPTION
	TBR01	
	TBR02	
	TBR03	
	TBR04	
	TBR05	
	TBR06	
	TBR07	
	TBR08	
	TBR09	
	TBR10	
	TBR11	
	TBR12	
	TBR13	
	TBR14	
	TBR15	

CHANGE LOG

DATE	PAGES AFFECTED	MECHANISM
16 November 2000	54-116, 151-222	Changed
16 November 2000	223 – 229	Deleted

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1.0 SCOPE

This compendium defines the specifications for the approved NITF Controlled Extensions (CE). NITF2.0 CE implementation is defined in MIL-STD-2500A. NITF2.1 CE implementation is defined in MIL-STD-2500B.

1.1 Purpose

This compendium provides the technical specifications and implementation requirements that USIGS systems must support when implementing NITFS CEs. Specific implementation requirements denoting which extensions should be implemented by the various USIGS systems are defined in the N0102, USIGS Interoperability Profile (UIP).

1.2 Applicability

This plan applies to DOD, IC, and NATO NITFS implementers that need to electronically exchange imagery support data.

2.0 REFERENCES

2.1 Department of Defense Standards and Handbook

MIL-STD-2500A	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 12 October 1994 with Notice 1, 7 February 1997, Notice 2, 26 September 1997, and Notice 3, 1 October 1998
MIL-STD-2500B	National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, 22 August 1997 with Notice 1, 2 October 1998
MIL-STD-188-196	Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 27 June 1996
MIL-STD-188-198A	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with Notice 1, 12 October 1994 and Notice 2, 14 March 1997
MIL-STD-188-199	Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 with Notice 1, 27 June 1996
MIL-STD-2301A	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 5 June 1998
MIL-STD-2045-44500	Tactical Communications Protocol 2 (TACO2) for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 29 July 1994 and Notice 2, 27 June 1996
MIL-STD-188-197A	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard, 12 October 1994
MIL-STD-2411	Raster Product Format, 5 October 1994
MIL-STD-2411-1	Registered Data Values for Raster Product Format, 30 August 1994
MIL-STD-2411-2	Integration of Raster Product Format Files into the National Imagery Transmission Format, 26 August 1994
MIL-HDBK-1300A	National Imagery Transmission Format Standard (NITFS), 12 October 1994

(Copies of the above standards and handbook are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Other Department of Defense Publications

DOD/JTA V2.0	Department of Defense Joint Technical Architecture Version 2.0, March 1998

(Copies of the JTA are available from the Defense Information Systems Agency, Center for Standards, 10701 Parkridge Boulevard, Reston, VA 20191-4353.)

2.3 Joint Chief of Staff Publications

JV2010	Joint Vision 2010, Chairman of the Joint Chiefs of Staff, Office of the Secretary of Defense
CJCSI 6212.01A	Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems, 30 June 1995

2.4 National Imagery and Mapping Agency Publications

N0105/98	NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, Review Draft 4, 25 August 1998
PIAE	National Imagery Transmission Format Standard Profile for Imagery Archives Extensions (PIAE) Version 2.0, 25 April 1996
NPIAE	NIMA Profile for Imagery Archive Extensions (NPIAE) for the National Imagery Transmission Format Standard (NITFS), 26 September 1997
STDI-0001	National Support Data Extensions (SDE) (Version 1. 3) for the National Imagery Transmission Format Standard (NITFS), 2 October 1998
NNPP	NITFS Five-Year Program Plan

(Copies of the above NIMA publications are available from the National Imagery and Mapping Agency, ATTN: NIMA/SES, MS-P24, 12310 Sunrise Valley Drive, Reston, VA. 20191-3449.)

2.5 Defense Information Systems Agency Publications

JIEO Circular 9002	Requirements Assessment and Interoperability Certification of C4I and AIS Equipment and Systems, 23 January 1995
NITFS Tag Registry	Official Register of NITFS Tagged Record Extensions, latest update as posted at http://jitc-emh.army.mil/nitf/tag_reg/mast.htm

(Copies of the above documents are available from the Joint Interoperability Test Command, NITFS Test Facility, Building 57305, Fort Huachuca, AZ 85613-7020.)

2.6 NATO Standardization Agreements

STANAG 4545	NATO Secondary Imagery Format

(Copies of NATO documents are available from the Central US Registry, 3072 Army, Pentagon, Washington DC 20310-3072.)

2.7 International Standards

ISO/IEC 12087-5	Information technology - Computer graphics and image processing - Image Processing and Interchange (IPI) - Functional specification - Part 5: *Basic image interchange format (BIIF)*
ISO/IEC 8632-1,2,3,4:1994	Information technology - Computer graphics metafile for the storage and transfer of picture description information - Parts 1 through 4

REFERENCES

ISO/IEC 8632:1992	Information technology - Computer graphics metafile for the storage and transfer of picture description information, AMD.1:1994 - Parts 1-4: Rules for profiles
ISO/IEC 10918-1:1994	Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines
ISO/IEC 10918-4:1998	Information technology - Digital compression and coding of continuous-tone still images - Part 4: Registration procedures for JPEG profile, APPn marker, and SPIFF profile ID marker

(Application for copies may be addressed to the American National Standards Institute, 13th Floor, 11 West 42nd Street, New York, NY 10036).

3.0 ACRONYMS

ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
BIIF	Basic Image Interchange Format
BWCWG	Bandwidth Compression Working Group (under NTB)
CADRG	Compressed ARC Digitized Raster Graphics
CCITT	International Telegraph and Telephone Consultative Committee
CD	Committee Draft
CGM	Computer Graphics Metafile
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
CTE	Certification, Test, Evaluation
CWG	Communications Working Group (under NTB)
DGIWG	Digital Geographic Information Working Group
DIA	Defense Intelligence Agency
DIGEST	Digital Geographic Information Exchange Standard
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DOD	Department of Defense
DPPDB	Digital Point Positioning Data Base
DSP	Defense Standardization Program
DSPO	Defense Support Project Office
EO	Electro-Optical
FEC	Forward Error Correction
FGDC	Federal Geographic Data Committee
FWG	Format Working Group (under NTB)
GIS	Geographic Information System
GSMC	Geospatial Standards Management Committee
IC	Intelligence Community
IEC	International Electrotechnical Commission
INCA	Intelligence Communications Architecture
IR	Infrared
IS	International Standard
ISMC	Imagery Standards Management Committee
ISO	International Organization for Standardization
ISP	International Standardized Profile
ITU	International Telecommunications Union

ACRONYMS

JITC	Joint Interoperability Test Command
JPEG	Joint Photographic Experts Group
JTA	Joint Technical Architecture
JTC1	Joint Technical Committee for Information Technology
JV	Joint Vision
MPEG	Motion Pictures Expert Group
NATO	North Atlantic Treaty Organization
NCCB	NIMA Configuration Control Board
NIMA	National Imagery and Mapping Agency
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NPIAE	NIMA Profile for Imagery Archive Extensions
NSIF	NATO Secondary Imagery Format
NTB	NITFS Technical Board (under GSMC - ISMC)
OASD	Office of the Assistant Secretary of Defense
OSD	Office of the Secretary of Defense
PMO	Program Management Office
RFC	Request for Change
RPF	Raster Product Format
SAR	Synthetic Aperture Radar
SDE	Support Data Extension
SDTS	Spatial Data Transfer Standard
TACO2	Tactical Communications Protocol 2
TRE	Tagged Record Extension
UAV	Unmanned Aerial Vehicle
UIP	USIGS Interoperability Profile
US	United States
USGS	United States Geological Survey
USIGS	United States Imagery and Geospatial Information System
UTA	USIGS Technical Architecture
VPF	Vector Product Format
VQ	Vector Quantization
WD	Working Draft

4.0 Support DATA EXTENSION (SDE) General Overview

4.1 Generic Tagged Record Extension (TRE) Mechanism.

The Tagged Record Extensions (TRE) defined in this document are "Controlled tagged record Extensions" (CE) as defined in MIL-STD-2500B. The TRE format is summarized here for ease of reference. Table 4-1 describes a CE's general format.

Table 4-1. Controlled Tagged Record Extension Format
(TYPE R = Required, C = Conditional, <> = null data allowed)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Type Identifier. A valid alphanumeric identifier properly registered with the NTB.	6	alphanumeric	N/A	R
CEL	Length of CEDATA Field. The length in bytes of the data contained in CEDATA. The TRE's overall length is the value of CEL + 11.	5	00001 to 99985	bytes	R
CEDATA	User-Defined Data. This field shall contain data primarily of character data type (binary data is acceptable for extensive data arrays, such as color palettes or look-up tables) defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user defined.	†	user-defined	N/A	R

† equal to value of CEL field.

The Unique Extension type Identifier (CETAG) and Length of CEDATA Field (CEL) fields essentially form a small (11-byte) TRE subheader. The format and meaning of the data within the User-Defined Data (CEDATA) field is the subject of this document for several, individual CEs.

Multiple TREs can exist within the TRE area. There are several such areas, each of which can contain 99,999 bytes worth of TREs. There is also an overflow mechanism, should the sum of all TREs in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of TREs.

While the CEs defined in this document will typically be found in the image subheader, it is possible that they could appear in the Tagged Record Extension Overflow (TRE_OVERFLOW) Data Extension Segment (DES) which is being used as an overflow of the image subheader.

If the information contained within a TRE is not available, the extension will not be present in the file or segment. For example, if the image is not part of a stereo set, the STERO extension will not be present. The set of TRE stored within the file or segment can change over the lifetime of the image, due to additional information, removal of outdated information, or change in classification. Additional tables indicate which TRE must appear in every file or segment and which may be omitted.

When a TRE is present, all of the information listed as Required (R) must be filled in with valid information. Information listed as Conditional (C) may or may not be present, depending upon the value in a preceding field. Conditional fields that are not present do not occupy space in the file. Information identified with angle brackets (<R> or <C>) may contain valid information, or may contain ASCII spaces (i.e., hex 20) to indicate a null field and that valid data is unavailable.

Alphanumeric values that do not fill the allotted space are left justified within a field, and the remaining bytes are filled with ASCII spaces (i.e., hex 20). Numeric values are right justified within the field, with ASCII zeros (i.e., hex 30) extending to the left field boundary.

Reserved fields, identified by names of the form "(reserved-nnn)" maintain alignment and functional equivalence with similar extensions defined for systems beyond the scope of this document. The content of reserved fields is explicitly specified in the Value Range column. Systems generating these TREs shall insert the specified value into each reserved field; systems interpreting them may ignore the contents of reserved fields.

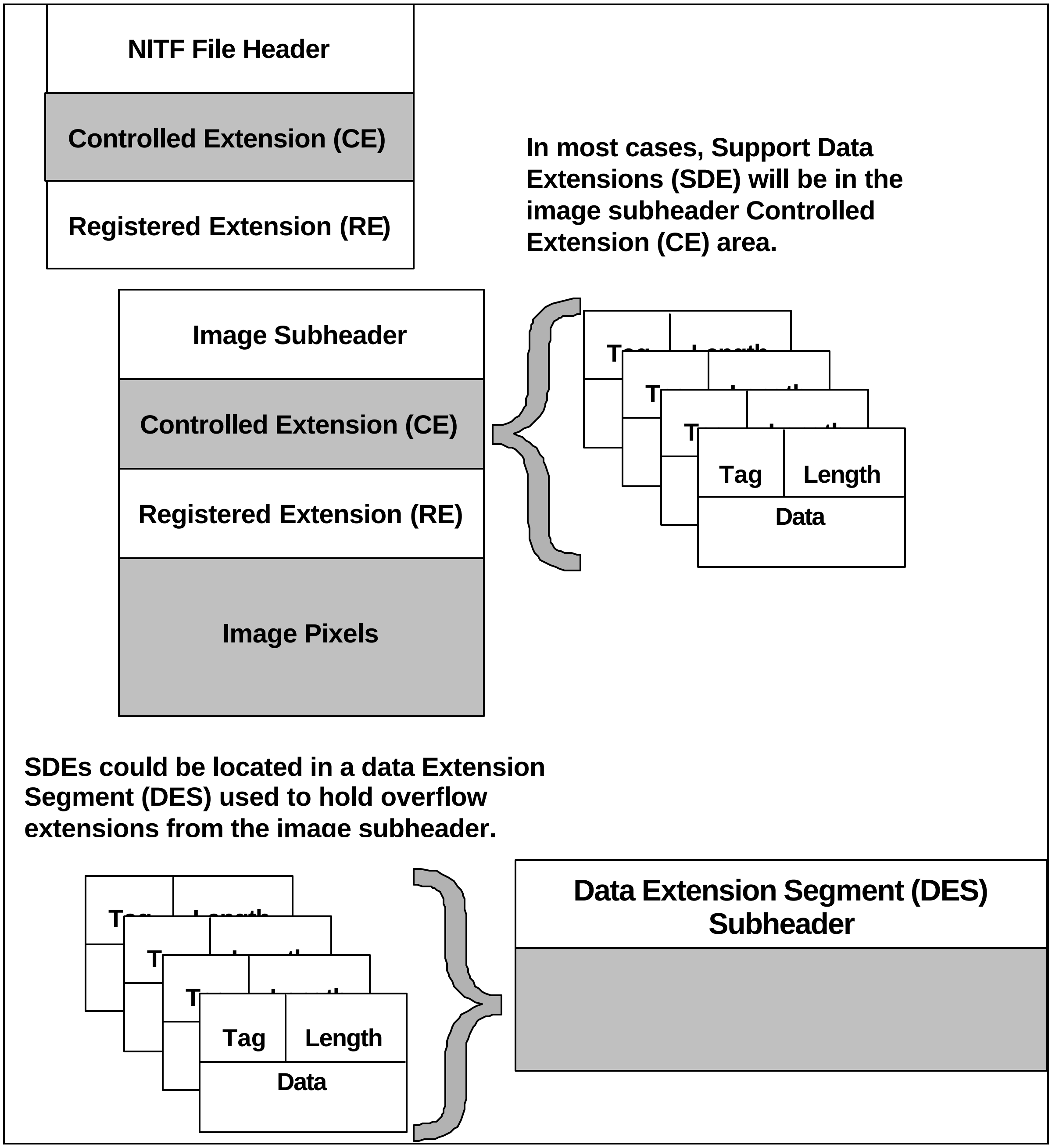


FIGURE 1-1. SUPPORT DATA EXTENSIONS (SDES) MAY BE LOCATED IN THESE AREAS

If the information contained within an extension is not available, the extension will not be present in the file. For example, many images may not contain an STREOB. If the intended use of a file does not require the information contained in an extension, it is not required to be present. The set of extensions stored within the file can change over the lifetime of the image. For example, the RPC00A tag may be added to the file at some time after the NITF 2.0 file is initially created, or additional STREOB extensions could be added as stereo mates are identified. When an extension is present, all of the information listed as required must be filled in.

5.0 ICHIPB SUPPORT DATA EXTENSION (SDE)

5.1 Introduction

As mensuration and geopositional tools proliferate within the United States Imagery and Geospatial Information System (USIGS) environment and the use of NITF image chips continues to expand, potential problems have been identified by the NITF Technical Board (NTB). One such problem arises when a mensuration tool, such as Ruler, is applied to an NITF image chip to determine the length or geoposition of an object within that chip. Ruler requires, as input, data that references the original full image as well as the image chip. This information is not provided within the NITF 2.0 header/subheader fields, or within the current NITF National, Airborne, or Commercial Support Data Extension (SDE) fields. This has resulted in the implementation of various, non-standard solutions for transferring this much needed "chipping" data along with an NITF chip. The ICHIPB Support Data Extension is the standard means whereby any recipient of a chipped image containing SDEs from the original full image, regardless of system or application, will be able to access the necessary data and apply a mensuration tool to the image chip in a uniform and consistent manner.

5.2 Purpose of this Document

This document provides a background of the circumstances leading up to the requirement for the ICHIPB SDE and specifies how this tag is to be used. Compliance with this specification will support consistent community implementation of ICHIPB.

5.3 ICHIPB Overview

As mensuration and geopositioning tools proliferate, several issues have been identified concerning the application of these tools to NITF-formatted image chips. Specifically, there is no mechanism, in the current NITF format, to pass a standardized set of data with an image chip such that a user can easily apply Ruler to that image. Ruler provides mensuration functions for client software applications by utilizing the original image line and sample values for the endpoints of the measured dimension in a geometry model for the image's collection sensor. The geometry model for a sensor consists in part of a transformation from the sensor coordinate system to the original line and sample coordinate system. Incorrect mensuration results will be computed if Ruler is not provided the original line and sample for each measured point. In order to apply Ruler to a chipped NITF image, the using application must provide the Ruler application with the grid point coordinates of interest in the chipped image as if those points came from the original full image. Unless this information is precisely included with the image chip, a user must use alternate methods to generate this data. As a result, several system-specific solutions have been proposed and implemented within the community. Each of these solutions addresses the problem in a different manner, and in many instances, do not generate the same exact points or offsets. In addition, the accuracies of these line and sample points vary. These factors could lead to a scenario where three imagery exploitation systems receive identical images, apply their unique algorithm, derive the points and chip offsets from the full image, input the data to Ruler, and receive mensuration results that are not identical.

Addition of an NITF Tagged Record Extension (TRE) to the set of National and Airborne SDEs as a Controlled Extension (CE) can easily alleviate this situation. By standardizing the data elements (which includes the line and sample corner points, offset data, etc. in a consistent manner) within this TRE, and including it with all image chips, exploiters will be more likely to arrive at the same answer from the mensuration process.

Another typical scenario involves the "chip of a chip" scenario. An exploiter in the Washington DC area satisfies an exploitation request and generates an exploited image chip. This image chip is disseminated as an NITF Product to a single user and is also archived in an Image Product Library (IPL). Another user at CENTCOM downloads the image from the IPL and proceeds to mensurate on the image using Ruler. Unless ICHIPB is included with the image, he/she can not be sure that the results from Ruler are based on valid inputs. This user then takes a subset of the image and generates a chip from the chip, which is then forwarded to a tactical user. The tactical system receiving the second generation chip wants to apply a geopositioning tool to the image, but will be unable to unless he/she has a specific, standard way to reference points in the chipped image with the original full image line and sample points. Inclusion in the chipped image of ICHIPB with the SDE from the original full image will satisfy the mensuration processing need.

5.4 Background

The ICHIPA extension was developed via a series of technical interchange meetings as well as through comment and inputs from the NTB community. The ICHIPA extension was based on the simplification of and generalization of the currently registered I2MAPD extension. System specific I2MAPD data fields were either removed or generalized such that there would be no system-specific dependencies within ICHIPA.

This specification for ICHIPB resulted from attempting to apply ICHIPA to chipped imagery collected by airborne sensors containing attribute data within the Airborne SDE. The Airborne SDE and ICHIPA do not provide a consistent means to identify the width and height of the original full image to which the coverage of the SDE applies. Although ICHIPA may provide sufficient information when used with national SDE and the associated national product naming conventions, a more general-purpose mechanism was needed to accurately process and display coordinate information for chipped images. The changes to ICHIPA resulting in ICHIPB provide a means to identify the number of pixel rows and number of pixel columns in the original full image for which the coverage of the SDEs is applicable.

Version 1.0 of ICHIPB represents a major simplification of I2MAPD pertaining to dewarped (non-linear) capabilities. For example, the previously existing grid overlay has been deleted. As such, ICHIPB deals only with linear situations where only the four line and sample “original” product coordinates are considered. Thus, there is no need for nth order polynomials and the tag length is fixed at 224 bytes. On the other hand, several existing features have been retained such as the non-linear transformation flag, which indicates whether the associated image is dewarped or not, and the anamorphic correction indicator. The scan block number is added to reflect comments received from the user community.

5.5 Implementation of ICHIPB

ICHIPB is a system-independent NITF TRE that, when included with the SDEs in all NITF image chips, will support all users within the USIGS environment for the mensuration of SDE-based image chips (non-dewarped imagery only). It holds the support data that analysts need when using Ruler to mensurate or determine detailed geospatial parameters on pixel-based features within image chips. ICHIPB also holds other limited, processing-related information, such as various correction indicators and scale factor, that are useful to receiving systems.

5.5.1 Generation and Use of ICHIPB (Non-dewarp Scenarios)

The ICHIPB TRE shall be generated by all NITF applications that produce NITF formatted image chips of simple linear (non-dewarped) images that include the Ruler complement of national, commercial and airborne SDE. NITF receiving systems capable of interpreting and using national and airborne data extensions shall properly recognize, read and interpret the information within ICHIPB when present in an image chip.

Ruler mensuration uses the line and sample indexing scheme of the original image to determine various geospatial measurements and position within an image, be it the original image or a chip of the original image. ICHIPB captures image chip corner point coordinate information that is mapped to the original image coordinate system as shown in figure 3-1. The mapping function is the result of a linear interpretation between image corner points and as such, can be assumed for only the simple linear (non-dewarped) processed imagery.

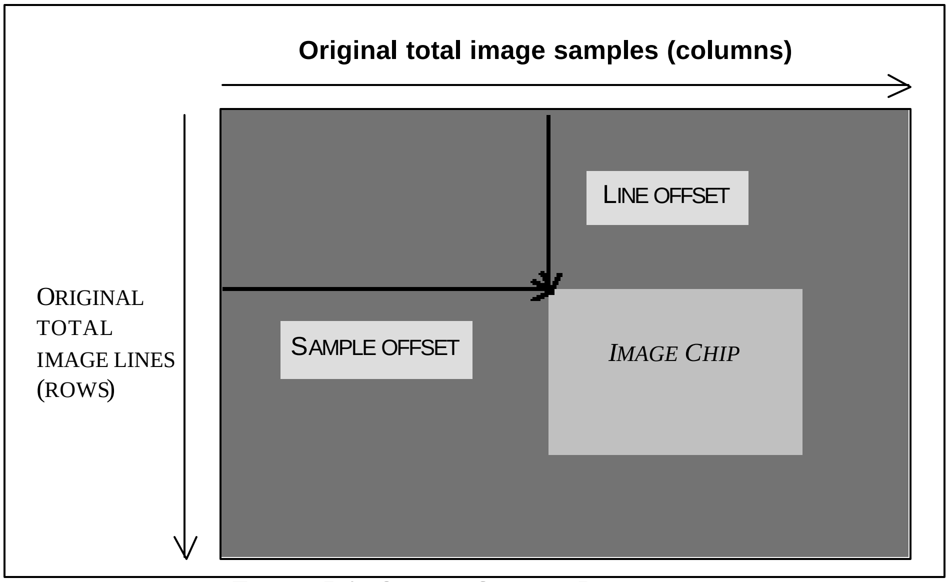


FIGURE 5-1. OUTPUT CHIPPED PRODUCT

The reason for this is twofold. First, few systems today process dewarped imagery and even fewer can mensurate and calculate geopositions from dewarped imagery. Second, due to the complexity of the algorithms that derive line and sample corner points and offset data, as well as the required processing power required, standardization of the algorithms for the community would be difficult. Therefore, standardizing the linear transformation, a straight forward process, is an appropriate baseline for ICHIPB. For a more detailed explanation of this mapping function, and specific examples of chipping non-dewarped imagery, refer to the appendices of this document.

5.5.2 Dewarp Scenarios

In addition, a new TRE or a revision to ICHIPB is recommended for more complex mensuration requirements. This is because the current TRE is not sufficient for addressing dewarp scenarios.

To maintain interoperability within the USIGS, ICHIPB shall be included with all non-dewarped NITF chips, specifically when the chip is disseminated. It shall also be included with NITF chips of dewarped images that include the original SDE to serve as a flag that the coverage of the SDE is different from the coverage of the pixels in the chip.

5.6 Format of ICHIPB

The ICHIPB controlled TRE provides the data needed to mensurate and calculate geopositions of features on chips. This TRE provides the output product row and column data for the image, as well as those data points referenced back to values for the original full image. For this TRE, the original line and sample grid point values will be provided at the four corners of the intelligent image data in the chip (for those cases where the chip includes pad pixels).

5.6.6 ICHIPB Field Specification

The Tagged Record Extension fields for ICHIPB are specified in tables 1, 2, and 3.

Table 5-1. ICHIPB TRE Subheader Fields

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique extension type identifier	6	ICHIPB	R
CEL	Length of CEDATA field	5	00224	R
CEDATA	User-defined data	224	See table 2	R

Table 5-2. ICHIPB TRE User Defined field format

FIELD	NAME	SIZE	VALUE RANGE	TYPE
XFRM_ FLAG	Non-linear Transformation Flag	2	Numeric 00 (non-dewarped, data provided), 01 (no data provided)	R
SCALE_ FACTOR	Scale Factor Relative to R0 (original full image resolution)	10	Numeric (typically reciprocal of display magnification) xxxx.xxxxx	R
ANAMRPH_ CORR	Anamorphic Correction Indicator	2	Numeric 00 (no anamorphic correction) 01 (anamorphic correction applied)	R
SCANBLK_ NUM	Scan Block Number (scan block index)	2	00-99 00 if not applicable	R
OP_ ROW_11	Output product row number component of grid point index (1,1) for intelligent data	12	Numeric xxxxxxxx.yyy (typically 00000000.500)	R
OP_ COL_11	Output product column number component of grid point index (1,1) for intelligent data	12	Numeric xxxxxxxx.yyy (typically 00000000.500)	R
OP_ ROW_12	Output product row number component of grid point index (1,2) for intelligent data	12	Numeric xxxxxxxx.yyy	R
OP_ COL_12	Output product column number component of grid point index (1,2) for intelligent data	12	Numeric xxxxxxxx.yyy	R
OP_ ROW_21	Output product row number component of grid point index (2,1) for intelligent data	12	Numeric xxxxxxxx.yyy	R

TABLE 5-2. ICHIPB TRE USER DEFINED FIELD FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
OP_ COL_21	Output product column number component of grid point index (2,1) for intelligent data	12	Numeric xxxxxxxx.yyy	R
OP_ ROW_22	Output product row number component of grid point index (2,2) for intelligent data	12	Numeric xxxxxxxx.yyy	R
OP_ COL_22	Output product column number component of grid point index (2,2) for intelligent data	12	Numeric xxxxxxxx.yyy	R
FI_ ROW_11	Grid point (1,1), row number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ COL_11	Grid point (1,1), column number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ ROW_12	Grid point (1,2), row number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ COL_12	Grid point (1,2), column number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ ROW_21	Grid point (2,1), row number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ COL_21	Grid point (2,1), column number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ ROW_22	Grid point (2,2), row number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ COL_22	Grid point (2,2), column number in full image coordinate system	12	Numeric xxxxxxxx.yyy	R
FI_ROW	Full Image Number of Rows	8	Numeric 00000000 and 00000002 to 99999999	R
FI_COL	Full Image Number of Columns	8	Numeric 00000000 and 00000002 to 99999999	R

Note: - Row and column indexing, NITF nomenclature, corresponds to line and sample indexing in original product nomenclature.
- If XFRM_FLAG is 01, then remaining values will be zero fill.

TABLE 5-3. ICHIPB TRE USER DEFINED FIELD DEFINITIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
XFRM_FLAG	Non-linear Transformation Flag. If image is non-dewarped, field is 00. For all others, flag is 01 with zero fill in the remaining fields.
SCALE_FACTOR	Scale factor relative to the full image resolution 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; 0004.00000 then R2; 0008.00000 then R3; 0016.00000 then R4; 0032.00000 then R5; 0064.00000 then R6; 0128.00000 then R7
ANAMRPH_CORR	If no anamorphic correction, 00; otherwise 01
SCANBLK_NUM	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.
OP_ROW_11	Output product row number component of grid point index (1,1) for intelligent data. Typically 00000000.500
OP_COL_11	Output product column number component of grid point index (1,1) for intelligent data. Typically 00000000.500
OP_ROW_12	Output product row number component of grid point index (1,2) for intelligent data.
OP_COL_12	Output product column number component of grid point index (1,2) for intelligent data.
OP_ROW_21	Output product row number component of grid point index (2,1) for intelligent data.
OP_COL_21	Output product column number component of grid point index (2,1) for intelligent data.
OP_ROW_22	Output product row number component of grid point index (2,2) for intelligent data.
OP_COL_22	Output product column number component of grid point index (2,2) for intelligent data.
FI_ROW_11	Grid point (1,1), row number in full image coordinate system. Note: 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.
FI_COL_11	Grid point (1,1), column number in full image coordinate system. Note: 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.
FI_ROW_12	Grid point (1,2), row number in full image coordinate system. Note: 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.
FI_COL_12	Grid point (1,2), column number in full image coordinate system. Note: 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.
FI_ROW_21	Grid point (2,1), row number in full image coordinate system. Note: 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.
FI_COL_21	Grid point (2,1), column number in full image coordinate system. Note: 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.

TABLE 5-3. ICHIPB TRE USER DEFINED FIELD DEFINITIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
FI_ROW_22	Grid point (2,2), row number in full image coordinate system. Note: 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.
FI_COL_22	Grid point (2,2), column number in full image coordinate system. Note: 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.
FI_ROW	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. Note: 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.
FI_COL	The number of pixel columns in the original full image for which the coverage of the SDEs is applicable. 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. Note: 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.

5.7 Effectivity

This ICHIPB proposal impacts the imagery and mapping community from both the system development and CONOPS perspectives within the USIGS. As a result, to provide adequate time for program offices and systems/software developers to assess impacts and plan implementations, ICHIPB's effectivity will be 1 year from the validation, approval, and final publication of this document and will apply to applications subscribing to NITF versions 2.0 and 2.1.

5.8 Test Criteria

5.8.1 ICHIPB Pack Criteria

The ICHIPB TRE must be included in all image segments that contain Ruler focused SDEs (National, Commercial and/or Airborne SDE) when the coverage of the pixel data is less than the coverage of the SDEs.

Applications which generate a chipped image segment from any image source that contains Ruler focused SDEs must preserve the SDEs from the source and include a properly populated ICHIPB TRE in the chipped image segment, even when chipping on FAF (block) boundaries.

The XFRM_FLAG field must have the value '00' when the pixel values in the image segment represent non-dewarped image data. The other fields of the TRE must be properly populated with valid data.

The XFRM_FLAG field must have the value '01' when the pixel values in the image segment represent other than non-dewarped image data. The other data fields of the TRE must be populated with the designated default values for those fields.

The SCALE_FACTOR field must contain the appropriate scale factor value relative to the original full image resolution (RO). This value must directly correlate with the value in the IMAG field of the image segment subheader. Allowed values are: 0001.00000 for RO (original image resolution)

0002.00000 for R1 (1/2 resolution)

0004.00000 for R2 (1/4 resolution)

0008.00000 for R3 (1/8 resolution)

0016.00000 for R4 (1/16 resolution)

0032.00000 for R5 (1/32 resolution)

0064.00000 for R6 (1/64 resolution)

0128.00000 for R7 (1/128 resolution) -OR-

the reciprocal of the image magnification when pixel values are not scaled by factors of 2.

The ANAMRPH_CORR field must have the value '00' when no anamorphic correction has been done to the pixel values in the image segment. It must have the value '01' when the pixel values have undergone anamorphic correction.

When chipping from images with multiple scan blocks, the SCANBLK_NUM field must identify the scan block to which the grid points expressed in FI_ROW_nn and FI_COL_nn are referenced.

The 'output product' row and column number fields identify the four 'corner' intelligent pixel indices (NITF common coordinate system row/column values) of the polygon that outlines (encloses) the intelligent pixels of the chipped pixel values in the image segment being packed.

For OP_ROW_11 and OP_COL_11, the common coordinate system row/col index value for the intelligent 'corner' pixel, upper left. (The condition where OP_ROW_11 is less than both OP_ROW_21 and OP_ROW_22 AND OP_COL_11 is less than both OP_COL_12 and OP_COL_22.)

For OP_ROW_12 and OP_COL_12, the common coordinate system row/col index value for the intelligent 'corner' pixel, upper right. (The condition where OP_ROW_12 is less than both OP_ROW_21 and OP_ROW_22 AND OP_COL_12 is greater than both OP_COL_11 and OP_COL_21.)

For OP_ROW_21 and OP_COL_21, the common coordinate system row/col index value for the intelligent 'corner' pixel, lower left. (The condition where OP_ROW_21 is greater than both OP_ROW_11 and OP_ROW_12 AND OP_COL_21 is less than both OP_COL_12 and OP_COL_22.)

For OP_ROW_22 and OP_COL_22, the common coordinate system row/col index value for the intelligent 'comer' pixel, lower right. (The condition where OP_ROW_22 is greater than both OP_ROW_11 and OP_ROW_12 AND OP_COL_22 is greater than both OP_COL_11 and OP_COL_21.)

The 'full image' row and column number fields (FI_ROW_11, FI_COL_11, FI_ROW_12, FI_COL_12, FI_ROW_21, FI_COL_21, FI_ROW_22 and FI_COL_22) must contain the actual grid index values of the full SDE coverage grid coordinate system for each of the four output product pixel indices in the corresponding OP_ROW/OP_COL fields.

The 'full image' number of rows/columns fields (FI_ROW, FI_COL) must be populated with the total number of pixel rows and pixel columns in the 'full image' pixel grid for which the coverage of the SDEs is applicable. For imagery with multiple scan blocks, these values represent those of the single scan block from which the image chip was extracted. When this information is not available to the chipping application, it will populate these fields with the designated default value (all zeros).

The chipping application must correctly populate the IGEOLO fields in the chipped image subheader to correspond with the geolocation of the corner points of the chip as derived from the SDE.

5.8.2 ICHIPB Unpack Criteria

Applications capable of interpreting (point positioning, mensuration, etc.) Ruler focused SDEs must be able to recognize and properly apply the information in the ICHIPB TRE relative to the full coverage SDEs.

Interpret operations performed on a chipped image segment using the Ruler focused SDEs must obtain the same results as if performed on the original full image for which the coverage of the SDEs is applicable.

When the XFRM_FLAG field has a value other than '00', the application must not proceed with SDE interpret functions that rely on the data being 'non-dewarped'.

The application must recognize and use the SCALE_FACTOR value when using the Ruler focused SDEs.

The application must recognize whether anamorphic correction has been applied and account for the correction when using the Ruler focused SDEs.

The application must accommodate chipping from images with multiple scan blocks and apply the appropriate offsets within the SDE grid coordinate space. It must identify and use the correct set of SDEs applicable to the scan block from the support data extensions even when SDEs for other scan blocks may be included from the original multiple scan block image.

The application must interpret the four 'output product' and 'full image' corner indices in the specified order, upper-left, upper-right, lower-left, then lower-right (11,12,21,22).

The application must properly interpret the four 'output product' and 'full image' corner indices when 'pad pixels' from the original image are included in the chipped image and recognize that these corner points identify the bounds of the 'intelligent' pixels.

When the 'full image' number of rows/columns fields (FI_ROW, FI_COL) are populated with values of all zeros, the application must recognize that the total number of rows/columns of the original image was not available to the chipping application. It must not presume a 'zero area' image or disrupt (crash) the normal operation of the application.

When presenting geographical information from the chipped image, the application must clearly identify whether that information is based on the values in the IGEOLO field, or whether it is based on use of the SDEs.

5.9 Summary

The ICHIPB NITF TRE is an SDE mechanism by which exploiters of non-dewarped imagery chips can generate the required data for Ruler mensuration. By requiring that all systems generating non-dewarped imagery implement this TRE, interoperability will be maintained. This standard will enforce a uniform solution to the application of Ruler to NITF images. The effectivity stated in paragraph 3.2 will provide sufficient time for commercial and government developers to plan for the use of ICHIPB within their systems, tools, and products.

5.10 Glossary

Chip	A portion of another image, be it from the original image as captured by a sensor, or from a sub-image cropped from an original image.
Coverage	The entirety of pixel rows and columns of an original image that directly correlate to the attributes in the Support Data Extensions resulting from the original image capture.
Geopositioning	The process of determining the precise location of an object relative to the Earth's surface.
Grid Points	The line and sample index values (coordinates) of the chipped image in the applicable reference grid coordinate system.
Line and Sample	The row and column of the image, respectively.
Mensuration	The process of measuring positions, distances, and object dimensions (such as length, height, diameter) on an image or map.
Original Full Image	The entire image pixel data for which the attribute information in the Support Data Extensions applies. For images with multiple scan blocks, "Original Full Image" refers to the single scan block from which the image chip was sourced.
Output Product	The image product resulting from the chipping operation.
SDEs	Support Data Extensions. A set of Tagged Record Extensions. The National, Airborne, and Commercial SDEs contain attribute information providing the details of the original full image capture sensor and the original capture event.
Intelligent Pixels	As defined for chipping within this context, are those pixels that possess visual utility or convey exploitable or potentially exploitable information to the user or an application.
Significant Pixels	All pixels included within the number of rows (NROWS) and number of columns (NCOLS) counts in an image subheader. They may or may not include intelligent and/or pad pixels.
Pad Pixels	Those pixels with sample values that have offer no real meaning or intelligence to the image. Pad pixels (sometimes referred to as “fill” or “gray”) may be used to complete or “fill out” portions of an image to maintain consonance between row/column counts and block sizes and/or to distinguish a starting location of intelligent pixels.
Warping	Non-dewarped imagery is projected in the same plane as originally collected by the sensor and possesses linear characteristics inherent to the original collection process. Dewarped imagery is imagery that has been changed from its original collection plane to one that is more suitable for display. Dewarped imagery possesses non-linear characteristics as a result of the transformation process.

5.11 Appendix A, Pixel vs. Grid Overview

5.11.1 Introduction

This appendix provides detailed explanations and illustrations of the relationships between image pixels and the NITF grid space over which the images are laid. Three examples are presented: 1) simple chip; 2) chipping after image rotation of original image; and 3) chipping beyond the edge of the original image. It should be noted that in all examples, “image” and “grid” illustrations are highly exaggerated to provide greater detail and visualization. The image sizes are unrealistic and should never be encountered in a real world situation. Lastly, throughout the illustrations and explanations in this and subsequent appendices, different uses of the term “pixel” are used. They are presented here to prepare the reader in understanding the chipping processes. Intelligent pixels, as defined for chipping within this context, are those that possess visual utility or convey exploitable or potentially exploitable information to the user or an application. Significant pixels are all pixels included within the number of rows (NROWS) and number of columns (NCOLS) counts in the image subheader. They may or may not possess intelligence. Pad pixels are those with sample values that offer no real meaning or intelligence to the image. Pad pixels (sometimes referred to as “fill” or “gray”) may be used to complete or “fill out” portions of an image to maintain consonance between row/column counts and block sizes and/or to distinguish a starting location of intelligent pixels. In all cases, pad pixels are used to maintain the uniform raster row/column structure of the intended matrix of pixel values.

5.11.2 Pixel vs. Grid Orientation.

The chipping process involves the replication of some portion of a source image plus a copy of the Support Data Extensions (SDEs) that address the coverage for the original image operation. The resulting image chip is also known as the Output Product (OP). The original image operation to which the SDE coverage applies is defined as the Full Image (FI). Since the chip is a subset of the full image, it must be capable of inheriting all of the information necessary to perform mensuration and other exploitation functions. For this to occur, the SDEs presume a grid associated with the original imagery operation. To use the SDEs, the chip pixels must be related back to the original grid, regardless of what manipulations (e.g., rotation, reduced resolution, chip of a chip, etc.) have occurred.

In the following illustration, an image chip of NITF size NROWS = 3 and NCOLS = 4 is being created from a full image of NITF size NROWS = 9 and NCOLS = 7. In both the chip and full image cases, the (row,column) indices are such that the upper left corner contains pixel (0,0), the upper right corner contains pixel (0,NCOLS-1), the lower left corner contains pixel (NROWS-1,0), and the lower right corner contains pixel NROWS-1, NCOLS-1). (Note: Row and column values are zero-based indices which correspond with NITF display of images IAW MIL-STD 2500A, paragraph 5.5.1.1).

To determine where a chip’s corner points are in relation to the full image grid coverage from which it is drawn, the location of the center of each of the chip’s corner pixels must be determined in relation to the full image’s grid space. (Note: Since a pixel is an abstract object whose shape and size are not easily defined, the pixels in this appendix are portrayed in square space, the size of “one unit,” to easily determine orientation and measurements). With the center point of a square being located at one half of its height and width, the center of each OP and FI pixel will typically be 0.5, 0.5. In this particular case, the center points of all chip pixels are coincident with the center points of the corresponding pixels in the full image. Also, for this case, all significant pixels in the chip and the full image are considered intelligent pixels.

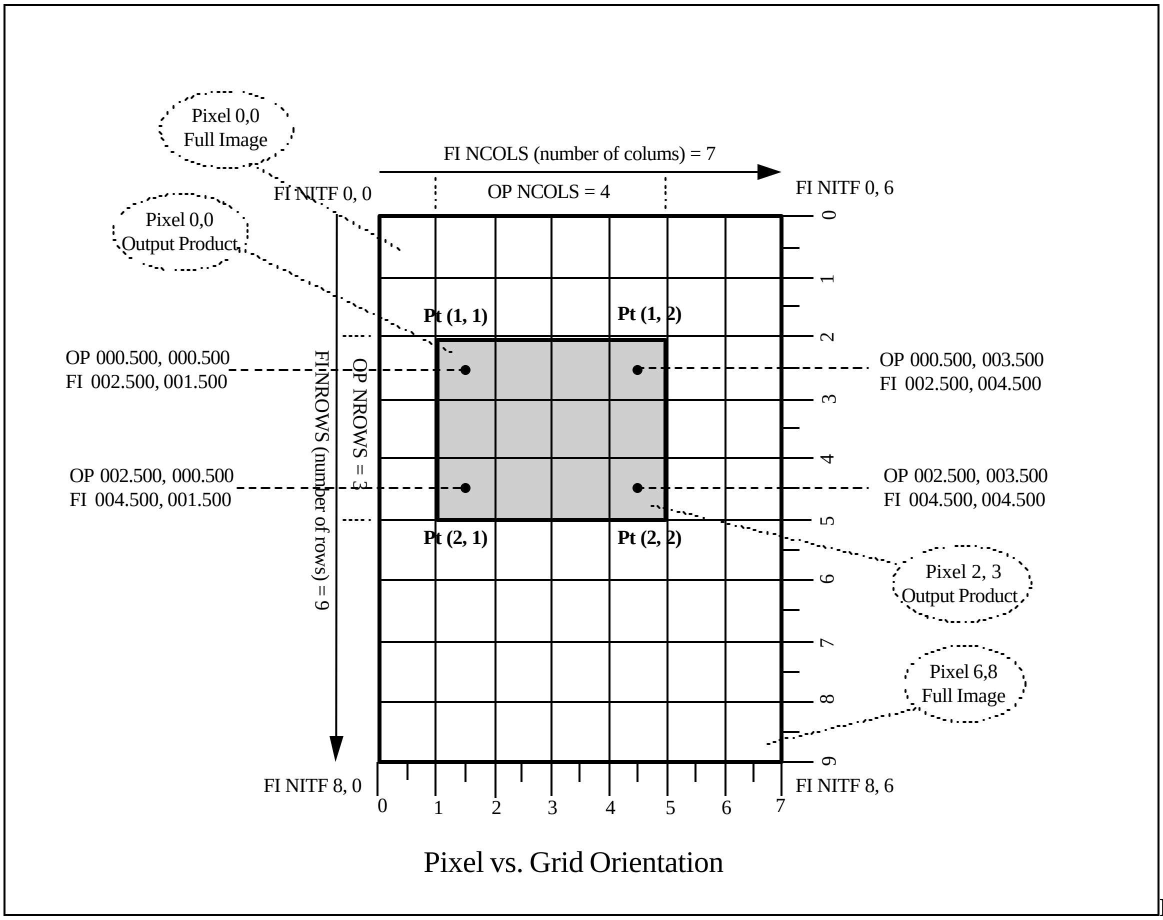


FIGURE 5-2. PIXEL VS. GRID ORIENTATION

Given the aforementioned information, the specific index values for completing the ICHIPB corner points for the chip (OP) and their corresponding location full image (FI) are as follows:

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	00000002.500
	OP_COL_11:	00000000.500	FI_COL_11:	00000001.500
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000002.500
	OP_COL_12:	00000003.500	FI_COL_12:	00000004.500
Pt (2,1)	OP_ROW_21:	00000002.500	FI_ROW_21:	00000004.500
	OP_COL_21:	00000000.500	FI_COL_21:	00000001.500
Pt (2,2)	OP_ROW_22:	00000002.500	FI_ROW_22:	00000004.500
	OP_COL_22:	00000003.500	FI_COL_22:	00000004.500

Using the corner point values above and other related information, a NITF interpreter should be able mensurate and ascertain other information from the chip by using the FI support data that accompanies it, just as if the interpreter was mensurating across the full image.

5.11.3 Pixel vs. Grid Orientation - Rotation

In the following example, the same chip and full images, as in figure A-1, are used again; however, in this case, the full image has been rotated approximately 30 degrees. With this new orientation, two new factors need to be addressed and considered: "pad" pixels and non-coincident pixel center points.

In the illustration below, pad pixels are those that appear within the 12 x 11 NITF image space but are NOT part of the intelligent pixels within the 9 x 7 rotated image. The resulting visual affect is similar to when a NITF viewer rotates an image for display, such as in a north orientation. Accordingly, the significant pixels of the full image contain both intelligent and pad pixels, but in the chip, all significant pixels are also intelligent pixels.

Unlike the first illustration in figure A-1, the center points of the chip's corner pixels are no longer coincident with center points of the pixels in the full image grid. In this example, the chip (OP) values used in the ICHIPB corner point index fields remain the same (due to same chip size); however, the full image (FI) index values are not on the "0.5" grid points. The FI values are derived from where the chip's pixel center points are in relation to the full image grid. Given these relationships, the following values, which are estimates for the purpose of this illustration and discussion, are used to complete the ICHIPB corner point index fields:

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	0000003.400
	OP_COL_11:	00000000.500	FI_COL_11:	00000001.250
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000001.850
	OP_COL_12:	00000003.500	FI_COL_12:	00000003.850
Pt (2,1)	OP_ROW_21:	00000002.500	FI_ROW_21:	00000005.100
	OP_COL_21:	00000000.500	FI_COL_21:	00000002.200
Pt (2,2)	OP_ROW_22:	00000002.500	FI_ROW_22:	00000003.650
	OP_COL_22:	00000003.500	FI_COL_22:	00000004.850

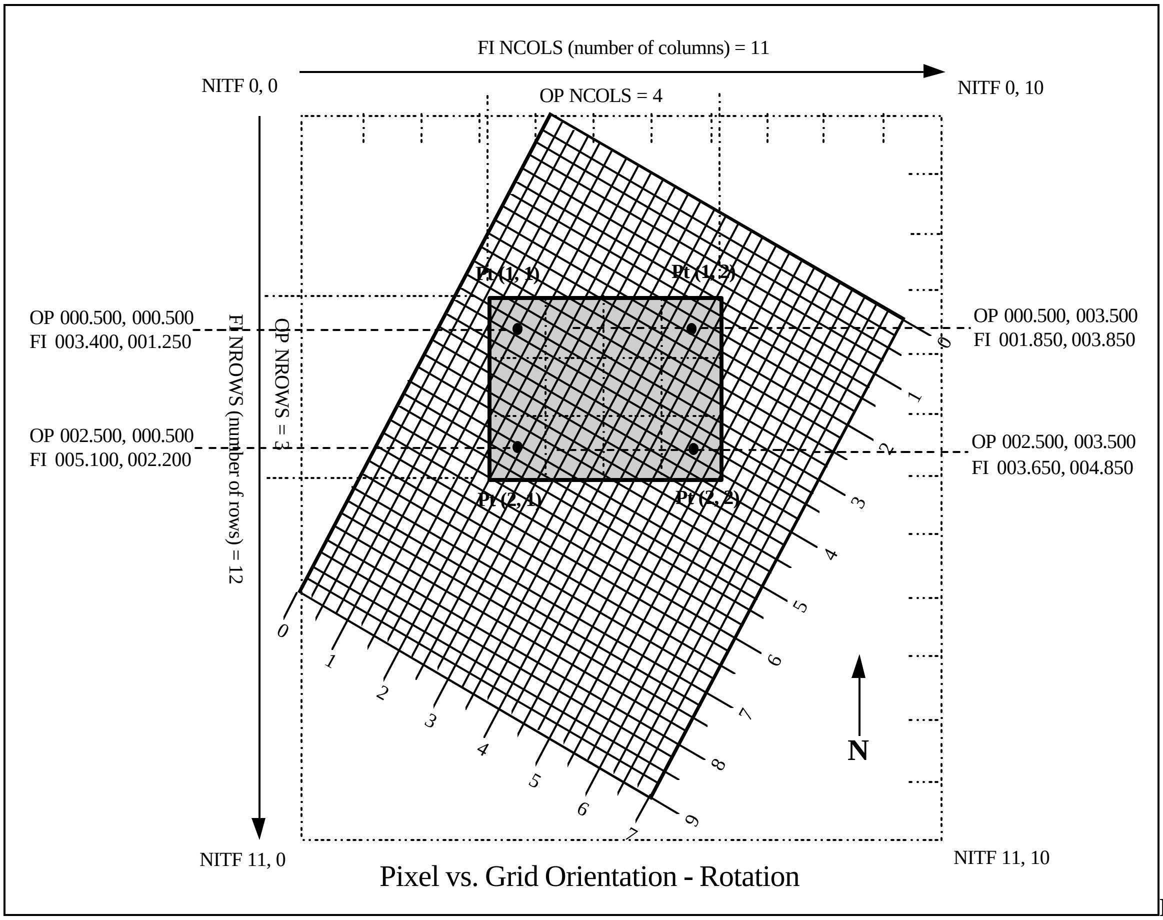


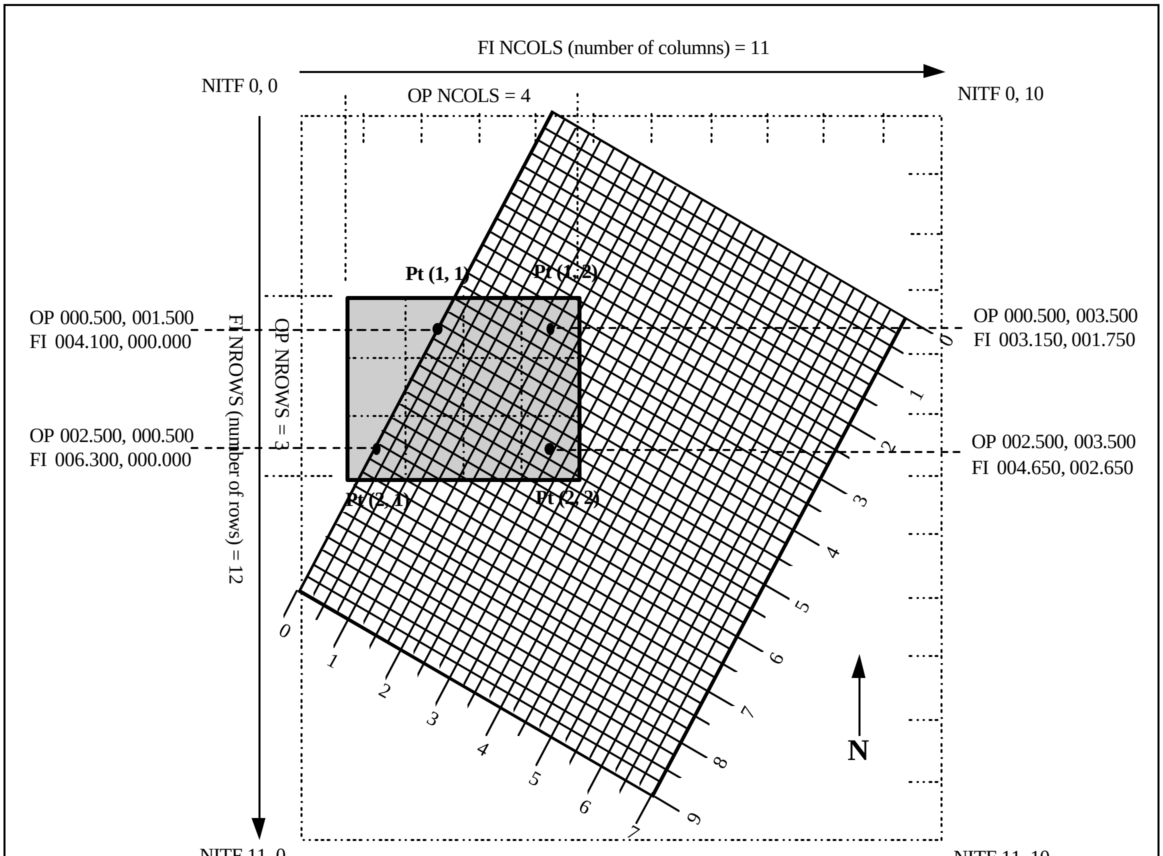
FIGURE 5-3. PIXEL VS. GRID ORIENTATION - ROTATION

Again, using the corner point values above and other related information, a NITF interpreter should be able mensurate and ascertain other information from the chip by using the FI support data that accompanies it, just as if the interpreter was mensurating across this portion of the full image.

5.11.4 Pixel vs. Grid Orientation - Rotation and "Intelligent" Pixels

Figure A-3 offers another possibility in image chipping whereby not all of the pixels comprising the image chip possess intelligence. In this case, the chip will continue to possess a NITF size of NROWS = 3 and NCOLS = 4; however, pad pixels (at 0, 0 and1, 0) will be included in the chip to account for the absence of any pixel contributions from the full image at those locations. Unlike the previous two examples, this case offers intelligent and pad pixels within the significant pixels of both the chip and the full image.

For the chip to properly access the support data coverage offered by the full image, the chip's corner points must be indicative of pixels possessing intelligence. Accordingly, this example will deviate from the previous ones in that OP Pt 1,1 will not reflect corner point indices of 0.5, 0.5. Since this chip will contain unintelligent, pad pixels in the first column, the corner point values of Pt 1,1 will now be 0.5, 1.5, avoiding the unintelligent pixel present at 0, 0



Pixel vs. Grid Orientation - Rotation and “Intelligent” Pixels

FIGURE 5-4. PIXEL VS. GRID ORIENTATION - ROTATION AND “INTELLIGENT” PIXELS

The remaining OP point values are the same and the corresponding FI point values are determined in the same manner as before. Accordingly, the following values, which are again estimates for the purpose of this illustration and discussion, are used to complete the ICHIPB corner point index fields:

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	00000004.100
	OP_COL_11:	00000001.500	FI_COL_11:	00000000.000
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000003.150
	OP_COL_12:	00000003.500	FI_COL_12:	00000001.750
Pt (2,1)	OP_ROW_21:	00000002.500	FI_ROW_21:	00000006.300
	OP_COL_21:	00000000.500	FI_COL_21:	00000000.000
Pt (2,2)	OP_ROW_22:	00000002.500	FI_ROW_22:	00000004.650
	OP_COL_22:	00000003.500	FI_COL_22:	00000002.650

With the corner point values representing intelligent pixels, as shown above, and other related information, a NITF interpreter should again be able to mensurate and ascertain other information from the chip, just as if the interpreter was mensurating across this portion of the full image.

5.12 Appendix B, Chipped Output Product

This example demonstrates the relationship of a chip the size of NROWS = 120 and NCOLS = 100 with a full image of the size NROWS = 400 and NCOLS = 300. The chip's NITF 0,0 pixel corresponds to the full image's pixel 099, 099 location. For this example, the image should be considered full frame, with no scan blocks, with regards to format.

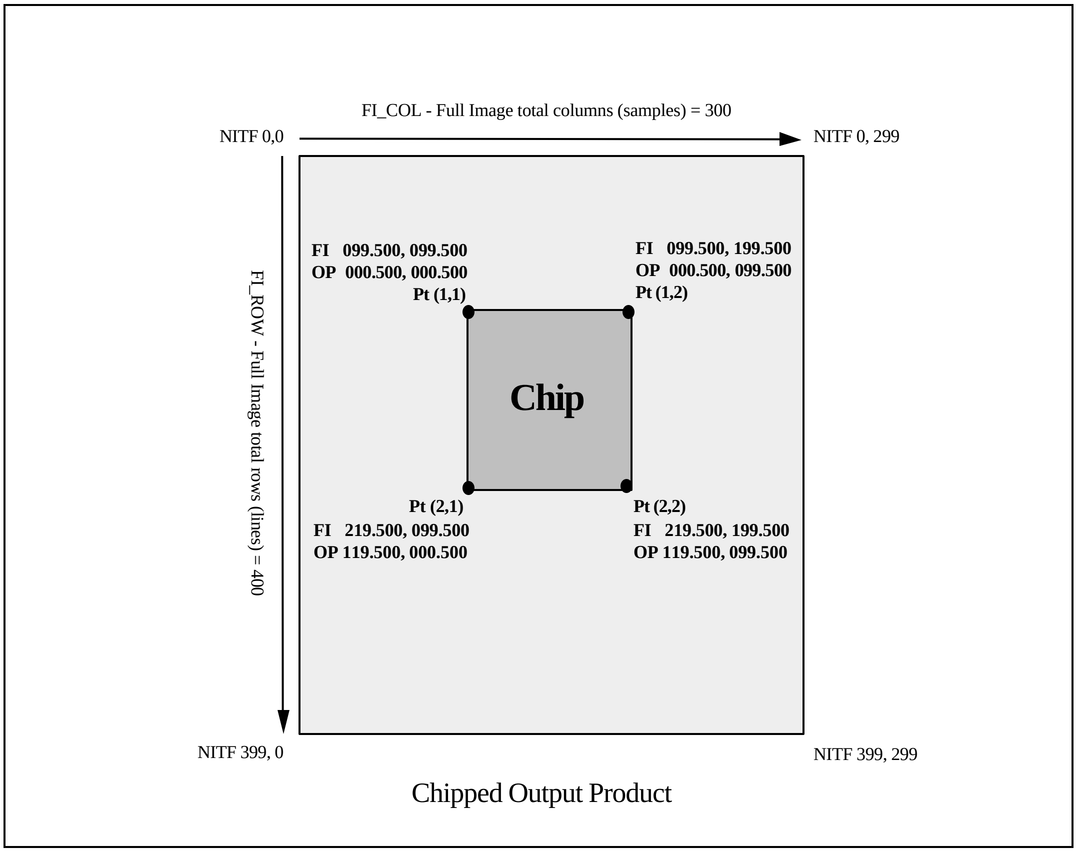


FIGURE 5-5. CHIPPED OUTPUT PRODUCT

In the above example, Output Product (OP) values reflect the actual grid corner points of the image chip as it would stand independently, while the Full Image (FI) values provide those same OP points' values in the full image's corresponding grid space. Since the Support Data Extensions (SDEs) that will be included with the image chip will provide coverage for the entire 400 x 300 FI, ICHIPB's FI_ROW and FI_COL will be populated with the values 00000400 and 00000300, respectively. The ICHIPB grid corner point fields will be populated as follows:

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	00000099.500
	OP_COL_11:	00000000.500	FI_COL_11:	00000099.500
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000099.500
	OP_COL_12:	00000099.500	FI_COL_12:	00000199.500
Pt (2,1)	OP_ROW_21:	00000119.500	FI_ROW_21:	00000219.500
	OP_COL_21:	00000000.500	FI_COL_21:	00000099.500
Pt (2,2)	OP_ROW_22:	00000119.500	FI_ROW_22:	00000219.500
	OP_COL_22:	00000099.500	FI_COL_22:	00000199.500

5.13 Appendix C, Chipped Output Product - Multiple Scan Blocks

This example demonstrates generation of two chips, each the size of NROWS = 90 and NCOLS = 70. The source image is of the size NROWS = 308 and NCOLS = 300 and is comprised of 3 scan blocks, each of size NROWS = 100 and NCOLS = 300, and 4 rows of pad pixel separation between each adjacent scan block pair. One chip will be taken from the first scan block starting with scan block 1's pixel 004, 069. The second chip will be taken from the third scan block starting with its pixel 004,149 (see Note 1).

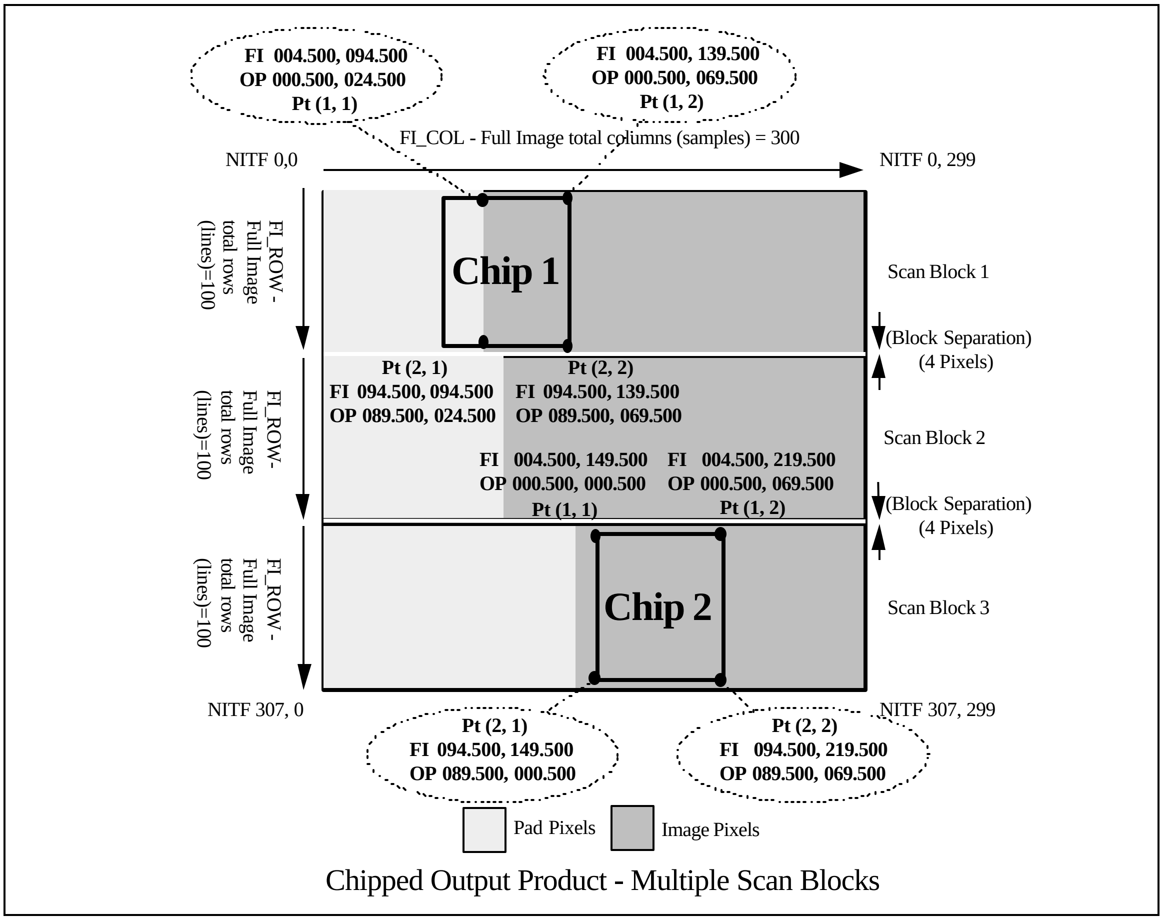


FIGURE 5-6. CHIPPED OUTPUT PRODUCT - MULTIPLE SCAN BLOCKS

For this example, consideration should be given to cases where applications cut chips on some fixed row and column multiple, such as those that chip on "FAF boundaries." If these conditions exist and there is a desire for the area of interest to be in the center of the image chip, the resulting chip may include some pad pixels as part of its significant image data. While this may not be desirable from an aesthetic perspective, it does not present any functional limitations. With proper application of ICHIPB corner points and use of the support data that will accompany the chip, the means exist to navigate beyond the pad pixels and into the intelligent pixels in the resulting chip.

In the above examples, Output Product (OP) values reflect the actual intelligent pixel grid corner points of the image chips as they would stand independently, while the Full Image (FI) values provide those same OP points' values in the full image's (scan block 1 for Chip 1; scan block 3 for Chip 2) corresponding grid space. Since the Support Data Extensions (SDEs) that will be included with each image chip will provide separate coverage for each 100 x 300 FI scan block individually, ICHIPB's FI_ROW and FI_COL in each example will be populated with the values 00000100 and 00000300, respectively. Since Chip 1 was cut from scan block 1 and Chip 2 was cut from scan block 3, each chip's ICHIPB SCANBLK_NUM field will be populated with 01 and 03, respectively. The ICHIPB grid corner point fields will be populated as follows:

ICHIPB Grid Corner Points - Chip 1

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	00000004.500
	OP_COL_11:	00000024.500	FI_COL_11:	00000094.500
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000004.500
	OP_COL_12:	00000069.500	FI_COL_12:	00000139.500
Pt (2,1)	OP_ROW_21:	00000089.500	FI_ROW_21:	00000094.500
	OP_COL_21:	00000024.500	FI_COL_21:	00000094.500
Pt (2,2)	OP_ROW_22:	00000089.500	FI_ROW_22:	00000094.500
	OP_COL_22:	00000069.500	FI_COL_22:	00000139.500

ICHIPB Grid Corner Points - Chip 2

Pt (1,1)	OP_ROW_11:	00000000.500	FI_ROW_11:	00000004.500
	OP_COL_11:	00000000.500	FI_COL_11:	00000149.500
Pt (1,2)	OP_ROW_12:	00000000.500	FI_ROW_12:	00000004.500
	OP_COL_12:	00000069.500	FI_COL_12:	00000219.500
Pt (2,1)	OP_ROW_21:	00000089.500	FI_ROW_21:	00000094.500
	OP_COL_21:	00000000.500	FI_COL_21:	00000149.500
Pt (2,2)	OP_ROW_22:	00000089.500	FI_ROW_22:	00000094.500
	OP_COL_22:	00000069.500	FI_COL_22:	00000219.500

Cutting chips across scan blocks is highly discouraged at this time because of the complications that may arise from the independent support data that exists for each scan block. Since only one set of support data can be referred to via the ICHIPB's SCANBLK_NUM, coverage for the entire chip will not be possible and errors or incorrect values may result when attempting geographical point positioning or performing other measurements in the other areas represented by the "uncovered" scan blocks. Accordingly, chips resembling those in the following examples should be avoided.

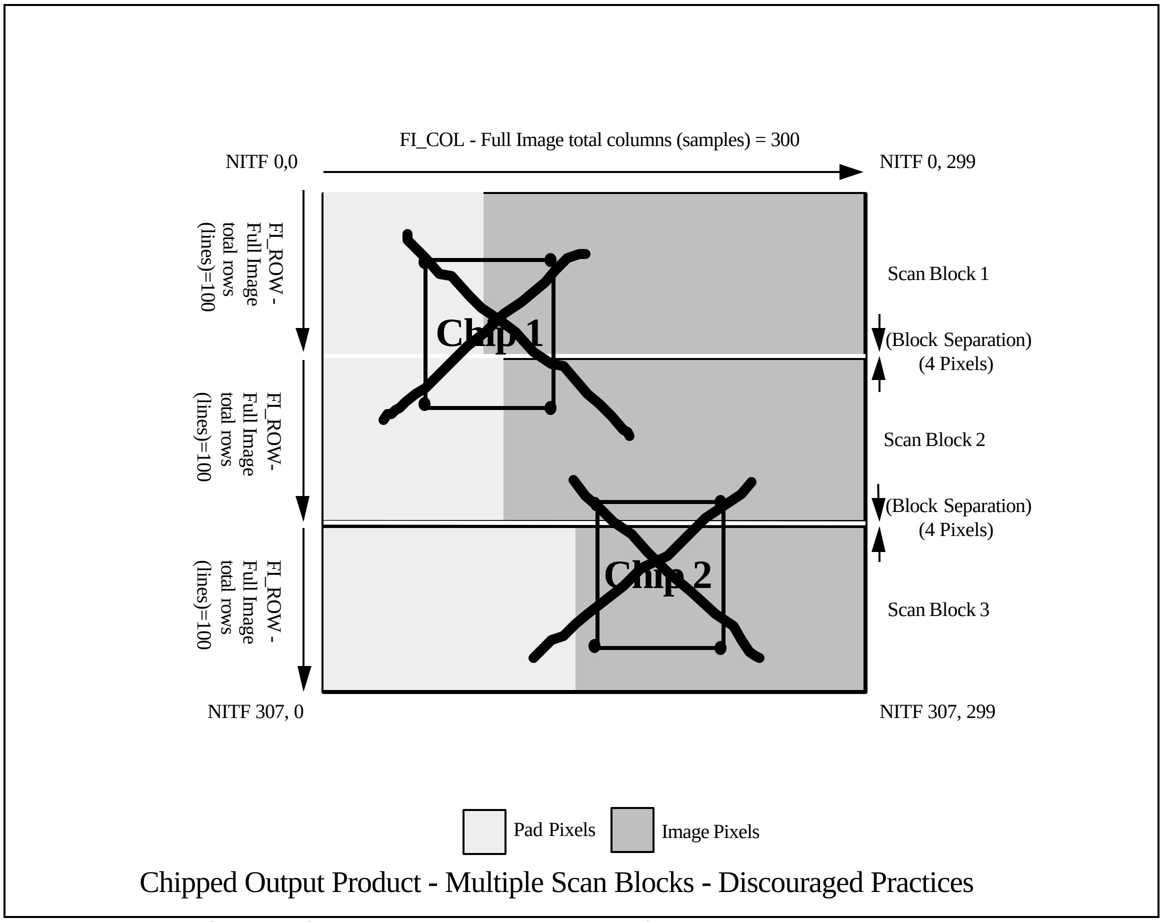


FIGURE 5-7. CHIPPED OUTPUT PRODUCT - MULTIPLE SCAN BLOCKS - DISCOURAGED PRACTICES

(Note 1: Using each individual scan block's 0,0 pixel to determine a chip's relative location in the block is a generic approach used in this document. Sensor products, both now and in the future, may use different scan block separation schemes and, as such, cannot be addressed in this document. If a scan block separation scheme is known, it would be possible for a NITF interpreter to calculate the chip's offsets from the beginning of the entire NITF image data; however, the interpreter would have to be cognizant of all schemes it will process to be able to produce chips in this manner. Since ICHIPB is not intended to be community or sensor specific, and support data is specific to each scan block, individual 0,0 pixel points are used to determine chip offsets within scan blocks.)

6.0 Profile for Imagery Access Image Support Extensions

6.1 PIAE 1.0 - Version C

This support extension is designed to provide an area to place fields not currently carried in NITF but are contained in the Standards Profile for Imagery Access (SPIA). Most imagery related information is contained in the NITF main headers and Support Data Extensions (SDEs). The purpose of this extension is to minimize redundant fields while providing space for all information. This extension shall be present no more than once for each image in the NITF file. When present, this extension shall be contained within the image extended subheader data field of the image subheader or within an overflow DES if there is insufficient room to place the entire extension within the image extended subheader data field.

Table 6-1. Profile for Imagery Access Image (PIAIMC)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAIMC	R
CEL	Length Of PIAIMC Extension	5	00362	R
CEDATA	User-Defined Data	362	table 6-2	R

Table 6-2. Profile for Imagery Access Image (PIAIMC) Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
CLOUDCVR	Cloud Cover	3	N	000 to 100, 999	O
SRP	Standard Radiometric Product	1	A/N	Y, N	O
SENSMODE	Sensor Mode	12	A/N	WHISKBROOM, PUSHBROOM, FRAMING, SPOT, SWATH, TBD	O
SENSNAME	Sensor Name	18	A/N	USIGS DM, SENSOR - TYPE Name	O
SOURCE	Source	255	A/N	alphanumeric	O
COMGEN	Compression Generation	2	N	00 to 99	O
SUBQUAL	Subjective Quality	1	A/N	P-Poor, G - Good, E - Excellent, F- Fair	O
PIAMSNNUM	PIA Mission Number	7	A/N	EARS 1.1 page 4-28	O
CAMSPECS	Camera Specs	32	A/N	alphanumeric	O
PROJID	Project ID Code	2	A/N	EARS Appendix 9	O
GENERATION	Generation	1	N	0 to 9	O
ESD	Exploitation Support Data	1	A/N	Y, N	O
OTHERCOND	Other Conditions	2	A/N	EARS 1.1 page 4 to 28	O
MEAN GSD	MEANGSD	7	N	00000.0 to 99999.9 Expressed in inches, accuracy=10%	O

Table 6-2. Profile for Imagery Access Image (PIAIMC) Data and Ranges (continued).

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
IDATUM	Image Datum	3	A/N	Horizontal_Reference_Datum_Code (refer to DDDS element	O
IELLIP	Image Ellipsoid	3	A/N	DIGEST, Part 3, table 8-1	O
PREPROC	Image Processing Level Code	2	A/N	USIGS DM, IMAGE-DATASET Processing Level Code	O
IPROJ	Image Projection System	2	A/N	DIGEST, Part 3, table 6-1	O
SATTRACK	Satellite Track	8	N	Minimum values: PATH(J)=0001 ROW(K)=0001 Maximum values: PATH(J)=9999 ROW(K)=9999 Recorded as PATH/ROW=00010001 to 99999999	O

Table 6-3. Description of PIAIMC Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CLOUDCVR	Indicates the percentage of the image that is obscured by cloud. A value of 999 indicates an unknown condition.
SRP	Indicates whether or not standard radiometric product data is available.
SENSMODE	Identifies the sensor mode used in capturing the image.
SENSNAME	Identifies the name of the sensor used in capturing the image.
SOURCE	Indicates where the image came from (e.g., magazine, trade show, etc.).
COMGEN	Counts the number of lossy compressions done by the archive.
SUBQUAL	Indicates a subjective rating of the quality of the image.
PIAMSNNUM	Indicates the mission number assigned to the reconnaissance mission.
CAMSPECS	Specifies the brand name of the camera used, and the focal length of the lens.
PROJID	Identifies collection platform project identifier code.
GENERATION	Specifies the number of image generations of the product. The number (0) is reserved for the original product.
ESD	Indicates whether or not Exploitation Support Data is available and contained within the product data.
OTHERCOND	Indicates other conditions that affect the imagery over the target.
MEANGSD	The geometric mean of the across and along scan center-to-center distance between contiguous ground samples.

Table 6-3. Description of PIAIMC Data Fields (continued).

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
IDATUM	Identifies the mathematical representation of the earth used to geo-correct/or to rectify the image. (Identifies the Datum associated with IGEOLO.)
IELLIP	Identifies the mathematical representation of the earth used to geo-correct/or to rectify the image. (Identifies the Ellipsoid associated with IGEOLO.)
PREPROC	Identifies the level of radiometric and geometric processing applied to the product by the commercial vendor.
IPROJ	Identifies the 2D-map projection used by commercial vendors to geo-correct/or to rectify the image.
SATTRACK	Identifies location of an image acquired by LANDSAT or SPOT (only) along the satellite path.

6.2 Profile for Imagery Access Product Support Extension - Version D

The data found in the Product Support Extension addresses information regarding the products derived from source imagery. While there is product-related data in the NITF main header and SDEs, many fields contained in the Standards Profile for Imagery Access (SPIA) are absent. This extension aligns the SPIA and NITF for product information, and adds descriptive detail associated with products. This extension shall be present no more than once for each product. When present, this extension shall be contained within the extended header data field of the NITF file header or within an overflow DES if there is insufficient room to place the entire extension within the file's extended header data field.

Table 6-4. Profile for Imagery Access Product (PIAPRD)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAPRD	R
CEL	Length Of PIAPRD Extension	5	00201 to 63759	R
CEDATA	User-Defined Data	201 to 63759	table 6-5	R

Table 6-5. PIAPRD Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
ACCESSID	Access ID	64	A/N	alphanumeric	O
FMCONTROL	FM Control Number	32	A/N	alphanumeric	O
SUBDET	Subjective Detail	1	A/N	P- Poor, F - Fair, G - Good, E - Excellent	O
PRODCODE	Product Code	2	A/N	EARS 1.1 Appendix 6	O
PRODUCERSE	Producer Supplement	6	A/N	alphanumeric	O
PRODIDNO	Product ID Number	20	A/N	alphanumeric	O
PRODSNME	Product Short Name	10	A/N	alphanumeric	R
PRODUCERCD	Producer Code	2	A/N	alphanumeric	O
PRODCRTIME	Product Create Time	14	A/N	CCYYMMDDHHMMSS (ZULU)	O
MAPID	Map ID	40	A/N	alphanumeric	O
SECTITLEREP	SECTITLE Repetitions	2	N	00 to 99	R
SECTITLE1	Section Title	40	A/N	alphanumeric	C
PPNUM1	Page/Part Number	5	A/N	alphanumeric	C
TPP1	Total Pages/Parts	3	N	001 to 999	C
....					
SECTITLEnn	Section Title	40	A/N	alphanumeric	C
PPNUMnn	Page/Part Number	5	A/N	alphanumeric	C

Table 6-5. PIAPRD Data and Ranges (continued)

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TPPnn	Total Pages/Parts	3	N	001 to 999	C
REQORGREP	REQORG Repetitions	2	N	00 to 99	R
REQORG1	Requesting Organization	64	A/N	alphanumeric	C
....					
REQORGnn	Requesting Organization	64	A/N	alphanumeric	C
KEYWORDREP	KEYWORD Repetitions	2	N	00 to 99	R
KEYWORD1	Keyword String 1	255	A/N	alphanumeric	C
....					
KEYWORDnn	Keyword String nn	255	A/N	alphanumeric	C
ASSRPTREP	ASSRPT Repetitions	2	N	00 to 99	R
ASSRPT1	Associated Report 1	20	A/N	alphanumeric	C
....					
ASSRPTnn	Associated Report nn	20	A/N	alphanumeric	C
ATEXTREP	ATEXT Repetitions	2	N	00 to 99	R
ATEXT1	Associated Text 1	255	A/N	alphanumeric	C
....					
ATEXTnn	Associated Text nn	255	A/N	alphanumeric	C

Table 6-6. Description of PIAPRD Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ACCESSID	Contains an archive unique identifier. This could be the product filename, a record identifier, a reference number, the product id, or any other means to access the product from the archive.
FM CONTROL	Identifies foreign material associated with the product.
SUBDET	Indicates a subjective rating of useful detail available in the product.
PRODCODE	Identifies the category of product data stored in the archive.
PRODUCERSE	Identifies the element within the producing organization that created the product.
PRODIDNO	Identifies a product stored in the archive with a producer assigned number.
PRODSNME	Identifies the abbreviated name of a product stored in the archive.
PRODUCERCD	Identifies the organization responsible for creating or modifying the product.
PRODCRTIME	Identifies the date or the date and time that the product was created or last modified, expressed in ZULU time

Table 6-6. Description of PIAPRD Data Fields (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MAPID	Identifies a map associated with the product.
SECTITLEREP	Identifies the number of times the SECTITLE, PPNUM, and TPP fields repeat per extension instance.
SECTITLE1	Identifies the first user defined title of a section of a multi-section product.
PPNUM1	Identifies the first page/part number of the section identified in SECTITLE1.
TPP1	Identifies the total number of pages or parts associated with SECTITLE1 and PPNUM1.
SECTITLEnn	Identifies the nnth user defined title of a section of a multi-section product.
PPNUMnn	Identifies the nnth page/part number of the section identified in SECTITLEnn.
TPPnn	Identifies the nnth number of pages or parts associated with SECTITLEnn and PPNUMnn.
REQORGREP	Identifies the number of times the REQORG field repeats per extension instance.
REQORG1	Identifies the first organization requesting that an image be placed in an archive. This is the first field represented based on the value of REQORGREP.
REQORGnn	Identifies the nnth organization requesting that an image be placed in an archive. The number of REQORGs between the previous field and this is represented in the REQORGREP field.
KEYWORDREP	Identifies the number of times the KEYWORD field repeats per extension instance.
KEYWORD1	Provides the first block of a freeform text description of the product.
KEYWORDnn	Provides the nnth block of a freeform text description of the product. The number of KEYWORDSs between the previous field and this is represented in the KEYWORDREP field.
ASSRPTREP	Identifies the number of times the ASSRPTREP field repeats per extension instance.
ASSRPT1	First field for the entry of another known report associated with the product.
ASSRPTnn	Provides the nnth field of other known reports associated with the product. The number of ASSRPTs between the previous field and this is represented in the ASSRPTREP field.
ATEXTREP	Identifies the number of times the ATEXTREP field repeats per extension instance.
ATEXT1	Provides the first text block further describing the imagery product.
ATEXTnn	Provides the nnth text block further describing the imagery product. The number of ATEXTs between the previous field and this is represented in the ATEXTREP field.

6.3 Profile for Imagery Access Target Support Extension - Version B

The Target Extension is designed to accommodate more than just the essential target data. It contains descriptive data about the targets. This extension shall be present once for each target identified in the image. There may be up to 250 of these extensions for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

Table 6-7. Profile for Imagery Access Target (PIATGB)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIATGB	R
CEEL	Length of PIATGB Extension	5	000117	R
CEDATA	User-Defined Data	117	table 6-8	R

Table 6-8. PIATGB Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TGTUTM	Target UTM	15	A/N	XXXNNnnnnnnnnnn	O
PIATGAID	Target Identification	15	A/N	6 character Area Target ID 10 Character BE, or 15 character BE + suffix	O
PIACTRY	Country Code	2	A/N	FIPS 10-4	O
PIACAT	Category Code	5	N	DIAM 65-3-1	O
TGTGEO	Target Geographic Coordinates	15	A/N	ddmmssXdddmmssY	O
DATUM	Target Coordinate Datum	3	A/N	In accordance with Appendix B, Attachment 10, XI-DBDD-08 93 Aug 93.	O
TGTNAME	Target Name	38	A/N	alphanumeric target names	O
PERCOVER	Percentage of Coverage	3	N	000 to 100	O
TGTLAT	Target Latitude	10	N	±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 blank.	O

Table 6-8. PIATGB Data and Ranges (continued)

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TGTLON	Target Longitude	11	N	±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 blank.	O

Table 6-9. Description of PIATGB Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
TGTUTM	Identifies the Universal Transverse Mercator (UTM) grid coordinates that equate to the geographic coordinates of the target element.
PIATGAID	Identifies a point or area target (DSA, LOC or BAS).
PIACTRY	Identifies the country in which the geographic coordinates of the target element reside.
PIACAT	Classifies a target element by its product or the type of activity in which it can engage.
TGTGEO	Specifies a point target's geographic location in latitude and longitude.
DATUM	Identifies the datum of the map used to derive the target coordinates (UTM or GEO).
TGTNAME	Identifies the official name of the target element based on the MIIDS/IDB name.
PERCOVER	Percentage of the target covered by the image.
TGTLAT	Specifies a point target's geographic location in latitude (in decimal degrees).
TGTLON	Specifies a point target's geographic location in longitude (in decimal degrees).

6.4 Profile for Imagery Access Person Identification Extension - Version B

The Person Extension is designed to identify information contained in the Imagery Archive that is directly related to a person(s) contained in a data type (image, symbol, label, and text). This extension shall be present for each person identified in a data type. There may be up to 500 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

Table 6-10. Profile for Imagery Access Person (PIAPEB)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAPEB	R
CEL	Length of PIAPEB Extension	5	00094	R
CEEDATA	User-Defined Data	94	table 6-11	R

Table 6-11. PIAPEB Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
LASTNME	Last Name	28	A/N	alphanumeric	O
FIRSTNME	First Name	28	A/N	alphanumeric	O
MIDNME	Middle Name	28	A/N	alphanumeric	O
DOB	Birth Date	8	A/N	CCMMDDYY	O
ASSOCTRY	Associated Country	2	A/N	Per FIPS 10-4	O

Table 6-12. Description of PIAPEA Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
LASTNME	Identifies the surname of individual captured in an image.
FIRSTNME	Identifies the first name of individual captured in an image.
MIDNME	Identifies the middle name of individual captured in an image.
DOB	Identifies the birth date of the individual captured in the image.
ASSOCTRY	Identifies the country the person captured in the image is/are associated with.

6.5 Profile for Imagery Access Event Extension - Version A

The Event Extension is designed to provide an area for specific information about an event or events that are identified on an image. This extension shall be present for each event identified in an image. There may be up to 100 of these extensions present for each data type in a NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

Table 6-13. Profile for Imagery Access Event (PIAEVA)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAEVA	R
CEL	Length of PIAEVA Extension	5	00046	R
CEDATA	User-Defined Data	46	table 6-14	R

Table 6-14. PIAEVA Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
EVENTNAME	Event Name	38	A/N	alphanumeric	O
EVENTTYPE	Event Type	8	A/N	POL, DIS, COMMO, MILEX, ECON, NUC, SPACE, MILMOV, CIVIL	O

Table 6-15. Description of PIAEVA Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
EVENTNAME	The recognized name of the event.
EVENTTYPE	Indicates the generic type of event associated with the product.

6.6 Profile for Imagery Access Equipment Extension - Version A

The Equipment Extension was created to provide space in the NITF file for data contained in the archive that is specifically related to equipment that is contained in an image. This extension shall be present for each instance of equipment identified in an image. There may be up to 250 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

Table 6-16. Profile for Imagery Access Equipment (PIAEQA)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAEQA	R
CEL	Length of PIAEQA	5	00130	R
CEDATA	User-Defined Data	130	table 6-17	R

Table 6-17. PIAEQA Data and Ranges

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
EQPCODE	Equipment Code	7	A/N	NGIC Foreign Equipment Guide	O
EQPNOMEN	Equipment Nomenclature	45	A/N	NGIC Foreign Equipment Guide	O
EQPMAN	Equipment Manufacturer	64	A/N	alphanumeric	O
OBTYPE	OB Type	1	A/N	MIIDS/IDB	O
ORDBAT	Type Order of Battle	3	A/N	EARS 1.1	O
CTRYPROD	Country Produced	2	A/N	FIPS 10-4	O
CTRYDSN	Country Code Designed	2	A/N	FIPS 10-4	O
OBJVIEW	Object View	6	A/N	Right, Left, Top, Bottom, Front, Rear	O

Table 6-18. Description of PIAEQA Data Fields

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
EQPCODE	A unique designated equipment code identifying a category of equipment.
EQPNOMEN	Nomenclature used to identify a piece of equipment.
EQPMAN	Identifies the manufacturer of a piece of equipment.
OBTYPE	Indicates the type of order of battle according to MIIDS/IDB
ORDBAT	Indicates the type of order of battle according to EARS 1.1
CTRYPROD	Identifies the country that produced the object
CTRYDSN	Identifies the country that designed the original object
OBJVIEW	View of the object.

6.7 Image Access Data Element Mapping to NITF

The following table maps all Imagery Access data elements to their proper location in a NITF file when transmitting imagery data and associated metadata.

Table 6-19. Image Access Data Element mapping to NITF

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
ABPP (N2)	ABPP	IMAGE SUBHEADER
ACCESSID (A/N64)	ACCESSID	PIAPRC, PIAPRD
ANGLETONORTH (N3)	ANGLE_TO_NORTH	USEN1A, USEN2A, USEN2B, EXPLTA, EXQPTA, USE00A
ASSOCTRY (A2)	ASSOCTRY	PIAPEA, PIAPEB
ASSRPT (A/N20)	ASSRPT	PIAPRC, PIAPRD
ATEXT (A/N255)	ATEXT	PIAPRC, PIAPRD
AUTHORITY (A/N20) ATUHORITY (A/N40)	FSCAUT (2500A) FSCAUT (2500B)	HEADER
AUTHTYP (A/N 1)	FSCATP (2500B)	HEADER
CAMSPECS (A/N 32)	CAMSPECS	PIAIMB, PIAIMC
CAT (N5)	PIACAT	PIATGA , PIATGB
CLASS (A1)	FSCLAS	HEADER
CLASSRSN (A/N 1)	FSCRSN (2500B)	HEADER
CLASSYS (A/N 2)	FSCLSY (2500B)	HEADER
CLASTXT (A/N 44)	FSCLTX (2500B)	HEADER
CLEVEL (N2)	CLEVEL	HEADER
CLOUDCVR (N3)	CLOUDCVR	PIAIMB, PIAIMC
CODEWORDS (A/N40) CODEWORDS (A/N11)	FSCODE (2500A) FSCODE (2500B)	HEADER
COMGEN (N2)	COMGEN	PIAIMB, PIAIMC
CONTROL (A/N40) CONTROL (A/N2)	FSCTLH (2500A) FSCTLH (2500B)	HEADER
CTRYCD (A2)	PIACTRY	PIATGA, PIATGB
CTRYDSN (A2)	CTRYDSN	PIAEQA
CTRYPROD (A2)	CTRYPROD	PIAEQA
DATUM (A3)	DATUM	PIATGA, PIATGB
DOB (A/N6) DOB (A/N8)	DOB DOB	PIAPEA PIAPEB
DWNG (A/N6)	FSDDVT (2500A)	HEADER
WNGFEVT (A/N40)	FSDEVT (2500A)	HEADER
DECLASTYP (A/N 2)	FSDCTP (2500B)	HEADER
DECLASSDTE (A/N 8)	FSDCDT (2500B)	HEADER
DECLASXMP (A/N 4)	FSDCXM (2500B)	HEADER
DWNGRD (A/N 1)	FSDG (2500B)	HEADER
DWNDTE (A/N 8)	FSDGDT (2500B	HEADER
EQPCODE (A/N7)	EQPCODE	PIAEQA
EQPMAN (A64)	EQPMAN	PIAEQA

Table 6-19. Image Access Data Element mapping to NITF (continued)

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
EQPNOMEN (A/N45)	EQPNOMEN	PIAEQA
ESD (A1)	ESD	PIAIMB, PIAIMC
EVENTNAME (A/N38)	EVENTNAME	PIAEVA
EVENTTYPE (A8)	EVENTTYPE	PIAEVA
FCNTLNR (A/N15)	FSCTLN (2500B)	HEADER
FIRSTNME (A/N 28)	FIRSTNME	PIAPEA, PIAPEB
FMCONTROL(A/N32)	FMCONTROL	PIAPRC, PIAPRD
GENERATION(N1)	GENERATION	PIAIMB, PIAIMC
ICAT(A8)	ICAT	IMAGE SUBHEADER
ICORDS (A1)	ICORDS	IMAGE SUBHEADER
ICRNPTS (N84)	IGEOLO (TRUNCATED TO N60)	IMAGE SUBHEADER
IDATUM (A/N3)	IDATUM	PIAIMC
IELLIP (A/N3)	IELLIP	PIAIMC
IGEOLO (A/N60)	IGEOLO	IMAGE SUBHEADER
IMAGEID (A/N80)	ITITLE	IMAGE SUBHEADER
IPROJ (A/N2)	IPROJ	PIAIMC
IREP (A8)	IREP	IMAGE SUBHEADER
KEYWORD (A/N 255)	KEYWORD	PIAPRC, PIAPRD
LASTNME (A/N28)	LASTNME	PIAPEA, PIAPEB
LICENSE (A/N50)	ICOM (License values will be transmitted in the first 50 bytes of the comments field)	IMAGE SUBHEADER
MAPID (A/N40)	MAPID	PIAPRC, PIAPRD
MEANGSD (N5) MEANGSD (N7)	MEAN_GSD MEAN_GSD	USEN1A, EXOPTA, USE00A PIAIMC
MIDNME (A/N28)	MIDNME	PIAPEA, PIAPEB
MISSION (A/N7)	PIAMSNNUM	PIAIMB, PIAIMC
NBANDS (N1) NBANDS (N5)	NBANDS (2500A) XBANDS (2500B)	IMAGE SUBHEADER
NCOLS (N8)	NCOLS	IMAGE SUBHEADER
NIIRS (N3)	NIIRS NRIS	USEN1A IMBLKA, IMBLKB
NROWS (N8)	NROWS	IMAGE SUBHEADER
OBJVIEW (A6)	OBJVIEW	PIAEQA
OBLANGLE (N5)	OBL_ANG	USEN1A, EXOPTA, USEOOA
OBTYPE (A1)	OBTYPE	PIAEQA
ORDBAT(A/N3)	ORDBAT	PIAEQA
OTHERCOND (A2)	OTHERCOND	PIAIMB, PIAIMC
PERCOVER (N3)	PERCOVER	PIATGA, PIATGB
PLATID (A/N14)	MISSION	STDIDC
PPNUM (A/N4)	PPNUM	PIAPRC, PIAPRD
PREPROC (A/N2)	PREPROC	PIAIMC
PRODCODE (A2)	PRODCODE	PIAPRC, PIAPRD
PRODCRTIME (A/N14)	PRODCRTIME	PIAPRC, PIAPRD
PRODFMT(A9)	FHDR	HEADER
PRODFSIZE (N12)	FL	HEADER
PRODIDNO (A/N20)	PRODIDNO	PIAPRC, PIAPRD
PRODSNME (A/N10)	PRODSNME	PIAPRC, PIAPRD

Table 6-19. Image Access Data Element mapping to NITF (continued)

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
PRODTITLE (A/N50)	FTITLE	HEADER
PRODUCERCD (A 2)	PRODUCERCD	PIAPRC, PIAPRD
PRODUCERSE (A/N 6)	PRODUCERSE	PIAPRC, PIAPRD
PROJID (A2)	PROJID	PIAIMB, PIAIMC
RELEASE (A/N40)	FSREL	HEADER
REQORG (A/N64)	REQORG	PIAPRC, PIAPRD
RPC (A1)	SUCCESS	RPC00A
SATTRACK	SATTRACK	PIAIMC
SECTITLE (A/N40)	SECTITLE	PIAPRC, PIAPRD
SENSMODE (A/N12)	SENSMODE	PIAIMB, PIAIMC
SENSNAME (A/N18)	SENSNAME	PIAIMB, PIAIMC
SOURCE (A/N255)	SOURCE	PIAIMB, PIAIMC
SRCDTE	FSSRDT (2500B)	HEADER
SRP (A1)	SRP	PIAIMB, PIAIMC
STEREOID (A/N40) STEREOID (A/N60)	ST_ID ST_ID	STREOA STREOB, STEROB
SUBDET (A1)	SUBDET	PIAPRC, PIAPRD
SUBQUAL (A1)	SUBQUAL	PIAIMB, PIAIMC
SUNAZ(N3)	SUN_AZ	MPDN1A, USE00A, EXOPTA
SUNELEV (N3)	SUN_EL	MPDN1A, USE00A, EXOPTA
TGTGEO (A/N15)	TGTGEO	PIATGA, PIATGB
TGTID (A/N15)	PIATGAID	PIATGA, PIATGB
TGTLAT (N10)	TGTLAT	PIATGB
TGTLON (N11)	TGTLON	PIATGB
TGTNAME (A/N38)	TGTNAME	PIATGA
TGTUTM (A/N16)	TGTUTM	PIATGA
TIMECOLL (A/N14)	IDATIM	IMAGE SUBHEADER
TPP (N3)	TPP	PIAPRC, PIAPRD

7.0 Commercial Support data extension (SDE)

7.1 Generic Tagged Extension Mechanism

The tagged record extensions defined in this document are CEs as defined in Section 5.9 of the NITF 2.0 document. The CE format is summarized here for ease of reference. Tables 7-1 and 7-2 describe the general format of a CE. NOTE: All blanks or spaces in this document are defined as ASCII spaces (i.e. hex '20') and are used interchangeably.

Table 7-1 Controlled Tagged Record Extension Format

R = required, C = conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type Identifier	6	alphanumeric	R
CEL	Length of CEDATA Field	5	00001 to 99985	R
CEDATA	User-Defined Data	†	User-defined	R

† Equal to value of CEL field

All fields of all of the tags defined within this section are of type "Required".

Table 7-2 Controlled Tagged Record Extension Field Descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain a valid alphanumeric identifier properly registered with the NTB.
CEL	This field shall contain the length in bytes of the data contained in CEDATA. The tagged record's length is 11+ the value of CEL.
CEDATA	This field shall contain data of either binary or character data types defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user-defined.

The CETAG and CEL fields essentially form a small (11 byte) tagged record subheader. The format and meaning of the data within the CEDATA field is the subject of this section for several, individual CEs.

Multiple tagged extensions can exist within the TRE area. There are several such areas, each of which can contain up to 99,999 bytes worth of tagged extensions. There is also an overflow mechanism, should the sum of all tags in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of tags. Figure 7-1 shows a diagram of the tagged extension locations within the NITF 2.0 file structure.

While the extensions defined in this document will typically be found in the image subheader, it is possible that they could appear in a DES that is being used as an overflow of the image subheader.

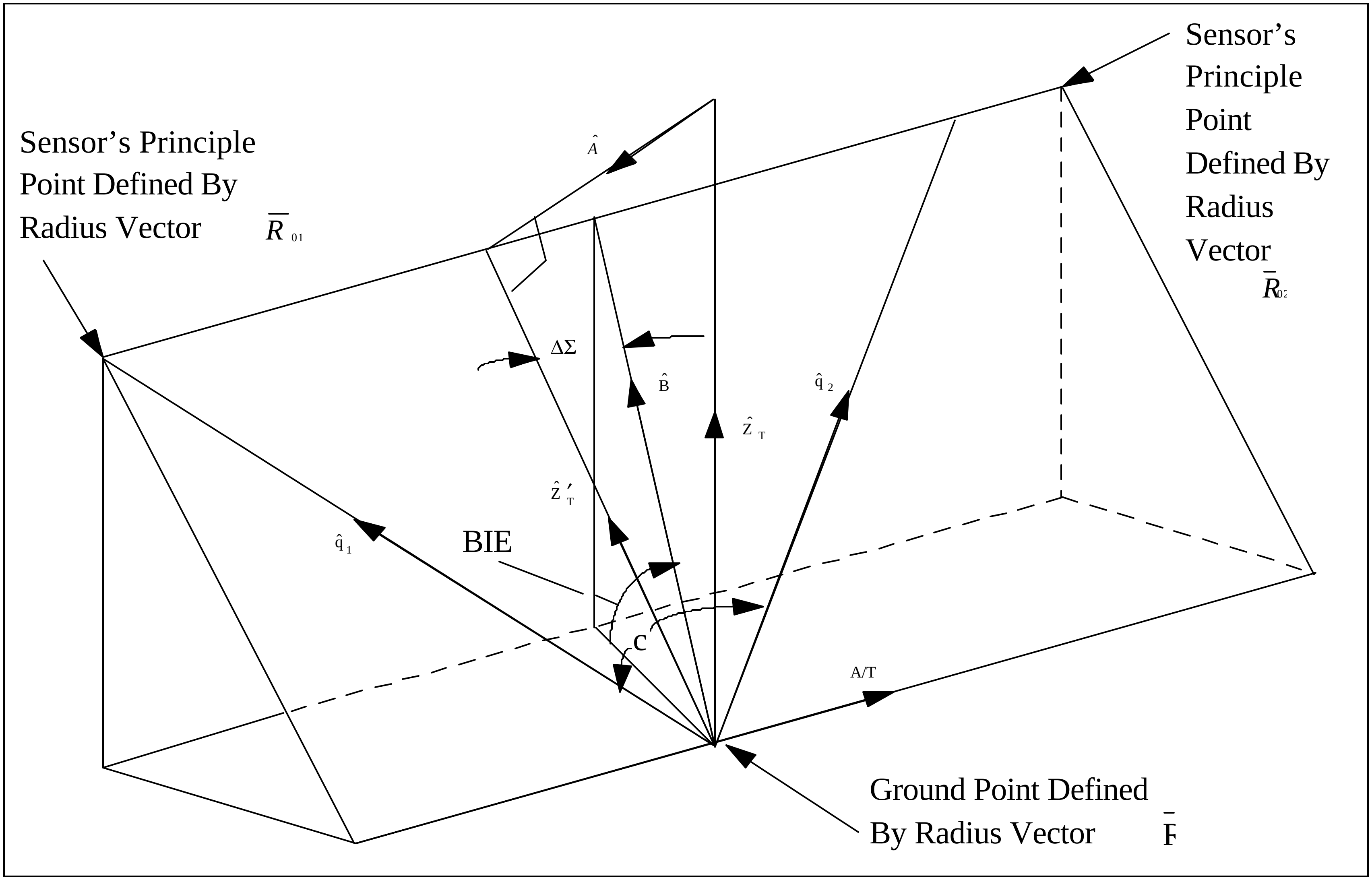


FIGURE 7-1. ILLUSTRATION OF ANGLES INVOLVED IN STEREO IMAGERY

7.2 STDIDC - Standard ID

The Standard ID extension contains image identification data that supplements the image subheader. Some parameters in this extension may be used by USIGS compliant systems. The format and description for the user-defined fields of the STDIDC extension are detailed in table 7-3. A single STDID is placed in the image subheader; where several images relate to a single scene; an STDIDC may be placed in each applicable image subheader. Note: The fields ACQUISITION_DATE through END_ROW constitute an image ID which is used by other SDEs (e.g., STREOB) to designate unique images for associating imagery pairs or sets.

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT

R = Required, C = Conditional, <> = null data allowed.

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
CETAG	Unique Extension Identifier	6	STDIDC	N/A	R
CEL	Length of Data Field	5	00089	bytes	R
The following fields define STDIDC					
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	YYYYMMDDHHMMSS		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.	14	alphanumeric Valid values as per list maintained by JITC		R
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	alphanumeric 01 to 99, A1 to A9 B1 to B9 … Z1 to Z9		R

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
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	000 to 999		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	AA to ZZ		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	00 to 99		R
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	alphanumeric		R
BLANK_FILL	Blank Fill	1	blank or _		<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 cross-scan direction relative to start of the original reference image tiling.	3	001 to 999		R

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
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 along-scan direction relative to start of the original reference image tiling.	5	00001 to 99999		R
END_SEGMENT	Ending Segment ID of this file	2	AA to ZZ		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	001 to 999		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 along-scan direction relative to start of the original reference image tiling.	5	00001 to 99999		R
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	AA to ZZ		<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	0001 to 1866		<R>

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
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	DDMMXDDDMMY		R
	reserved	5	spaces		<R>
	reserved	8	spaces		<R>

7.3 USE00A - Exploitation Usability

The Exploitation Usability extension is intended to allow a user program to determine if the image is usable for the exploitation problem currently being performed. It also contains some catalogue metadata. The format and descriptions for the user-defined fields of the USE00A are detailed in table 7-4.

Table 7-4. USEOOA - Exploitation Usability Extension Format

R = Required, C = Conditional, < > = null data allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	USEOOA	N/A	R
CEL	Length Data Fields	5	00107	bytes	R
The following fields define USE00A					
ANGLE_TO_NORTH	Angle to North. Angle to true north measured clockwise from first row of the image.	3	000 to 359	degrees	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	000.0 to 999.9	inches	R
	reserved	1	spaces		<R>
DYNAMIC_RANGE	Dynamic Range. Dynamic range of pixels in image.	5	00000 to 99999		<R>
	reserved	3	spaces		<R>
	reserved	1	spaces		<R>
	reserved	3	spaces		<R>
OBL_ANG	Obliquity Angle	5	00.00 to 90.00	degrees	<R>
ROLL_ANG	Roll Angle	6	±90.00	degrees	<R>
	reserved	12	spaces		<R>
	reserved	15	spaces		<R>
	reserved	4	spaces		<R>
	reserved	1	space		<R>
	reserved	3	spaces		<R>
	reserved	1	spaces		<R>
	reserved	1	space		<R>

Table 7-4. USE00A - Exploitation Usability Extension Format (continued)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
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	00 to 99		R
REV_NUM	Revolution Number. The revolution number in effect at the northernmost point of orbit.	5	00001 to 99999		R
N_SEG	Number of Segments	3	001 to 999		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	000001 to 999999		<R>
	reserved	6	spaces		R
	reserved	6	spaces		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	-90.0 to +90.0, or 999.9	degrees	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	000.0 to 359.0, or 999.9	degrees	R

7.4 STREOB - Stereo Information

The STREO extension provides links between several images that form a stereo set to allow exploitation of elevation information. There can be up to 3 STREO extensions per image. The format and descriptions for the User Defined fields of the STREOB extension is detailed in table 7-5. The Stereo geometry definitions for Bisector Elevation Angle (BIE), convergence angle, and asymmetry angle are specified in paragraph 2.3.1.

Table 7-5. STREOB - Stereo Information Extension Format
R = Required, C = Conditional, < > = null data allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	STREOB	N/A	R
CEL	Length of Data Field	5	00094	bytes	R
The Following Fields Define STREOB :					
ST_ID	Stereo Mate. The image ID of the first stereo mate. The fields ACQUISITION_DATE through END_ROW in the STDIDC tag constitute the image ID.	60	alphanumeric	N/A	R
N_MATES	Number of Stereo Mates. If there are no stereo mates, there will not be any STREOB (TBR) extensions in the file. If there is a STREOB (TBR) extension, then there will be at least 1 stereo mate.	1	1 to 3	N/A	R
MATE_INSTANCE	Mate Instance identifies which stereo mate is described in that extension. For example, this field contains a 2 for the second stereo mate.	1	1 to 3	N/A	R
B_CONV	Beginning Convergence Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_CONV	Ending Convergence Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>

Table 7-5. STREOB - Stereo Information Extension Format (continued)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
B_ASYM	Beginning Asymmetry Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_ASYM	Ending Asymmetry Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
B_BIE	Beginning BIE less Convergence Angle of Stereo Mate, defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	6	± 90.00	degrees	<R>
E_BIE	Ending BIE less Convergence Angle of Stereo Mate, defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	6	± 90.00	degrees	<R>

7.5 Stereo Geometry Definitions

Refer to figure 7-1. Stereo geometry is often described in terms of convergence angle and asymmetry angle at a ground point defined by radius vector $\overline{\mathrm{R}}$. These angles are measured in the plane formed by the two lines of sight (one for each image) to the ground point. Given the geocentric radius vectors to the sensor's principle point for the two images, $\overline{\mathrm{R}}_{01}$ and $\overline{\mathrm{R}}_{02}$, the two line of sight vectors to the ground point are given by:

$$\overline{L}_1 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{01}$$

$$\overline{L}_2 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{02}$$

Where all of the above vectors are defined in the S_E coordinate system. Let:

$$\hat{q}_1 = -\overline{L}_1 \ / \ |\overline{L}_1|$$

$$\hat{q}_2 = -\overline{L}_2 \ / \ |\overline{L}_2|$$

The convergence angle, C, is the angle between $\hat{q}_1$ and $\hat{q}_2$ and is given by:

$$C = \cos^{-1}(\hat{q}_1 \bullet \hat{q}_2), \quad 0 \le C \le p$$

The asymmetry angle, ♠3, at a ground point is the angle between the projection of $\hat{Z}_T$ into the plane of the convergence angle and the bisector, B, of the convergence angle. $\hat{Z}_T$ is the ground geocentric "up" and is defined by geocentric radius vector $\overline{R}$,

$$\hat{Z}_T = \overline{R} \ / \ |\overline{R}|$$

Define vector $\hat{\mathrm{A}}$ perpendicular to the plane of the convergence defined by vectors $\hat{q}_1$ and $\hat{q}_2$. Then:

$$\hat{\mathrm{A}} = (\hat{q}_1 \times \hat{q}_2) / |\hat{q}_1 \times \hat{q}_2|$$

The unit vector along the projection of $\hat{Z}_T$ into the plane of the convergence, $\hat{Z}'_T$ is given by:

$$\hat{Z}'_T = \hat{A} \times (\hat{Z}_T \times \hat{A}) \ / \ |\hat{A} \times (\hat{Z}_T \times \hat{A})|$$

The unit vector along the bisector, $\hat{\mathrm{B}}$, of the convergence angle (the angle between $\hat{q}_1$ and $\hat{q}_2$) is given by:

$$\hat{B} = (\hat{q}_1 + \hat{q}_2) \ / \ |\hat{q}_1 + \hat{q}_2|$$

The asymmetry angle is computed by:

$$\Delta\Sigma = \cos^{-1}(\hat{\mathrm{B}} \bullet \hat{\mathrm{Z}}'_T), \quad 0 \le \Delta\Sigma \le p/2$$

If $\hat{Z}'_T$ lies in the positive Along-Track (A/T) direction from $\hat{\mathrm{B}}$,

$$\hat{A} \bullet \left(\hat{Z}'_T \times \hat{B} \right) < 0$$

Note that figure 7-1 shows $\hat{Z}'_T$ in the minus A/T direction from $\hat{B}$. The elevation angle of the bisector of the Stereo Convergence Angle, BIE is given by:

$$\text{BIE} = \sin^{-1}\left(\hat{Z}_T \bullet \hat{B} \right)$$

7.6 Exploitation and Mapping Support Data (TBR)

The Exploitation and Mapping Support Data Extension will provide the necessary information to perform accurate geo-positioning and mensuration. The Government has agreed to provide resolution as to form and content.

Background. This data extension may be executed in either of two methods:

1) A Rational Polynomial Relating Position to Image Coordinates plus Associated Error Propagation

   – Candidate Models: RPC, Universal Math Model

   – Technique does require user to maintain proprietary sensor camera models

   – Issues with regard to accuracy, precision & error propagation to be addressed for mapping applications

2) Ephemeris-based Geo-positioning

   – Allows user to perform triangulation to determine location and associated errors

   – Requires use of rigorous projection models

   – Issues regarding:

a) Maintenance of Camera Models for each sensor platform

b) Proprietary Camera Models

c) User System Implementation requires extensive documentation of camera models and ephemeris reduction techniques for each satellite sensor.

d) Standard ephemeris data format for all commercial vehicles.

8.0 Airborne Support Data Extension (SDE)

8.1 Overview

That set of support data needed to accomplish the mission of a system receiving a NITF file is referred to as "appropriate" support data. The appropriate support data may vary across systems receiving NITF files. A system receiving a NITF file may add or subtract support data before passing the file to another system with a different mission. This strategy implies a modular support data definition approach.

This section specifies the format and content of a set of Tagged Record Extensions for the NITF file format. The specified tagged records incorporate all SDEs relevant to synthetic aperture radar (SAR), visible (EO), infrared (IR), multispectral (MSI), and hyperspectral (HSI) primary imagery. The information that makes up the SDE is derived from referenced interface documents. Systems using imagery formatted according to NITF from airborne sensors should be designed to extract the needed data from the tagged records described herein.

8.1.1 Technical Assistance

The standardization, use and application of the ASDE defined in this specification is a new, largely untried venture for the airborne imaging community. The Imagery Standards Management Committee (ISMC) NITFS Technical Board (NTB) has authorized an activity within the Format Working Group (FWG) ad-hoc working group to provide technical oversight and assistance for the initial implementers of this specification. The objective of this FWG activity working group is to validate that the specification is correct, complete, consistent, unambiguous, and testable for compliance. The working group provides a forum where those implementing to the specification can come and benefit from the experience of others attempting to implement, a central place to get consolidated 'lessons learned' from other attempts to implement during the validation period. The ISMC/NTB desires to centrally collect beneficial inputs/comments from all implementers. They are especially interested in specific situations where strict adherence to the specification may result in 'nonsensical' population of the data fields in image products. Users and implementers of this specification are highly encouraged to contact and participate in the NTB working group. Contact may be made through the NTB Chairman, see the NTB home page at URL://www.ismc.nima.mil/ntb/.

8.1.2 Defined Support Data Extensions

Table 8-1 lists the support data extensions described in this chapter, and whether they are required for airborne imagery. They are defined for use with EO, infrared IR and MSI collected on airborne sensor platforms. Several are similar to existing and proposed extensions developed by other programs and sensors, and can be considered aliases to those extensions (e.g., AIMIDB is nearly identical with STDIDC used for commercial satellite imagery).

Table 8-1. Airborne Support Data Extensions
REQ. = REQUIRED, OPT. = OPTIONAL, N/A = NOT APPLICABLE

TITLE	TAG	SAR	EO	IR	MSI/HSI	MTI-ONLY
Aircraft Information	ACFTA ACFTB	Req.	Req.	Req.	Req.	Req.
Additional Image Identification	AIMIDA AIMIDB	Req.	Req.	Req.	Req.	Opt.
Multispectral/ Hyperspectral Band Parameters	BANDSA	N/A	Opt.	Opt.	Opt.	N/A
Image Block Information	BLOCKA	Opt.	Opt.	Opt.	Opt.	N/A
Exploitation Usability Optical Information	EXOPTA	N/A	Opt.	Opt.	Opt.	N/A
Exploitation Related Information	EXPLTA EXPLTB	Opt.	N/A	N/A	N/A	Opt.
Airborne SAR Mensuration Data	MENSRA MENSRB	Opt.	N/A	N/A	N/A	N/A
Exploitation Related Information	EXPLTA EXPLTB	Opt.	N/A	N/A	N/A	Opt.

TABLE 8-1. AIRBORNE SUPPORT DATA EXTENSIONS (CONTINUED)

TITLE	TAG	SAR	EO	IR	MSI/HSI	MTI-ONLY
Airborne SAR Mensuration Data	MENSRA MENSRB	Opt.	N/A	N/A	N/A	N/A
Mensuration Data	MPDSRA	Opt.	N/A	N/A	N/A	N/A
Mission Target	MSTGTA	Opt.	Opt.	Opt.	Opt.	Opt.
Moving Target Information Report	MTIRPA MTIRPB	Opt.	N/A	N/A	N/A	Req.
Patch Information	PATCHA PATCHB	Opt.	N/A	N/A	N/A	N/A
Rapid Positioning Data	RPC00B	Opt.	Opt.	Opt.	Opt.	N/A
EO-IR Sensor Parameters	SENSRA	N/A	Req.	Req.	Req.	N/A
Secondary Targeting Info	SECTGA	Opt.	Opt.	Opt.	Opt.	Opt.
Stereo Information	STREOB	N/A	Opt.	Opt.	Opt.	N/A

Each tag ends with a revision letter; the initial definition will uses the revision letter “A”, and revised tags have names ending in “B” (“C”,”D”, etc.) as revisions are approved. A transition plan for implementing tag changes will accompany any such revisions (typically, for a period of time, both the previous and subsequent versions should be supported by receivers of NITF products, while new producer implementations should use the latest versions.

The section that describes the purpose of an extension is titled without the revision letter, such that if the extension were to change, the purpose paragraph would not require changing. For example, section 8.3.3 describes the BANDS or Multispectral / Hyperspectral Band Parameters extension. The actual tag, however, is BANDSA. If in the future, a change is made, section 8.3.3 will continue to describe the BANDS or Multispectral / Hyperspectral Band Parameters extensions, but would include a definition of both the BANDSA and BANDSB tagged extensions.

8.1.3 Support Data Extension Placement

For NITF 2.0 files, ASDEs will be placed in Extended Header Data area of the respective file header or image subheader as required by each ASDE in this document. Optionally (or by necessity, due to collective byte content in the Extended Header Data area) ASDEs may be placed in appropriate “Controlled Extensions” overflow Data Extension Segment. For NITF 2.1 files, the placement will be same with one exception; in the event of the total byte count exceeding the size of the Extended Header Data area, ASDE placement may continue into the User Defined Data area before reverting to a “TRE_OVERFLOW” Data Extension Segment.

8.2 Technical Notes

8.2.1 Geospatial Coordinates

Figure 8-1 shows the earth coordinate frame, the local North-East-Down (NED) coordinate frame, and the platform location parameters: latitude and longitude. The platform location parameters define the location in earth coordinates of the sensor platform, or more specifically, the platform center of navigation. The center of navigation is the origin of the local NED coordinate frame; its location within the platform is defined uniquely for each platform and sensor. The local NED coordinates are North (N), East (E), and Down (D) as shown.

The earth surface in figure 8-1 is described in the World Geodetic System of 1984 (WGS-84) as two different model surfaces. The two surfaces are an ellipsoid and a geoid (see figure 8-2). The ellipsoid is an ideal mathematical surface; the geoid is the mean-sea-level surface of the earth as determined by gravitational potential (elevation of the geoid relative to the ellipsoid varies with location from -102 to +74 meters). Platform latitude and longitude are referenced to the ellipsoid, while platform altitude mean sea level (MSL) is defined with respect to the geoid: Altitude MSL is the vertical distance from mean sea level to the platform. The Global Positioning System is referenced to the ellipsoid.

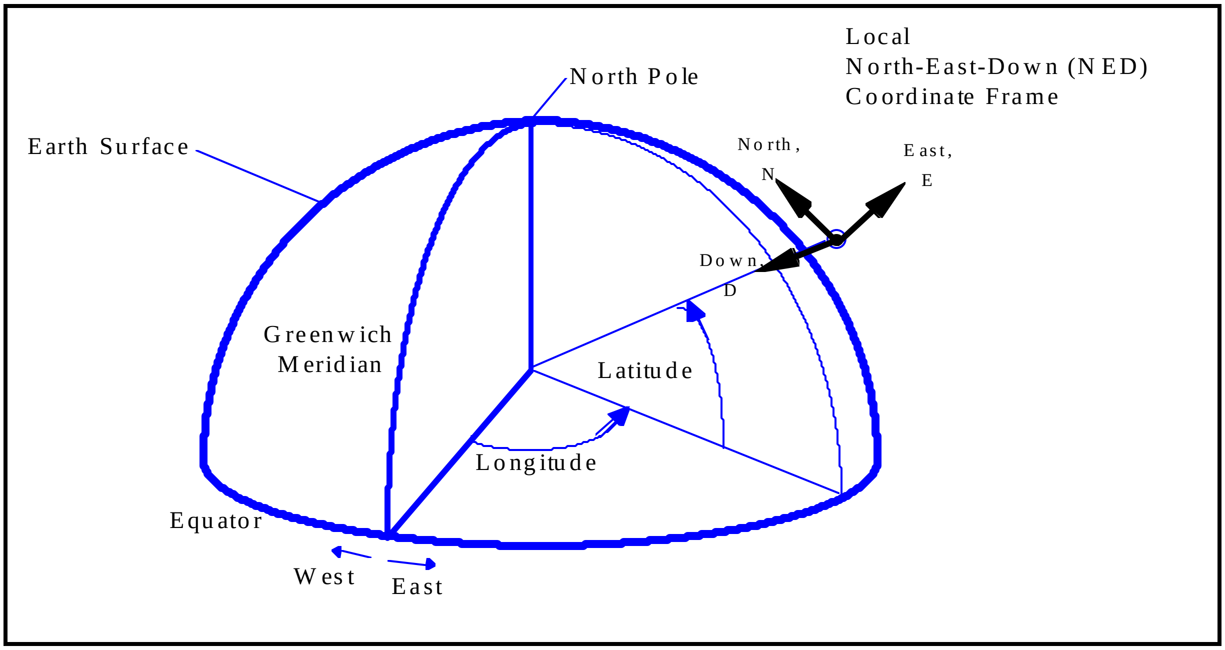


FIGURE 8-1. PLATFORM LOCATION COORDINATES

The Down-axis (D) of the NED coordinate frame lies normal to the geoid. That is, D lies in the direction of gravitational acceleration. The North-axis (N) and East-axis (E) lie in the geometric plane perpendicular to D (the horizontal plane), with N in the direction of True North.

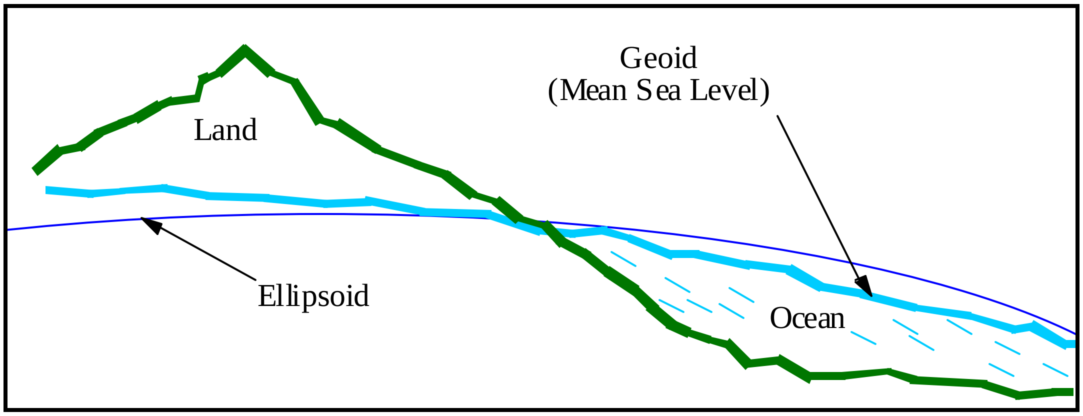


FIGURE 8-2. ELLIPSOID AND GEOID MODELS OF THE EARTH SURFACE

8.2.2 Attitude Parameters: Heading, Pitch, And Roll

Heading, pitch, and roll relate the platform body coordinate frame to the local NED frame. Figure 8-3 shows the platform body coordinates. X_a is positive forward, along the roll axis. Y_a is positive right, along the pitch axis. Z_a is positive down, along the yaw axis. The platform body frame, like the local NED frame, has its origin at the center of navigation. Heading is the angle from north to the NED horizontal projection of the platform positive roll axis, X_a (positive from north to east). Pitch is the angle from the NED horizontal plane to the platform positive roll axis, X_a (positive when X_a is above the NED horizontal plane), and is limited to values between ±90 degrees. Roll is the rotation angle about the platform roll axis. Roll is positive if the platform positive pitch axis; Y_a (right wing) lies below the NED horizontal plane.

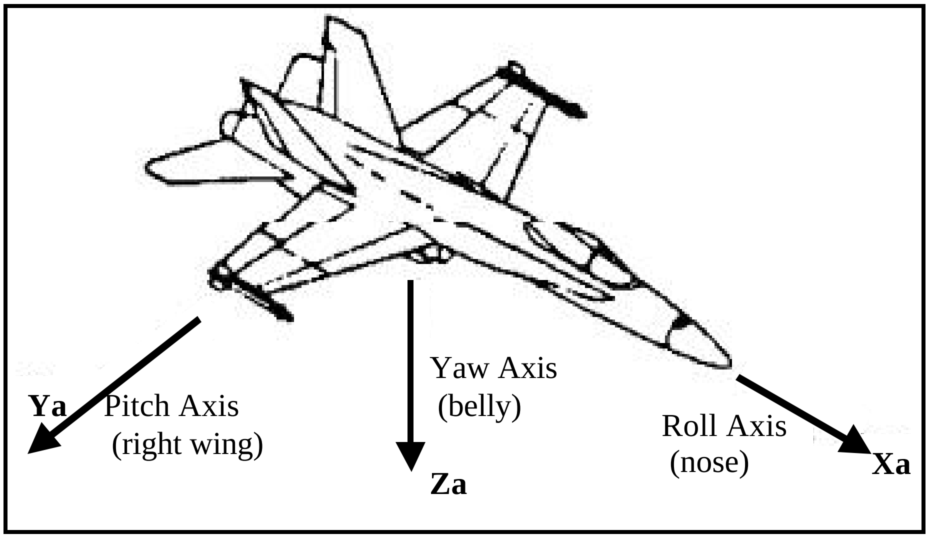


FIGURE 8-3. PLATFORM BODY COORDINATE FRAME

8.2.3 NITF Pixel Ordering

The NITF coordinate system is a left to right, top to bottom, coordinate system. Column numbers increase to the right, and row numbers increase downwards. The first pixel within a block is at the upper left, with subsequent pixels to the right along the row, until the last pixel of a row is followed by the left-most pixel of the next lower row. See figure 8-5.

Care must be taken to generate imagery with pixels ordered as specified by NITF.An historic coordinate system for some SAR systems is left to right, bottom up, with scan lines oriented in the direction of the radar beam (cross-track) and pixel locations representing distance (range). When mapping on the right side of the aircraft, the first pixel of each scan line is at minimum range with subsequent pixels at increasing range; when mapping on the left side, the first pixel of each scan line is at maximum range with subsequent pixels at decreasing range. See figure 8-4. Imagery from these, and other similar systems, will display *mirrored* on an NITF screen unless the pixels are reordered to be consistent with the NITF standard. Although this discussion specifically addresses some known SAR systems, similar care must be taken with EO/IR imagery to ensure correct pixel ordering within NITF files.

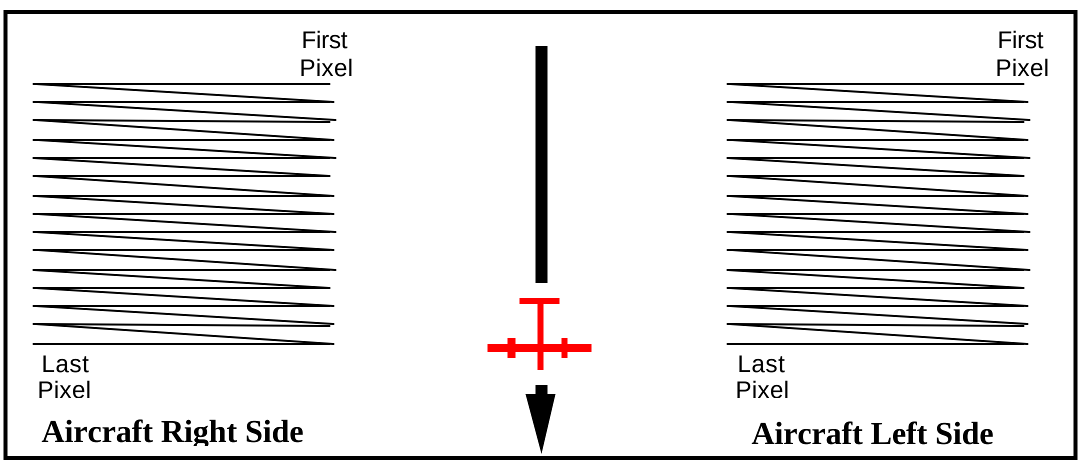


FIGURE 8-4. HISTORIC SAR SCANNING PATTERNS

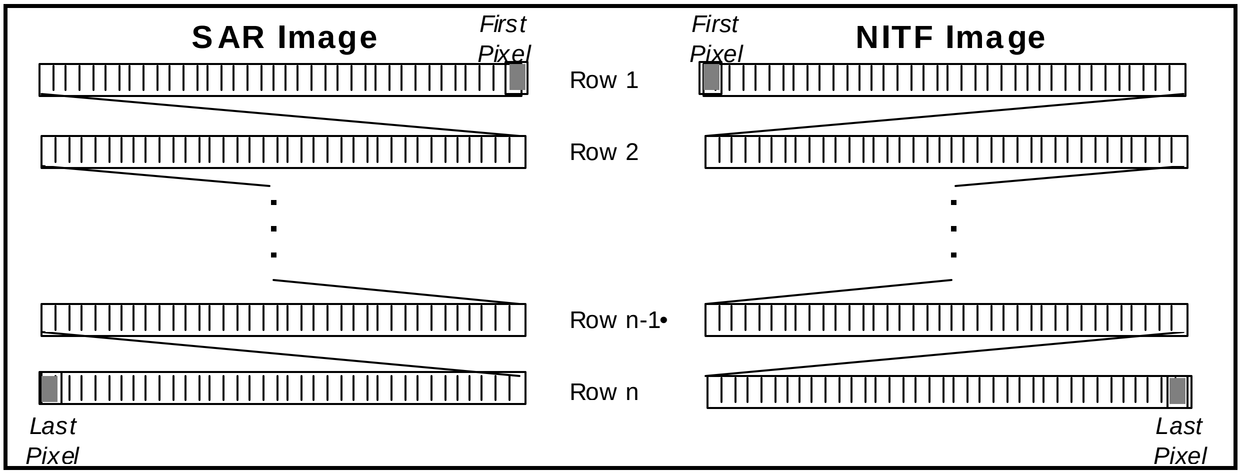


FIGURE 8-5. HISTORIC SAR COLLECTION RELATIONSHIP WITH THE NITF COORDINATE SYSTEM

8.2.4 Rational projection Model

The geometric sensor model describing the precise relationship between image coordinates and ground coordinates is known as a Rigorous Projection Model. A Rigorous Projection Model expresses the mapping of the image space coordinates of rows and columns (r,c) onto the object space reference surface geodetic coordinates (j , l , h).

RPC00 supports a common approximation to the Rigorous Projection Models. The approximation used by RPC00 is a set of rational polynomials exp ressing the normalized row and column values, (r_n , c_n), as a function of normalized geodetic latitude, longitude, and height, (P, L, H), given a set of normalized polynomial coefficients (LINE_NUM_COEF_n, LINE_DEN_COEF_n, SAMP_NUM_COEF_n, SAMP_DEN_COEF_n). Normalized values, rather than actual values are used in order to minimize introduction of errors during the calculations. The transformation between row and column values (r,c), and normalized row and column values (r_n , c_n), and between the geodetic latitude, longitude, and height (j , l , h), and normalized geodetic latitude, longitude, and height (P, L, H), is defined by a set of normalizing translations (offsets) and scales that ensure all values are contained in the range -1 to +1.

P = (Latitude	- LAT_OFF)	÷ LAT_SCALE
L = (Longitude	- LONG_OFF)	÷ LONG_SCALE
H = (Height	- HEIGHT_OFF)	÷ HEIGHT_SCALE
r_n = (Row	- LINE_OFF)	÷ LINE_SCALE
c_n = (Column	- SAMP_OFF)	÷ SAMP_SCALE

The rational function polynomial equations are defined as:

$$\mathrm{r_n} = \frac{\sum_{i=1}^{20} \mathrm{LINE\_NUM\_COEF_i} \cdot \rho_i(\mathrm{P,L,H})}{\sum_{i=1}^{20} \mathrm{LINE\_DEN\_COEF_i} \cdot \rho_i(\mathrm{P,L,H})} \quad \text{and} \quad \mathrm{c_n} = \frac{\sum_{i=1}^{20} \mathrm{SAMP\_NUM\_COEF_i} \cdot \rho_i(\mathrm{P,L,H})}{\sum_{i=1}^{20} \mathrm{SAMP\_DEN\_COEF_i} \cdot \rho_i(\mathrm{P,L,H})}$$

The rational function polynomial equation numerators and denominators each are 20-term cubic polynomial functions of the form:

$$\sum_{i=1}^{20} C_i \cdot \rho_i(P, L, H) =$$

$$\begin{array}{llll}
C_1 & + C_6 \cdot L \cdot H & + C_{11} \cdot P \cdot L \cdot H & + C_{16} \cdot P^3 \\
+ C_2 \cdot L & + C_7 \cdot P \cdot H & + C_{12} \cdot L^3 & + C_{17} \cdot P \cdot H^2 \\
+ C_3 \cdot P & + C_8 \cdot L^2 & + C_{13} \cdot L \cdot P^2 & + C_{18} \cdot L^2 \cdot H \\
+ C_4 \cdot H & + C_9 \cdot P^2 & + C_{14} \cdot L \cdot H^2 & + C_{19} \cdot P^2 \cdot H \\
+ C_5 \cdot L \cdot P & + C_{10} \cdot H^2 & + C_{15} \cdot L^2 \cdot P & + C_{20} \cdot H^3
\end{array}$$

Note: The order of terms differs between different applications. This order is used with RPC00B and the Digital Point Positioning Data Base. RPC00A uses a different term order.

where coefficients $C_1 \cdots C_{20}$ represent the following sets of coefficients:
LINE_NUM_COEF_n, LINE_DEN_COEF_n, SAMP_NUM_COEF_n, SAMP_DEN_COEF_n

The image coordinates are in units of pixels. The ground coordinates are latitude and longitude in units of decimal degrees and the geodetic elevation in units of meters. The ground coordinates are referenced to WGS-84.

8.2.5 Stereo Projection Model

The two images comprising a Stereo Pair are referred to as the Left and Right images; the Beginning and Ending Asymmetry, Convergence, and Bisector Elevation angles define the geometry between the two images (figure 8-7). The Beginning and Ending angles are always measured from the first and last lines, respectively, of the Left image, but measurement locations in the Right image are dependent on the rotation required to align the imagery (figure 8-6). When the two images are collected in succession along a flight path, the fore (aft) image is the Left (Right) image.

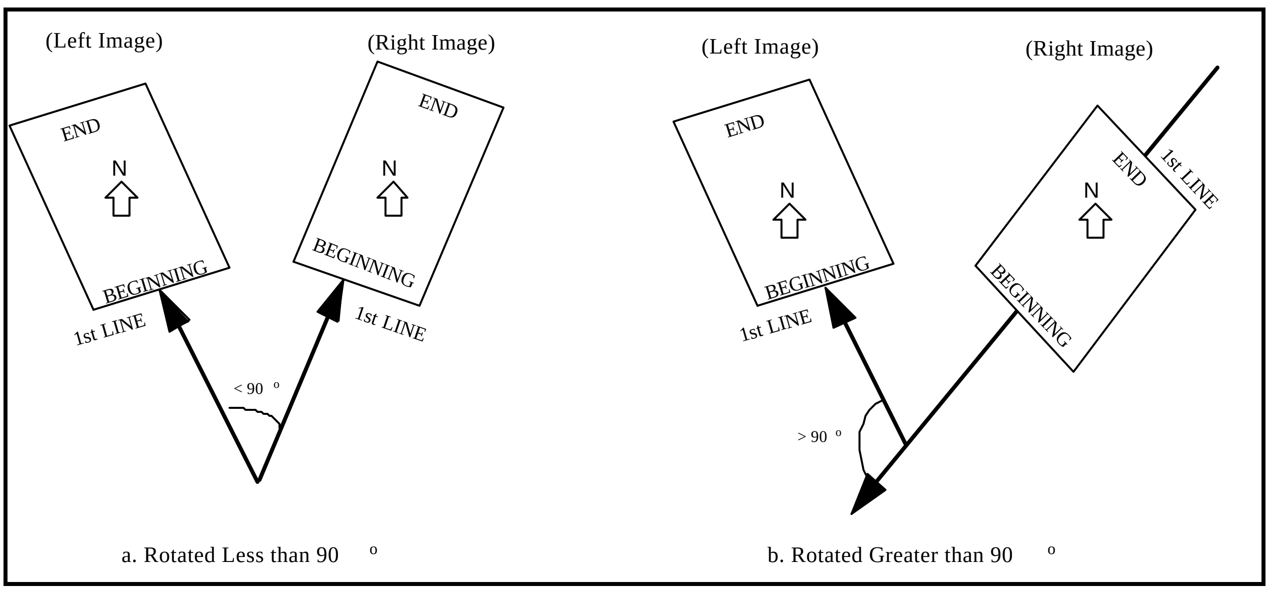


FIGURE 8-6. LOCATION OF BEGINNING/ENDING ANGLES

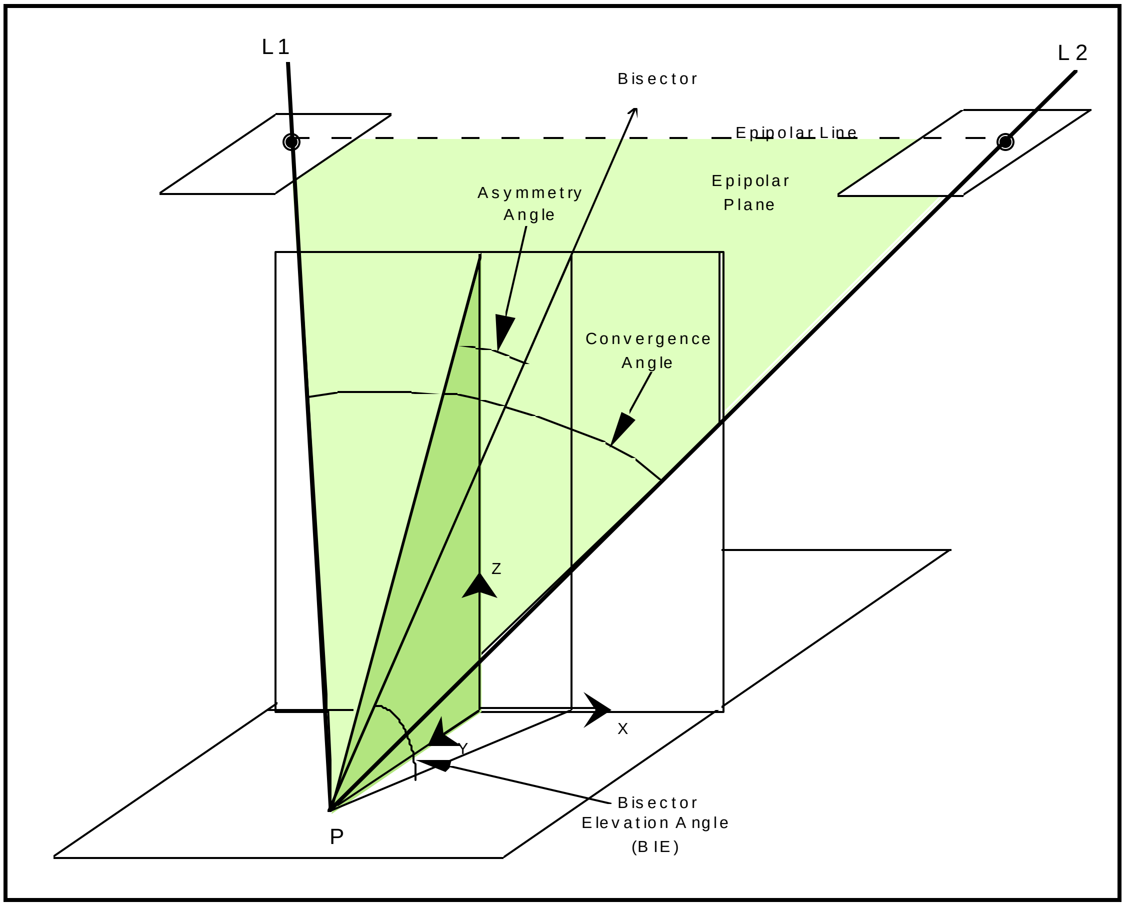


FIGURE 8-7. ASYMMETRY ANGLE, CONVERGENCE ANGLE AND BISECTOR ELEVATION ANGLE

8.2.6 Date Representations – Y2K Compliance

Several extensions contain non-standard date formats with the year represented by only two digits. In all fields containing two digit year representations, 00 through 59 indicate the years 2000 through 2059, and 60 through 99 indicate 1960 through 1999. As affected extensions evolve, the fields will be expanded to support standard date formats with four digits for the year.

8.2.7 Reduced Resolution Imagery

Large images are often processed into Reduced Resolution Data Sets (RRDS) to simplify and speed display and zooming functions. When a reduced resolution image is produced the associated mensuration data can be recalculated to be consistent with the new image, or the reduction can be flagged and the original data inserted without change into the new file. The latter approach is recommended as repeated recalculations to accommodate multiple resolution changes can result in degraded data.

Within NITF files, the image subheader IMAG field indicates the relation between image pixel spacing and associated TRE data.

IMAG = 1.0 means the TRE data apply directly (1:1) to the image – the TRE data was recalculated if the file is a member of a RRDS.

IMAG ≠ 1.0 means the TRE data is not already scaled, and must be recalculated before use.

The following fields must be recalculated:

TRE	SAR Fields Altered
ACFTB	ROW_SPACING COL_SPACING
EXPLTB	N_SAMP
BLOCKA	N_LINES
MPDSRA	ROWS_IN_BLK COLS_IN_BLK OP_ROW OP_COL
MENSRB	ORP_ROW ORP_COL
PATCHB	LNSTOP A_Z_L N_V_L NPIXEL

TRE	EO Fields Altered
ACFTB	ROW_SPACING COL_SPACING
EXOPTA	MAX_LP_SEG MEAN_GSD
BANDSA	ROW_SPACING COL_SPACING BAND_GSD

Use of ICHIPB (see section 5.0) is highly recommended for reduced resolution imagery; ICHIPB must be used if IMAG precision is insufficient to specify the exact reduction ratio of the image.

8.3 Detailed Requirements

8.3.1 AIMID - Additional Image ID

The Additional Image ID extension is used for storage and retrieval from standard imagery libraries. AIMID is a required component of all airborne imagery files. A single AIMID is placed in the respective subheader of every NITF image segment . Data from AIMID are copied into the first forty characters of the image subheader ITITLE (NITF 2.0) or IID2 (NITF 2.1) field.

8.3.1.1 AIMIDA Format Description

The format and description for the user- defined fields of the AIMIDA extension are detailed in table 8-2. Note that the fields from MISSION_DATE through END_ROW, inclusive, shall also constitute the first forty characters of the Image Subheader ITITLE/IID2 field.

Table 8-2. AIMIDA – Additional Image ID Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	AIMIDA	N/A	R
CEL	Length of Entire Tagged Record.	5	00069	bytes	R
The following fields define AIMIDA					
MISSION_DATE	Aircraft T.O. Date. The date of the collection mission (date of aircraft takeoff) in the format DDMMMYY, in which DD is the day of the month (01-31), MMM is the first three characters of the month (JAN – DEC), and YY is the last two digits of the year (00 – 99).	7	DDMMMYY		R
MISSION_NO	Mission Identification. Four character descriptor of the mission. Contents are user defined, except that at least one character must not be numeric.	4	alphanumeric		R
FLIGHT_NO	Flight Number. Each flight shall be identified by 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	00, 01 to 09 A1 to A9 B1 to B9 … Z1 to Z9		R
OP_NUM	Image Operation Number. Reset to 001 at the start of each flight. A value of 000 indicates the airborne system does not number imaging operations.	3	000 to 999		R

Table 8-2. AIMIDA – Additional Image ID Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
START_SEGMENT	Start Segment ID. Identifies images as separate pieces (segments) within an imaging operation. AA is the first segment; AB is the second segment, etc. Spaces indicate the image is not segmented.	2	AA to ZZ, spaces		<R>
REPRO_NUM	Reprocess Number. For SAR imagery 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, a "01" indicates the first reprocess/enhancement, etc. For visible and infrared imagery this field shall contain 00 to indicate no reprocessing or enhancement.	2	00 to 99		R
REPLAY	Replay. 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 of T01 to T99 indicates it was retransmitted.	3	000, G01 to G99, P01 to P99, T01 to T99		R
(reserved-001)		1	1 space		R
START_COLUMN	Starting Tile Column Number. For tiled (blocked) sub-images, the number of the first tile relative to start of the original image tiling within this segment. Tiles are rectangular arrays of pixels that subdivide an image. For untiled images this field shall contain 01.	2	01 to 99		R
START_ROW	Starting Tile Row Number. For tiled (blocked) sub-images, the number of the first tile relative to start of the original image tiling within this segment. For untiled images this field shall contain 00001.	5	00001 to 99999		R
END_SEGMENT	Ending Segment. Ending segment ID of this file. Spaces indicate the image is not segmented.	2	AA to ZZ spaces		<R>
END_COLUMN	Ending Tile Column Number. For tiled (blocked) sub-images, the number of the last tile relative to start of the original image tiling within this segment. For untiled images this field shall contain 01.	2	01 to 99		R

Table 8-2. AIMIDA – Additional Image ID Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
END_ROW	Ending Tile Row Number. For tiled (blocked) sub-images, the number of the last tile relative to start of the original image tiling within this segment. For untiled images this field shall contain 00001.	5	00001 to 99999		R
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	AA to ZZ		<R>
(reserved-002)		4	4 spaces		R
LOCATION	Location of the center of the first image block, provides rough indication of geographic coverage. The format ddmmX represents degrees (00-89) and minutes (00-59) of latitude, with X = N or S for north or south, and dddmmY represents degrees (000-179) and minutes (00-59) of longitude, with Y = E or W for east or west, respectively.	11	ddmmXdddmmY		R
TIME	This field shall contain the collection time referenced to UTC, and accurate to 1 minute, of the first line of the image in the format hhmmZ, in which hh is the hour (00-23), and mm is the minute (00-59); the final character "Z" is required.	5	hhmmZ		R
CREATION_DATE	This field shall contain the collection date of the first line of the image in the format DDMMMYY, in which DD is the day of the month (01-31), MMM is the first three characters of the month (JAN – DEC), and YY is the last two digits of the year (00 – 99). This date is coordinated with the collection time, i.e., the date changes at midnight UTC.	7	DDMMMYY		R

8.3.1.2 AIMIDB Format Description

The format and description for the user- defined fields of the AIMIDB extension are detailed in table 8-3.

Note that the fields from ACQUISITION_DATE through END_TILE_ROW, inclusive, constitute the ST_ID field in the STREOB extension of a stereo mate image, and portions of these fields shall constitute the first forty characters of the Image Subheader ITITLE field. Table 8-4 illustrates the mapping between ITITLE and these fields.

TABLE 8-3. AIMIDB – ADDITIONAL IMAGE ID EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	AIMIDB	N/A	R
CEL	Length of Entire Tagged Record.	5	00089	bytes	R
The following fields define AIMIDB					
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 CCYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). This field is equivalent to the IDATIM field in the image subheader.	14	CCYYMMDDhhmmss		R
MISSION_NO	Mission Number. 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” (without quotes) shall be used if no specific descriptor is known.	4	PPNN U0NN UNKN		R
MISSION_ IDENTIFICATION	Name of the Mission. The Air Tasking Order Mission Number should be used, if available, followed by spaces. “NOT AVAIL.” (two words separated by a single space and a trailing period, but without quotes) shall be used if the Mission name is unavailable.	10	Alphanumeric		R

Table 8-3. AIMIDB – Additional Image ID Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
FLIGHT_NO	Flight Number. Each flight shall be identified by 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	00 01 to 09 A1 to A9 B1 to B9 … Z1 to Z9		R
OP_NUM	Image Operation Number. Reset to 001 at the start of each flight and incremented by 1 for each distinct imaging operation. Reset to 001 for the imaging operation following 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	000 to 999		R
CURRENT_SEGMENT	Current Segment ID. 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	AA to ZZ		R
REPRO_NUM	Reprocess Number. For SAR imagery 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, a 01 indicates the first reprocess/enhancement, etc. For visible and infrared imagery this field shall contain 00 to indicate no reprocessing or enhancement.	2	00 to 99		R
REPLAY	Replay. 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 of T01 to T99 indicates it was retransmitted.	3	000, G01 to G99, P01 to P99, T01 to T99		<R>
(reserved-001)		1	1 space		R

Table 8-3. AIMIDB – Additional Image ID Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
START_TILE_COLUMN	Starting Tile Column Number. For tiled (blocked) sub-images, 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 untiled (single block) images this field shall contain 001.	3	001 to 099		R
START_TILE_ROW	Starting Tile Row Number. For tiled (blocked) sub-images, the number of the first tile within the CURRENT_SEGMENT, relative to tiling at the start of the imaging operation. For untiled (single block) images this field shall contain 00001.	5	00001 to 99999		R
END_SEGMENT	Ending Segment. 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	00, AA to ZZ		R
END_TILE_COLUMN	Ending Tile Column Number. For tiled (blocked) sub-images, the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging. operation For untiled (single block) images this field shall contain 001.	3	001 to 099		R
END_TILE_ROW	Ending Tile Row Number. For tiled (blocked) sub-images, the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging operation. For untiled (single block) images this field shall contain 00001.	5	00001 to 99999		R
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	AA to ZZ		<R>
(reserved-002)		4	4 spaces		R

Table 8-3. AIMIDB – Additional Image ID Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
LOCATION	Location of 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 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 ½ mile in error, and not actually represent any point within the boundary of the image. Spaces indicate the location is unavailable.	11	DdmmXdddmmY, spaces		<R>
(reserved-003)		13	13 spaces		R

Table 8-4. Mapping Between AIMIDB and ITITLE/IID2

ITITLE/IID2 LOCATION (BYTES)	AIMIDB FIELD
1 - 7	ACQUISITION_DATE (formatted as DDMMMYY, where: DD is the day of the month, MMM is a three letter abbreviation of the month, JAN, FEB, … DEC, YY is the least significant 2 digits of the year).
8 – 11	MISSION_NO
12 – 13	FLIGHT_NO
14 – 16	OP_NUM
17 – 18	CURRENT_SEGMENT
19 – 20	REPRO_NUM
21 – 23	REPLAY
24	Space
25 – 26	START _TILE_COLUMN (least significant 2 bytes)
27 – 31	START _TILE_ROW
32 – 33	END_SEGMENT
34 – 35	END_TILE_COLUMN (least significant 2 bytes)
36 - 40	END_TILE_ROW

8.3.2 ACFT - Aircraft Information

ACFT provides miscellaneous information unique to airborne sensors. The ACFT extension is required. A single ACFT extension, containing information relative to the capture of its associated image data will be placed in the respective subheader of every NITF image segment.

8.3.2.1 ACFTA Format Description.

The format and descriptions for the user-defined fields of the ACFTA extension are detailed in table 8-5.

Table 8-5. ACFTA – Aircraft Information Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	ACFTA	N/A	R
CEL	Length of Entire Tagged Record.	5	00132	bytes	R
The following fields define ACFTA					
AC_MSN_ID	Aircraft Mission Identification. Name of the Mission. “NOT AVAIL.” (without quotes) shall be used if the Mission name is unavailable.	10	Alphanumeric, NOT AVAIL.		R
SCTYPE	Scene Type. C = Collection Plan R = Retasked space = Immediate, or Unplanned	1	C,R,space		<R>
SCNUM	Scene Number identifies the current scene, and is determined from the mission plan, except for immediate spot scenes, where it has the value 0000. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.	4	0000 to 9999		R
SENSOR_ID	Sensor ID. Identifies which specific sensor produced the image. ASR = ASARS-2 APG = APG-73 DST = DarkStar Other sensors: TBD	3	alphanumeric		R
PATCH_TOT	Patch Total. Total Number of Patches contained in this image segment, and therefore, the number of PATCH extensions contained in this image subheader. Not used for EO-IR imagery.	4	SAR: Spot: 0001 Search: 0001 to 0999 EO-IR: 0000		R
MTI_TOT	MTI Total. Total Number of MTIRP extensions contained in this file. Each MTIRP identifies 1 to 999 moving targets. Shall contain 000 for EO-IR imagery.	3	SAR: 000 to 999 EO-IR: 000		R

Table 8-5. ACFTA – Aircraft Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
PDATE	Processing Date. SAR: when raw data is converted to imagery. EO-IR: when image file is created. DD is the day of the month (01 to 31), MMM is the month (JAN – DEC), and YY contains the two least significant digits of the year. This date changes at midnight UTC.	7	DDMMMYY		R
IMHOSTNO	Immediate Scene Host. Together with Immediate Scene Request ID below, denotes the scene that the immediate was initiated from and can be used to renumber the scene, Example: If the immediate scene was initiated from scene number 123 and this is the third request from that scene, then the scene number field will be zero, the immediate scene host field will contain 123 and the immediate scene request id will contain 00003. When the scene number is greater than 999, this field will only contain the three least significant digits of the scene number; any resulting ambiguity can be resolved by comparing collection times. Shall contain 000 for Pre-Planned scenes.	3	000 to 999		R
IMREQID	Immediate Scene Request ID	5	00000 to 99999		R
SCENE_SOURCE	Scene Source. Indicates the origin of the request for the current scene. A scene is single image or a collection of images providing contiguous coverage of an area of interest. 0 = Pre-Planned 1 to 6 = Sensor Specific: For ASARS-2: 1 = Scene Update (uplink) 2 = Scene Update (manual - via pilot's cockpit display unit) 3 = Immediate Scene (immediate spot or search range adjust) 5 = Preplanned Tape Modification 6 = SSS Other Sensors: TBD.	1	0 to 6		R

Table 8-5. ACFTA – Aircraft Information Extension Format (continued)

<table>
<tr><th>FIELD</th><th>NAME/DESCRIPTION</th><th>SIZE</th><th>VALUE RANGE</th><th>UNITS</th><th>TYPE</th></tr>
<tr><td>MPLAN</td><td>Mission Plan Mode. Defines the current sensor specific collection mode.
For ASARS-2:
01 – Search
02 – Spot 3
04 – Spot 1
07 – Continuous Spot 3
08 – Continuous Spot 1
09 – EMTI Wide Frame Search
10 – EMTI Narrow Frame Search
11 – EMTI Augmented Spot
12 – EMTI Wide Area MTI (WAMTI)
13 – Monopulse Calibration
14 – 99 are reserved.
Other sensors: TBD</td><td>2</td><td>01 to 99</td><td></td><td>R</td></tr>
<tr><td colspan="6">Where the image extends along an extended path, as with SAR Search mode 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 scene centerline of the area to be imaged.
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 not used.
The location may be expressed in either degrees-minutes-seconds or in decimal degrees.
The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.
The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).</td></tr>
<tr><td>ENTLOC</td><td>Entry Location.</td><td>21</td><td>ddmmss.ssXdddmmss.ssY
±dd.dddddd±ddd.dddddd</td><td></td><td>R</td></tr>
<tr><td>ENTELV</td><td>Entry Elevation.</td><td>6</td><td>-01000 to +30000</td><td>ft.</td><td>R</td></tr>
<tr><td>EXITLOC</td><td>Exit Location.</td><td>21</td><td>ddmmss.ssXdddmmss.ssY
±dd.dddddd±ddd.dddddd</td><td></td><td><R></td></tr>
<tr><td>EXITELV</td><td>Exit Elevation.</td><td>6</td><td>-01000 to +30000</td><td>ft.</td><td><R></td></tr>
</table>

Table 8-5. ACFTA – Aircraft Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
TMAP	True Map Angle. SAR: 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 desired track heading. EO-IR: 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. A value of 999.999 indicates the true map angle is unavailable.	7	000.000 to 180.000, 999.999	degrees	R
RCS	RCS Calibration Coefficient. Performance calibration value for SAR sensor equipment.	3	040 to 080		<R>
ROW_SPACING	Row Spacing SAR: Ground plane distance between corresponding pixels of adjacent rows, measured in feet. EO-IR: Angle between corresponding pixels of adjacent rows, measured in microradians at center of image.	7	SAR: 00.0000 to 99.9999 EO-IR: 0000.00 to 9999.99	ft µ-radians	R
COL_SPACING	Column Spacing SAR: Ground plane distance between adjacent pixels within a row, measured in feet. EO-IR: Angle between adjacent pixels within a row, measured in microradians at center of image.	7	SAR: 00.0000 to 99.9999 EO-IR: 0000.00 to 9999.99	ft µ-radians	R
SENSERIAL	Sensor vendor's serial number. 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.	4	0001 to 9999		<R>

Table 8-5. ACFTA – Aircraft Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
ABSWVER	Airborne Software Version. Airborne software version (vvvv) and Revision (rr) numbers.	7	vvvv.rr		<R>

8.3.2.2 ACFTB Format Description

The format and descriptions for the user-defined fields of the ACFTB extension are detailed in table 8-6.

Table 8-6. ACFTB – Aircraft Information Extension Format
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	ACFTB	N/A	R
CEL	Length of Entire Tagged Record.	5	00207	bytes	R
The following fields define ACFTB					
AC_MSN_ID	Aircraft Mission Identification. "NOT AVAILABLE" (two words separated by a single space, but without quotes) shall be used if the mission id is unavailable.	20	Alphanumeric, NOT AVAILABLE		R
AC_TAIL_NO	Aircraft Tail Number	10	alphanumeric		<R>
AC_TO	Aircraft Take-off. Date and Time, referenced to UTC, in the format CCYYMMDDhhmm, in which CCYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), and mm is the minute (00 to 59).	12	CCYYMMDDhhmm		<R>

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
SENSOR_ID_TYPE	Sensor ID Type. Identifies which sensor type produced the image. For Radar Imagery: SAR For EO-IR: ccff where cc indicates the sensor category: IH (High Altitude / Long Range IR) IM (Medium Altitude IR) IL (Low Altitude IR) MH (Multispectral High Altitude / Long Range) MM (Multispectral Medium Altitude) ML (Multispectral Low Altitude) VH (Visible High Altitude / Long Range) VM (Visible Medium Altitude) VL (Visible Low Altitude) VF (Video Frame) And ff indicates the sensor format: FR (Frame) LS (Line Scan) PB (Pushbroom) PS (Pan Scan) Content of several fields below depends upon the value of this field.	4	Alphanumeric		R

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
SENSOR_ID	Identifies which specific sensor produced the image. Currently allowable values: APG-73 AIP ASARS1 ASARS2 CA236 (Darkstar EO) CA260 CA261 CA265 CA270 CA295 D500 DB110 DS-SAR (Darkstar Radar) GHR (Global Hawk Radar) HYDICE HSAR IRLS (ATARS) LAEO (ATARS) MAEO (ATARS) SIR-C SYERS TSAR (Tactical SAR on Predator) Other values are TBD. Content of several fields below depends upon the value of this field.	6	Alphanumeric		R
SCENE_SOURCE	Scene Source. Indicates the origin of the request for the current scene. A scene is single image or a collection of images providing contiguous coverage of an area of interest. 0 = Pre-Planned 1 to 9 = Sensor Specific: For ASARS-2: 1 = Scene Update (uplink) 2 = Scene Update (manual - via pilot's cockpit display unit) 3 = Immediate Scene (immediate spot or search range adjust) 5 = Preplanned Tape Modification 6 = SSS Other Sensors: TBD.	1	0 to 9		<R>
SCNUM	Scene Number. 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	000000 to 999999		R

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
PDATE	Processing Date. SAR: when raw data is converted to imagery. EO-IR: when image file is created. CCYY is the year, MM is the month (01–12), and DD is the day of the month (00 to 31). This date changes at midnight UTC.	8	CCYYMMDD		R
IMHOSTNO	Immediate Scene Host. Together with Immediate Scene Request ID below, denotes the scene that the immediate scene was initiated from and can be used to renumber the scene, 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	000000, 000001 to 999999		R
IMREQID	Immediate Scene Request ID. Only non-zero for immediate scenes.	5	00000, 00001 to 99999		R

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
MPLAN	Mission Plan Mode. Defines the current sensor-specific SENSOR_TYPE / SENSOR_ID collection mode. For AIP: 013 – Monopulse Calibration 014 – Wide Area MTI (WAMTI) 015 – Coarse Resolution Search 016 – Medium Resolution Search 017 – High Resolution Search 018 – Point Imaging 019 – Swath MTI (SMTI) 020 – Repetitive Point Imaging For ASARS-2: 001 – Search 002 – Spot 3 004 – Spot 1 007 – Continuous Spot 3 008 – Continuous Spot 1 009 – EMTI Wide Frame Search 010 – EMTI Narrow Frame Search 011 – EMTI Augmented Spot 012 – EMTI Wide Area MTI (WAMTI) 013 – Monopulse Calibration For APG-73: 001 – Strip (Search) 002 – Spotlight Other sensors: SAR – TBD EO-IR: 001-003 – Reserved 004 – EO Spot 005 – EO Point Target 006 – EO Wide Area Search 014 – IR Spot 015 – IR Point Target 016 – IR Wide Area Search 017 – 999 are reserved	3	001 to 999		R

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 spaces.
The location may be expressed in either degrees-minutes-seconds or in decimal degrees.
The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.
The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
ENTLOC	Entry Location.	25	ddmmss.ssssX dddmmss.ssssY or ±dd.dddddddd ±ddd.dddddddd		<R>
LOC_ACCY	Location Accuracy. The 90% probable circular error in ENTLOC and EXITLOC positions. Unknown=000000 or 000.00	6	000.01 to 999.99 000000, 000.00	Feet	<R>
ENTELV	Entry Elevation. Imaging operation entry point ground elevation.	6	-01000 to +30000	feet or meters	<R>
ELV_UNIT	Unit of Elevation. Defines unit for Entry and Exit Altitudes. f=feet, m=meters	1	f or m		<R>
EXITLOC	Exit Location.	25	ddmmss.ssssX dddmmss.ssssY or ±dd.dddddddd ±ddd.dddddddd		<R>
EXITELV	Exit Elevation. Imaging operation exit point ground elevation.	6	-01000 to +30000	feet or meters	<R>
TMAP	True Map Angle. SAR: 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 desired track heading. EO-IR: 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	000.000 to 180.000	degrees	<R>

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
ROW_SPACING	Row Spacing measured at the center of the image. Distance in the image plane between corresponding pixels of adjacent rows measured in feet or meters; or Angular center-to-center distance (pitch) between corresponding pixels of adjacent rows measured in micro-radians. If the actual spacing (or associated units) is unknown, the default value of 0000000 will be entered.	7	00.0000 to 99.9999 0000.00 to 9999.99 0000000	feet or meters µ-radians	R
ROW_SPACING_ UNITS	Unit of Row Spacing. f = feet m = meters r = µ-radians u = unknown spacing	1	f, m, r or u		R
COL_SPACING	Column Spacing measured at the center of the image. Distance in the image plane between adjacent pixels within a row measured in feet or meters; or 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" will be entered.	7	00.0000 to 99.9999 0000.00 to 9999.99 0000000	feet or meters µ-radians	R
COL_SPACING_ UNITS	Unit of Column Spacing. f = feet m = meters r = µ-radians u = unknown spacing	1	f, m, r or u		R
FOCAL_LENGTH	Sensor Focal Length. Effective distance from optical lens to sensor element(s), used when either ROW_SPACING_UNITS or COL_SPACING_UNITS indicates µ-radians. 999.99 indicates focal length is not available or not applicable to this sensor.	6	000.01 to 899.99, 999.99	cm	R
SENSERIAL	Sensor vendor's serial number. 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	000001 to 999999		<R>
ABSWVER	Airborne Software Version. Airborne software version (vvvv) and Revision (rr) numbers.	7	vvvv.rr		<R>

TABLE 8-6. ACFTB – Aircraft Information Extension Format (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CAL_DATE	Calibration Date. Date sensor was last calibrated. CCYY is the year, MM is the month (01–12), and DD is the day of the month (00 to 31).	8	CCYYMMDD		<R>
PATCH_TOT	Patch Total. Total Number of Patches contained in this file, and therefore, the number of PATCH extensions. 0000 for EO-IR imagery.	4	SAR: Spot: 0000 to 0001 Search: 0000 to 9999 EO-IR: 0000		R
MTI_TOT	MTI Total. Total Number of MTIRP extensions contained in this file. Each MTIRP identifies 1 to 999 moving targets. 000 for EO-IR imagery.	3	SAR: 000 to 999 EO-IR: 000		R

TABLE 8-7. ROW AND COLUMN SPACING

SENSOR_ID_TYPE	ROW_SPACING	COL_SPACING
SAR	Image plane distance (ft/m)	Image plane distance (ft/m)
ccFR	Angle between pixels (μ-radians)	Angle between pixels (μ-radians)
ccLS	Angle between pixels (μ-radians)	Image plane distance (ft)
ccPB	Image plane distance (ft)	Angle between pixels (μ-radians)
ccPS	Angle between pixels (μ-radians)	Angle between pixels (μ-radians)

8.3.3 BANDS - Multispectral / Hyperspectral Band Parameters

The BANDS extension is defined to or supplement information in the NITF image subheader where additional parametric data is required. This data extension is placed in each image subheader as required. Each Band must be identified either by the wavelength of peak response (BANDPEAK), or the wavelengths of its edges (BANDLBOUNDn, BANDUBOUNDn). The format and descriptions of the user-defined fields of this extension are detailed in table 8-8.

TABLE 8-8. BANDSA – MULTISPECTRAL / HYPERSPECTRAL BAND PARAMETERS EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	BANDSA	N/A	R
CEL	Length of Entire Tagged Record.	5	00072 to 45980	bytes	R
The Following Fields Define BANDSA					
ROW_SPACING	Row Spacing measured at the center of the image. Distance in the image plane between corresponding pixels of adjacent rows measured in feet or meters; or Angular center-to-center distance (pitch) between corresponding pixels of adjacent rows measured in micro-radians (µ-radians).	7	00.0000 to 99.9999 0000.00 to 9999.99	feet or meters µ-radians	R
ROW_SPACING_ UNITS	Unit of Row Spacing. f = feet m = meters r = µ-radians	1	f, m or r		R
COL_SPACING	Column Spacing measured at the center of the image. Distance in the image plane between adjacent pixels within a row measured in feet or meters; or Angular center-to-center distance (pitch) between adjacent pixels within a row measured in micro-radians (µ-radians).	7	00.0000 to 99.9999 0000.00 to 9999.99	feet or meters µ-radians	R
COL_SPACING_U NITS	Unit of Column Spacing. f = feet m = meters r = µ-radians	1	f, m or r		R
FOCAL_LENGTH	Sensor Focal Length. Effective distance from optical lens to sensor element(s), used when either ROW_SPACING_UNITS or COL_SPACING_UNITS indicates µ-radians. 999.99 indicates focal length is not available or not applicable to this sensor.	6	000.01 to 899.99, 999.99	cm	R

Table 8-8. BANDSA – Multispectral / Hyperspectral Band Parameters Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
BANDCOUNT	Number of Bands comprising the image. Fields BANDPEAKn through BANDGSDn will be repeated for each band.	4	0001 to 0999	N/A	R
BANDPEAKn	Band n Peak Response Wavelength. Must be specified unless BANDLBOUNDn and BANDUBOUNDn are specified.	5	00.01 to 19.99	µm	<C>
BANDLBOUNDn	Band n Lower Wavelength Bound. The wavelength for the nth band at the lower 50% (-3db) point of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDUBOUNDn	Band n Upper Wavelength Bound. The wavelength for the nth band at the higher 50% (-3db) point of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDWIDTHn	Band n Width. The wavelength difference between the upper and lower bounds at the 50% (-3db) points of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDCALDRKn	Band n Calibration (Dark). The calibrated receive power level for the nth band that corresponds to a pixel value of 0.	6	0000.1 to 9999.9	µw / (cm^2-sr-µm)	<C>
BANDCALINCn	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	00.01 to 99.99	µw / (cm^2-sr-µm)	<C>
BANDRESPn	Band n Spatial Response. Nominal pixel size, expressed in microradians	5	000.1 to 999.9	µradians	<C>
BANDASDn	Band n Angular Sample Distance. The pixel center-to-center distance, expressed in microradians.	5	000.1 to 999.9	µradians	<C>
BANDGSDn	Band n Ground Sample Distance. The average distance between adjacent pixels for the nth band.	5	00.01 to 99.99	m	<C>

8.3.4 BLOCK - Image Block Information

Image Block Information is optional, but often needed for exploitation of imagery. BLOCK is placed in the image subheader with the corresponding AIMID and ACFT extensions. The format for the user defined fields of the BLOCKA extension and a description of their contents is detailed in table 8-9.

Table 8-9. BLOCKA – Image Block Information Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	BLOCKA	N/A	R
CEL	Length of Entire Tagged Record.	5	00123	bytes	R
The following fields define BLOCKA					
BLOCK_INSTANCE	Block number of this image block.	2	01 to 99		R
N_GRAY	SAR: The number of gray fill pixels. EO-IR: 00000	5	00000 to 99999		R
L_LINES	Row Count.	5	00001 to 99999		R
LAYOVER_ANGLE	<u>Layover Angle</u>. SAR: The angle between the first row of pixels (NITF row 1) and the layover direction in the image, measured in a clockwise direction. Defaults to spaces. EO-IR: spaces.	3	000 to 359, spaces	degrees	<R>
SHADOW_ANGLE	<u>Shadow Angle</u>. SAR: The angle between the first row of pixels (NITF row 1) and the radar shadow in the image, measured in a clockwise direction. Defaults to spaces. EO-IR: spaces.	3	000 to 359, spaces	degrees	<R>
(reserved-001)		16	16 spaces		R
The following four fields repeat earth coordinates image corner locations described by IGEOLO in the NITF image subheader, but provide higher precision. . Note that the order of these coordinates is different from IGEOLO. Spaces indicate the value of a coordinate is unavailable or inapplicable. The format Xddmmss.cc represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and Ydddmmss.cc represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).					
FRLC_LOC	<u>First Row Last Column Location</u>. Location of the first row, last column of the image block.	21	XDDMMSS.SSYDDDMMSS.SS, ±DD.DDDDDD±DDD.DDDDDD spaces		<R>
LRLC_LOC	<u>Last Row Last Column Location.</u> Location of the last row, last column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd spaces		<R>
LRFC_LOC	<u>Last Row First Column Location</u>. Location of the last row, first column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd spaces		<R>
FRFC_LOC	<u>First Row First Column Location</u>. Location of the first row, first column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd spaces		<R>
(reserved-002)		5	010.0		R

8.3.5 EXOPT - Exploitation Usability Optical Information

The Exploitation Usability Optical Information extension is optional. EXOPT provides metadata that allows a user program to determine if the image is suitable for the exploitation problem currently being performed. It contains some of the fields, which would make up a NIMA standard directory entry. The format and descriptions for the user-defined fields of the EXOPTA are detailed in table 8-10. A single EXOPT is placed in the image subheader with the corresponding AIMID and ACFT extensions.

Table 8-10. EXOPTA – Exploitation Usability Optical Information Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	EXOPTA	N/A	R
CEL	Length Data Fields.	5	00107	bytes	R
The following fields define EXOPTA					
ANGLE_TO_NORTH	Angle to True North. Measured clockwise from first row of the image.	3	000 to 359	degrees	<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	000.0 to 999.9	inches	<R>
(reserved-001)		1	1		R
DYNAMIC_RANGE	Dynamic Range of image pixels.	5	00000 to 65535		<R>
(reserved-002)		7	7 spaces		R
OBL_ANG	Obliquity Angle. Angle between the local NED horizontal and the optical axis of the image.	5	00.00 to 90.00	degrees	<R>
ROLL_ANG	Roll Angle of the platform body.	6	±90.00	degrees	<R>
PRIME_ID	Primary Target ID	12	alphanumeric		<R>
PRIME_BE	Primary Target BE / OSUFFIX (target designator)	15	alphanumeric		<R>
(reserved-003)		5	5 space		R
N_SEC	Number Of Secondary Targets in Image. Determines the number of SECTG extension present in the image subheader.	3	000 to 250		R
(reserved-004)		2	2 spaces		R
(reserved-005)		7	0000001		R
N_SEG	Number of Segments. Segments are separate imagery pieces within an imaging operation.	3	001 to 999		R
MAX_LP_SEG	Maximum Number of Lines Per Segment. Includes overlap lines.	6	000001 to 199999		<R>
(reserved-006)		12	12 spaces		R

Table 8-10. EXOPTA – Exploitation Usability Optical Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
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	±90.0, 999.9	degrees	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	000.0 to 359.9, 999.9	degrees	R

† See section 8.2.2

8.3.6 EXPLT - Exploitation Related Information

The Exploitation Related Information extension is optional. EXPLT provides metadata that allows a user program to determine if the image is suitable for the exploitation problem currently being performed. It contains some of the fields, which would make up a NIMA standard directory entry. A single EXPLT is placed in the image subheader with the corresponding AIMID and ACFT extensions.

8.3.6.1 EXPLTA Format Description

The format for the user defined fields of the EXPLTA extension and a description of their contents is detailed in table 8-11.

TABLE 8-11. EXPLTA – EXPLOITATION RELATED INFORMATION EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	EXPLTA	N/A	R
CEL	Length of Entire Tagged Record	5	00087	bytes	R
The following fields define EXPLTA					
ANGLE_TO_NORTH	Angle measured clockwise in degrees from first row of the image to True North.	3	000 to 359	degrees	R
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from +00 (broadside) to +85 degrees; aft looking squint angles range from -00 to -60 degrees.	3	-60 to +85	degrees	R

Table 8-11. EXPLTA – Exploitation Related Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
MODE	Mode represents both the collection mode and the processing mode. For Spot imagery the first character indicates the collection mode with "1" for SPOT 1 Mode, and "3" for SPOT 3 Mode; the second and third characters indicate the processing (sampling) mode: "SP"=Slant Plane, "GP"=Ground Plane, and "ES"=Enhanced Spot. For Search mode imagery the first two characters yy represent the nominal impulse response, and the third character is "S."	3	xSP,xGP,xES,yyS		R
(reserved -001)		16	spaces		R
GRAZE_ANG	The angle, measured in degrees at the target, between the focus plane and line of sight to the radar.	2	00 to 90	degrees	R
SLOPE_ANG	The angle between the SAR plane and the focus plane. Given GRAZE_ANG ψ and SQUINT_ANGLE θ, $SLOPE\_ANG = COS^{-1}\left[\frac{COS\,\psi COS\,\theta}{\sqrt{(SIN^2\psi SIN^2\theta + COS^2\theta)}}\right]$ Note: SLOPE_ANG is equal to GRAZE_ANG for broadside mapping (θ = 0).	2	00 to 90	degrees	R
POLAR	The first character indicates the nominal transmit polarization, and the second character indicates the nominal receive polarization. Each can be Horizontal (H) or Vertical (V).	2	HH, HV, VH, VV		R
NSAMP	Pixels per Line (includes fill)	5	00001 to 99999		R
(reserved-002)		1	0		R
SEQ_NUM	Sequence within Coupled Imagery Set	1	1 to 6		<R>
PRIME_ID	Target Designator of primary target	12	alphanumeric		<R>
PRIME_BE	Basic Encyclopedia ID / OSUFFIX (target designator) of the primary target	15	alphanumeric		<R>
(reserved-003)		1	0		R
N_SEC	Number of Secondary Targets in image.†	2	00 to 10		<R>
IPR	Commanded impulse response.††	2	00 to 99	feet	<R>
(reserved-004)		2	01		R
(reserved-005)		2	spaces		R
(reserved-006)		5	00000		R
(reserved-007)		8	spaces		R

† determines number of SECTGA extensions

†† replicated in each MPDSRA extension

8.3.6.2 EXPLTB Format Description

The format for the user defined fields of the EXPLTB extension and a description of their contents is detailed in table 8-12.

Table 8-12. EXPLTB – Exploitation Related Information Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	EXPLTB	N/A	R
CEL	Length of Entire Tagged Record	5	00101	bytes	R
The following fields define EXPLTB					
ANGLE_TO_NORTH	Angle, measured clockwise about the origin of the image, from first row of the image to True North.	7	000.000 to 359.999	degrees	R
ANGLE_TO_NORTH_ ACCY	<u>Angle to North Accuracy</u>. 90% probable error value. Unknown=000000 or 00.000	6	00.001 to 44.999, 000000, 00.000	degrees	R
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from +00.000 (broadside) to +85.000 degrees; aft looking squint angles range from –00.000 to –60.000 degrees.	7	-60.000 to +85.000	degrees	R
SQUINT_ANGLE_ ACCY	<u>Squint Angle Accuracy</u>. 90% probable error value. Unknown=000000 or 00.000	6	00.001 to 44.999, 000000, 00.000	degrees	R

Table 8-12. EXPLTB – Exploitation Related Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
MODE	Mode represents both the collection mode and the processing mode. Subtle differences existing among legacy systems are accommodated by unique mode designations. For ASARS-2 (including AIP, the ASARS Improvement Program): For Search mode imagery the first two characters yy represent the nominal impulse response, in feet, and the third character is “S.” For Spot imagery the first character x indicates the collection mode: 1 = SPOT 1 Mode 2 = Point Imaging 3 = SPOT 3 Mode 4 = Repetitive Point Imaging Mode. The second and third characters indicate the processing (sampling) mode: SP = Slant Plane GP = Ground Plane ES = Enhanced Spot PR = Preview For APG-73: 3SP = Slant Plane Spot 3GP = Ground Mode Spot yyS = Search Mode (same as ASARS-2) For Global Hawk: GSP = Spot Mode, GSH = Search Mode, and GMT = Moving Target Mode.	3	ASARS-2 & AIP: xSP, xGP, xES, xPR, yyS APG-73: 3SP, 3GP, yyS Global Hawk: GSP, GSH, GMT		R
(reserved-001)		16	spaces		R
GRAZE_ANG	The angle, measured in degrees at the target, between the focus plane and line of sight to the radar.	5	00.00 to 90.00	degrees	R
GRAZE_ANG_ACCY	Accuracy of Grazing Angle. 90% probable error value. Unknown=00000 or 00.00	5	00.01 to 90.00, 00000, 00.00	degrees	R
SLOPE_ANG	The angle between the SAR plane and the focus plane. Given GRAZE_ANG ψ and SQUINT_ANGLE θ, $SLOPE\_ANG = COS^{-1}\left[\frac{COS\,\psi\,COS\,\theta}{\sqrt{\left(SIN^{2}\psi\,SIN^{2}\theta + COS^{2}\theta\right)}}\right]$	5	00.00 to 90.00	degrees	R

Table 8-12. EXPLTB – Exploitation Related Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
	Note: SLOPE_ANG is equal to GRAZE_ANG for broadside mapping (θ = 0).				
POLAR	The first character indicates the nominal transmit polarization, and the second character indicates the nominal receive polarization. Each can be Horizontal (H) or Vertical (V).	2	HH, HV, VH, VV		R
NSAMP	Pixels per Line (includes fill)	5	00001 to 99999		R
(reserved-002)		1	0		R
SEQ_NUM	Sequence within Coupled Imagery Set	1	1 to 6		<R>
PRIME_ID	Target Designator of primary target	12	alphanumeric		<R>
PRIME_BE	Basic Encyclopedia ID / OSUFFIX (target designator) of the primary target	15	alphanumeric		<R>
(reserved-003)		1	0		R
N_SEC	Number of Secondary Targets in image.† Default = 00.	2	00 to 99		R
IPR	Commanded impulse response.†† Unknown = 00.	2	00 to 99	feet	R

† determines number of SECTGA extensions
†† replicated in each MPDSRA extension

8.3.7 MENSR - Airborne SAR Mensuration Data

MENSR provides the collection geometry parameters required by image mensuration programs; it is optional, but its use will allow more accurate mensuration.

8.3.7.1 MENSRA Format Description

The format and description for the user defined fields of the MENSRA extension is detailed in table 8-13.

Table 8-13. MENSRA – Airborne SAR Mensuration Data Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MENSRA	N/A	R
CEL	Length of Entire Tagged Record	5	00155	bytes	R
The following fields define MENSRA					
Collection Central Reference Point (CCRP): In the Search mode, the airborne system chooses a CCRP along the scene centerline for each patch. The CCRP will be near the patch line center. The patch center (PC), the actual, geometric center of the processed imagery, may be offset from the CCRP along the scene centerline. The range and azimuth offsets are given in feet; Increasing range is positive, and Azimuth is positive in the direction that subtends an acute angle with the directed scene track. In the Spot Mode, the CCRP is in the exact center of the scene; therefore, the offsets are both equal to 0. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.					
CCRP_LOC	CCRP Location.	21	ddmmss.ssXdddmmss.ssY		R
CCRP_ALT	CCRP Altitude. The elevation of the CCRP above mean sea level (MSL).	6	-01000 to +30000	ft.	R
OF_PC_R	Range Offset Between CCRP And Patch Center.	7	±2000.0	ft.	R
OF_PC_A	Azimuth Offset Between CCRP And Patch Center.	7	±2000.0	ft.	R
COSGRZ	Cosine of Grazing Angle. Computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). Cos (y) = RGM/RSM	7	0.00000 to 1.00000		R
RGCCRP	Range to CCRP. Estimated slant range in feet from the antenna at mid collection array to the CCRP.	7	0000000 to 3000000	ft.	R
RLMAP	Right/Left. This field indicates whether the map was imaged from the right (R) side or the left (L) side of the aircraft.	1	L or R		R

Table 8-13. MENSRA – Airborne SAR Mensuration Data Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CCRP_ROW	CCRP row number	5	00000 to 19999		R
CCRP_COL	CCRP column number	5	00000 to 19999		R
ACFT_LOC	Aircraft Location position at the UTC of the Patch. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.	21	ddmmss.ssXdddmmss.ssY		R
ACFT_ALT	Aircraft Altitude in feet above mean sea level (MSL) at the UTC of the Patch.	5	00000 to 99999	ft.	R
CCRP Unit Basis Vector: The computations of patch parameters are based on a rectangular coordinate system at the current patch CCRP. The unit basis vectors for this local coordinate system are the range, azimuth and altitude vectors. The range vector points in the range direction away from the aircraft; the azimuth vector points in the cross range direction, and subtends an acute angle with the directed scene track; and the altitude vector points straight up. The variables are given as real numbers and are referred to a North, East, Down coordinate system whose origin is at the scene entry point. These data have meaning in Search scenes only.					
C_R_NC	Range Unit Vector, North	7	±1.0000		R
C_R_EC	Range Unit Vector, East	7	±1.0000		R
C_R_DC	Range Unit Vector, Down	7	±1.0000		R
C_AZ_NC	Azimuth Unit Vector, North	7	±1.0000		R
C_AZ_EC	Azimuth Unit Vector, East	7	±1.0000		R
C_AZ_DC	Azimuth Unit Vector, Down	7	±1.0000		R
C_AL_NC	Altitude: North Component	7	±1.0000		R
C_AL_EC	Altitude: East Component	7	±1.0000		R
C_AL_DC	Altitude: Down Component	7	±1.0000		R

8.3.7.2 MENSRB Format Description

The format and description for the user defined fields of the MENSRB extension is detailed in table 8-14.

TABLE 8-14. MENSRB – AIRBORNE SAR MENSURATION DATA EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

<table>
<tr><th>FIELD</th><th>NAME/DESCRIPTION</th><th>SIZE</th><th>VALUE RANGE</th><th>UNITS</th><th>TYPE</th></tr>
<tr><td>CETAG</td><td>Unique Extension Identifier</td><td>6</td><td>MENSRB</td><td>N/A</td><td>R</td></tr>
<tr><td>CEL</td><td>Length of Entire Tagged Record</td><td>5</td><td>00205</td><td>bytes</td><td>R</td></tr>
<tr><td colspan="6">The following fields define MENSRB</td></tr>
<tr><td colspan="6">Aircraft Position:
The format ddmmss.ssssX represents degrees (00-89), minutes (00-59), seconds (00-59), and decimal fractions of seconds (0000-9999) of latitude, with X = N for north or S for south, and dddmmss.ssssY represents degrees (000-179), minutes (00-59), seconds (00-59), and decimal fractions of seconds (0000-9999) 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).</td></tr>
<tr><td>ACFT_LOC</td><td>The aircraft position at the UTC of the Patch.</td><td>25</td><td>ddmmss.ssssX
dddmmss.ssssY
or
±dd.dddddddd
±ddd.dddddddd</td><td></td><td>R</td></tr>
<tr><td>ACFT_LOC_ACCY</td><td><u>Aircraft Position Accuracy</u>. 90% probable circular error value.
Unknown=000000 or 000.00</td><td>6</td><td>000.01 to 999.99
000000 or 000.00</td><td>feet</td><td>R</td></tr>
<tr><td>ACFT_ALT</td><td>The aircraft altitude in feet above mean sea level (MSL) at the UTC of the Patch.</td><td>6</td><td>000000 to 999999</td><td>ft</td><td>R</td></tr>
<tr><td colspan="6">Collection Reference Point:
In Search modes, the airborne system chooses a Reference Point (RP) which may be at or near the center of each patch. The Patch Center, the actual, geometric center of the processed imagery, may be offset from the RP.
In Spot Modes, the RP is in the exact center of the scene, so the offsets are both equal to 0.
The location of the RP relative to the image is specified either by offset values (OF_PC_R & OF-PC_A) or by row/column location (RP-ROW & RP_COL); at least one set of fields must contain valid information, deterermined by individual sensor capabilities.
The format ddmmss.ssssX represents degrees (00-89), minutes (00-59), seconds (00-59), and decimal fractions of seconds (0000-9999) of latitude, with X = N for north or S for south, and dddmmss.ssssY represents degrees (000-179), minutes (00-59), seconds (00-59), and decimal fractions of seconds (0000-9999) 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).
Where accuracy of the data does not warrant maximum precision, space characters will replace fractional digits; the decimal points are required and their position within the field will not change with changing accuracy. For example, “ddmmss.   Xdddmmss.   Y” (with 4 spaces between decimal points and X/Y) if position is only known to within ±100 ft.</td></tr>
<tr><td>RP_LOC</td><td><u>Reference Point Location</u></td><td>25</td><td>ddmmss.ssssX
dddmmss.ssssY
or
±dd.dddddddd
±ddd.dddddddd</td><td></td><td>R</td></tr>
</table>

Table 8-14. MENSRB – Airborne SAR Mensuration Data Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
RP_LOC_ACCY	Reference Point Location Accuracy. 90% probable circular error value. Unknown=000000 or 000.00	6	000.01 to 999.99, 000000, 000.00	feet	R
RP_ELV	Reference Point Elevation. The elevation of the reference point above mean sea level (MSL).	6	-01000 to +30000	ft	R
OF_PC_R	Range Offset. Distance between the RP and the Patch Center. Positive values indicate the RP is closer than the Patch Center to the sensor. Default = +0000.0	7	±9999.9	ft	<R>
OF_PC_A	Azimuth Offset Distance between the RP and the Patch Center. Positive values indicate the RP occurs behind (i.e., earlier) than the Patch Center. Default = +0000.0	7	±9999.9	ft	<R>
COSGRZ	Cosine of the Graze Angle. Computed by dividing the ground plane range of the RP to the antenna at mid collection array (RGM) by the slant range of the RP to the antenna at mid array (RSM):c	7	0.00000 to 1.00000		R
RGCRP	Estimated Slant Range in feet from the antenna at mid collection array to the RP	7	0000000 to 3000000	ft	R
RLMAP	This field indicates whether the map was imaged from the right (R) side or the left (L) side of the aircraft.	1	L, R		R
RP_ROW	Row containing the RP	5	00001 to 99999		<R>
RP_COL	Column containing the RP	5	00001 to 99999		<R>
Reference Point Unit Basis Vectors: The unit basis vectors needed to mensurate within a tile are the basis vectors that align with the row and column directions in the image plane. The basis vectors point in the direction of increasing row and column indices. For images in an along-track by cross-track orientation, the row direction corresponds to along-track and the column direction corresponds to cross-track. For images in a range by azimuth orientation, the row direction corresponds to azimuth while the column direction corresponds to range. The altitude vector is perpendicular to the row and column vectors and points up. In the unit basis vector names given below, the range vector name is tied to the column direction and the azimuth vector name is tied to the row direction. The variables are given as pure numbers in an earth-fixed NED coordinate system centered at the scene (segment) reference point.					
C_R_NC	Range Unit Vector, North	10	±1.0000000		R
C_R_EC	Range Unit Vector, East	10	±1.0000000		R
C_R_DC	Range Unit Vector, Down	10	±1.0000000		R
C_AZ_NC	Azimuth Unit Vector, North	9	±1.000000		R
C_AZ_EC	Azimuth Unit Vector, East	9	±1.000000		R
C_AZ_DC	Azimuth Unit Vector, Down	9	±1.000000		R
C_AL_NC	Altitude: North Component	9	±1.000000		R
C_AL_EC	Altitude: East Component	9	±1.000000		R
C_AL_DC	Altitude: Down Component	9	±1.000000		R
TOTAL_TILES_COLS	Total number of tiles in imaging operation in column direction.	3	001 to 999		<R>

Table 8-14. MENSRB – Airborne SAR Mensuration Data Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
TOTAL_TILES_ROWS	Total number of tiles in imaging operation in row direction.	5	00001 to 99999		<R>

8.3.8 MPDSR - Mensuration Data

MPDSR provides additional information required by most advanced image mensuration programs, such as RULER; it is optional, but required for accurate mensuration. This extension is designed to be used with the information contained in a companion BLOCK extension (identified by BLK_NUM) supporting the same image block. The format and descriptions for the user-defined fields of the MPDSRA extension are detailed in table 8-15.

Table 8-15. MPDSRA – Mensuration Data Extension Format

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MPDSRA	N/A	R
CEL	Length of Entire Tagged Record	5	00188	bytes	R
The following fields define MPDSRA					
BLK_NUM	BLOCK_INSTANCE (see BLOCK) to which this mensuration data applies.	2	01 to 99		R
IPR	Commanded impulse response.	2	01 to 99	feet	R
NBLKS_IN_WDG	Total number of image blocks in this imaging operation segment.	2	01 to 99		R
ROWS_IN_BLK	Number of Rows in each Image Block	5	00001 to 99999		R
COLS_IN_BLK	Number of Columns in each Image Block	5	00001 to 99999		R
ORP_X	X, Y, and Z components of the Output Reference Point (ORP) position vector in the Earth Centered Fixed (ECF) coordinate system.	9	±99999999	feet	<R>
ORP_Y		9	±99999999	feet	<R>
ORP_Z		9	±99999999	feet	<R>
ORP_ROW	Row Containing ORP	5	00001 to 19999		<R>
ORP_COLUMN	Column Containing ORP	5	00001 to 19999		<R>
FOC_X	X, Y, and Z components of Focus Plane Normal (FPN) Vector in Earth Centered Fixed (ECF) coordinate system.	7	±1.0000		<R>
FOC_Y		7	±1.0000		<R>
FOC_Z		7	±1.0000		<R>
ARP_TIME	Collection Start Time in seconds past midnight UTC	9	00000.000 to 86399.999	seconds	R
(reserved-001)		14	spaces		R
The Antenna Reference Point position, velocity, and acceleration at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the RP for the SPOT modes.					
ARP_POS_N	Antenna Reference Point Position at ARP_TIME.	9	±99999999	feet	R
ARP_POS_E		9	±99999999	feet	R
ARP_POS_D		9	±99999999	feet	R
ARP_VEL_N	Antenna Reference Point Velocity at ARP_TIME.	9	±99999.99	feet/sec	R
ARP_VEL_E		9	±99999.99	feet/sec	R
ARP_VEL_D		9	±99999.99	feet/sec	R

Table 8-15. MPDSRA – Mensuration Data Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
ARP_ACC_N	Antenna Reference Point Acceleration at ARP_TIME.	8	±100.000	feet/sec^2	R
ARP_ACC_E		8	±100.000	feet/sec^2	R
ARP_ACC_D		8	±100.000	feet/sec^2	R
(reserved-002)		13	000.0000001.0		R

8.3.9 MSTGT - Mission Target Information

MSTGT provides information from the collection plan associated with the image, and should identify specific targets contained within the image (however, due to collection geometry, a referenced target may not actually correspond to the area contained in the image). Use of MSTGT is optional. The format and description of the user-defined fields of MSTGTA are given in table 8-16. As many as 256 instances of this data extension may occur in each NITF image segment.

TABLE 8-16. MSTGTA – MISSION TARGET INFORMATION EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	MSTGTA	N/A	R
CEL	Length of Entire Tagged Record.	5	00101	bytes	R
The Following Fields Define MSTGTA					
TGT_NUM	Pre-Planned Target Number. A number assigned to each preplanned 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.	5	00001 to 99999		R
TGT_ID	Designator of Target	12	alphanumeric		<R>
TGT_BE	Basic Encyclopedia ID / OSUFFIX (target designator) of target.	15	alphanumeric		<R>
TGT_PRI	Pre-Planned Target Priority: 1 = top priority 2 = second, etc.	3	001 to 999		<R>
TGT_REQ	Target Requester. Identification of authority requesting targets image.	12	alphanumeric		<R>

Table 8-16. MSTGTA – Mission Target Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	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 the file, loses all value and should be discarded. The date and time is in the format CCYYMMDDhhmm in which CCYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59).	12	CCYYMMDDhhmm		<R>
TGT_TYPE	Pre-Planned Target Type: 0 = point 1 = strip 2 = area	1	0 to 9		<R>
TGT_COLL	Pre-Planned Collection Technique: 0 = vertical 1 = forward oblique 2 = right oblique 3 = left oblique 4 = best possible 5 to 9 = reserved	1	0 to 9		R
TGT_CAT	Target Functional Category Code from DIAM-65-3-1. The five character numeric code 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	10000 to 99999		<R>
TGT_UTC	Planned Time at Target. Format is hhmmssZ: hh = Hours, mm = Minutes, ss = Seconds, Z = UTC time zone.	7	hhmmssZ		<R>

Table 8-16. MSTGTA – Mission Target Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
TGT_ELEV	Target Elevation, MSL. Planned elevation of point target. For strip and area targets, this corresponds to the average elevation of the target area. Measured in feet or meters, as specified by TGT_ELEV_UNIT.	6	-01000 to +30000	feet or meters	<R>
TGT_ELEV_UNIT	Unit of Target Elevation. f = feet, m = meters.	1	f or m		<R>
TGT_LOC	Target Location. Planned latitude/ longitude of corresponding portion of target. Location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or 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	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd		R

8.3.10 MTIRP - Moving Target Report

This optional extension provides a standard format to report moving targets located by the radar system. MTIRP may accompany an associated image, in which case this extension is placed in the image subheader. If no image accompanies MTIRPB, it is placed in the file header, and the first 40 characters of the FTITLE field in the file header are filled in accordance with table 8-17. Multiple MTIRP extensions may be included in a single header (see MTI_TOT in ACFT).

Table 8-17. FTITLE Contents for MTI-only Files

FTITLE LOCATION (BYTES)	CONTENT
1 – 3	“MTI”
4 – 17	DATIME field from MTIRPB
18 – 37	AC_MSN_ID field from ACFTB
38 – 40	spaces

8.3.10.1 MTIRPA Format Description

The format and descriptions for the user-defined fields of MTIRPA are detailed in table 8-18. As many as 256 targets may be reported in a single extension.

Table 8-18. MTIRPA – Moving Target Report Extension Format
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MTIRPA	N/A	R
CEL	Length of Entire Tagged Record	5	00072 to 08742	bytes	R
	The following fields define MTIRPA				
MTI_DP	Destination Point at which the scene was collected.	2	01 to 99		<R>
MTI_PACKET_ID	MTI Packet ID Number	3	001 to 999		R
PATCH_NO	The number of the patch within which the targets of this report were located.	4	0001 to 0999		R
WAMTI_FRAME_NO	The number of the Frame within which the targets of this report were located. This field is only used with the Wide Area MTI mode.	5	00001 to 32767		<R>
WAMTI_BAR_NO	The number of the Wide Area Bar within which the targets of this report were located. This field is only used with the Wide Area MTI mode.	1	1 to 7		<R>
UTC	Time in seconds past midnight UTC when the sensor scanned the targets identified in this report.	8	00000.00 to 86399.99	seconds	R

Table 8-18. MTIRPA – Moving Target Report Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from +00.0 (broadside) to +85.0 degrees; aft looking squint angles range from –00.0 to –60.0 degrees.	5	-60.0 to +85.0	degrees	<R>
COSGRZ	Cosine of the Graze Angle. Computed by dividing the ground plane range of the RP to the antenna at mid collection array (RGM) by the slant range of the RP to the antenna at mid array (RSM). $\cos(\psi) = RGM/RSM$	7	0.00000 to 1.00000		R
NO_VALID_TGTS	Number of MTI targets contained in this extension. Determines the number of occurrences of TGT_n_LOC, TGT_n_VEL_R, TGT_n_SPEED, TGT_n_HEADING, TGT_n_AMPLITUDE, and TGT_n_CAT fields.	3	001 to 256		R
TGT_n_LOC	Target Location. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.	21	ddmmss.ssXdddmmss.ssY		C
TGT_n_VEL_R	Target Radial Velocity. A positive value indicates target n is moving away from the sensor, and a negative value indicates target n is moving toward the sensor.	4	±200	feet/sec	<C>
TGT_n_SPEED	Target Estimated Ground Speed.	3	000 to 200	feet/sec	<C>
TGT_n_HEADING	Target Heading. Direction that the nth target is moving rounded to the nearest degree and referenced to True North. 0=North, 90=East, 180=South, and 270=West	3	000 to 359	degrees	<C>

Table 8-18. MTIRPA – Moving Target Report Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
TGT_n_AMPLITUDE	Target Signal Amplitude. Relative signal strength of the return for the moving target. A value of 00 indicates a target with a very weak return signal while a value of 15 indicates a moving target with a very strong return signal; intermediate values are scaled accordingly. Provides a coarse indication of relative size of the moving target.	2	00 to 15		<C>
TGT_n_CAT	Target Classification Category: H = Helicopter T = Tracked U = Unknown W = Wheeled	1	H,T,U,W		<C>

8.3.10.2 MTIRPB Format Description

The format and descriptions for the user defined fields of MTIRPB are detailed in table 8-19. . As many as 999 targets may be reported in a single extension;

TABLE 8-19. MTIRPB – MOVING TARGET REPORT EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MTIRPB	N/A	R
CEL	Length of Entire Tagged Record	5	00119 to 42035	bytes	R
The following fields define MTIRPB					
MTI_DP	Destination Point at which the scene was collected.	2	01 to 99		<R>
MTI_PACKET_ID	MTI Packet ID Number	3	001 to 999		R
PATCH_NO	The number of the patch within which the targets of this report were located.	4	0001 to 0999		R
WAMTI_FRAME_NO	The number of the Frame within which the targets of this report were located. This field is only used with the Wide Area MTI mode.	5	00001 to 32767		<R>
WAMTI_BAR_NO	The numb er of the Wide Area Bar within which the targets of this report were located. This field is only used with the Wide Area MTI mode.	1	1 to 7		<R>

Table 8-19. MTIRPB – Moving Target Report Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
DATIME	Scan Date & Time. This field shall contain the date and time, referenced to UTC, when the targets identified in this report were scanned by the sensor. In the format CCYYMMDDhhmmss, CCYY 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).	14	CCYYMMDDhhmmss		R
ACFT_LOC	The aircraft position when the sensor scanned the targets identified in this report. 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 or 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 or 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	ddmmss.ssXdddmmss.ssY or ±dd.dddddd±ddd.dddddd		R
ACFT_ALT	Aircraft Altitude in feet above mean sea level (MSL) at the UTC of the Patch.	6	000000 to 999999	feet or meters	R
ACFT_ALT_UNIT	Unit of Aircraft Altitude. f = feet, m = meters	1	f or m		R
ACFT_HEADING	Aircraft Heading.	3	000 to 359	degrees	R
MTI_LR	Side of aircraft from which the MTI information is gathered.	1	R or L		<R>
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from +00.00 (broadside) to +85.00 degrees; aft looking squint angles range from –00.00 to –60.00 degrees.	6	-60.00 to +85.00	degrees	<R>
COSGRZ	Cosine of the Graze Angle. Computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). $\cos(\psi) = RGM/RSM$ 9.99999 = unknown	7	0.00000 to 1.00000, 9.99999		R

Table 8-19. MTIRPB – Moving Target Report Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
NO_VALID_TGTS	Number of MTI targets contained in this extension. Determines the number of occurrences of TGT_n_LOC, TGT_n_LOC_ACCY, TGT_n_VEL_R, TGT_n_SPEED, TGT_n_HEADING, TGT_n_AMPLITUDE, and TGT_n_CAT fields.	3	001 to 999		R
TGT_n_LOC	Target Location. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.	23	ddmmss.sssX dddmmss.sssY or ±dd.ddddddd ±ddd.dddddd		C
TGT_n_LOC_ACCY	Target Location Accuracy. Approximate 90% probable circular error value. Unknown=000000 or 000.00	6	000.01 to 999.99, 000000, 000.00	feet	C
TGT_n_VEL_R	Target Radial Velocity. A positive value indicates target n is moving away from the sensor, and a negative value indicates target n is moving toward the sensor.	4	±200	feet/sec	<C>
TGT_n_SPEED	Target Estimated Ground Speed.	3	000 to 200	feet/sec	<C>
TGT_n_HEADING	Target Heading. Direction that the nth target is moving rounded to the nearest degree and referenced to True North. 000=North, 090=East, 180=South, and 270=West	3	000 to 359	degrees	<C>
TGT_n_AMPLITUDE	Target Signal Amplitude. Relative signal strength of the return for the moving target. A value of 00 indicates a target with a very weak return signal while a value of 15 indicates a moving target with a very strong return signal; intermediate values are scaled accordingly. Provides a coarse indication of relative size of the moving target.	2	00 to 15		<C>
TGT_n_CAT	Target Classification Category: H = Helicopter T = Tracked U = Unknown W = Wheeled	1	H,T,U,W		<C>

8.3.11 PATCH - Patch Information

PATCH provides information describing a portion of an image, a patch, to support exploitation. In order to achieve the specified resolution in a SAR image, the phase history data must be continuously collected over a calculated flight path distance; this batch of phase history is then processed into one SAR image patch. A search scene typically consists of many abutting or overlapping patches; each patch of the scene may be treated as an independent image and placed into a separate file, or placed into separate NITF image segments within a single file; where multiple patches of a scene exactly abut to form a mosaic image, they may all (up to 999) be placed into a single NITF image segment. PATCH contains support data pertaining to a single image patch, and one PATCH extension is created for each image patch; The PATCH_TOT field of the ACFT extension contains the total number of patches contained in the NITF image segment (and corresponding PATCH extensions contained in the image subheader). For spot modes there will normally be only one patch, and the corresponding PATCH may be omitted if all necessary information appears elsewhere in the file. PATCH extensions are placed in the subheader of the image containing the described patch.

8.3.11.1 PATCHA Format Description

The format and description for the user-defined fields of the PATCHA extension is detailed in table 8-20.

TABLE 8-20. PATCHA – PATCH INFORMATION EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	PATCHA	N/A	R
CEL	Length of Entire Tagged Record	5	00115	bytes	R
	The following fields define PATCHA				
PAT_NO	Patch Number. Patches are numbered consecutively, starting with 0001 for each image within a file.	4	0001 to 0999		R
LAST_PAT_FLAG	Last Patch of Search Scene. Flag to indicate that this patch is the last in a search scene. When all patches of a scene are not contained within a single image, PATCH_TOT in ACFTB cannot indicate the total number of patches in the scene; this flag then makes it clear that the scene ends with this patch. 0 = Not End, 1 = End.	1	0 or 1		R
LNSTRT	Absolute starting and ending line numbers of this patch within an overall image (scene). Provides similar information to ILOC in the image subheader, but in a form more suitable for some operations. Identifies specifically where this patch fits relative to the other N patches comprising an overall scene, whereas relative values in ILOC are referenced to the object to which this patch is attached.	7	0000001 to 9999999		R
LNSTOP		7	0000020 to 9999999		R

Table 8-20. PATCHA – Patch Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
AZL	Number of azimuth lines in current patch	5	00020 to99999	lines	R
NVL	Number of valid azimuth lines.	5	00020 to 99999	lines	<R>
FVL	First Valid Line. The Spot mode frame dimensions are 2,720 azimuth lines by 2,720 range pixels. In the Continuous Spot mode, the Spot scene does not always completely fill the frame. Therefore, these variables together describe the location of the valid imagery within the 2,720 azimuth lines transferred. These variables have no meaning in the Search mode.	3	001 to 681		<R>
NPIXEL	Number of image pixels per line.	5	Spot: 00170 to 06000 Search: 00272 to 08160	pixels	R
FVPIX	First Valid Pixel Index. Location of the first pixel on a line. This variable, with the number of pixels per line, will define the location of the image within the 8,160 pixels per line for search and 2,720 for spot.	5	Spot: 00001 to 02551 Search: 00001 to 07889		R
FRAME	Spot Frame Number. In Continuous Spot Mode, each image about the same Map Center (a single scene) is called a Frame. The Frame Number starts at 1 and is incremented by 1 for each frame of the scene. Contains spaces for Search and Single Spot modes.	3	001 to 512		<R>
UTC	Coordinated Universal Time. Time in seconds (accurate to 0.01 seconds) of the start of the current patch or, in the case of Spot, the current scene or frame. UTC uses a 24-hour clock where a value of 00000.0 corresponds to midnight.	8	00000.00 to 86399.99	seconds	R
SHEAD	Scene Heading. The Scene Heading is a variable that references the scene to True North. In Search scenes, it is the angle from True North to the Scene CenterLine. In Spotlight Scenes, it is the angle from True North to the Azimuth Vector.	7	000.000 to 359.999	degrees	R
GRAVITY	Local Gravity	7	31.0000 to 33.9999	feet/sec^2	<R>

Table 8-20. PATCHA – Patch Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
INS_V_NC	Ins Platform Velocity, North/East/Down. The Inertial Navigator Platform velocity is given in a North, East, Down earth-fixed coordinate system. These parameters are valid at the time specified by UTC.	5	±9999	feet/sec	R
INS_V_EC		5	±9999	feet/sec	R
INS_V_DC		5	±9999	feet/sec	R
OFFLAT	Geodetic Latitude/Longitude Offset. The Geodetic Latitude/Longitude Offset is the accumulated latitude/longitude correction currently being used to correct the Inertial Navigation System (INS) aircraft position outputs. The offset is given in seconds of a degree; North and East are positive.	8	±80.0000	seconds	<R>
OFFLONG		8	±80.0000	seconds	<R>
TRACK	Track Heading. The track heading is measured in degrees relative to true North. The measurement is clockwise about the vertical from North to the projection of the aircraft roll axis into the level plane, and is valid at the time specified by UTC.	3	000 to 359	degrees	R
GSWEEP	Ground Sweep Angle. The ground sweep angle is determined by the required azimuth resolution and is the angle over which phase history is collected. The measurements are given in degrees.	6	000.00 to 120.00	degrees	R
SHEAR	Patch Shear Factor. Targets are imaged in the slant plane determined by the Processing Central Reference Point and the SAR velocity vector at mid-array. The conversion from target spacing in the ground plane to target spacing in the slant plane for each patch allows the optimal matching of terrain features in one patch to those in the next.	8	0.850000 to 1.000000		<R>

8.3.11.2 PATCHB Format Description

The format and description for the user-defined fields of the PATCHB extension is detailed in table 8-21.

Table 8-21. PATCHB – Patch Information Extension Format
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	PATCHB	N/A	R
CEL	Length of Entire Tagged Record	5	00121	bytes	R
The following fields define PATCHB					
PAT_NO	Patch Number. Patches are numbered consecutively, starting with 0001, for each image within a file.	4	0001 to 0999		R
LAST_PAT_FLAG	Last Patch of Search Scene. Flag to indicate that this patch is the last in a search scene. When all patches of a scene are not contained within a single file, PATCH_TOT in ACFTB cannot indicate the total number of patches in the scene; this flag then makes it clear that the scene ends with this patch. 0 = Not End, 1 = End.	1	0 or 1		<R>
LNSTRT	Absolute starting and ending line numbers of this patch within an overall image (scene). Provides similar information to ILOC in the image subheader, but in a form more suitable for some operations. Identifies specifically where this patch fits relative to the other N patches comprising an overall scene, whereas relative values in ILOC are referenced to the object to which this patch is attached.	7	0000001 to 9999999		R
LNSTOP		7	0000020 to 9999999		R
AZL	Number of azimuth lines in current patch	5	00020 to99999	lines	R
NVL	Number of valid azimuth lines.	5	00020 to 99999	lines	<R>
FVL	First Valid Line. some Spot modes, the Spot scene does not always completely fill the frame. Therefore, these variables together describe the location of the valid imagery within the azimuth lines transferred. These variables have no meaning in the Search modes.	3	001 to 681		<R>

Table 8-21. PATCHB – Patch Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
NPIXEL	Number of image pixels per line.	5	Spot: 00170 to 06000 Search: 00272 to 43000	pixels	R
FVPIX	First Valid Pixel Index. Location of the first pixel on a line. This variable, with the number of pixels per line, will define the location of valid data in the image..	5	Spot: 00001 to 06000 Search: 00001 to 43000		R
FRAME	Spot Frame Number. In Continuous Spot Mode, each image about the same Map Center (a single scene) is called a Frame. The Frame Number starts at 001 and is incremented by 1 for each frame of the scene. Contains spaces for Search and Single Spot modes.	3	001 to 512		<R>
UTC	Coordinated Universal Time. Time in seconds (accurate to 0.01 seconds) of the start of the current patch or, in the case of Spot, the current scene or frame. UTC uses a 24-hour clock where a value of 00000.00 corresponds to midnight.	8	00000.00 to 86399.99	seconds	R
SHEAD	Scene Heading. The Scene Heading is a variable that references the scene to True North. In Search scenes, it is the angle from True North clockwise to the Scene Center Line. In Spotlight Scenes, it is the angle from True North clockwise to the Azimuth Vector (projection of the line of sight from the sensor onto a horizontal plane).	7	000.000 to 359.999	degrees	R
GRAVITY	Local Gravity	7	31.0000 to 33.9999	feet/sec^2	<R>
INS_V_NC	Ins Platform Velocity, North/East/Down. The Inertial Navigator Platform velocity is given in a North, East, Down earth-fixed coordinate system. The measurements are given in units of feet/second. These parameters are valid at the time specified by UTC.	5	±9999	feet/sec	R
INS_V_EC		5	±9999	feet/sec	R
INS_V_DC		5	±9999	feet/sec	R

Table 8-21. PATCHB – Patch Information Extension Format (continued)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
OFFLAT	Geodetic Latitude / Longitude Offset. The Geodetic Latitude/Longitude Offset is the accumulated latitude/longitude correction currently being used to correct the Inertial Navigation System (INS) aircraft position outputs. The offset is given in seconds of a degree; North and East are positive.	8	±80.0000	seconds	<R>
OFFLONG		8	±80.0000	seconds	<R>
TRACK	Track Heading. The track heading is measured in degrees relative to true North. The measurement is clockwise about the vertical from North to the projection of the aircraft roll axis into the level plane, and is valid at the time specified by UTC.	3	000 to 359	degrees	R
GSWEEP	Ground Sweep Angle. The ground sweep angle is determined by the required azimuth resolution and is the angle over which phase history is collected. The measurements are given in degrees.	6	000.00 to 120.00	degrees	R
SHEAR	Patch Shear Factor. Targets are imaged in the slant plane determined by the Processing Central Reference Point and the SAR velocity vector at mid-array. The conversion from target spacing in the ground plane to target spacing in the slant plane for each patch allows the optimal matching of terrain features in one patch to those in the next.	8	0.850000 to 1.000000		<R>
BATCH_NO	Consecutive number for coherent files collected during a mission.	6	000001 to 999999		<R>

8.3.12 RPC00 - Rapid Positioning Capability

RPC00 contains rational function polynomial coefficients and normalization parameters that define the physical relationship between image coordinates and ground coordinates. Use of RPC00 is optional. The format and descriptions for the user-defined fields of the RPC00B extension is detailed in table 8-22. A discussion of the polynomial functions is contained in Section 8.2.4. Note that the order of terms in the polynomial in RPC00B is different from RPC00A (defined in STDI-0001).

Table 8-22. RPC00B – Rapid Positioning Capability Extension Format
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	RPC00B		R
CEL	Length of Entire Tagged Record.	5	01041	bytes	R
The following fields define RPC00B					
SUCCESS		1	1		R
ERR_BIAS	Error - Bias. 68% non time-varying error estimate assumes correlated images.	7	0000.00 to 9999.99	meters	R
ERR_RAND	Error - Random. 68% time-varying error estimate assumes uncorrelated images.	7	0000.00 to 9999.99	meters	R
LINE_OFF	Line Offset	6	000000 to 999999	pixels	R
SAMP_OFF	Sample Offset	5	00000 to 99999	pixels	R
LAT_OFF	Geodetic Latitude Offset	8	±90.0000	degrees	R
LONG_OFF	Geodetic Longitude Offset	9	±180.0000	degrees	R
HEIGHT_OFF	Geodetic Height Offset	5	±9999	meters	R
LINE_SCALE	Line Scale	6	000001 to 999999	pixels	R
SAMP_SCALE	Sample Scale	5	00001 to 99999	pixels	R
LAT_SCALE	Geodetic Latitude Scale (cannot be ±00.0000)	8	±90.0000	degrees	R
LONG_SCALE	Geodetic Longitude Scale (cannot be ±000.0000)	9	±180.0000	degrees	R
HEIGHT_SCALE	Geodetic Height Scale (cannot be ±0000)	5	±9999	meters	R
LINE_NUM_COEFF_1 (through) LINE_NUM_COEFF_20	Line Numerator Coefficients. Twenty coefficients for the polynomial in the Numerator of the r_n equation.	12 --- 12	±9.999999 E±9 --- ±9.999999 E±9		R --- R
LINE_DEN_COEFF_1 (through) LINE DEN_COEFF_20	Line Denominator Coefficients. Twenty coefficients for the polynomial in the Denominator of the r_n equation.	12 --- 12	±9.999999 E±9 --- ±9.999999 E±9		R --- R
SAMP_NUM_COEFF_1 (through) SAMP_NUM_COEFF_20	Sample Numerator Coefficients. Twenty coefficients for the polynomial in the Numerator of the c_n equation.	12 --- 12	±9.999999 E±9 --- ±9.999999 E±9		R --- R
SAMP_DEN_COEFF_1 (through) SAMP_DEN_COEFF_20	Sample Denominator Coefficients. Twenty coefficients for the polynomial in the Denominator of the c_n equation.	12 --- 12	±9.999999 E±9 --- ±9.999999 E±9		R --- R

8.3.13 SECTG - Secondary Targeting Information

SECTG contains a list of secondary targets tasked in the original collection and may not be present in a derived image. Target information in exploited/derived imagery is contained in PIATG (see section 6). PIATG should be used instead of SECTG for actual target information in exploited and derived imagery. The format and description for the user-defined fields of the SECTGA are detailed in table 8-23. As many as 250 SECTGA extensions can exist in a single NITF file, with the N_SEC field of EXOPTA or EXPLTA providing the total count. Either SEC_ID, SEC_BE, or both must contain a valid identifier.

TABLE 8-23. SECTGA – SECONDARY TARGETING INFORMATION EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	SECTGA	N/A	R
CEL	Length of Entire Tagged Record.	5	00028	bytes	R
The following fields define SECTGA					
SEC_ID	Designator of Secondary Target	12	alphanumeric		<R>
SEC_BE	Basic Encyclopedia ID of secondary target, including the OSUFFIX (target designator).	15	alphanumeric		<R>
(reserved-001)		1	0		R

8.3.14 SENSR - EO-IR Sensor Parameters

The SENSR provides information about the sensor and its installation. The SENSR extension is required. The format and descriptions for the user-defined fields of the SENSR extension are detailed in table 8-24. Imaging operations that require substantial time, for example push broom sensors, may require multiple SENSR extensions to adequately describe imaging geometry. The SENSR extension(s) are placed in the image subheader.

TABLE 8-24. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT
R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	SENSRA	N/A	R
CEL	Length of Entire Tagged Record.	5	00132	bytes	R
The Following Fields Define SENSRA					
REF_ROW	Reference Row. Data in this extension was collected at REF_ROW, REF_COL of the imaging operation. Identifies the point at which the data of this extension was valid during extended imaging operations.	8	00000000 to 99999999		<R>
REF_COL	Reference Column	8	00000000 to 99999999		<R>
SENSOR_MODEL	Sensor Model Name. Identifies which specific sensor produced the image.	6	alphanumeric		<R>
SENSOR_MOUNT	Sensor Mounting Pitch Angle. Angle in degrees between the longitudinal centerline of the platform and the sensor scan axis. Normally only applicable to push broom sensors.	3	±45	degrees	<R>

TABLE 8-24. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
SENSOR_LOC	Sensor Location. The earth coordinate sensor location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive). This field shall be filled with spaces if the sensor location is unknown or unavailable.	21	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd spaces	N/A	<R>
SENSOR_ALT_ SOURCE	Sensor Altitude Source. Identifies the source for the value in SENSOR_ALT (and associated reference level): B = Barometric Altimeter (MSL) G = Global Positioning System (WGS-84 Ellipsoid) M = Manual Entry (undetermined) R = Radar Altimeter (AGL)	1	B, G, M, R		<R>
SENSOR_ALT	Sensor Altitude. Altitude above reference level specified by SENSOR_ALT_SOURCE; measured in feet or meters, as specified by SENSOR_ALT_UNIT.	6	-01000 to +99000	feet or meters	<R>
SENSOR_ALT_UNIT	Unit of Sensor Altitude. Applies to both SENSOR_ALT and SENSOR_AGL, and may only be null if both altitudes are null. f = feet, m =meters	1	f or m		<R>
SENSOR_AGL	Sensor Radar Altitude. Altitude above ground level (AGL), measured in feet or meters, as specified by SENSOR_ALT_UNIT. Filled with spaces when not available, or outside equipment operating range.	5	00010 to 99000	feet or meters	<R>

TABLE 8-24. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
SENSOR_PITCH	Sensor Pitch Angle. Angular position of the sensor optical axis , about the platform pitch axis (i.e., angle from the yaw (Za) axis to the projection of the sensor optical axis (line of sight) onto the Xa, Za plane). Measured positive from the yaw axis to the positive platform roll (Xa) axis. For push broom sensors, the angle from the platform roll axis Xa to the projection of the sensor scan axis onto the Xa, Za plane. †	7	±90.000	degrees	<R>
SENSOR_ROLL	Sensor Roll Angle. Angular position of the sensor optical axis, about the platform roll axis (i.e., angle from the positive pitch (Ya) axis to the projection of the sensor optical axis (line of sight) onto the Ya, Za plane). Measure positive from the positive pitch (Ya) axis toward the positive yaw (Za) axis.†	8	±180.000	degrees	<R>
SENSOR_YAW	Sensor Yaw Angle. Angular position of the sensor optical axis, about the platform yaw axis (i.e., angle from the positive roll (Xa) axis to the projection of the sensor optical axis (line of sight) onto the Xa, Ya plane). Measured positive from the positive roll (Xa) axis toward the positive pitch (Ya) axis.†	8	±180.000	degrees	<R>
PLATFORM_PITCH	Platform Pitch. †	7	±90.000	degrees	<R>
PLATFORM_ROLL	Platform Roll†	8	±180.000	degrees	<R>
PLATFORM_HDG	Platform Heading. †	5	000.0 to 359.9	degrees	<R>
GROUND_SPD _ SOURCE	Ground Speed Source. R = Doppler Radar N = Navigation System G = Global Positioning System M = Manual Entry space = unknown	1	R, N, G, M, space		<R>
GROUND_SPD	Ground Speed reported by GROUND_SPEED_SOURCE at time of imagery collection.	6	0000.0 to 9999.9		<R>
GROUND_SPD_UNIT	Unit of Ground Speed. May be null only if GROUND_SPD is null. k =knots, f =feet/sec., m =meters/sec.	1	k, f, m		<R>
GROUND_TRACK	Ground Track. The angle from north to the horizontal projection of the platform path (positive from north to east).	5	000.0 to 359.9	degrees	<R>

TABLE 8-24. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT (CONTINUED)

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
VERT_VEL	Vertical Velocity. Measured in either feet/min. or meters/min. as specified by VERT_VEL_UNIT.	5	±9999	feet or meters per min	<R>
VERT_VEL_UNIT	Unit of Vertical Velocity. May be null only if VERT_VEL is null. f =feet/min., m =meters/min.	1	f or m		<R>
SWATH_FRAMES	Number of Frames per Swath. A Swath is a continuous strip of frames swept out by the scanning motion of certain dynamic sensors. Platform dynamics may cause the number of frames to vary from one swath to another.	4	0001 to 9999		<R>
N_SWATHS	Number of Swaths.	4	0001 to 9999		<R>
SPOT_NUM	Spot Number. Number in point targets mode.	3	001 to 999		<R>

† See section 8.2.2

8.3.15 STREO — Stereo Information

The STREO extension provides links between several images that form a stereo set to allow exploitation of elevation information. Use of STREO is optional. There can be up to 3 STREO extensions per image. The format and descriptions for the User Defined fields of this extension is detailed in table 8-25.

TABLE 8-25. STREOB – STEREO INFORMATION EXTENSION FORMAT

R = REQUIRED, C = CONDITIONAL, <> = BCS SPACES ALLOWED FOR ENTIRE FIELD

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	STREOB	N/A	R
CEL	Length of Entire Tagged Record.	5	00094	bytes	R
The Following Fields Define STREOB					
ST_ID	Stereo Mate. The image id of the first stereo mate. This field contains the values of the first 60 characters of the ITITLE/IID2 field in the image subheader of the stereo mate image.	60	alphanumeric		R
N_MATES	Number of Stereo Mates. If there are no stereo mates, there will be no STREO extensions in the file. If there is a STREO extension, then there will be at least 1 stereo mate.	1	1 to 3		R
MATE_INSTANCE	Mate Instance. Identifies which stereo mate is described in this extension. For example, this field would contain a 2 for the second stereo mate.	1	1 to 3		R

Table 8-25. STREOB – Stereo Information Extension Format (continued)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
B_CONV	Beginning Convergence Angle. Defined at the first lines of the left and /right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the last line of the right image shall be used. Accuracy of elevation measurements is reduced with large convergence angles.	5	00.00 to 99.99 100.0 to 179.9	degrees	<R>
E_CONV	Ending Convergence Angle. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right image shall be used. Accuracy of elevation measurements is reduced with large convergence angles.	5	00.00 to 99.99 100.0 to 179.9	degrees	<R>
B_ASYM	Beginning Asymmetry Angle. Defined at the first lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, last line of the right image shall be used.	5	00.00 to 90.00	degrees	<R>
E_ASYM	Ending Asymmetry Angle. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right image shall be used.	5	00.00 to 90.00	degrees	<R>
B_BIE	Beginning Bisector Intercept Elevation less Convergence Angle of Stereo Mate. Defined at the first lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the last line of the right image shall be used.	6	±90.00	degrees	<R>
E_BIE	Ending Bisector Intercept Elevation less Convergence Angle of Stereo Mate. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right image shall be used.	6	±90.00	degrees	<R>

8.4 Definitions

Altitude	The height of an object above a given reference level. Within the Airborne SDE domain, altitude refers to the distance between the aircraft/sensor and a reference point on the Earth, as stated within a data element's definition.
Batch	One interval of SAR phase history data that is collected periodically over a given flight path.
Block	For use within the Airborne SDE domain, an image *BLOCK* represents the entire coverage of all abutting/overlapping *PATCH*es within a *SCENE*. An image *BLOCK* can also represent the coverage of a single SAR spot, or single VIMAS continuous or frame capture. Not to be confused with image Fast Access Format (FAF) blocks or tiles.
Elevation	The height of the Earth's surface at a given point above a given reference level. Within the Airborne SDE domain, elevation refers to the distance between a given point of interest on the Earth and a reference level, as stated within a data element's definition.
Flight Path	The ground path traveled by the airborne platform during an imaging collection operation.
Patch	A portion of an image created from a *BATCH* of SAR phase history.
Scene	A single image or a collection of images providing continuous coverage of an area of interest. In search modes, a *SCENE* may consist of one or more image segments, and comprises all imagery captured within a given scene number (SCNUM) within a given imagery operation number (OP_NUM). Within a SAR spot (or VIMAS continuous or frame capture), a scene will be typically comprised of a single image segment.
Scene Centerline	An imaginary line which runs between all patches (or single images from a SAR spot, or VIMAS continuous/frame capture) comprising a scene. The scene centerline originates at the center of the first line of pixels and terminates at the center of the last line of pixels in the scene.
Segment	(1) A section or part of a NITF file. A NITF file may contain image segments, graphic segments, text segments, data extension segments, and/or reserved extension segments. Each segment is comprised of a segment subheader followed by the data applicable to that segment. (2) A means to partition an imaging operation into labeled portions (segments). Specific sensor, processing, or image abstract characteristics and limitations determine segment dimensions. For example, if a sensor in a search/scan mode collects and processes 640,000 rows within an imaging operation, the resulting image *may* be partitioned into 10 segments identified 'AA' - 'AJ', each of 64,000 rows. Likewise, if a framing sensor collected 3 consecutive frames of imagery (with each frame consisting of 10K columns X 30K rows), the resulting theoretical image from the imaging operation could be 10K columns X 90K rows, and comprised of 3 segments identified 'AA' - AC'.
Tiles	Pixel ordering in a manner that allows rapid roaming within large images. A tiled image is comprised of a rectangular array of uniform, adjoining sub-images called tiles, similar to the formation of a tiled floor. Fast Access Format (FAF) blocks are tiles.
Track	The path on the earth's surface directly beneath the Flight Path of the airborne platform. The path may (or may not) be geographically coincident to that of a scene centerline.

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9.0 IOMAPA Tagged Record Extension Description

The IOMAPA tagged extension contains the data necessary to perform the output amplitude mapping process for each scan within each image frame. This post-processing is applied after the image data has undergone the data expansion process using the 12-bit JPEG/DCT algorithm.

The output amplitude mapping function is generally the inverse of the input amplitude mapping function that is performed as a pre-processing step before the data compression process is executed.

Note: An exception to this case is when the output of the compression is scaled by a factor (S2) to change the precision of the output product relative to the input data precision.

The explanation of the input amplitude mapping is included to describe the pre-processing performed before the compression process. The pre-processing steps are shown in figure 9-1 and the post-processing steps are shown in figure 9-2 for mapping methods 1 through 3.

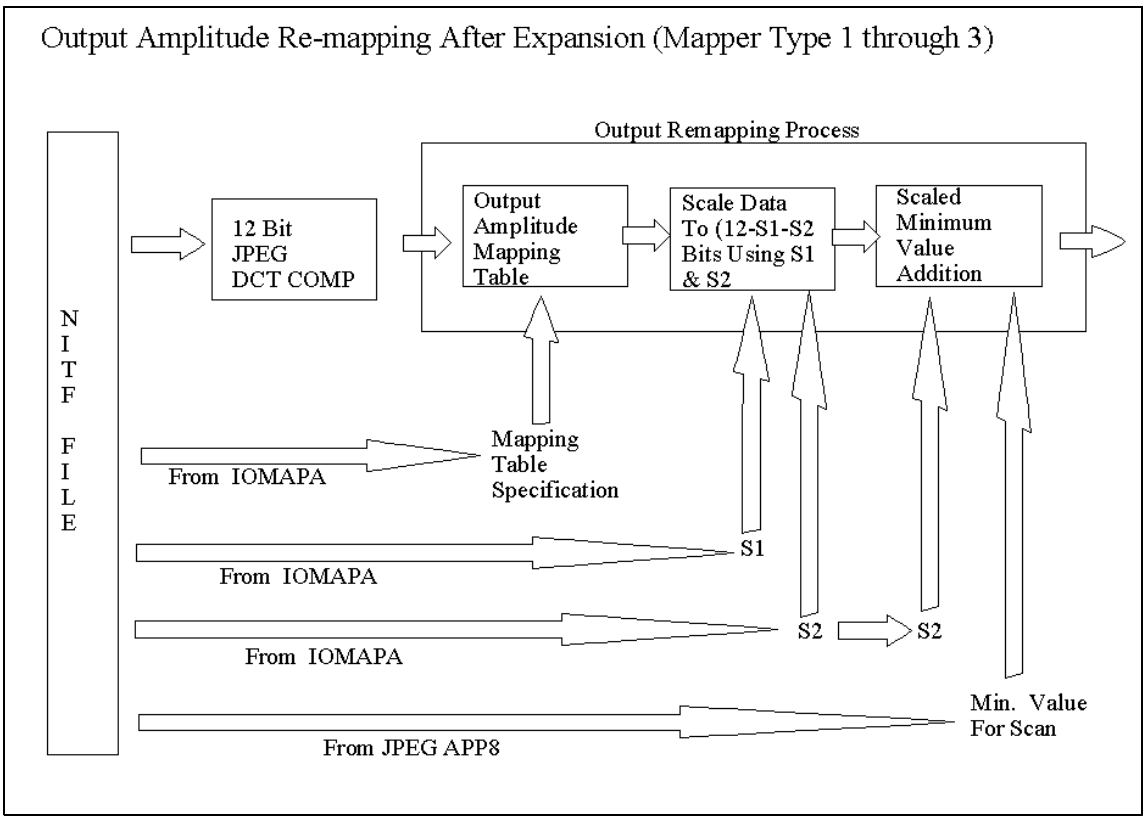

FIGURE 9-1. PRE-PROCESSING STEPS

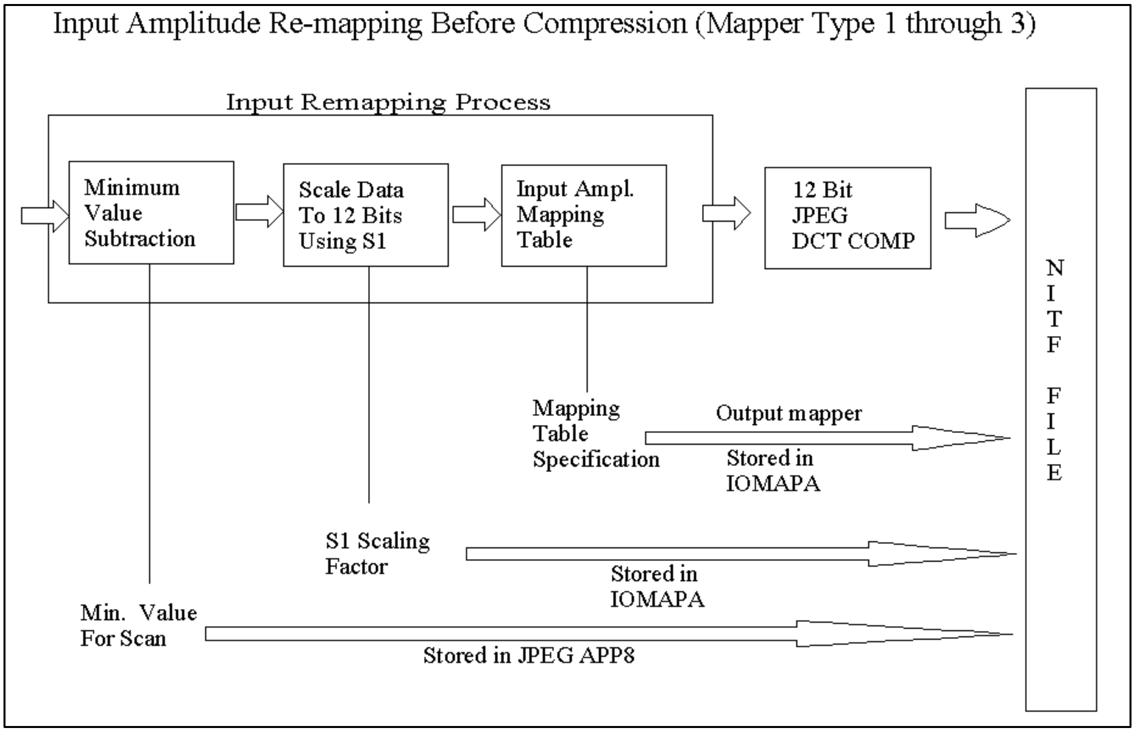

FIGURE 9-2. POST-PROCESSING STEPS

9.1 Format Description and Mapping Method Functions

The IOMAPA data extension is used to transfer the required information needed for the inverse of the input mapping function, i.e., the output amplitude mapping function which is applied to the image data after expansion.

Tables 9-1 to 9-3 defines the format for the NITF controlled tagged record extensions bearing the tag of IOMAPA. The IOMAPA tag is meant to be stored in the image subheader portion of the NITFS file structure. Portions of this tagged record extension are variable depending upon the value of the MAP_SELECT field within the extension.

9.1.1 Functionality of NITF JPEG/DCT Compressor using the IOMAPA TRE

The input amplitude mapping function takes the image data with a known minimum value and performs a three step pre-processing function on each scan contained in the image frame before it is sent to the JPEG/DCT compressor.

The first operation subtracts the minimum pixel intensity for each scan from each pixel in the corresponding scan of the image frame. For example, the minimum value for scan 1 is subtracted from the pixels contained in the scan 1 data block. The minimum value for each scan is stored in the JPEG application segment, APP6/(Extension NITF0001), in order to pass this information to the expander.

The second step in the mapping process is to use a S1 factor to scale the original data up to a 12-bit precision. If the original input data has 9-bit precision, then the S1 scale factor would be set to 3.

The third step in the mapping process is to apply an input mapping function, specified as part of a compression database, to the data. The compressor fills in the values of the IOMAPA extension from the compression database defining the appropriate output amplitude mapping function to be used by the expander.

In actual practice, the second and third steps can be performed with a scaled lookup table in order to gain efficiency in the implementation of the input mapping process.

If the MAP_SELECT field is equal to 0, then the subtraction of the minimum value from each block shall not be performed. The second and third steps shall also be bypassed because the mapper type 0 is used to turn off the re-mapping process. However, the data can be scaled with the output mapper after the JPEG expansion to decrease the precision of the data if the S2 factor is non-zero.

9.1.1.1 Input Amplitude Mapping Method 0

The amplitude mapping method 0 is used to turn off the minimum value subtraction and re-mapping pre-processing options. The minimum values of the scan is loaded into APP6/(Extension NITF0001), and a non-zero S2 output scaling factor can be loaded into the IOMAPA tag, but the data remains unchanged before it is compressed.

9.1.1.2 Input Amplitude Mapping Method 1

Table 9-2 describes the format of the controlled tag extension used to pass the parameters used in the amplitude mapping method 1. The controlled tag extension (method 1) contains a value by value listing or table for the output lookup process. The output lookup table is the inverse mapping of the input lookup table used by the compressor.

The input mapping table is contained in a compressor database, but is not needed by the expander and is not included in the IOMAPA tag. The tag also contains the input scale factor value S1, and the output precision scale change value S2.

The input amplitude mapping process that uses the input amplitude-mapping table shall be defined as:

IXX = (IX - MIN) * ISF   Scale the data to 12-bits after the subtraction of the minimum value

If IXX is less than 0 then IXX = 0   Clamp the value to the limits for the input amplitude function

If IXX is greater than IXMAX then IXX = IXMAX

IXXX = input_amplitude_map_table [IXX]	Input amplitude mapping table with starting index of 0 used to re-map value

Where:

IX	Original Pixel Data
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
ISF = 2**(S1)	Scale Factor Exponent where S1 is a data item included in IOMAPA
IXX	Scaled Original Pixel Data
IMAX = 4096	
IXMAX = IMAX – 1	Maximum Value for Input to Map Table
IXXX	Re-mapped Image Pixel Data
int[]	Denotes integer truncation

Note: The resultant re-mapped value shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to IXMAX.

9.1.1.3 Input Amplitude Mapping Method 2

Table 9-3 describes the format of the controlled tag extension used to pass the parameters needed for amplitude mapping method 2. If the MAP_SELECT flag is set to 2, a generalized log mapping shall be utilized as the basis for the input amplitude mapping function. The parameters R, S1, and IMAX shall be used to generate the function. The parameters R, S1, and S2 shall be loaded into the IOMAPA extension. The input amplitude mapping process for when the MAP_SELECT is set to 2 is defined below:

IX = Original Pixel Value	
IXX = IX – MIN	Subtract the minimum value for the image block
If R is not equal to 1.0	Perform log mapping
IXXX = int[(B * ln(1.0 + A*IXX)) + 0.5]	
Else	
IXXX = IXX * ISF	Special case for log mapping if R=1.0
Where:	
IX	Original Image Pixel Data
IXX	Image Pixel Data after the minimum value subtraction
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
A = (R-1.0)/IXMID	
B = IXMAX/(ln(1.0+A*ISMAX))	
R	Log Ratio data item loaded into IOMAPA
IMAX = 4096	IMAX shall be 4096 for 12-bit JPEG/DCT
IXMAX = IMAX - 1	
ISMAX = (IMAX/ISF)-1	Scaled maximum
IXMID = (IMAX/(2*ISF)	Scaled mid-point
ISF = 2**(S1)	Scale Factor S1
IXXX	Re-mapped Image Pixel Data
int[]	Denotes integer truncation

Note: The resultant re-mapped value IXXX shall then be clamped to ensure that it is greater or equal to zero and less than or equal to IXMAX.

9.1.1.4 Input Amplitude Mapping Method 3

Table 9-4 describes the format of the controlled tag extension used to pass the parameters for amplitude mapping method 3. Mapping method 3 uses a 3-segment polynomial mapping process, where each interval is described by a fifth order polynomial. The starting point for each interval and a set of six coefficients defining the polynomial for each segment shall be database items. The coefficients stored in the IOMAPA tag are different from the ones used in the input mapping process.

The coefficients stored in the tag usually reflect the inverse mapping characteristics of the input mapper coefficients. The input mapper coefficients are stored in a compressor database, but are not needed by the expander and are not included in the IOMAPA tag.

If the MAP_SELECT flag is set to the value 3, the following segmented polynomial mapping shall be used for each pixel before the 12-bit JPEG/DCT compression process.

IX = Original Pixel Value

IXX = IX – MIN	Subtract the minimu m value for the image block
IXXX = IXX * ISF	Shifted input value IXX is scaled by ISF

The scaled original pixel (IXXX) value shall determine which segment of the polynomial function shall be used.

Segment (J) shall be defined as

XIB(J-1) <= IXXX < XIB(J)   For J = 1, 2, and 3

Where

XIB(J) are segment bounds

XIB(0) = 0 and XIB(3) = 4096

XIB(1) and XIB(2) are contained in a compression database

The scaled input pixel value (IXXX) shall be mapped using the coefficients (ai) for the appropriate polynomial segment as defined above. These coefficients are stored in a compressor database and are not included in the IOMAPA tag. Output coefficients, which perform the inverse operation of the (ai)'s, are included in the IOMAPA tag.

The output mapping segment bounds correspond to the mapped values of the input segment bounds and are included in the NITF CDE IOMAPA. The two output segment boundaries can be calculated using the a0 input mapping coefficients for the second and third segments, respectively. The simple expressions for the output segment boundaries are due to the IZ term being equal to 0 at the XIB(1) and XIB(2) input mapping segment boundaries.

XOB(1) = int[a0 + 0.5]	where a0 is from the input mapping coefficients for segment 2
XOB(2) = int[a0 + 0.5]	where a0 is from the input mapping coefficients for segment 3

The input mapping expression for the polynomial function is given below:

IZ = IXXX - XIB(J-1)

IY = int[a0 + a1*IZ + a2*(IZ**2) + a3*(IZ**3) + a4*(IZ**4) + a5*(IZ**5) + 0.5]

Where:

IX	Original pixel value
IXX	Image Pixel Data after minimum value subtraction
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
IXXX	Scaled value to determine segment number
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
a0, a1, a2, ..., a5	6 Input Mapper Coefficients For Segment J{ X(J-1) <= IXXX < X(J) }
XIB(J-1)	Lower Boundary for Input Mapper Segment J
XOB(J-1)	Lower Boundary for Output Mapper Segment J
IY	Re-mapped image pixel value
IMAX = 4096	
IXMAX = IMAX - 1 = 4095	
int[]	Denotes integer truncation

Note: The output of the polynomial mapping function (IY) shall be clamped to ensure that it is greater than or equal to zero and less or equal to IXMAX.

9.1.2 Functionality of NITF JPEG/DCT Expander when using the IOMAPA TRE

The output amplitude mapping function takes the reconstructed image data from the JPEG expansion process and performs a three step post-processing function on the data unless mapping method 0 is applied. The first step in the re-mapping process is to apply an output mapping function specified by the IOMAPA extension present in the NITF file. The second operation re-scales the data values using the S1 and S2 values. The final operation adds the minimum value extracted from the JPEG APP6/(Extension NITF0001) application segment to each pixel value.

If the MAP_SELECT field is equal to 0, then the re-mapping amplitude function and the addition of the minimum value shall not be performed. Only the S2 factor shall be used to change the precision of the data to (orig_precision-S2) bits.

9.1.2.1 Output Amplitude Mapping Method 0

The amplitude mapping method 0 code describes to the interpreter of the NITF file that no input or output re-mapping function or minimum value shift is applied to the data. However, if the S2 field is not equal to zero, the data values shall be scaled by the factor of 2**S2. The output scaled pixel value shall use the following expression:

OX = int[(IY/OSF)]

Where:

IY = Pixel Value From JPEG Expander

OSF = 2**(S2)

OX = Output Precision Scaled Pixel Value

9.1.2.1 Output Amplitude Mapping Method 1

Table 9-2 describes the format of the controlled tag extension for amplitude mapping method 1.

The IOMAPA tag (method 1) contains a value by value listing or table for the output lookup process. The tag also contains the input scale factor value S1, and the output precision scale change value S2.

The output amplitude mapping process, which utilizes the output amplitude-mapping table, shall be defined as:

If IY is less than 0 then IY = 0	Clamp the input to the output amplitude function.
If IY is greater than IXMAX then IY = IXMAX	
IXX = output_amplitude_map_table[IY]	Virtual array with the values of the output amplitude mapping table loaded starting at index 0.
OX = int[(IXX/(ISF*OSF)) + 0.5] + int[(MIN/OSF)+0.5]	Scaled Output Data with scaled image block minimum added.

Where:

IY	Pixel Data from JPEG Expander
IMAX = 4096	
IXMAX = IMAX – 1	Maximum Value for Input to Map Table
ISF = 2**(S1)	Scale Factor Exponent where S1 is a data item included in IOMAPA
OX	Re-scaled Image Pixel Data

OSF = 2**(S2)	Scale Factor Exponent where S2 is a data item included in IOMAPA
MIN	Minimum pixel value for image block extracted from the NITF JPEG application segment APP6/(Extension NITF0001)
OMAX = (IMAX/(ISF*OSF))-1	Maximum Value Clamp for Final Output
int[]	Denotes integer truncation

Note: The resultant output shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.2.2.3 Output Amplitude Mapping Method 2

Table 9-3 describes the format of the controlled tag extension for amplitude mapping method 2.

If the MAP_SELECT flag is set to 2, a generalized log mapping shall be utilized as the basis for the output amplitude mapping function. The parameters R, S1, S2, and IMAX shall be utilized to generate the function. The parameters R, S1, and S2 shall be extracted from the IOMAPA tag.

The output amplitude mapping process for when the MAP_SELECT set to 2 is defined below:

If IY is less than 0 then IY = 0	Clamp the input to the function.
If IY is greater than IXMAX then IY = IXMAX	
If R is not equal to 1.0	
IX = int[(((exp(IY/B)-1.0)/A)/OSF) + 0.5]	
Else	
IX = int[(IY/(ISF*OSF)) + 0.5]	
OX = IX + int[(MIN/OSF) + 0.5]	Scaled Output Data with Scaled Image Block Minimum Added

Where:

IY	Clamped Pixel Data from JPEG Expander
R	Log Ratio data item from IOMAPA Tag
A = (R-1.0)/IXMID	
B = IXMAX/(ln(1.0+A*ISMAX))	
IXMID = (IMAX/(2*ISF)	Scaled mid-point
ISMAX = (IMAX/ISF)-1	Scaled maximum
IMAX = 4096	IMAX shall be 4096 for 12-bit JPEG/DCT
IXMAX = IMAX – 1	Maximum input
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
OSF = 2**(S2)	Scale Factor (S2 from IOMAPA)
IX	Re-scaled output mapped pixel (with minimum still subtracted)
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)

OX	Re-scaled Image Pixel Data
OMAX = (IMAX/(ISF*OSF))-1	Maximum Value for Final Output
int[]	Denotes integer truncation
exp()	Exponential Function (e**x)

Note: The resultant output shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.1.2.2 Output Amplitude Mapping Method 3

Table 9-4 describes the format of the controlled tag extension for amplitude mapping method 3. Mapping method 3 uses a 3-segment polynomial mapping process where each interval is described by a fifth order polynomial. The break point for each interval and a set of six coefficients defining the polynomial for each segment shall be extracted from the IOMAPA tag.

If the MAP_SELECT flag is set to the value 3, the following segmented polynomial mapping shall be utilized for each pixel output from the expansion process.

The output pixel (IY) from the JPEG/DCT expansion process shall determine which segment of the polynomial function shall be utilized.

Segment (J) shall be defined as

XOB(J-1) <= IY < XOB(J) For J = 1, 2, and 3

Where

XOB(J) are output mapper segment bounds

XOB(0) = 0 and XOB(3) = 4096

XOB(1) and XOB(2) are extracted from the NITF CDE IOMAPA

The output pixel value (IY) shall be mapped using the coefficients (bi) for the appropriate polynomial segment as defined above. The expression for the polynomial function is given below:

If IY is greater than 4095, then IY = 4095.

If IY is less than 0, then IY = 0.

IZ = IY - XOB(J-1)

IXX = int[b0 + b1*IZ + b2*(IZ**2) + b3*(IZ**3) + b4*(IZ**4) + b5*(IZ**5) + 0.5]

Where the coefficients b0 through b5 are included in the NITF CDE IOMAPA.

The output of the polynomial mapping function (IXX) shall be scaled by the following relationship:

IX = int[(IXX/(ISF*OSF)) + 0.5]

OX = IX + int[(MIN/OSF) + 0.5]

Where:

IY	Pixel value from expansion process (Determines Segment Number Location)
X(J-1)	Lower Boundary for Segment J
b0, b1, b2, ..., b5	6 Output Mapper Coefficients For Segment J { X(J-1) <= IY < X(J) }
IXX	Intermediate value from polynomial equation

IX	Re-scaled output mapped pixel (with minimum still subtracted)
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
OSF = 2**(S2)	Scale Factor (S2 from IOMAPA)
OX	Re-scaled Image Pixel Data
MIN	Minimum pixel value for image lock and extracted from the NITF JPEG application segment APP6/(Extension NITF0001)
OMAX = ((IMAX/(ISF*OSF)) - 1)	Final output value clamp IMAX = 4096
int[]	Denotes integer truncation

The resultant output (OX) shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.1.3 IOMAPA Tagged Record Extension Format Tables

TABLE 9-1. IOMAPA FORMAT FOR MAPPING METHOD 0
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	00006	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	0	R
S2	Scale Factor 2	2	00 to 11	R

TABLE 9-2. IOMAPA FORMAT FOR MAPPING METHOD 1
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	08202	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	1	R
TABLE_ID	I/O TABLE USED (note 2)	2	00 to 99	0
S1	Scale Factor 1 (note 3)	2	00 to 11	R
S2	Scale Factor 2 (note 4)	2	00 to 11	R
OUTPUT MAP VALUE 0	First Output Mapping Value	2	(note 1)	R
….	……………….	..	….	…..
OUTPUT MAP VALUE 4095	Last Output Mapping Value	2	(note 1)	R

Notes: 1. Value is stored in 2 byte unsigned integer format (Most Sign. Byte First). The binary value is limited to be greater than or equal to 0 and less than or equal to 4095.
2. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
3. The value of S1 is used to scale the input data precision up to 12 bits. For the example of 8 bit-input data, the S1 value would be 4.
4. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.

TABLE 9-3. IOMAPA FORMAT FOR MAPPING METHOD 2

R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA	5	00016	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	2	R
TABLE_ID	I/O TABLE USED (note 1)	2	00 to 99	0
S1	Scale Factor 1 (note 2)	2	00 to 11	R
S2	Scale Factor 2 (note 3)	2	00 to 11	R
R_WHOLE	R Scaling Factor – Whole Part (note 4)	3	000 to 999	R
R_FRACTION	R Scaling Factor – Fractional Part (note 4)	3	000 to 255	R

Notes:
1. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
2. The value of S1 is used to scale the input data precision up to 12 bits. For the example of 8 bit-input data, the S1 value would be 4.
3. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.
4. The R values contain two parts, the fractional part and the whole part. The resultant of R is derived by the expression: R = R_WHOLE + (R_FRACTION/256)

TABLE 9-4. IOMAPA FORMAT FOR MAPPING METHOD 3

R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	00091	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	3	R
TABLE_ID	I/O TABLE USED (note 1)	2	00 to 99	0
S1	Scale Factor 1 (note 2)	2	00 to 11	R
S2	Scale Factor 2 (note 3)	2	00 to 11	R
NO_OF_SEGMENTS	Number of Segments	1	3	R
XOB_1	Segment Boundary 1	4	0000 to 4095	R
XOB_2	Segment Boundary 2	4	0000 to 4095	R
OUT_B0_1	B0 Coefficient of 1st Segment	4	(note 4)	R
OUT_B1_1	B1 Coefficient of 1st Segment	4	(note 4)	R
OUT_B2_1	B2 Coefficient of 1st Segment	4	(note 4)	R
OUT_B3_1	B3 Coefficient of 1st Segment	4	(note 4)	R
OUT_B4_1	B4 Coefficient of 1st Segment	4	(note 4)	R

TABLE 9-4. IOMAPA FORMAT FOR MAPPING METHOD 3 (CONTINUED)

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
OUT_B5_1	B5 Coefficient of 1st Segment	4	(note 4)	R
OUT_B0_2	B0 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B1_2	B1 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B2_2	B2 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B3_2	B3 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B4_2	B4 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B5_2	B5 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B0_3	B0 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B1_3	B1 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B2_3	B2 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B3_3	B3 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B4_3	B4 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B5_3	B5 Coefficient of 3rd Segment	4	(note 4)	R

Notes:
1. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
2. The value of S1 is used to scale the input data precision up to 12 bits.
3. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.
4. The value is stored in 4-byte IEEE single precision floating point format. Value range is the range available in the standardized 4-byte IEEE single precision floating point format. The 4 bytes are stored in "Network Transmission Order" where the 32 bits are ordered from bit 31 to bit 0 in contiguous order with no byte swapping.

Single-Precision	bit ordering
SIGN	bit 31
EXPONENT	bits 30-23 (bias 127)
FRACTION	bits 22-0

byte 1								byte 2								byte 3			byte 4		
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	…	8	7	…	0
S	E	E	E	E	E	E	E	E	f	f	f	f	f	f	f	f	…	f	f	…	f

10.0 Profile for Imagery Archives Extensions (PIAE)

10.1 Profile for Imagery Archives Image Support Extension

This support extension is designed to provide an area to place fields not currently carried in NITF but are contained in the Standard Profile for Imagery Archives. Most imagery related information is contained in the NITF main headers and Support Data Extensions (SDEs). The purpose of this extension is to minimize redundant fields while providing space for all information. This extension shall be present no more than once for each image in the NITF file. When present, this extension shall be contained within the image extended subheader data field of the image subheader or within an overflow DES if there is insufficient room to place the entire extension within the image extended subheader data field.

TABLE 10-1. PROFILE FOR IMAGERY ARCHIVES IMAGE (PIAIMB)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIAIMB	R
CEL	Length of PIAIMB extension	5	00337	R
CEDATA	User-defined data	337	See table 2 below	R

TABLE 10-2. PIAIMB DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
CLOUDCVR	Cloud Cover	3	N	000-100, 999	O
SRP	Standard Radiometric Product	1	A/N	Y, N	O
SENSMODE	Sensor Mode	12	A/N	WHISKBROOM, PUSHBROOM, FRAMING, SPOT, SWATH, TBD	O
SENSNAME	Sensor Name	18	A/N	Valid Sensor Name	O
SOURCE	Source	255	A/N	Alphanumeric	O
COMGEN	Compression Generation	2	N	00-99	O
SUBQUAL	Subjective Quality	1	A/N	P-Poor, G - Good, E - Excellent, F- Fair	O
PIAMSNNUM	PIA Mission Number	7	A/N	EARS 1.1 page 4-28	O
CAMSPECS	Camera Specs	32	A/N	Alphanumeric	O
PROJID	Project ID Code	2	A/N	EARS Appendix 9	O
GENERATION	Generation	1	N	0-9	O
ESD	Exploitation Support Data	1	A/N	Y, N	O
OTHERCOND	Other Conditions	2	A/N	EARS 1.1 page 4-28	O

TABLE 10.3 DESCRIPTION OF PIAIMB DATA FIELDS

Field	Value Definitions and Constraints
CLOUDCVR	Indicates the percentage of the image that is obscured by cloud. A value of '999' indicates an unknown condition.
SRP	Indicates whether or not standard radiometric product data is available.
SENSMODE	Identifies the sensor mode used in capturing the image.
SENSNAME	Identifies the name of the sensor used in capturing the image.
SOURCE	Indicates where the image came from (e.g., magazine, trade show, etc.).
COMGEN	Counts the number of lossy compressions done by the archive.
SUBQUAL	Indicates a subjective rating of the quality of the image.
PIAMSNNUM	Indicates the mission number assigned to the reconnaissance mission.
CAMSPECS	Specifies the brand name of the camera used, and the focal length of the lens.
PROJID	Identifies collection platform project identifier code
GENERATION	Specifies the number of image generations of the product. The number (0) is reserved for the original product.
ESD	Indicates whether or not Exploitation Support Data is available and contained within the product data.
OTHERCOND	Indicates other conditions which affect the imagery over the target.

10.2 Profile for Imagery Archives Product Support Extension - Version C

The data found in the Product Support Extension addresses information regarding the products derived from source imagery. While there is product related data in the NITF main header and SDEs, many fields contained in the Standards Profile for Imagery Archives(SPIA) are absent. This extension aligns the SPIA and NITF for product information, and adds descriptive detail associated with products. This extension shall be present no more than once for each product. When present, this extension shall be contained within the extended header data field of the NITF file header or within an overflow DES if there is insufficient room to place the entire extension within the file's extended header data field.

TABLE 10-4. PROFILE FOR IMAGERY ARCHIVES PRODUCT (PIAPRC)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIAPRC	R
CEL	Length of PIAPRC extension	5	00201 - 63759	R
CEDATA	User-defined data	201-63759	See table 5 below	R

TABLE 10-5. PIAPRC DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
ACCESSID	Access ID	64	A/N	Alphanumeric	O
FMCONTROL	FM Control Number	32	A/N	Alphanumeric	O
SUBDET	Subjective Detail	1	A/N	P- Poor, F - Fair, G - Good, E - Excellent	O
PRODCODE	Product Code	2	A/N	EARS 1.1 Appendix 6	O
PRODUCERSE	Producer Subelement	6	A/N	Alphanumeric	O
PRODIDNO	Product ID Number	20	A/N	Alphanumeric	O
PRODSNME	Product Short Name	10	A/N	Alphanumeric	R
PRODUCERCD	Producer Code	2	A/N	Alphanumeric	R
PRODCRTIME	Product Create Time	14	A/N	DDHHMMSSZMONYY	O
MAPID	Map ID	40	A/N	Alphanumeric	O
SECTITLEREP	SECTITLE Repititions	2	N	00-99	R
SECTITLE1	Section Title	40	A/N	Alphanumeric	C
PPNUM1	Page/Part Number	5	A/N	Alphanumeric	C

TABLE 10-5. PIAPRC DATA AND RANGES (CONTINUED)

Field	Name	Size	Fmt	Value Range	Type
TPP1	Total Pages/Parts	3	N	001-999	C
....					
SECTITLEnn	Section Title	40	A/N	Alphanumeric	C
PPNUMnn	Page/Part Number	5	A/N	Alphanumeric	C
TPPnn	Total Pages/Parts	3	N	001-999	C
REQORGREP	REQORG Repetitions	2	N	00-99	R
REQORG1	Requesting Organization	64	A/N	Alphanumeric	C
....					
REQORGnn	Requesting Organization	64	A/N	Alphanumeric	C
KEYWORDREP	KEYWORD Repetitions	2	N	00-99	R
KEYWORD1	Keyword String 1	255	A/N	Alphanumeric	C
....					
KEYWORDnn	Keyword String nn	255	A/N	Alphanumeric	C
ASSRPTREP	ASSRPT Repetitions	2	N	00-99	R
ASSRPT1	Associated Report 1	20	A/N	Alphanumeric	C
....					
ASSRPTnn	Associated Report nn	20	A/N	Alphanumeric	C
ATEXTREP	ATEXT Repetitions	2	N	00-99	R
ATEXT1	Associated Text 1	255	A/N	Alphanumeric	C
....					
ATEXTnn	Associated Text nn	255	A/N	Alphanumeric	C

TABLE 10-6. DESCRIPTION OF PIAPRC DATA FIELDS

Field	Value Definitions and Constraints
ACCESSID	Contains an archive unique identifier. This could be the product filename, a record identifier, a reference number, the product id, or any other means to access the product from the archive.
FM CONTROL	Identifies foreign material associated with the product.
SUBDET	Indicates a subjective rating of useful detail available in the product.
PRODCODE	Identifies the category of product data stored in the archive.
PRODUCERSE	Identifies the element within the producing organization that created the product.
PRODIDNO	Identifies a product stored in the archive with a producer assigned number.
PRODSNME	Identifies the abbreviated name of a product stored in the archive.
PRODUCERCD	Identifies the organization responsible for creating or modifying the product.
PRODCRTIME	Identifies the date or the date and time that the product was created or last modified.
MAPID	Identifies a map associated with the product.
SECTITLEREP	Identifies the number of times the SECTITLE, PPNUM, and TPP fields repeat per extension instance.
SECTITLE1	Identifies the first user defined title of a section of a multi-section product.
PPNUM1	Identifies the first page/part number of the section identified in SECTITLE1.
TPP1	Identifies the total number of pages or parts associated with SECTITLE1 and PPNUM1.
SECTITLEnn	Identifies the nnth user defined title of a section of a multi-section product.
PPNUMnn	Identifies the nnth page/part number of the section identified in SECTITLEnn.
TPPnn	Identifies the tnnth number of pages or parts associated with SECTITLEnn and PPNUMnn.
REQORGREP	Identifies the number of times the REQORG field repeats per extension instance.

TABLE 10-6. DESCRIPTION OF PIAPRC DATA FIELDS (CONTINUED)

Field	Value Definitions and Constraints
REQORG1	Identifies the first organization requesting that an image be placed in an archive. This is the first field represented based on the value of REQORGREP.
REQORGnn	Identifies the nnth organization requesting that an image be placed in an archive. The number of REQORGs between the previous field and this is represented in the REQORGREP field.
KEYWORDREP	Identifies the number of times the KEYWORD field repeats per extension instance.
KEYWORD1	Provides the first block of a freeform text description of the product.
KEYWORDnn	Provides the nnth block of a freeform text description of the product. The number of KEYWORDSs between the previous field and this is represented in the KEYWORDREP field.
ASSRPTREP	Identifies the number of times the ASSRPTREP field repeats per extension instance.
ASSRPT1	First field for the entry of another known report associated with the product.
ASSRPTnn	Provides the nnth field of other known reports associated with the product. The number of ASSRPTs between the previous field and this is represented in the ASSRPTREP field.
ATEXTREP	Identifies the number of times the ATEXTREP field repeats per extension instance.
ATEXT1	Provides the first text block further describing the imagery product.
ATEXTnn	Provides the nnth text block further describing the imagery product. The number of ATEXTs between the previous field and this is represented in the ATEXTREP field.

10.3 Profile for Imagery Archives Target Support Extension

The Target Extension is designed to accommodate more than just the essential target data. It contains descriptive data about the targets. This extension shall be present once for each target identified in the image. There may be up to 250 of these extensions for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 10-7. PROFILE FOR IMAGERY ARCHIVES TARGET (PIATGA)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIATGA	R
CEEL	Length of PIATGA extension	5	00096	R
CEDATA	User-defined data	96	See table 8 below	R

TABLE 10-8. PIATGA DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
TGTUTM	Target UTM	15	A/N	XXXNNnnnnnnnnnn	O
PIATGAID	Target Identification	15	A/N	6 character Area Target ID 10 Character BE, or 15 character BE + suffix	O
PIACTRY	Country Code	2	A/N	FIPS 10-3	O
PIACAT	Category Code	5	N	DIAM 65-3-1	O
TGTGEO	Target Geographic Coordinates	15	A/N	ddmmssXdddmmssY	O
DATUM	Target Coordinate Datum	3	A/N	In accordance with Appendix B, Attachment 10, XI-DBDD-08 93 Aug 93.	O
TGTNAME	Target Name	38	A/N	Alphaumeric target names	O
PERCOVER	Percentage of Coverage	3	N	000-100	O

TABLE 10.9 DESCRIPTION OF PIATGA DATA FIELDS

Field	Value Definitions and Constraints
TGTUTM	Identifies the Universal Transverse Mercator (UTM) grid coordinates that equate to the geographic coordinates of the target element.
PIATGAID	Identifies a point or area target (DSA, LOC or BAS)
PIACTRY	Identifies the country in which the geographic coordinates of the target element reside.
PIACAT	Classifies a target element by its product or the type of activity in which it can engage.
TGTGEO	Specifies a point target's geographic location in latitude and longitude.
DATUM	Identifies the datum of the map used to derive the target coordinates (UTM or GEO).
TGTNAME	Identifies the official name of the target element based on the MIIDS/IDB name.
PERCOVER	Percentage of the target covered by the image.

10.4 Profile for Imagery Archives Person Identification Extension

The Person Extension is designed to identify information contained in the Imagery Archive that is directly related to a person(s) contained in adata type (image, symbol, label, text). This extension shall be present for each person identified in a data type. There may be up to 500 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 10-10. PROFILE FOR IMAGERY ARCHIVES PERSON (PIAPEA)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIAPEA	R
CEL	Length of PIAPEA extension	5	00092	R
CEEDATA	User-defined data	92	See table 11 below	R

TABLE 10-11 PIAPEA DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
LASTNME	Last Name	28	A/N	Alphanumeric	O
FIRSTNME	First Name	28	A/N	Alphanumeric	O
MIDNME	Middle Name	28	A/N	Alphanumeric	O
DOB	Birth Date	6	A/N	MMDDYY	O
ASSOCTRY	Associated Country	2	A/N	Per FIPS 10-3	O

TABLE 10-12. DESCRIPTION OF PIAPEA DATA FIELDS

Field	Value Definitions and Constraints
LASTNME	Identifies the surname of individual captured in an image.
FIRSTNME	Identifies the first name of individual captured in an image.
MIDNME	Identifies the middle name of individual captured in an image.
DOB	Identifies the birth date of the individual captured in the image.
ASSOCTRY	Identifies the country the person captured in the image is/are associated with.

10.5 Profile for Imagery Archives Event Extension

The Event Extension is designed to provided an area for specific information about an event or events that are identified on an image. This extension shall be present for each event identified in an image. There may be up to 100 of these extensions present for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 10-13 PROFILE FOR IMAGERY ARCHIVES EVENT (PIAEVA)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIAEVA	R
CEL	Length of PIAEVA extension	5	00046	R
CEDATA	User-defined data	46	See table 14 below	R

TABLE 10-14 PIAEVA DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
EVENTNAME	Event Name	38	A/N	Alphanumeric	O
EVENTTYPE	Event Type	8	A/N	POL, DIS, COMMO, MILEX, ECON, NUC, SPACE, MILMOV, CIVIL	O

TABLE 10-15 DESCRIPTION OF PIAEVA DATA FIELDS

Field	Value Definitions and Constraints
EVENTNAME	The recognized name of the event.
EVENTTYPE	Indicates the generic type of event associated with the product.

10.6 Profile for Imagery Archives Equipment Extension

The Equipment Extension was created to provide space in the NITF file for data contained in the archive that is specifically related to equipment that is contained in an image. This extension shall be present for each instance of equipment identified in an image. There may be up to 250 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 10-16 PROFILE FOR IMAGERY ARCHIVES EQUIPMENT (PIAEQA)

Field	Name	Size	Value Range	Type
CETAG	Unique extension type ID	6	PIAEQA	R
CEL	Length of PIAEQA	5	00130	R
CEDATA	User-defined data	130	See table 17 below	R

TABLE 10-17 PIAEQA DATA AND RANGES

Field	Name	Size	Fmt	Value Range	Type
EQPCODE	Equipment Code	7	A/N	NGIC Foreign Equipment Guide	O
EQPNOMEN	Equipment Nomenclature	45	A/N	NGIC Foreign Equipment Guide	O
EQPMAN	Equipment Manufacturer	64	A/N	Alphanumeric	O
OBTYPE	OB Type	1	A/N	MIIDS/IDB	O
ORDBAT	Type Order of Battle	3	A/N	EARS 1.1	O
CTRYPROD	Country Produced	2	A/N	FIPS 10-3	O
CTRYDSN	Country Code Designed	2	A/N	FIPS 10-3	O
OBJVIEW	Object View	6	A/N	Right, Left, Top, Bottom, Front, Rear	O

TABLE 10-18 DESCRIPTION OF PIAEQA DATA FIELDS

Field	Value Definitions and Constraints
EQPCODE	A unique designated equipment code identifying a category of equipment.
EQPNOMEN	Nomenclature used to identify a piece of equipment.
EQPMAN	Identifies the manufacturer of a piece of equipment.
OBTYPE	Indicates the type of order of battle according to MIIDS/IDB
ORDBAT	Indicates the type of order of battle according to EARS 1.1
CTRYPROD	Identifies the country that produced the object
CTRYDSN	Identifies the country that designed the original object
OBJVIEW	View of the object.

10.7 Appendix A SPIA Data Element Mapping to NITFS

The following table maps all SPIA data elements to their proper location in an NITFS file when transmitting imagery data and associated metadata.

SPIA Element		NITF Element	NITF Location
ABPP (N2)		ABPP	IMAGE SUBHEADER
ACCESSID (A/N64)		ACCESSID	PIAPRC
ANGLETONORTH (N3)		ANGLE_TO_NORTH	USE26A
ASSOCTRY (A2)		ASSOCTRY	PIAPEA
ASSRPT (A/N20)		ASSRPT	PIAPRC
ATEXT (A/N255)		ATEXT	PIAPRC
AUTHORITY (A/N20)		FSCAUT	HEADER
CAMSPECS (A/N 32)		CAMSPECS	PIAIMB
CAT (N5)		PIACAT	PIATGA
CLASS (A1)		FSCLAS	HEADER
CLEVEL (N2)		CLEVEL	HEADER
CLOUDCVR (N3)		CLOUDCVR	PIAIMB
CODEWORDS (A/N40)		FSCODE	HEADER

SPIA Element		NITF Element	NITF Location
COMGEN (N2)		COMGEN	PIAIMB
CONTROL (A/N40)		FSCTLH	HEADER
CTRYCD (A2)		PIACTRY	PIATGA
CTRYDSN (A2)		CTRYDSN	PIAEQA
CTRYPROD (A2)		CTRYPROD	PIAEQA
DATUM (A3)		DATUM	PIATGA
DOB(A/N6)		DOB	PIAPEA
DWNG (A/N6)		FSDDVT	HEADER
DWNGEVT (A/N40)		FSDEVT	HEADER
EQPCODE (A/N7)		EQPCODE	PIAEQA
EQPMAN (A64)		EQPMAN	PIAEQA
EQPNOMEN (A/N45)		EQPNOMEN	PIAEQA
ESD (A1)		ESD	PIAIMB
EVENTNAME (A/N38)		EVENTNAME	PIAEVA
EVENTTYPE (A8)		EVENTTYPE	PIAEVA
FIRSTNME (A/N 28)		FIRSTNME	PIAPEA
FMCONTROL(A/N32)		FMCONTROL	PIAPRC
GENERATION(N1)		GENERATION	PIAIMB
ICAT(A8)		ICAT	IMAGE SUBHEADER
ICORDS (A1)		ICORDS	IMAGE SUBHEADER
IGEOLO (A/N60)		IGEOLO	IMAGE SUBHEADER
IMAGEID (A/N40)		ITITLE	IMAGE SUBHEADER
IREP (A8)		IREP	IMAGE SUBHEADER
KEYWORD (A/N 255)		KEYWORD	PIAPRC
LASTNME (A/N28)		LASTNME	PIAPEA
MAPID (A/N40)		MAPID	PIAPRC

SPIA Element		NITF Element	NITF Location
MEANGSD (N5)		MEAN_GSD	USE26A
MIDNME (A/N28)		MIDNME	PIAPEA
MISSION (A/N7)		PIAMSNNUM	PIAIMB
NBANDS (N1)		NBANDS	IMAGE SUBHEADER
NCOLS (N8)		NCOLS	IMAGE SUBHEADER
NIIRS (N3)		NIIRS	USE26A
NROWS (N8)		NROWS	IMAGE SUBHEADER
OBJVIEW (A6)		OB~~B~~JVIEW	PIAEQA
OBLANGLE (N5)		OBL_ANG	USE26A
OBTYPE (A1)		OBTYPE	PIAEQA
ORDBAT(A/N3)		ORDBAT	PIAEQA
OTHERCOND (A2)		OTHERCOND	PIAIMB
PERCOVER (N3)		PERCOVER	PIATGA
PPNUM (A/N4)		PPNUM	PIAPRC
PRODCODE (A2)		PRODCODE	PIAPRC
PRODCRTIME (A/N14)		PRODCRTIME	PIAPRC
PRODFMT(A9)		FHDR	HEADER
PRODFSIZE (N12)		FL	HEADER
PRODIDNO (A/N20)		PRODIDNO	PIAPRC
PRODSNME (A/N10)		PRODSNME	PIAPRC
PRODTITLE (A/N50)		FTITLE	HEADER
PRODUCERCD (A 2)		PRODUCERCD	PIAPRC
PRODUCERSE (A/N 6)		PRODUCERSE	PIAPRC
PROJID (A2)		PROJID	PIAIMB
RELEASE (A/N40)		FSREL	HEADER
REQORG (A/N64)		REQORG	PIAPRC

SPIA Element		NITF Element	NITF Location
RPC (A1)		SUCCESS	RPC00A
SECTITLE (A/N40)		SECTITLE	PIAPRC
SENSMODE (A/N12)		SENSMODE	PIAIMB
SENSNAME (A/N18)		SENSNAME	PIAIMB
SOURCE (A/N255)		SOURCE	PIAIMB
SRP (A1)		SRP	PIAIMB
STEREOID (A/N40)		ST_ID	STREOA
SUBDET (A1)		SUBDET	PIAPRC
SUBQUAL (A1)		SUBQUAL	PIAIMB
SUNAZ(N3)		SUN_AZ	MPD26A
SUNELEV (N3)		SUN_EL	MPD26A
TGTGEO (A/N15)		TGTGEO	PIATGA
TGTID (A/N15)		PIATGAID	PIATGA
TGTNAME (A/N38)		TGTNAME	PIATGA
TGTUTM (A/N16)		TGTUTM	PIATGA
TIMECOLL (A/N14)		IDATIM	IMAGE SUBHEADER
TPP (N3)		TPP	PIAPRC

10.8 APPENDIX B: Extension Version Transition Plan

10.8.1 Purpose

The purpose of this appendix is to define a plan to facilitate migration from legacy to target baseline versions of PIAE tags. It is intended to provide general developmental guidance to the imagery community in an effort to minimize the interoperability problems that may arise from version modifications to the PIAE standard. It is provided as planning guidance to eliminate the need for program office maintenance of software elements providing support to legacy PIAE tags beyond the specified transition period.

10.8.2 Scope and Effectivity

The plan covers those PIAE versions in existence after the approval of the standard. Dated versions of PIAE tags can be identified by the last letter of the CETAG (e.g., "PIAPRC" represents version "C" of the Product tag while "PIAIMB" represents version "B" of the Image tag). The plan defines the processing requirements for legacy and target tag versions. Legacy tag versions are those that exist prior to a modification to the approved PIAE standard. Target tag versions are those resulting from approved modifications to an existing version. A target tag is a new tag version of an old tag for which a new baseline has been approved and has become the new PIAE standard. For example, if an RFC to the PIAE standard is approved (by the ISMC) that will change the PIATGA tag to a "B" version, the PIATGA tag will then be considered a "legacy" tag and the PIATGB tag will be considered the "target" tag for the transition period. After the transition period, the PIATGB tag would simply be recognized as the "baseline" tag.

The transition plan applies to the following types of modifications to PIAE tags:

- Tag placement

- Tag content (i.e., name, length, and data).

The transition plan applies to developers of Read Only (RO), Write Only (WO), and Read and Write (RW) system segments that process imagery or imagery related products. It does not apply to developers of Legacy systems who's systems are planned for replacement within the specified transition period. Legacy systems are exempt from the requirements to support PIAE tag version revisions. The transition plan is effective for the life of the PIAE standard and all approved version revisions to it.

10.8.3 Placement and Content of Controlled Tag Extensions

The placement and content of the PIAE tags within NITF files shall be as specified in the PIAE tag format definition. MIL-STD-2500A allows controlled tag extensions to be placed within the following major NITF file components:

- Field XHD of the NITF File Header
- Field IXSHD of the NITF Image Subheader
- Field SXSHD of the NITF Symbol Subheader
- Field LXSHD of the NITF Label Subheader
- Field TXSHD of the NITF Text Subheader
- The Data Extension Segment (DES) when overflow conditional exist.

10.8.4 Transition Concept

The goal of the transition plan is to gradually eliminate the presence of old PIAE tags once new tags have been approved by the standards approval process. To accomplish this goal, product WO, RO, and WR segments are directed to adopt the newest versions of all PIAE tags at the earliest time possible and to continue support for legacy tags through a 12 month transition period. This transition period commences with ISMC approval of tag version modifications. The following graphic provides conceptual illustration.

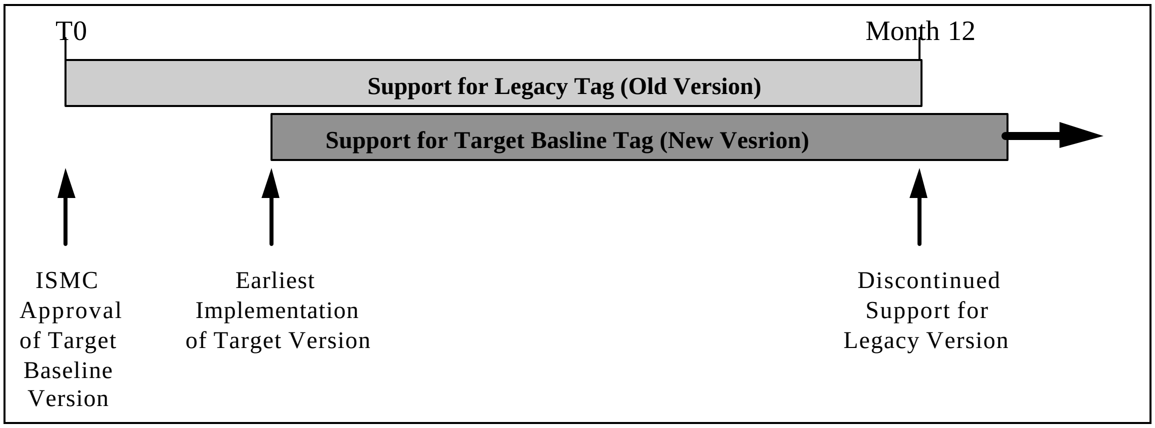

FIGURE 10-1 TWELVE MONTH TRANSITION 1

10.8.5 Read Only Segments

A RO segment is a system element that only receives and reads NITFS 2.0 input files. A RO segment will not create NITFS 2.0 output. RO segments shall look for, find, and read controlled tag extensions where specified by the PIAE format definition and generically authorized by MIL-STD-2500A. During the specified 12 month transition period, RO segments shall incorporate the capability to read all target tag versions while maintaining read capability for all legacy tag versions. Support to legacy tag versions shall cease at the end of the transition period.

10.8.6 Write Only Segments

A WO segment is a system element that only creates NITFS 2.0 files. A WO segment will not receive and read NITFS 2.0 input. WO segments shall generate, pack, and transmit controlled tag extensions where defined by the PIAE format definition. During the specified 12 month transition period, WO segments shall incorporate the capability to write all target tag versions while maintaining write capability for all legacy tag versions. Support to legacy tag versions shall cease at the end of the transition period.

10.8.7 Read and Write Segments:

A RW segment is a system element that receives and reads input NITFS 2.0 files and creates NITF 2.0 output files. RW segments shall perform the combined functions of RO and WO segments as specified above. In addition, if reading of the legacy version of a tag does not provide sufficient input to fill required fields to write the target versions, ASCII blanks shall be used during the transition period to fill the fields.

RW segments that store (on-line, near-line, off-line) imagery or imagery related products, shall ensure that stored products are populated with both, legacy and target, versions of the tag under transition. Product population of both tag versions shall occur once, for every product stored within the segment, for the transition period.

10.8.8 Sending Systems

Sending systems are those systems that transmit (output) imagery or imagery related NITFS products to user or archival systems. The group includes those systems that generate or format products for transmission. When employed, the PIAE tags are packaged within the NITFS file format. Sending systems employing the tags are directed to adopt the newest version of all tags employed while simultaneously discontinuing use of older versions.

Adoption of new extension versions is to be done at the earliest time permissible within interoperability and developmental budget and timeline constraints. A concession to the adoption requirement is made when interfacing receiver systems are unable to process new tag versions. In this case, sending systems are directed to package the new and the immediate predecessor version of the new tag within transmitted products.

10.8.9 Receiving Systems

Receiving systems are those systems that accept (input) imagery or imagery related products from generating or archival systems. The group includes those systems that input NITFS formatted products for viewing, manipulation, or archival purposes. When employed, the PIAE tags, within products, are identified and read into the system for processing or storage. Receiving systems employing the tags are directed to retain the ability to concurrently identify, read, and process the immediate predecessor version of a new tag and the new tag itself.

Adoption of the ability to identify, read, and process version revisions of PIAE tags is to be at the earliest time permissible within interoperability and developmental budget and timeline constraints.

10.8.10 Final System Configuration

No system is required to process any more that the current PIAE tag version and its immediate predecessor version. In an effort to promote community-wide interoperability, development system program offices are urged to move toward the newest PIAE tag versions as soon as possible.

Modifications to the PIAE standard will not be approved without community cost and schedule impact assessments. Proposed modifications to the standard that act to impute undue implementation difficulties upon the development community will be considered for deferral.

11.0 BCKGDA Controlled Extension

This extension is used for scaling NITF images and overlays for the purposes of printing and for setting background color. It provides information needed to print and scale the displayable part of an NITFS file.

11.1 BCKGDA Field Formats

TABLE 11-1. BCKGDA - FIELD SIZES AND DEFINITIONS
R = Required, C = Conditional

FIELD	NAME	SIZE	RANGE	TYPE
CETAG	Tag Name	6	BCKGDA	R
CEL	Length of Extension Tag	5	00099	R
BGWIDTH	Background Width. The width, in PIXUNITS, of the complete NITF composition (This is not CLEVEL size, this is the composition (e.g. -paper size))	8	00000000 to 99999999	R
BGHEIGHT	Background Height. The HEIGHT, in PIXUNITS, of the complete NITF composition (This is not CLEVEL size, this is the composition (e.g. -paper size))	8	00000000 to 99999999	R
BGRED	Background Red. The red component of the background	8	00000000 to 00000255	R
BGGREEN	Background Green. The green component of the background	8	00000000 to 00000255	R
BGBLUE	Background Blue. The blue component of the background	8	00000000 to 00000255	R
PIXSIZE	Pixel Size. The number of pixels per PIXUNITS: "INCHES or CENTIMETERS only	8	00000000 to 99999999	R
PIXUNITS	Pixel Units. The unit of measure for printing of a pixel of the NITF composition	40	alphanumeric: DEVICE, PIXELS, INCHES, CENTIMETERS, or POINTS	R

Note: The PIXSIZE is defined for PIXUNITS of INCHES or CENTIMETERS only.

If the PIXSIZE is 100 and the PIXUNITS is "INCHES" the NITF composition units of measure for printing is 100 pixels per inch (The same logic holds true for "CENTIMETERS").

If the PIXUNITS is "DEVICE PIXELS" then the composition is output to the print device with a one to one pixel correspondence.

If the PIXUNITS is POINTS then the composition units of measure for printing is 72 pixels per inch or 28.3464 pixels per centimeter.

12.0 NBLOCA Tagged Record Extension

NBLOCA et of each image frame relative to each other within a NITF image. The first image frame offset is the number of bytes in the image subheader. All of the other offsets are the number of bytes in the previous image block or frame.

This extension allows the NITF image to be accessed in a random or parallel fashion by providing the ability to find the offset to the location of the first data byte of any frame or block. This offset is determined by summing the offset values for the previous blocks, and allows direct access to a frame without reading through any portion of the image frames. For JPEG applications, these offsets are to the Start Of Image (SOI) markers, which are always the first element for each JPEG compressed frame.

Table 12-1 defines the format for the NITF controlled tagged record extension bearing the tag of NBLOCA. This extension is meant to be stored in the NITF image subheader portion of the NITF file structure.

TABLE 12-1. NBLOCA FORMAT
R = Required, O = Optional, C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	NBLOCA	R
CEL	Length of CEDATA Fields (note 1)	5	00008 to 99988	R
FRAME_1_OFFSET	First Image Frame Offset. From beginning of NITF image subheader (note2).	4	note 2	R
NUMBER_ OF_FRAMES	Number of Blocks. Number of blocks for which offsets are listed.	4	note 3	R
FRAME_2_OFFSET	Second Image Frame Offset. Offset in Bytes of the beginning of the 2nd image frame from the beginning of the 1st image frame (note 5).	4	note 4	C
....	....	....	....	....
FRAME_N_OFFSET	Frame Offset. Offset in bytes of the beginning of the nth image frame from the beginning of the N-1 image frame.	4	note 4	C

Notes:
1. This value is dependent upon the number of image frame offsets, which are stored in this controlled data extension.
2. Value is stored in 4 byte unsigned binary integer representation with a range of 439 to 999999 (Bounds for image subheader size). This offset is equal to the size of the image subheader. The bytes are ordered from the most significant to the least significant.
3. Value is stored in 4 byte unsigned binary integer representation with a range of 1 to 24996 (Limits due to max size of CETAG). The bytes are ordered from the most significant to the least significant.
4. Value is stored in 4 byte unsigned binary integer representation with a range of 1 to (2**32 - 1). The bytes are ordered from the most significant to the least significant.
5. For JPEG applications, this is the offset between the SOI marker of the 2nd Image Frame from the SOI marker of the 1st Image Frame.

13.0 OFFSET tagged record extension description

This definition establishes the format and provides a detailed description of the data and data format for the CE OFFSET to the NITF 2.0. This extension defines the offset of the first pixel of an NITF 2.0 image from the first pixel of the full image described by the accompanying support data. If the NITF 2.0 image is blocked differently from the full image, or is not aligned to the full image block structure, this extension allows the NITF 2.0 image to be located relative to the full image, such that the support data can be used properly. Table 13-1 defines the format for the controlled tagged record extension to the NITF bearing tag OFFSET.

TABLE 13-1. OFFSET FORMAT DESCRIPTION
R = Required

FIELD	DESCRIPTION	SIZE	FORMAT VALUE	TYPE
CETAG	Tag Record Identifier	1 to 6	OFFSET	R
CEL	Tag Data Field Length	5	00016	R
LINE	Align-Scan Offset of First Pixel	8	00000000 to 99999999	R
SAMPLE	Cross-Scan Offset of First Pixel	8	00000000 to 99999999	R

14.0 RULER Extension

For information regarding this Tag(s) (MISC) refer to following:

Call the JITC Certification Test Facility at Commercial (520) 538-5458 or DSN 879-5458

15.0 HISTOA Extension

15.1 Introduction

The purpose of the Softcopy History Tagged Record Extension, HISTOA, is to provide a history of the softcopy processing functions that have been applied to NITF imagery. It is meant to describe previous processing actions and the current state of the imagery that was distributed within the intelligence and imagery user community. To be effective, HISTOA needs to be applied to the NITF product as early as practical and must be updated each time the image is processed and saved by a softcopy processing system. This will allow the user to know with confidence the complete history of the imagery. HISTOA may be created as the NITF image is created, or when the imagery is first modified.

15.2 Background and Motivation

With the development of standard processing flows for national imagery, and incorporation of preprocessing to convert some baseline imagery formats into “Display-Ready” imagery, it became necessary to differentiate between the Display-Ready products and the baseline formats. Also, imagery users expressed frustration with the fact that softcopy-processing functions were being applied repeatedly to imagery, without their knowledge. This repetition of processing steps on a single image resulted in a degraded and sometimes unusable image. The users desired a method of recording the types and frequency of Softcopy processing steps applied to each image.

Based on these concerns, a BHIST Tagged Record Extension was originally developed for some national systems and approved by the NTB in 1997. The purpose of the BHIST tag was to indicate the Display-Ready status of the image, to identify any pixel remapping, and to provide a mechanism for tracking softcopy processing functions (e.g. Dynamic Range Adjustment, Sharpening, and Tonal Transfer Curve) applied to the image. (Refer to Appendix A for a complete description of these functions.) BHIST was later expanded to include imagery produced by other national systems, plus airborne and commercial imagery, and became HISTOA.

15.3 Softcopy History Tag Structure

The structure of HISTOA is based on reporting “processing events.” Each processing event consists of a series of fields that indicate the type of processing that has been applied to the image at that moment in time. In order to determine what processing has been applied to the image over time, the entire set of processing events must be read. Relevant information includes tonal processing, compression, image resolution, rectification, and magnification. A comment field is also provided in each processing event to allow users to capture relevant information not accounted for in the pre-defined fields. The structure allows for up to 99 separate processing events to be recorded. The basic structure of the tag is shown in table 15-1.

The first eight fields within the tag are required to be filled when the tag is created, but are not repeated for each processing event. Therefore, when HISTOA is generated, it is structured as shown in table 15-1 and the first eight fields are filled. The population of all the fields in HISTOA shall be left justified with spaces included where necessary (a space is denoted by BCS 0x20). Leading zeros may also be necessary in some of the numeric fields. A description of the first eight fields in the tag is given in table 15-2.

To be effective, HISTOA must be updated each time a new NITF product (file) is formulated after the image is processed by a softcopy processing system.

TABLE 15-1. HISTOA SUBHEADER FIELDS
R = REQUIRED, C = CONDITIONAL

FIELD	NAME	SIZE	RANGE	TYPE
CETAG	Unique Extension ID	6	HISTOA	R
CEL	Length of Extension Tag	5	00115 to 83512	R
SYSTYPE	System Type	20	alphanumeric	R
PC	Prior Compression	12	alphanumeric	R
PE	Prior Enhancements	4	alphanumeric	R
REMAP_FLAG	System Specific Remap	1	0 to 9; BCS 0x20	R
LUTID	Data Mapping ID from the ESD	2	00 to 64	R
NEVENTS	Number of Processing Events	2	01 to 99	R
EVENT01	First Processing Event	variable	alphanumeric	R
...	...	...	...	...
EVENTnn	Most Recent Processing Event	variable	alphanumeric	C

Table 15-2. HISTOA Subheader Field Descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain the unique extension name or ID for the Softcopy His tory Tag. Since this is version A of the history tag, this field will be filled with HISTOA.
CEL	This field shall contain the total length of the tag data (all of which follows this field), including all existing process events.
SYSTYPE	This field shall contain the name of the sensor from which the original image was collected. For national imagery, the valid field codes are contained in the NITF Implementation Requirements Document (S2035). The codes in the SYSTYPE field shall be left justified and the remainder of the field filled with spacesto 20 characters. The NTB has requested that this tag be able to handle other types of airborne and commercial imagery currently supported by NITF. Additional valid field codes are listed below: ASARS-2 ASARS System GHR Global Hawk Radar SYERS-EO SYERS Electro-Optical System SYERS-MSI SYERS Multispectral System SYERS-IR SYERS Infrared System DSR Dark Star Radar TSAR TESAR TBD Other
PC	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 is 4 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate or the quality level. The types of compression are indicated by the following codes: Value Definition DP43 DPCM (Differential Pulse Coded Modulation) – 4.3 bpp DC13 DCT (Discrete Cosine Transform –1.3 bpp DC23 DCT (Discrete Cosine Transform) – 2.3 bpp NJNL NITFIRD JPEG – Lossless NJQ0 NITFIRD JPEG – Quality Level 0 NJQ1 NITFIRD JPEG – Quality Level 1 NJQ2 NITFIRD JPEG – Quality Level 2 C11D NITF Bi-level – 1D C12S NITF Bi-level – 2DS C12H NITF Bi-level – 2DH M11D NITF Bi-level – 1D M12S NITF Bi-level with masked blocks – 2DS M12H NITF Bi-level with masked blocks – 2DH

Table 15-2. Subheader Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PC (continued)	C207 NITF ARIDPCM – 0.75 bpp C214 NITF ARIDPCM – 1.40 bpp C223 NITF ARIDPCM – 2.30 bpp C245 NITF ARIDPCM – 4.50 bpp C3Q0 NITF Lossy JPEG – Q0 Custom Tables C3Q1 NITF Lossy JPEG – Q1 Default Tables C3Q2 NITF Lossy JPEG – Q2 Default Tables C3Q3 NITF Lossy JPEG – Q2 Default Tables C3Q4 NITF Lossy JPEG – Q4 Default Tables C3Q5 NITF Lossy JPEG – Q5 Default Tables M3Q0 NITF Lossy JPEG with masked blocks – Q0 Custom M3Q1 NITF Lossy JPEG with masked blocks – Q1 Default M3Q2 NITF Lossy JPEG with masked blocks – Q2 Default M3Q3 NITF Lossy JPEG with masked blocks – Q3 Default M3Q4 NITF Lossy JPEG with masked blocks – Q4 Default M3Q5 NITF Lossy JPEG with masked blocks – Q5 Default C4LO NITF Vector Quantization – Lossy M4LO NITF Vector Quantization with masked blocks C5NL NITF Lossless JPEG M5NL NITF Lossless JPEG with masked blocks NC00 NITF uncompressed NM00 NITF with masked blocks uncompressed I1Q1 NITF Downsample JPEG – Q1 I1Q2 NITF Downsample JPEG – Q2 I1Q3 NITF Downsample JPEG – Q3 I1Q4 NITF Downsample JPEG – Q4 I1Q5 NITF Downsample JPEG – Q5 WVLO Wavelet Lossy WVNL Wavelet Lossless JP20 JPEG 2000 NONE No Compression UNKC Unknown Compression The entire PC field is 12 bytes long to allow for the concatenation of up to 3 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.

Table 15-2. Subheader Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PE	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 data with DRA but no enhancements from IDEX UE11 Unenhanced 22 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.
REMAP_FLAG	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 blank (BCS 0x20), but 2 – 9 are reserved for future use. A value of 0 means that no systems 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 space. Values from 2 – 9 are reserved for future use and shall not be used at this time.
LUTID	This field shall contain the DMID (Data Mapping ID). See section 15.4.1The 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.
NEVENTS	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.

15.3.1 Definition of the Processing Events

In addition to populating the first eight fields, the one initiating the *first processing event* will populate the first eight fields and additional applicable fields as necessary, designating NEVENT as “01”. In terms of implementation, a processing event is similar to a record. The NEVENTS field is a repetition factor that determines how many records or processing events must be read. A processing event has been defined as one or more of the specific processing functions shown in table 15-3 that may be applied to the NITF formatted image. In order to determine what processing has been applied to the image over time, the entire set of processing events must be read. These functions include compression and expansion, rotation, sharpening, magnification, and are normally applied to the imagery by commercial or government softcopy packages. A description of the Processing Event Fields is given in table 15-4.

Table 15-3. Processing Event Fields
R = REQUIRED, C = CONDITIONAL

FIELD	NAME	SIZE	RANGE	TYPE
PDATE	Processing Date and Time	14	CCYYMMDDHHmmSS	R
PSITE	Processing Site	10	alphanumeric	R
PAS	Softcopy Processing Application	10	alphanumeric	R
NIPCOM	Number of Image Processing Comments	1	0 to 9	R
IPCOM1	Image Processing Comment 1	80	alphanumeric	C
...	...	...	...	...
IPCOMn	Image Processing Comment n	80	alphanumeric	C
IBPP	Input Bit Depth (actual)	2	01 to 64	R
IPVTYPE	Input Pixel Value Type	3	alphanumeric	R
INBWC	Input Bandwidth Compression	10	alphanumeric	R
DISP_FLAG	Display-Ready Flag	1	0 to 9, space (BCS 0x20)	R
ROT_FLAG	Image Rotation	1	0, 1	R
ROT_ANGLE	Angle of Rotation	8	000.0000 to 359.9999	C
ASYM_FLAG	Asymmetric Correction	1	0, 1, BCS 0x20	R
ZOOMROW	Mag in Line (row) Direction	7	00.0000 to 99.9999	C
ZOOMCOL	Mag in Element (column) Direction	7	00.0000 to 99.9999	C
PROJ_FLAG	Image Projection	1	0, 1	R
SHARP_FLAG	Sharpening	1	0,1	R
SHARPFAM	Sharpening Family Number	2	-1, 00 to 99	C
SHARPMEM	Sharpening Member Number	2	-1, 00 to 99	C
MAG_FLAG	Symmetrical Magnification	1	0, 1	R
MAG_LEVEL	Level of Relative Magnification	7	00.0000 to 99.9999	C
DRA_FLAG	Dynamic Range Adjustment (DRA)	1	0, 1, 2	R
DRA_MULT	DRA Multiplier	7	000.000 to 999.999	C
DRA_SUB	DRA Subtractor	5	-9999 to +9999	C
TTC_FLAG	Tonal Transfer Curve (TTC)	1	0,1	R
TTCFAM	TTC Family Number	2	-1, 00 to 99	C
TTCMEM	TTC Member Number	2	-1, 00 to 99	C
DEVLUT_FLAG	Device LUT	1	0, 1	R
OBPP	Output Bit Depth (actual)	2	01 to 64	R
OPVTYPE	Output Pixel Value Type	3	alphanumeric	R
OUTBWC	Output Bandwidth Compression	10	alphanumeric	R

Table 15-4. Processing Event Field Descriptions

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PDATE	This field shall contain the date and time (UTC) on which this processing event occurred. The valid form of the field is CCYYMMDDhhmmss, where CC is the first two digits of the year (00 to 99), YY is the last two digits of the year (00 to 99), MM is the month (01 to 12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC (Zulu) is assumed to be the time zone designator to express the time of day. 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, 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.
PSITE	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.
PAS	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.
NIPCOM	This field shall contain the valid number of image processing comments for this processing event. The valid field codes are 0 to 9.
IPCOM1	This field shall contain the first line of comment text. The fields IPCOM1 to IPCOMn, if present shall contain free form alphanumeric text. They are intended for use as a single comment block and shall be used that way. This field shall be omitted if the value in NIPCOM field is zero. The 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.
IPCOMn	This field shall contain the n^{th} line of comment text, based on the value of the NIPCOM field. See description above for IPCOM1 for usage. This field shall be omitted if the value in NIPCOM field is zero.
IBPP	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.
IPVTYPE	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 events have been performed and before compression. Valid entries are INT for integer, SI for 2's complement signed integer, R for real, C for complex, B for bi-level, and U for user defined. The databits of INT and SI values shall appear in the file in order of significance, beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating-point representation (IEEE754). C values shall be represented with the Real and Imaginary parts each represented in IEEE 32-bit floating point representation (IEEE754) and appearing adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.

Table 15-4. Processing Event Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
INBWC	This field shall indicate the type of bandwidth compression or expansion that has been applied to the image prior to 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 such as DCT or DPCM. 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 the following codes: <u>Value</u> <u>Definition</u> DP43 DPCM (Differential Pulse Coded Modulation) – 4.3 bpp DC13 DCT (Discrete Cosine Transform – 1.3 bpp DC23 DCT (Discrete Cosine Transform) – 2.3 bpp NJNL NITFIRD JPEG – Lossless NJQ0 NITFIRD JPEG – Quality Level 0 NJQ1 NITFIRD JPEG – Quality Level 1 NJQ2 NITFIRD JPEG – Quality Level 2 C11D NITF Bi-level – 1D C12S NITF Bi-level – 2DS C12H NITF Bi-level – 2DH M11D NITF Bi-level – 1D M12S NITF Bi-level with masked blocks – 2DS M12H NITF Bi-level with masked blocks – 2DH C207 NITF ARIDPCM – 0.75 bpp C214 NITF ARIDPCM – 1.40 bpp C223 NITF ARIDPCM – 2.30 bpp C245 NITF ARIDPCM – 4.50 bpp C3Q0 NITF Lossy JPEG – Q0 Custom Tables C3Q1 NITF Lossy JPEG – Q1 Default Tables C3Q2 NITF Lossy JPEG – Q2 Default Tables C3Q3 NITF Lossy JPEG – Q2 Default Tables C3Q4 NITF Lossy JPEG – Q4 Default Tables C3Q5 NITF Lossy JPEG – Q5 Default Tables M3Q0 NITF Lossy JPEG with masked blocks – Q0 Custom M3Q1 NITF Lossy JPEG with masked blocks – Q1 Default M3Q2 NITF Lossy JPEG with masked blocks – Q2 Default M3Q3 NITF Lossy JPEG with masked blocks – Q3 Default M3Q4 NITF Lossy JPEG with masked blocks – Q4 Default M3Q5 NITF Lossy JPEG with masked blocks – Q5 Default C4LO NITF Vector Quantization – Lossy M4LO NITF Vector Quantization with masked blocks C5NL NITF Lossless JPEG M5NL NITF Lossless JPEG with masked blocks NC00 NITF uncompressed NM00 NITF with masked blocks uncompressed I1Q1 NITF Downsample JPEG – Q1 I1Q2 NITF Downsample JPEG – Q2 I1Q3 NITF Downsample JPEG – Q3 I1Q4 NITF Downsample JPEG – Q4 I1Q5 NITF Downsample JPEG – Q5 WVLO Wavelet Lossy WVNL Wavelet Lossless JP20 JPEG 2000 NONE No Compression

Table 15-4. Processing Event Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
INBWC (continued)	UNKC Unknown Compression OTLO Unknown lossy compression – requires mandatory IPCOM entry to explain technique or source OTNL Unknown lossless compression – requires mandatory IPCOM entry to explain technique or source The entire BWC 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 zeros. Examples of valid codes for the BWC field are shown below. The DP43E00000 code indicates that a 4.3 DPCM compressed input image was expanded prior to NITF formation. The DC13E00000 code indicates that 1.3 DCT compressed input image was expanded prior to NITF formation. The NONE000000 code indicates that the input image to the NITF formation process was uncompressed.
DISP_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. Display-Ready data has had a system-specific transformation applied to it that is described in section 15.4.1. The valid field codes are 0 to 9 and a blank (BCS 0x20) A value of 0 means that image is not Display-Ready and must be converted to a displayable format, using the pre-defined mappings for Linlog or PEDF formats. A value of 1 means that the image is Display-Ready and needs only basic tonal processing and device compensation for correct display. A value of space (BCS0x20) means the image is inherently displayable. Values 2 to 9 are reserved for future use and shall not be used at this time..
ROT_FLAG	This field shall indicate if the image has been rotated. The valid field codes are 0 and 1. A value or 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.
ROT_ANGLE	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.
ASYM_FLAG	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 blank (BCS 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 space (BCS 0x20) means the imagery did not need correcting. If this field is equal to 1, the ZOOMROW and ZOOMCOL fields must be filled with the magnification levels in the row (line) and column (element) directions, respectively.
ZOOMROW	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.
ZOOMCOL	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.
PROJ_FLAG	This field shall indicate if the image has been projected from the collection geometry into another geometry 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.

Table 15-4. Processing Event Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
SHARP_FLAG	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 SHARPMEN fields must be filled with the appropriate numbers. Refer to paragraph 15.5 for a more complete description of the sharpening kernel database.
SHARPFAM	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 a part of the existing group of families and members, a value of –1 shall be placed in this field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph 15-5 for a more complete description of the sharpening kernel database.
SHARPMEM	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 a part of the existing group of families and members, a value of –1 shall be placed in this field and the nature of the sharpening kernel shall be specified in the comment section. Refer to 15.5 for a more complete description of the sharpening database.
MAG_FLAG	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 0 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.
MAG_LEVEL	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.
DRA_FLAG	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, 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.
DRA_MULT	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.
DRA_SUB	This field shall contain the subtractor value of the DRA. The valid field codes are 000.000 to 999.999. This field is conditional on the DRA_FLA G field being equal to 1.
TTC_FLAG	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 15-5 for more complete description of the TTC database.

Table 15-4. Processing Event Field Descriptions (continued)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
TTCFAM	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 a part of the existing group of families and members, 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 15-5 for a more complete description of the TTC database.
TTCMEM	This field shall contain the number of the TTC member, if a TTC was applied to the image. The valid field codes are 00 to 99. This field is conditional on the TTC_FLAG field. If the TTC is not a part of the existing group of families and members, 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 15-5 for a more complete description of the TTC database.
DEVLUT_FLAG	This field shall indicate if 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 t 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, an appropriate method for describing the LUT shall be given.
OBPP	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 15.4), the IBPP field would contain 08 and the OBPP field would contain 11. The OBPP 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.
OPVTYPE	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, B for bi-level, SI for 2's complement signed integer, R for real, U for user-defined, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating-point representation (IEEE754). C values shall be represented with the Real and Imaginary parts each 32-bit floating point representation (IEEE754) and appearing adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.
OUTBWC	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 such as DCT or DPCM. 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 the same codes used in the INBWC field and can be found in the field description for INBWC. The entire BWC 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. Examples of valid codes for the BWC field are shown below. The NJQ1C00000 code indicates that the processed image was saved as a NITFIRD JPEG compressed image at quality level 1. The NJNLC00000 indicates that the processed image was saved as a NITFIRD JPEG lossless compressed image. The C3Q3C00000 code indicates that the processed image was saved as a NITFS JPEG compressed image at quality level 3.

15.3.2 Use of the Comments Field

The comment field within HISTOAis consistent with the current NITFS image subheader. The NIPCOM field indicates how many lines of comments are utilized in each processing event. Each line of comments is 80 bytes and the maximum number of lines is 9. These lines of comments within the tag are provided in each processing event to allow users to capture relevant information not accounted for in the pre-defined fields. The types of information that might be included are an unknown input data format, a compression algorithm not accounted for in the BWC field, or details on the interpolation algorithm used for image rotation. If warping or magnification is performed on the image, the details of these functions could be described in the comment section. HISTOA assumes that the ELT package is using the IDEX-based sharpening kernels and TTCs. If an ELT package is using another type of sharpening kernel or tonal adjustment, the comment field could be used to describe these functions.

Another use for the comments field would be to describe processing functions on imagery that have not yet been standardized or well-defined. One such example is multi-spectral image products. Softcopy processing of MSI products is still in the experimental stages and a standard processing flow has not been defined. If the Softcopy History Tag is used with an MSI product, the comment section could be used to describe new processing techniques developed for this imagery.

15.4 Additional Information

The following information is from the Softcopy Image Processing Chain Baseline document developed by the Image Chain Analysis group at Eastman Kodak, dated January 27, 1998.

15.4.1 Display-Ready Transformations

The Display-Ready transformations to be applied to certain imagery depend on the format, as indicated by the DMID (Data Mapping Identifier) in the ESD (Exploitation Support Data). A DMID value of 7 or 8 indicates that the image is in PEDF (Piecewise Extended Density Format), while a DMID value between 12 and 64 indicates that the image is in Linlog format.

15.4.2 PEDF Data

PEDF is the default format for some systems. The 8 bpp PEDF data must be transformed into a displayable density format commonly called Display-Ready, prior to enhancement and display. The equations below are used to expand the 8 bpp PEDF data to displayable 11 bpp or 8 bpp density format data. The recommended transformation from 8 bpp PEDF is the 11-bpp-density format mapping (11bDF), shown in equation A.1. Softcopy exploitation systems limited to an 8-bpp-bit depth should use the 8-bpp conversion, shown in equation A.2, to convert 8 bpp PEDF to 8-bpp density format (8bDF).

These equations are used to expand the 8 bpp PEDF data to displayable 11 bpp or 8 bpp density format data.

11 bpp Density Format (11bDF)

$$11\,\mathrm{bDF}(i) = \frac{2047}{382.5} \cdot \begin{cases} i & i \leq 127.5 \\ 2 \cdot (i - 127.5) + 127.5 & i > 127.5 \end{cases} \qquad \text{(A.1)}$$

The input range is $0 \leq i \leq 255$. The output is an 11-bpp integer.

8 bpp Density Format (8bDF)

$$8\,\mathrm{bDF}(i) = \min\left(\max\left(i, 2 \cdot (i - 127.5) + 127.5\right), 255\right) \qquad \text{(A.2)}$$

The input range is $0 \leq i \leq 255$. The output is an 8-bpp integer.

15.4.3 Linlog Data

Linlog format is the 8-bpp-default format for some systems. The 8 bpp Linlog format must be transformed into a displayable format, referred to as Display-Ready. The equations below are used to expand the 8 bpp Linlog data to displayable 11 bpp or 8-bpp log format data. The recommended transformation from 8 bpp Linlog is the 11-bpp-log format mapping (11bLF), shown in equation A.3. Softcopy exploitation systems limited to an 8 bpp bit depth should use the 8 bpp conversion, shown in equation A.4, to convert 8 bpp Linlog to 8 bpp log format (8bLF).

These equations are used to expand the 8-bpp Linlog data to displayable 11 bpp or 8-bpp-log format.

11 bpp Log Format (11bLF):

$$11bLF(i) = \frac{2047}{15}\begin{cases} 0 & i = 0 \\ \log_2(i) & 0 < i \leq 117 \\ \log_2\left[2^{\frac{i}{(17)}} - 1\right] & i > 117 \end{cases} \tag{A.3}$$

The input range is $0 \leq i \leq 255$. The output is an 11-bpp integer.

8 bpp Log Format (8bLF):

$$8bLF(i) = \frac{255}{15}\begin{cases} 0 & i = 0 \\ \log_2(i) & 0 < i \leq 117 \\ \log_2\left[2^{\frac{i}{(17)}} - 1\right] & i > 117 \end{cases} \tag{A.4}$$

The input range is $0 \leq i \leq 255$. The output is an 8-bpp integer.

15.5 Sharpening Families

The Sharpening Family 0 provides control of the modulation in the high frequency region of the scene spectrum. The strength of the sharpening kernels varies from moderate blurring, using a gain of 0.6 to very strong edge enhancement, and using a gain of 32. Family 0 provides adequate sharpness for all modes of imagery and is the default family for all image sources. Figure 15-1 depicts Sharpening Family 0: members 0 to 63. Each member increases in gain in equal log steps. This is done in order to achieve equal changes in perception of sharpness. These kernels are actually 3x3 kernels in a 5x5 filter design; i.e. the outside values of the kernel are zero and may be omitted for fast processing.

The Sharpening Family 1 provides the same type of control as Family 0, but with a much finer control. The strength of the compensation ranges from a blurring kernel with a gain of 0.8 to a maximum edge enhancement using a gain of 25. Figure 15-2 depicts Sharpening Family 1: members 0 through 63. Each member increases in gain at the Nyquist frequency in equal log steps.

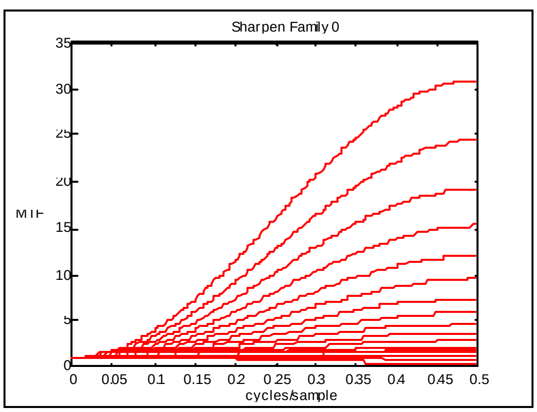

FIGURE 15-1. SHARPENING FAMILY 0: MEMBERS 0 TO 63

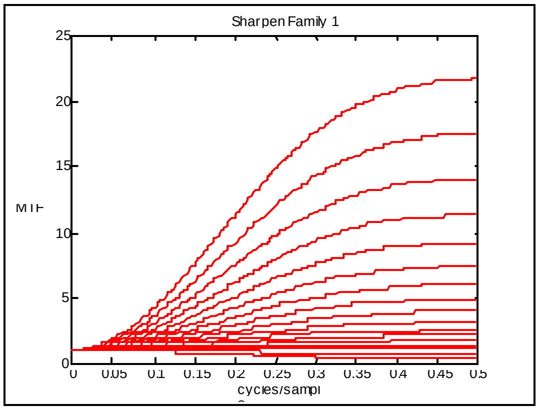

FIGURE 15-2. SHARPENING FAMILY 1: MEMBERS 0 TO 63

15.6 TTC Families

The default TTC family can be used for all image sources and modes. The TTCs are designed to allow the user to manipulate the contrast of a displayed image by redistributing the image's histogram. The contrast can be changed to allow the visualization of scene characteristics. This includes shadow regions, highlights, and mid-tone regions in the image. The default TTC family is shown in figure B-3. This TTC family has 64 members that vary from member 0, improving the shadow regions to member 32, providing no additional contrast to member 63, improving the highlight regions. All members in between these ranges offer slightly improved contrast and can be used for all image sources. All of the TTC families are available from the Government upon request.

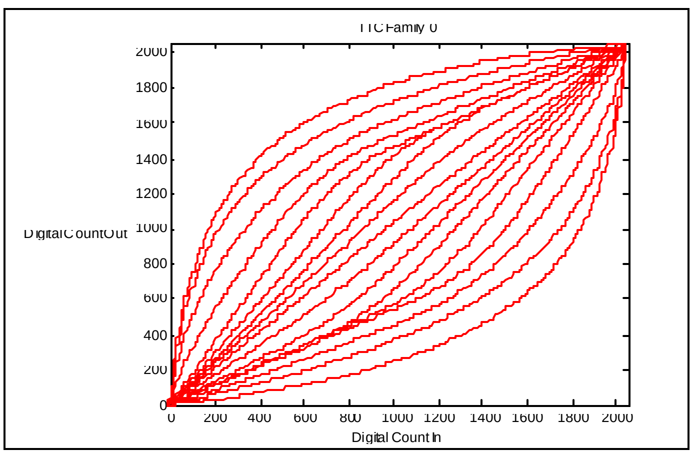

FIGURE 15-3. DEFAULT TCC FAMILY

16.0 Support Data Extension

For information regarding this National SDE contact National Imagery and Mapping Agency, Attn: NIMA Customer Support/COD, Mail Stop P-38, 12310 Sunrise Valley Drive, Reston VA 20191-3449

17.0 CMETAA SUPPORT DATA EXTENSION

17.1 INTRODUCTION

As Synthetic Aperture Radar (SAR) complex imagery becomes increasingly available to intelligence activities, separate organizations, each serving its own community, independently advance their ability to sense, process, disseminate, and exploit complex SAR data.

Typically, complex data from one class of sources can only supply one class of users. Although sophisticated processing and exploitation algorithms exist for end-to-end transmission, these sources can not exchange information from the sensor to multiple classes of users, or from user to user, because a standard format does not exist.

An increasing number of MASINT algorithms require Complex SAR Data (Complex Image (CI) Data and SAR Video Phase History (VPH)) as input. There is a growing need for a common data file to support interoperability capabilities between users, since a variety of platforms and processors generate this data.

The Complex SAR Data Format Standard Initiative (CDFI) effort developed the CMETAA Tagged Record Extension (TRE) to satisfy this interoperable need. Used in conjunction with the NITF file format, CMETAA provides the structure for complex SAR data metadata while NITF provides the data formatting structure.

17.2 PURPOSE OF THIS SECTION

This section establishes the specification of the CMETAA TRE which has been developed to provide a foundation for interoperability in the interchange of Synthetic Aperture Radar (SAR) imagery and SAR imagery related data among applications. The CMETAA preamble provides a detailed description of the background and structure of the format, as well as specification of the valid data and format for all fields defined with CMETAA.

CMETAA conforms to the architectural and data object specifications of the National Imagery Transmission Format Version 2.1 (NITF 2.1). NITF 2.1 is a profile of the International Standard ISO/IEC 12087-5, the Basic Image Interchange Format (BIIF).

Compliance with this specification will support consistent community implementation of CMETAA.

17.3 BACKGROUND

Under the Complex SAR Data Format Standard Initiative (CDFI), established in the Fall of 1997, a team of engineers from TASC (prime contractor), ERIM and Eastman Kodak Company was tasked to select an existing or create a new file format appropriate for housing VPH, and pre- and post-autofocus CI data.

CDFI activities began by characterizing the present sources of complex SAR data. This task was broken down into three areas: 1) determining the SAR processing chains for a variety of space/airborne commercial and government SAR platforms including: Dark Star, Global Hawk, ASARS 2 Legacy, AIP, RADARSAT 2) identifying the complex data port of each processing chain and 3) ascertaining the file format of each SAR data port.

Next, CDFI examined the SAR exploitation algorithms, specifically MASINT algorithms, noting their metadata requirements and comparing them to the formats now used in SAR sources.

Once the various SAR platforms, file formats and exploitation algorithms metadata requirements had been identified, the CDFI program proceeded to identify a flexible file format that was inclusive of present formats and requirements. Nine candidate file formats were reviewed and compared against an ideal format. At the conclusion of the process, the NITF file format was identified as being best suited for SAR complex data.

Finally, with the file format identified, CDFI developed potential migration strategies for each SAR system. This included identifying obstacles which might hinder a SAR system ability to comply with the standard, and proposing methods to overcome these obstacles. In summary, CDFI four tasks were as follows:

a Review current and future SAR platforms and document processing chains, data ports and types of complex data products.

b Document the input signal and metadata requirements of today's major SAR exploitation algorithms with particular emphasis on MASINT algorithms.

1) Review current and future SAR file formats; select the format most appropriate for the CDFI effort;

2) Prepare a CDFI Tagged Record Extension (TRE - CMETAA) for registration after selecting NITF as the format;

3) Document existing SAR complex data compression techniques; make recommendations for complex metadata parameters.

c Develop a convergence strategy for the interoperable use of the new CDFI metadata file format.

Running concurrent to the CDFI TRE development activities was the CMPLXA TRE. Designed to support the down link activities of the ASARS Improvement Program (AIP), CMPLXA specifically addressed the metadata needs of the ASARS platform. As both the CMPLXA and CMETAA tags matured, the NITF Technical Board (NTB) requested that the two tags merge to better support community interoperability requirements. As part of this task, the AIP contractor and CDFI personal organized joint editing sessions. One of the tools used during these sessions was a field-by-field rating system of the CMETAA TRE to indicate the level of difficulty the AIP contractor expected to encounter during CMETAA implementation. A copy of rating definitions and field ratings can be found in 17.12 Annex E.

CMETAA STRUCTURE

The CMETAA TRE data structure is divided into the following 2 sections.

Section 1 - General SAR information.

(indices 100 - 700)

This section contains general descriptive information about the SAR complex data contained in the NITF file structure e.g. collection mode, center frequency, processor version number. It also contains two fields (RELATED_TRES and ADDITIONAL_TRES) which indicates if the NITF file contains additional TREs related to SAR processing. The TREs listed in these fields are done so with the approval of the CMETAA document custodian. To date, the following TREs have been approved by the CMETAA custodian: AIMIDA, AIMIDB (Support Data Extensions for Airborne Sensors STDI-0002), MTXFIL and AIPBCA. For more information on these TREs see the NITF Tag Registry: http://jitc.fhu.disa.mil/nitf/tag_reg/tag_reg.htm

Section 2 - Complex Image Data.

(indices 800 - 19300)

This section contains the CMPLXA TRE and additional complex data metadata.

17.4 TERMS, DEFINITIONS, AND ABBREVIATIONS

17.4.1 DEFINITIONS

For the purposes of the CMETAA TRE, the following definitions apply.

a. **2D-FFT.** Two dimensional Fast Fourier Transform. Transforms spatial domain data into the frequency domain using the discrete Fourier transform as defined below:

$$F(u,v) = \Im(f(m,n)) = \left(\frac{1}{MN}\right)\sum_{n=0}^{N-1}\sum_{m=0}^{M-1} f(m,n)e^{-j2p\left[\frac{u\bullet m\bullet \mathrm{IF\_AFFTS}}{M}+\frac{v\bullet n\bullet \mathrm{IF\_RFFTS}}{N}\right]}$$

where CMETAA fields IF_AFFTS and IF_RFFTS are equal to one another and have a value of ± 1

b. **Antenna Aim Point.** The Antenna Aim point is the location on the ground of the center of the antenna beam pattern at the sensor reference point. The values are given in degrees and/or meters depending on the choice of the nominal geometry reference.

c. **Band.** One of the two-dimensional (row/column) arrays of pixel sample values that comprise an image. For the basic use of NITF, the band values are homogeneous data types for each band. In the case of monochrome or indexed color images (single 2-dimensional array of pixel values with possible look-up-tables), the image array consists of one band. In the case of RGB images (three 2-dimensional arrays of pixel values; 8 bits each of Red, Green and Blue values for each pixel), the image consists of three bands. In the case of complex data, it is possible to specify inphase (I) and quadrature (Q) samples as separate bands, or alternatively, magnitude (M) and phase (P) as separate bands.

d. **The Basic Character Set.**. This character set is selected from ISO/IEC 646. Valid BCS character codes range from 20 through 0xFF and line feed (0x0A), form feed (0X0B), and carriage return (0X0C).

e. **Basic Character Set-Alphanumeric.** A subset of the Basic Character Set. The range of allowable characters consists of space through tilde (single bytes with values ranging from 20 to 7E) from the Basic Latin Collection.

f. **Basic Character Set-Numeric.** A subset of the Basic Character Set which consists of the digits ‘0’ through ‘9’, ‘plus sign’, ‘minus sign’, ‘decimal point’, and ‘slash’.

g. **Block.** A rectangular array of pixel values within a NITF file which is a subset of an image. An image consists of the union of non-overlapping blocks.

h. **Channel.** A channel, in this context, is mapped to the transmit and receive signal modes in the radar hardware. For example, the transmitted signal could be through a horizontally-polarized transmit antenna and the received signal through a vertically-polarized receive antenna. This specifies a specific polarimetric channel, typically written, HV. An HH channel could have the same transmitted signal, but a received signal through a horizontally-polarized receive antenna. Other channels might include VV and VH. Note that a collection of polarimetric channels might be related, but each is given its own CMETAA header. The balancing of the polarimetric channels can be included in the CMETAA header, however. Note that there is no balancing field for interferometric (up-and-down antenna) and bistatic (side-by-side antenna) channels, however.

i. **Complex SAR Data.** Complex SAR Data traditionally takes the form of Complex Image (CI) Data or Video Phase History (VPH) Data. While both data are represented as complex numbers, the CI data has gone through a 2D-FFT and can be viewed as an image, while VPH data has not been through a 2D-FFT and therefore is not viewable as an image.

j. **Conditional.** An adjective applied to data fields whose existence depends on the value of the designated Required field preceding the Conditional field.

k. **Coordinated Universal Time.** The time scale maintained by the Bureau International de L'Heure (International Time Bureau) that forms the basis of a coordinated dissemination of standard frequencies and time signals. UTC is equivalent to the mean solar time at the prime meridian at Greenwich, England.

l. **Data Extension Segment.** Data Extension Segment is a construct used to encapsulate different data types where each type is encapsulated in its own DES.

m. **Displayable.** Information that can be exhibited in visual form.

n. **Field.** Logically primitive item of data, sometimes referred to as an attribute.

o. **Focus Plane.** The focus plane is defined to be the XY plane in an orthogonal XYZ coordinate system with its origin at the center of the scene being imaged. The focus plane normal unit vectors describe this XY plane. The Image Formation Processor (IFP) selects parameters to optimally focus scatterers located in this plane. The focus plane is defined to be the same as the ground plane, even though the term 'ground plane' has some geographical notions associated with it. Sometimes IFPs include a 'height-of-focus' from some nominal geographical ground plane to focus scatterers at a certain height, but here the ground plane and focus plane definition includes this height-of-focus.

p. **Frame Image.** A Synthetic Aperture Radar (SAR) data collection in which the sensor steers its antenna beam to continuously illuminate the area being imaged.

q. **Ground Plane.** One of the two most common viewing perspectives for SAR imagery. The ground plane is defined to be the same as the focus plane.

r. **Image**. A representation of physical visualization, for example, a picture. An image is the computer (digital) representation of a picture. An image is comprised of discrete picture elements called pixels structured in an orderly fashion consisting of pixel value arrays formatted using bands and blocks.

s. **Image Display Plane.** The plane that the Image Formation Processor (IFP) projects or positions scatters in the three dimensional scene. One common choice for the Image Display Plane is a close fit to the nominal data collection surface, defined here to be the slant plane. Another common choice for the Image Display Plane is the focus plane or, equivalently, the ground plane.

t. **Imaging Operation.** Refers to all of the SAR coverage necessary to satisfy one tasking assignment. Note: a tasking assignment may be one frame image or one scan image. An imaging operation is composed of one or more image segments.

u. **Image Output Reference Point.** The Image Output Reference point is defined to be the same as the scene center.

v. **Non-blank.** Non-blank indicates that the field cannot be filled entirely by the BCS-A space character (0x20). It may contain space characters when included with other characters.

w. **Patch.** An image formation processing element (i.e. that portion of the SAR data segment that undergoes a 2D-FFT). In some systems the patch size and the segment size will be the same (e.g. Source 1); for other systems patches will be smaller (e.g. AIP).

x. **Pixel.** An abbreviation for the term “picture element”.

y. **Profile.** A set of one or more base standards, and where applicable, the identification of chosen classes, subsets, options, and parameters of those base standards, necessary for accomplishing a particular function.

z. **Required.** An adjective applied to data fields that must be present and filled with valid data or default data.

aa. **Scan Image.** A SAR data collection in which antenna pointing is fixed relative to the flight line resulting in a moving antenna footprint that sweeps along a strip of terrain parallel to the path of motion.

bb. **SARIQ.** Radio hologram (initial phase information) from a synthetic aperture radar.

cc. **Scene Center.** The scene center is defined to be the center of a spotlight SAR image. It is also known as the motion compensation point and central reference point. For a strip map image, the scene center is defined to be the intersection of the motion compensation line with the line down the center of the azimuth collection aperture.

dd. **Segment.** Definition 1: An instance of a data type that is contained in a NITF file. A segment is comprised of a subheader and associated data (e.g., an image subheader together with image data comprises an image segment).
Definition 2: An instance of an imaging operation. A segment is as large a phase continuous portion of the scene as the sensor can generate. The following actions cause a segment change to occur:
1) Vehicle re-aiming
2) Segment size exceeds file constraints of the systems.

ee. **Sensor Reference Point.** The Sensor Reference point is defined to be the position of the sensor at aperture center. These values can be expressed in meters or degrees and meters, depending on the nominal geometry reference that is specified**.**

ff. **Slant Plane.** The Slant Plane is defined to be the instantaneous slant plane at aperture center. The instantaneous slant plane is the plane containing the instantaneous antenna phase center velocity vector and the instantaneous slant range vector, which is the line-of-sight vector from scene center to the antenna phase center. Since the antenna phase center velocity vector is changing over time, the reference point is just chosen to be at aperture center to give a close fit to the nominal data collection surface.

gg. **Sub-Patch.** Aggregate of data that is smaller than a patch.

hh. **Swath/Swath Width.** In strip map mode, the Swath Width is defined to be the width in range of the image in the slant plane. Usually, it corresponds to a range gate or time window in the sensor hardware that is centered around the nominal motion compensation line (or, equivalently, motion compensation time).

ii. **Tagged Record Extension.** A means to provide additional attributes about standard data segments not contained in the standard NITF header or sub-header fields.

jj. **Tile.** A subsection of the patch containing a single NITF file used during down link by some systems (e.g. AIP). Not o be confused with the NITF “blocking” structure within an NITF file.

17.4.2 ABBREVIATIONS:

a	ASCII	American National Standard Code for Information Interchange
b	BCS	Basic Character Set
c	BCS-A	Basic Character Set - Alphanumeric
d	BCS-N	Basic Character Set - Numeric
e	C	Conditional
f	CI	Complex Image
g	CMETAA	Complex Metadata Tagged Record Extension Version A
h	CS	Character String
i	DES	Data Extension Segment
j	FFT	Fast Fourier Transform
k	NITF	National Imagery Transmission Format
l	NITFS	National Imagery Transmission Format Standard
m	R	Required field that must be filled by a value
n	<R>	Required field that may be filled with zeros if BCS-N or spaces if BCS-A. <R> fields should be populated with non-space or non-zero values whenever possible.
o	SAR	Synthetic Aperture Radar
p	TRE	Tagged Record Extension
q	UTC	Coordinated Universal Time
r	UTM	Universal Transverse Mercator
s	VPH	Video Phase History Data

17.5 SPECIFICATION

17.5.1 SCOPE

17.5.1.1 SYSTEM APPLICABILITY

The goal of the CMETAA specification is to provide a common data format that increases interoperability among disparate SAR collectors and processing/exploitation systems; and to facilitate the full understanding of a complex scene (e.g., as part of a battlefield, intelligence, commercial or military situation). Only when all data from SAR sources can be successfully brought to each user to provide a total picture can a situation be fully understood.

Complex SAR data preserves both the phase and the magnitude information of the returned signal, as contrasted with magnitude-detected SAR data, in which an image is produced that corresponds to the point-by-point magnitude of the complex data, but from which all phase information has been removed. Thus, CMETAA is applicable to all SAR collection systems – those that preserve phase history data and provide it to users along with imagery, as well as those that provide only magnitude-detected SAR data (i.e., imagery alone).

17.5.1.2 MODEL FOR USING CMETAA

Some of the terms used in CMETAA refer to a generic SAR data collection model. This model was designed to aid interoperability processes between different SAR systems by providing a common frame of reference to discuss a wide range of SAR data collections. The terms used to describe the CMETAA data model are as follows:

a **Imaging operation**: Refers to all of the SAR coverage necessary to satisfy one tasking assignment. Note: a target may be one frame image or one scan image. An imaging operation is composed of one or more segments.

b **Segment**: The largest phase continuous portion of an imaging operation.

c **Patch**: An image formation processing element, i.e. that portion of the image segment which undergoes a 2D-FFT. In some systems the patch and the segment will be the same size.

d **Tile**: A subsection of the patch. Patch size is directly correlated to downlinking, communications, or hardcopy processing requirements.

Figures 17-1 and 17-2 illustrate CMETAA data model. Since the AIP program will be the first system to use CMETAA operationally, Figures 17-3 and 17-4 demonstrate how the generic model can be applied to an existing SAR system.

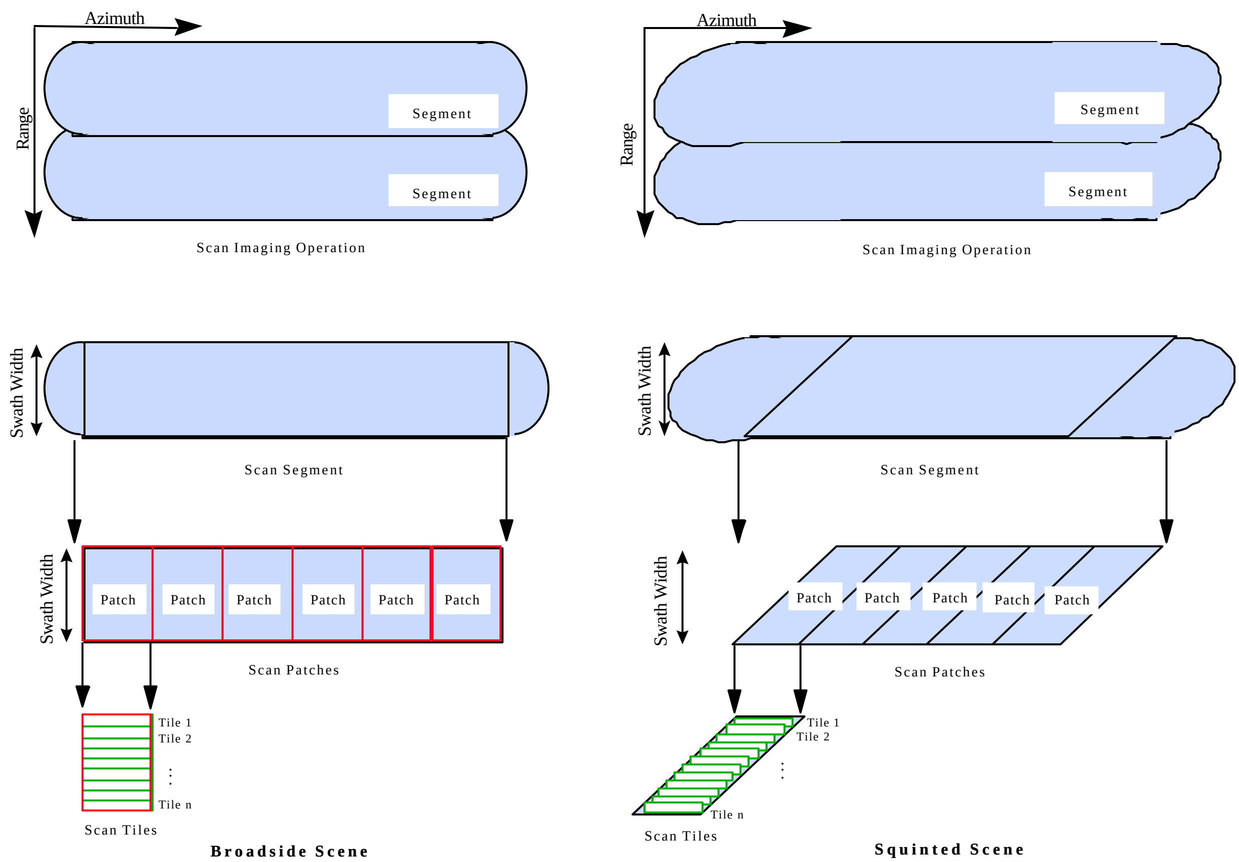

FIGURE 17-1. GENERIC COMPLEX DATA MODEL FOR A SCAN COLLECTION

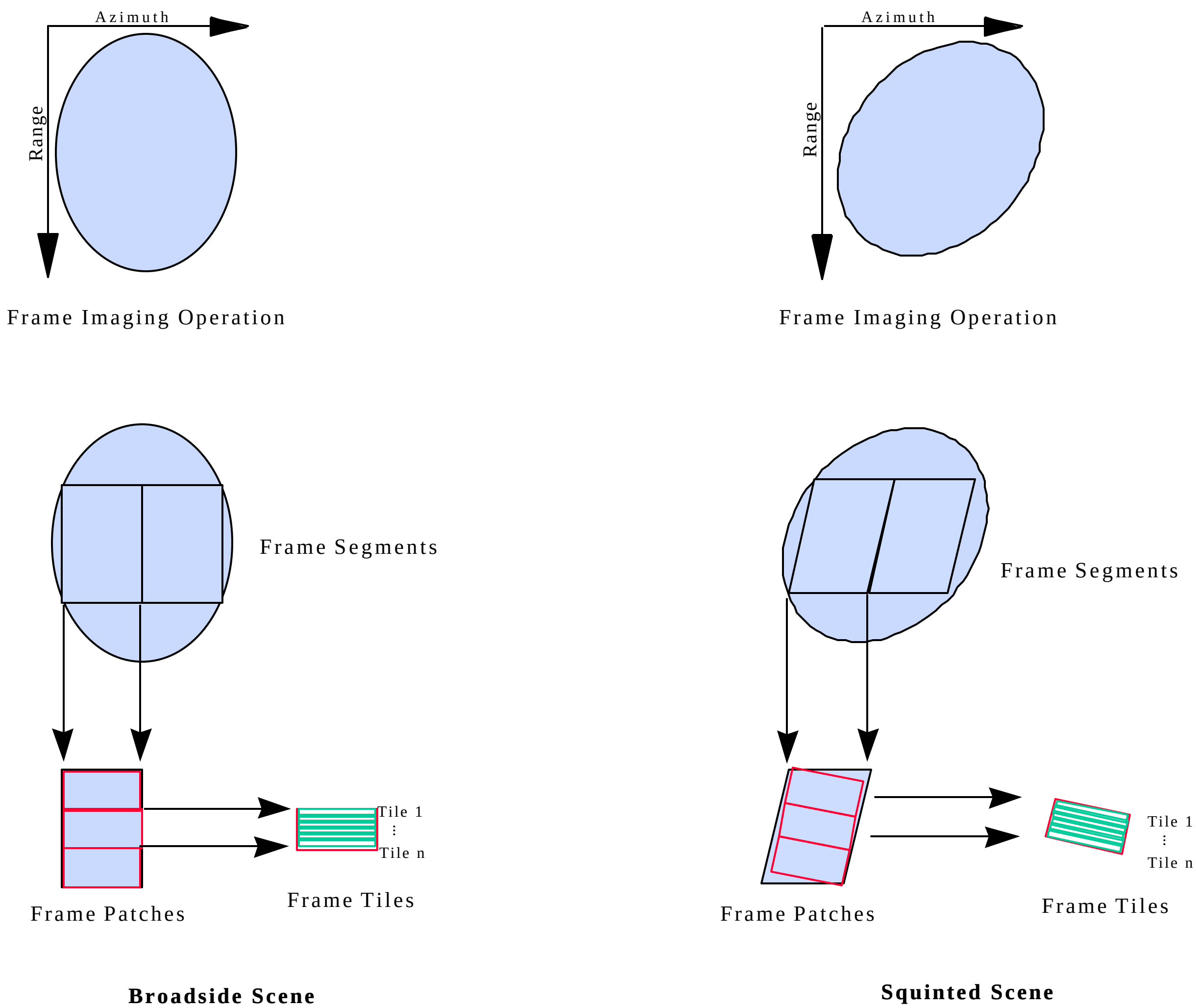

FIGURE 17-2. GENERIC COMPLEX DATA MODEL FOR A FRAME COLLECTION

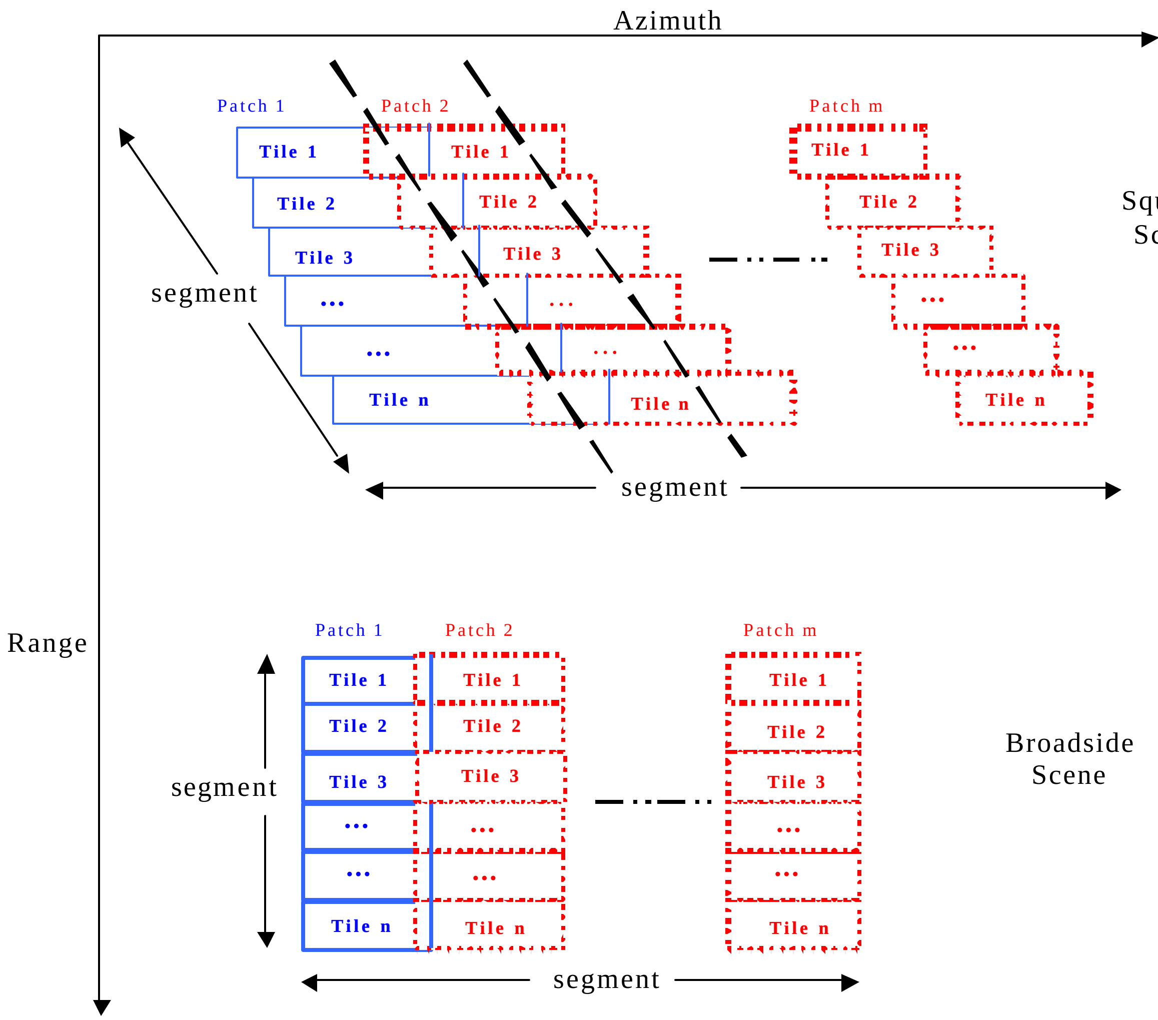

FIGURE 17-3. **AIP REPRESENTATION OF A SCAN IMAGE, BROADSIDE AND SQUINTED**

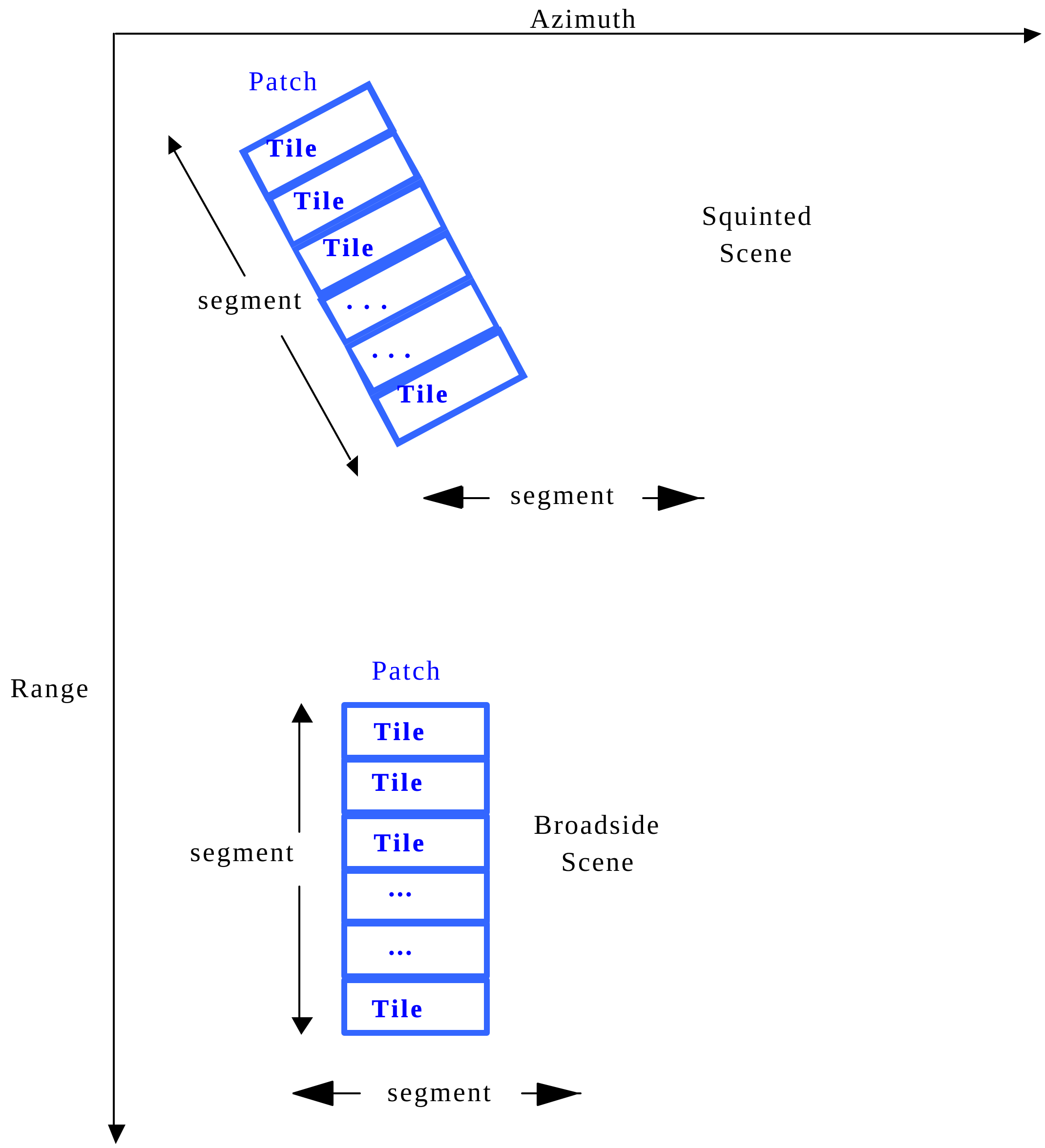

FIGURE 17-4. <u>**AIP REPRESENTATION OF A FRAME IMAGE, BROADSIDE AND SQUINTED**</u>

17.6 APPLICABILITY

17.6.1 PURPOSE OF CMETAA

CMETAA is a complex SAR data format specification, consistent with NITF 2.0/2.1, that describes both SAR phase history data, SAR complex imagery data, the magnitude of complex imagery data, or the phase of complex imagery data, that can provide a common data format framework for all users of SAR complex data.

17.6.2 FUNCTIONALITY PROVIDED BY CMETAA

In the past, complex SAR information was transformed to magnitude-detected data at the source with the resulting real imagery from a single source being transmitted directly to only one user. Currently, if complex data (i.e., complex imagery data or complex phase history data) from a single source is desired, then its sensor-specific format must be understood and handled by the end-user.

CMETAA's vision for the future is the total interoperability of complex SAR data, where data can be exchanged among sources and users, and where all users can receive complex data in a standard format from all sources and platforms, whether airborne or spaceborne, commercial- or government-operated.

CMETAA will support the transition from point-to-point dissemination (where less metadata is needed, since both sides know about the system) to broadcast (where recipients need more metadata across diverse communities). The standard consists of product data (VPH, Complex Image, detected in various forms) and product support data (metadata or auxiliary data).

The standard will accommodate data collected to optimize response to a particular exploitation algorithm. For example, since different exploitation algorithms excel under different collection parameters, CMETAA can provide the information that allows a user to know which exploitation algorithm governed the collection of a particular data set. It will also simplify data representation from current and future sources, since CMETAA can reduce the large amount of AUX information and system-specific knowledge needed to be transmitted to a user.

Also, in keeping with evolving security considerations, CMETAA will make it easier to generate exploitation products using published algorithms on unprotected data. This is because classification is moving toward restrictions based on content (e.g., target) rather than type of data (e.g., VPH). Finally, CMETAA will ultimately lead to a complex SAR data dissemination environment dominated by "user pull of data", incremental transmission, and automated target/data identification and extraction, all crucial to handling the growing volume of data that will test the resources of government and commercial users.

17.6.3 FORMAT

The format of the NITF file consists of a header, followed by data type segments with their associated subheaders. The header specifies profile and structural information that allows proper interpretation of the rest of the header and subheaders.

A TRE that pertains to the entire file is typically part of the User Defined Header Data field (UDHD) in the file header. If the TRE pertains to individual images, the TRE can be found in the User Defined Image Data field in the IXSHD field of each image subheader. If the TRE does not fit in these fields it will overflow into a Data Extension Segment (DES). Complex Image Data will be placed in the image segment data field with the CMETAA TRE in the image segment subheader while Video Phase History Data and its auxiliary metadata will be placed in a DES that is defined in a separate document. The CMETAA TRE will be placed in the IXSHD field of each appropriate image subheader.

All headers and subheaders have their character data specified in the lexical constraints of BCS-A or BCS-N (See definitions 17.4.1d, 17.4.1e and 17.4.1f).

17.6.3.1 ENCODING

This section describes the six columns comprising the CMETAA TRE which is in paragraph 17.7 of this document.

Column I Index: A numbered index used to locate fields.

Column II Field name: A short name used for references in the text descriptions. For most field names, the first part of the field name gives the classification of the field:

- RD_ - Radar Parameters
- CMPLX _ - Complex Image
- IF_ - Image Format
- POL_ - Polarimetrics
- T_ - Time Parameters
- CG_ - Collection Geometry
- MC_ - MOCOMP, Motion Compensation
- CA_ - Calibration
- WF_ - Waveform Parameters
- VPH_ - Video Phase History
- RF_ Interference
- PP_ Per Pulse Descriptors

Column III Description: A short descriptive name, followed by a more detailed definition.

Column IV CE/Size: Character Encoding: A = BCS-A; N =BCS-N. Size: Equals the number of bytes that are reserved for the field. Size is fixed and must be filled with valid data or the specified default. For those "Required" fields BCS-A "trailing spaces" will be applied to fill the field, for fields labeled BCS-N "leading zeros (0)" will be applied to fill the field.

Column V Value Range: Valid information must fall within the ranges identified and may be a range, an enumerated set, or a single value.

Column VI Type: A selection from the following codes:

R: Required element It must be present.

<R> Required element that has a default value of zero if BCS-N, or spaces if BCS-A. The intent of these optional fields is to fill them with appropriate values whenever possible.

C: Conditional element; this element is omitted based on the value of its "dependent element". For example, if IF_MAP_TYPE is not MGRS than no MGRS Coordinates (IF_MGRSZONE, etc.) are present in the file. A conditional field may or may not be present depending on the value of one or more preceding required fields.

The data that appears in all fields specified in the tables, including numbers, shall be represented using the basic character set with eight bits (one byte) per character. All field size specifications given specify a number of bytes.

17.6.3.2 HEADER/SUBHEADER

Each NITF file begins with a header whose fields contain identification, origination information, security information, and the number and size of data items contained in file structure. Figure 17-5 provides an overview of a NITF 2.1 file as well as the organization of the Image Segment component. As the figure 17-5 shows, the CMETAA TRE will be housed in the IXSHD field of the image subheader. A more complete representation of a NITF 2.1 header can be found in Annex C. Note: Some controlled extensions may appear in the UDID field of the image subheader. VPH metadata will be housed in a different portion of the NITF 2.1 file structure, the Data Extension Segment (DES), which will be described under a separate text.

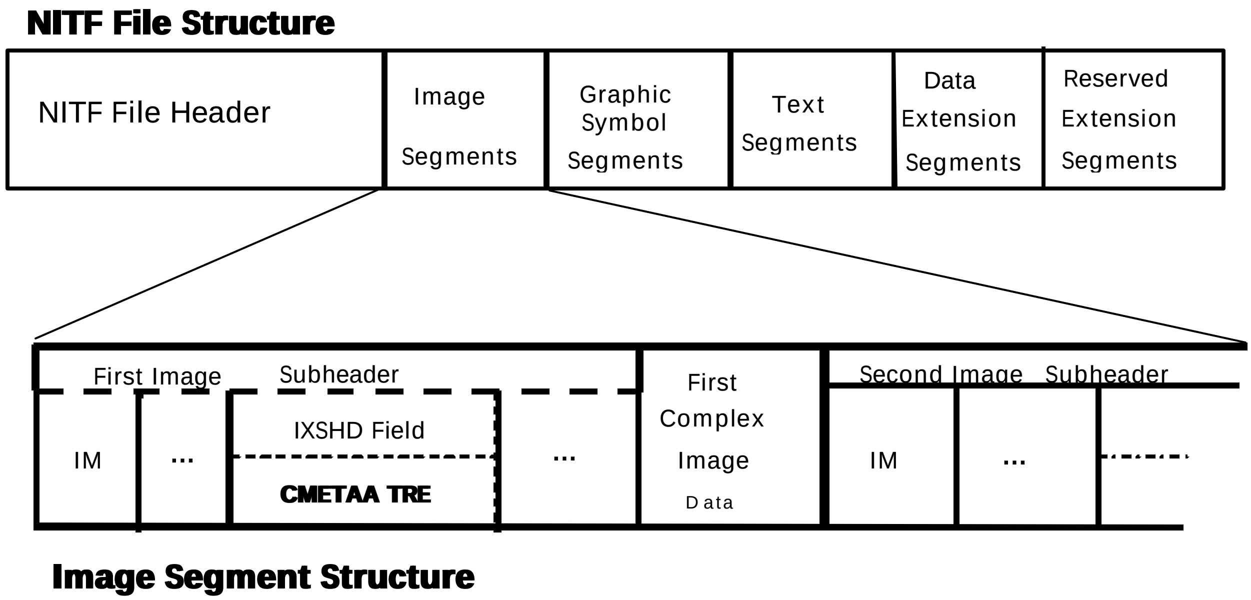

FIGURE 17-5. HEADER/SUBHEADER STRUCTURE

17.6.4 IMAGE DATA FIELD

The complex image data is found in the image data section following the appropriate image subheader.

17.6.5 COMPLEX SAR DATA

Complex SAR data is generally found in one of two data formats, In-phase and Quadrature phase (IQ) or Magnitude and Phase (MP) data, where IQ and MP are related as follows:

$$M = \sqrt{I^2 + Q^2} \qquad\qquad P = a\tan 2(I,Q)$$

In CMETAA, the format type is indicated in the CMPLX_DOMAIN field. This field not only informs the user whether the data is in IQ or MP format but also describes the data ordering. Choices for CMPLX_DOMAIN are as follows:

- IQ – I and Q interleaved data, I values are the first pixel component
- QI – Q and I interleaved data, Q values are the first pixel component
- MP – Magnitude and Phase interleaved data, Magnitude values are the first pixel component
- M – Magnitude only
- P Phase Only
- I1Q2 – I and Q data in the 1st and 2nd bands, respectively.
- Q1I2 – Q and I data in the 1st and 2nd bands, respectively.
- M1P2 – M and P data in the 1st and 2nd bands, respectively.
- P1M2 – P and M data in the 1st and 2nd bands, respectively

As shown in Figure 17-5, complex data is located within the NITF file after the image subheader. Possible formats for complex data storage include the following:

- IQ interleaved – I and Q data values are interleaved and stored sequentially in one image data file.

- QI interleaved – Q and I data values are interleaved and stored sequentially in one image data file.

- IQ banded - I and Q data values are stored separately i.e. all of the I data is stored sequentially in the first band followed by all of the Q data is stored sequentially in the second band. This format is similar to NITF multispectral imagery.
- QI banded - Q and I data values are stored separately i.e. all of the Q data is stored sequentially in the first band followed by all of the I data is stored sequentially in the second band. This format is similar to NITF multispectral imagery.
- MP interleaved– M and P data values are interleaved and stored sequentially in one image data file.
- MP banded - M and P data values are stored separately i.e. all of the M data is stored sequentially in the first band followed by all of the P data is stored sequentially in the second band. This format is similar to NITF multispectral imagery and is the format selected by the AIP platform.
- M, Magnitude only - Only M values stored sequentially in one image data file.
- P Phase Only - Only P values stored sequentially in one image data file.

Sizes of each I,Q,M,P components range from 04 to 64 bits with 8, 16, 32 bits per complex data component being the most common.

Note that when the data is interleaved, the number of columns (NCOLS) in the NITF image subheader refers to the number of data pairs (I, Q, or M, P). Also, the block size element (NPPBH) refers to the number of data pairs in a block. In addition, the CMETAA fields include the number of bits per first component and the number of bits per second component. In the NITF image subheader, the number of bits per pixel would be the sum of bits in these two components (e.g., 8 bits magnitude and 12 bits phase would translate to 20 bits per pixel (NBPP)). However, the two components would occupy the nearest byte boundary to store the data. In other words, in the example, the 8 bits magnitude component would occupy one byte, while the 12 bits phase component would occupy 2 bytes. Note that this overrides the definition of 'INT' in the NITF image subheader field PVTYPE which denotes 16 bits or 2 bytes.

17.6.6 DEFINITIONS FOR FFT & ZERO PADDING

The 2D-FFT of motion-compensated (and possibly polar-formatted) phase history data produces a complex image which, after additional enhancement processing, produces an exploitable SAR image. The phase history is often "zero padded" to increase the sampling density of the complex SAR image. For many exploitation algorithms, it is important to know the exact details of the zero-padding, so that approximations do not introduce unwanted phase contributions.

Figure 8.2 shows an exact specification of zero padding, where the signal data is denoted as gray and the zeros as white in the diagram. The record and element (row, column) locations of the DC point (zero frequency) and the corner locations of the signal data is specified in the CMETAA header. These locations are sufficient to describe the signals and zeros from any processor.

The header row and column notation apply to whatever data enters the 2D-FFT. If the input into the 2D-FFT is a subsection of a larger data array then the location of the zero pad and signal location reported in the header correspond to this subsection, not the full-sized data array.

The first example depicts the DC in the data center with phase history data in the slant plane.

The second example depicts the DC in the data corner with phase history in the slant plane.

The third example depicts the DC in the data center with phase history data in the ground plane.

The fourth example depicts the DC in the data corner with phase history data in the ground plane.

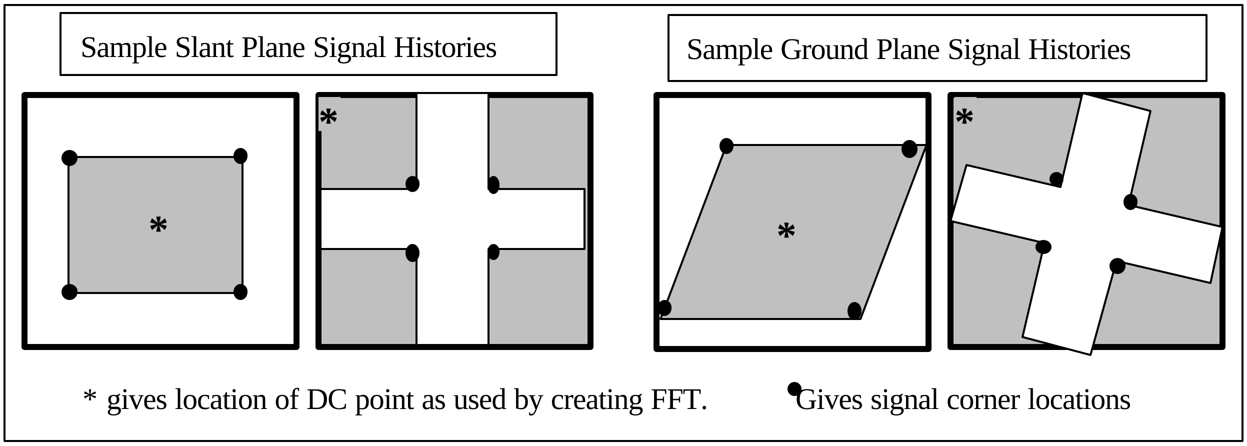

FIGURE 17-6. SIGNAL HISTORIES

Note: Definitions for Magnitude Imagery Pixel Value Representation based on Complex I and Q Values, formally contained in 17.7 and 17.8 have been moved to Annex A (17.8).

17.7 CMETAA

The following table contains all of the fields for CMETAA. Questions regarding this tag may be referred to Robert Garneau of Litton TASC (781-942-2000 ext. 2935) or Elizabeth Frey of Eastman Kodak (716-253-6074).

<R> = Indicated default value may occupy this field with the intent to ease early implementation of the CDFI TRE.

Alphabetic fields are left justified and spacefilled, numeric fields are right justified and zero filled

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
	TRETAG	TRE Name This field shall contain the unique extension name or ID for the CDFI TRE.	A/6	CMETAA	R
	TREL	TRE Data Length This field shall contain the total length of the TRE.	N/5	01582	R
100	RELATED_TRES	Related TREs Subtag mechanism. Indicates the number of additional TREs contained in this NITF file which pertain to SAR processing. CMETAAThe following TREs have been approved by the CMETAA custodian: AIMIDA AIMIDB MTXFIL AIPBCA Default = 00 For more information on these TREs see the NITF Tag Registry: http://jitc.fhu.disa.mil/nitf/tag_reg/tag_reg.html	N/2	01 to 20 or 00	R
200	RELATED_TRES	Name of Additional TRE States the name of the TRE referenced by RELATED_TRES. Each TRE name is 6 bytes in length. Note: CMETAA's listing of additional TREs is done so with the approval of the CMETAA document custodian	A/120	Alphanumeric AIMIDA AIMIDB AIPBCA	R
300	RD_PRC_NO	Processor Version Number Describes the software/hardware configuration used to generate the data.	A/12	Alphanumeric	R
400	IF_PROCESS	VPH Processing Method Method of image formation (i.e. VPH processing alg.). This list is extensible through the document custodian. RM = Range migration PF = Polar Format CD = Chirp Descaling (alphabetic fields are left justified and spacefilled)	A/4	RM PF CD	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
500	RD_CEN_FREQ	Nominal Center Frequency Band Describes the nominal center frequency band. This list is extensible through the document custodian. L C P S SC X KA KU	A/4	L C P S SC X KA KU	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
600	RD_MODE	Collection Mode Describes the collection mode. This list is extensible through the document custodian. 0FR - Mode 0, slant plane 0FG - Mode 0, ground plane 1FR - Mode 1, slant plane 1FG - Mode 1, ground plane 2FR - Mode 2, slant plane 2FG - Mode 2, ground plane 22FR - Mode 5, slant plane 22FG - Mode 5, ground plane 07A - Mode 3 area, slant plan 07L - Mode 3 LOC, slant plan 14A - Mode 4 area, slant plane 14L - Mode 4 LOC, slant plane 1SP - ETP, spotlight 1, slant 3SP - ETP, spotlight 3, slant 10S - ETP, scan, slant GSP - Tier 2+ spot mode GSH - Tier 2+ search mode AIP13 - Monopulse Calibration AIP14 - Wide Area MTI (WAMTI) AIP15 - Coarse Resolution Search AIP16 -Medium Resolution Search AIP17 - High Resolution Search AIP18 - Point Imaging AIP19 - Swath MTI (SMTI) AIP20 - Repetitive Point Imaging AS201 - Search AS202 - Spot 3 AS204 - Spot 1 AS207 - Continuous Spot 3 AS208 - Continuous Spot 1 AS209 - EMTI Wide Frame Search AS210 - EMTI Narrow Frame Search AS211 - EMTI Augmented Spot AS212 - EMTI Wide Area MTI (WAMTI) AS213 - Monopulse Calibration	A/5	0FR 0FG 1FR 1FG 2FR 2FG 22FR 22FG 07A 07L 14A 14L 1SP 3SP 10S GSP GSH AIP13 AIP14 AIP15 AIP16 AIP17 AIP18 AIP19 AIP20 AS201 AS202 AS204 AS207 AS208 AS209 AS210 AS211 AS212 AS213	R
700	RD_PATCH_NO	Data Patch Number Field Patch instance for an imagery operation. <R> = 0000 = Not Applicable	N/4	0001-9999 or 0000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
800	CMPLX_DOMAIN	Complex Domain defines whether the two components form a rectangular (IQ) or a polar (MP) coordinate system and which component are present in this image. Operational and efficiency considerations may dictate that the magnitude and phase components be contained in a separate files with the M or P defining the content of this image type of image samples. This list is extensible through the document custodian. IQ = I and Q interleaved data, note I values = first pixel component QI = Q and I interleaved data, note Q values = first pixel component MP = Magnitude and Phase interleaved data, note Magnitude values = first pixel component I1Q2 – I and Q data stored in the 1st and 2nd bands, respectively Q1I2 – Q and I data stored in the 1st and 2nd bands, respectively M1P2 – M and P data stored in the 1st and 2nd bands, respectively P1M2 – P and M data stored in the 1st and 2nd bands, respectively M = Magnitude P = Phase	A/5	IQ QI MP I1Q2 Q1I2 M1P2 P1M2 M P	R
900	CMPLX_MAG_REMAP_TYPE	Type of Magnitude Mapping applied to M pixel component values. This list is extensible through the document custodian. NS = No Scaling LINM = Linear Magnitude LINP = Linear Power LOGM = Log Magnitude LOGP = Log Power LLM = Lin-Log Magnitude Default = NA = Not Applicable	A/4	NS LINM LINP LOGM LOGP LLM or NA	<R>
1000	CMPLX_LIN_SCALE	Complex Linear Scale Factor Complex Linear Scale Factor applied to each pixel in the image or image block. Used for LINM, LINP and LLM mapping in index 900. Default = 1.00000	N/7	.000001 to 99999.9 or 1.00000	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
1100	CMPLX_AVG_POWER	Average Power of the image data associated with the NITF IM sub-header containing CMETAA. Avg. Power = $S(I^2 + Q^2)/n$ Default = 0000000, unknown Avg. Power	N/7	.000001 to 99999.9	<R>
1200	CMPLX_LINLOG_TP	Complex LinLog Transition Point Refers to the pixel value where linear scaling is applied to pixels less than the Transition Point (TP) value. Log scaling is applied to pixel values larger than the TP. Applied to LLM data denoted in field CMPLX_MAG_SCALE_TYPE (Index 900). Default = 00000 = Not Applicable	N/5	00000 to 65535	<R>
1300	CMPLX _PHASE _QUANT_FLAG	Phase Quantization Flag Quantization Flag Indicates whether the phase data has been quantized. This list is extensible through the document custodian. NS = No Scaling UQ1 = Uniformly Sampled (low) Quantizer UQ2 = Uniformly Sampled (center) Quantizer	A/3	NS UQ1 UQ2	R
1400	CMPLX _PHASE_QUANT _BIT_DEPTH	Phase Quantization Bit Depth:The number quantizer bits used in UQ1 or UQ2 in index 1300. If “CMPLX _PHASE _QUANT_FLAG” = NS than field contains 00.	N/2	01 to 32, or 00 if field 1300 is NS	R
1500	CMPLX _SIZE_1	Size of First Pixel Component in Bits. The Inphase component when CMPLX_DOMAIN is IQ; The Quadrature component when CMPLX_DOMAIN is QI; The magnitude component when CMPLX_DOMAIN is MP. Note: component sizes will be identical for I and Q	N/2	04 to 64 Commonly 8,16,32	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
1600	CMPLX _IC_1	Data Compression of First Pixel Component. Magnitude only (M) or the magnitude portion of the Magnitude/Phase (MP). No Compression (NC) for IQ or Phase (P) until standard compression available. This list is extensible through the document custodian. NC = No compression C3 = JPEG Lossy (as defined in MIL-STD-188-198A) C5 = JPEG Lossless (as defined in MIL-STD-188-198A) I1 = Downsampled JPEG Data Compression Information (as defined by NIMA N0106-97) C4 = Vector Quantizer (as defined in MIL-STD-188-199) C6 = JPEG 2000 (currently being reviewed by the NTB) C7 = Complex Data Compression (designator reserved for future complex data compression) Note the following compression alg. currently have no assigned standards but are currently being investigated. TC = Trellis Coded Quantizer NS = Nonlinear Scalar Quantized US = Uniform Scalar Quantized Default = NC	A/2	NC C3 C5 C6 I1 C4 C7 TC NS US	R
1700	CMPLX _SIZE_2	Size of Second Pixel Component in Bits. The Quadrature component when CMPLX_DOMAIN is IQ; The Inphase component when CMPLX_DOMAIN is QI; The phase component when CMPLX_DOMAIN is MP Use spaces for either mag or phase alone (as the only component) Default = 00 Note: component sizes will be identical for I and Q.	N/2	04 to 64 Commonly 8,16,32 or 00 indicating no second component	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
1800	CMPLX _IC_2	Data Compression, second pixel component. Phase compression. No Compression (NC) for IQ until standard compression available Spaces indicate that field is not applicable. This list is extensible through the document custodian. NC = No compression C3 = JPEG Lossy (as defined in MIL-STD-188-198A) C5 = JPEG Lossless (as defined in MIL-STD-188-198A) I1 = Downsampled JPEG Data Compression Information (as defined by NIMA N0106-97) C4 = Vector Quantizer (as defined in MIL-STD-188-199) C6 = JPEG 2000 (currently being reviewed by the NTB) C7 = Complex Data Compression (designator reserved for future complex data compression) Note the following compression alg. currently have no assigned standards but are currently being worked by the NTB. TC = Trellis Coded Quantizer NS = Nonlinear Scalar Quantized US = Uniform Scalar Quantized Default = NC	A/2	NC C3 C5 C6 I1 C4 C7 TC NS US	R
1900	CMPLX _IC_BPP	Complex Imagery Compressed Bits per Pixel. The average bits per pixel for the complex pixels after compression. Default = 00000, implies no compression	N/5	0.001 to 64.00 or 00000	<R>
2000	CMPLX_WEIGHT	Type of Weighting applied to data. Weighting is applied to I,Q data prior to conversion to MP data. This list is extensible through the document custodian. UWT = Unweighted, uniform (default) SVA = Spatially Variant Apodization TAY = Taylor Weighting HNW = Hanning Window HMW = Hamming Window	A/3	UWT SVA TAY HNW HMW	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
2100	CMPLX_AZ_SLL	Azimuth (AZ) Sidelobe Level. Absolute value of the level that the azimuth (AZ) sidelobe response is below that of the main return. Applies only to Taylor weighted data. Default = 00 = Unweighted or other	N/2	00 to 99 (decibels)	R
2200	CMPLX_RNG_SLL	Range (RNG) Sidelobe Level. Absolute value of the level that the range (RNG) sidelobe response is below that of the main return. Applies only to Taylor weighted data. Default = 00	N/2	00 to 99 (decibels)	R
2300	CMPLX_AZ_TAY_NBAR	Azimuth Taylor nbar. Number of sidelobes affected by weighting. Applies only to Taylor weighted data. Default = 00 = Unweighted or other	N/2	00 to 99	R
2400	CMPLX_RNG_TAY_NBAR	Range Taylor nbar. Number of sidelobes affected by weighting. Applies only to Taylor weighted data . Default = 00 = Unweighted	N/2	00 to 99	R
2500	CMPLX_WEIGHT_NORM	Complex Weight Normalization function for Taylor weighting. This list is extensible through the document custodian. AVG: Average normalization RMS: Root Mean Square normalization Default = Three spaces if not applied	A/3	AVG RMS or 3 spaces	<R>
2600	CMPLX_SIGNAL_PLANE	Plane of the complex image S = Slant plane G = Ground Plane	A/1	S/G	R
2700	IF_DC_SF_ROW	Sample Location of DC (zero frequency) in row dimension in the spatial frequency domain for the 2-D FFT of the patch.	N/6	000000 to 999999	R
2800	IF_DC_SF_COL	Sample Location of DC (zero frequency) in column dimension in the spatial frequency domain for the 2-D FFT of the patch.	N/6	000000 to 999999	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
2900	IF_PATCH_1_ROW	Sample Location of the signal corner in the row dimension, upper left in the spatial frequency domain for the 2-D FFT of the patch. Origin (0,0) is located at the upper left corner of the patch. Note: The row coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system. Default = -99999 = NA = Not Applicable	N/6	000000 to 9999999 or -99999	<R>
3000	IF_PATCH_1_COL	Sample Location of the signal corner in the column dimension, upper left in the spatial frequency domain for the 2-D FFT of the patch. . Origin (0,0) is located at the upper left corner of the patch. Note: The column coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system. Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
3100	IF_PATCH_2_ROW	Sample Location of the signal corner in the row dimension, upper right in the spatial frequency domain for the 2-D FFT of the patch. Origin (0,0) is located at the upper left corner of the patch. Note: The row coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system. Default = -99999 = NA = Not Applicable	N/6	000000 to 9999999 or -99999	<R>
3200	IF_PATCH_2_COL	Sample Location of the signal corner in the column dimension, upper right in the spatial frequency domain for the 2-D FFT of the patch. Origin (0,0) is located at the upper left corner of the patch. Note: The column coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
3300	IF_PATCH_3_ROW	Sample Location of the signal corner in the row dimension, bottom right in the spatial frequency domain for the 2-D FFT of the patch. Origin (0,0) is located at the upper left corner of the patch. Note: The row coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system. Default = -99999 = NA = Not Applicable	N/6	000000 to 9999999 or -99999	R
3400	IF_PATCH_3_COL	Sample Location of the signal corner in the column dimension, bottom right in the spatial frequency domain for the 2-D FFT of the patch. . Origin (0,0) is located at the upper left corner of the patch. Note: The column coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
3500	IF_PATCH_4_ROW	Sample Location of the signal corner in the row dimension, bottom left in the spatial frequency domain for the 2-D FFT of the patch. . Origin (0,0) is located at the upper left corner of the patch. Note: The row coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system. Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
3600	IF_PATCH_4_COL	Sample Location of the signal corner in the column dimension, bottom left in the spatial frequency domain for the 2-D FFT of the patch. Origin (0,0) is located at the upper left corner of the patch. Note: The column coordinate shown in this field is a localized value specific to one patch. It does not correspond to a multiple patches row/col coordinate system Default = -99999 = NA = Not Applicable	N/6	000000 to 9999999 or -99999	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
3700	IF_DC_IS_ROW	Sample Location of DC (zero frequency) in row dimension in the image space relevant to the origin of the full image (i.e. image segment). Origin (0,0) is located at the upper left corner of the image segment	N/8	00000000 to 99999999	R
3800	IF_DC_IS_COL	Sample Location of DC (zero frequency) in column dimension in the image space relevant to the origin of the full image (i.e. image segment). Origin (0,0) is located at the upper left corner of the image segment	N/8	00000000 to 99999999	R
3900	IF_IMG_ ROW_DC	Row Location of Patch (IM) relative to the full image (image segment). If this image is the entire image segment use 00000000. Origin (0,0) is located at the upper left corner of the image segment Default = 00000000	N/8	00000001 to 99999999 or 00000000	<R>
4000	IF_IMG_COL_DC	Column Location of Patch (IM) relative to the full image (image segment). If this image is the entire image segment use 00000000. Origin (0,0) is located at the upper left corner of the image segment Default = 00000000	N/8	00000001 to 999999999 or 00000000	<R>
4100	IF_TILE_1_ROW	Sample Location of valid tile data in the row direction, upper left. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4200	IF_TILE_1_COL	Sample Location of valid tile data in the column direction, upper left. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4300	IF_TILE_2_ROW	Sample Location of valid tile data in the row direction, upper right. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4400	IF_TILE_2_COL	Sample Location of valid tile data in the column direction, upper right. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
4500	IF_TILE_3_ROW	Sample Location of valid tile data in the row direction, lower right. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4600	IF_TILE_3_COL	Sample Location of valid tile data in the column direction, lower right. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4700	IF_TILE_4_ROW	Sample Location of valid tile data in the row direction, lower left. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4800	IF_ TILE_4_COL	Sample Location of valid tile data in the column direction, lower left. Origin (0,0) is located at the upper left corner of the tile Default = -99999 = NA = Not Applicable	N/6	000000 to 999999 or -99999	<R>
4900	IF_RD	Range Deskew Indicates whether range deskew has been applied to the VPH data. Y = Yes, range deskewed applied N = No, range deskewed still exists O = Obviated (range deskew not necessary/not applicable)	A/1	Y/N/O	R
5000	IF_RGWLK	Range Walk Correction Y = yes, range walk applied N = no, range walk exists in image O = Obviated (not necessary/not applicable)	A/1	Y/N/O	R
5100	IF_KEYSTN	Range Curvature and Keystone Distortion Correction Y = yes, range curvature and keystone distortion correction applied N = no, range curvature and keystone distortion exists in image O = Obviated (not necessary/not applicable) Default = One space	A/1	Y/N/O or 1 space	<R>
5200	IF_LINSFT	Residual Linear Shift Correction Y = Yes, correction applied N = No, correction not applied O = Obviated (not necessary/not applicable) Default = One space	A/1	Y/N/O or 1 space	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
5300	IF_SUBPATCH	Sub-patch Phase Correction Y = Yes, sub-patch phase correction applied N = No, correction not applied O = Obviated (not necessary/not applicable) Default = One space	A/1	Y/N/O or 1 space	<R>
5400	IF_GEODIST	Other Deterministic Geometric Distortion Corrections Y = Yes, correction applied N = No, correction not applied O = Obviated (not necessary/not applicable) Default = One space	A/1	Y/N/O or 1 space	<R>
5500	IF_RGFO	Range Fall-off Correction (Sensitivity Time Control) Y = Yes, correction applied N = No, correction not applied O = Obviated (not necessary/not applicable)	A/1	Y/N/O	R
5600	IF_BEAM_COMP	Antenna Beam Pattern Compensation Applied Image amplitude deshading applied to compensate for antenna pattern falloff. Y = Yes, correction applied N = No, correction not applied O = Obviated (not necessary/not applicable)	A/1	Y/N/O	R
5700	IF_RGRES	Range Direction Resolution (e.g. cross track, cross scan) Resolution of the main lobe of the SAR IPR at the -3db, range direction. Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	0000.000 to 9999.999 (meters)	R
5800	IF_AZRES	Azimuth Resolution (e.g. along track) Resolution of the main lobe of the SAR IPR at the -3db, azimuth direction. Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	0000.000 to 9999.999 (meters)	R
5900	IF_RSS	Range Sample Spacing (e.g. cross track, cross scan) Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	00.00000 to 99.99999 (m/pix)	R
6000	IF_AZSS	Azimuth Sample Spacing, (e.g. along track) Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	00.00000 to 99.99999 (m/pix)	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
6100	IF_RSR	Range Sample Rate (samples/ commanded IPR) Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	00.00000 to 99.99999 (samples/IPR)	R
6200	IF_AZSR	Azimuth Sample Rate (samples/ Commanded IPR) Note: This definition pertains to the image plane of the image. mmmm.mmm	N/8	00.00000 to 99.99999 (samples/IPR)	R
6300	IF_RFFT_SAMP	Original Range (e.g. cross scan, cross-track) FFT Non-zero Input Samples The original number of input FFT range samples prior to zero padding (e.g. at polar format).	N/7	0000001 to 9999999	R
6400	IF_AZFFT_SAMP	Original Azimuth (e.g. along track) FFT Non-zero Input Samples The original number of input FFT azimuth samples prior to zero padding (e.g. at polar format).	N/7	0000001 to 9999999	R
6500	IF_RFFT_TOT	Total Range (e.g. cross scan, cross-track) FFT Length The total number of input FFT range samples (e.g. at polar format).	N/7	0000001 to 9999999	R
6600	IF_AZFFT_TOT	Total Azimuth (e.g. along track) FFT Length The total number of input FFT azimuth samples (e.g. at polar format).	N/7	0000001 to 9999999	R
6700	IF_SUBP_ROW	Sub-patch Size, Row (Range Direction) Number of row pixels (i.e. pixels per row) in one processing sub-patch (size and locations of phase discontinuities) Default = 000000, no sub-patch	N/6	000001 to 999999 (pixels) or 000000	<R>
6800	IF_SUBP_COL	Sub-patch Size, Column (Azimuth Direction) Number of column pixels (i.e. pixels per column) in one processing sub patch (size and locations of phase discontinuities) Default = 000000, no sub-patch	N/6	000001 to 999999 (pixels) or 000000	<R>
6900	IF_SUB_RG	Subpatch Counts, Range, (e.g. cross scan, cross-track) Number of processing sub patches in the range direction (size and locations of phase discontinuities) Default = 0000, no sub-patch	N/4	0001 to 1000 or 0000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
7000	IF_SUB_AZ	Subpatch Counts, Azimuth, (e.g. along track) Number of processing sub patches in the azimuth direction (size and locations of phase discontinuities) Default = 0000, no sub-patch	N/4	0001 to 1000 or 0000	<R>
7100	IF_RFFTS	FFT Sign Convention in Range (e.g. cross scan, cross-track) Defines sign of exponent in kernel for range FFT. exp ±j2p… + = positive - = negative	A/1	+, -	R
7200	IF_AFFTS	FFT Sign Convention in Azimuth (e.g. along track) Defines sign of exponent in kernel for azimuth FFT. exp ±j2p… + = positive - = negative	A/1	+, -	R
7300	IF_RANGE_DATA	Range Data Range (e.g. cross-scan, cross-track) Indicates range orientation of the data ROW_INC = range increases as row index increases ROW_DEC = range decreases as row index increases COL_INC = range increases as column index increases COL_DEC = range decreases as column index increases	A/7	ROW_INC ROW_DEC COL_INC COL_DEC	R
7400	IF_INCPH	Increasing phase Flag to indicate whether phase increases or decreases with increasing range (e.g. cross-scan, cross-track). + = Increases with distance - = Increases with distance Default = Space = unknown	A/1	+,- or 1 space	<R>
7500	IF_SR_NAME1	Super Resolution Algorithm Name, First Iteration This list is extensible through the document custodian. S-SVA = Super SVA NLS = Non Linear Least Squares HDI = High Definition Imaging HDSAR = High Definition SAR CLEAN = Point Return Cleaning SPECEST= General Spectrum Estimation Default = Eight spaces = Not applied	A/8	S-SVA NLS HDI HDSAR CLEAN SPECEST or 8 spaces	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
7600	IF_SR_AMOUNT1	Amount or Factor of Super Resolution Applied to the Image, First Iteration Amount or Factor of Super Resolution Applied to image. ss.sssss Default = 01.00000	N/8	01.00000 to 99.99999	R
7700	IF_SR_NAME2	Super Resolution Algorithm Name, Second Iteration This list is extensible through the document custodian. S-SVA = Super SVA NLS = Non Linear Least Squares HDI = High Definition Imaging HDSAR = High Definition SAR CLEAN = Point Return Cleaning SPECEST= General Spectrum Estimation Default = Eight spaces = Not applied	A/8	S-SVA NLS HDI HDSAR CLEAN SPECEST or 8 spaces	<R>
7800	IF_SR_AMOUNT2	Amount or Factor of Super Resolution Applied to the Image, Second Iteration Amount or Factor of Super Resolution Applied to image. ss.sssss Default = 01.00000	N/8	01.00000 to 99.99999	R
7900	IF_SR_NAME3	Super Resolution Algorithm Name, Third Iteration This list is extensible through the document custodian. S-SVA = Super SVA NLS = Non Linear Least Squares HDI = High Definition Imaging HDSAR = High Definition SAR CLEAN = Point Return Cleaning SPECEST= General Spectrum Estimation Default = Eight spaces = Not applied	A/8	S-SVA NLS HDI HDSAR CLEAN SPECEST or 8 spaces	<R>
8000	IF_SR_AMOUNT	Amount or Factor of Super Resolution Applied to the Image, Third Iteration Amount or Factor of Super Resolution Applied to image. ss.sssss Default = 01.00000	N/8	01.00000 to 99.99999	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
8100	AF_TYPE1	First Autofocus Iteration This list is extensible through the document custodian. N = None MD = Mapdrift PGA = Phase Gradient Autofocus PHDIF = Phase Difference Autofocus HOAF = High Order Auto Focus	A/5	N MD PGA PHDIF HOAF	R
8200	AF_TYPE2	Second Autofocus Iteration This list is extensible through the document custodian. N = None MD = Mapdrift PGA = Phase Gradient Autofocus PHDIF = Phase Difference Autofocus HOAF = High Order Auto Focus	A/5	N MD PGA PHDIF HOAF	R
8300	AF_TYPE3	Third Autofocus Iteration This list is extensible through the document custodian. N = None MD = Mapdrift PGA = Phase Gradient Autofocus PHDIF = Phase Difference Autofocus HOAF = High Order Auto Focus	A/5	N MD PGA PHDIF HOAF	R
8400	POL_TR	Transmit Polarization Describes polarization of the electromagnetic plane wave transmitted from the antenna. This list is extensible through the document custodian. V = Vertical polarization H = Horizontal polarization L = Left Circular R = Right Circular T = Theta (described in reference to an X-Z coordinate system plane) P = Phi (described in reference to an X-Y coordinate system plane)	A/1	H, V, L, R, T, P	R
8500	POL_RE	Receive Polarization Describes the sensitivity of the receive antenna to the polarized plane wave. This list is extensible through the document custodian. V = Vertical polarization H = Horizontal polarization L = Left Circular R = Right Circular T = Theta (described in reference to an X-Z coordinate system plane) P = Phi (described in reference to an X-Y coordinate system plane)	A/1	H, V, L, R, T, P	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
8600	POL_REFERENCE	Polarization Frame of Reference Describes the polarization frame of reference Examples: ANT = Antenna pointing coordinates (e.g. H and V referenced to the face of a phased array antenna). SCN = Scene or Target centered coordinates (e.g. H and V referenced to local gravity and ground plane). User may spacefill or add additional data. XYZ = General reference frame describing Theta Phi coordinate frames (XYZ directions specified in the user defined data of this field). Entries left justified, space filled to the right. Default = 40 spaces	A/40	ANT (plus user defined data) SCN (plus user defined data) XYZ (plus user defined data) or 40 spaces	<R>
8700	POL	Polarimetric Data Set Is this image part of a polarimetric data set? P = Yes, a fully polarimetric data set. Like and cross poles simultaneously transmitted and received. D = Yes, a polarimetrically diverse data set. Like and cross poles alternately transmitted; simultaneously received. N = No polarimetric	A/1	P, D, N	R
8800	POL_REG	Pixel Registered Are the images in the polarimetric data set pixel to pixel registered and overlapping? Y = Yes N = No Default = Space. Space is required when POL (index 8700) = N	A/1	Y/N/space	<R>
8900	POL_ISO_1	Minimum Polarization Isolation between this image / signal channel and the other channels. dd.dd Default = 00000. 00000 required when POL (index 8700) = N	N/5	00.00 to 99.99 (decibels) or 00000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
9000	POL_BAL	RCS Gray Level Balancing Indicated if the pixel radar cross section (gray level) has been balanced against other channels, requires balancing and if the balancing coefficients are present in this file A = Balancing coefficients have not been applied and are provide in fields 9100-9200. B = Data has balanced channels, coefficients not provided in fields 9100-9200. C = Balancing coefficients have been applied and are provide in fields 9100-9200. U = Unbalanced channels, no coefficients given; no balancing applied. Default = Space. Space is required when POL (index 8700) = N	A/1	A B C U or space	<R>
9100	POL_BAL_MAG	Pixel Amplitude Balance Coefficient Coefficient to be applied for pixel RCS amplitude balance of this channel against the others (at least 1 polar channel has mag = 1) where a channel is a collection specified by polarization of the antenna on transmit and receive. Default = 00000000 when POL (index 8700) = N or POL_BAL (index 9000) is U. c.cccccc Default = 00000000. 00000000 is required when POL (index 8700) = N or POL_BAL (index 9000) is U.	N/8	0.000000 to 0.999999 or 00000000	<R>
9200	POL_BAL_PHS	Pixel Phase Balance Coefficient Coefficient to be applied for pixel phase balance of this channel against the others (at least 1 polar channel has phase = 0). Default = 00000000. 00000000 is required when POL (index 8700) = N or POL_BAL (index 9000) is U.	N/8	±n.nnnnn 0.000000 to 9.999999 (radians) or 00000000	<R>

127

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
9300	POL_HCOMP	Radar Hardware Phase Balancing Radar hardware phase balancing required to give a flat response in fast time to a sphere return. A = Balancing coefficients have not been applied and are provided in fields 9400-9500. B = Data has balanced channels, coefficients not provided in fields 9100-9200. C = Balancing coefficients have been applied and are provide in fields 9100-9200 U = Unbalanced channels, no coefficients given; no balancing applied Default = Space. Space is required when POL (index 8700) = N	A/1	A B C U space	<R>
9400	POL_HCOMP_BA SIS	Basis Set Name of the basis set for phase balancing coefficients. This list is extensible through the document custodian. LEGENDRE POLYNOMIAL Default = 10 spaces. 10 spaces are required when POL (index 8700) = N or POL_BAL (index 9000) is U.	A/10	LEGENDRE POLYNOMIAL or 10 spaces	<R>
9500	POL_HCOMP_CO EF_1	Radar Hardware Phase Balancing Radar hardware phase balancing first coefficient needed to give a flat response in fast time to a sphere return Default = 00000000. 00000000 is required when POL (index 8700) = N or POL_BAL (index 9000) is U.	N/9	-99999999 to 999999999 (may include explicit decimal point) or 000000000	<R>
9600	POL_HCOMP_CO EF_2	Radar Hardware Phase Balancing Radar hardware phase balancing second coefficient needed to give a flat response in fast time to a sphere return Default = 000000000. 000000000 is required when POL (index 8700) = N	N/9	-99999999 to 999999999 (may include explicit decimal point) or 000000000	<R>
9700	POL_HCOMP_CO EF_3	Radar Hardware Phase Balancing Radar hardware phase balancing third coefficient needed to give a flat response in fast time to a sphere return Default = 000000000. 000000000 is required when POL (index 8700) = N	N/9	-99999999 to 999999999 (may include explicit decimal point) or 000000000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
9800	POL_AFCOMP	Radar Autofocus Phase Balancing Autofocus has been done the same or differently for each channel, where a channel is a collection specified by polarization of the antenna on transmit and receive. This list is extensible through the document custodian. A = Autofocus applied to this channel using the same methods and coefficients as for the other channels. D = Different autofocus applied to this channel than to the other channels. M= Master autofocus channel. Autofocus derived from this channel is used on the other channels. N = No autofocus applied to this channel Default = Space. Space is required when POL (index 8700) = N	A/1	A D M N space	<R>
9900	POL_SPARE_A	Spare alpha field Default = 15 spaces	A/15	15 spaces	<R>
10000	POL_SPARE_N	Spare numeric field Default = 000000000	N/9	000000000	<R>
10100	T_UTC_YYYYMMMDD	YYYYMMMDD The 4 digit year, letter month and Universal Time Coordinated (UTC) date. This field and the next time field establishes the date/ time of collection (e.g. at center of aperture reference point) for complex-image data contained in this file. Note: The date found in this field may or may not match the IDATIM field found in the image subheader.	A/9	YYYYMMMDD	R
10200	T_HHMMSSUTC	UTCHHMMSS The UTC hours, minutes and seconds, 24 hour clock, associated with the data set. This field and the previous date field establishes the date/ time of collection (e.g. at center of aperture) for complex-image data contained in this file. Note: The time found in this field may or may not match the IDATIM field found in the image subheader.	N/6	HHMMSS	R
10300	T_HHMMSSLOCAL	Civil Time of Collection Local civil time of collection, 24 hour clock. Default = six spaces	A/6	HHMMSS or 6 spaces	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
10400	CG_SRAC	Slant Range at Sensor Reference Center Distance from the sensor reference point (e.g. aperture reference point) to the ground reference point. mmmmmmmm.mm	N/11	00000000.00 to 99999999.99 (m)	R
10500	CG_SLANT_CONFIDENCE	Slant Range 95% Confidence Interval The accuracy at the 95% confidence interval of the slant range measurement. This is the magnitude of the confidence interval. mmmm.mm Default = 0000000	N/7	0000.00 to 9999.99 (m) or 0000000	<R>
10600	CG_CROSS	Cross Track Range at Sensor Reference Center (e.g. Aperture Center) Distance from the sensor reference point center to the broadside point on the scene center line. mmmmmmmm.mm Default = 00000000000	N/11	00000000.00 to 99999999.99 (m) or 00000000000	<R>
10700	CG_CROSS_CONFIDENCE	Cross Track Range at Sensor Reference Center 95% Confidence Interval (e.g. aperture reference point) The accuracy at the 95% confidence interval of the cross track range measurement. This is the magnitude of the confidence interval. Default = 0000000	N/7	0000.00 to 9999.99 (m) or 0000000	<R>
10800	CG_CAAC	Cone Angle at Sensor Reference Point (e.g. aperture reference point) The angle, measured at the radar, between the reference velocity vector and the reference range vector. ±ddd.dddd	N/9	±ddd.dddd (deg) ±179.000 deg	R
10900	CG_CONE_CONFIDENCE	Cone Angle 95% Confidence The accuracy at the 95% confidence interval of the Cone Angle measurement. This is the magnitude of the confidence interval. d.dddd Default = 000000	N/6	0.0000 to 0.9999 (deg) or 000000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
11000	CG_GPSAC	Ground Plane Squint Angle The Ground Plane Squint Angle is the angle measured from cross track (broadside) to the great circle joining the ground point directly below the Sensor Reference Point (SRP) to the Output Reference Point (ORP). Forward looking Squint Angles range from 0 (broadside) to +89 degrees and aft looking Squint Angles range from broadside to -89 degrees. ±dd.dddd	N/8	±dd.dddd (deg)	R
11100	CG_GPSAC_CONFIDENCE	Squint Angle 95% Confidence The accuracy at the 95% confidence interval of the Squint Angle measurement. This is the magnitude of the confidence interval. d.dddd Default = 000000	N/6	0.0000 to 0.9999 (deg) or 000000	<R>
11200	CG_SQUINT	Slant Plane Squint Angle The Squint Angle is the angle measured from cross track (broadside) in the slant plane to the vector joining the Aperture Reference Point (ARP) to the Output Reference Point (ORP). Forward looking Squint Angles range from 0 (broadside) to +89 degrees and aft looking Squint Angles range from broadside to -89 degrees. ±dd.dddd	N/8	±dd.dddd (deg)	R
11300	CG_GAAC	Grazing Angle at Sensor Reference Point Center (e.g. aperture center) The angle, measured at the Output Reference Point, between the ground plane and the Reference Position Vector. dd.dddd	N/7	00.0000 to 89.9999(deg)	R
11400	CG_GAAC_CONFIDENCE	Grazing Angle at Sensor Reference Point Center 95% Confidence The accuracy at the 95% confidence interval of the Grazing Angle at Aperture Center measurement d.dddd Default = 000000	N/6	0.0000 to 0.9999 (deg) or 000000	<R>
11500	CG_INCIDENT	Incidence angle The angle between an incoming beam and the perpendicular to the object surface at the point of incidence. This value is the compliment of the grazing angle (index 11300). dd.dddd Default = 0000000	N/7	00.0000 to 89.9999 (deg) or 0000000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
11600	CG_SLOPE	Slope angle The angle between the slant plane and the focus plane of the image i.e. cross track grazing angle. ±dd.ddd Default = 0000000	N/7	±dd.ddd (deg) 00.0000 to 89.9999 or 0000000	<R>
11700	CG_TILT	Tilt angle The angle between the respective Y axes of the slant plane and the focus plane coordinate systems. ±dd.dddd Default = 00000000	N/8	±dd.dddd (deg) ±44.9999 or 00000000	<R>
11800	CG_LD	Look Direction Indicates which side of the imaging platform the image was taken, left or right of the velocity vector.	A/1	L, R	R
11900	CG_NORTH	North Relative to the Top Image Edge Angle from right (defined at the top edge of the image i.e. first row of the image data when the origin (0,0) is located at the upper left corner of the patch) counter-clockwise to north. e.g. On an image viewed north up, this angle is 90 deg. ddd.dddd	N/8	ddd.dddd (deg) 000.0000 to 359.9999	R
12000	CG_NORTH_CONFIDENCE	North Angle 95% Confidence The accuracy at the 95% confidence interval of the North Angle measurement. d.dddd Default = 000000	N/6	0.0000 to 9.9999 (deg) or 000000	<R>
12100	CG_EAST	East Relative to the Top Image Edge Angle from right (defined at the top edge of the image) counter-clockwise to east. e.g. On an image viewed north up, this angle is 0 deg. ddd.dddd	N/8	ddd.dddd (deg) 000.0000 to 359.9999	R
12200	CG_RLOS	Range LOS rel the Top Image Edge Angle from right (defined at the top edge of the image) counter-clockwise to the LOS from near range to far range. Note: This points in the general direction away from the SAR. ddd.dddd	N/8	ddd.dddd (deg) 000.0000 to 359.9999	R
12300	CG_LOS_CONFIDENCE	Range LOS 95% Confidence The accuracy at the 95% confidence interval of the range LOS angle measurement. This is the magnitude of the confidence interval. d.dddd Default = 000000	N/6	0.0000 to 9.9999 (deg) or 000000	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
12400	CG_LAYOVER	Layover Angle Angle from right (defined at the top edge of the image) counter-clockwise to the layover direction. Note: This points in the general direction of the SAR. ddd.dddd Default = 00000000	N/8	ddd.dddd (deg) 000.0000 to 359.9999 or 00000000	<R>
12500	CG_SHADOW	Shadow Angle Angle from right (defined at the top edge of the image) counter-clockwis e to the angle at which shadows fall behind illuminated targets. Note: This points in the general direction away from the SAR. ddd.dddd Default = 00000000	N/8	000.0000 to 359.9999 (deg) or 00000000	<R>
12600	CG_OPM	Out of Plane Motion Maximum angle between the slant plane and imaging platform flight path with respect to the ground reference point. nnn.nnn Default = 0000000	N/7	nnn.nnn (miliarcsec) 000.000 to 999.999 or 0000000	<R>
12700	CG_MODEL	Nominal Geometry Reference Geometry Coordinate System used for the Collection Geometry Data Items. This geometry applies to fields 12800 - 137000 and 14400 - 14800 and 15900 – 16100. These fields come in triples *_X, *_Y, *_Z.. The X field is used for the first coordinate (WGS latitude; ECEF distance from the center of the earth to an earth surface point), The _Y field is used for the second (WGS longitude; ECEF distance from the center of the earth through the equator 90 deg. east) and _Z the third (WGS altitude; ECEF from the center of the earth through the north pole 90 deg. east). This list is extensible through the document custodian. ECEF = Earth Centered Earth Fixed (meters from geocenter) WGS84 = Latitude (deg) Longitude (deg) Alt (m) XYZSC = local flat earth coords; scene center as origin Please see Annex B for a reference text describing the above coordinate systems	A/5	XYZSC ECEF WGS84	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
12800	CG_AMPT_X	Aimpoint of Antenna, x (Illum. Ref Pt.) x coordinate of the center of the antenna beam pattern aimpoint at the sensor reference point. If index 12700 has ECEF or XYZSC use meters. If WGS84 use degrees. ±dddddddd.ddd or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0089.9999999 (deg)	R
12900	CG_AMPT_Y	Aimpoint of Antenna, y (Illum. Ref Pt.) y coordinate of the center of the antenna beam pattern aimpoint at the sensor reference point. If index 12700 has ECEF or XYZSC use meters. If WGS84 use degrees. ±mmmmmmmm.mmm or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0179.9999999 (deg)	R
13000	CG_AMPT_Z	Aimpoint of Antenna, z (Illum. Ref Pt.) z coordinate of the center of the antenna beam pattern aimpoint at the sensor reference point. ±mmmmmmmm.mmm	N/13	±99999999.999 (meters)	R
13100	CG_AP_CONF_XY	Aimpoint 95% Confidence States the 95% confidence at the horizontal aimpoint measurement Circular Error distance. Default = 000000	N/6	000000 to 999.99 (meters) or 000000	<R>
13200	CG_AP_CONF_Z	Aimpoint 95% Confidence States the confidence at the vertical aimpoint measurement as a Linear Error Percent Distance. Default = 000000	N/6	000000 to 999.99 (meters) or 000000	<R>
13300	CG_APCEN_X	Sensor Reference Point (x) (e.g. aperture center) x component of the sensor position at the sensor reference point. If index 12700 has ECEF or XYZSC use meters. If WGS84 use degrees. ±mmmmmmmm.mmm or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0089.9999999 (deg)	R
13400	CG_APCEN_Y	Sensor Reference Point (y) y component of the sensor position at the sensor reference point. If index 12700 has ECEF or XYZSC use meters. If WGS84 use degrees. ±mmmmmmmm.mmm or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0179.9999999 (deg)	R
13500	CG_APCEN_Z	Sensor Reference Point (z) z component of the sensor position at the sensor reference point. ±mmmmmmmm.mmm	N/13	±99999999.999 (meters)	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
13600	CG_APER_CONF_XY	Sensor Reference Point 95% Confidence States the 95% confidence at the horizontal sensor reference point (e.g. aperture center) measurement Circular Error distance. mmm.mm Default = 000000	N/6	000.00 to 999.99 (meters) or 000000	<R>
13700	CG_APER_CONF_Z	Sensor Reference Point Center 95% Confidence States the 95% confidence at the vertical sensor reference point (e.g. aperture center) measurement Linear Error distance. mmm.mm Default = 000000	N/6	000.00 to 999.99 (meters) or 000000	<R>
13800	CG_FPNUV_X	Focus Plane Normal Unit Vector, x x component of the unit vector perpendicular to the focus plane.	N/9	-1.000000 to +1.000000 (unitless)	R
13900	CG_FPNUV_Y	Focus Plane Normal Unit Vector, y y component of the unit vector perpendicular to the focus plane.	N/9	-1.000000 to +1.000000 (unitless)	R
14000	CG_FPNUV_Z	Focus Plane Normal Unit Vector, z z component of the unit vector perpendicular to the focus plane.	N/9	-1.000000 to +1.000000 (unitless)	R
14100	CG_IDPNUVX	Image Display Plane Normal Unit Vector, x x component of the unit vector perpendicular to the plane of the formed image	N/9	-1.000000 to +1.000000 (unitless)	R
14200	CG_IDPNUVY	Image Display Plane Normal Unit Vector, y y component of the unit vector perpendicular to the plane of the formed image.	N/9	-1.000000 to +1.000000 (unitless)	R
14300	CG_IDPNUVZ	Image Display Plane Normal Unit Vector, z z component of the unit vector perpendicular to the plane of the formed image.	N/9	-1.000000 to +1.000000 (unitless)	R
14400	CG_SCECN_X	Scene Center (Image Output Reference Point), x in ground plane Output Reference Point, x coordinate. If index 12700 has ECEF or XYZSC use meters, if WGS84 use degrees. ±mmmmmmmm.mmm or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0089.9999999 (deg)	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
14500	CG_SCECN_Y	Scene Center (Image Output Reference Point), y in ground plane Output Reference Point, y coordinate. If index 12700 has ECEF or XYZSC use meters, if WGS84 use degrees. ±mmmmmmmm.mmm or ±dddd.ddddddd	N/13	±99999999.999 (meters) or ±0179.9999999 (deg)	R
14600	CG_SCECN_Z	Scene Center (Image Output Reference Point), z Output Reference Point, z coordinate. ±mmmmmmmm.mmm	N/13	±99999999.999 (meters)	R
14700	CG_SC_CONF_XY	Scene Center 95% Confidence States the 95% confidence at the scene center horizontal measurement (ground plane) as a circular error distance. mmm.mm	N/6	000.00 to 999.99 (meters)	R
14800	CG_SC_CONF_Z	Scene Center 95% Confidence States the 95% confidence at the scene center vertical measurement as a Linear error distance. mmm.mm	N/6	000.00 to 999.99 (meters)	R
14900	CG_SWWD	Swath Width Range width for a SAR strip map or scan mode. The refers to the slant plane image segment and patch width in the range direction. If frame image, value equals range width. mmmmm.mm	N/8	00000.00 to 99999.99 (meters)	R
15000	CG_SNVEL_X	Sensor Nominal Velocity, x' x component of the sensor velocity at the sensor reference point. ±mmmmm.mmm	N/10	±99999.999 (m/sec)	R
15100	CG_SNVEL_Y	Sensor Nominal Velocity, y' y component of the sensor velocity at the sensor reference point. ±mmmmm.mmm	N/10	±99999.999 (m/sec)	R
15200	CG_SNVEL_Z	Sensor Nominal Velocity, z' z component of the sensor velocity at the sensor reference point. ±mmmmm.mmm	N/10	±99999.999 (m/sec)	R
15300	CG_SNACC_X	Sensor Nominal Acceleration x" x component of the sensor acceleration at the sensor reference point. ±mmmmm.mmm	N/10	±99.999999 (m/sec^2)	R
15400	CG_SNACC_Y	Sensor Nominal Acceleration y" y component of the sensor acceleration at the sensor reference point. ±mmmmm.mmm	N/10	±99.999999 (m/sec^2)	R
15500	CG_SNACC_Z	Sensor Nominal Acceleration z" z component of the sensor acceleration at the sensor reference point. ±mmmmm.mmm	N/10	±99.999999 (m/sec^2)	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
15600	CG_SNATT_ROLL	Sensor Nominal Attitude Roll Sensor angular attitude around the nominal velocity vector at the sensor reference point (e.g. aperture center). ±ddd.ddd Default = -9999999 = NA = Not Applicable	N/8	±179.999 (deg) or -9999999	<R>
15700	CG_SNATT_PITCH	Sensor Nominal Attitude Pitch Sensor angular attitude around the pitch axis at the sensor reference point. ±ddd.ddd Default = -9999999 = NA = Not Applicable	N/8	±179.999 (deg) or -9999999	<R>
15800	CG_SNATT_YAW	Sensor Nominal Attitude Yaw Sensor angular attitude around the yaw axis at the sensor reference point (e.g. aperture center). ±ddd.ddd Default = -9999999 = NA = Not Applicable	N/8	±359.999 (deg) or -9999999	<R>
15900	CG_GTP_X	Geoid Tangent Plane Normal, x x component of the unit vector perpendicular to the reference geoid (reference geoid WGS84) at the output reference point. Default = 000000000	N/9	-1.000000 to +1.000000 (unitless) or 000000000	<R>
16000	CG_GTP_Y	Geoid Tangent Plane Normal, y y component of the unit vector perpendicular to the reference geoid (reference geoid WGS84) at the output reference point. Default = 000000000	N/9	-1.000000 to +1.000000 (unitless) or 000000000	<R>
16100	CG_GTP_Z	Geoid Tangent Plane Normal, z z component of the unit vector perpendicular to the reference geoid (reference geoid WGS84) at the output reference point. Default = 000000000	N/9	-1.000000 to +1.000000 (unitless)	<R>

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
16200	CG_MAP_TYPE	<u>Mapping Coordinate</u> Type of mapping coordinate used This list is extensible through the document custodian. GEOD = GEOgraphic Decimal degrees Latitude/Longitude (deg) Note: Field indexes 16300 through 17400 only appear when CG_MAP_TYPE (Index 16200) has value GEOD (133 bytes). MGRS = Military Grid Reference System UTM (Universal Transverse Mercator) expressed in MGRS uses the format: zzBJKeeeeeeennnnnnn where " zzBJK" represents the zone band and 100 km square with in the zone, and "eeeeeee' and "nnnnnnn" represent residuals of easting and northing. NA = Not Applicable Note: Field indexes 17500 – 18100 only appear when CG_MAP_TYPE (Index 16200) has value MGRS (133 bytes). NOTE: 133 space characters if fields can not be populated.	A/4	GEOD MGRS NA	R
NOTE: Field indexes 16300 through 17400 only appear when CG_MAP_TYPE (Index 16200) has value GEOD.					
16300	CG_PATCH_LATCEN	<u>Latitude of the Patch Center</u> Latitude of the patch image center ±dd.ddddddd See section 17.5.1.2 for patch definition	N/11	±89.9999999 (deg)	C
16400	CG_PATCH_LNGCEN	<u>Longitude of the Patch Center</u> Longitude of the patch image center ±ddd.ddddddd See section 17.5.1.2 for patch definition	N/12	±179.9999999 (deg)	C
16500	CG_PATCH_LTCORUL	<u>Latitude of the Patch Corner, upper left</u> ±dd.ddddddd See section 17.5.1.2 for patch definition	N/11	±89.9999999 (deg)	C
16600	CG_PATCH_LGCORUL	<u>Longitude of the Patch Corner, upper left</u> ±ddd.ddddddd See section 17.5.1.2 for patch definition	N/12	±179.9999999 (deg)	C

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
16700	CG_PATCH_LTCORUR	Latitude of the Patch Corner, upper right +dd.ddddddd See section 17.5.1.2 for patch definition	N/11	+89.9999999 (deg)	C
16800	CG_PATCH_LGCORUR	Longitude of the Patch Corner, upper right +ddd.ddddddd See section 17.5.1.2 for patch definition	N/12	+179.9999999 (deg)	C
16900	CG_PATCH_LTCORLR	Latitude of the Patch Corner, lower right +dd.ddddddd See section 17.5.1.2 for patch definition	N/11	+89.9999999 (deg)	C
17000	CG_PATCH_LGCORLR	Longitude of the Patch Corner, lower right +ddd.ddddddd See section 17.5.1.2 for patch definition	N/12	+179.9999999 (deg)	C
17100	CG_PATCH_LTCORLL	Latitude of the Patch Corner, lower left +dd.ddddddd See section 17.5.1.2 for patch definition	N/11	+89.9999999 (deg)	C
17200	CG_PATCH _LNGCOLL	Longitude of the Patch Corner, lower left +ddd.ddddddd See section 17.5.1.2 for patch definition	N/12	+179.9999999 (deg)	C
17300	CG_PATCH_LAT _CONFIDENCE	Latitude 95% Confidence The accuracy at the 95% confidence interval of the patch latitude measurement.	N/9	0000000000 to 9.9999999 (deg)	C
17400	CG_PATCH_LONG_CONFIDENCE	Longitude 95% Confidence The accuracy at the 95% confidence interval of the patch longitude measurement	N/9	0.0000000 to 9.9999999 (deg)	C
NOTE: Field indexes 17500 through 18100 only appear when CG_MAP_TYPE (Index 16200) has value MGRS.					
17500	CG_MGRS_CENT	MGRS Image Center	A/23	zzBJKeeeeeeeeennnnnnnnn	C
17600	CG_MGRSCORUL	MGRS Image Upper Left Corner	A/23	zzBJKeeeeeeeeennnnnnnnn	C
17700	CG_MGRSCORUR	MGRS Image Upper Right Corner	A/23	zzBJKeeeeeeeeennnnnnnnn	C
17800	CG_MGRSCORLR	MGRS Image Lower Right Corner	A/23	zzBJKeeeeeeeeennnnnnnnn	C
17900	CG_MGRCORLL	MGRS Image Lower Left Corner	A/23	zzBJKeeeeeeeeennnnnnnnn	C
18000	CG_MGRS_CONFIDENCE	MGRS 95% Confidence The accuracy at the 95% confidence interval of the MGRS measurement mmmm.mm	N/7	0000.00 to 9999.99 (meters)	C
18100	CG_MGRS_PAD	MGRS Blank Padding fills MGRS conditional portion to same length as the Lat/Long conditional	A/11	ASCII spaces	C

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
NOTE: Field index 18150 only appears when CG_MAP_TYPE (Index 16200) has value NA.					
18150	CG_MAP_TYPE_ BLANK	Blank fill if GEOD or MGRS are Not Applicable.	A/133	133 spaces	C
18200	CG_SPARE_A	Spare alpha field Blank fill	A/144	Space	<R>
18300	CA_CALPA	Radiometeric Calibration Parameter System specific radiometric calibration parameter. Default = 0000000	N/7	nnnnnnn 0.00000 to 999.999 or 0000000	<R>
18400	WF_SRTFR	Chirp Start Frequency Beginning frequency of transmitted linear chirp signal. HHHHHHHHHHHH.H	N/14	000000000000.0 to 999999999999.9 (Hz)	R
18500	WF_ENDFR	Chirp End Frequency Ending frequency of transmitted linear chirp signal. HHHHHHHHHHHH.H	N/14	000000000000.0 to 999999999999.9 (Hz)	R
18600	WF_CHRPRT	Chirp Rate The ramp frequency of the linear FM chirp signal. ±MM.MMMMMM 000000000 = nonchirp signal	N/10	±99.999999 (MHz/msec) or 0000000000	R
18700	WF_WIDTH	Pulsewidth Length of out going linear chirp pulses. s.sssssss	N/9	0.0000000 to 0.9999999 (sec)	R
18800	WF_CENFRQ	Center frequency Center frequency of the transmitted linear chirp signal. HHHHHHHHHHH.H	N/13	00000000000.0 to 99999999999.9 (Hz)	R
18900	WF_BW	Chirp Bandwidth Bandwidth of the transmitted linear chirp signal. HHHHHHHHHHH.H	N/13	00000000000.0 to 99999999999 .9 (Hz)	R
19000	WF_PRF	Pulse Repetition Frequency (PRF) Frequency of pulse in the pulse train, in Hz. HHHHH.H	N/7	00000.0 to 99999.9 Hz	R
19100	WF_PRI	Pulse Repetition Interval Interpulse periods = 1/PRF s.sssssss	N/9	0.0000000 to 0.9999999 sec	R
19200	WF_CDP	Coherent Data Period Indicates the duration of the SAR imaging operation i.e. how long the radar beam painted the target. sss.sss	N/7	000.000 to 100.000 sec	R
19300	WF_NUMBER_O F_PULSES	Number of Pulse The maximum number of pulses used to form this image.	N/9	2 to 999999999	R

INDEX	FIELD	FIELD NAME AND DESCRIPTION	SIZE BYTES	VALUE RANGE	TYPE
19400	VPH_COND	The field is used to determine whether VPH is included in this support data tag. Y = Yes, VPH conditional fields will be present N = N, if VPH conditional fields will be not present	A/1	N	R

17.8 ANNEX A: DEFINITIONS FOR MAGNITUDE IMAGERY PIXEL VALUE REPRESENTATION BASED ON COMPLEX I AND Q VALUES.

Power = **Intensity** = $I^2 + Q^2$ can be 32-bit Integer or Floating Point

Voltage = **Amplitude** = $\sqrt{I^2 + Q^2}$ can be 16-bit integer or 32-bit Floating Point

A pixel **Magnitude** is either an amplitude or an intensity scaled to minimize pixel oversaturation (pixels at highest display level) and pixel under saturation (pixels at the lowest display level) when mapped into an unsigned (normally 8-bit) integer for display. **Scaling** applies a multiplication factor to the image or image block by a value chosen to maximize best use of the pixel value type's dynamic range while minimizing pixel over- and under- saturation. Scaling may be linear, logarithmic, or a combination (lin-log). For lin-log, a transition point (pixel value) from linear to logarithmic representation is chosen to optimize the qualities (e.g., display) while maximizing pixels in the linear region and minimizing pixel over- and under- saturation.

The following are descriptive examples for calculating the magnitude imagery pixel values for Linear Magnitude, Linear Power, Log Magnitude, Log Power, and Lin-Log Magnitude. Actual implementations may vary.

Linear Magnitude (LINM)

$$LINM = Amplitude = \sqrt{I^2 + Q^2}$$

If LINM is outputted in N-bit unsigned integer notation and the computations were performed in IEEE 32-bit floating point notation, then

$$LINM = INT\left(Lin\_Scale\_Factor\sqrt{I^2 + Q^2}\right)$$

where

Lin_Scale_Factor for linear magnitude is the normalization factor for the conversion and is provided in IEEE 32-bit floating point. A typical scale factor is

$$Lin\_Scale\_Factor = \frac{2^N - 1}{M_{pk}}$$

M_{pk} is the peak magnitude of the image block.

Linear Power (LINP)

$$LINP = \text{Intensity} = I^2 + Q^2$$

If LINP is outputted in N-bit unsigned integer notation and the computations were performed in IEEE 32-bit floating point notation, then

$$LINP = INT[Lin\_Scale\_Factor(I^2 + Q^2)]$$

where Scale_Factor for linear power is the normalization factor for the conversion and is provided in IEEE 32-bit floating point. A typical scale factor is

$$Lin\_Scale\_Factor = \frac{2^N - 1}{P_{pk}}$$

P_{pk} is the peak power of the image block.

Log Magnitude (LOGM)

There are various methods to computing the log magnitude so that its output is in N-bit unsigned integer notation. In general, the log magnitude can be computed by

$$LOGM = INT\left[\frac{20\log_{10}(LINM)}{DBperSTEP}\right]$$

limit: $0 = LOGM = 2^N-1$

where

LINM is the linear magnitude, and DBperSTEP is the number of decibels per output step.

The ASARS-2 system uses the above form of the LOGM algorithm to remap LINM 32768 levels into 240 gray levels. Gray level "bins" are determined as follows:

dB/bin = DBperSTEP = 20*log10(32768)/240 = 0.376288 (or approximately 3/8 dB per step).

Log Power (LOGP)

Similar to LOGM, if power is available, the log power in N-bit unsigned integer notation can be computed by

$$LOGP = INT\left[\frac{10\log_{10}(LINP)}{DBperSTEP}\right]$$

limit: $0 \leq LOGP \leq 2^N-1$

where

LINP is the linear power, and DBperSTEP is the number of decibels per output step.

Lin-Log Magnitude (LLM)

There are various algorithms to calculate lin-log magnitude. The form of the lin-log magnitude equation in general use is:

For pixel value < Transition Point,

Lin-Log Magnitude = $LINM = INT(Lin\_Scale\_Factor\sqrt{I^2 + Q^2})$

For pixel value $\geq$ Transition Point,

Lin-Log Magnitude = $LOGM = INT\left[\frac{20\log_{10}(LINM)}{DBperSTEP}\right]$

Where the Transition Point is 117.

Another form of the lin-log magnitude equation is

$$\text{Lin-Log Magnitude} = 17 \log_2 (\text{LINM}) = 56.4728 \log_{10} (\text{LINM}).$$

For this form, the Lin_Scale_Factor used to calculate LINM is picked to drive the average image power to the range 300 < Avg_Power < 4000, where 2000 is currently specified for lin-log magnitude imagery.

Phase

is the four quadrant arctan(Q/I) over the range of 0 to 2π radians. Phase may be represented by a real (32-bit floating-point) value type, or by an n-bit unsigned integer. If the data type is integer we restrict phase to unsigned because there is only one pixel value type (PVTYPE) field in the NITF image subheader. Hence, in the magnitude/phase mode, the PVTYPE must be set to 'INT' versus 'SI' since magnitude is always unsigned. For floating point ('R'), phase can be signed. Note that when the 'C' mode is specified, the complex data type is I, Q interleaved with a 32-bit floating point value per component. Otherwise, PVTYPE will be set to 'INT' or 'R', and the complex format is specified by CMETAA fields. Note that CMETAA overrides the size of the 'INT' field from a fixed 16 bits. In the integer mode, one way phase may be scaled is by using an n-bit uniform scalar quantizer which divides the 2π radians of phase into 2^n quanta, each $\frac{2\pi}{2^n}$ radians. This quantizer is denoted 'UQ1' in the CMPLX_PHASE_QUANT_FLAG in CMETAA. For example, an 8-bit USQ represents phase by 256 quanta, each $\frac{\pi}{128}$ radians. Another way (UQ2) phase may be scaled is centering the steps $\frac{2\pi}{2^n}$ over the 2^n quanta. Thus, for the 8-bit example, in UQ1, a step value of 0 corresponds to phase in the range from 0 to $\frac{\pi}{128}$ radians, while in UQ2, a step value of 0 corresponds to phase in the range from $-0.5*\frac{\pi}{128}$ radians to $0.5*\frac{\pi}{128}$ radians.

dB: The decibel relationship between amplitude and intensity is:

$$20 \log_{10} (\text{Amplitude}) = 10 \log_{10} (\text{Intensity}).$$

Definitions for Complex Imagery Weighting

Spatially Variant Apodization (SVA)

SVA is a sidelobe reduction technique that applies a windowed (e.g., 3 x 3 or 5 x 5) convolution test to the complex image. Sidelobe reduction techniques based on the convolution test results are applied to each region tested and vary spatially.

Taylor Weights

Applied to I, Q data. Data is later converted to M, P in some systems.

The discrete Taylor window is specified by three parameters N, $\bar{n}$, and SLL where:

- N is the number of coefficients in the Taylor window;
- $\bar{n}$ is the number of nearly constant-level sidelobes adjacent to the mainlobe;
- SLL is the peak sidelobe level (in dB) relative to the mainlobe peak.

Typical choices for values are SLL=-30 dB with $\bar{n}$=4 and SLL = -35 dB with $\bar{n}$=5, with N dictated by the number of range or azimuth signal history samples being processed. The weights are computed as follows:

$$W(n) = 1 + 2\sum_{m=1}^{\bar{n}-1} F_m \cos\left[\frac{2\pi m(n - N/2 + 0.5)}{N}\right] \qquad \text{for } n = 0, 1, ..., N-1.$$

F_m are cosine weights determined by

$$F_m = \frac{(-1)^{(m+1)} \prod_{i=1}^{\bar{n}-1}\left[1 - \frac{m^2/\sigma^2}{A^2 + (i-0.5)^2}\right]}{2\prod_{\substack{j=1 \\ j \neq m}}^{\bar{n}-1}\left(1 - m^2/j^2\right)}$$

where

$$A = \frac{\ln\left(B + \sqrt{(B^2 - 1)}\right)}{\pi}, \quad B = 10^{-\frac{SLL}{20}}, \quad \text{and} \quad \sigma^2 = \frac{\bar{n}^2}{A^2 + (\bar{n} - 0.5)^2}$$

The computational procedure requires $\bar{n} \geq 2A^2 + 0.5$

Hanning, Hamming, Unweighted Weights

$$W(n) = 1 - 2w\cos\left(\frac{2\pi n}{N}\right) \qquad \text{for } n = 0, 1, ..., N-1.$$

Where Unweighted: w = 0

Hanning: w = 0.5

Hamming: w = 0.42

Note: The terms “Range and Azimuth” refer to the two dimensions of the image or image block and may be interchanged with “Range and Doppler”, “Range and Cross-Range”, “Track and Cross-Track” and “Scan and Cross-Scan” as appropriate.

17.9 ANNEX B: DOCUMENTS REFERENCED BY THIS SPECIFICATION

MIL-STD-2500B, National Imagery Transmission Format Version 2.1

International Standard ISO/IEC 12087-5, Basic Image Interchange Format (BIIF)

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Note: The following geometry coordinate systems are located under different names:

XYZSC look under Coordinate System, Rectangular

ECEF look under Coordinate System, Earth Fixed

17.10 ANNEX C: CMETAA FIELDS NAMES PRESENTED ALPHABETICALLY

Index Number	Field Name	Field Description
8100	AF_TYPE1	First Autofocus Iteration
8200	AF_TYPE2	Second Autofocus Iteration
8300	AF_TYPE3	Third Autofocus Iteration
18300	CA_CALPA	Radiometeric Calibration Parameter
12800	CG_AMPT_X	Aimpoint of Antenna, x (Illum. Ref Pt.)
12900	CG_AMPT_Y	Aimpoint of Antenna, y (Illum. Ref Pt.)
13000	CG_AMPT_Z	Aimpoint of Antenna, z (Illum. Ref Pt.)
13100	CG_AP_CONF_XY	Aimpoint 95% Confidence
13200	CG_AP_CONF_Z	Aimpoint 95% Confidence
13300	CG_APCEN_X	Sensor Reference Point (x)
13400	CG_APCEN_Y	Sensor Reference Point (y)
13500	CG_APCEN_Z	Sensor Reference Point (z)
13600	CG_APER_CONF_XY	Sensor Reference Point 95% Confidence
13700	CG_APER_CONF_Z	Sensor Reference Point Center 95%Confidence
10800	CG_CAAC	Cone Angle at Sensor Reference Point (e.g. apertureR Reference point)
10900	CG_CONE_CONFIDENCE	Cone Angle 95% Confidence
10600	CG_CROSS	Cross Track Range at Sensor Reference Center (e.g. ApertureCenter)
10700	CG_CROSS_CONFIDENCE	Cross Track Range at Sensor Reference Center 95% Confidence Interval (e.g. Aperture Reference Point)
12100	CG_EAST	East Relative to the Top Image Edge
13800	CG_FPNUV_X	Focus Plane Normal Unit Vector, x
13900	CG_FPNUV_Y	Focus Plane Normal Unit Vector, y
14000	CG_FPNUV_Z	Focus Plane Normal Unit Vector, z
11300	CG_GAAC	Grazing Angle at Sensor Reference Point Center (e.g. apertureCenter)
11400	CG_GAAC_CONFIDENCE	Grazing Angle at Sensor Reference Point Center 95% Confidence
11000	CG_GPSAC	Ground Plane Squint Angle
11100	CG_GPSAC	Squint Angle 95% Confidence
15900	CG_GTP_X	Geoid Tangent Plane Normal, x
16000	CG_GTP_Y	Geoid Tangent Plane Normal, y
16100	CG_GTP_Z	Geoid Tangent Plane Normal, z
14100	CG_IDPNUVX	Image Display Plane Normal Unit Vector, x
14200	CG_IDPNUVY	Image Display Plane Normal Unit Vector, y
14300	CG_IDPNUVZ	Image Display Plane Normal Unit Vector, z
11500	CG_INCIDENT	Incidence angle
12400	CG_LAYOVER	Layover Angle
11800	CG_LD	Look Direction
12300	CG_LOS_CONFIDENCE	Range LOS 95% Confidence
16200	CG_MAP_TYPE	Mapping Coordinate
17900	CG_MGRCORLL	MGRS Image Lower Left Corner
17500	CG_MGRS_CENT	MGRS Image Center
18000	CG_M RS_CONFIDENCE	MGRS 95% Confidence
18100	CG_MGRS_PAD	MGRS Blank Padding
17800	CG_MGRSCORLR	MGRS Image Lower Right Corner
17600	CG_MGRSCORUL	MGRS Image Upper Left Corner
17700	CG_MGRSCORUR	MGRS Image Upper Right Corner
12700	CG_MODEL	Nominal Geometry Reference
11900	CG_NORTH	North Relative to the Top Image Edge
12000	CG_NORTH_CONFIDENCE	North Angle 95% Confidence
12600	CG_OPM	Out of Plane Motion
17300	CG_PATCH_LAT_CONFIDENCE	Latitude 95% Confidence
16300	CG_PATCH_LATCEN	Latitude of the Patch Center
17000	CG_PATCH_LGCORLR	Longitude of the Patch Corner, lower Right
16600	CG_PATCH_LGCORUL	Longitude of the Patch Corner, upper left

16800	CG_PATCH_LGCORUR	Longitude of the Patch Corner, upper Right
16400	CG_PATCH_LNGCEN	Longitude of the Patch Center
17200	CG_PATCH_LNGCOLL	Longitude of the Patch Corner, lower left
17400	CG_PATCH_LONG_CONFIDENCE	Longitude 95% Confidence
17100	CG_PATCH_LTCORLL	Latitude of the Patch Corner, lower left
16900	CG_PATCH_LTCORLR	Latitude of the Patch Corner, lower Right
16500	CG_PATCH_LTCORUL	Latitude of the Patch Corner, upper left
16700	CG_PATCH_LTCORUR	Latitude of the Patch Corner, upper Right
12200	CG_RLOS	Range LOS Rel the Top Image Edge
14700	CG_SC_CONF_XY	Scene Center 95% Confidence
14800	CG_SC_CONF_Z	Scene Center 95% Confidence
14400	CG_SCECN_X	Scene Center (Image Output Reference Point), x in ground plane
14500	CG_SCECN_Y	Scene Center (Image Output Reference Point), y in ground plane
14600	CG_SCECN_Z	Scene Center (Image Output Reference Point), z
12500	CG_SHADOW	Shadow Angle
10500	CG_SLANT_CONFIDENCE	Slant Range 95% Confidence Interval
11600	CG_SLOPE	Slope angle
15300	CG_SNACC_X	Sensor Nominal Acceleration x"
15400	CG_SNACC_Y	Sensor Nominal Acceleration y"
15500	CG_SNACC_Z	Sensor Nominal Acceleration z"
15700	CG_SNATT_PITCH	Sensor Nominal Attitude Pitch
15600	CG_SNATT_ROLL	Sensor Nominal Attitude Roll
15800	CG_SNATT_YAW	Sensor Nominal Attitude Yaw
15000	CG_SNVEL_X	Sensor Nominal Velocity, x
15100	CG_SNVEL_Y	Sensor Nominal Velocity, y’
15200	CG_SNVEL_Z	Sensor Nominal Velocity, z’
18200	CG_SPARE_A	Spare alpha field Blank fill
11200	CG_SQUINT	Slant Plane Squint Angle
10400	CG_SRAC	Slant Range at Sensor Reference Center
14900	CG_SWWD	Swath Width
11700	CG_TILT	Tilt angle
1100	CMPLX_AVG_POWER	Average Power
2100	CMPLX_AZ_SLL	Azimuth (AZ) Sidelobe Level
2300	CMPLX_AZ_TAY_NBAR	Azimuth Taylor nbar
800	CMPLX_DOMAIN	Complex Domain
1600	CMPLX_IC_1	Data Compression of First Pixel Component
1800	CMPLX_IC_2	Data Compression, second pixel Component
1900	CMPLX_IC_BPP	Complex Imagery Compressed Bits per Pixel
1000	CMPLX_LIN_SCALE	Complex Linear Scale Factor
1200	CMPLX_LINLOG_TP	Complex LinLog Transition Point
900	CMPLX_MAG_REMAP_TYPE	Type of Magnitude Mapping applied to M pixel Component values
1400	CMPLX_PHASE_QUANT_BIT_DEPTH	Phase Quantization Bit Depth
1300	CMPLX_PHASE_QUANT_FLAG	Phase Quantization Flag
2200	CMPLX_RNG_SLL	Range (RNG) Sidelobe Level
2400	CMPLX_RNG_TAY_NBAR	Range Taylor nbar
2600	CMPLX_SIGNAL_PLANE	Plane of the Complex image
1500	CMPLX_SIZE_1	Size of First Pixel Component in Bits
1700	CMPLX_SIZE_2	Size of Second Pixel Component in Bits
2000	CMPLX_WEIGHT	Type of Weighting applied to data
2500	CMPLX_WEIGHT_NORM	Complex Weight Normalization function for Taylor weighting
7200	IF_AFFTS	FFT Sign Convention in Azimuth (e.g. along track)
6400	IF_AZFFT_SAMP	Original Azimuth (e.g. along track) FFT Non-zero Input Samples
6600	IF_AZFFT_TOT	Total Azimuth (e.g. along track) FFT Length
5800	IF_AZRES	Azimuth Resolution (e.g. along track)
6200	IF_AZSR	Azimuth Sample Rate (samples/Commanded IPR)
6000	IF_AZSS	Azimuth Sample Spacing, (e.g. along track)
5600	IF_BEAM_COMP	Antenna Beam Pattern Compensation

3800	IF_DC_IS_COL	Sample Location of DC
3700	IF_DC_IS_ROW	Sample Location of DC
2800	IF_DC_SF_COL	Sample Location of DC
2700	IF_DC_SF_ROW	Sample Location of DC
5400	IF_GEODIST	Other Deterministic Geometric Distortion Corrections
4000	IF_IMG_COL_DC	Column Location of Patch (IM)
3900	IF_IMG_ROW_DC	Row Location of Patch (IM)
7400	IF_INCPH	Increasing phase
5100	IF_KEYSTN	Range Curvature and Keystone Distortion Correction
5200	IF_LINSFT	Residual Linear Shift Correction
3000	IF_PATCH_1_COL	Sample Location of the signal Corner in the Column dimension, upper left
2900	IF_PATCH_1_ROW	Sample Location of the signal Corner in the Row dimension, upper left left
3200	IF_PATCH_2_COL	Sample Location of the signal Corner in the Column dimension, upperR Right
3100	IF_PATCH_2_ROW	Sample Location of the signal Corner in the Row dimension, upperR Right
3400	IF_PATCH_3_COL	Sample Location of the signal Corner in the Column dimension, bottomR Right
3300	IF_PATCH_3_ROW	Sample Location of the signal Corner in the Row dimension, bottomR Right
3600	IF_PATCH_4_COL	Sample Location of the signal Corner in the Column dimension, bottom left
3500	IF_PATCH_4_ROW	Sample Location of the signal Corner in the Row dimension, bottom left
400	IF_PROCESS	VPH Processing Method
7300	IF_RANGE_DATA	Range Data Range (e.g. Cross-scan, Cross-track)I
4900	IF_RD	Range Deskew
6300	IF_RFFT_SAMP	Original Range (e.g. Cross scan, Cross-track)
6500	IF_RFFT_TOT	Total Range (e.g. Cross scan, Cross-track)
7100	IF_RFFTS	FFT Sign Convention in Range (e.g. Cross scan, Cross-track)
5500	IF_RGFO	Range Fall-off Correction (Sensitivity Time Control)
5700	IF_RGRES	Range Direction Resolution (e.g. Cross track, Cross scan)
5000	IF_RGWLK	Range Walk Correction
6100	IF_RSR	Range Sample Rate (samples/Commanded IPR)
5900	IF_RSS	Range Sample Spacing (e.g. Cross track, Cross scan)
8000	IF_SR_AMOUNT1	Amount or Factor of Super Resolution Applied to the Image, 1st Iteration
7600	IF_SR_AMOUNT2	Amount or Factor of Super Resolution Applied to the Image, 2nd Iteration
7800	IF_SR_AMOUNT3	Amount or Factor of Super Resolution Applied to the Image, 3rd Iteration
7500	IF_SR_NAME1	Super Resolution Algorithm Name, First Iteration
7700	IF_SR_NAME2	Super Resolution Algorithm Name, Second Iteration
7900	IF_SR_NAME3	Super Resolution Algorithm Name, Third Iteration
7000	IF_SUB_AZ	Subpatch Counts, Azimuth, (e.g. along track)
6900	IF_SUB_RG	Subpatch Counts, Range, (e.g. Cross scan, Cross-track)
6800	IF_SUBP_COL	Sub-patch Size, Column (Azimuth Direction)
6700	IF_SUBP_ROW	Sub-patch Size, Row (Range Direction)
5300	IF_SUBPATCH	Sub-patch Phase Correction
4200	IF_TILE_1_COL	Sample Location of valid tile data in the Column direction, upper left.
4100	IF_TILE_1_ROW	Sample Location of valid tile data in the Row direction, upper left.
4400	IF_TILE_2_COL	Sample Location of valid tile data in the Column direction, upperR Right.
4300	IF_TILE_2_ROW	Sample Location of valid tile data in the Row direction, upperR Right.
4600	IF_TILE_3_COL	Sample Location of valid tile data in the Column direction, lowerR Right.

4500	IF_TILE_3_ROW	Sample Location of valid tile data in the Row direction, lowerR Right.
4800	IF_TILE_4_COL	Sample Location of valid tile data in the Column direction, lower left..
4700	IF_TILE_4_ROW	Sample Location of valid tile data in the Row direction, lower left.
100	NUMBER_TRES	Related TREs Subtag mechanism
8700	POL	Polarimetric Data Set
9800	POL_AFCOMP	Radar Autofocus Phase Balancing
9000	POL_BAL	RCS Gray Level Balancing
9100	POL_BAL_MAG	Pixel Amplitude Balance Coefficient
9200	POL_BAL_PHS	Pixel Phase Balance Coefficient
9300	POL_HCOMP	Radar Hardware Phase Balancing
9400	POL_HCOMP_BASIS	Basis Set
9500	POL_HCOMP_COEF_1	Radar Hardware Phase Balancing
9600	POL_HCOMP_COEF_2	Radar Hardware Phase Balancing
9700	POL_HCOMP_COEF_3	Radar Hardware Phase Balancing
8900	POL_ISO_1	Minimum Polarization Isolation between this image / signalChannel and the other Channels
8500	POL_RE	Receive Polarization
8600	POL_REFERENCE	Polarization Frame of Reference
8800	POL_REG	Pixel Registered
9900	POL_SPARE_A	Spare alpha field
10000	POL_SPARE_N	Spare numeric field
8400	POL_TR	Transmit Polarization
500	RD_CEN_FREQ	Nominal Center Frequency Band
600	RD_MODE	Collection Mode
700	RD_PATCH_NO	Data Patch Number Field
300	RD_PRC_NO	Processor Version Number
200	RELATED_TRES	Name of Additional TRE
10300	T_HHMMSSLOCAL	Civil Time of Collection
10200	T_HHMMSSUTC	UTCHHMMSS The UTC hours, minutes and seconds
10100	T_UTC_YYYYMMMDD	YYYYMMMDD The 4 digit year, letter month and Universal Time Coordinated (UTC) date
18900	WF_BW	Chirp Bandwidth
19200	WF_CDP	Coherent Data Period
18800	WF_CENFRQ	Center frequency
18600	WF_CHRPRT	Chirp Rate
18500	WF_ENDFR	Chirp End Frequency
19300	WF_NUMBER_OF_PULSES	Number of Pulses
19000	WF_PRF	Pulse Repetition Frequency (PRF)
19100	WF_PRI	Pulse Repetition Interval
18400	WF_SRTFR	Chirp Start Frequency
18700	WF_WIDTH	Pulsewidth Length