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NGA STANDARDIZATION DOCUMENT

Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

(2013-08-28)

Version 2.0.0

NATIONAL CENTER FOR GEOSPATIAL INTELLIGENCE STANDARDS

CONTACTS

The following points of contact are provided for assistance in understanding the contents of this guidance document.

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TBD/TBR Listing

Page Number	TBD/TBR	Description
34	TBD001	Currently there is no registered value within NITFS to indicate a “joint classification system” to be shown in the example.
41	TBD002	No example of how to indicate a classification extension within a NITFS file was available at time of publication.
42	TBD003	No example of how to indicate a classification by compilation within a NITFS file was available at time of publication.

Change Log

Date	Pages Affected	Mechanism
01 August 2007	All	Version 1.0, Initial Publication
01 May 2013	All	Version 2.0, Final Draft
28 August 2013	All	Version 2.0, Published Version

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery transmission Format (NITF) suite of standards in support of interoperability among systems within the National System For Geospatial Intelligence (NSG) Enterprise, systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

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EXECUTIVE SUMMARY

The Implementation Practices of the National Imagery Transmission Format Standard (NITFS) (IPON) is a compilation of common practices, conventions, and guidelines for implementing the NITFS. The IPON's objective is to help promote common specification and application of the NITFS suite of standards by all fielded and developmental digital imagery-related systems.

The IPON contains common conventions for implementing the suite of National Imagery Transmission Format (NITF) standards that promote and sustain NITFS compliance and interoperability for the production, storage, cataloging, discovery, selection, exploitation, and dissemination of digital imagery, raster map, and other related raster products.

The National Geospatial-Intelligence Agency has oversight of the standardization and testing process whereby digital imagery systems achieve and sustain NITFS compliance and interoperability. The practices described in the IPON address implementation conventions for NITF 1.1, NITF 2.0, NITF 2.1, and the related NITFS standards and specifications for imagery compression, graphic annotation, and data extensions.

These practices alone do not establish implementation requirements. NITFS implementation requirement details are located in appropriate requirement documents, system specifications, interface specifications, statements of work, etc. Those involved with developing requirements, preparing specifications and acquisition documents, and implementing the NITFS may draw from the information in the IPON to promote consistent application of the NITFS throughout the digital imagery enterprise.

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1 INTRODUCTION

1.1 Purpose

To help promote common specification and application of the National Imagery Transmission Format (NITF) suite of standards by all fielded and developmental digital imagery-related systems. The Implementation Practices of the National Imagery Transmission Format Standard (NITFS) (IPON) document describes common conventions for implementing the suite of NITFS standards that promote and sustain NITFS compliance and interoperability for the production, storage, cataloging, discovery, selection, exploitation, and dissemination of digital imagery, raster map, and other related raster products.

1.2 Scope

This document contains general technical information for the use and implementation of the NITFS within the digital imagery enterprise. It provides implementation practices and conventions based on NITFS Compliance Test and Evaluation (CTE) Facility experiences with:

- Production Sources
    - Digital Point Positioning Database (DPPDB)
    - Controlled Image Base (CIB)
    - National Technical Means (NTM)
    - Dissemination Element (DE)
    - Front-End Processing Environment (FPE)
    - Enhanced Production System (EPS)
    - Low Cost Media (LCM) Production System
    - Joint Surveillance Target Attack Radar System (Joint STARS) Common Ground Station (CGS)
    - Common Imagery Processor (CIP)
- Archive and Dissemination Related Applications:
    - NGA Libraries (NL)
    - Image Product Library (IPL)
    - Image Access Service (IAS)
    - NIMA Common Client (CC)
    - BroadSword
    - Digital Products Data Warehouse (DPDW)
- Exploitation Related Applications:
    - Integrated Exploitation Capability
    - Multi-Source Intelligence Toolkit (MINT)
    - Precision Targeting Workstation (PTW)
    - Joint Tactical Workstation (JTW)
    - RULER mensuration engine
    - Commercial-Off-The-Shelf (COTS) Electronic Light Tables (ELTs)
    - Government-Off-The-Shelf (GOTS) ELTs
- Management Applications:
    - Imagery Exploitation Support System (IESS)
    - National Exploitation System (NES)
    - Enhanced Integration Tool (EIT)
    - Planning Tool for Resourse Integration, Syncronization, and Management (PRISM)
- Distributed Common Ground/Surface System (DCGS) Instances
    - Tactical Exploitation System (TES) (Army)
    - Joint Service Imagery Processing System - National (JSIPS-Nat) (Marines)
    - Tactical Exploitation Group (TEG) (Marines)
    - Joint Service Imagery Processing System - Navy (JSIPS-N) (Navy)
    - Deployable Shelterized System (DSS) (Air Force)
    - Deployable Transit-cased System (DTS)

    - Korean Combat Operations Intelligence Center (KCOIC)
- Commercial imagery providers
    - GeoEye
    - DigitalGlobe

Since the IPON is intended as a living document; the above list is representative only and not all-inclusive. It is included to give readers an appreciation for the scope and breadth of imagery systems, applications and products that the Facility has had contact with.

1.3 Background

1.3.1 NITF Version 1.1

The development of the NITF was initiated in 1985 under the auspices of the Imagery Acquisition Management Plan (IAMP) Working Group of the Office of the Assistant Secretary of Defense, Command, Control, Communications, and Intelligence (OASD/C^3I). Version 1.0 of the NITF was published, but not released, in 1988. This version served as the prototype for demonstrating the format could be implemented. In 1988 and 1989, the NITF was successfully implemented and tested on six different systems using operational communications media with cryptographic and forward error correction devices. The specification for NITF Version 1.1 was approved and released by OASD/C3I on 1 March 1989 as the NITF baseline version.

1.3.2 NITF Version 2.0

NITF version 2.0 was published along with a suite of military standards designated as the National Imagery Transmission Format Standard (NITFS) in June 1993. The major additions to NITF Version 1.1 included the Tactical Communications Protocol 2 (TACO2) to enable transmission over tactical circuits; improved image compression using the Joint Photographic Experts Group (JPEG) compression algorithm; support for large images and color images; and symbolic annotations using Computer Graphics Metafile (CGM). The Central Imagery Office (CIO) had since been organized and became the NITFS Program Manager.

1.3.3 NITF Version 2.1

A number of factors have driven the changes made to NITF Version 2.0 during recent years. Among these are: 1) the creation of the National Geospatial-Intelligence Agency (NGA) (formerly NIMA); 2) the Department of Defense (DoD) mandate for the selection and implementation of commercial/international standards over government/military standards where possible; 3) user requirements for improved fusion of information, whether imagery, geospatial, or other data types; and 4) the ever increasing need to share data within and external to systems of the DoD/Intelligence Community. NITF Version 2.1 is based on extensive coordination among NITFS users, within the National Systems for Geospatial Intelligence (NSG) community, North Atlantic Treaty Organization (NATO), Allied Nations, national and international standards bodies, and with commercial vendors and groups dealing with related standards and technologies. Military Standard 2500C and Standardization Agreement (STANAG) 4545 serve as the technical baseline for establishing an International Profile of International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 12087-5, Basic Image Interchange Format (BIIF). A summary of changes made to the existing NITF 2.0 baseline in support of the NITF 2.1 is addressed in Appendix C of the N-0105/98.

NITF Version 2.1 compliance testing began 1 October 1998. NITF 2.1 testing will be done in parallel with NITF 2.0 testing until the need for testing of NITF 2.0 capability ceases. The capability to test NITF 2.0 will be maintained until contractual requirements for NITF 2.0 have been satisfied. The need to unpack and interpret NITF 2.0 files will continue indefinitely.

1.3.4 NSIF Version 1.0/Version 1.01

The NATO Secondary Imagery Format (NSIF) is essentially the NATO equivalent of the NITF 2.1 file format. Both formats are profiles of the ISO BIIF and structurally mirror each other.

1.4 References

1.4.1 Policy and Planning Documents

10USC442	United States Code, Title 10, Section 442, 3 January 2012.
50USC404e	United States Code, Title 50, Section 404e, 3 January 2012.
Executive Order 12333	United States Intelligence Activities, 4 December 1981.
Executive Order 12951	Release of Imagery Acquired By Space-Based National Intelligence Reconnaissance Systems, 22 February 1995.
Executive Order 12958,	Classified National Security Information, 28 March 2003 as amended.
CJCSI 3137.01D	The Functional Capabilities Board (FCB) Process, 26 May 2009.
CJCSI 3170.01H	Joint Capabilities Integration and Development System, 10 January 2012.
CJCSI 3312.01B	Joint Military Intelligence Requirements Certification, 10 June 2010.
CJCSI 3470.01	“Rapid Validation and Resourcing of Joint Urgent Operational Needs (JUONS) in the Year of Execution,” 15 July 2005.
CJCSI 3505.01A	“Target Coordinate Mensuration Certification and Program Accreditation,” 11 March 2009.
CJCSI 6212.01E	Interoperability and Supportability of Information Technology and National Security Systems, 15 December 2008.
CJCSI 6212.01F	Net Ready Key Performance Parameter (NR KPP), 21 March 2012.
DCID 1/7	The Intelligence Community Open Source Program, 26 September 2000.
DCID 6/6	Security Controls on the Dissemination of Intelligence Information, 11 July 2001
DISR	Department of Defense Information Technology Standards Registry (DISR), https://DISRonline.disa.mil
DOD CIO	DoD Net-Centric Services Strategy, Strategy for a Net-Centric, Service Oriented DoD Enterprise, 4 May 2007.
DOD CIO DTM 09-013	“Registration of Architecture Descriptions in the DoD Architecture Registry System (DARS),” Change 2, March 10, 2011.
DODD 4630.05	Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS); May 05, 2004.

DODD 5000.01	The Defense Acquisition System, November 20, 2007.
DODD 5100.35	Military Communications-Electronics Board (MCEB), 10 March 1998.
DODD 5105.60	Department of Defense Directive (DODD) 5105.60, National Geospatial-Intelligence Agency, 29 July 2009.
DODD 8000.01	Management of the Department of Defense Information Enterprise, 10 February 2010.
DODD 8330.aa	Department of Defense Directive (DODD) 8330.aa, Data Sharing in a Net-Centric Department of Defense, 23 April 2007.
DODI 3115.15	Geospatial Intelligence, 6 December 2011.
DODI 4630.8	Procedures for Interoperability and Supportability of Information Technology and National Security Systems (NSS); June 30, 2004.
DODI 5000.02	Operation of the Defense Acquisition System, 8 December 2008.
DODI 8100.04	DoD Unified Capabilities (UC), 09 December 2010.
DODI 8330.aa	Interoperability of Information Technology (IT), Including National Security Systems (NSS), 7 December 2012 (draft).
DODI 8410.02	NETOPS for the Global Information Grid, 19 December 2008.
DODI 8500.2	Information Assurance (IA) Implementation, 6 February 2003.
DODI 8510.01	DoD Information Assurance Certification and Accreditation Process (DIACAP), 28 November 2007.
DOD IEA 1.2	Defense Information Enterprise Architecture 1.2, May 2010.
DOD UCR	Unified Capabilities Requirements 2008, Change 2 (UCR 2008, Change 2), December 2010.
ICD	Initial Capabilities Document, Writer's Guide, Version 2.3, 23 April 2012.
ICD 113	Intelligence Community Directive (ICD) Functional Managers, 19 May 2009.
ICD 115	Capability Requirements Process, 21 December 2012.
ICD 501	Intelligence Community Directive (ICD) Discovery and Dissemination or Retrieval of Information within the Intelligence Community, 21 January 2009.
!CD 503	ICD Intelligence Community Information Technology Systems Security Risk Management, Certification and Accreditation, 15 September 2008
ICD 710	Classification Management and Control Markings System, 21 June 2013
ICD 801	Acquisition, Effective 15 August 2006, Amended 16 August 2009.

IC IT Enterprise Strategy	Intelligence Community Information Technology Enterprise Strategy 2012-2017.
JIEO Circular 9008	NITFS Certification Test and Evaluation Program Plan, 30 June 1993, with Errata Sheet dated 20 June 1997. (Superceded by NGA Document N-0105; referenced herein for historical purposes.)
Joint Publication 1-02	Department of Defense Dictionary of Military and Associated Terms, 8 November 2010 (As Amended Through 15 April 2012).
N-0105/98	National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan
NSGD FM 1100	Roles and Responsibilities of the Department of Defense (DoD) Geospatial Intelligence (GEOINT) Manager and Intelligence Community (IC) Functional Manager (FM) for GEOINT, 6 May 2011.
NSG Instruction FM 1103	Governance Structure for Geospatial Intelligence (GEOINT) Functional Management, 23 April 2010.
NSGD AS 8103.0	GEOINT Functional Manager Seal of Approval, 01 July 2013 (anticipated).
NSG Pub 1-0	Geospatial Intelligence (GEOINT) Basic Doctrine, September 2006.
NITF 1.1 Vol I	Department of Defense, National Imagery Transmission Format, Certification Plan Volume I, Policy, 02 January 1990. (Superceded by NGA Document N-0105; referenced herein for historical purposes.)
NITF 1.1 Vol II	Department of Defense, National Imagery Transmission Format, Certification Plan Volume II, Processes and Procedures 02 January 1990. (Superceded by NGA Document N-0105; referenced herein for historical purposes.)
OMBC A-16	Office of Management and Budget (OMB) Circular (OMBC) A-16, Coordination of Geographic Information and Related Spatial Data Activities, as amended, 19 August 2002
OMBC A-16 Supplemental	OMBC A-16 Supplemental Guidance, 10 November 2010

(Requests for copies of the above policy and planning documents may be addressed to the Joint Interoperability Test Command, NITFS Test and Evaluation Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.)

1.4.2 Military Standards (MIL-STDs) and Handbooks

MIL-HDBK-1300A	Military Handbook for the National Imagery Transmission Format Standard (NITFS), 12 October 1994.
MIL-STD 2500A	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 12 October 1994 with Notice 1, 07 February 1997; Notice 2, 26 September 1997; and Notice 3, 01 October 1998.
MIL-STD 2500C	National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 01 May 2006.

MIL-STD 188-161	Interoperability and Performance Standards for Digital Facsimile Equipment, 30 October 1991.
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 188-197A	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard, 12 October 1994.
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, Notice 2, 14 March 1997, Notice 3, 01 March 2001, and Notice 4, 01 March 2010..
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 2301	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 12 October 1994.
MIL-STD 2301A	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 05 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 2411	Raster Product Format, 6 October 1994, Change Notice 1 17 January 1995, Change Notice 2 16 August 2001
MIL-STD 2411-1	Registered Data Values for Raster Product Format, 30 August 1994, Change Notice 1 16 August 2001
MIL-STD 2411-2	Integration of Raster Product Files into the National Imagery Transmission Format, 26 August 1994
MIL-STD 6040	United States Message Text Format (USMTF) Note: The baseline for this standard is updated frequently, but this has no impact within the context of its current use within the NITFS. Currency of the USMTF has potential impact when MTF data within NITF files is passed to external processes.
MIL-PRF 89041A	Controlled Image Base (CIB), 28 March 2000
MIL-PRF 89038	Compressed ARC Digitized Raster Graphics (CADRG), 6 October 1994, Amendment 1 27 April 1999, Amendment 2 28 March 2000
MIL-PRF 89034	Digital Point Positioning Data Base (DPPDB), 23 March 1999, Amendment 1 27 June 2000

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

1.4.3 National Geospatial-Intelligence Agency (NGA)/National Imagery and Mapping Agency (NIMA) Specifications and Publications

AGIPDD	Advanced Geospatial Intelligence Product.Description Document, Version D, 17 April 2008 (Superceded by NSGPDD.)
N0101-G	Geospatial and Imagery Access Services Specification (GIAS), Version 3.5, 26 June 2000.
N0102-G	USIGS Interoperability Profile (UIP), 26 June 2000. SCN001, 06 August 2001.
N-0106-97	National Imagery Transmission Format Standard (NITFS) Bandwidth Compression Standards and Guidelines, 25 August 1997.
NGA.IP.0006_1.0	National Imagery Transmission Format Standard, Version 2.1, Implementation Profile for Tactical Hyperspectral Imagery (HSI) Systems, Version 1.0, 27 July 2011.
NGA.STND.0012-1_2.1	National System for Geospatial Intelligence Metadata Foundation (NMF) Part 1: Core, Version 2.1, 26 March 2012.
NGA.STND.0024-2_1.0	Sensor Independent Complex Data (SICD), Volume 2, File Format Description Document, Version 1.0, 01 August 2011.
NGA.STND.0025-2_1.0	Sensor Independent Derived Data (SIDD), Volume 2, NITF File Format Description Document, Version 1.0, 01 August 2011.
NGA.STND.00033_1.0	Geopolitical Entities, Names, and Codes (GENC) Standard, Version 1.0, 27 November 2012
NSGPDD	National System for Geospatial-Intelligence Product Description Document, Base Document, 17 May 2012
STDI-0001	National Support Data Extension (SDE) (Version 1.3) for the National Imagery Transmission Format Standard (NITFS), with Change Notice 3, dated 18 March 2010
STDI-0002-1_4.0	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 4.0, 01 August 2011
STDI-0002-2_4.0	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 4.0, 03 December 2012

(Requests for copies of the above NGA/NIMA Specifications and Publications may be made to the National Geospatial-Intelligence Agency, Attn.: NCGIS, MS-P-106, 12310 Sunrise Valley Drive, Reston, VA 20191-3449.)

1.4.5 NATO Standardization Agreements

STANAG 4545	NATO Secondary Imagery Format (Version 2.0); 06 May 2013.
STANAG 4607	NATO Ground Moving Target Indicator Format (GMTIF), Edition 3, 14 September 2010.

STANAG 7074 — Digital Geographic Information Exchange Standard (DIGEST), Edition 2.0, June 1997.

(Requests for copies of the above STANAGs may be made to SAF/AQIJ, 1060 AF Pentagon (5D156), Washington, DC 20330-1060.)

1.4.6 International Standards

CCITT	Recommendation T.4, Standardization of Group 3 Facsimile Apparatus or Document Transmission, 1998
ISO/IEC Directives	Procedures for the technical work of ISO/IEC JTC1 on Information Technology, Third Edition 1995.
ISO/IEC TR10000-1	Information technology - Framework and Taxonomy of International Standardized Profiles - Part 1: General principles and documentation framework, third edition, 1995.
ISO/IEC TR10000-2	Information technology - Framework and taxonomy of International Standardized Profiles - Part 2: Principles and Taxonomy for OSI Profiles, third edition, 1995.
ISO/IEC 8632-1:1999	Information Technology - Computer graphics - Metafile for the storage and transfer of picture description information - Part 1: Functional Specification, second edition, 2010.
ISO/IEC 8632-3:1999	Information Technology - Computer graphics - Metafile for the storage and transfer of picture description information - Part 3: Binary Encoding.
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 9973:2006	Information Technology - Computer graphics, image processing and environmental data representation - Procedures for Registration of Items, 14November 2006.
ISO/IEC 10646-1:1993	Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multiple Plane, AMD 6, 15 Nov. 1996.
ISO/IEC 10918-1:1994	Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines, 15 December 1994.
ISO/IEC 10918-2:1995	Information technology - Digital compression and coding of continuous-tone still images: Compliance testing, 15 August 1995.
ISO/IEC 10918-3:DIS	Information Technology; Digital Compression and Coding of Continuous-Tone Still Images; Part 1: Extensions, 01 May 1997.
ISO/IEC 10918-4:DIS	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, 26 Dec. 96.

ISO/IEC 15444-1:2000	Information technology - JPEG 2000 image coding system - Part 1: Core Coding System
ISO/IEC 15444-1-AMD1	Information technology - JPEG 2000 image coding system - Part 1: Core Coding System, Amendment 1
ISO/IEC 15444-1-AMD2	Information technology - JPEG 2000 image coding system - Part 1: Core Coding System, Amendment 2
ISO/IEC 15444-4:2002	Information technology - JPEG 2000 image coding system - Part 4: Image Coding System: Conformance testing
ISO/IEC 11072:1993	Information technology - Computer graphics - Computer Graphics Reference Model, 01 Oct. 92.
ISO/IEC 12087-1:1995	Information technology - Computer graphics and image processing - Image processing and Interchange - Functional specification Part 1: Common architecture for imaging, 15 April 1995.
ISO/IEC 12087-2:1994	Information technology - Computer graphics and image processing - Image processing and Interchange - Functional specification Part 2: Programmer's imaging kernel system application program interface.
ISO/IEC 12087-3:1995	Information technology - Computer graphics and image processing - Image processing and Interchange - Functional specification Part 3: Image Interchange Facility (IIF), AMD 1, 15 December 1997.
ISO/IEC 12087-5: 1998	Information technology; Computer graphics and image processing; Image Processing and Interchange; Functional Specification - Part 5: Basic Image Interchange Format.
BPCGM01.00	Information Technology - Computer Graphics and Image Processing - Registered Graphical Item, Class: BIIF Profile - Computer Graphics Metafile Version 01.00 (BPCGM01.00)
BPJ2K01.00	Information technology - Computer graphics and image processing - registered graphical item - Class: BIIF Profile - BIIF Profile for JPEG 2000 Version 01.00 (BPJ2K01.00) (Superceded by BPJ2K01.10)
BPJ2K01.10	Information technology - Computer graphics and image processing - registered graphical item - Class: BIIF Profile - BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10)
NSIF01.01	Information Technology - Computer Graphics and Image Processing - Registered Graphical Item, Class: BIIF Profile - NATO Secondary Imagery Format Version 01.01 (NSIF01.01)
ITU T.4 (1993:03)	Terminal Equipment and Protocols for Telematic Services - Standardization of Group 3 Facsimile Apparatus for Document Transmission, AMD2 08/95.

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

1.4.7 Other Documents

Controlled Access Program Coordination Office (CAPCO), Intelligence Community Classification and Control Markings Implementation Manual and Register.

IC Chief Information Officer, Intelligence Community Inter-Domain Transfer Policy, 9 November 1999, Draft. (U/FOUO)

Bandwidth Compression (BWC) Guide for JPEG 2000 Visually Lossless and Numerically Lossless Compression of Imagery Data Working Draft 1.0

S2035A	NITF Implementation Requirements Document (NITFIRD)
MISP v6.3	Motion Imagery Standards Profile (MISP), Version 6.3, October 2011.
MISB Standard 0102.9	Motion Imagery Standards Board (MISB), Security Metadata Universal and Local Sets for Digital Motion Imagery, 1 September 2010.
MISB Standard 0604.2	Time Stamping and Transport of Compressed Motion Imagery and Metadata, 9 June 2011.
MISB Standard 0902.1	MISB Motion Imagery Sensor Minimum Metadata Set, 9 June 2010.

1.5 Applicability

The NITFS is the designated standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community as defined by Executive Order 12333, the DoD and other Departments or Agencies of the United States Government as governed by Memoranda of Agreement (MOAs) with those Agencies, and the Intelligence Community/DoD. Adherence to U.S. Federal and DoD standards is required before a particular system can be employed in joint or combined operations. The DoD Directive 4630.05 states that for purposes of compatibility, interoperability, and integration all Command, Control, Communications, and Intelligence (C^3I) systems developed for use by U.S. forces are considered to be for joint use.

1.6 Authority

The Office of the Director of National Intelligence (ODNI) is the Intelligence Community authority for mandatory NITFS compliance. The NGA is the DoD authority requiring compliance with the NITFS. The NGA/National Center for Geospatial Intelligence Standards (NCGIS) is the Test Program Authority and provides management oversight for the NITFS Test and Evaluation Program. The Joint Interoperability Test Command (JITC), an element of the Defense Information Systems Agency (DISA), is the Executive Agent to NGA/NCGIS for execution of the NITFS Test and Evaluation Program. Figure 1-1 depicts these organizational relationships.

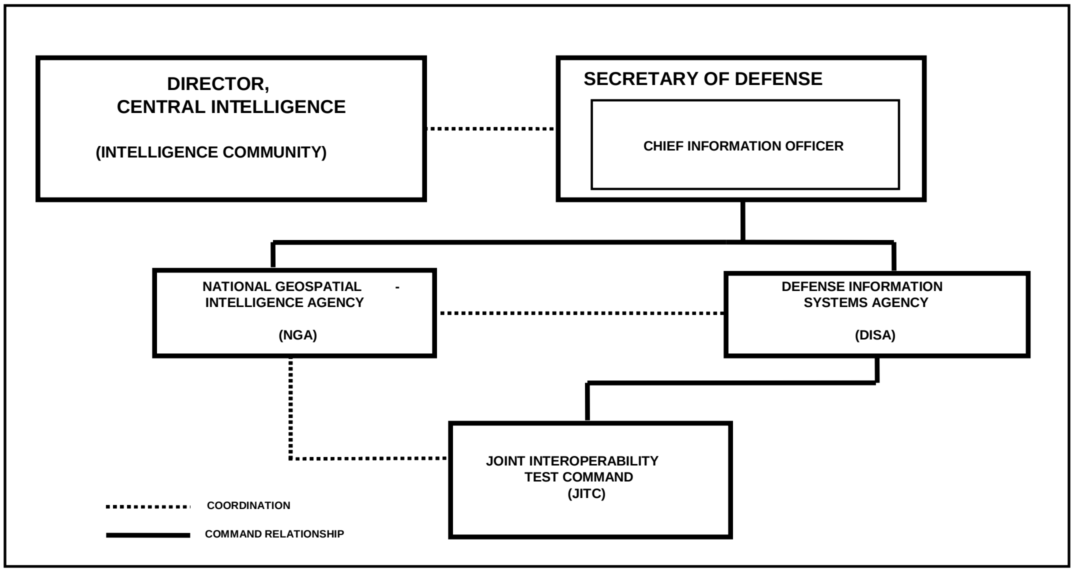

Figure 1-1. NITFS Test Organizational Relationships

1.7 Definitions

For the purpose of this specification, the following terms are defined as stated:

1.7.1 Certification (Interoperability)

Confirmation that a National Security System (NSS) and Information Technology System has undergone appropriate testing; that the applicable standards and requirements for compatibility, interoperability, and integration have been met; and a system is ready for joint and/or combined use. See CJCSI 6212.01F. (Note: For the NITF 2.0 test program, the term 'System Certification' was used to designate those systems (hardware and software) which implemented both NITF 2.0 and TACO2 and successfully completed NITFS compliance testing.)

1.7.2 Compliance Registration (Standards Compliance)

A statement attesting to the fact that an implementation, product, or component has been tested as meeting NITFS applicable compliance criteria. The degree of compliance is recorded in a registry.

1.7.3 NITFS Test and Evaluation Facility

The personnel, equipment, data, and facilities for conducting NITFS compliance testing and maintaining the NITFS test program for NGA along with the policies, procedures, planning, etc.

1.7.4 Common Coordinate System (CCS)

The virtual row and column indexed coordinate grid against which all NITF file components are ultimately referenced. The location of NITF components with an attachment level of zero is referenced to the origin of the CCS. The extent of the CCS is defined by the complexity level designation.

1.7.5 Compatibility, Interoperability, and Integration

A policy set by DoD and the Joint Staff defining the requirements certification process and identifying assessment criteria. See JCSI 6212.01C, DoD Directive 4630.5, DoD Instruction 4630.8, and the DoD 5000 series documents.

1.7.6 Conditional

In the context of NITF, a data field whose existence depends on the value addressed in a previous field.

1.7.7 Configuration Item

A specific component of hardware and/or software that has an impact on NITFS compliance.

1.7.8 Configuration Management

A discipline applying technical and administrative direction and monitoring to:

- Identify and document the functional and physical characteristics of a configuration item.
- Control changes to those characteristics.
- Record and report change processing and implementation status.

1.7.9 Developmental System

A system that has not been approved for use and/or production.

1.7.10 Digital Imagery System

The equipment and procedures used in the collection, storage, display, manipulation, analysis, annotation, exchange, and/or transmission of imagery and imagery products.

1.7.11 Dissemination System

A system with functional requirements to distribute digital imagery via electronic communications channels. Imagery processing is primarily focused on preparing the data for the eccentricities (e.g., constrained bandwidth, noise environment, etc.) of the communications channels across which it will be disseminated. For example, a representative system is the DE.

1.7.12 Exploitation System

Systems with functional requirements to analyze, exploit, and extract information from digital imagery to produce an exploited imagery product. Representative systems include Integrated Exploitation Capability, NIMA Softcopy Exploitation Systems as defined by the NIMA Imagery Information Exploitation Environment (NIIEE), Common Exploitation Workstation (CEW), etc.

1.7.13 Fielded System

A system providing a service to a specific community with approval for use and/or production.

1.7.14 Implementation Under Test

A candidate implementation of any portion of the NITFS suite of standards for which compliance testing is being performed. An implementation does not necessarily comprise a full imagery system.

1.7.15 Library System

A system with functional requirements to catalogue, store, and retrieve digital imagery. Representative systems include IPL, NL, etc.

1.7.16 Mandatory

Obligatory or compulsory, not optional.

1.7.17 NITFS Compliance

The ability of an implementation to create and output NITFS compliant files and/or to accept NITFS files and recognize the component parts as prescribed in the NITFS Test and Evaluation Program Plan.

1.7.18 NITFS Component Compliance

A statement to the fact that an item (as opposed to a full implementation) has been tested for compliance to a specific subset of the NITFS compliance criteria.

1.7.19 Native Mode

The intrinsic attributes and operational mode of an imagery system. When an imagery system's architecture, design, and/or internal representation for images, graphics, labels, text, and/or other data is not in accordance with the NITFS, its native mode is considered to be other than NITFS.

1.7.20 NITF

The National Imagery Transmission Format. The term NITF is often used to describe a file that is formatted according to the NITFS. The term usually inherits the context of the latest version of NITF when the version is not specifically identified.

1.7.21 NITFS

The National Imagery Transmission Format Standard, comprised of the suite of standards applicable to the format and exchange of digital imagery. The term is used when addressing the overall national imagery standardization effort.

1.7.22 NITF Version 1.1

The initial version of NITF implemented for which a formal testing program was established. Requirements for compliance with NITF Version 1.1 are fully described in the NITF Version 1.1, Volume I, NITF Certification Plan Policy and Volume II, Certification Plan Processes and Procedures.

1.7.23 NITF Version 2.0

The second version of NITF implemented for which a formal testing program was established. Requirements for compliance with NITF Version 2.0 were, originally, fully described in Joint Interoperability and Engineering Organization (JIEO) Circular 9008, NITFS Certification Test and Evaluation Program Plan. JIEO 9008 has been superseded by N-0105, which contains applicable program information for NITF version 2.0.

1.7.24 NITF Version 2.1

The third version of NITF establishing the formal compliance test program and is documented in N-0105.

1.7.25 Optional

In the NITF context, a data field that must be present, but may not contain applicable data.

1.7.26 Pack

To create or construct an NITF file within the set of conditions and constraints defined for compliance with the NITFS.

1.7.27 Primary Imagery System

The equipment and procedures used in the electronic collection, storage, and exchange of original quality, non-exploited imagery and imagery products.

1.7.28 Production System

A system with functional requirements to generate digital imagery from sensor sources. Representative systems include CIP, Digital Production System (DPS), Point Positioning Production System (PPPS), etc.

1.7.29 Required

In the NITF context, a data field that must be present and contain valid data.

1.7.30 Secondary Imagery Dissemination System (SIDS)

The equipment and procedures supporting the process of post-collection electronic dissemination of C^3I data, over a time interval ranging from near-real-time to a period of days, at a quality level determined by receiver requirements.

1.7.31 System Under Test

A candidate imagery system for which NITFS compliance testing is being performed.

1.7.32 Tactical System

A system with requirements to operate when deployed into the battlefield; often characterized by the need to obtain data communications from military tactical communication channels vice fixed plant communications typical of commercial civilian organizations.

1.7.33 Unpack

To interpret and make appropriate use of the imagery, data, and associated information contained in an NITF compliant file. In most instances, this includes the capability to accurately display and/or print the contents of an NITF file.

1.7.34 National System for Geospatial Intelligence (NSG)

The National System for Geospatial Intelligence (NSG) is the combination of technology, policies, capabilities, doctrine, activities, people, data, and organizations necessary to produce geospatial intelligence in an integrated multi-intelligence, multi-security domain environment.

1.7.35 USIGS Interoperability Profile

The United States Imagery and Geospatial System (USIGS) Interoperability Profile (UIP) defines the profile for software interface standards to be used to achieve interoperability between multiple clients and servers within the USIGS architecture.

1.8 Test Program Concept

The NITFS Test and Evaluation Program is composed of the NITFS Test and Evaluation Facility, policies, procedures, and administrative and planning actions required to achieve and sustain an imagery implementation's compliance with the NITFS and interoperability within the NSG through testing. The test program supports both the DoD and the Intelligence Community objectives for ensuring an interoperable format for the exchange of digital imagery products among heterogeneous systems.

1.8.1 National Geospatial-Intelligence Agency (NGA)

The NGA/NCGIS oversees the process whereby imagery systems achieve and sustain NITFS compliance and interoperability through the NITFS Test and Evaluation Program. Initial compliance testing of an imagery system is achieved at the designated test facility, the JITC, or at alternate locations as approved by the JITC. Compliance to standards and interoperability within NSG is sustained through retesting, as necessitated by changes to the NITFS, changes to (or problems with) tested NITFS configuration items, or when directed by NGA/NCGIS, as long as the imagery system is operational.

1.8.2 Joint Interoperability Test Command (JITC)

The JITC serves as the NGA/NCGIS executive agent for execution of NITFS test related activities. The JITC has established an NITFS testing facility that supports compliance testing of NITFS capable implementations, validation testing of proposed additions to NITFS, and other NITFS related test activities.

1.9 NITFS Implementation and Use Policies

The following policies apply to the implementation and use of the NITFS:

1.9.1 General

Those systems, subsystems, and components within the USIGS which exchange digital imagery shall achieve compliance with the NITFS as specified by the NSG Architecture and the DISR.

1.9.1.1 NITF Version 1.1. NITF 1.1 implementation began in 1989. NITF 2.0 implementation began in 1993. To support interoperability during the transition from NITF 1.1, all NITF 2.0 compliant systems were required to allow for the proper interpretation and use of NITF 1.1 formatted files and the creation of NITF 1.1 compliant files. Generation of NITF 1.1 is now prohibited. NITF 1.1 only systems should no longer be used in the field. However, due to the existence of legacy NITF 1.1 files, NITF 2.0 and NITF 2.1 systems may elect to continue to interpret NITF 1.1 files if the implementations operational concept reflects a need to interpret NITF 1.1 files.

1.9.1.2 NITF Version 2.0. Fielded imagery systems should be at least NITF 2.0 compliant with plans to upgrade/replace with NITF 2.1 capabilities.

1.9.1.3 NITF Version 2.1. NITF 2.1 compliant systems typically have a mode of operation that allows for proper interpretation and use of NITF 2.0 formatted files and that limits the creation of an NITF file content to the constraints of NITF 2.0. Developmental systems are encouraged to be tested for and achieve NITF 2.1 compliance prior to fielding. NITF 2.1 capable systems may optionally continue to interpret NITF 1.1 files if called for by the systems concept of operations.

1.9.1.4 Distributed Applications. Some developers may choose to implement systems that distribute NITFS functions across several processing platforms that are networked together. In such cases, the systems will be evaluated as a whole in determining which NITFS attributes and associated compliance criteria apply to each component of the system. In any case, provision shall be made for the system to fully satisfy the Complexity Level (CLEVEL) criteria for its applicable operational requirements before the system will be registered as NITFS compliant.

1.9.1.5 NITFS Components. Developers may choose to submit components and/or products that implement only a portion of the NITFS compliance requirements for testing and registration. The component shall be tested for compliance to the applicable standards. Component registration does not mean that any implementation that uses the registered component is deemed fully compliant with NITFS. Use of the registered component may, however, expedite test and evaluation of the implementation for compliance registration.

1.9.1.6 TACO2. The use of TACO2 continues today in some user communities. Although no longer required to obtain NITFS compliance registration, if TACO2 is implemented, NITFS compliance testing is required.

1.10 Points of Contact

1.10.1 NITFS Technical Board (NTB)

National Geospatial-Intelligence Agency
ATTN: NCGIS (Mail Stop P-106)
12310 Sunrise Valley Drive
Reston, VA 20191-3449
Phone: (703) 262-4400
Fax: (703) 262-4401
URL: http://www.gwg.nga.mil/ntb/

1.10.2 NITFS Test Information, Test Scheduling, Implementation Consulting

Joint Interoperability Test Command
NITFS Compliance Test and Evaluation Facility
ATTN: JTF
Building 57305
P.O. Box 12798
Fort Huachuca, AZ 85670-2798
Phone: (520) 538-5458 or 5494
Fax: (520) 538-5257
STE: (520) 538-5458
E-mail: disa.jitc.nitf@mail.mil

URL: http://jitc.fhu.disa.mil/nitf/nitf.html

1.10.3 Imagery Standardization and GWG Information

National Geospatial-Intelligence Agency
ATTN: NCGIS (Mail Stop P-106)
12310 Sunrise Valley Drive
Reston, VA 20191-3449
Phone: (703) 262-4400
Fax: (703) 262-4401
URL: http://www.gwg.nga.mil/ntb/

2 GENERAL NITFS IMPLEMENTATION COMPLIANCE

2.1 General

2.1.1 NITFS Compliance Criteria

The NITFS compliance criteria are derived from the suite of NITFS documents and are documented in NGA document N-0105. The JITC NITF Compliance Test Plan Criteria documents testing and measurements. These reference documents are at http://www.gwg.nga.mil/ntb/baseline/documents.html.

2.1.2 Pack/Unpack

The term pack means to create or construct an NITF file within the set of conditions and constraints defined for compliance with the NITFS. The term unpack means to interpret and properly display imagery data (images and symbols) and accurately process associated information contained in an NITF file. N-0105, paragraph 5.1.2, further addresses the Pack/Unpack definition.

2.1.3 NITFS Compliance Principles

The NITFS compliance principles provide guidance for implementing compliance programs. The principles describe the common denominators of successful compliance programs; i.e., principles of legal risk reduction which compliance programs must follow to be effective. N-0105, paragraph 5.1.3, addresses NITFS compliance principles.

2.1.4 Native Mode Rule

The term Native Mode Rule refers to the imagery system or application running processes natively must also demonstrate the same processes in NITF; i.e., graphic annotations or text generation. N-0105, paragraph 5.1.4, provides additional Native Mode Rule information.

2.2 NITFS Complexity Levels (CLEVELs)

NITF implementations are categorized and tested according to their ability to pack and/or unpack files with various complexities. The CLEVEL concept allows NITFS to be implemented on a wide range of hardware platforms with various levels of internal resources while maintaining a baseline level of interoperability between all compliance tested systems. For NITF 2.1, five CLEVELs have been defined, CL03, CL05, CL06, CL07, and CL09. A summary of the attributes for each CLEVEL is in N-0105, Table 5-1. Applications/systems generating NITFS files shall mark them at the lowest CLEVEL for which they qualify.

2.3 NITFS Compliance Features

Specific features, attributes, and compliance test requirements are described in NGA document N-0105, paragraph 5.3 and Table 5-1. The following are NITF 2.1 features identified for compliance testing:

- Common Coordinate System (CCS) Extent (origin) To max (row, column)
- Maximum File Size
- Image Size (Image(s) placed within CCS extent)
- Image Blocking (Rectangular blocks allowed)
- Monochrome (MONO) No Compression
- Color (RGB and RGB/LUT) No Compression
- Multiband (MULTI) No Compression
- JPEG DCT Compression (MONO, RGB, YCbCr601)
- Downsampled JPEG DCT Monochrome (MONO)
- JPEG Lossless Compression (MONO, RGB)
- JPEG 2000 Compression (MONO, RGB/LUT, RGB, YCbCr601, MULTI)
- Bi-LEVEL Compression (MONO, RGB/LUT)
- VQ (MONO, RGB/LUT)
- Multiband (MULTI) Compression
- NODISPLY (Elevation Data, Location Grid, Matrix Data)
- Vectors in Polar Coordinates (POLAR)
- Number of Image Segments, CGM Graphic Segments, Text Segments, Data Extension Segments (DESs) Per File
- Aggregate Size of Graphic Segments Per File
- CGM Graphic Profile
- Text Format Codes Supported
- Text Data Per Segment
- Tagged Record Extensions (TREs)

2.4 NITFS Compliance Basic Functional Requirements

2.4.1 NITF Pack

An implementation must pack NITF compliant files that at least support packing attributes corresponding with those available in its native mode of operation. Not all NITF pack attributes available at any particular CLEVEL must be implemented. Required pack features are at the discretion of the implementation sponsor. Systems with image capture or input devices must support the CLEVELs and the boundary conditions of the image size(s) that can be captured. NITF implemented features must be compliant and within the CLEVEL constraints. NGA document N-0105, paragraph 5.4.1, provides additional information on NITFS compliance test functional pack requirements.

2.4.2 NITF Unpack

An implementation must unpack, interpret, and display any NITF compliant file at the CLEVEL for which compliance is being tested. The capability for unpack must be equal to or greater than the CLEVEL pack capability. It must also unpack any NITF file with a lesser CLEVEL. An unpack implementation must be robust enough to support all NITF file features (even if it can not pack the feature) that may be invoked by any pack implementation of equal or lesser CLEVEL.

For those implementations attempting to unpack NITF files with a higher CLEVEL, a processing/display risk may exist. The implementation must at least alert the system operator of that risk and provide the option to abort the unpack process. The process decision should not adversely disrupt the system operation (such as requiring the system to re-boot or re-initialize). NGA document N-0105, paragraph 5.4.2, provides additional information on NITFS compliance test functional unpack requirements.

2.4.3 Nested CLEVELs

NITFS CLEVELs are based on an application's capabilities and robustness. The higher the CLEVEL the more robust the implementation's processing capabilities must be. An example is number of bands supported. For CLEVEL 03 products, the application must demonstrate its capability to process files containing up to 9 bands. For CLEVEL 05 and 06 compliance, a processor must support up to 256 bands and a CLEVEL 07 and 09 processor must support up to 999 bands. Nesting CLEVELs indicate a CLEVEL 05 processor must also process CLEVEL 03 capabilities. Therefore, all NITF implementations must demonstrate the capability to process NITF features associated with each CLEVEL lower than it is being tested/registered for.

2.4.4 Common Coordinate System (CCS)

The CCS defines the boundary rectangle of the combined displayable elements (image and graphic segments) contained within an NITF file for each respective CLEVEL. NGA document N-0105, paragraph 5.4.4, addresses test requirements for the CCS.

2.4.5 JPEG 2000 Compression

NITFS JPEG 2000 compression process is governed by ISO/IEC 15444-1 and ISO/IEC BIIF PROFILE BPJ2K01.10. All unpack capable implementations must support JPEG 2000 Profile 1 decoding. The decoders are required to fully decode any ISO 15444-1, Profile-1 file produced within the constraints of the CLEVEL implemented by the NITF/NSIF decoder and section 7 of the BPJ2K01.10.

All pack capable implementations with requirements to support JPEG 2000 must correctly encode image arrays into a compliant JPEG 2000 Profile 1 codestreams according to the JPEG 2000 codestream syntax, marker segment definitions, filtering processes, and coding algorithms in the BPJ2K01.10 Profile for either section 7, Appendices D, E or F based on their specific requirements.

2.4.6 JPEG Discrete Cosine Transform (DCT) Compression

NITF JPEG DCT was introduced during the NITF version 2.0 to 2.1 transition. It provided compression encoding generally used for full color and grayscale continuous-tone pictorial images; does not work well with bitonal or palette-color images. Compression is variable and governed by a number of parameters; typical settings provide from 10:1 to 20:1 reductions in file size. The ISO/IEC 10918 standard covers both lossy and lossless compression. This document concerns lossy compression, which employs discrete cosine transforms (DCT) and other processes. All unpack capable implementations must support JPEG decompression and all pack capable implementations with requirements to support JPEG compression must implement JPEG DCT using the specifications and guidance contained within MIL-STD 188-198A and do so within the bounds of the criteria established for unpacking. Additional test requirements are addressed in NGA document N-0105, paragraph 5.4.6. The implementation must replace the corrupted restart interval with a suitable pattern so that when displaying the decoded image, the compressed data stream error is clearly apparent to the viewer. (A 2 by 2, 2-color checker board pattern per JPEG neighborhood is recommended for this replacement pattern.)

2.4.7 Downsampled JPEG

Downsample JPEG was an interim capability between JPEG DCT and JPEG 2000 compression. The NITF community discovered that downsampling imagery before JPEG DCT compression would provide better final product resolution than just JPEG DCT compression. Now that JPEG 2000 is operational, Downsample JPEG is considered obsolete. N-0105, paragraph 5.4.7, provides unpack and pack compliance requirements.

2.4.8 Lossless JPEG

Lossless JPEG typically gives about 2:1 compression; i.e., about 12-bits per color pixel. The lossless mode does not use DCT, since round off errors prevent a DCT calculation from being lossless. Lossless encodes the difference between each pixel and the predicted value for the pixel. The predicted value is a function of the already-transmitted pixels just above and to the left of the current one (i.e., their average; eight different predictor functions are permitted). Now that JPEG 2000 is available and in use, Lossless JPEG is considered obsolete. N-0105, paragraph 5.4.8, provides unpack and pack compliance requirements.

2.4.9 Bi-Level Compression

Bi-Level (Group III Facsimile) Compression) was based on the facsimile machine industry. Its use within NITFS has been phased out. The need for Bi-Level compressed data can be easily satisfied using JPEG 2000 compression technology. Bi-Level compression interpretation is allowed within the bounds of the established criteria, but is no longer a requirement. N-0105, paragraph 5.4.9, provides additional test information regarding Bi-Level. MIL-STD 188-196 was inactivated in 2003, but contains requirements for Bi-Level compression if it is necessary.

2.4.10 Vector Quantization (VQ) Compression

VQ is a predictable lossy compression. The VQ compression algorithm examines each v x h pixel kernel in the input image and uses a clustering technique to develop a limited codebook that contains the most representative kernels. Presently, all unpack capable implementations must support Vector Quantization (VQ) decompression and must comply with the specifications and guidance contained within MIL-STD 188-199 and the criteria established for unpacking addressed in N-0105. Pack capable implementations with requirements to support VQ compression must only pack VQ compressed image segments within the bounds of the criteria established for unpacking.

2.4.11 ARIDPCM Compression

The ARIDPCM compression was used in NITF 1.1 formatted files. ARIDPCM was phased out along with support for NITF 1.1. Unpack capable implementations with an operational need to read legacy NITF 1.1 files may continue to support decompression of ARIDPCM compressed image segments. However, ARIDPCM compression is not allowed in NITF 2.1 files.

2.4.12 CGM Graphics

CGM is the preferred graphic implementation used for symbol and annotation representation for NITF products. Implementations must support unpacking NITF 2.0 and 2.1 products containing CGM graphic segments. Those implementations that support annotation generation using graphics in their native mode must also support CGM graphic generation for NITF. The applicable profile for CGM in NITF 2.1 is that described by MIL-STD 2301A. The applicable profile for CGM in NITF 2.0 is that described by MIL-STD 2301. Both MIL-STDs will eventually be replaced with ISO/IEC BPCGM01.00, *BIIF Profile for Computer Graphic Metafile version 01.00*.

Common issues identified during CGM compliance testing are:

Interpret (unpack)

- Auxiliary color support. Applications that do not support the CGM auxiliary color are unable to display those CGM edge, hatch, or line elements (dashed, dashed dot, etc.) that have included auxiliary color.
- Edge Visibility Flag. Edge visibility acts as an override on visible edges turning all edges off. If edge visibility is ON an application must honor the edge_out flag parameter value.
- Polygon Set support. Many exploit applications are unable to demonstrate its ability to interpret and display polygon sets. At the time this document was originally published, Polygon Set CGMs are not widely generated.
- Honoring Edge_Out_Flag. Many applications do not support the OFF flag for graphic edges. Edges are always presented in the ON condition.
- Large Line and Edge widths. Some applications find it difficult to display wide lines and edges especially those that are dashed or dotted. The element features appear to run into each other.
- Large CGM segment processing: The processing speed among exploitation applications vary greatly. Some applications process CGM by separating each graphic element into its own graphic to display. With multi element segments, with possibly thousands of elements, significant processing time is required. This processing method can slow the interpretation and display down considerably. The individual element breakout method can also present repack issues. In some cases, the number of graphical elements may exceed the maximum number allowed by NITFS.

Generate (pack)

- Begin Metafile elements out of order. The Begin Metafile group (Metafile version, Metafile Element List and Metafile Description) are required to be executed in sequential order. There are some exploit applications that will not interpret the CGM product if they are out of order. The appropriate order for the Begin Metafile elements are:
  - METAFILE VERSION
  - METAFILE ELEMENT LIST
  - METAFILE DESCRIPTION
  - [FONT LIST] – If a font element is present.
- Line and Edge generation. When producing lines and edges an implementation must follow the mathematically-defined center of the line concept. Line and edges widths are initiated at a center point and alternates the fill from one side to the other.
- Metafile Description. CGM support applications are required to identify and process CGM graphics containing the following substring:
  - NITF/CGM-APP-2.0 (for CGM placed in NITF 2.0 and/or 2.1 files)
  - NITF/CGM;ProfileEd:2301-2/Source:producer;Date:YYYYMMDD (for NITF 2.1 files containing extended elements or type parameters.

The following are example elements requiring the CGM Profile Metafile descriptor:

- Filled-Area primitives (hatch)
- Edge Visibility command (off)
- Edge Type parameters (dotted, dash-dot, and dash-dot-dot)
- Line Type primitives (dotted, dash-dot, and dash-dot-dot)
- Polygon Set elements
- Auxiliary Color element
- Transparency element

2.4.13 Bit-Mapped Symbols

A Bit-mapped symbol is a map of bits that form a particular picture when rendered to a display. Bit-mapped symbology has been phased out and replaced with CGM graphics. The use of bit-mapped symbols is limited to legacy NITF 1.1 and 2.0 formatted files. All unpack capable implementations must support the unpacking and display of NITF version 1.1 and 2.0 files that contain bit-mapped symbols (graphic segments). NITF 2.1 pack capable implementations supporting graphics must generate only CGM-formatted graphics unless they are re-packing (into NITF 2.0) legacy NITF 2.0 files with existing bit-mapped symbols.

2.4.14 Monochrome

A monochrome product is a single wavelength one band image consisting of shades, also known as grayscale or black-and-white. Archival and exploitation implementations must support unpacking and processing monochrome image segments with the following Number of Bits Per Pixel (NBPP) pixel depths: 1, 8, 12, 16, 32, and 64 bits per pixel with Actual Bits Per Pixel (ABPP) pixel depths of 1, 8, 12, 11-16, 32, and 64 bits per pixel. Implementations with the requirement to generate and/or pack monochrome image data must do so within the bounds of the criteria established for unpacking.

2.4.15 Color

Color imagery products consist of three wavelength bands providing an RGB color space. Usually, true color (RGB) is defined to mean at least 256 shades of red, green, and blue, for a total of at least 16,777,216 color variations. Multiband (MULTI) products may have a larger bit depth then RGB color products and provide a greater color variation number. Archival and exploitation implementations must support unpacking and processing color image segments. (The display device does not necessarily need to be a color display.) single band (NBPP = 1 or 8) with look-up-table (LUT), three band (NBPP = 8 for each band, total of 24-bits), and multiband (NBPP > 8 for each band) must be supported. All pack capable implementations with the requirement to generate and/or pack color image data must do so within the bounds of the criteria established for unpacking.

2.4.16 Multiband

Multiband Imagery products are images optically acquired in more than one spectral or wavelength interval. Each individual image is usually of the same physical area and scale but of a different spectral band. Archival and exploitation implementations must support unpacking and processing multiband image segments containing up to nine bands for CLEVEL 03 implementations, 256 bands for CLEVEL 05 and 06, and 999 bands for CLEVEL 07 implementations. Implementations, with requirements to generate and/or pack multiband image data, must do so within the bounds of the criteria established for unpacking.

2.4.17 No display Image Representation

2.4.17.1 Matrix Data

NITF supports imagery products not specifically intended for display. Those products contain an Image Representation (IREP) value NODISPLY. An example of a NODSPLY NITF product is matrix gridded data. Gridded data is two-dimensional data representing an atmospheric or oceanic parameter along an evenly spaced matrix. Unpack capable implementations may optionally support image segments with matrix data. When supported, the implementation must pass the data field content to the appropriate NODISPLY data application according to the Image Category (ICAT) value for further processing. Implementations without a requirement to support NODISPLY data must not be adversely affected when image segments containing such data are encountered. At the very least, the implementation must alert the operator about segments requiring this additional processing prior to display. Pack capable implementations with requirements to support the NODISPLY data must do so within the bounds of the criteria established for unpacking.

2.4.17.2 Elevation Data

Digital Terrain Elevation Data (DTED) products are supported within the NITFS format. DTED is a uniform matrix of terrain elevation values, which provide basic quantitative data for systems and applications requiring terrain elevation, slope, and/or surface roughness information. Unpack capable implementations may optionally support exploitation of elevation matrix data contained within an image segment. Those systems that choose to implement this feature must do so in accordance with the criteria detailed in STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST, version 1.2A), Annex D. Applications supporting DTED data display must be able to indicate the elevation for all pixels within the image pixel array that have elevation data associated with them. The implementation must also present the associated accuracy information given in the GeoSDE. All pack capable implementations with the requirement to pack elevation matrix data must do so within the bounds of the criteria established for unpacking.

2.4.17.3 Location Grid Data

Unpack capable implementations may optionally support exploitation of location grid data contained within an image segment. Those systems that choose to implement this feature must do so in accordance with the criteria detailed in STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST 1.2A), Annex D. In general, if a file contains an image segment with pixel data, a corresponding image segment with location grid data and the appropriate GeoSDE, the implementation must be able to indicate the location coordinates for all pixels within the image pixel array that have location data associated with them. The implementation must also present the associated accuracy information given in the GeoSDE. All pack capable implementations with the requirement to pack location grid data must do so within the bounds of the criteria established for unpacking.

2.4.18 Masked Tables

All unpack capable implementations must properly interpret and use block and pixel mask tables. Unpack capable implementations must interpret and properly use the pad pixel value when defined in masked tables. A pad pixel value of zero must be treated as transparent. Pack capable implementations that insert block and/or pixel mask tables must populate them with accurate offset and related values.

2.4.19 Tagged Record Extensions (TREs)

Tagged Record Extensions (TREs) may appear in the following fields: UDHD, XHD, UDID, IXSHD, SXSHD, TXSHD, and the TRE_OVERFLOW Data Extension Segment (DES) regardless of CLEVEL. Only NTB approved TREs are allowed as shown in the TRE portion of the NITFS Tagged Extension Registry; see http://jitc.fhu.disa.mil/cgi/nitf/registers/trereg.aspx. As a minimum, unpack capable implementations must at least ignore TREs and properly unpack the segment in which the TRE exists. If the implementation supports the interpretation of TREs, it must also do so when the TREs happen to be located in a TRE_OVERFLOW DES.

2.4.20 Data Extension Segments (DESs)

Only NTB approved Date Extension Segments (DESs) are allowed as shown in the DES portion of the NITFS DES Register; seehttp://jitc.fhu.disa.mil/cgi/nitf/registers/desreg.aspx. All unpack capable implementations must be able to interpret NITF files containing the STREAMING_FILE_HEADER DES. If the implementation supports the interpretation of TREs, it must also support the TRE_OVERFLOW DES. As a minimum, unpack capable implementations must at least ignore other DESs and properly unpack other supported file segments.

2.4.21 Reserved Extension Segments (RESs)

Only NTB approved Reserved Extension Segments (RESs) are allowed within a NITF file. Currently, there are no approved RES for use within NITF.

2.4.22 TACO2

TACO2 communications is being phased out as a NITF test requirement. However, those tactical systems, and systems with requirements to interface with tactical systems, must provide a means for exchanging files. TACO2 testing can be provided upon request.

2.4.23 Communications Channels

Present compliance testing does not support file exchange across communication channels, however, if there is a need to process data across a specific protocol, the test facility will work with the requiring facility to demonstrate that requirement.

2.4.24 Physical Exchange Media

All systems must provide some means to exchange NITF files for compliance test purposes. Most systems have some type of media peripheral(s) to at least support system operation and maintenance that can be used for this purpose. Alternative arrangements to complete compliance testing must be coordinated with the JITC Test and Evaluation Facility personnel when this is not the case.

2.4.25 NITF 1.1 Files

All NITF 2.1 unpack capable implementations may elect to support the unpack and interpretation of NITF 1.1 files if their concept of operations (CONOPS) calls for such support. All NITF 2.1 implementations are prohibited from packing NITF 1.1 files in order to allow the eventual elimination of legacy 1.1 files through attrition.

2.4.26 NITF 2.0 Files

All NITF 2.1 unpack capable implementations must be able to unpack any NITF version 2.0 compliant file as defined in the N-0105. All pack capable implementations may optionally support the capability to pack NITF files within the constraints of NITF 2.0 as defined in N-0105. See N-0105, Appendix K, Constraints for NITF 2.0 compliance. Note: Even though JIEO Circular 9008 is the retired NITFS Certification Test and Evaluation Program Plan, it can still be used as a reference document for historical/additional NITF 2.0 implementation guidance.

2.5 NITF 2.0 Criteria

2.5.1 CLEVELS 1 through 6

The NITFS Test Program Plan, N-0105, defines the NITF 2.0 compliance criteria for digital imagery products. Table 5-4 in N-0105 provides a summary of NITF 2.0 compliance test criteria.

2.5.2 STREAMING FILE HEADER DES

There is no known producer of the Streaming File Header DES and as such, there is no requirement to generate or interpret it. The original concept was as follows for NITF 2.0 and 2.1 and is provided as information:

NITF 2.0 (CLEVEL 7) Notice 2 to MIL-STD 2500A added CLEVEL 07 to mark NITF 2.0 files that use STREAMING_FILE_HEADER DES. In some operational circumstances (e.g., those with critical time or storage constraints) all the information (incomplete length fields) needed to populate the header fields may not be available at the start of file creation and transfer. STREAMING_FILE_HEADER, DES shall be used to provide the data needed to complete the file header. Incomplete length fields shall be populated with the character "9" (0x39) as a placeholder. Systems receiving a file with an incomplete header shall locate the DES and interpret the data in the DES as though it is actually located at the beginning of the file. The system may restore the file header fragment from the DES to populate the header. Any modification of this file shall result in the file being stored with a fully compliant and complete header and the Streaming File header DES removed. The STREAMING_FILE_HEADER DES for NITF 2.1 files is non-CLEVEL dependent. Each of the four NITF 2.1 CLEVELs (03, 05, 06 and 07) may make use of the STREAMING_FILE_HEADER DES in NITF 2.1.

2.6 NITF 1.1 Compliance Criteria

2.6.1 Minimum Compliant NITF Field Values and Ranges

The following subset of NITF capabilities has been prescribed to ensure a common level of functionality with systems using NITF version 1.1. Related message parameters are described below.

a. Image/Sub-image Parameters. Imagery will be gray scale and may be from 8 x 8 to 512 x 512 pixels, 8 bits-per-pixel. Images may be either uncompressed or compressed using ARIDPCM. Since sub-images may be overlaid on a base image, there may be from 0 to 5 images per message. The size of the largest image in the message may be up to 512 columns by 512 rows. The aggregate size of all remaining images within a message must not exceed 50 percent of the base image.
b. Symbol Parameters. Symbols will be bit-mapped and may be 1 to 512 lines of 1 to 512 pixels per line, 1 bit-per-pixel, in white foreground on black background (N), black foreground on transparent background (K), or white foreground on transparent background (W). There may be 0 to 100 symbols per message. The maximum aggregate size of all symbols within a message must not exceed 262,144 bits.
c. Label Parameters. Labels will be in STA between 0 and 320 characters long. They may be white foreground (text) on transparent background, white on black, black on transparent or black on white. There may be 0 to 100 labels per message. The aggregate size of all labels within a message must not exceed 2,000 STA characters.
d. Text Parameters. Text files will be composed of STA characters. There may be 0 to 5 text files per message. The aggregate size of all text files within a message must not exceed 10,000 STA characters.
e. Display and Attachment levels. Although NITF 1.1 included display and attachment levels, there is one significant difference when compared to how NITF 2.0 and 2.1 implement them. NITF 1.1 allowed a display level of 0 (Zero). A zero display level is not allowed in NITF 2.0 and 2.1. Therefore, care must be taken when converting between these formats to adjust logically Display levels and their associated attachment levels.

2.6.2 Minimum Compliance Capabilities

2.6.2.1 Receive/Interpret (Unpack) Capabilities. An NITF compliant Receive (unpack) capable system must be able to receive and unpack any minimum compliant NITF file.

2.6.2.2 Transmit/Generate (Pack) Capabilities. An NITF compliant Transmit (Pack) system must be able to pack and transmit a minimum compliant NITF file that will include selected combinations of:

- 0 images per message (Note: in NITF 1.1 files were referred to as messages.)
- At least 1 image per message

- Compressing imagery with ARIDPCM using at least 1 rate (optional)
- 0 symbols per message
- At least 1 symbol per message, if there is no symbol waiver
- 0 labels per message
- At least 1 label per message, if there is no label waiver
- 0 text files per message
- At least 1 text file per message, if there is no text waiver

2.7 Date Handling Compliance Criteria

2.7.1 Although most date handling related issues resulting from the year 2000 transition have been resolved through the update of applications and operating systems, some specific date handling issues will remain for some time. The most significant issue remaining is converting between legacy formatted files (1.1 and 2.0) and NITF 2.1.

2.7.2 All presentation to users of dates will use four-digit year regardless of the internal or NITF file representation of the date. In some instances, where the century of the date is ambiguous, the first two characters of the year may be shown as hyphens. See the discussion about birth dates in paragraph 2.7.4.

2.7.3 All date sensitive manipulation or calculations will be done with due consideration for the appropriate century.

2.7.4 For NITF 2.0 and NITF 1.1 formatted files, the implementation must associate century according to the Window Date Rule established by NGA. It must be noted, however, that the application of the window date rule must be logically applied and not arbitrarily. The exception to that rule is the DOB field in the PIAE TREs, Dates of Birth cannot be interpreted using the Window Date Rule as it may result in improper interpretation; i.e., someone born in 1946 would be interpreted as being born in 2046.

2.8 Use of CLEVEL 99

CLEVEL 99 was introduced in NITF 2.0 to accommodate certain systems/programs that needed to produce compliant NITF files using features outside the constraints of the existing CLEVEL definitions. The use of this CLEVEL is discouraged and should not be used, as most NITFS systems will not be able to interpret the file. The predominant use of CLEVEL 99 is for NITF 2.0 files that exceed the 2GB file size constraint of CLEVEL 06.

2.9 Use of CLEVEL 09

CLEVEL 09 was added to MIL-STD 2500C to designate NITF 2.1 files that exceed the CLEVEL 07 constraints defined in its table A-10, but remain within the bounds of the standard. There are many features that could cause an NITF 2.1 file to be marked CLEVEL 09; however, only NTB coordinated implementations will be incorporated into the NITFS test program and be required for NITFS compliance registration. All programs preparing to develop CLEVEL 09 NITF files should coordinate their implementation with the NTB (ntbchair@nga.mil).

The following list of NITF features have been coordinated with the NTB and are known implementations of CLEVEL 09. Although other CLEVEL 09 possibilities exist, support for these features is required to obtain NITFS compliance registration. This list was current at the time of publication and will be updated with each release of the IPON. In between publications of the IPON, developers should contact the JITC NITF Compliance Test Facility (jitcn@disa.mil) for a current list.

NTB Coordinated CLEVEL 09 Features:

a. Files containing more than 100 Graphic Symbol Segments
b. Files containing more than 100 Image Segments
c. Files implementing the big block option
d. Files with a file length of 10GB or greater

3 COMMON NITFS IMPLEMENTATION PRACTICES & GUIDELINES

3.1 General

The NITFS is designed to provide standardization while allowing flexibility to meet varied missions within the NSG. To support interoperability, consideration must be given to identifying the functionality desired within and across user communities. Given the wide range of available metadata within the NITFS, interoperability can best be achieved by working to understand the purpose of metadata and how it applies across the enterprise and within user communities. NITFS and imagery (when combined with various metadata) can support different functional requirements such as precision targeting, Battle Damage Assessment, Battlefield Preparation activities, mensuration and many other intelligence related support functions.

This section is intended to assist imagery system Program Managers, developers and users by documenting the implementation choices and approaches commonly used across the NITFS community. Practices for specific user groups and specific to various sets of metadata (TREs) are addressed in other sections.

3.2 Originating Station Identification (OSTAID)

Each NITF file contains a place (field) where the Originating Station of the file can be identified. The OSTAID is a required alphanumeric field in the NITF file header that contains the identification code or name of the organization, system, or station. This field may not contain all Basic Character Set - Alphanumeric (BCS-A) spaces (0x20). Generally, the user can populate this field either at file creation time or through some default (header) setting depending on the CONOPS of the station.

The operational intent of the OSTAID is to provide a place to identify in human readable form what entity was the generation source of a given NITF file. The NITFS does not otherwise dictate how this field is used. It is left to the community of interest to determine its use given its general purpose.

When determining its use, consideration should be given to the conventions in use and the expected movement of the imagery throughout the affected architecture. For example, if the imagery is being moved in a very closed community of users, then each originating station or entity may be identified in the OSTAID. Decisions must be made if the field is auto populated or manually populated, some applications allow a default to be set or at least for the operator to edit this field. If the information is variable, then possibly a drop down menu approach may be used if provided for by the application. If the OSTAID is fixed based on the physical system, then perhaps a hard coded value may be used.

Most applications/systems apply a default OSTAID to ensure a compliant file is generated as spaces are not allowed in this field. This may be fine for some CONOPS but may be inadequate for others.

The recommended practice is to apply information that will have meaning to the recipient such that they can know the facility/station creating the NITF file. The usage of default values that merely specify what software product produced the file is discouraged.

Consideration should be given to circumstances when altering the OSTAID is appropriate, generally when a file has changes made to it that are significant enough that the changing station/operator takes on ownership of the resulting file. This can be an objective decision but generally, any significant alteration in the file should result in a change in the OSTAID.

The following are the practices as generally used.

Exploitation Applications: All will default to a set value, usually the Application Name, unless the operator edits the field. Some systems provide a mechanism to configure a local default.

Libraries: Both the NL and IPL will leave the OSTAID as originally populated upon ingest. When converting a non-NITF file to NITF, a default value is used prior to export.

3.3 Product Identification and File Naming

Within the NITF community there are formal and sometimes informal conventions practiced for file naming and product identification. It is important that, within communities of users, these conventions are known and dealt with accordingly as they often add increased usability to imaging operations. Appendix D provides additional information.

3.4 Date and Time Fields

There are numerous places to indicate Dates and Times within NITF files. Locations include the file header, image segment subheaders, graphic and text segment subheaders and within the metadata vehicles such as TREs.

3.4.1 The File Date and Time (FDT) field contains the Coordinated Universal Time (UTC) time (Zulu) of the origination of the file. The value in this field is updated each time the file is modified and saved.

3.4.2 The Image Date and Time (IDATIM) field contains the date and time of the image acquisition. Once populated, the content of this field is never changed. The importance of this field is often over-looked or misunderstood. Image analysts often compare images of a given area to determine changes over time. If the IDATIM is changed to anything other than the actual acquisition time, it is obvious what kind of problem that could create. Libraries use this field to catalogue an image for discovery and retrieval by users, so again, it is important that it maintain the actual acquisition date and time.

The definition of IDATIM in the NITFS does not define what is considered to be the acquisition time of an image for the various types of imagery that are collected. The system design should determine the most appropriate point in time to declare as acquisition time (e.g., first line of a scanned image, shutter time of frame image, etc.).

3.4.3 The Text Date and Time (TXTDT) field contains the time of the text origination. The field value is updated any time the text content is modified and saved.

3.4.4 There may be times when only a portion of a date and time field is known. Hyphens should be used for unknown components of the date and time field. There may be legacy systems that used unique methods for handling the generation of date and time information prior to establishing the practice of using hyphens.

3.5 Security Fields

3.5.1 General

The NITFS provides a mechanism for internally recording security markings and handling instructions for the overall file as well as individual data segments within the file. Generally, the same capability available for marking portions of a hard copy document can be applied when marking an NITF file. Each Image, Graphic, Textual, and Metadata segment within an NITF file can be independently marked and the overall

NITF file can be marked to represent the accumulative classification of the individual segments within the file.

The NITFS does not establish or control security policy or concept of operations for secure handling of imagery and related data. The standard simply provides an approved structural means (security fields) for including security markings in NITFS formatted data files. System sponsors, developers, and users should work together at the community and imagery system level to apply a combination of technical and procedural practices to address security content, understanding that the file format provides only the container for content. This section provides information and guidance to support this process. Sponsors and Developers can assist users and security managers by considering and making implementation choices that facilitate achieving proper security handling of NITF files. A brief description of how security marking is handled in the NITFS for US Classification Markings is as follows.

- NITF 2.1: The concept in NITF 2.1 for security handling is similar to that traditionally used for hard copy documents based on the Controlled Access Program Coordination Office (CAPCO) guidelines and Executive Order (EO) 12958 (revoked in 2010 in favor of EO 13526). The NITF 2.1 data fields for security directly correlate to the security elements of information defined in EO 12958.
- NITF 2.0: NITF 2.0 also has a robust marking capability but was defined before the publication of EO 12958. Legacy data production centers continue to produce and disseminate data with security marking conventions that pre-date EO 12958. Even so, the security data field values can be interpreted and used within the guidelines of current security policy established at individual facilities or operations centers based on CAPCO guidelines. Recommended practice for correlating NITF 2.0 security fields with the EO 12958-based NITF 2.1 security fields is provided in appendix G.
- NITF 1.1 (Legacy): A limited capability existed for NITF 1.1 security marking.

3.5.2 Current Policy

Community policy addressing security and control markings must be consulted for guidance on properly managing and distributing data. Policy documentation, along with program-specific security guidance, provides producers with the correct syntax and use of security markings.

For a U.S. File Security Classification System, the following documents will provide information assisting in the population of the security group fields.

- Executive Order 13526, Classified National Security Information, 29 December 2009.
- ICD 503, IC IT Systems Security Risk Management, Certification and Accreditation, 15 September 2008
- ICD 710, Classification Management and Control Markings System, 21 June 2013
- Controlled Access Program Coordination Office (CAPCO), Intelligence Community Classification and Control Markings Register and Manual, Version 5.1, 30 December 2011
- NGA.STND.0033_1.0, Geopolitical Entities, Names and Codes Standard at **https://nsgreg.nga.mil/genc/discovery**
- DoD IT Principals Memorandum Mandating the Use of Country Code Standards within the Department of Defense, 23 January 2013

3.5.2.1 Correlation with CAPCO Security Marking Banner

The NITF 2.1 security group fields can be correlated with the traditional security marking banner used in documents and for marking media containers. This view of the information content of the NITF 2.1 security group may facilitate understanding of how to populate the fields. The security marking banner is organized to visually portray eight categories of security marking information.

1. US Classification Markings

2. Non-US Classification Markings
3. Joint Classification Markings
4. SCI Control System Markings
5. Special Access Program Markings
6. Foreign Government Information Markings
7. Dissemination Control Markings
8. Non-Intelligence Community Markings

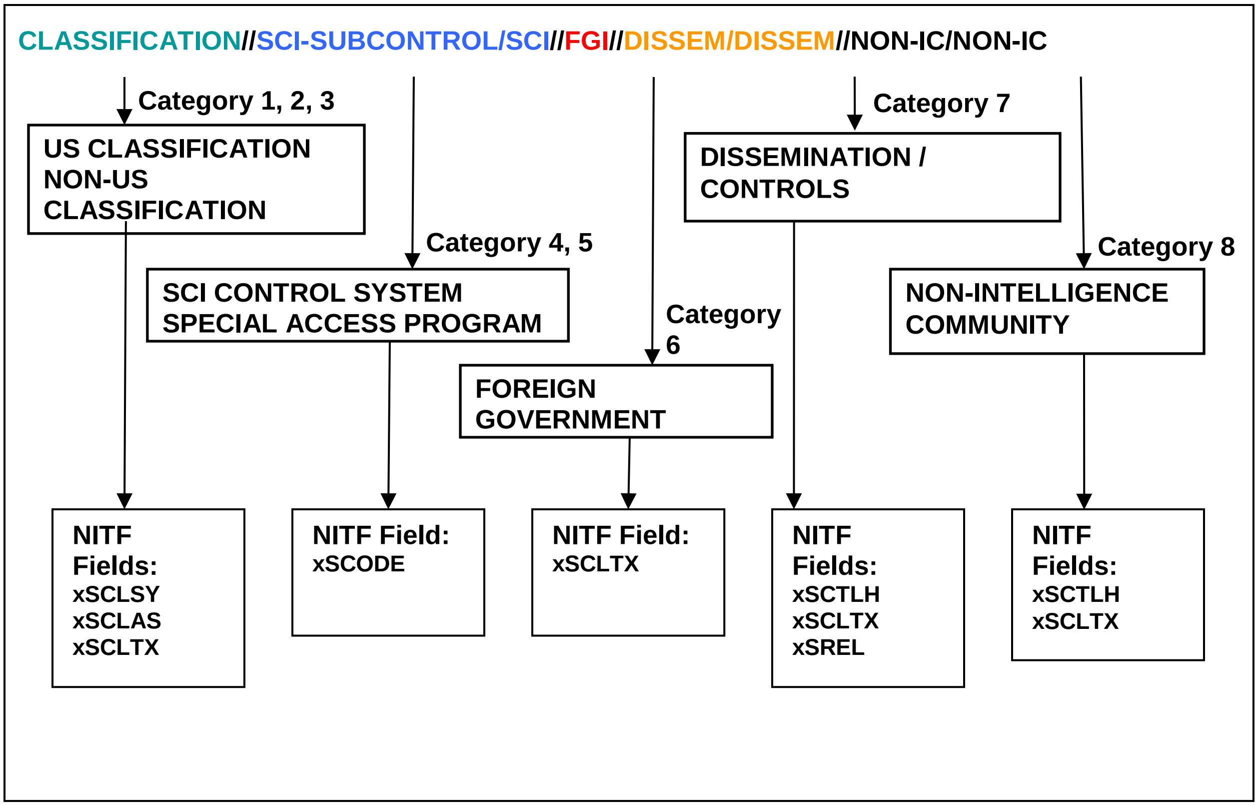

Figure 3-1 Generic Security Marking Banner Layout

Table 3-1 contains some guidance/best practices for exploitation applications when displaying security banners for NITF2.1 products. The examples are a guide only and may not necessarily applicable in all instances.

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products
1- US Classification Examples: UNCLASSIFIED CONFIDENTIAL SECRET TOP SECRET	xSCLSY Security Classification System xSCLAS Security Classification Examples: xSCLSY xSCLAS US U US C US S US T	The 2-character country code value ‘US’ in the xSCLSY field designates the United States government as the ‘Owner Producer’ having purview over the classification marking of the information resource.	Exploitation Apps should extract the two char country code US from xSCLSY and place in the banner. Exploitation Apps should extract Classification codes from xSCLAS and populate the banner with expanded description: UNCLASSIFIED CONFIDENTIAL SECRET TOP SECRET Example for Banners: <xSCLSY code><space><xSCLAS code> US UNCLASSIFIED US CONFIDENTIAL US SECRET US TOP SECRET

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products

2- Non-US Classification
 	
Examples:
 	
//DEU SECRET
//NATO UNCLASSIFIED
//NATO RESTRICTED
	xSCLSY
	Security Classification System
	xSCLAS
	Security Classification
	
	Examples:
	xSCLSY xSCLAS
	DE S
	XN U
	XN R
		The Non-US classification is indicated by either a 2-character country code or an NTB-designated multi-entity code (e.g. XN = NATO).
		The xSCLAS code value 'R' represents the non-US level of classification 'RESTRICTED'.
		
		Note: not all nations comply with the same country code standard when self-originating security classification markings. E.g. the United Kingdom prefers the use of code 'UK' instead of 'GB' or 'GBR', which are specified in ISO 3166-1.
			Exploitation Apps should extract the two char country code from xSCLSY and place in the banner.
			Exploitation Apps should extract Classification codes from xSCLAS and populate the banner with the single character code.
			
			S or U or R or whatever char is present.
			
			Example for Banners:
			//<xSCLSY code><space><xSCLAS code>
			Note; this is structured by concatenating <xSCLSY> and <xSCLAS> with a <space> between elements...
			//DE S
			//XN U
			//XN R

3- Joint Classification Example: //JOINT SECRET CAN GBR USA	xSCLSY Security Classification System xSCLAS Security Classification xSCLTX Classification Text Examples: xSCLSY xSCLAS ?? S xSCLTX ??_CAN,GBR,USA	TBD001. There currently is no code registered with the NTB to indicate "joint classification'. The associated 3-character country codes are placed in the xSCLTX field, separated by commas.	Exploitation Apps should extract the two char country code from xSCLSY and place in the banner. Exploitation Apps should extract Classification code from xSCLAS and populate the banner with the single character code. Exploitation Apps should extract the 3-char country codes from the xSCLTX. For display, extract text from xSCLTX and include this text AsIs in the banner.

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products

4- SCI Control System markings
 	
Examples:
 	
//TK
//SI-G
//SI-G/TK
	xSCODE
	Codewords.
	
	Examples:
	
	xSCODE
	TK
	SI-G
	SI-G TK
		SCI Control Systems and their subsets listed in xSCODE are kept together, separated by a hyphen. Multiple SCI Control Systems are separated from each other by a single space character.	Exploitation Apps should extract the codewords from xSCODE and place in the banner.
			
			Example for Banners:
			//<xSCODE codeword_1><space>xSCODE codeword_n> Note: for display, use 'space' between Codewords. Same text as in the xSCODE element.
			
			//TK
			//SI-G
			//SI-G TK

5- Special Access Program Example: Special Access Required (SAR) Buttered Popcorn (BP)] //SAR-BP	xSCODE Codewords. Example: xSCODE SAP-BP	Special Access Program and their subsets in xSCODE are kept together, separated by a hyphen. Multiple programs are separated from each other by a single space character.	Exploitation Apps should extract the codewords from xSCODE and place in the banner. Example for Banners: //<xSCODE codeword_1><space><xSCODE codeword_n> Note: for display, use 'space' between Codewords. Same text as in the xSCODE element. //SAR-BP SAR-XX

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products

6- Foreign Government Information
 	
Examples:
 	
//FGI AUS
//FGI DEU GBR
//FGI
//FGI DEU GBR
	xSCLTX
	Classification Text
	
	Examples:
	
	<u>xSCLTX</u>
	FGI_AUS
	FGI_DEU,GBR
	FGI
		The code value of 'FGI_' or 'FGI" is placed in the xSCLTX field when the source(s) of the information resource is not concealed. 3-character country codes are used, and separated by commas
		.
		The code value of 'FGI' standing alone without country codes is placed in the xSCLTX field when the source(s) of the information resource must be concealed.	

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products

7- Dissemination Control
 	
Examples:
 	
//FOUO
//NOFORN
//ORCON
//IMCON/NOFORN
 	
//REL TO USA, AUS, CAN
//REL TO USA, AUS, NNNN
	xSCTLH
	Control and Handling
	xSCLTX
	Classification Text
	xSREL
	Releasing Instructions.
	
	Examples:
	
	<u>xSCTLH</u> <u>xSCLTX</u>
	FO
	NF
	OC
	CH CH_IM,NF
	
	<u>xSREL</u>
	USA AUS CAN
	USA AUS NNNN
		The xSCTLH field contains, when applicable, a 2-character (digraph) code identifying the expansion or limitation (caveats) on the distribution of the information resource.
		
		Where possible, use digraph values from the CAPCO Register. In some instances, the NTB has assigned 2-character values for caveats that do not otherwise have a 2-character digraph.
		
		The code value 'CH' is used when more than one dissemination control digraph is needed, or when a SIC code is needed (see section 3.5.3). When xSCTLH contains the code value CH, the caveats are listed in the xSCLTX field.
			Exploitation Apps should extract the Control & Handling digraphs from xSCTLH and place in the banner. In the banner, the delimiter between multiple C&H values should be a <comma>. If xSCTLH=CH, then extract the digraphs [full text string including CH, etc.] from the xSCLTX.
			If the value in xSCTLH is a single alphanumeric character, then this is a SIC code and there are no control and handling codes. Display this code as <x>
			Example for Banners:
			//<xSCTLH >
			If value is a single alphanumeric character, display as <x>.
			If the value is a two character digraph other than 'CH', display the digraph as a two char digraph in the banner.
			//FO
			//NF
			//OC
			If the value from xSCTLH is CH, extract the full text from xSCLTX where the data is encoded as SIC:# CH_IM,NF. Note: there may be additional data in the xSCTLH field. Extract all text data from xSCLTX and display in the banner in the same format as the xSCTLH text. This will look like: SIC:# CH_IM,NF.
			Extract the full text and display as;
			//SIC:# CH_IM,NF
			
			Exploitation Apps should extract the Country Codes from the xSREL and place in the banner as follows:
			//REL TO <same text string>

Table 3-1. Security Marking Banner Correlation with NITF2.1 Security Group Fields

Marking Category	NITF2.1 Security Element	Comments	Guidance/Best Practices for Exploitation Application Display Banner for NITF 2.1 Products

8- Non-Intelligence Community
 	
Examples:
//LIMDIS
//SPECAT
//SBU NOFORN
	xSCTLH
	Control and Handling.
	
	xSCLTX
	Classification Text
	
	Examples:
	
	<u>xSCTLH</u> <u>xSCLTX</u>
	DS
	SC
	CH CH_SBU-NF
		Use the same approach as described above for Dissemination Controls.
		
		Intelligence Community and Non-Intelligence Community markings can be distinguished since there is no duplication of code list values.
			If the value in xSCTLH is a single alphanumeric character, then this is a SIC code and there are no control and handling codes. See above details.
			Example for Banners:
			//<xSCTLH >
			If value is a single alphanumeric character, include this character in the display banner.
			If the value is a two character digraph, display the digraph as a two char digraph in the banner.
			//DS
			//SC
			If the value from xSCTLH is CH, extract the digraphs from xSCLTX where the data is encoded as CH_SBU-NF. Note: there may be additional data in the xSCLTX field delimited by a <space>. Extract all text and include in the display in the same format.
			For CH_SBU-NF, extract the values and display as: //CH_SBU-NF.
			
			If there are multiple values in concatenated 'CH' string within the xSCLTX, use the same format in the display banner.

3.5.2.2 Correlation with CAPCO Classification Authority Block

In addition to the security marking banner, the classification authority block is used to provide additional security marking information. The following diagram provides an overview of the NITF 2.1 security group fields used to contain the information needed for the classification authority block.

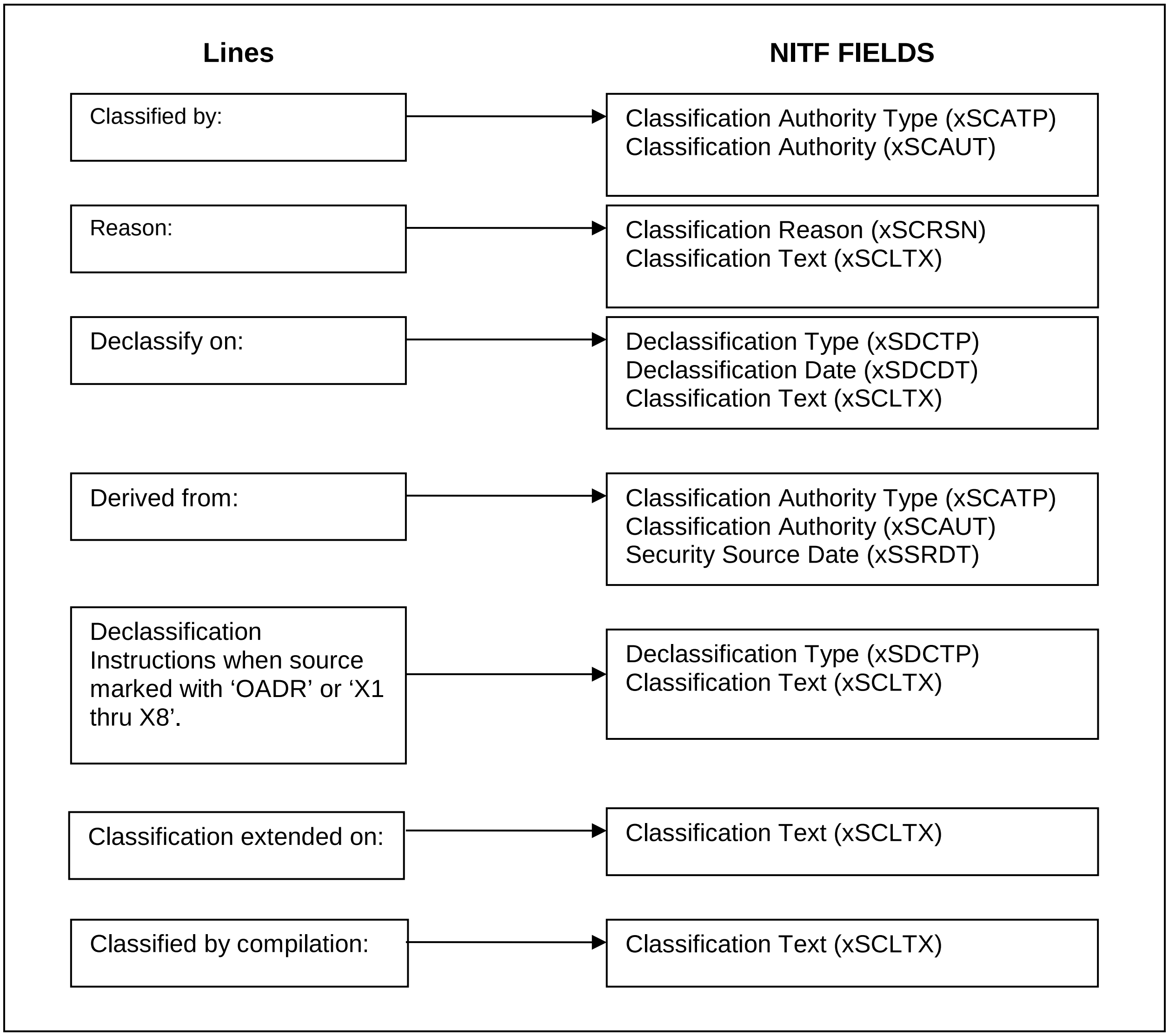

Figure 3-2. Classification Authority Block

Table 3-2. Classification Authority - Correlation with NITF2.1 Security Group Fields

Line	NITF2.1 Security Element	Comments
1- Classified by: Examples: Classified by: David Smith, Chief Division 5 Classified by: ID#MNo1, Chief Division 5	xSCATP Classification Authority Type xSCAUT Classification Authority Examples: xSCATP O xSCAUT David Smith, Chief Division 5 ID#MNo1, Chief Division 5	The alphabetic code value 'O' in the xSCATP field designates that the xSCAUT field is populated with information about the original classification authority. The xSCAUT field contains the identity, by name or personal identifier, and position title of the original classification authority.
2- Reason: Examples: Reason: Military Plans Reason: Foreign Relations Reason: 1.4(a) Reason: 1.4(d) Reason: 1.4(a) and (d)	xSCRSN Classification Reason xSCLTX Classification Text Examples: xSCRSN xSCLTX A D A D M RSN_A,D	The code values (A-H) used in the XSCRSN field correspond to the reasons for original classification per E.O. 12958 as amended, Section 1.4 (a thru h). Additional codes are: Code 'M' designates two or more classification reasons apply; the reasons are listed in xSCLTX. Code 'N' designates the content is classified under authority of E.O. 12952.
3- Declassify on: Examples: Declassify on: 15 days after the travel event Declassify on: November 1, 2011 Exemption, 25-year rule	xSDCTP Declassification Type xSDCDT Declassification Date xSCLTX Classification Text. Examples: xSDCTP xSDCDT xSCLTX DE DE_* DD 20111101 X (xSDCSM=25X1)	The code value 'DD' in the xSDCTP field designates that the xSDCDT field is populated with a declassification date. The code value 'DE' in the xSDCTP field designates that the xSCLTX field is populated with a declassification event. The xSCLTX field contains the description of the event (a character string) upon which the information resource shall be automatically declassified if not properly exempted from automatic declassification.

Table 3-2. Classification Authority - Correlation with NITF2.1 Security Group Fields

Line	NITF2.1 Security Element	Comments
4- Derived from: Examples: Derived from: Memorandum dated12/1/03, Subj: Funding Problems Derived from: Classification Guide for YYY System dated 03/31/2009	xSCATP Classification Authority Type xSCAUT Classification Authority xSSRDT Security Source Date Examples: <u>xSCAUT</u> <u>xSSRDT</u> Memorandum 20031201 Subj: Funding Problems Classification 20090331 Guide for YYY System	The code values 'D' for single source or 'M' for multiple sources in the xSCATP field designate that the xSCAUT field is populated with information about the derivative classification authority. The xSCAUT field contains the identity, by name or personal identifier, and position title of the derivative classification authority and a citation of the authoritative source(s) of the classification markings used in a classified resource. The xSSRDT field indicates the date of the source used to derive the classification of the resource. In the case of multiple sources, the date of the most recent source is used.
5- Declassification Instructions when source marked with 'OADR' or 'X1 thru X8'.	xSDCXM Declassification Exemption Example: <u>xSDCXM</u> O X1	The alphabetic code value 'O' in the xSDCXM field indicates that the source information was marked as Originating Agency Determination Required (OADR). The codes X1-X8 indicate that the source information was marked with declassification exemptions codes X1-X8. The 'derived from' fields described in 4 above identify the source and its date of origin. These markings permit a determination of when the classified information is 25 years old and, if permanently valuable, subject to automatic declassification. NOTE: NITF files originated after September 22, 2003 are not to use codes X1-X8 except when deriving information from a source using those codes.
6- Classification extended on:	xSCLTX Classification Text. Example: <u>xSCLTX</u>	[TBD002]

Table 3-2. Classification Authority - Correlation with NITF2.1 Security Group Fields

Line	NITF2.1 Security Element	Comments
7- Classified by compilation:	xSCLTX Classification Text. Example: A series of unclassified image segments together form a classified compilation	[TBD003] Anticipate designating a code for use in xSCLTX which would signal that the compilation reason is recorded in the SSECGPA TRE.

3.5.3 Additional Guidance on the use of xSCLTX Field

When the xSCLTX field is required to support multiple security group entries, the follow guidance is provided. Information that routinely populates the xSCLTX field will remain first in the character string. An example: A NITF 2.1 file containing a Security Information Classification (SIC) code is normally populated in the xSCLTX field. If multiple security entities must be provided in the field, populate with spaces between security entities and commas between codes, .for example; see table 3-3.

Table 3.3. Example use of xSCLTX

Field	Name	Size	Example
xSCLTX	File/Segment Classification Text	43	SIC:1 CH_cc,cc

3.5.4 Common Security Related Implementation Considerations

<u>File type conversions</u>

When systems convert file types (formats) that do not have internal security information to NITF, a method may be required to ensure operator/human intervention is accomplished to ensure the NITF security fields are properly populated when a new file is generated from an external format; i.e., TIFF, GIF, TFRD.

Converting security field information between NITF 2.1 and 2.0 may not be a one-for-one conversion depending on the specific situation. To provide a common practice for conversion, a transliteration scheme is provided in appendix G for use within the NITFS community.

<u>Security marking preservation</u>

Some imagery applications convert NITF to an internal format for data processing, exploitation, and other purposes. The modified imagery data may then be exported in NITFS format. Care must be taken that proper security marking of the data is maintained throughout the process. Consideration must be given that adding value to the data may also increase the required security marking for the value-added product.

<u>Security information alteration</u>

Since each segment in an NITF file has its own set of security fields, care must be taken when an NITF file is altered to ensure that security information is also logically altered. For example if a (S) SECRET file is being changed to include a TOP SECRET segment the overall file classification must be altered to (TS) TOP SECRET accordingly. As with hard copy documents, human intervention should be considered a must when this occurs. Implementers can assist users by incorporating user-alerts into the interface when such changes occur.

3.5.5 Community/System Implementation Considerations

NITF data producers

NITF file producers should ensure the security fields are properly populated before dissemination at the time of production, as failure to do so will create security issues for downstream users of the data.

Exploitation Applications

To reduce possible security violation issues, exploitation application developers are encouraged to develop a Graphical User Interface (GUI) in a manner that ensures the operator is made fully aware of the security values located in the NITF file security group fields. Unless the interface is developed to read, interpret, and make the information available in human readable form for both viewing and, in some cases, editing by the operator, full advantage of the security fields cannot be realized. It is important for the GUI to prominently display the overall NITF file classification. Many applications implement this using an always-on-top banner type label.

Incorporating features such as drop-down menus, user alerts, and access controlled configurable default field values can be beneficial to facilitating proper security.

Image/Information Libraries

Image and information library sponsors and developers should consider NITF file security marking and handling when ingesting, processing, and exporting imagery products. A combination of automated and human intervention procedures may be required to ensure proper security marking and handling is accomplished.

Table 3-2 provides new guidance on population of the xSCTLH fields. However, the following convention has already been implemented by NGA commercial libraries for populating the NITF 2.0 and 2.1 xSCTLH fields with Security Indicator Code (SIC) values;

- The xSCTLH field contains a restrictive SIC (in the first character position for NITF 2.1, 8th position for 2.0) for all Commercial NITF image products that intersect, or are contained within, the DEZ
- The xSCTLH field contains a least-restrictive SIC (in the first character position for NITF 2.1, 8th position for 2.0) for all Commercial NITF imagery products that do not intersect, and are not contained within, the DEZ.

The recommendations for remediation and extraction of NITF 2.1 xSCTLH fields are as follows;
Remediation of xSCTLH fields for NITF 2.1 files received by libraries from external sources

Read the content of the xSCTLH field. Typically, it might be blank or contain a digraph.

- If there is a single character [left justified] or no entry, e.g., CI products, then verify that this is the appropriate SIC code or replace with a valid SIC code provided there is no need to specify handling caveats.
- If there are handling caveats [digraphs] or handling caveats need to be defined and included, then assign the value of 'CH' and generate/populate the xxCLTX overflow fields in accordance with the IPON, i.e., SIC:#<space> CH_<handling rules, comma delimited> [Note: other info may be included–<space> delimited…]

Extraction of xSCTLH information from NITF 2.1 files for NSG segments (including ELTs)

- If xSCTLH has a *single* character [left justified], use this char as the SIC code.
- If it is two characters other than CH, set the SIC code to 5
- If the value is 'CH', extract the SIC code and other info from the xSCLTX overflow fields

<u>Guards</u>

Image Guards are applications whose function is to provide some level of automated NITF file downgrading or movement between classification levels, e.g Radiant Mercury and ISSE Guard. These applications are generally required to undergo formal security accreditation in addition to achieving NITFS compliance before fielding.

3.5.6 File Generation/Packing Guidelines

Users should have the ability to establish default settings in imagery application software for security field population. Developers should consider how to assist users in properly handling security of NITF files by building in ways for them to easily access, view, and if necessary, modify security information in the headers. There is always a danger in having the software do some things automatically without user knowledge or input. For example, the operator should always be involved in the changing of security information in an NITF file.

Developers may provide drop-down menu lists for some security fields. When content is restricted to valid entries, this reduces or eliminates the chance of unapproved security terms/words/codes being used.

GUI may provide lists to show human understandable selection along with actual code value; i.e., a drop-down menu list may fully spell out valid entries for the operator, such as country names, and, when selected, the application applies the valid code or abbreviation. Important considerations for drop-down menus include:

- Allowance for operator to override list selection with free text entry
- Maintenance/editing of drop-down list entries
- Master lists and pared down short lists
- Valid NITF 2.1 field values
- Valid NITF 2.0 field values

3.5.7 File Unpack/Interpret Guidelines

Banner presentation of security markings for human view per CAPCO guidelines.

- Map NITF 2.1 field values/codes to CAPCO banner presentation
- Map NITF 2.0 field values/codes to CAPCO banner presentation
- When presenting actual security field content:
  - Show actual code/value in the field, and
  - Show the expanded presentation of the field code/value for human view

In addition to the examples provided in table 3-1, a representative implementation from one program/community is documented below.

IECS/S Security Marking Banner Display Implementation:

To generate a security banner to be displayed in an ELT application window for NITF 2.1 files or to be "stamped" on chipped images, extract the text contents from the designated NITF header fields in the order indicated below, adding leading ""//" or other changes/expansions as described and concatentate as shown below:

//FSCLAS^//FSCODE^//FSCTLH^//FSCLTX^//REL^TO^FSREL^// where "^" = BCS space character (0x20)

[1] For the classification codes populated in the FSCLAS field, populate the banner with the expanded [spelled out] field value: UNCLASSIFIED, CONFIDENTIAL, SECRET or TOP SECRET

[2] If a field is filled with BCS-spaces (0x20), do not include this field in the banner, including the leading "//", and proceed to the next field in the list and populate accordingly

[3] If FSREL is filled with BCS-spaces, do not include "REL TO" and the ending "^//", i.e. //FSCLAS^//FSCODE^//FSCTLH^//FSCLTX^//

[4] If FSCTLH is "CH" or a single character (0-9, A-Z), do not include FSCTLH in the banner including the leading "//"

[5] If FSCLTX contains a BCS-space separated string starting with "FGI" then include this portion of the field with a leading "//":

- "FGI" displays as //FGI indicating Foreign Government Information where the source is concealed
- "FGI_text" displays as //FGI_text where "text" is one or more ISO 3166 country code trigraphs
- "FGIP_text" should not be used, but if it does it should be displayed as //FGIP_text.

[6] If FSCLTX contains a BCS-space separated string starting with "CH_" then include the trailing portion of the field with a leading "//": "CH_text" displays as //text

For NITF 2.0 files, use the following convention: //FSCLAS^//FSCODE^//FSCTLH^//REL^TO^FSREL^//

[1] Apply the same rules [1] through [3] as NITF 2.1

[2] Include all BCS-space-separated strings in FSCTLH, excluding only single-character (0-9, A-Z) strings

3.6 File Background Color (FBKGC)

The concept of file background color was introduced during the NITF 2.0 era (MIL-STD 2500A, Change Notice 2). An interoperability problem was discovered in the field when the receiver's default background color (color of the 'canvas area' established by the extent of the CCS) was different from the originator's background color. This mismatch created the potential for the originator's symbol/text annotations to not be visible on the receiver's screen. To allow the designation of FBKGC without disrupting the integrity of the format, the first three bytes of the ONAME field were re-designated as the FBKGC field for use in specifying the file background color. The values placed in the FBKGC field are interpreted as three 8-bit binary RGB values in Red, Green, and Blue order. The use of the FBKGC field continues in NITF 2.1.

Per the ISO BIIF standard, the fields within the NITF headers are constrained to be UTF-8 encoded characters. Unfortunately, the use of the binary RGB value in the FBKGC field deviates from this constraint of the ISO standard, a fact for which awareness only came after a large number of systems had already implemented the feature. Consequently, NITFS will continue to use the FBKGC field as currently specified while acknowledging the minor deviation from the BIIF standard. Implementers are cautioned that values placed in this field may adversely disrupt the logical sequence of a UTF-8 encoded text stream if/when attempting to read this field as a character field.

Implementers need to accommodate the dual use of the FBKGC/ONAME field in NITF 2.0 files due to the possibility of older files not having a FBKGC value in the first three characters of what was the ONAME field. The following logic is a recommended practice for NITF 2.0 FBKGC interpret, discover, display and conversion to NITF 2.1 file format.

3.6.1 Converting NITF 2.0 to 2.1 format.

For applications that wish to convert NITF 2.0 files into NITF 2.1 file format or incorporate the FBKGC into an NITF 2.0 formatted file should consider the following:

- When any of the three characters (8-byte values) following the ENCRYP field are outside the BCS-A values range, the probability that the file employs FBKGC is high. Maintain the field values as received when converting from NITF 2.0 to 2.1.
- When the three characters following the ENCRYP field are within the BCS-A value range and are of the same value, the probability of the file employing FBKGC is high. Maintain the field byte values as received when converting from NITF 2.0 to 2.1.
- When the three characters following the ENCRYP field are within the BCS-A value range and are not the same value, the probability of the file employing FBKGC is low. An application wishing to convert this NITF 2.0 file to NITF 2.1 format may consider the following:
    - Check the number of BCS-A spaces that follow the originators name in the ONAME field. Shift the originators name three space to the right and add a tilde (~) value three times for the FBKGC field entry.

For example, an NITF 2.0 file not employing FBKGC:

Field Name	Byte Size	Value
ENCRYP	1	0
ONAME	27	DISA (JITC) followed by 16 BCS spaces

Employing FBKGC to the file header, shift the ONAME value 3 bytes to the right and insert 3 BCS-A Tilde characters in front of the ONAME value.

Field Name	Byte Size	Value
ENCRYP	1	0
FBKGC	3	3 unsigned binary integer tilde characters (0x7E, 0x7E, 0x7E)
ONAME	24	DISA (JITC) followed by 13 BCS spaces

- In the case where there are no BCS-A spaces available to shift into, recommend the application duplicate the first three bytes of the ONAME for the FBKGC field value shifting the ONAME field byte values to the right and truncating right most characters as needed.

3.6.2 Displaying NITF 2.0 file format.

Recommend practice for displaying NITF 2.0 files with or without FBKGC implemented.

- In all cases, use the three bytes following the ENCRYP field to define the background color.
- When displaying content of the ONAME field; when the three characters (8-byte values) following the ENCRYP field are outside the BCS-A values range, the probability that the file employs FBKGC is high. Display the 24-character ONAME field.
- When the three characters following the ENCRYP field are within the BCS-A value range and are of the same value, the probability of the file employing FBKGC is high. Display the 24-character ONAME field.
- When the three characters following the ENCRYP field are within the BCS-A value range and are not the same value, the probability of the file employing FBKGC is low. Display both the 3-character FBKGC field and the 24-character ONAME field as if it were a 27-character field.

3.7 Originator's Name and Phone Number (ONAME, OPHONE)

The use of the ONAME and OPHONE fields varies from system to system. Some applications require direct operator action to populate these fields, while some provide default values that can be changed by the operator. Developers should consider relevant CONOPS during the lifecycle of an NITF file. An originator's name and phone number are essentially perishable information. It may be applicable to provide an organizational name instead of an individual's name and a helpdesk number instead of a particular person's phone number. The following is a general guideline:

Producer: Imagery sources populate with general source if classification level allows it. NOTE: There are TREs where sensors/producers provide origination type information.

Dissemination Point: Imagery simply passing through a dissemination point would not alter the information as it comes from the producer. However, if the file is modified by the dissemination point it should update the ONAME and OPHONE fields with their information.

Exploitation Applications: When analysts exploit a file, they should update the ONAME and OPHONE fields with their information.

Archiving: Upon ingest into and export out of an image library, the fields should retain the incoming information. However, if modifications and/or conversions are made to the file, the ONAME and OPHONE should reflect the library.

3.8 Image Representation (IREP)

The IREP field provides information to indicate how the image data is to be represented. For example, an image where each pixel is represented based on a Red, Green, and Blue color value would be RGB. This field should be used in conjunction with the ICAT, ISUBCAT and IREPBAND fields to interpret the significance of each band in the image.

A known case of IREP MULTI used today for NITF version 2.0 imagery is for a four band commercial product structured where the first three bands are in BGR order and the fourth band is a Near Infrared band. The IREPBANDn fields for each band are populated with B, G, R, and N respectively to expressly identify which band has a specified representation. The representation associated with IREPBANDn values of R, G, and B is Red, Green, and Blue. However, there is no defined representation for IREPBANDn = N. This is a legacy practice in NITF 2.0 that continues into the NITF 2.1 era so that these specific NITF 2.0 products can be expressed in NITF 2.1 with similar characteristics. The value N has been formally registered as an allowed value for IREPBANDn as provided for in the NITF 2.1 standard. The value N is to be treated in the same manner as the space value defined for IREPBANDn.

3.9 Image Category (ICAT) and Product Discovery Attributes

The intent of the ICAT field in the image subheader is to provide a general category of the image segment pixel data. For example, a Synthetic Aperture Radar (SAR) image would have the ICAT value SAR and Raster Map would have the ICAT value MAP. Generally, this field is not intended for use in making processing decisions regarding the image segment.

Processing information needed by a system can be found in the other image subheader fields. This field can be useful for discovery and retrieval for image archives; i.e., a user may want to retrieve all the SAR images tied to a geographical area.

3.9.1 Commonly supported ICAT values:

3.9.1.1 Commercial

ICAT	Definition	Image
VIS	Visual – Raster pixels	Panchromatic monochrome and RGB color

		imagery
MS	Multispectral	4-band Pan-Sharpened and 3-band Pan-Sharpened false color
CLOUD	Cloud cover	Cloud cover grid (not displayable without additional processing)

3.9.1.2 Tactical

ICAT	Definition	Image
VIS	Visual – Raster pixels	Single band monochrome and 3-band RGB color imagery
SAR	Synthetic Aperture Radar. Electromagnetic waves identifying the range, altitude, direction, or speed of both moving and fixed objects	Single band monochrome
IR	Infrared. Invisible radiation wavelengths	Single band monochrome
EO	Electro Optical. Electric field that varies slowly compared with the frequency of light	Single band monochrome

3.10 ICORDS/IGEOLO

3.10.1 When populated, the NITFS image subheader ICORDS/IGEOLO fields provide a bounding polygon (four points) for the coverage of the image data on the earth. The coordinates in these fields are intended to provide general orientation/coverage only, and are not intended for any interpretation other than to establish the approximate location on the earth (e.g., for data discovery/retrieval purposes within libraries, etc.). For applications requiring precise and accurate location information, the use of support data from appropriate TREs is required. Image products void of support data for precise measurements should only be considered useful for regional visual familiarization and/or registration to trusted reference products such as NGA's CIB and DPPDB.

3.10.2 It should also be noted that to help meet tight production and dissemination timelines, some imagery collection and production systems are known to populate IGEOLO with rough approximations of the corner points even when the actual imagery products have support data (TREs) that allows more accurate and precise determination of the corner point geographical locations. This practice can result in exploitation/mensuration tools getting different geographical location values for the corner points when using the support data as compared to those populated in the IGEOLO field. The IGEOLO fields should be populated even if the support data contains more detailed information. As mentioned above and in the standard; IGEOLO are intended to be used for ascertaining general coverage and cataloging only, and are not intended for any interpretation, other than to establish the approximate location of the significant image data on the earth.

3.10.3 Another reason to avoid IGEOLO data for positioning is when four corner points are included in the image segment and the visual ground coverage of the image is not inclusive of the entire image pixel space. The ground coverage may not be represented by well-defined corners and therefore may not be coincident with the pixel space array corner points. In these cases, the producer of the image segment should populate the IGEOLO with the most appropriate values for data discovery/retrieval of the ground coverage that is available in the image array. For example, where a horizon is in the image array, corner points cannot represent the points in the sky, but perhaps the points on the ground nearest the Earth-horizon juncture. One image processor populates the IGEOLO corner points that are not on the earth with spaces in this case. The most appropriate values may have even less coverage than the horizon juncture, to better describe the useful coverage of image data in the segment for discovery/retrieval purposes. Note that this situation can cause interpreting applications difficulties if they are attempting to perform certain mensuration functions using only the IGEOLO data. Figure 3-1 presents examples of this situation.

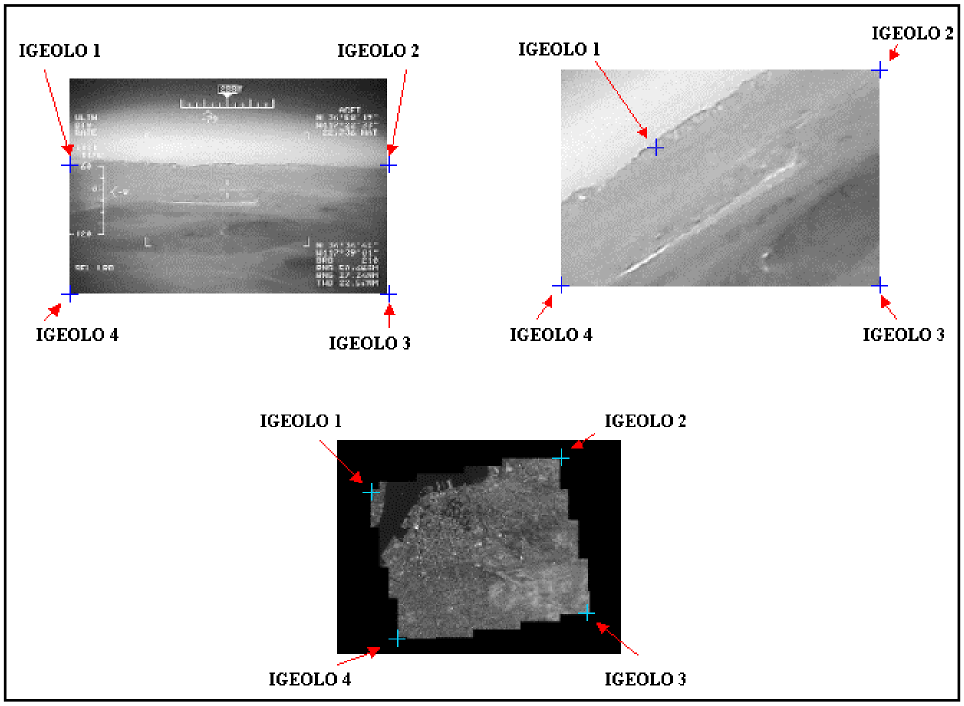

Figure 3-2. IGEOLO examples

3.10.4 Short of actual degree of accuracy statements associated with measurement data, applications/tools that present geographical coordinates and measurements to the user need to have, at a minimum, some readily apparent means to identify the source of data and means for calculating positional values. E.g., state results were derived from linear interpolation from IGEOLO corner point values, grid point matrices, Rational Polynomial Coefficient equations, camera model parameters, replacement camera model, with or without use of elevation data, etc. This allows the operator receiving the measurement information to make informed decisions as to the accuracy and reliability of the data being provided by the application.

3.10.5 One screener application uses two approaches for manipulating imagery with missing IGEOLO. If the source imagery contains any valid, including space-filled IGEOLO, it will retain the original IGEOLO values for single-frame and single-frame zoom output products. If the user chips an image with less than four valid corner points, the application will populate the image subheader image coordinate representation (ICORDS) field with a space (BCS 0x20) signifying the IGEOLO fields are not present. It inserts an ICHIPB TRE and BLOCKA TRE and populates its location fields with the IGEOLO from the parent image. The addition of the BLOCKA TRE preserves the original data provided by the sensor-processor.

3.11 Image and Data Compression

3.11.1 The NITFS over the years has incorporated the use of various image compression algorithms to facilitate different operational requirements. The types of image compression supported within the NITFS are listed below. JPEG 2000 is the preferred method of compression for the near future. JPEG 2000 provides a significant increase in capability over previous compression methods and is the preferred method of compression for the near future. As this transition occurs and legacy compression types are phased out, additional phase-out guidance will be issued by the NTB for future implementations.

3.11.2 JPEG Lossy and Lossless compression. The legacy form of JPEG (DCT and Lossless) is used for continuous tone types of imagery such as photographic images. It is expected that systems will have to continue to interpret legacy JPEG for an indeterminate time into the future. Some libraries may offer conversion services for migrating legacy JPEG to JPEG 2000.

3.11.3 Vector Quantization (VQ). This compression is used primarily by NGA to compress maps into the CADRG product. For this reason NITFS applications are only required to decompress and display VQ compressed NITFS image segments.

3.11.4 Bi-Level or Facsimile compression. Bi-Level compression is now optional, and not recommended. This compression algorithm is used for two color images of one bit-per-pixel and complies with the category 3 Facsimile standard to allow for interoperability with facsimile images.

3.11.5 ARIDPCM. Used in NITF 1.1, ARIDPCM was the compression used before the incorporation of JPEG. Creation of ARIDPCM is not allowed. Systems that may encounter NITF 1.1 files should allow for the decompression of legacy ARIDPCM NITF 1.1 files.

3.11.6 JPEG 2000. JPEG 2000 uses improved methods of repackaging compressed data that enables significant improvements in its utility. NITF 2.1 incorporates the use of JPEG 2000; details are in the BIIF Profile for JPEG 2000 (BPJ2K01.10).

3.12 Reduced Resolutions

Proper marking, identification and use of the image magnification/reduction factor value in the Image Magnification (IMAG) field of the Image Subheader are critical to a variety of image exploitation processes. This is particularly true, for example, when TREs containing support data referenced to the original source image row/column grid are preserved/copied into reduced (or enlarged) resolution image segments. To make proper use of the original (unmodified) support data, it is essential to maintain the correlation of the pixel value row/column indices in the magnified/reduced image array to their original row/column grid positions upon which the support data is based.

3.12.1 Unpack

3.12.1.1 Presentation of the pixel values in each image segment are aligned with the row/column reference grid of the CCS regardless of the individual image resolution as expressed in the IMAG field of each image segment. The first pixel of each image segment is located in the CCS at the row/column point indicated in the ILOC field relative to the attachment level reference point.

3.12.1.2 When using image support data (e.g., TREs) for image exploitation functions, the magnification (or reduction) factor, relative to the original source image resolution upon which the support data is based, must be included in the exploitation process.

3.12.1.3 When the IMAG field is populated with the designated default value, 1.0 (or 1.00), the image support data is interpreted as being directly correlated with the pixel array data in the image segment.

3.12.1.4 When decimal values (vice the /2, /4, /8, etc. convention) appear in the IMAG field to indicate the magnification (or reduction) factor, the potential impact of the available precision in the field must be considered in the 'error budget' of exploitation processes using the value.

3.12.1.5 When an ICHIPx TRE is available for the image segment, the reduction/magnification value in the SCALE_FACTOR field takes precedence over the corresponding, but potentially less precise, magnification/reduction value in the IMAG field. (NOTE: It is recommended the implementation provide a means to alert the user if the values in the SCALE_FACTOR and IMAG fields are inconsistent when performing exploitation functions involving resolution considerations.

3.12.1.6 When exploiting JPEG 2000 compressed image data, multiple resolutions of the image data may be available for extraction from the compressed data stream. Some compressed data streams may not include all the data (code blocks) needed to extract the full resolution upon which the support data is based. The correlation of the pixel value row/column indices in the magnified/reduced image array to the row/column grid positions upon which the support data is based must be maintained regardless of which available resolution of the image data is extracted from the compressed data stream.

3.12.2 Pack

3.12.2.1 An NITF file may be packed with multiple image segments, some of which have different resolutions (different IMAG values). When doing so, the image segments are placed in the NITF CCS using the ILOC field values to identify the row/column position (relative to the attachment level reference point) of the first pixel of each image array in the CCS regardless of individual image segment resolution.

3.12.2.2 The value in the IMAG field of each image segment represents the resolution magnification (or reduction) factor of the segments pixel array data as compared with the original source resolution of the image data upon which the image segment's support data is based.

3.12.2.3 When the resolution of the image pixel array data and associated support data directly correlate, the IMAG field is populated with the designated default value, 1.0 (followed by a space character), or alternatively, 1.00.

3.12.2.4 For reductions that are reciprocals of non-negative powers of two (2), the IMAG field is populated using the /2 (for 1/2), /4 (for 1/4), etc. convention. Otherwise, decimal values are used to indicate the magnification (or reduction) factor.

3.12.2.5 When the precision available in the IMAG field is not adequate to support the intended exploitation of the image and its support data, the ICHIPx TRE (SCALE_FACTOR field) is used to contain the increased precision reduction/magnification value. The values placed in the IMAG and SCALE_FACTOR fields must be consistent with one another, varying only in representation and precision. (NOTE: The factor value representation in the SCALE_FACTOR field is the reciprocal of the value representation approach used in the IMAG field.)

3.12.2.6 When the image data is JPEG 2000 compressed, the IMAG field value is populated with the highest resolution available for extraction from the compressed image data stream relative to the original source image data upon which the image segments support data is based.

3.13 Image Data Mask Tables

The Image Data Mask is a mechanism within the NITF structure, which helps to describe images containing empty blocks and special (transparent or pad) pixels. An image data mask table always follows the image subheader data. An M in the image subheader IC field is a quick identifier that an image data mask table is present. The image data mask table can provide two sets of offsets, one identifying the non-recorded blocks (mask blocks) if present, and the other identifying any blocks containing pad pixels. When pad pixels are present, a flag in the Image Data Mask Pad Output Pixel Code (TPCD) field is applied representing the pixel code that represents a pad pixel in the image data. When the field is populated with a hexadecimal value of zero, an application is required to present the pad pixels as transparent. Otherwise, pad can be treated as any user-defined color. Some of the uses for an Image Data Mask are:

- Identification of pad pixels existing as a result of blocking (blocks around the edges of the image may not be full of significant pixels)
- Identification of non-recorded blocks, i.e. mask blocks
- Flagging of pixels to be treated as transparent so underlining pixels display instead

- Use of block masks as an offset to the beginning of each block (not used by any known product, but is allowed)

There are currently at least four known NITFS product producers supporting the Image Data Mask. Each product and its specific implementation are briefly described below.

Controlled Image Base (CIB). CIB is a dataset of orthophotos, made from rectified grayscale images and is always blocked six by six, resulting in thirty-six blocks. CIB uses a combination of both mask block and pad pixel offsets in the Image Data Mask. The mask block offsets identify non-recorded blocks and the pad pixel offsets identify the blocks that have pad in them. The pad is a result of the image mosaicking and rectification process, which causes an amalgamation of images leaving some areas of the minimum bounding rectangle empty. Furthermore, CIB always uses the pixel value of 216 to identify pad pixels, which means the pad can be treated as any user-defined color. Figure 3-4 provides an illustration of pad pixel and mask use in CIB.

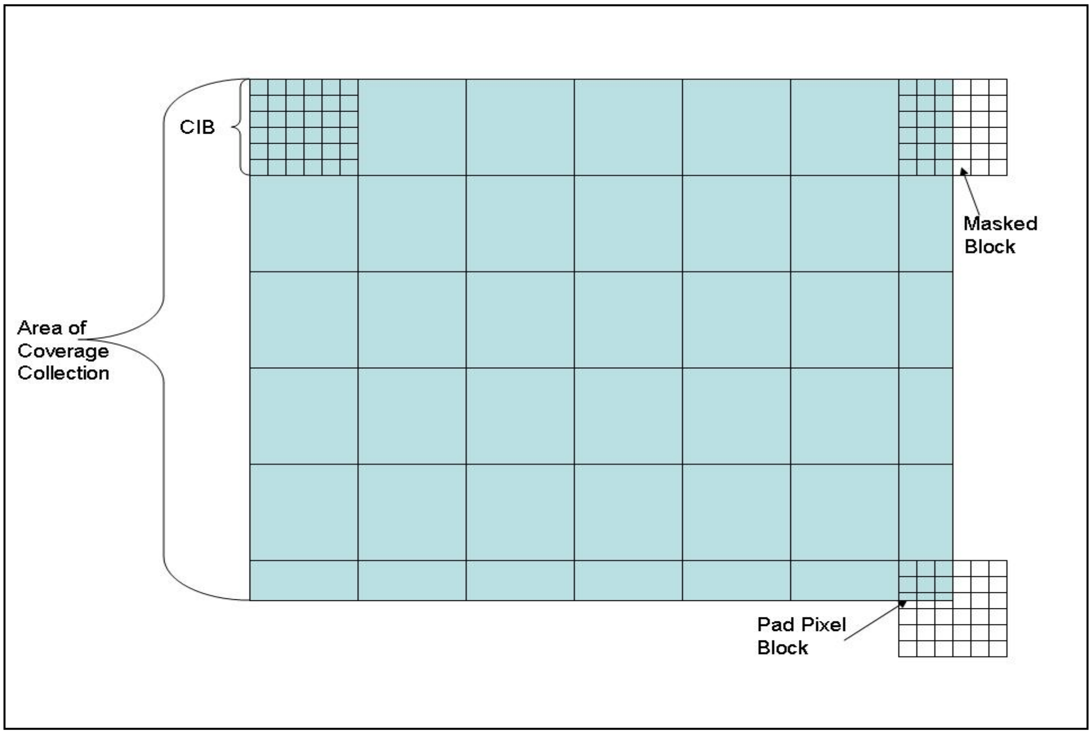

Figure 3-3. CIB use of Masked and Pad Pixel blocks

Compressed Arc-Digitized Raster Graphics (CADRG). CADRG is a dataset of digital maps and charts. It uses the Image Data Mask in the same manner as CIB.

Shuttle Radar Topography Mission (SRTM). SRTM consists of four data types: Digital Terrain Elevation Data (DTED), Terrain Height Error Data (THED), Orthorectified Image Mosaic (OIM), and Seam Hole Composite Map (SHCM). THED, OIM, and SHCM are in NITF, whereas DTED has its own format. All three of the NITF products use the Image Data Mask.

- THED describes the random accuracy of the DTED. It is an array of accuracy postings, which correspond to each DTED posting. THED does not use mask blocks, but does use pad pixels to identify postings that do not have a corresponding DTED posting.
- OIM is a SAR magnitude image. OIM does not use mask blocks, but does use pad pixels, specifically transparent pixels. Cells of data that are partial are identified in the Image Data

Mask and any pixels not having an actual value are assigned a pad value of 0. By definition, 0 is a flag that requires the pixel to be treated as transparent.

- SHCM is a color-coded raster map used to overlay the OIM to show the location of radar seams, holes in the dataset, and the voids that have been filled. SHCM uses the Image Data Mask in the same manner as OIM, where 0 is used to indicate which pixels should be treated as transparent pad. With this product, the majority of the pixels are assigned 0, and only the seams, holes, and voids are assigned actual values. This allows the SHCM to overlay an OIM, resulting in an overall display of the seams, holes, and voids on top of the OIM.

The Common Image Processor (CIP) also supports the Image Data Mask; mainly for mosaicked search mode Synthetic Aperture Radar (SAR) products.

Exploitation and Information Library applications presently do not support generating data masked tables, those applications generate pad pixels as intelligent pixel data. NITF compliance registered exploitation applications are however able to interpret and process masked table data as intended. Information Library applications export data masked products as-is, maintaining the table along with support data. Library chipped products are, for the most part, focused on intelligent pixel data. Libraries are rarely expected, by a client customer, to process pad pixel or masked block data.

3.14 NITFS Common Coordinate System (CCS)

A basic concept employed by the NITF is that of the CCS. The concept is simply that all of the displayable elements in an NITF file fall within a virtual bounding rectangle of those elements. It is the resulting bounding rectangle that is identified as the CCS for a particular NITF file. The primary impact is that the CCS has an impact on the CLEVEL of the file. The CCS is independent of the display device but some means such as panning must be available to allow the operator visual access to all of the CCS.

3.15 Image, Graphic/Symbol, and Text Overlays

3.15.1 NITF allows the non-destructive overlaying of graphic data within the CCS of an NITF file. This is a significant feature of the NITF. The factors that impact the use of this capability are Display and Attachment levels as well as relative locations of overlays within the CCS.

3.15.2 Implementers should consider the impact on overlays when performing functions such as rotating and zooming. For example, if an image is rotated that has an overlaid graphic the graphics meaning and significance may change if it is not rotated with the image. Generally, there are three ways to handle this situation. First the overlay can be rotated with the image maintaining its relative position and then burned-in to the image. Second, the overlay is automatically removed from the rotated image. The third and preferred method is to rotate the overlay in a manner that allows it to remain as a nondestructive graphic.

3.16 Text Segments

The NITFS provides for the inclusion of textual segments within an NITF file. The purpose of the text segments is to provide information related to the file or other file segments. Generally, text segments are created with an editor that can be launched from the imagery application or through an import function.

3.16.1 The NITF program presently supports four Text Segment types:

Standard (STA): An implementation must unpack and display text data in all text segments marked with the text format code for STA. STA represents the Basic Latin character set that can be displayed using most English-language based editors.

For text segments formatted as STA:

1. Contents are composed of none other than the following BCS characters: Line Feed (0x0A), Form Feed (0x0C), Carriage Return (0x0D), and space (0x20) through tilde (0x7E).
2. All lines are separated by carriage return/line feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the line feed character.
3. Text data is presented as a contiguous file, with each permitted BCS character immediately following the other.
4. Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.
5. No field delimiters or special characters are used to designate the end of the text data.

If more than one text segment is included in the NITF file, the last character of the first segment is followed by the first character of the next segment's subheader.

The following editors are able to interpret and display STA formatted test files:

1. Microsoft Notepad
2. Microsoft Wordpad
3. Internet Explorer
4. Mozilla Firefox
5. UNIX Text editor (openWin)

UCS Transformation Format 1 (UT1): The implementation must unpack and display text data in all text segments marked with the text format code UT1 (single octet) representing the Latin-1 Supplement character set.

For text segments formatted as UT1:

1. Contents are composed of none other than the following characters: Line Feed (0x0A), Form Feed (0x0C), Carriage Return (0x0D), and space (0x20) through tilde (0x7E) and No break space (0xA0) through small "y" with diaeresis (0xFF).
2. All lines are separated by carriage return/line feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the line feed character.
3. Text data is presented as a contiguous file, with each permitted character immediately following the other.
4. Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.
5. No field delimiters or special characters are used to designate the end of the text data.
6. If more than one text segment is included in the NITF file, the last character of the first segment is followed by the first character of the next segment's subheader.

The following editors are able to interpret and display UT1 formatted test files:

1. Microsoft Notepad
2. Microsoft Wordpad
3. Internet Explorer
4. Mozilla Firefox
5. UNIX Text editor (openWin)

Message Text Format (MTF): MTF is based on MIL-STD 6040. For text segments identified by the text format code for MTF, the implementation must be able to unpack and display the text data. MTF is a specific Text Format designed for military use, and includes unique formatting codes based on the 69 character lines used in military message traffic over the years. To interpret and display MTF properly, an MTF capable interpreter must be used. The implementation may optionally pass the text data to an MTF capable application for further processing in accordance with MIL-STD 6040.

For proper display of text files formatted as MTF:

1. Contents are composed of none other than the following characters: Line Feed (0x0A), Form Feed (0x0C) and space (0x20) through tilde (0x7E).
2. Line endings are identified by either a sixty nine character count or the use of double solidus (0x2F), (// (end of set marker) may identifying CR/LF) , where the first character of the next line (if present) immediately follows the line feed character.
3. Text data is presented as a contiguous file, with each permitted character immediately following the other.
4. Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.
5. No field delimiters or special characters are used to designate the end of the text data, however, the // end of set marker is always present at the end of the text data.
6. If more than one text segment is included in the NITF file, the last character of the first segment is followed by the first character of the next segment's subheader.

<u>UCS Transformation Format 8 (UTF-8) Subset (U8S)</u>: For text segments identified by the text format code for U8S (either 1-byte or 2-byte encoded), the implementation must be able to unpack and display the text data. Certain Web browsers are capable of displaying U8S.

Contents are composed of none other than the following BCS characters: Line Feed (0x0A), Form Feed (0x0C) Carriage Return (0x0D), and space (0x20) through tilde (0x7E), No break space (0xA0) through small "y" with diaeresis (0xFF), and Inverted exclamation mark (0xC2 A1) through small "y" with diaeresis (0x C3 BF).

1. All lines are separated by carriage return/line feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the line feed character.
2. Text data is presented as a contiguous file, with each permitted character immediately following the other.
3. Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.
4. No field delimiters or special characters are used to designate the end of the text data.
5. If more than one text segment is included in the NITF file, the last character of the first segment is followed by the first character of the next segment's subheader.

3.16.2 Commercial NITF License Text Segment

For distribution purposes, all commercial satellite imagery products must contain one License text segment that provides an imagery end user licensing agreement between the satellite company (seller) and end user (purchaser). The License provides information that governs the use of the commercial products (imagery, data, or documentation). The following are commercial licensing identifiers:

1. Text Segment subheader Text Identifier field TEXTID will contain the "LICENSE" value.
2. Text Segment subheader Text Title field TXTITL will contain a lead in character value indicating the license type.
3. The first line in the text data will state that data within is an imagery end user license agreement.

3.17 Tagged Record Extensions (TREs)

Within NITF 2.1, the primary method of packaging metadata is through the application of TREs. TREs represent a set of configuration managed data segments that may contain a variety of information related to the entire NITF file or a portion of the NITF file. In addition to the following principles or concepts applicable to TREs, please refer to the TRE Lifecyle section contained in Appendix N.

a. Generally configuration controlled and published.

b. Uniquely named and registered to ensure integrity is preserved and controlled.
c. Last character is generally used to version the TRE. As it is changed/updated, its root name retains its relationship with previous versions.
d. TREs are listed individually and grouped on the Registry by user groups; i.e., airborne related TREs.
e. Anyone may nominate a new TRE. Nominations are evaluated to determine if existing TREs will accomplish the objective. A new version may be needed if modifications result in a new TRE that will be of use to the target users.

3.18 Data Extension Segments (DESs)

In addition to TREs, another mechanism for packaging metadata is a DES. A DES allows the NITF to include other data types not already accommodated by other segment types. An additional function of the DES area is to include storing large quantities of TREs that may not fit in their associated user-defined or extended header segments, due to volume or design. This situation is known as overflow.

3.18.1 TRE Overflow.

The DES structure's utility becomes readily apparent when it comes to storing large amounts of metadata in a single, confined area. Until recently, using the DES to store overflowed TREs from other segments within the NITF file was rare. TRE overflow is supported in both NITF 2.0 and 2.1, but generally NITF 2.0 will not use overflow.

3.18.2 Streaming File Header.

The streaming file header capability has evolved into a solution seeking a problem. Originally intended for image captures on-the-fly where specifics about size and duration of an imaging operation was not known when the initial NITF structure was established to hold the image data, no known producer exists.

3.18.3 WBRD_FRAME.

Call the JITC NITFS Test Facility at Commercial (520) 538-5458 for information regarding this DES.

3.18.4 CSSHPA.

The Shapefile DES (CSSHPA) is a general wrapper structure for an ESRI Shapefile. It provides global information for the entire NITF dataset.

3.18.5 CSATTA.

The Attitude Data DES, version A (CSATTA) provides sensor attitude information needed to use a rigorous mathematical model to perform geolocation and mensuration.

3.18.6 XML_CONTENT_DES. This generic DES provides a mechanism for placing eXtensible Markup Language (XML) -formatted data content within North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF) and NTIF - formatted files.

3.18.7 Special data types.

Uses other than overflow, streaming file header, and XML content must be registered and approved by the NITFS Technical Board (NTB). Although there are currently no other approved implementations, various communities are considering developing DES to contain video clips, moving target indicator information, animations, and other data.

3.19 NITFS Usability

The NITFS documents do not currently identify requirements for the usability of systems implementing NITFS. A system can be in technical compliance with the standards, yet not be well suited for use in its targeted user environment. The following usability factors are based upon observations made during past NITFS compliance tests. The purpose is to raise awareness of human factor considerations when developing a system. Implementers are encouraged to identify additional usability factors pertinent to the fielding objectives of the NITFS system being developed.

3.19.1 Target Audience Description

The developer has prepared a target audience description for the system and used it in the design and development of the system. An appropriate Human Factors Engineering (HFE) and Safety evaluation has been conducted.

3.19.2 Operator’s Manual

An up-to-date operator's manual for the system was available at the time of compliance testing.

3.19.3 Consistent User Interface

The system has a consistent user interface with the appearance of a single integrated application. There is no perception of needing to exit and enter multiple routines to handle NITF operations. There is no need to enter commands at the operating system prompt once the application is started.

3.19.4 Header/Subheader Defaults

The system does not require an operator entry for each and every NITF file header or subheader field value. It provides some mechanism for establishing default values and automatic calculation of values where appropriate.

3.19.5 Header/Subheader Edit

The system does not use hard coded header/subheader defaults that cannot be changed without re-coding and recompiling the program. The system provides edit capabilities for header/subheader values in a controlled manner depending on the access privilege of different levels of users.

3.19.6 Screen and Imagery Board Correspondence

A method is provided to handle the circumstance when the screen or other rendering device does not have the same pixel display capacity as the imagery processing board. There are clear procedures for setting up the appropriate parameters for proper image display. There is some means to alert the operator that the rendered image may be cropped because the display device does not handle the full image size as received (when no roaming or panning capability is provided).

3.19.7 Automatic Rendering

NITF file components are automatically displayed according to the NITF file header values without operator intervention; i.e., the operator is not required to read NITF header values and manually place components of the file for display.

3.19.8 Direct Text Entry

The system allows for the entry of text without the operator needing to be aware of special procedures for insuring only the NITFS STA, UT1, U8S and MTF set of characters (without special word processing control codes, but with proper CR/LF line terminators) are entered into the NITF file.

3.19.9 User Alerts

There is some method to alert the operator that text or image comment fields are included within the NITF file being viewed and there is a convenient means to view the contents. The operator is alerted to other aspects regarding the file being viewed that are not readily apparent from the image display (such things as: user defined or extended data is included in the file; the image has color components but has been modified for display on a monochrome system; the file is in NITF 1.1, 2.0 or 2.1 format; security code words are included in the file headers; particular components could not be properly parsed or interpreted, etc.).

3.19.10 Automatic Assist

The implementation assists the operator in preparing NITF files that do not exceed the established boundary conditions for a specific CLEVEL. There is no excessive dependence on operator knowledge or procedures to ensure only compliant files are packed.

4 ARCHITECTURE-RELATED NITFS IMPLEMENTATION GUIDELINES

4.1 General

Within the NSG Enterprise there have evolved separate communities or sub architectures each with unique requirements (i.e., National, Airborne/Tactical, commercial). At the same time, the objective NSG Enterprise provides a homogeneous environment where data can easily be accessed and used between these individual communities across the Global Information Grid (GIG). The NITFS has been designed to provide sufficient functionality to serve the entire NSG community. In doing so, the features supported by the NITFS fall into two significant areas, required and optional. This allows the acquisition community to properly size NITFS capable systems such that program costs are reduced while still affording a baseline level of interoperability across the NSG. Full interoperability at the user level can only be achieved, however, if the optional NITF features are properly selected for support during the acquisition process. This encompasses understanding the data flow and interfaces involved with the subject system.

Prior to the development or acquisition of an NITFS related system full consideration should be given to the test strategy, whether it is a single exploitation package or major system. NITFS compliance testing will evaluate the conformance and compliance of the imagery products' data and metadata to the applicable standards and assess the discoverability, retrievability, understandability, and exploitability of the imagery product by the anticipated and unanticipated user communities across the NSG Enterprise.

Individual programs generating NITFS-compliant products are also required/expected to document how their sensor/system/products will implement the NITFS to ensure discoverability, retrievability, understandability, and exploitability by the anticipated and unanticipated user communities across the NSG Enterprise. The document should identify the specific features to be implemented and what metadata will be contained in the output products. These documents go by numerous titles, such as Data Element Content Specification, Product Implementation Specification, Fielding Plan, Implementation Specification, Data Population Plan, etc. Regardless of the document title used, it will identify the services, functionality, and mission capability requirements that will need to be ratified by the appropriate authority, to ensure the requirements are fully identified, valid and meet the needs of the designated end-user.

4.2 Implementation Profiles

4.2.1 The NITFS standards provide a very broad range of capabilities/features. To promote interoperability within the NSG, several communities have collaborated and defined implementation profiles for their products. The implementation profiles are configuration-managed documents which define the use of the NITFS within a specific community. The intent of the document is to provide developers and the anticipated users a detailed description of the products and the functional capabilities. The document defines how a product is structured and the metadata contents expected to be contained within. It takes the broad NITF format capabilities and identifies which of the numerous features the product will implement to ensure its discoverability, retrievability, understandability, and exploitability by the anticipated and unanticipated user communities across the NSG Enterprise. For example, NGA.IP.0006_1.0, National Imagery Transmission Format Standard, Version 2.1, Implementation Profile for Tactical Hyperspectral (HSI) Systems, Version 1.0, 27 July 2011 defines how an HSI product is structured and what metadata will be contained within a NITFS-compliant HSI product. Any program seeking to produce HSI products or use HSI products can refer to the Implementation Profile to see what is required/expected by/within the NSG for these product types. As such, when the production system is tested for NITFS compliance it will be based on the specifics of the Implementation Profile and its identified NITFS restrictions and not the full bounds of MIL-STD-2500C.

4.2.2 Other examples of this type of approach include: issuing security classification marking guidance for specific exercises (e.g. the Proper Use Memorandum (PUM) NGA 09-018 (Unclassified) for EMPIRE CHALLENGE domestic imagery release); specifying common metadata content requirements (e.g. the EMPIRE CHALLENGE Metadata and file naming requirements document); and documenting specific image identification requirements (e.g. IPON, appendix J, the Tactical Image Identifier). These documents address specific features and capabilities within the NITFS and how NITFS-compliant systems/products will implement them to enhance discoverability, retrievability, understandability, and exploitability by the anticipated and unanticipated user communities.

4.3 Source Production Systems

Generally, these sources generate imagery. The platform type can vary. The following are some of the known NITF related systems. (Note: Existence in this section/list does not assume active NITFS compliance, or that the application is currently in the field, please consult the NITFS registry http://jitc.fhu.disa.mil/nitf/nitf.html).

4.3.1 National Technical Means (NTM)

4.3.2 National Production Systems

a. Enhanced Production System (EPS). The EPS produces compressed and uncompressed, unexploited, single segment NTM images in NITF version 2.0 format files.
b. Low Cost Media (LCM). The LCM system produces compressed and uncompressed, unexploited, single segment NTM images in NITF version 2.0 format files.
c. Dissemination Element (DE). The DE is a system designed to provide users with National Imagery on a near-real-time basis.
d. Front-End Processing Environment (FPE). An image geopositioning and data extraction system used primarily for NTM image assessment, geopositioning, and imagery based production. Typical outputs are refined image metadata (AMSD (1) and USMSD) along with image orthomosaics. New capabilities include the production of CIB and DPPDB products.

4.3.3 NGA In-house Production Products (DPPDB, CIB, CADRG).

NGA maintains some in-house production of DPPDB and CIB for special purpose or high-interest projects, however most DPPDB and CIB production has been out-sourced. NGA no longer produces CADRG in-house, all production has been out-sourced.

4.3.4 NGA Out-sourced DPPDB Producers. T

he DPPDB provides the Warfighter with a deployable resource, in a computer workstation environment, that can quickly and accurately derive latitude, longitude, and elevation. The DPPDB is a digital product historically produced by NGA. It replaced the hardcopy Point Positioning Data Base product. The DPPDB product is an all-digital product consisting of three main components:

- imagery support data
- a map graphic for reference
- stereo imagery

The production of the DPPDB has recently been out-sourced to various vendors. At time of publication the following lists the currently identified outsource producers of the DPPDB file format and within the guidelines of MIL-PRF-89034.

a. BAE Socet Set DataThruWay
b. Raytheon DPPDB Production System
c. Orbimage DPPDB Production System (ODPS)
d. Harris Geospatial Information Production System (GIPS) Baseline

4.3.5 NGA Outsourced Controlled Image Base (CIB) Producers.

CIB is a dataset of orthophotos, made from rectified grayscale aerial images, see MIL-PRF 89041A. CIB supports various weapons, C3I theater battle management, mission planning, digital moving map, terrain analysis, simulation, and intelligence systems. The following lists the currently identified outsource producers of the CIB file format.

a. Orbimage Image CIB Production System
b. Raytheon CIB Production System
c. Harris GIPS Baseline CIB Production
d. SpaceImaging CIB
e. BAE SocetSet DataThruWay
f. General Dynamics Geoeye GeoWorx

4.3.6 NGA Enhanced Controlled Image Base (ECIB) Products.

ECIB is the updated format for CIB products. The new performance specification is currently in the review/approval process. ECIB files are physically formatted within a NITF 2.1 file, with JPEG 2000 compression. The ECIB product can be produced at multiple resolutions. The most common resolutions are 0.5-, 1-, and 5-meter. ECIB also allows for the option of non-standard or native resolution (e.g. airborne sources). The ECIB root directory, named “Enhanced Product Format” consists of four main components:

- TOC.xml
- Overview.ntf
- Shapefiles
- Frame File

4.3.7 Airborne/Tactical Producers

Tactical remote sensing systems may include still and motion imagery from Electro-Optical (all spectra) and Synthetic Aperture Radar (SAR) sensors, to include Ground Moving Target Indicator (GMTI) data sources. Generally, these sources collect imagery and transmit/transfer the collected imagery to a ground station /processor, such as a Distributed Common Ground Surface/System (DCGS) or Common Imagery Processor (CIP). The actual platform type may vary; indeed some of the sensors may be ground- based or water-based. The format of the original imagery as collected may or may not be in the NITF. If it is not, it will require a ground station or some type of processor to convert it into the NITF. NITFS compliance testing will evaluate the conformance and compliance of the imagery products' data and metadata to the applicable standards and assess the discoverability, retrievability, understandability, and exploitability of the imagery product by the anticipated and unanticipated user communities across the NSG Enterprise.

See appendix O for a list of standards and guidance documents frequently used within the Airborne/Tactical Community .

The following are some of the known NITF related systems.
Note: Existence in this section/list does not assume active NITFS compliance, or that the application is currently in the field. This is intended to be a representative list; not all-inclusive. Please consult the NITFS registry http://jitc.fhu.disa.mil/nitf/nitf.html.

a. Global Hawk. The Global Hawk started as an Advanced Concept Technology Demonstration (ACTD) Theater Level Unmanned Aerial Vehicle (UAV) program that produces NITF imagery. A production version and Maritime Demonstration program evolved from the ACTD. The Global Hawk System is comprised of the Global Hawk air vehicle, the ground station, and the support segment. The primary mission of the Global Hawk System is autonomous, long endurance, all weather, day/night wide area reconnaissance and surveillance imagery collection and dissemination. The Block 20 includes the Enhanced Integrated Sensor system (EISS) consisting of a SAR, EO camera, and an IR camera. These imaging sensors, when combined with the ground segment will provide imagery products to user elements.
b. Common Imagery Processor (CIP). The CIP is the primary sensor-processing element of the Common Imagery Ground/Surface System (CIGSS)/Distributed Common Ground/Surface System (DCGS). The function of the CIP is to accept imagery and support data and process it in real time, with latency, into exploitable NITF 2.0 and 2.1 products with the appropriate metadata extensions and output them to other elements of the CIGSS/DCGS.
c. Tactical Unmanned Aerial Vehicle (TUAV). The TUAV system provides intelligence collection and targeting capability as a direct support asset to the Brigade Commander and his staff.
d. Senior-Year Electro-Optical Reconnaissance System (SYERS). The SYERS provides electro-optical and infrared imagery in support of theater commanders. The system required a ground station processor to convert the native format into NITFS files.
e. Joint Surveillance Target Attack Radar System (Joint STARS) Common Ground Station (CGS) Group. The Joint STARS CGS is a mobile multi-sensor Command, Control, Communications, Computers, and Intelligence (C^4I) Imagery Intelligence tactical data processing and evaluation center. Joint Stars can produce NITFS-formatted imagery and GMTI files.
f. SHAred Reconnaissance Pod (SHARP). The SHARP is carried by an F/A-18. The SHARP system is comprised of the CA-279 suite of imaging sensors, a SHARP Reconnaissance Management System (SRMS), a common data link (CDL), a data storage system (DSS), a mission load PCMCIA card and other weapon replaceable assemblies necessary for system operations. SHARP generated imagery is encapsulated in NITF 2.1 files for DSS storage and/or downlink via CDL to a DCGS.
g. Advanced Synthetic Aperture Radar System (ASARS) 2 Improvement Program (AIP). The ASARS-2 Improvement Program (AIP) was designed to bring the latest commercial-off-the shelf (COTS) technology to the warfighter. The AIP brings operational capabilities, including near real-time, precision targeting; broad area synoptic coverage; on-board processing; ground moving target indications; and complex imagery for measurement intelligence applications.

4.3.8.1 Distributed Common Ground/Surface System (DCGS) Instances.

DCGS core components are an integrated set of imagery processing, dissemination, exploitation, and archiving applications for the theater/tactical imagery analysis community. DCGS core components include a CIP, Image Product Library (IPL) and Imagery Exploitation Support System (IESS). DCGS core components must exchange formatted messages, transfer imagery, and support the discovery process through the Distributed Common Ground/Surface Systems Integration Backbone (DIB) Metadata Catalog. DCGS implementations continue to evolve. The list below includes some programs for historical reference and is intended to be representative only.

a. Army
    1. Tactical Exploitation System (TES). TES is the U.S. Army's objective Tactical Exploitation of National Capabilities (TENCAP) system for the 21st century. TES replaces the Advanced Electronic Processing and Dissemination System, Enhanced Tactical Radar Correlator, and Modernized Imagery Exploitation System. TES combines all TENCAP functionality into a single, integrated, scalable system specifically designed for split-based operations as Forward or Main elements. TES serves as an interface between national systems and in-theater tactical forces and directly receives data from theater and tactical assets. TES receives, processes, exploits, and disseminates imagery data from direct downlinks and from ground stations for national and theater platforms. TES serves as the preprocessor of the All Source Analysis System, CGS, and the Digital Topographic Support System.
    2. DCGS-Army (DCGS-A). The core functions of DCGS-A are to Task, Post, Process and Use (TPPU) data from all sources, particularly Army and Joint ISR sensors. DCGS-A will consist of Fixed, Mobile, and Embedded configurations fielded across maneuver, maneuver support, and maneuver sustainment organizations at all echelons. DCGS-A is the net-centric ISR component of the Army's Battle Command System. DCGS-A will provide capabilities necessary for commanders to access information beyond what is collected by their organic assets. DCGS-A will provide access to tactical, theater, and national intelligence collection, analysis, early warning, and targeting capabilities.

b. Navy
    1. Joint Service Imagery Processing System-Navy (JSIPS-N). JSIPS-N, the Navy's implementation of the Joint Service Imagery Processing System (JSIPS) program, is employed both shipboard, and, in some cases, at land-based facilities. JSIPS-N supports the needs of the embarked air wing and flag staff by providing a capability to receive, process, exploit, and disseminate national and theater imagery. The primary function of the JSIPS-N is to provide a means to develop accurate target coordinates and support tactical air Naval strike operations based on near-real-time image receipt, exploitation, and available databases.
    2. DCGS-Navy (DCGS-N). DCGS-N has mostly replaced JSIPS-N and PTW in the Navy. It provides the Navy's primary intelligence, surveillance, reconnaissance and targeting (ISR&T) support capability. DCGS-N is the Navy's primary ISR & T support system, providing processing, exploitation and dissemination services at the operational and tactical levels of warfare. DCGS-N makes maximum use of mature commercial / government-off-the-shelf and joint services software, tools and standards to provide a scalable, modular and extensible multi-source capability that is interoperable with the other service and agency DCGS systems.

c. Air Force (AF)
    1. AF Distributed Common Ground System (DCGS). AF DCGS is a system-of-systems that connects geographically separated fixed and deployed intelligence, surveillance, and reconnaissance ground stations via wide and campus area networks. AF DCGS will be responsive to the intelligence requirements of the unified commands, their delegated representatives, or the Joint Forces Air Combat Command.
    2. Common Imagery Exploitation System (CIES). CIES is a United States Air Force (USAF) DCGS-I system that combines the functionality of Deployable Shelterized System and

Deployable Transit System into a common imagery exploitation system. CIES is a multi-segment, multi-intelligence (multi-INT) system that enables users to receive, transfer, process, exploit, archive, produce, and disseminate imagery and formatted messages from tactical and national reconnaissance imagery assets via direct feeds or downlinks.

3. Korean Combat Operations Intelligence Center (KCOIC). KCOIC is a combined USAF and Republic of Korea Air Force multi-INT Reconnaissance Ground Station. Two fusion centers coordinate their efforts to develop detailed signals intelligence templating and provide automated aids to assist in near-real-time multi-INT, multi-sensor processing, exploitation, and dissemination of intelligence data. Intelligence collection focuses on critical command and control (C2) nodes, guiding collection systems to enemy C2 nodes, correlating databases, and sharing information with other intelligence entities.

d. Marines
   1. United States Marine Corps (USMC) JSIPS-National. USMC JSIPS-National supports USMC national imagery requirements by processing and screening imagery received from the Defense Dissemination System and performing imagery exploitation on selected target imagery. USMC JSIPS-National disseminates reconnaissance reports and exploited secondary imagery to tactical Marine sites.
   2. Tactical Exploitation Group (TEG). TEG is a Marine Expeditionary Force (MEF) asset. TEG processes and screens F/A-18 Tactical Reconnaissance imagery received from mission tapes or data links. TEG performs imagery exploitation on selected target imagery, disseminates reconnaissance reports, and exports secondary imagery to the MEF Intelligence Analysis System via digital tactical backbone communication systems, including subordinate Intelligence Analysis Systems and USMC JSIPS-National.

4.4 Exploitation Applications

4.4.1 Government Developed Exploitation Systems

Government developed exploitation systems continue to evolve. The list below includes some programs for historical reference and is intended to be representative only.

a. Integrated Exploitation Capability. The Integrated Exploitation Capability system provides a Geospatial Intelligence Exploitation Capability - an integrated collection of COTS and GOTS exploitation tools that enables the softcopy exploitation of geospatial-intelligence. The Integrated Exploitation Capability provides COTS-based tools and infrastructure that facilitates NSG exploitation capability. The Integrated Exploitation Capability enables timely access to massive imagery repositories and Multi-INT intelligence (GIS, Advanced Geospatial-Intelligence, ELINT, and SIGINT databases via JWICS/INTELINK) through integrated, synergistic workgroups. The Integrated Exploitation Capability supplements or replaces existing exploitation/production capabilities. The Integrated Exploitation Capability provides imagery users with a comprehensive suite of software and hardware designed to advance imagery exploitation capabilities based primarily on COTS products. The Integrated Exploitation Capability deliveries comply with NSG standards and complement other NGA programs and systems used to manage and support imagery exploitation capabilities.
b. Global Command and Control System - Joint (GCCS-J). GCCS-J is the principal foundation for dominant battlespace awareness, providing an integrated, near real-time picture of the battlespace necessary to conduct joint and multinational operations. GCCS-J fuses select command and control capabilities into a comprehensive, interoperable system by exchanging imagery, intelligence, status of forces, and planning information. Within GCCS-J, the Situational Awareness, Force Protection, and battlespace portions are called the Common Operational Picture (COP). COP is the mechanism for a distributed data processing and exchange environment that allows each Area Of Responsibility to tailor the view to their Command role. A common picture is a key tool for the Commanders in planning, conducting operations, monitoring, execution, and coordinating operations. In addition, the COP is a tool for sharing critical standing and situation dependent information across the battlespace to

achieve success in the full spectrum of operations. COP is currently used to execute operational directives with the Joint Task Forces (JTF) and individual units.

c. Commercial Application Work Station (CAWS). Comprised of Multisource Automatic Target Recognition with Interactive Exploitation (MATRIX) and Multi-image Exploitation Tool (MET).
d. Multisource Automatic Target Recognition with Interactive Exploitation (MATRIX). The MATRIX is a softcopy image and analysis, support data processing and display system designed to support imagery exploitation requirements, such as Indications & Warning, target monitoring, and dynamic targeting. MATRIX has been replaced by the VITEC ELT.
e. Multi-image Exploitation Tool (MET). MET, developed by Harris, is part of the Integrated Exploitation Capability and provides an integrated suite of advanced image analysis, registration and visualization tools that enhance exploitation and expand productivity with automation. MET is also used for commercial exploitation products.

4.4.2 Commercial Exploitation Products

Commercial exploitation applications continue to evolve. The list below includes some programs for historical reference and is intended to be representative only.

a. ERDAS IMAGINE. ERDAS IMAGINE is an image, mapping, and visualization product. IMAGINE enables a user to combine different types of geographic data with imagery and organize the data into a mapping project. IMAGINE provides map composition tools, image rectification and re-projection services, a Global Positioning System receiver live link capability, mosaicking tools, color balancing and image interpretation functions, ortho-rectification capabilities, image classification tools, graphical spatial modeling, and other means for analyzing imagery and geographic data. The IMAGINE software runs on a variety of processing platforms and operating systems. The IMAGINE product was developed by ERDAS of Atlanta, Georgia.
   IMAGINE provides the capability to import and export imagery and/or map compositions to and from the NITFS via an optional add-on software module, the NITF Import/Export module. Likewise, the RPF_Exporter module provides the ability to export CIB and CADRG files according to their respective data product format specifications.
   The IMAGINE NITF Import/Export module provides a means to utilize NITF data by combining imagery, annotation, text and a limited amount of support data. IMAGINE integrates all of this data into a map composition. The NITF module supports NITF 2.0 and 2.1, and NSIF 1.0.
   The IMAGINE RPF_Exporter module provides a means to export NITF data in accordance with the CADRG and CIB Military Specifications (MIL-C-89038 and MIL-C-89041 respectively). Note that the product names CADRG and CIB are registered trademarks. Only NGA authorized producers generate CADRG and CIB. This test only assessed the ability of the IMAGINE RPF_Exporter module to produce data products according to the CIB and CADRG product specifications and related standards. Completion of this NITFS test does not grant authorization to produce NGA CIB and CADRG products.
b. Overwatch Systems Boston Operations (OSBO) (formerly Paragon Imaging, Inc.) family of imagery applications. OSBO provides an assortment of at least nine image processing software applications. The applications provide image processing and exploitation capability or, in some cases, limited display and exploitation functionality for a wide variety of users. The functionality supported by some of the products include: Image Quality and Enhancement, Geo Mensuration, Geospatial Data Integration, Geo-Registration, Robust Symbology Management, Automatic Target Recognition and NTM capabilities using a mix of NITF, GeoTIFF, and Shape files as well as other commercial file formats. The OSBO imaging applications can ceate and produce NITF products from both NITF and non-NITF sources. Additionally, the OSBO applications can support the NSIF 1.0 to the same degree as NITF 2.1. The following are imaging applications within the OSBO family:
   - ELT/5500
   - ELT/5500PRO

- ELT/3500
- ELT/1500
- Global ImageViewer
- ImageScout with Image Light Table (ILT) Plus
- ImageScout with ILT Plus Special Edition
- ELT/NET (interpret only)
- RemoteView

c. Digital Imagery Exploitation Production System (DIEPS). GTE Government Systems Inc. sponsored and developed the DIEPS v5.0.1-2. DIEPS generates, transmits, receives, and interprets grayscale and color imager, labels, symbols, and text files. The DIEPS product consisted of eight separate platform configurations of which one was successfully tested for TACO2 compliance.
d. Geo*View. Geo*View was developed by the Multi-Sensor Exploitation Branch of the Air Force Research Laboratory (AFRL). The Geo*View is a JAVA©-based, platform independent, geospatial imagery data viewer, and an NITF viewing and metadata editing tool. The Geo*View is designed for use by the warfighter as well as the imagery analyst. Originally designed to support viewing and editing NITF data, Geo*View has since been augmented with tools supporting imagery and video exploitation. The Geo*View allows the user to view and edit existing NITF, NSIF, and a number of commercial product formats. Additionally, the users are able to add annotations and text to images, edit headers, and delete or add informational TREs. PAR has renamed the application GV.
e. PhotoTelesis Image & Communication Environment (ICE). ICE 4.0 provides imagery capture and tactical communication functions to the Lightweight Video Reconnaissance (LVRS) Army program and the Over-The-Horizon (OTH) Airborne Sensor Information Systems Navy program.
f. VITec. This commercial software product provides users with the capability to display, parse, and exploit NITF files. The VITecPC, version 4.1.1 provides tools for displaying, parsing, exploiting, and analyzing NITF 2.1, 2.0, 1.1 (interpret) and NSIF 1.0 digital imagery. The VITecPC supports National and Commercial SDEs and PIAEs. VITec was replaced by SOCET GXP®.
g. Common Spectral Measurement and Signature Intelligence (MASINT) Exploitation Capability (COSMEC). The COSMEC is a spectral processing software package focusing on analysis and interpretation of spectral data. The COSMEC is an imagery processing software package mainly focusing on analysis and interpretation of spectral data. It provides the capability to develop and generate intelligence information products from spectral data. COSMEC is developed to interpret data formats from HYDICE, HYMAP, Landsat, SPOT, TRIPS, IKONOS, SINDRI, and NITF 2.0 and 2.1. COSMEC is capable of converting the pixel cube data and limited support data information from the spectral formats into NITF 2.1 format. It is also capable of limited modification and repacking (adding CGM annotations and text segment data) of NITF files.
h. Image Scout. Image Scout with ILT Plus SE is an NITF 2.1 CLEVEL 7 imagery application that runs on a Windows XP 32-bit hardware platform. The application provides high performance wide-area search and negation tools for NTM imagery as well as advanced ELT exploitation functionality, including support for many commercial imagery file formats. This support includes layering of multiple imagers to one view, geo-referenced chipping, ultra smooth panning, 30+ imagery algorithms, blend/flicker/swipe with multiple imagers or maps, snail-trail recording, and advanced graphics tools. For the NTM capability, ImageScout with ILT Plus SE is configured with the NGA RULER mensuration software to exploit NTM imagery products.
i. Environment for Visualizing Images (ENVI) Software. The ENVI family of software solutions is an imagery processing application developed by ITT Visual Information Solutions for use by the commercial industry, government agencies, and academia. The ENVI product comes with two integrated user interfaces - the common ENVI Standard and the new ENVI Zoom. While the ENVI principally provides processing and analysis tools for spectral data (multispectral and hyperspectral), it also provides a set of tools for traditional image analysis.

Image processing functions/tools supported by ENVI include: image enhancement tools, image registration and orthocorrection (geometric correction tools), qualitative and quantitative change detection, three dimensional views (drapes) of imagery data over corresponding terrain (elevation) data, creation of image subsets (chipping), image feature classification algorithms, terrain analysis, radar image data analysis, map composition, and a number of Geospatial Information System (GIS) features including importing a number of GIS vector formats. ENVI users can also access and view streamed Image Access Solutions imagery using the ENVI Zoom interface.

The ENVI Standard interface imports a variety of image formats, including those used for satellite and airborne sensors as well as those used by other image processing software. ENVI capably imports and exports NITF-formatted files when configured with the NITF plug-in module. At this point in time, the NITF module focuses on providing the ability to import/export a wide variety of image data (pixel values) options and providing limited support for interpretation and generation of image support data as contained in NITF TREs and DESs. ENVI makes the data field content of TREs and DESs available for human view and provides ground-coordinate to image-coordinate correlation for commercial satellite-sourced NITF imagery that contains the rapid positioning capability and the DIGEST TREs GEOPS, PRJPS, GEOLO (Local Geographic), and MAPLO (Local Cartographic).

The ENVI Zoom interface is a new simplified re-architecture of the ENVI Standard interface and currently installs along with the established ENVI Standard interface in order to provide comprehensive support for full ENVI and NITF capabilities since the ENVI Zoom interface does not yet have all the necessary capabilities. The new UI of ENVI Zoom allows for rapid display of images and ease of use for image display manipulation not provided in the ENVI Standard interface. ENVI Zoom includes a limited set of the functionality from within the ENVI product. The image processing functions/tools supported by ENVI Zoom includes: display enhancement, anomaly detection, and creation of image subsets (chipping). ENVI Zoom is capable of importing and exporting NITF-formatted files and currently does not support display of NITF graphics segments.

ITT developed the ENVI NITF module using a set of re-usable software libraries. The ITT NITF Libraries (NITFLib) software modules provide a variety of interpret and generate capabilities for NITF files and for imagery files formatted per the NSIF. Developers created the NITFLib for potential re-use in support of a variety of DoD-sponsored efforts and programs.

j. SOCET GXP®. SOCET GXP® is an imagery processing software application developed by BAE Systems that provides the ability to process a wide range of imagery from both government and commercial sources. The product is capable of supporting image and geospatial analyst production needs with a scalable software configuration. The user can display, manipulate, annotate, and extract information, as well as export data in standard formats with flexible information layout and manipulation. It is capable of interfacing with Geographic Information Systems and Visualization/Simulation systems.

   SOCET GXP® is intended to provide support to the warfighter by allowing users to view, report, and analyze remote sensing data and customers with the capability to visualize, parse, mensurate, geo-position, and archive NITF imagery. The SOCET GXP® has the capability to display and manipulate multiband images, either manually or by applying previously developed algorithms. The product supports a variety of NITF TREs that have been identified and are in use within the Commercial, Airborne, and National communities.

k. Multi-image Exploitation Tool (MET). MET, developed by Harris, provides an integrated suite of advanced image analysis, registration and visualization tools that enhance exploitation and expand productivity with automation.

4.5 Archive and Dissemination Applications

Archive and dissemination applications continue to evolve. The list below includes some programs for historical reference and is intended to be representative only.

a. Image Product Library (IPL). The IPL plays a significant role in the NSG Architecture providing for the storage, cataloging, discovery, retrieval, and delivery of imagery products to users of the NSG.
b. NGA Library (NL). The NL plays a significant role in the NSG Enterprise by providing for the storage, cataloging, discovery, retrieval, and delivery of imagery products to NSG users.

4.6 Management Applications

Management applications continue to evolve. The list below is intended to be representative only.

a. Imagery Exploitation Support System (IESS). Provides automated support for the imagery exploitation cycle. This cycle includes exploitation management and reporting requirements, imagery selection and dissemination, production of Imagery Interpretation Reports (IIR), and packaging and distribution of IIRs. These IIRs must be distributed within timelines consistent with mission requirements, database management, and research capabilities. The IESS can be single or multi-hosted with shared database access.
b. Air Force Mission Support System (AFMSS). AFMSS consists of computer and software tools that support aircraft and weapon mission planning. AFMSS uses several different hardware versions, all comprising commercial off-the-shelf components. AFMSS core software is combined with tailored Aircraft/Weapon/Electronics modules to provide a Mission Planning System (MPS) for each aircraft type. The outputs of AFMSS-based MPSs are combat mission folders (comprising maps, images, and flight information) and data transfer devices.
c. Planning Tool for Resourse Integration, Syncronization, and Management (PRISM). A web based set of applications fielded to the theaters and commands. It operates on both JWICS and SIPRNet and provides numerous tools for the theater/JTF collection and exploitation managers. The PRISM interfaces with IESS and the Common Sensor Planner to provide collection and exploitation requirements management information to DCGS-Imagery Intelligence operators.

4.7 Commercial Imagery Providers

Commercial imagery providers are a relatively new source. It should be expected that participating companies will change as new technologies and capabilities are developed. The list below includes some programs for historical reference and is intended to be representative only.

a. Space Imaging. Space Imaging’s IKONOS earth imaging satellite provides a reliable stream of image data for commercial high-resolution satellite data products. IKONOS produces 1-meter black-and-white (panchromatic) and 4-meter multispectral (red, green, blue, near-infrared) imagery that can be combined in a variety of ways to accommodate a wide range of high-resolution imagery applications. All Space Imaging imagery products are either processed at the Ground Station in Thornton, Colorado and/or at the Regional Operation Centers at various locations around the world. The Ground Station software used to process all Space Imaging System products is developed and maintained by Raytheon System Company. The Ground Station software can output a number of file formats including NITF 2.0. When requested, the Ground Station software will process imagery and produce data files conforming to MIL-STD-2500A, Change Notice 3, National Imagery Transmission Format (Version 2.0). The same Ground Station software is used by all regional affiliates.
b. DigitalGlobe Quickbird 02 (QB02). The QB02 is a collection and production system that produces high-resolution earth images in a variety of processing levels. The lowest available processing level above raw data, Level 1, is divided into two sub-levels termed 1A considered Raw and 1B which is called Basic. 1A imagery is delivered in individual Detector Chip Array (DCA) files that can be ordered with or without radiometric correction and with or without non-responsive detector fill. 1B images are virtual linear arrays which have been generated from the DCA strips and are radiometrically and geometrically corrected. 1B images have been

resampled to a map grid but not projected onto the Earth. 1A data is geometrically raw, whereas 1B data will include sensor corrections, accounting for image artifacts due to optical distortion and detector geometry. The level 2A or Rectified product is rectified product to a customer selectable map projection and datum.
The QuickBird sensor is a pushbroom imager and therefore acquires image data one line at a time by sweeping across the earth's surface. The QuickBird platform supports 12 detector chip assemblies (DCAs) or detector arrays. There are 6 DCAs for the panchromatic (PAN) band, and 6 DCAs for the multispectral (MS) bands. Each PAN DCA contains 1 linear detector array. Each MS DCA contains 4 linear arrays representing the colors blue, green, red, and near infrared.

c. ClearView. ClearView is an NGA contract defining dataset requirements for Commercial Data Providers (CDPs). Participating CDPs are Space Imaging, DigitalGlobe and OrbImage. The datasets are created in NITF 2.0 and are provided to the Commercial Satelite Imagery Library (CSIL) for archival and follow-on dissemination to NGA customers worldwide.
d. NextView. NextView is an NGA contract defining dataset requirements for CDPs. Participating CDPs are DigitalGlobe and GeoEye (Space Imaging and OrbImage merger). The datasets are created in NITF 2.1 employing JPEG 2000 compression and DIGEST TREs. The NextView files are provided to the unclassified NGA Library (UNIL) for archival and follow-on dissemination to NGA customers worldwide.
e. EnhancedView. EnhancedView is another NGA contract defining dataset requirements for CDPs. DigitalGlobe (the sole CDP after the merger with GeoEye) is expected to launch the WorldView-3 satellite in 2014. DigitalGlobe intends to deliver spectral diversity and offer multiple Short-Wave Infrared bands that allow for accurate imaging through haze, fog, dust, smoke and other air-born particulates.

4.8 Specialized Applications and Code Libraries

Commercial exploitation applications continue to evolve. The list below includes some programs for historical reference and is intended to be representative only.

a. NITF Services Library (NSL). The NSL is a set of Application Program Interfaces (APIs) that will be used to provide NITF and imaging capabilities for the latest release of Defense Information Infrastructure (DII) Common Operating Environment (COE) software. This is in support of the Joint DoD community and specifically the DISA. Application developers will use the public APIs provided by the NSL to process, display, and create NITF products. The NSL is being included in the DII COE as a COE Component of the Imagery Toolkit (IMTK). The NSL will eventually become the mandated set of APIs to use when processing NITF, NSIF, and BIIF imagery in the DII COE.
b. CASE Executive. A user environment that supports the analysis of SAR complex data. It provides a GUI for a collection of tools, algorithms, and other services for complex data exploitation. The algorithms operate upon complex images to produce output reports in the form of text, plots or derived complex images. CASE Executive provides a set of viewers that allow the analyst to examine these outputs in whichever form they take. CASE Executive is also structured to allow individual users to easily integrate and configure their own local algorithms into the GUI.
c. Synthetic Imagery Generation System (SIGS). The SIGS is a computer-based system that provides rapid generation of photorealistic synthetic imagery. A user selects a background terrain image and manually inputs (or receives inputs from a simulator) the geographic location, number and status of Order-of-Battle equipment (i.e., vehicles, aircraft, ships), location of fixed objects (i.e., buildings), and basic reconnaissance platform attributes such as viewing angle and resolution. SIGS uses these inputs to generate synthetic imagery that is utilized in military exercises and training events when live imagery is not available. The integration of imagery enhances the realism of the training activities and validates prototype secondary image dissemination networks. SIGS has the limited ability to input background terrain imagery in NITF (first image in an NITF file) and output the generated images up to

1024x1024 pixels in the NITF format. Several enhancements have been added to SIGS version 5.5 affecting NITF file processing. The user interface was converted from C++ to Java, while most of the image file processing remained in existing C++ libraries. This required the implementation of a Java Native Interface (JNI) layer between the Java user interface and C++ libraries for both import and export of images. The native background format for SIGS was migrated to NITF file format instead of the SIGS-unique format of earlier versions. Additionally, the capability was added to import large NITF CLEVEL 6 images along with an enhanced ability to maintain the bit depth of background images through the import, generation, and export processes.

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Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

APPENDIX A

ACRONYMS
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
16 July 2013	Added DCGS-N and definition for “DIA”	For completeness.
16 July 2013	Updated foreword.	For clarification.
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions.

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG) Enterprise, systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

ABPP	Actual Bits Per Pixel
ACF	Asymmetrical Correction Factor
ACTD	Advanced Concept Technology Demonstration
AEDP	Allied Engineering Document Publication
AF	Air Force
AFMSS	Air Force Mission Support System
AFRL	Air Force Research Laboratory
AGIPDD	Advanced Geospatial Intelligence Product Description Document
AIP	Advanced Synthetic Aperture Radar System 2 Improvement Program
AMC	Air Mobility Command
ANSI	American National Standards Institute
AOI	Area of Interest
API	Application Program Interface
ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
ASARS	Advanced Synthetic Aperture Radar System
ASCII	American Standard Code for Information Interchange
ASDE	Airborne Support Data Extensions
BCS	Basic Character Set
BCS-A	Basic Character Set - Alphanumeric
BCS-N	Basic Character Set - Numeric
BIIF	Basic Image Interchange Format
BIT	Binary Digit
BWC	Bandwidth Compression
C2	Command and Control
C^3I	Command, Control, Communications, and Intelligence
C^4I	Command, Control, Communications, Computers, and Intelligence
CADRG	Compressed ARC Digitized Raster Graphic
CAPCO	Controlled Access Program Coordination Office
CAWS	Commercial Application Work Station
CC	Common Client
CCITT	Consultative Committee for International Telegraph and Telephone
CCS	Common Coordinate System
CDL	common data link
CDP	Commercial Data Provider
CE	Controlled Extension
CEW	Common Exploitation Workstation
CGM	Computer Graphics Metafile
CGS	Common Ground Station
CIB	Controlled Image Base
CIES	Common Imagery Exploitation System
CIGSS	Common Imagery Ground/Surface System
CIO	Central Imagery Office
CIP	Common Imagery Processor
CJCSI	Chairman, Joint Chiefs of Staff Instruction
CLEVEL	Compliance Level (for version 2.0) Complexity Level (for version 2.1)
COE	Common Operating Environment
COMRAT	Compression Rate Code
CONOPS	Concept of Operations
COSMEC	Common Spectral Measurement and Signature Intelligence Exploitation Capability
COTS	Commercial Off-The-Shelf
CR/LF	Carriage Return/Line Feed
CSIL	Commercial Satelite Imagery Library
CSMWG	Community Sensor Model Working Group

DCA	Detector Chip Array
DCA	detector chip assemblies
DCGS	Distributed Common Ground/Surface System
DCGS-A	Distributed Common Ground/Surface System-Army
DCGS-I	Distributed Common Ground/Surface System-IMINT
DSGS-N	Distributed Common Ground/Surface System-Navy
DCID	Director of Central Intelligence Directive
DCT	Discrete Cosine Transform
DE	Dissemination Element
DES(s)	Data Extension Segment(s)
DEZ	Domestic Exclusion Zone
DIA	Defense Intelligence Agency
DIB	Distributed Common Ground/Surface Systems Integration Backbone
DIEPS	Digital Imagery Exploitation Production System
DIGEST	Digital Geographic Information Exchange Standard
DII	Defense Information Infrastructure
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DISR	Department of Defense Information Technology Standards Registry
DoD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DPDW	Digital Products Data Warehouse
DPPDB	Digital Point Positioning Data Base
DPS	Digital Production System
DSS	Data Storage System
DSS	Deployable Shelterized System
DTED	Digital Terrain Elevation Data
DTS	Deployable Transit-cased System
ECS-A	Extended Character Set - Alphanumeric
EISS	Enhanced Integrated Sensor system
EIT	Enhanced Integration Tool
ELINT	Electronic Intelligence
ELT	Electronic Light Table
ENVI	Environment for Visualizing Images
EO	Executive Order
EPS	Enhanced Production System
FAF	Fast Access Format
FPE	Front-End Processing Environment
GENC	Geopolitical Entities, Names, and Codes
GEOINT	Geospatial Intelligence
GeoSDE	Geospatial Support Data Extension
GeoTIFF	Geostationary Earth Orbit Tagged Image File Format
GIAS	Geospatial and Imagery Access Services Specification
GIF	Graphics Interchange Format
GIG	Global Information Grid
GIPS	Geospatial Information Production System
GIS	Geospatial Information System
GMTI	Ground Moving Target Indicator
GMTIF	Ground Moving Target Indicator Format
GOTS	Government Off-The-Shelf
GSD	ground sample distance

GUI	Graphical User Interface
GWG	Geospatial Working Group
HFE	Human Factors Engineering
IAMP	Imagery Acquisition Management Plan
IAS	Image Access Service
IC	Image Compression
IC	Intelligence Community
ICAT	Image Category
ICE	Image & Communication Environment
IDEX	Image Data Exploitation
IEC	International Electrotechnical Commission
IESS	Imagery Exploitation Support System
IIF	Image Interchange Facility
ILT	Image Light Table
IMAG	Image Magnification
IMINT	Imagery Intelligence
IMODE	Image Mode
IMODE B	Band interleaved by Block
IMODE P	Band interleaved by Pixel
IMODE R	Band interleaved by Row
IMODE S	Band Sequential
IMTK	Imagery Toolkit
IP	Internet Protocol
IPL	Image Product Library
IPON	Implementation Practices of the National Imagery Transmission Format Standard
IR	Infrared
ISO	International Organization for Standardization
ISR	Intelligence, Surveillance, and Reconnaissance
ISSE	Information Support Server Environment
JCSI	Joint Chiefs of Staff Instruction
JFIF	Joint Photographic Experts Group File Interchange Format
JIEO	Joint Interoperability and Engineering Organization
JITC	Joint Interoperability Test Command
JNI	Java Native Interface
Joint STARS	Joint Surveillance Target Attack Radar System
JP2	Joint Photographic Experts Group 2000 minimal interchange format
JPEG	Joint Photographic Experts Group
JSIPS	Joint Service Imagery Processing System
JSIPS-N	Joint Service Imagery Processing System-Navy
JSIPS-Nat	Joint Service Imagery Processing System-National
JTW	Joint Tactical Workstation
JWICS	Joint Worldwide Intelligence Communications System
KCOIC	Korean Combat Operations Intelligence Center
LAT	Latitude
LCM	Low Cost Media
LF	Line Feed
LL	lower left
LON	Longitude
LR	lower right
LUT(s)	Look-up Table(s)
LVRS	Lightweight Video Reconnaissance

MATRIX	Multisource Automatic Target Recognition with Interactive Exploitation
MEF	Marine Expeditionary Force
MET	Multi-image Exploitation Tool
MIL-C	Military Specification
MIL-HDBK	Military Handbook
MIL-PRF	Military Performance Specification
MIL-STD	Military Standard
MINT	Multi-Source Intelligence Toolkit
MIS	Multi-image Scene
MITOC	Multi-Image Scene Table of Contents
MMU	Memory Management Unit
MOA	Memoranda of Agreement
MPF	Master Product File
MS	Multispectral
MSI	Multispectral Imagery
MTF	Message Text Format
MTI	Moving Target Indicator
Multi-INT	Multi-Intelligence
N/A	not applicable
NATO	North Atlantic Treaty Organization
NBPP	Number of Bits Per Pixel
NCDRD	National Imagery Transmission Format Version 2.1 Commercial Dataset Requirements Document
NCGIS	National Center for Geospatial Intelligence Standards
NES	National Exploitation System
NGA	National Geospatial-Intelligence Agency (formerly National Imagery and Mapping Agency)
NIIEE	National Imagery and Mapping Agency Imagery Information Exploitation Environment
NIMA	National Imagery and Mapping Agency
NITF	National Imagery Transmission Format
NITFIRD	National Imagery Transmission Format Implementation Requirements Document
NITFLib	National Imagery Transmission Format Libraries
NITFS	National Imagery Transmission Format Standard
NL	National Geospatial-Intelligence Agency Library
NSG	National System for Geospatial-Intelligence
NSIF	North Atlantic Treaty Organization Secondary Imagery Format
NSGPDD	National System for Geospatial-Intelligence Product Description Document
NSL	National Imagery Transmission Format Services Library
NSPIA	National Imagery and Mapping Agency Standards Profile for Imagery Archive
NSS	National Security Systems
NTB	National Imagery Transmission Format Technical Board
NTM	National Technical Means
NUTA	National Imagery and Mapping Agency United States Imagery and Geospatial System Technical Architecture
OASD/C^3I	Office of the Assistant Secretary of Defense, Command, Control, Communications, and Intelligence
ODNI	Office of the Director of National Intelligence
ODPS	Orbital Digital Point Positioning Data Base Production System
OIM	Orthorectified Image Mosaic
OSBO	Overwatch Systems Boston Operations
OSI	Open Systems Interconnection
OTH	Over-The-Horizon

PCMCIA	Personal Computer Memory Card International Association
PDA	Personal Digital Assistant
PIAE	Profile for Imagery Archive Extension
PNG	Portable Network Graphics
PPPS	Point Positioning Production System
PRISM	Planning Tool for Resource Integration, Synchronization, and Management
PTW	Precision Targeting Workstation
PUB	Publication
QB02	Quickbird 02
RDPS	Raytheon Digital Point Positioning Data Base Production System
RES(s)	Reserved Extension Segment(s)
RGB	Red, Green, and Blue
RIF	RULER Interface Format
ROME	Reconnaissance Operations Management Enterprise
RPC	Rapid Positioning Capability
RPF	Raster Product Format
RRDS(s)	Reduced resolution data set(s)
RSM	Replacement Sensor Model
SAF/AQIJ	Secretary of the Air Force for Acquisition, Reconnaissance Systems Division
SAR	Synthetic Aperture Radar
SATOC	Standard American Standard Code for Information Interchange Table of Contents
SCI	
SDE(s)	Support Data Extension(s)
SHARP	SHAred Reconnaissance Pod
SHCM	Seam Hole Composite Map
SIC	Security Indicator Code
SIDS	Secondary Imagery Dissemination System
SIGINT	Signals Intelligence
SIGS	Synthetic Imagery Generation System
SIPRNet	Secret Internet Protocol Router Network
SPIFF	Still Picture Interchange File Format
SRMS	SHAred Reconnaissance Pod Reconnaissance Management System
SRTM	Shuttle Radar Topography Mission
STA	Standard
STANAG(s)	Standardization Agreement(s)
STE	Secure Terminal Equipment
STU-III	Secure Telephone Unit-3rd Generation
SYERS	Senior-Year Electro-Optical Reconnaissance System
TACO2	Tactical Communications Protocol 2
TBD	To Be Determined
TBP	To Be Published
TBR	To Be Researched
TCP	Transmission Control Protocol
TEG	Tactical Exploitation Group
TENCAP	Tactical Exploitation of National Capabilities
TES	Tactical Exploitation System
TFRD	Tape Format Requirements Document
THED	Terrain Height Error Data
TIFF	Tagged Image File Format
TII	Tactical Image Identifier
TLM	Tile Length Marker
TOC	Table of Contents

TPPU	Task, Post, Process and Use
TRE(s)	Tagged Record Extension(s)
TUAV	Tactical Unmanned Aerial Vehicle
U.S.	United States
U/FOUO	Unclassified/For Official Use Only
U8S	Universal Multiple Octet Coded Character Set Transformation Format8 Subset
UAV	Unmanned Aerial Vehicle
UCS	Universal Multiple Octet Coded Character Set
UIP	United States Imagery and Geospatial System Interoperability Profile
UL	upper left
UNIL	Unclassified National Geospatial-Intelligence Agency Library
UR	upper right
URL	Uniform Resource Locator
USAF	United States Air Force
USIGS	United States Imagery and Geospatial System
USMC	United States Marine Corps
USMSD	Universal Sensor Model Support Data
USMTF	United States Message Text Format
UT1	Universal Multiple Octet Coded Character Set Transformation Format 1
UTC	Coordinated Universal Time (i.e., ZULU)
UTF-8	Universal Multiple Octet Coded Character Set Transformation Format 8
VIMAS	Visible, Infrared, and Multispectral Airborne Sensor
VQ	Vector Quantization
WAMTI	Wide Area Moving Target Indicator
WGS 84	World Geodetic System 1984
XML	extensible mark-up language
YCbCr	Y=Brightness of signal, Cb=Chrominance (blue), Cr=Chrominance (red).

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Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

APPENDIX B

NITFS OPERATION COLLECTION MODEL VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description
B-4	TBD001	B.1.3 Background.

Change Log

Date	Pages Affected	Mechanism
18 July 2013	B-5 and B-7	Community review of IPON version 2.0

Editors Notes

Date	Change	Rationale
16 July 2013	Updated foreword.	For clarification.
16 July 2013	“discernable” “,	For correctness
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

B.1 INTRODUCTION

B.1.1 Purpose.

This appendix describes the imaging operation models that form the foundation for the proper use and application of National Imagery Transmission Format Standard (NITFS) products that contain prominent groups of Support Data Extensions (SDEs). It is to specify a common basis of understanding for those involved in the specification, implementation, validation testing, and eventual compliance testing of systems that use NITF products containing SDEs. This appendix also addresses the implications of extracting (chipping) portions of image products while maintaining the integrity of the associated support data.

B.1.2 Scope.

The models described in this appendix address the following groups of NITF Tagged Record Extensions:

- National Technical Means Support Data Extensions
- Airborne Support Data Extensions (ASDEs)
- Raster Product Format Support Data Extensions (RPF SDEs)
- Digital Point Positioning Data Base Support Data Extensions (DPPDB SDEs)
- Geospatial Support Data Extensions (GeoSDEs)

B.1.3 Background.

(TBD001)

B.1.4 References

STDI-0002	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 4.0, 1 August 2011
STDI-0001	National Support Data Extension (SDE) (Version 1.3) for the National Imagery Transmission Format Standard (NITFS), 2 October 1998
S2035A	NITF Implementation Requirements Document (NITFIRD)
MIL-STD 2411	Raster Product Format, 6 October 1994, Change Notice 1 17 January 1995, Change Notice 2 16 August 2001
MIL-STD 2411-1	Registered Data Values for Raster Product Format, 30 August 1994, Change Notice 1 16 August 2001
MIL-STD 2411-2	Integration of Raster Product Files into the National Imagery Transmission Format, 26 August 1994
MIL-PRF 89041A	Controlled Image Base (CIB), 28 March 2000
MIL-PRF 89038	Compressed ARC Digitized Raster Graphics (CADRG), 6 October 1994, Amendment 1 27 April 1999, Amendment 2 28 March 2000
MIL-PRF 89034	Digital Point Positioning Data Base (DPPDB), 23 March 1999, Amendment 1 27 June 2000

B.1.5 Definitions

a. Bar (WAMTI). A portion (strip) of a WAMTI frame.
b. Block, NITF. An indexed (row/column) structural unit of pixels (sub-array) within an NITF file, often referred to as a tile.
c. Block, Coverage. A defined coverage area of pixel values for which the attributes and parameters within a TRE(s) are applicable, sometimes referred to as a scan block.
d. Canted Search Scene. A series of search mode scenes where the direction of each scene center line varies. For example, a series of short scans along a winding canyon conducted as a single planned imaging operation.

e. Frame. An image collected from a framing sensor, point sensor, or a spot sensor. An imaging operation (scene) may consist of collecting one or more frames (images).
f. Frame (WAMTI). A unit of SAR data when operating in the Wide Area Moving Target Indicator (WAMTI) mode. The WAMTI Frame data may be subdivided into Bars.
g. Image. A row/column (line/sample) array of pixel values (imagery data) the mission planner has identified for collection within a collection scene. The imagery data that results from an imaging operation of a sensor. An image is often subdivided into indexed rows/columns of blocks/tiles. One or more images may comprise a scene.
h. Look. A mechanism for identifying/grouping related images of a Multi-image Scene (MiS). A Look has roughly the same footprint/coverage as the MiS.
i. Mission Identifier / Mission Number. An identification of the specific collection mission that identifies the imagery collection mission to automated management systems and their users.
j. Moving Target Search Mode(s). An imaging operation mode wherein the detected information is moving targets instead of pixels.
k. Operation Number. Within a collection mission, there may be numerous collection tasks or objectives to collect data for specific areas of interest. Each task/objective for an area of interest results in an imaging operation. One or more images can be collected during an imaging operation. A unique operation number (index value or count) is assigned to each imaging operation to differentiate among separate imaging operations. The operation number is part of the information used by external systems to track products that result from the imaging operation task/objective.
l. Point Mode(s). Some framing or point sensors have multiple modes of operation, that is, different parameters of operation for which the sensor may be tasked for image collection. For example, a sensor with narrow, medium, and wide modes of operation may provide options for small, medium, and wide area fields of view for collected image frames.
m. Scene. A planning concept used somewhat differently depending on the context of the planned collection. An imaging scene is a single image, or a collection of images that provides contiguous coverage of an area of interest. This term is often used interchangeably with imaging operation and image. A collection scene may be initiated by three types of planning processes: (1) Collection Plan; (2) Re-Tasking; and (3) Unplanned/Immediate.
n. Scene Number vs. Operation Number. There are several conventions for assigning scene and operation numbers. Generally, for airborne collection systems, the scene number and operation number are the same thing. See the discussion on Multi-Image Table of Content elsewhere in this document for details on handling multi-image scenes.
   Other practices do exist. For example, presume a mission is planned to collect imagery over three areas of interest. The first area can be satisfied with a single image collection (first imaging operation, 1 image/scene); the second area requires 4 images (second imaging operation, 4 images/scenes); the third area requires 1 image (third imaging operation, 1 image/scene). In this example, one means of indexing is to re-initialize the scene number index for each new Operation number (i.e., Op1, Sc1; Op2, Sc1, Sc2, Sc3, Sc4; Op3, Sc1). Some collection systems internally manage imaging operations by a simple indexing of each instance of single image collection, whether or not there are more than one image being collected for the scene. This indexing approach uses the first scene number of the imaging operation as the Operation Number (i.e., Op1, Sc1; Op2, Sc2, Sc3, Sc4, Sc5; Op6, Sc6). There is no right or wrong approach. The objective is to establish a unique means of tracking/managing imaging operations. (The second approach does greatly reduce the number of actual imaging operations that can be tracked in a single mission because it precludes the re-initialization of scene numbers for each imaging operation).
o. Search Mode(s). Generally a mode of continuous imaging. It may consist of continuous line scanning or a series of frame shots, a series of Spot collections, etc. May be called scan mode.
p. Spot Mode(s). A SAR imaging operation mode similar to frame modes for electro-optical cameras. The detected image is of a specific size (vice continuous scan) aimed at a center point.

B.2 OPERATION COLLECTION MODEL

B.2.1 Model Overview.

The model focuses on the following inter-related aspects of imagery collection and production:

a. The planning means (model) for describing how the data is to be collected.
b. The image model for orienting, ordering and structuring the actual collected data to correlate with the collection-planning model.
c. The model for packing the collected data (image operation model) into physical NITF files while maintaining association with the imaging operation.
d. The means of clearly associating pixels in NITF files with their original position in the initial collection imaging operation and the associated attributes and parameters from the original collection.
e. The means for mission planning systems, imagery product management systems, archive and dissemination systems, exploitation systems, etc. to correlate physical NITF files with the original product tasking, imaging, and production attributes.

B.2.2 Planning Model.

The planning part of the model attempts to generalize how system operators describe what is to be collected. The main objective is to create a common understanding of how data elements used in the file header, image subheader and SDE fields correlate to the collection planning processes. Automated process management systems desire to track the workflow from imagery requirement initiation, to planning the collection, executing the collection, processing the collected data, exploiting the collection, all the way through product(s) delivery, archive, and dissemination. Consequently, the data element terms applicable to the planning process must be used consistently throughout the entire process.

B.2.3 Image Data Collection Model.

The collected pixel data is eventually stored in NITF formatted files, either by on-board processing or processing at the ground station. The sensor produces the imagery data using (and constrained by) its available modes of collection based on its view of the image/scene to be captured as described by the collection plan. Regardless of the physical sensor processes used to collect the image data, there is an implied image/scene structure that makes up the imaging operation. This implied image scene may be of a nature or size that all of it never gets realized in a physical sense as a single entity (e.g., a single computer file). It is therefore useful to have an image operation model of the row/column (line/sample) matrix/grid of the data as originally collected by the sensor as described in the collection plan. This image operation has attributes and parameters associated with each pixel based on sensor outputs and navigational aids associated with the collection process. Some aspects of exploitation processing of the physical NITF files may require mapping pixels in the NITF files to their as collected position within the original collection grid (implied image) to make better use of the support data associated with the image.

B.2.3.1 Image Operation Model. The implied image consists of the row/column array(s) of pixels collected by a single imaging operation of the sensor (as inherently defined for that specific type of sensor). The array(s) of pixels may be blocked (tiled). Each block is given a reference row/column number beginning with row 1, column 1: 1,1; 1,2, ... 1,C; 2,1; 2,2; ...2,C; ..... R,1; R,2 ... R,C. Each contiguous row/column array can be conceived of as a single NITF image segment that is not constrained by field size constraints or other physical constraints imposed by current state of computer operating systems. The bounds are determined by the sensor’s mode of operation. Some of these image operations may be physically stored as single NITF image segments, or the image operation may be segmented (i.e., divided) into multiple NITF image segments.

B.2.3.2 Image attributes and parameters. Support data associated with the image operation describe the attributes and parameters about the image collection. In some instances, the area of coverage (scope) of the data is the entire set of pixels in the image. In other instances, the parameters/attributes are different for various portions of the image. Therefore, a means must exist to identify the coverage of parameters and attributes with respect to the entire image.

B.2.3.3 Image Segmentation. An imaging scene may be logically segmented (e.g., segment AA, segment AB, etc.) There are two circumstances for segmenting an implied image:

- The single image scene is so large, that it needs to be logically segmented into portions to ease physical storage and indexing constraints (e.g., row/column pixel counts; block number counts, etc.).
- To treat the multi-image scene collection scenario as if it were a single image entity. For this case, each image (sub-scene) in the imaging operation scene is designated as a segment (AA, AB, AC, etc.) of the overall abstract image.

Note: For legacy National Technical Means (NTM) data, the concept of segmentation is independent from the row/column indexing of Fast Access Format (FAF) blocks. The FAF block indexing does not re-initialize at segment boundaries.

B.2.3.4 Image Attribute Coverage Blocks. Each image segment (AA, AB, AC, etc) may be virtually subdivided into Coverage Blocks. When the attributes and parameters about the pixels within an image segment varies across the segment, Coverage Blocks shall be defined to associate attribute and parameter data (e.g., SDE data) with the appropriate pixels within the segment to which the data is applicable. Some systems refer to this concept as Scan Blocks.

B.2.3.5 Patches. Patches are an example of parameters/attributes varying across the pixels of an abstract image. Consider a continuous SAR search scene. As batches of SAR phase history data are processed into pixels, the resulting set of pixels (Patch) has parameters/attributes unique to that process. The correlation of the support data with the appropriate pixels (area of coverage) must be maintained when packing the image operation into NITF file structures. The potential exists for the set of pixels within a patch to be physically stored in a single NITF image segment, across several NITF image segments, or for multiple patches to be stored within a single NITF image segment. Additionally there could be a single image segment or multiple image segments stored within a single NITF file.

B.2.3.6 Processing Image Data into NITF Files. There are four principle scenarios available when processing the collected image data and its associated support data into physical NITF files based on the abstract image structure of the original imaging operation. The four scenarios are:

- Single Imaging Operation Packed into a Single NITF image Segment.
- Multiple Imaging Operations Packed into a Single NITF image Segment.
- Single Imaging Operation Packed into Multiple NITF image Segments.
- Multiple Imaging Operations Packed into Multiple NITF image Segments.

B.2.3.6.1 Single Imaging Operation Packed into a Single NITF Image Segment. This is the most straightforward approach for storing the original imaging operation into NITF. Care must be taken to assure the support data is properly associated with the appropriate pixel coverage. For example, a SAR search scene could potentially be stored in a single NITF image segment, but would likely have multiple PATCH extensions in the image segment subheader to identify varying coverage parameters as the along-scan pixel index increases.

B.2.3.6.2 Multiple Imaging Operations Packed into a Single NITF Image Segment. This approach results in a mosaic of the multiple image collection scenes pieced together into a single NITF image segment. When the support data varies for each of the original pieces, the BLOCK TRE or another means is needed to correlate multiple sets of support data to the applicable coverage areas within the image segment.

B.2.3.6.3 Single Imaging Operations into multiple NITF Image Segments. Production timeliness objectives may force asynchronous multiprocessing, wherein the abstract image needs to be divided into multiple NITF files. Multiple small files better serve limited processing capacity. Several options need to be considered:

B.2.3.6.3.1 Single Image Segment per NITF File. A single imaging operation could be stored as multiple NITF files, each NITF file having a single image segment. For this case, there must be some means provided to associate where the pixel coverage of each file relates to the overall image operation. There must be a means to associate support data coverage with applicable pixel data coverage. The proper local/global application of support data parameters and attributes must be clearly discernible.

B.2.3.6.3.2 Multiple Image Segments per NITF file. A single imaging operation could be stored as multiple NITF files, each NITF file having multiple image segments. The multiple image segments within the file can be mosaicked together in the CCS using the values in the ILOC, IDLVL, and/or IALVL fields. The image segments may or may not overlap depending on the capabilities of the sensor/generating software. Each image segment should contain the metadata associated with the pixel data coverage.

B.2.3.6.4 Multi-Image Scene (MiS) Table of Contents (MITOC). The DCGS community in conjunction with the NTB developed the MITOC extension to solve some of the challenges created with advanced framing and similar sensors implementing multi-image, to include multi-look, scene collects. Since framing and similar sensors often collect thousands of images just to satisfy one tasked scene, the tracking and maintenance of the images proved cumbersome. The MITOC paradigm prescribes a flexible method to organize the images and support data. The MITOC can be used for all of the alternatives described above. See STDI-0002, appendix O, for a full description of the MITOC.

B.2.4 Image Array and Pixel Geometry.

The organization of pixel values into arrays, the definition of pixel shape, and the correlation of pixel position with the geometry of the sensor collection are integral to the proper interpretation of the image support data. Appendix C lays a foundation for understanding key concepts for correlating support data coverage with pixel arrays. Appendix D provides standard IDs, naming conventions, and product identifiers.

Implementation Practices
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National Imagery Transmission Format Standard (IPON)

APPENDIX C

IMAGE ARRAY AND PIXEL GEOMETRY
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
16 July 2013	Modified foreword, changed font on page number.	For clarification and correctness.
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4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with National NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

C.1 General

To define, clarify, document, and attempt to establish consistency in the interpretation of Pixel Geometry and Pixel Support Data Extension (SDE) Grid Associations with regard to positioning, mensuration, and image chipping as used in National Imagery Transmission Format (NITF). The goal of this effort is to capture, quantify, and document these complex, but typically undefined, concepts such that NITF applications now and in the future will consistently implement them.

C.2 Background

Testing uncovered inconsistent results in simple geographical point extractions. Different interpretation and implementation of the following concepts appear to contribute to these discrepancies:

- Associating desired pixel indices/location in the NITF image data value array with the actual pixel location in SDE Coverage Grid Space (Pixel SDE Grid Association).
- Determining appropriate geometric/grid reference for the area within a desired pixel (Sub-Pixel Geometry).
- Relationship between the terms "LINE and SAMPLE" and "ROW and COLUMN" and their associated indexing conventions as used in the NITF suite of standards and support data specifications.
- Addressing pixel accumulation associated with reduced resolution data sets (RRDSs) and the related accuracy degradation.

C.3 Discussion

C.3.1 Pixels and Grid Interrelationships

Pixel SDE grid association is the concept whereby an Exploitation Application must be capable of accurately and consistently identifying ROW and COLUMN index values from the ordered NITF image array. Specifically, the Exploitation Application must be able to account for interrelationships of, and the effects associated with, image display rotation, alternate resolutions, and derived image product (chip or full imaging operation) in determining where the pixel of interest actually lies in a grid space upon which the associated support data is based.

A step-by-step discussion is necessary to identify the theoretical process involved with selecting a pixel of interest and obtaining a geo-point to which it is associated.

In figure C-1, the graphic represents an NITF image rendered for display. The ordered ROW (LINE) and COLUMN (SAMPLE) pair of (1,2) correctly identifies the NITF indices of the shaded pixel of interest. (Note: The NITF image array indices are zero-based, in accordance with Military Standard (MIL-STD) 2500A, paragraph 5.5.1.1).

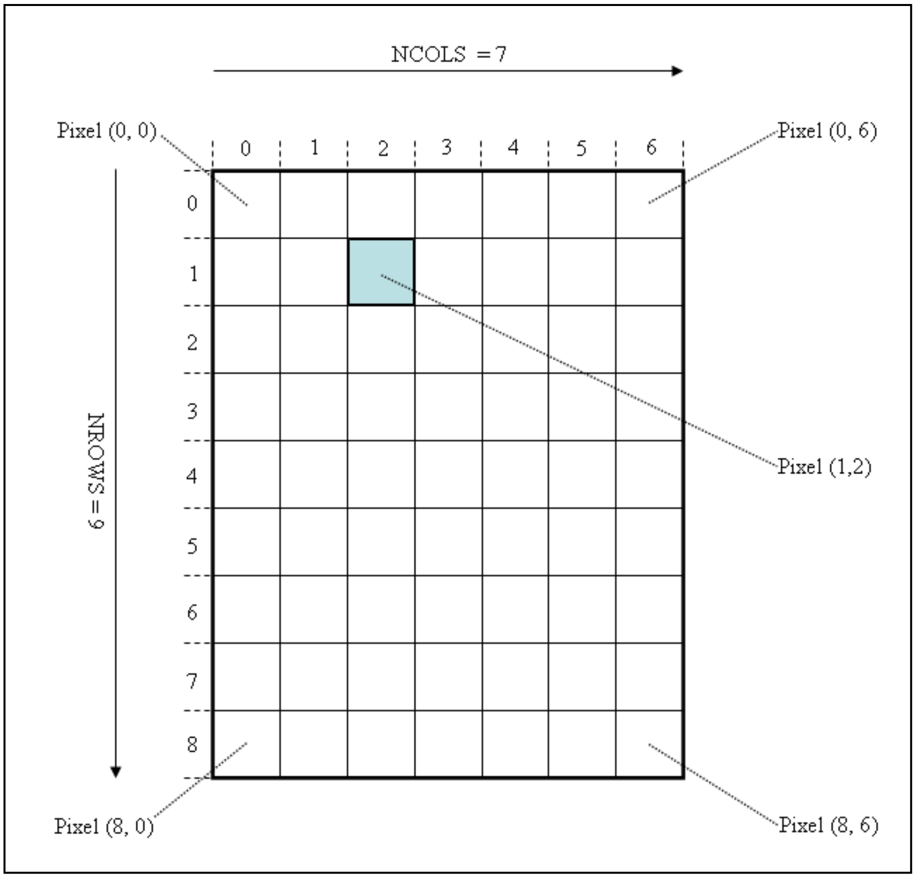


Figure C-1. Storage Array Grid

Pixel Geometry is used to define the process of identifying or establishing a pixel reference index point that can be used to represent the physical area covered by the pixel.

The ICHIPB specification allows for decimal values in its output product and full image grid point references. Considering the existence of decimal pixels, a means must exist to uniformly refer the collective pixel to its space within the support data. For non-rotated imagery, the mid-point of the pixel of interest is centered upon its respective location in SDE space. Using figure C-2 as an example, the pixel of interest (1,2) in the image Storage Array Grid maps to ROW and COLUMN pair (1.5,2.5) in the Spatial Grid.

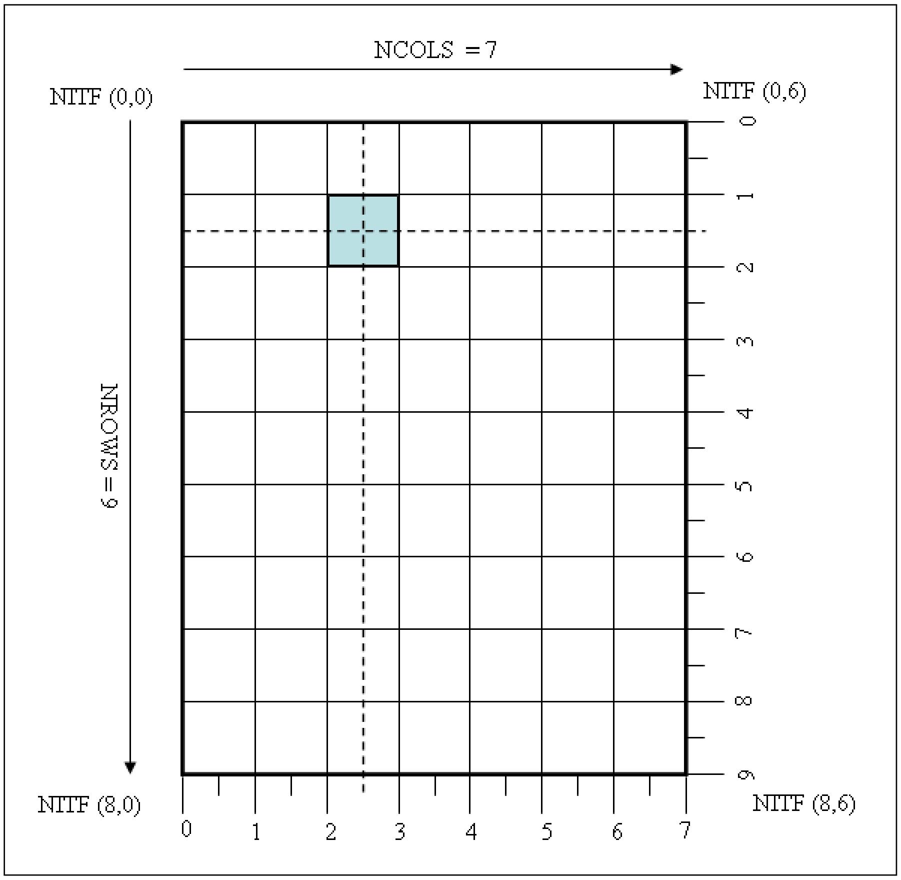


Figure C-2. Spatial Grid

In practice, Exploitation Applications employ different conventions. Using the same example, an Exploitation Application might submit ROW and COLUMN pair (2,3), from a unit counting notation rather than centered-index notation. Two different ROW and COLUMN pairs were derived for the same pixel of interest in figure C-2, other conventions could also be used. While some of these notations may seem unusual, without clear implementation guidance they can exist.

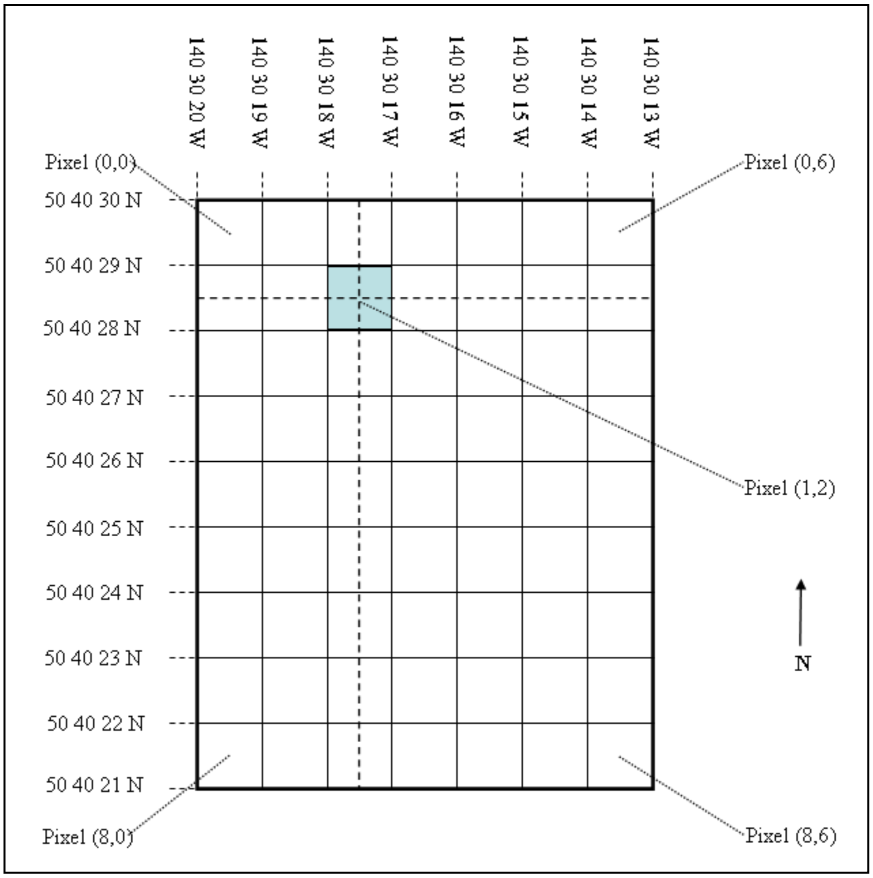


Figure C-3. Geographical Grid

Once the pixel of interest has been mapped from the Storage Array Grid to a Spatial Grid, the spatial grid references must be applied to a Geographical Grid identifying the physical location of the pixel. The Geographical Grid is typically formed from information provided by the image's SDEs. Figure C-3 provides a representation of the original pixel of interest (1,2) mapped to a Geographical Grid.

In the representation shown in figure C-3, pixel of interest (1,2) in the original Storage Array Grid covers a 1-second cell on the Earth, and the center-point is (50 40 28.50N,140 30 17.50W). An Exploitation Application or other implementation should calculate or determine this value if selecting the same pixel of interest.

C.3.2 Image Resolution and Pixel Accumulation

In many cases, it is difficult to identify the origin of reduced resolution data sets. Attempts to exploit this imagery may be challenging. Test efforts uncovered four general areas needing additional information and guidance to improve production and interpretation consistency. These areas are:

- Anamorphic/Asymmetrical Correction
- Reduced Resolution Data Sets
- IGEOLO, Mensuration, and Support Data
- Algorithms

C.3.2.1 Anamorphic/Asymmetrical Correction

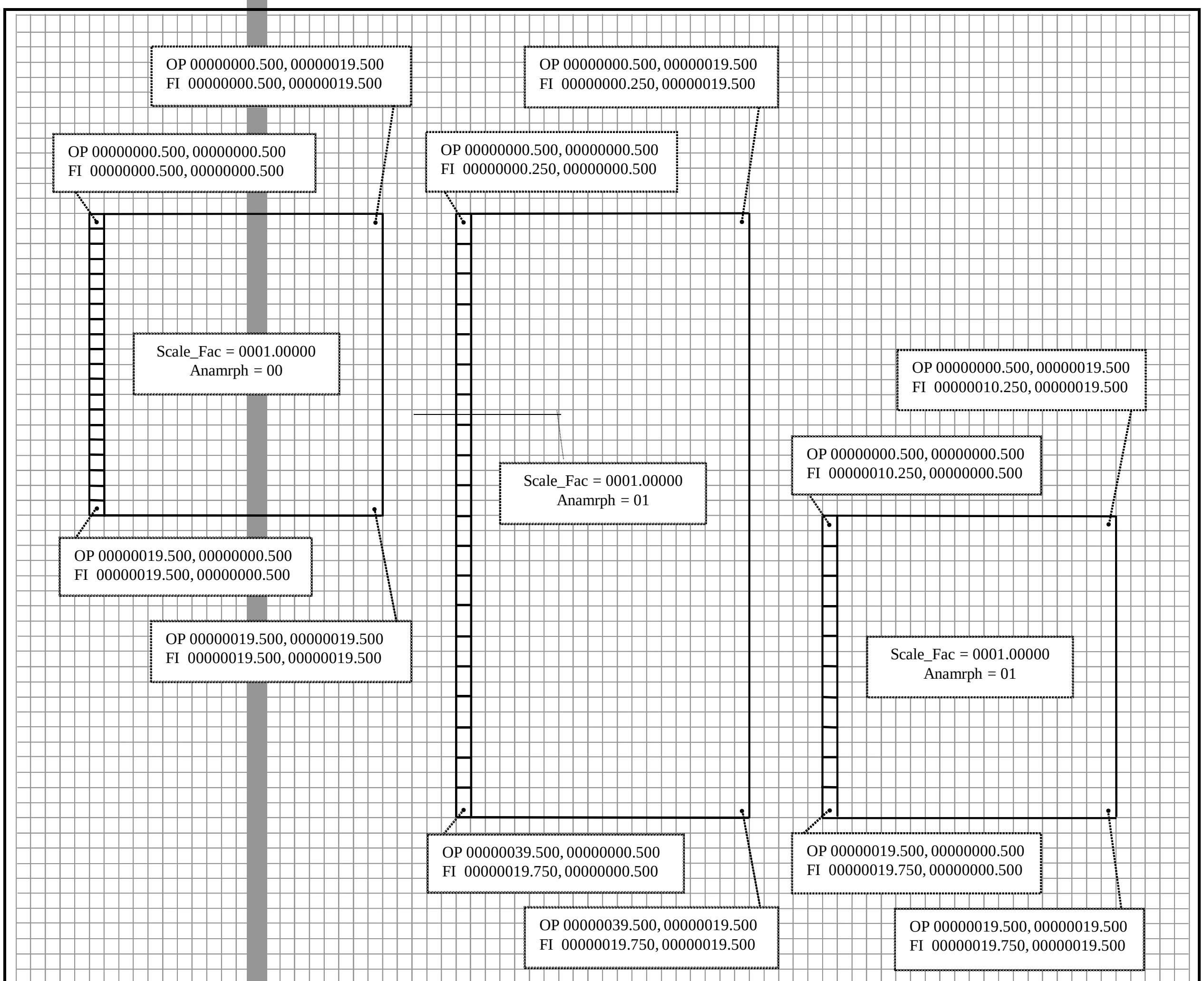


Figure C-4. Anamorphic Correction

Figure C-4 illustrates the anamorphic correction process, including original and subsequent dimensions. The image is full (IMAG = 1.0) resolution.

The original image is 20 pixels by 20 pixels. Continuing across the illustration, anamorphic correction results in a corrected image of NROWS = 40 and NCOLS = 20. Lastly, a chip cut from the lower half of the corrected original image maps the chipped image coordinates to the full image coordinates.

C.3.2.2 Reduced Resolution Data Set (RRDS)

The Reduced Resolution Data Set process provides the user community a method to reduce a large image into a more manageable scale. The geographical coverage presented in a RRDS remains unchanged, only the pixel array size is altered. The process of reducing imagery necessitates pixel accumulation. A single pixel represents more visual and geographical space in the reduced resolution than in the full resolution image.

Performing a half resolution reduction would result in the full resolution image (R0) being reduced by a factor of 2 in both row and column directions at each step in the RRDS generation process. Accordingly, the resulting image (R1) area is reduced to ¼ (IMAG = /2 or .5) of the original image for the R1 image and ⅛ (IMAG= /4 or .25) for the R2 image. The corresponding ICHIPx TRE data, necessary to denote the resulting aggregate pixel locations in the original, full resolution image (full image values) are provided to illustrate that although the IGEOLO geographic corner coordinates remain unchanged during the RSET generation process, the ICHIPx corner grid point indices do change to reflect the changed area represented by the aggregated pixels.

It should be noted that reduced scale output products can be legitimately produced in various scales to meet user requirements. The RRDS powers-of-two convention whereby the original image's rows and columns are reduced by a power of two remains in common use by image processing applications, often produced as temporary files to facilitate faster scrolling during image display.

C.3.2.3 RRDS, Mensuration, and Support Data

All RRDS retain the same coordinate values as those of the original full image (R0). This permits users to generate consistent, interpolated values from IGEOLO corner points for all image resolutions. While granularity is lost in the scaling process, as can be seen in table C-1, virtually no difference should be experienced between geospatial measurements from IGEOLO interpolation. The full image values in the ICHIPx TRE change within the RRDS product sequence to map the center of the ever larger ground coverage of the aggregated pixel area to the center of that same pixel array on the full image. Geospatial measurements from mensuration engine-generated values from the support data remain accurate, but with a lesser precision due to cursor pointing errors due to pixel accumulation. Figure C-6 illustrates this concept.

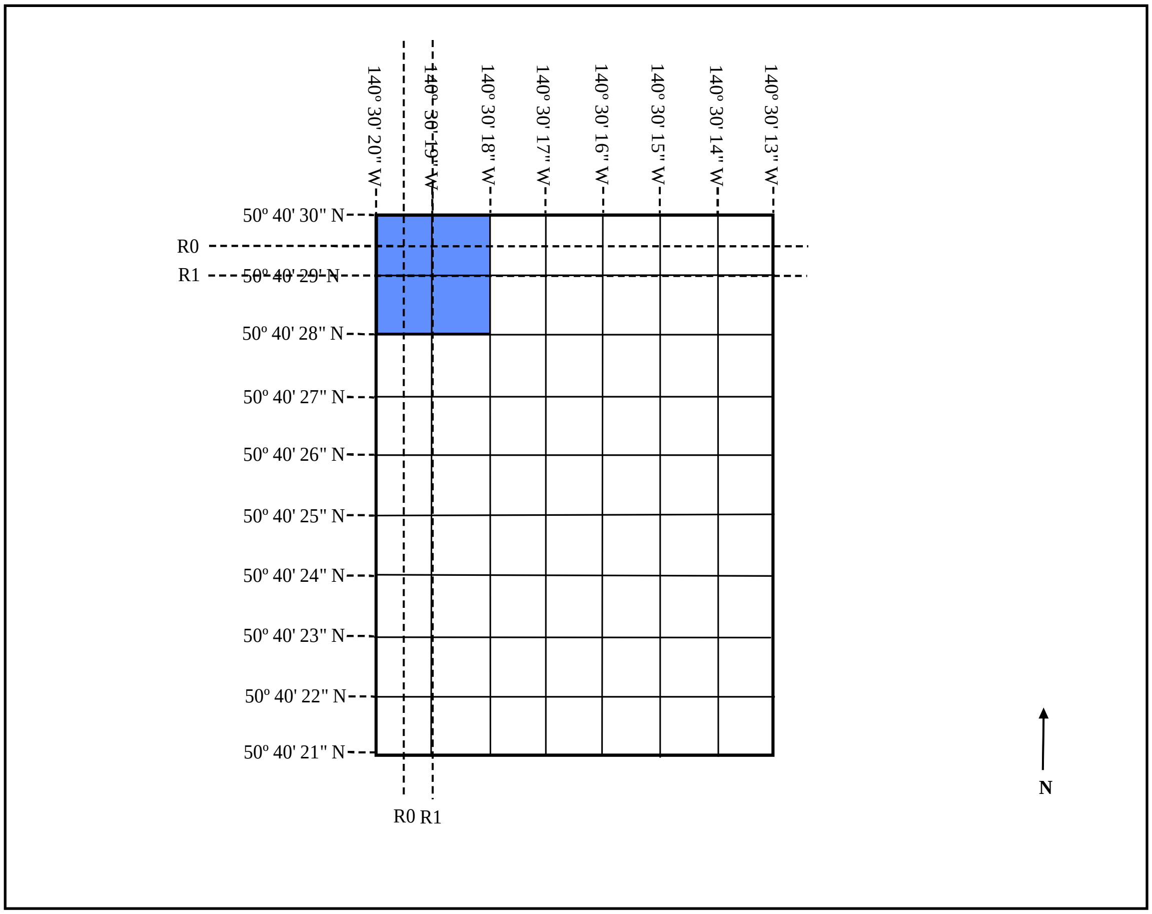


Figure C-5. Geographical Points

When obtaining measurements in this example, the expected geo-point values from RRDS mensuration for the first (0,0) pixel of the R0 image are:

50º 40' 29.50" N 140º 30' 19.50" W

The shaded area in this illustration represents the first pixel (0,0) in the R1 RRDS of the same image. Expected geo-point values from either of the methodologies above are:

50º 40' 29.00" N 140º 30' 19.00" W

(Note: The IGEOLO values assume that the interpolation process is capable of precision to 2 decimal places.)

NITF system developers should design their implementations in a manner to generate IGEOLO values accurately from the associated image's support data in the following manner:

UL Corner LAT:	Mensurated Image Pixel Latitude + 0.5 GSD
UL Corner LON:	Mensurated Image Pixel Longitude + 0.5 GSD
UR Corner LAT:	Mensurated Image Pixel Latitude + 0.5 GSD
UR Corner LON:	Mensurated Image Pixel Longitude - 0.5 GSD
LR Corner LAT:	Mensurated Image Pixel Latitude - 0.5 GSD
LR Corner LON:	Mensurated Image Pixel Longitude - 0.5 GSD
LL Corner LAT:	Mensurated Image Pixel Latitude - 0.5 GSD
LL Corner LON:	Mensurated Image Pixel Longitude + 0.5 GSD

(Note: The 0.5 GSD adjustment accounts for the distance from the center of the pixel of interest to its edge in either the X or Y directions. This is based upon the convention whereby the center (0.5,0.5) of a pixel is used to generate measurements for the pixel of interest. This example assumes the Northern and Western Hemispheres and that the image orientation is north up. Imagery from other hemispheres and other orientations would have to be adjusted appropriately.)

C.3.2.4 Algorithms

The following algorithms are offered to assist in calculating ICHIPB corner points and were used in determining the values in the examples.

a. To determine ICHIPB output product corner points (center-of-pixel) an image:

OP_ROW_11 = 1 - 0.5
OP_COL_11 = 1 - 0.5
OP_ROW_12 = 1 - 0.5
OP_COL_12 = (NCOLS / SF) - 0.5
OP_ROW_21 = (NROWS / SF * ACF) - 0.5
OP_COL_21 = 1 - 0.5
OP_ROW_22 = (NROWS / SF * ACF) - 0.5
OP_COL_12 = (NCOLS / SF) - 0.5

where:

ACF = Asymmetrical Correction Factor and:

1 x 1 = 1.00
1 x 2 = 2.00
2 x 3 = 1.50
etc.

(Note: ACF never applies to the column direction)

SF = Scale Factor from IMAG and ICHIPB and:
1.0 = 0001.0000 (R0)
/2 = 0002.0000 (R1)
/4 = 0004.0000 (R2)
etc…

NROWS and NCOLS are the dimensions of the original image

b. To determine a corrected and/or reduced resolution pixel's location in uncorrected and/or full resolution pixel grid space (e.g., ICHIPB FI_ROW_nn/FI_COL_nn values):

$$UNCORRECTED\_PIX\_LOC = \frac{CORRECTED\_PIX\_LOC}{ACF} \times SF$$

(Note: When calculating a column value, ACF is always 1)

c. Likewise, to determine an uncorrected and/or full resolution pixel's location in corrected and/or reduced resolution pixel grid space:

$$UNCORRECTED\_PIX\_LOC = \frac{CORRECTED\_PIX\_LOC}{SF} \times ACF$$

(Note: When calculating a column value, ACF is always 1)

Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

APPENDIX D

STANDARD IDENTIFICATION (ID) AND NAMING CONVENTIONS
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
18 July 2013	Changed font of page number, added space between two words in paragraph D.11.2 and corrected cite to figure number D-3.	For correctness
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions.

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the NITFS suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with National Imagery Transmission Format (NITF) version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

D.1 General

This appendix identifies general issues and guidance related to Standard ID and naming conventions. It also identifies community uses of each of them, where known.
The naming conventions described in this appendix have been developed to support several processing levels of imagery related products.

- Single image—single source, whether full image or a chip (partial) image. In this case the acquisition Image ID convention can be meaningfully used as a base name for subsequent processed images.
- Single image—multiple sources. The source files may be merged, mosaicked, or specially processed using advanced techniques to produce a single output image. In this case one of the source files may be designated "primary" and form the basis for subsequent naming decisions, or a new "product line" convention developed.
- Multiple image—single source. When a single input image is processed using several different techniques or sets of processing parameters and the resulting files are "bundled" into a single NITF file the acquisition Image ID is relevant, but care must be taken to distinguish it from the original source.
- Collections of related single NITF images. Some NITF image products are distributed on media organized within a hierarchical file structure; often by geographic location. In such cases the NITF file names may be database oriented and lack any reference to source. Naming conventions apply not only to filenames, which may be subject to computer operating system constraints, but to several data fields within the NITF structure, each of which may have field length limitations.
- The NITF 2.0 and NITF 2.1 main header File Title (FTITLE) field (80 characters) is often identical to the operating system filename (less an .ntf or .nitf extension). Exploited files often use topical or command specific names in the FTITLE field.
- The NITF 2.0 Image Subheader Image Title (ITITLE) field and the NITF 2.1 Image Identifier 2 (IID2) field (both 80 characters) are used to retain the acquisition Image ID as long as remains meaningful. When multiple sources are involved some producers designate one the primary source and enter it's ID, others assign a producer / control number sequence which can be traced back to the source if need be.
- The NITF 2.0 Image Subheader Image ID (IID) field and the NITF 2.1 Image Identifier 1 (IID1) field (both 10 characters) are used to designate the product line or processing descriptor applicable to the file. It does not identify the particular source image from which the product is derived.

Several alternative methods for identifying imagery products and assigning file names are in use within the National System for Geospatial-Intelligence (NSG) community. The file naming conventions addressed in this appendix are:

- 40-Character
- 57-Character
- 59-Character
- Moving Target Indicator (MTI)
- Controlled Image Base (CIB)/Compressed ARC Digitized Raster (CADRG)
- Digital Point Positioning Data Base (DPPDB)
- Digital Geographic Information Exchange Standard (DIGEST)

D.2 Legacy NTM Naming Convention

D.2.1 40-Character Naming Convention. This file naming structure consists of a 40-character image identifier described in Table D-1.

Table D-1. 40-Character Image Identifier (Generic)

Position	Description	Range
1-7	<u>Image/Product Date</u> The date representing the currency of the image product data; the date the image data was acquired. This date shall be the same as the date recorded in the NITF image subheader IDATIM field.	DDMONYY
8-11	<u>Mission Number, Primary</u> An alphanumeric code that identifies the collection means for the imagery product. E.g., mission project number, DIA-assigned Project Code, aircraft identifier, etc. The allowed values are constrained to the alphanumeric value range or value list specified for the applicable collection system and its associated production system.	Mission and/or collection system specific. See the specification for the applicable product identification TRE.
12-13	<u>Mission Number, Secondary</u> An alphanumeric code that refines/expands the mission number by providing an 'instance' sequence. E.g., a flight number, a fly-over index/count, a re-visit number, etc.	01 - 09 A1 to A9 B1 to B9 … Z1 to Z9 00
14-16	<u>Image Operation Number</u> The index value (count) of the acquisition or collection task/objective that resulted in this product.	000 to 999
17 - 18	<u>Beginning Image Segment ID</u> A code used in conjunction with other fields in the identifier to characterize multi-segment products. For single-segment products, the value is always 'AA'. For multi-segment products, the value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging operation, the code is 'AA'. When the identifier refers to a portion of the imaging operation, the code is that of the segment to which the first pixel value in the portion belongs.	AA to ZZ
19 - 20	<u>Reprocess Number</u> A code to differentiate different instances of the same image product resulting from reprocessing of the source data and/or enhancement processing of the originally processed image data. The value '00' indicates the data is the originally processed image. Values in the range '01' through '99' represent subsequent instances of reprocessing or enhancement processing.	00 to 99
21 - 23	<u>Replay</u> Replay indicates whether the data was retransmitted or re-stored to overcome exchange errors. Its value allows differentiation among multiple transmissions or exchanges of the same image product. The value '000' indicates that the data is from the initial exchange. Values in the range 'T01' to 'T99' indicate the instance of retransmission. Values in the ranges 'P01' to 'P99' and 'G01' to 'G99' are reserved for future use.	000, G01 to G99, P01 to P99, T01 to T99

Table D-1. 40-Character Image Identifier (Generic)

Position	Description	Range
24	Reserved for System Specific Use. The default values for this field are Underscore '_' and the Space character. When using the identifier as a file name, the underscore character is used. Either may be used when the identifier is used within NITF subheader or SDE fields.	Underscore (_) Space Character
25 - 26	Starting Column Block (or Tile) Number (See Note 1) The NITF block column index number for the first block of the image segment present in the actual data coverage to which the identifier is applicable. The column count is relative to the start of the segment specified by the Beginning Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is '01'. When the identifier refers to a portion of the imaging segment, the code is the column index of the block to which the first pixel value in the data coverage belongs. For single block images this field contains 01.	01 - 99
27	Flag1 Reserved for system specific indicator flag. Default value is 0	0
28 - 31	Starting Row Block (or Tile) Number The NITF block row index number for the first block of the image segment present in the actual data coverage to which the identifier is applicable. The row count is relative to the start of the segment specified by the Beginning Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is '01'. When the identifier refers to a portion of the imaging segment, the code is the row index of the block to which the first pixel value in the product coverage belongs. For single block images this field contains 00001.	0001 - 9999
32 - 33	Ending Image Segment ID For single-segment products, the value is always 'AA'. For multi-segment products, the value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging operation, the code is that of the last segment in the imaging operation. When the identifier refers to a portion of the imaging operation, the code is that of the segment to which the last pixel value in the portion belongs.	AA to ZZ
34 - 35	Ending Column Block (or Tile) Number The NITF block column index number for the last block of the image segment present in the actual data coverage to which the identifier is applicable. The column count is relative to the start of the segment specified by the Ending Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is the last column index in the entire segment. When the identifier refers to a portion of the imaging segment, the code is the column index of the block to which the last pixel value in the data coverage belongs. For single block images this field contains 01.	01 - 99

Table D-1. 40-Character Image Identifier (Generic)

Position	Description	Range
36	Flag2 Reserved for system specific indicator flag. Default value is 0	0
37 - 40	Ending Row Block (or Tile) Number The NITF block row index number for the last block of the image segment present in the actual data coverage to which the identifier is applicable. The row count is relative to the start of the segment specified by the Ending Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is the last row index in the entire segment. When the identifier refers to a portion of the imaging segment, the code is the row index of the block to which the last pixel value in the data coverage belongs. For single block images, this field contains 00001.	0001 - 9999
Note 1: The most common image block size used for large images is 1024 X 1024 pixels. The block size used within each file is specified in the Image Subheader in the Number of Pixels Per Block Horizontal (NPPBH) and Number of Pixels Per Block Vertical (NPPBV) fields.		

D.1.2 Relation Of Segment/Block Values To Data Coverage. Values for beginning and ending image segments and starting and ending block numbers are populated from the perspective of the entire data coverage of the identified imaging operation. The values are populated when an NITF file is first created from raw data or other non-NITF source (typically a TFRD file), and when only a portion of the maging operation is processed, the segment and block numbers reflect the location of the newly created file relative to the entire data coverage of the imaging operation. The starting segment value and the starting block row/column values in the NITF 2.0 Image Subheader ITITLE field or NITF 2.1 IID2 field reflect the offset from the origin (0,0 point) of the math model pertaining to the collection operation, and as such should not be changed if the National SDEs applicable to mensuration are to remain valid.

D.1.3 57-Character Naming Convention. This file naming structure consists of the 40-character image identifier described in Table D-1 followed by a 17-character suffix that addresses two characteristics of image files related to distribution and storage. Image files are often made available to users in a reduced resolution option to provide an overview (thumbnail) of the entire image or to provide more rapid scanning (viewing) of large images. Secondly, complete images in full resolution may exceed the file size limits of some computer operating systems and can be broken up into a related group of smaller files. The suffix consists of the following:

FFFFFFFFFFFFFFFFFFF…..FFFFFFFFFFFFFFFFFFF.rN_PART_nn_OF_mm.NTF

Where:

FFFF…	The 40-Character Image Identifier (see table D-1).
.rN	Indicates the resolution of the image within the file. r0 indicates the image is of original/full resolution. r1 through r9 indicate reduced resolution by factors of 2 (1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128).
_PART_nn_OF_mm	Indicates that the file is instance nn of mm total files that comprise the entire product specified by the 40-character identifier. When the total number of files comprising the entire product is not known, the mm value is set to 00 to indicate the count is unknown. The actual count should be placed in the last file of the product sequence.
.NTF	An optional extension to indicate the file is formatted in NITF.

D.1.4 Naming Persistence. When an NITF file is first created from raw data or other non-NITF source (typically a TFRD file) the NITF 2.0 File Title (FTITLE) field and the Image Subheader Image Title (ITITLE) field were always identical. For convenience, the file name of unexploited NTM image also used the 57-character identifier contained in the FTITLE (adding an .ntf extension). The file name and the FTITLE typically represented the actual pixel coverage (in terms of the beginning and ending segment and column/row indexes) in the NITF file and were changed as the image was chipped or scaled to different dimensions. The Image Subheader Image Title (ITITLE) field, however, was left unchanged as a record of the identification and dimensions of the original NITF source file.

D.3 Generic Naming Convention

D.3.1 59-Character Product Identifier. When originally proposed, the intent was that both National Technical Means (NTM) and commercial sources would adopt this common identifier, derived from the STDIDC TRE. Legacy NTM stayed with the 40-character ID; future NTM is developing an alternate ID structure. Although commercial sources populate STDIDC TRE, there is no express requirement to derive an image ID from this TRE for use in ITITLE/IID2, FTITLE, or filename. The only association for the 59-character ID, as derived from STDIDC, is the use of the 59-character ID in the STREOB TRE for associating imagery pairs or sets. See NITFS Application Summaries for commercial sourced NITF data for description of current practice for commercial image identifiers.

D.3.2 59-Character Image Identifier. The 59-character image identifier structure provides a means for uniqueness of product identification and for association of multiple files that may comprise a single product. Each NSG image production system using the 59-character identifier convention places additional product specific constraints on the use of the 59-character identifier. The image/product identifier TRE specification applicable to the producing systems (i.e., STDIDC) specifies these additional constraints. Table D-2 shows the field structure of the 59-character image identifier.

Table D-2. 59-Character Image Identifier

Position	Description	Range
1 - 14	Image/Product Acquisition Date and Time The date and UTC time representing the currency of the image product data; the date/time the image data was acquired. This date and time is the same as the date recorded in the NITF image subheader IDATIM field.	YYYYMMDDhhmmss
15 - 18	Mission Number, Primary An alphanumeric code that identifies the collection means for the imagery product. E.g., mission project number, DIA-assigned Project Code, aircraft identifier, etc. The allowed values are constrained to the alphanumeric value range or value list specified for the applicable collection system and its associated production system.	Mission and/or collection system specific. See the specification for the applicable product identification TRE.
19 - 28	Mission Number, Secondary An alphanumeric code that refines/expands the primary mission number with further mission-specific identification. E.g., a mission number from an Air Tasking Order.	Mission and/or collection system specific. See the specification for the applicable product identification TRE.
29 - 30	Mission Number, Tertiary An alphanumeric code that refines/expands the significance of the previous two mission number fields by providing an ‘instance’ sequence. E.g., a flight number, a fly-over index/count, a re-visit number, etc.	01 - 09 A1 to A9 B1 to B9 … Z1 to Z9 00
31 - 33	Image Operation Number The index value (count) of the acquisition or collection task/objective that resulted in this product.	000 to 999

Table D-2. 59-Character Image Identifier

Position	Description	Range
34 - 35	Beginning Image Segment ID A code used in conjunction with other fields in the identifier to characterize multi-segment products. For single-segment products, the value is always 'AA.' For multi-segment products, the value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging operation, the code is 'AA.' When the identifier refers to a portion of the imaging operation, the code is that of the segment to which the first pixel value in the portion belongs.	AA to ZZ
36 - 37	Reprocess Number A code to differentiate different instances of the same image product resulting from reprocessing of the source data and/or enhancement processing of the originally processed image data. The value '00' indicates the data is the originally processed image. Values in the range '01' through '99' represent subsequent instances of reprocessing or enhancement processing.	00 to 99
38 - 40	Replay Replay indicates whether the data was retransmitted or re-stored to overcome exchange errors. Its value allows differentiation among multiple transmissions or exchanges of the same image product. The value '000' indicates that the data is from the initial exchange. Values in the range 'T01' to 'T99' indicate the instance of retransmission. Values in the ranges 'P01' to 'P99' and 'G01' to 'G99' are reserved for future use.	000, G01 to G99, P01 to P99, T01 to T99
41	Reserved for System Specific Use The default values for this field are Underscore '_' and the Space character. When using the identifier as a file name, the underscore character shall be used. Either may be used when the identifier is used within NITF subheader or SDE fields.	Underscore (_) Space Character
42 - 44	Starting Column Block (or Tile) Number See Note 1 The NITF block column index number for the first block of the image segment present in the actual data coverage to which the identifier is applicable. The column count is relative to the start of the segment specified by the Beginning Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is '01.' When the identifier refers to a portion of the imaging segment, the code is the column index of the block to which the first pixel value in the data coverage belongs. For single block images this field contains 01.	001 - 999

Table D-2. 59-Character Image Identifier

Position	Description	Range
45 - 49	Starting Row Block (or Tile) Number The NITF block row index number for the first block of the image segment present in the actual data coverage to which the identifier is applicable. The row count is relative to the start of the segment specified by the Beginning Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is '01'. When the identifier refers to a portion of the imaging segment, the code is the row index of the block to which the first pixel value in the product coverage belongs. For single block images this field contains 00001.	00001 - 99999
50 - 51	Ending Image Segment ID For single-segment products, the value is always 'AA.' For multi-segment products, the value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging operation, the code is that of the last segment in the imaging operation. When the identifier refers to a portion of the imaging operation, the code is that of the segment to which the last pixel value in the portion belongs.	AA to ZZ
52 - 54	Ending Column Block (or Tile) Number The NITF block column index number for the last block of the image segment present in the actual data coverage to which the identifier is applicable. The column count is relative to the start of the segment specified by the Ending Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is the last column index in the entire segment. When the identifier refers to a portion of the imaging segment, the code is the column index of the block to which the last pixel value in the data coverage belongs. For single block images, this field contains 01.	001 - 999
55 - 59	Ending Row Block (or Tile) Number The NITF block row index number for the last block of the image segment present in the actual data coverage to which the identifier is applicable. The row count is relative to the start of the segment specified by the Ending Image Segment ID. The value depends on the scope/coverage of the identifier. When the identifier refers to the entire imaging segment, the code is the last row index in the entire segment. When the identifier refers to a portion of the imaging segment, the code is the row index of the block to which the last pixel value in the data coverage belongs. For single block images this field contains 00001.	00001 - 99999
Note 1: The most common image block size used for large images is 1024 X 1024 pixels. The block size used within each file is specified in the Image Subheader in the Number of Pixels Per Block Horizontal (NPPBH) and Number of Pixels Per Block Vertical (NPPBV) fields.		

D.4 Moving Target Indicator (MTI) File Naming Convention

Within the NITFS, STDI-0002, paragraph E.3.10 describes a legacy convention for populating the FTITLE field. The method was never widely used. The current practice is to implement North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) 4607, Ground Moving Target Indicator Format (GMTIF). Neither STANAG 4607 nor the companion Allied Engineering Document Publication (AEDP) mandates a file naming convention. Producers devise their own conventions. Most exploitation and display applications can accommodate different file name extensions. Three of the most commonly used file extensions are .gmti, .4607, and .cgmti.

D.5 Advanced Geospatial Intelligence Products

Advanced Geospatial Intelligence products reflect the application of special processing techniques to image collection operations which had previously been available only in single-image load level processed images. Several product lines under the Advanced Geospatial Intelligence umbrella use multiple source images as well as ancillary data files to produce value added products. Several different naming conventions have been developed to reflect the unique attributes of each product line. They are described in the Advanced Geospatial Intelligence Product Description Document (AGIPDD).

D.6 CIB/CADRG/Raster Product Format (RPF) Product Identifiers

CIB data files are arranged in a hierarchical directory/subdirectory structure. The CIB root (RPF) directory contains the Table of Contents (TOC) File, one or more Frame File directories, and one or more Overview images.

a. The TOC file provides an overview of the data content of the distribution media. It provides path names to each of the Frame Files on the interchange volume. User application software will use the path names to the Frame Files to locate the Frame Files. A.TOC is the file name.
b. CIB producers will choose the number of Frame File directories in a given volume and convention for assigning Frame files to directories. Each of the Frame file directories on a given interchange volume shall be uniquely named in a manner to be determined by an authorized producer. The producers may also assign nested Frame file directories as needed to organize the Frame files, using a variable hierarchy.
c. The Frame Files contain the tiled image and support data for the geographic frames on a CIB interchange volume. A CIB Frame File includes all NITF and RPF components. Each Frame file shall include the RPF header section, location section, coverage section, compression section, color/grayscale section, image section, optional attribute section, related images section and replace/update section (only present for replacements and updates). The frame file naming convention shall be in accordance with MIL-STD 2411. The <file name> is logically coded as follows: <6-radix><1-edition><1-producer code>.<data series and zone>.

D.7 DPPDB Product Identifiers

The first file is the Master Product File, with numerous subheader files that provide information about the DPPDB and the reference graphics. Following the Master Product File (MPF) are the files that comprise the reference graphic frames. The rest of the files contained on the DPPDB are image files.

a. Although there are no military preferences or standards that dictate the naming convention of the MPF, there is however an industry standard that is regularly used. The commonly used name is MASTPROD.NTF.
b. The reference graphic files are unmodified CADRG frame files. They are extracted from the CADRG media and recorded to the DPPDB product tape without further processing. These files are typically labeled very differently from source to source. Although the naming convention is different the extension of these files are all typically in .JA3 format.
c. The files following the reference graphic files contain single compressed images and the associated support data for each of the overview and full resolution data set images

comprising the DPPDB. These frame files typically are named according to what row and column they fall in within the associated map data. The industry standard for these files consists of four numbers and two alpha characters to indicate location. These files are always in NITF format.

D.8 DIGEST Geospatial SDE (GeoSDE)

Naming conventions for DIGEST have not been fully developed. Future releases of the IPON will include them as they are established.

D.9 For Systems Using The NTM Set of SDEs

The governing documents for legacy NTM practice for implementing NITFS 2.0 is the National Imagery Transmission Format Implementation Requirements Document (NITFIRD). Practices for implementing NITFS 2.1 from NTM sources is defined in the Advanced Geospatial Intelligence Product Description Document (AGIPDD).

D.10 For Systems Using The Airborne SDEs (ASDEs)

A new 53-character tactical image identifier has been established for use by the Airborne Community (See Appendix J for the Tactical Image Identifier (TII) Specification). The TII specification applies to NITF 2.1 formatted data only, and in particular to the Image Identification 2 (IID2) field in the NITF Image Segment Subheader. When using the TII specification, the previous Image Identifier formulation mapping partially derived from the Additional Image Identification (AIMIDx) Tagged Record Extension (TRE) shown in table E-4 of STDI-0002 shall not be used. It is very likely that the AIMIDB TRE method for image identification may be phased out altogether in the future.

D.10.1 Management and Tracking of the Imaging Process. Imagery exploitation management systems currently depend on the TII to track the imaging process. Once the imaging collection process is completed, the set of files (one or more) associated with the imaging operation is placed in storage for retrieval. A message is sent to the exploitation management system that the requested imaging operation is complete and product is available for exploitation. The TII is the means for the management system to identify which file(s) resulted from the imagery collection task.

D.11 For Systems Using The Commercial Set Of SDEs

D.11.1 When the Commercial Data Providers (CDPs) initiated offering NITF formatted products to the user community there was no agreed upon, coordinated/common naming convention. Each producer established their own. The following, are examples:

a. DigitalGlobe submitted the following convention:
   - Convention for its file name: YYMONDDHHMMSSbidtnnnnnnnnnnnn_nn_nnnn.NTF
     YYMONDDHHMMSS = acquisition time
     b <band> = P for panchromatic, M for multispectral, S for pan-sharpened, and X for non-images
     id <image identifier> = 1A, 1B or 2A
     t <tile identifier> = S for Scene and M for Mosaic
     nnnnnnnnnnnn_nn_nnnn = Product Order #
   - Convention for its File Header FTITLE and Image Subheader ITITLE are the same:
     Collector Identification = QB02
     Applied Corrections = Name of particular product line such as Raw, Basic, or Rectified
     acquisition date = YYYY-MM-DD
     acquisition time = Thh:mm.ssddddZ

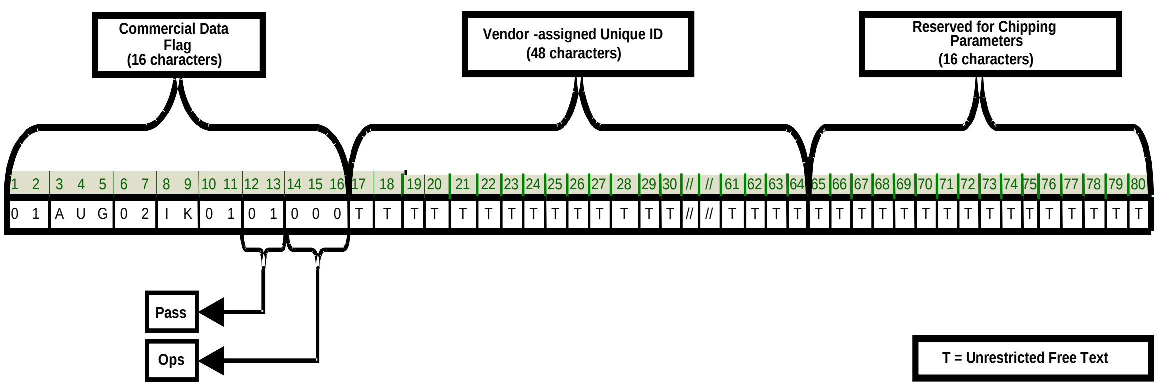
b. Space Imaging submitted the following convention:
   - Convention for its file name and File Header FTITLE are the same:

File Name/FTITLE = Product ID_Imagetype_Component Number.Image Extension; (e.g., po_13563_pan_000000.ntf)

- The convention for its Image Subheader is IMAGEID (59-bytes, 1st 59 chars of the STDIDC TRE) followed by:
  SENSOR: (1-byte, P for PAN or M for MSI)
  ALGORITHM: (2-bytes, PR for Projective Pan or BCS spaces)
  PRODTYPE: (5-bytes, Product Level Implementation code)
  BANDCOMPRESSION: (3 bytes, J08 for 8-bit JPEG, J12 for 12-bit JPEG, UCT for Uncompressed Tiled)
  RESERVED (10-bytes BCS spaces reserved)
  (e.g., 20030604191441SI_CARTERRA_0101279AA0000000100001AA01700020MPRSSGC UCT)

D.11.2 The NGA (NextView) NITF Version 2.1 Commercial Dataset Requirements Document (NCDRD) program participating Commercial producers adopted the following conventions.

Participating producers may generate a file name and File Header FTITLE convention unique to their internal product cataloging reference. The convention for the Image Subheader, as addressed in STDI-0006, is an 80-character field conforming to the following methodology:



The Commercial Data Flag component format is standard for all CDPs. Table D-3 describes those fields.

Table D-3. Commercial Data Flag components

Field Name	Data Type	Range of Values
Day (DD)	Numeric	01-31
Month (MMM)	Alpha	JAN-DEC, inclusive
Year (YY)	Numeric	00-99
CDP Platform Code (AA)	Alpha	QB = QuickBird, IK = IKONOS, OV = Overview, WV = WorldView
CDP Vehicle ID (NN)	Numeric	00-99
Pass (WW)	Numeric	01-99
Operation (XXX)	Numeric	001-999 (see Table 3.3-1 for allowed deviations)

Each CDP generates the Vendor-assigned Unique ID. The 48 character ID is unique for each file and is limited to a sub-set of BCS characters; they are BCS spaces (0x20), dashes, underscores, hyphens, upper and lower case alpha characters, and numbers. BCS spaces fill the unused characters when the IDs are less than 48 characters.

Unique (i.e., different) products created from the same underlying raw source imagery but only differ by some combination of processing parameters may have different unique identifiers applied. Both identifiers will point to a single product as opposed to having a single identifier point to multiple imagery products.

The Reserved for Chipping component shall be BCS space character filled by the CDPs.

D.12 For Systems Using The Geospatial Set Of SDEs

Within the DIGEST standard, there is a Standard ASCII Table of Contents (SATOC) that provides a mechanism to provide details about the contents of a DIGEST exchange medium. The file is formatted in ASCII as a colon delimited file. The file uses key words to identify information in an easily readable format. For example, information about the security and collection Area of Interest (AOI) may be contained in the file. Some of the information can be duplicated in NITF headers and sub headers. More information on the SATOC can be found in DIGEST Part 2 Annex E.

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APPENDIX E

CHIPPING
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions.

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial-Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

E.1 General

This appendix provides information on the chipping process in the National Imagery Transmission Format Standard (NITFS). Chipping refers to a subset of image pixels, and a full complement of metadata, that has been extracted from another full or partial image. When properly organized and structured, the resulting chip, along with supporting data, provides enough intelligence to allow imagery users and exploiters to extract information from the pixel subset with the same degree of confidence and accuracy as with the original, full imaging operation. In addition to satisfying visual needs, an intelligent chip provides the means for extracting or determining such things as geo-positions, distances, elevations, etc. These activities require an indexing scheme to convert row and column pairs within a chip displayed on a screen to line and sample pairs within the original full image product.

E.2 Chipping Paradigms

Whenever pixels are extracted or chipped from another image, a means must be incorporated that enables any recipient of the chip to determine where in the original imaging operation the chip originated. This enables the user to perform mensuration or geo-positioning functions within the chip in the same manner as the full image. Regardless of the chipping paradigm employed, all perform the same function: to enable the recipient/interpreter to reference the chip's corresponding location in the original imaging operation.

Currently, there are three acknowledged methodologies for structuring and producing NITF image chips. All are capable of providing the same level of accuracy and confidence; however, the NGA community officially supports and endorses only two. It is not uncommon to encounter products that employ all three means within the same NITF file/image segment. It should be noted that when such a practice is implemented, all chipping paradigms must be consistent and in harmony with each other.

E.2.1 ICHIPx Tagged Record Extension (TRE)

The NGA-preferred and endorsed means for recording pixel-boundary-chipping information is the ICHIPx TRE. The ICHIPx TRE evolved from the I2MAPD TRE, beginning as ICHIPA. Subsequent minor modifications to the ICHIPA resulted in ICHIPB. All NITF producers and interpreters should support the ICHIPB, and if necessary for backward compatibility, the ICHIPA.

In addition to recording pixel/grid boundaries/indices of the chip and those corresponding to the original, full image, the ICHIPB scan block origin and anamorphic correction, as required, and the full image's size.

Developers of new systems are encouraged to place the ICHIPB in all products, whether or not they are chips. This helps foster proper use of the TRE, unambiguous image dimension information, and allows for recording of other actions such as anamorphically corrected reduced resolution data sets (RRDSs).

Use, application, and implementation information related to the ICHIPB TRE can be found in NGA document STDI-0002, *Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF)*.

E.2.2 Fast Access Format (FAF)

Developers of new applications are discouraged from producing chip files based on the FAF-boundary paradigm. New interpreters may consider implementing this paradigm for legacy support reasons only.

FAF chipping is a practice whereby a chipping TRE is not needed to determine the chip's origin in the original full image space. This practice requires encoding the original image's dimensions (usually in 1024x1024 tile/block multiples) within an image ID that is placed in the ITITLE field of the NITF image subheader. This same information can usually be found in any TRE that stores additional image identification data such as the AIMIDB. Then, using the same image ID and re-encoding the new FAF corners of the chip, the new image ID representing the chip is placed in the FTITLE field of the NITF file. Hence, by applying the chip's FAF corner points to the original image, LINEs and SAMPLEs in the full image space can be derived for the chip.

E.2.3 I2MAPD Tagged Record Extension (TRE)

The I2MAPD TRE is a legacy product of the Image Data Exploitation (IDEX) system era. The Lockheed Martin Corporation (LMCO) developed it to support pixel-bound chipping. Current preferred method is the ICHIPB TRE.

There is no known official documentation of the I2MAPD, other than a 1995 User's Guide produced by the LMCO IDEX Program Office.

E.2.4 Recalculation

Applications may recalculate the supporting metadata describing the pixels chipped from another image and contained in the new output product. Downstream users of the new product wanting to access imagery from the original imaging operation should be able to trace the lineage of the pixels through the metadata. Recalculation is the current practice when chipping imagery files containing DIGEST SDEs. Some members of the Tactical/Airborne imagery community also choose to recalculate the supporting metadata instead of using the ICIHPB TRE.

E.3 Support Data

E.3.1 National Technical Means (NTM)

E.3.1.1 NTM Support Data Dependencies

The practice of altering support data is not encouraged and failure to heed the following precautions may result in interoperability problems, false exploitation conclusions, or other unexpected anomalies. Known dependencies exist between the chipping process (FAF, ICHIPx, or I2MAPD) and the associated support data in the following (current version) Tagged Record Extensions (TREs).

- STDIDB - Full/source image ID and dimensions for RULER mensuration.
- MPD03B - RULER mensuration.
- MPD26A - RULER mensuration.
- RPC00A - RULER mensuration.
- CSD31A - RULER mensuration.
- IMBLKB - RULER mensuration.

Changes to the content of any of the above TREs should be confirmed as accurate. Additionally, similar metadata may appear in different locations in an NITF file, and if changes are made in one area, there must be corresponding changes in all other areas, to maintain consistency within the entire NITF file.

E.3.2 Tactical/Airborne

The Airborne Community has elected to provide producers the option to pass support data along as collected or altered (recalculated) to correspond to processing actions (chipping, scaling, etc.). This philosophy is inferred in the Airborne Support Data Extensions (ASDEs) area of NGA document STDI-0002, whereby guidance on recalculation is offered.

While confidence in data may be eroded, and processing burdens increased for producers, in the recalculation paradigm, the interpreter's job is eased since everything has been properly adjusted to appear as if the image was collected as presented.

E.4 Other Information

To the maximum extent possible, chips should retain as much of the source image's historical information as possible. An application that produces chips should retain all of the original header information to the point that it does not provide false or other misleading characteristics about the product. For example, retaining the original image ID allows the chip recipient to retrieve the full image if additional/adjacent areas of interest are desired. Another example is the image source. Regardless of subsequent processing, the pixels that are in the chip will always have been captured by the same sensor that captured the full image. Maintaining as much of the original information as possible is important from a historical perspective, yielding much about the lineage or pedigree of the product.

E.5 NITF Compliance

Technical and general information regarding implementation, formal assessment, test criteria, etc., is present in the ICHIPB chapter in NGA document STDI-0002.

E.6 DIGEST Area of Interest (AOI)/Chipping

The Digital Geographic Information Exchange Standard (DIGEST) provides the Support Data Extensions (SDEs) format for rectified (corrected) image, matrix, or raster map data. As addressed in multiple military standards, when chipping with data that is non-rectified, the use of Tagged Record Extensions (TREs) ICHIPB or I2MAPD is required for referencing the source product. When chipping rectified imagery, the source product information is not referenced, thus appropriate metadata recalculations/updates become necessary to accurately denote the geographical footprint of a new sub-array. For DIGEST SDEs, the appropriate updates must be made for successful processing and exploitation of these products by DIGEST end-users. Therefore, the use of ICHIPB or I2MAPD is prohibited and only the complement DIGEST SDEs are applied when chipping DIGEST data.
While the likeliness of such an occurrence is small, there may be cases where sensor model and ICHIPB TREs are present in the same NITF image segment as DIGEST SDEs in support of diverse community requirements. For such cases, in August 2006 the NITFS Technical Board (NTB) offered the following guidance with respect to the collective use of sensor model TREs, ICHIPB, and DIGEST SDEs.

a. Generate: The ICHIPB TRE will only be used to reference an image AOI/chip or pixel sub-array from a non-rectified source image with original sensor-provided TREs (IMBLKx, IMSEGx, etc.) that some programs may use to define an original imaging operations coverage in association with the ICHIPB. If employed, the DIGEST SDEs will be generated/updated, as required, to identify the AOI/chip's placement within the source image's space.
b. Interpret: If original sensor-provided TREs (IMBLKx, IMSEGx, etc.) that some programs may use to define an original imaging operations coverage in association with the ICHIPB TRE, positioning, and/or replacement sensor model TREs are present in an image segment (or corresponding overlow), as well as DIGEST SDEs, the application will perform geo-location functions, etc., by using the sensor-provided TREs and ICHIPB TREs collectively or using the DIGEST TREs solely. The ICHIPB is not to be associated, or used in conjunction, with DIGEST SDEs.

To maintain source-to-chip geographical consistency, the following table offers guidance for the update and maintenance of existing DIGEST SDEs after a chipping event has occurred. There are currently two communities implementing the DIGEST SDEs. Included are the processes used when DIGEST chipping occurs. All Libraries are required to support both RPC and DIGEST, and it is recommended that Exploiters/ELTs support both types of geo-referencing data (RPC and DIGEST). Suggestions made by the NITF Compliance Test and Evaluation Facility are offered to producers for processes currently not being implemented:

Table E-1. DIGEST TREs

DIGEST TRE	Updates required	Comment
ACCHZ	No	TRE remains unchanged and is carried forward.
ACCPO	No	TRE remains unchanged and is carried forward.
ACCVT	No	TRE remains unchanged and is carried forward.
BNDPL	Yes	**Libraries:** 1) The TRE must be updated if unintelligent pixels are still referenced in the chipped area. 2) The TRE will be removed if the chipped area is made up of all intelligent pixels. **Exploiters/ELTs:** 1) The TRE should be updated if unintelligent pixels are still referenced in the chipped area. 2) The TRE will be removed if the chipped area is made up of all intelligent pixels. 3) Application removes the BNDPL TRE if option 1 is not supported along with other associated DIGEST TREs and uses the IGEOLO on processed product. 4) The application cannot pass the product on with an unaltered BNDPL TRE.
FACCB	No	TRE remains unchanged and is carried forward.
GEOLO	Yes	LSO and PSO should be updated to correspond to the new origin (row 0, column 0) in reference to the chip.
GEOPS	No	TRE remains unchanged and is carried forward.

Table E-1. DIGEST TREs

DIGEST TRE	Updates required	Comment
GRDPS	Yes	**Libraries must either:** 1) Chip along grid locations and maintain locations within the TRE of designated chipping area and remove those locations outside the chip when updating the TRE. 2) The Library recreates this TRE based on chipping any area of the product, and then average points in the new GRDPS TRE based on the old GRDPS TRE to recreate the TRE (requires higher processing power). **Exploiters/ELTs:** 1) If this TRE is present the application chip along grid locations and maintain locations within the chip and remove those locations outside the chip when updating the TRE (requires higher processing power). 2) If the application recreates this TRE based on chipping any area of the source product the application would then have to average points in the new GRDPS TRE based on the old GRDPS TRE to recreate the TRE (requires higher processing power). 3) Application removes the GRDPS TRE along with other associated DIGEST TREs and uses the IGEOLO on processed product. 4) The application cannot pass the product on with an unaltered GRDPS TRE.
MAPLO	Yes	LSO and PSO should be updated to correspond to the new origin (row 0, column 0) in reference to the chip.
PRJPS	No	TRE remains unchanged and is carried forward.

Table E-1. DIGEST TREs

DIGEST TRE	Updates required	Comment
REGPT	Yes	**Libraries must either:** 1) Create a new REGPT TRE to reference pixels in the chipped area (requires higher processing power). 2) Updated the TRE based on chipping on the current registration points provided in the source TRE, by keeping registration points within the chip and removing all other registration points outside of the chip and updating NUM_PTS and DIXn/DIYn to reflect the operation (requires higher processing power). **Exploiters/ELTs:** 1) This TRE be recreated to reference intelligent pixels in the chipped area (requires higher processing power). 2) The TRE can be updated by chipping on the current registration points provided in the source TRE, by keeping registration points within the chip and removing all other registration points outside of the chip and updating NUM_PTS and DIXn/DIYn to reflect the operation (requires higher processing power). 3) Remove the REGPT and ensure the resulting product has either a GEOLOB or MAPLOB. 4) Application removes the REGPT TRE along with other associated DIGEST TREs and uses the IGEOLO on processed product. 5) The application cannot pass the product on with an unaltered REGPT TRE.
SOURC	No	TRE remains unchanged and is carried forward.
SNSPS	No	TRE remains unchanged and is carried forward.

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Implementation Practices
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APPENDIX F

FORMAT TRANSLATION/CONVERSION SERVICES
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
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FOREWORD

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4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

F.1 INTRODUCTION

F.1.1 Purpose

To describe recommended practices for NITFS imagery related format translation or conversion services to assist developers and users of Imagery Exploitation Systems and Archive/Dissemination Applications. Appendix G separately covers converting security fields between NITF version 2.0 and NITF version 2.1 formats.

F.1.2 Scope

The translation/conversion services identified herein provide a starting point to assist developers in understanding the technical considerations for implementing format conversion services while taking into account the targeted user community, system requirements, standards compliance, and interoperability objectives. Though the identified translations/conversions are primarily focused on NITF 2.0 and NITF 2.1, the developer can use the information as a guide for converting TIFF, Sun Raster, JPEG, and JPEG 2000 to either NITF 2.0 or NITF 2.1 and vice versa. (Note: The Tape Format Requirements Document (TFRD) format is not addressed in this appendix as it is specifically addressed in S2035A, National Imagery Transmission Format Implementation Requirements Document). A major misconception by potential users of old NITF 2.0 applications is that they can simply have an implementer develop a simple translation process to translate an NITF 2.1 product to NITF 2.0 and the products will be fully compatible and functionally useful. However, this is not the case. Users and implementers should be aware that most NITF 2.1 file features cannot be converted to NITF 2.0 or other file formats because the features are not available in those formats. Most files that are converted from NITF 2.1 to other formats are generally not usable. It is strongly recommended that implementers not allow the conversion of NITF 2.1 to NITF 2.0. If users need the additional functions available in NITF 2.1, users should upgrade to an application supporting NITF 2.1.

This appendix addresses the following translation/conversion services:

- NITF to NITF conversion
  - NITF 2.0 to NITF 2.1
  - NITF 2.1 to NITF 2.0
  - Within segments
- Image Segments
- Graphic Segments
- NITF Text Segments
- NITF DES Segments
  - From one segment to another
- Graphic Segment to Image Segment
- Label Segment to Graphic Segment
- Changes in Image Representation
- NITF to JPEG, SunRaster, TIFF, GeoTIFF, JPEG 2000
- JPEG, SunRaster, TIFF, GeoTIFF, JPEG 2000 to NITF

F.1.3 Background

Testing of format conversion services in the past has often surfaced inconsistencies when attempting to convert NITF products (files). Applications have routinely shown conversion inconsistencies as follows:

a. Lost Image Segments. When requesting image-related conversion services for a product containing multiple image segments, the conversion process only maintains the first image segment, all other image segments are lost.

b. Applying Conversion To All Image Segments. The conversion service attempts to apply the selected image conversion service characteristics for the first image segment to all image segments in the file regardless of the different characteristics of individual image segments.
c. Display and Attachment Level. The service does not take into account the difference in the use of Display and Attachment Levels in relationship to the common coordinate system between the NITF 1.1, NITF 2.0, and NITF 2.1 file formats.
d. Bit-mapped Symbol Segments. The service incorrectly converts bit-mapped symbol segments supported in NITF 2.0 to some other graphic or image format. (Note: Continued use of bit-mapped symbol segments within NITF 2.0 files is highly discouraged. NITF 2.1 does not allow the use of bit-mapped symbol/graphic segments.)
e. Label Segments. The service incorrectly converts label segments supported in NITF 2.0 to some other graphic or image format. (Note: Continued use of label segments within NITF 2.0 files is highly discouraged and CGM Text graphics should be used. NITF 2.1 does not allow the use of label segments.)
f. JPEG Quantization/Huffman Tables. The service fails to embed the appropriate JPEG Quantization and Huffman tables when converting from NITF 2.0 JPEG compressed image segments that only contain references to external default Quantization/Huffman tables.
g. Bi-Level Images. The service incorrectly converts 1-bit-per-pixel non-compressed image segments supported in NITF 2.1.
h. CGM Version. The service incorrectly converts MIL-STD 2301A CGM features supported in NITF 2.1 to the earlier MIL-STD 2301 set of features supported in NITF 2.0.
i. Conversion to Less-Capable Formats. The service fails to identify unsupported NITF 2.1 image features when converting to NITF 2.0 from NITF 2.1.
   - Non-integer images. The CLEVEL constraints for NITF 2.0 only allow for binary and unsigned integer data. NITF 2.1 CLEVELs allow for binary, unsigned integer, signed integer, floating point real, and complex pixel values.
   - Masked images. NITF 2.0 only allowed block and pixel masks with non-compressed (NM) and VQ-compressed (M4) pixel data. NITF 2.1 extends the application of block and pixel masks to additional compression options.
   - Integer Images. Mishandling of images with characteristics other than those with Actual-Bits-Per-Pixel (ABPP) of 8-, 11-, or 12-bit and having an Image Compression (IC) of non-compressed (NC) or JPEG lossy compressed (C3).
j. Text Segment Encoding. Failure to identify unsupported UT1 and U8S text formats when converting from NITF 2.1 to NITF 2.0.
k. DES Segment. Failure to identify unsupported NITF 2.0 DES types when converting from NITF 2.1.

F.1.4 Implementation Considerations

The following implementation considerations should be used when implementing translation/conversion services:

a. Routinely converting NITF 2.0 products to NITF 2.1 may not always be necessary, as applications supporting NITF Version 2.1 (MIL-STD 2500C) are backward compatible with NITF 2.0 applications. Developers need to be concerned with potential products interfacing with applications developed and fielded without formal NITFS testing. Basic reasons to consider converting NITF 2.0 to NITF 2.1 include:
   - Migration of archive holdings to the latest version of NITF to promote future readability of the data (i.e., to avoid the potential for “digital amnesia” for reading older data formats as the digital data holdings age).
   - Merging data segments from NITF 2.0 data holdings with data segments from newer collections, especially when the newer data has characteristics not supported in NITF 2.0. Therefore, this appendix provides guidance on conversion from NITF 2.0 to NITF 2.1.

b. The rationale for providing NITF 2.1 to NITF 2.0 conversion services is to allow users without NITF 2.1 capable applications to access some varieties of NITF 2.1 data that may reside in libraries or other holdings. NITF 2.0 does not support many NITF 2.1 features. Consequently, not all NITF 2.1 files can be converted to NITF 2.0. Current NITF 2.0 user applications must be upgraded to NITF 2.1 applications if the users have a need for the newer features. Because of major limitations with NITF 2.0 functional capabilities, implementers are strongly discouraged from implementing NITF 2.1 to NITF 2.0 conversion services.

c. Image Libraries and similar network service providers may provide on-demand format conversion services. Through their client interface, users can request data holdings be delivered according to user-specified format and parameter options. The user can explicitly select conversion parameters for each selected product (file), or typically, the user can define pre-set parameters for exporting data from the library. For example, regardless of the various data formats/options of data files in the library, the user may set up a template to always deliver the data in a specific format (e.g., NITF 2.0), with images at a specific precision (e.g., 8-bit-per-pixel) and compression (JPEG quality level 3), a specific resolution, etc. In this case, the service provider is obliged to look at the format and parameters of the requested data holdings and attempt to convert or reform the data to match the default user-prescribed parameters.

   Since NITF 2.1 capable user applications (exploiters) can read NITF 2.0, it may be more timely and efficient to deliver NITF 2.0 holdings as NITF 2.0 unless the user expressly requests conversion to NITF 2.1. Perhaps the client interface for the default delivery options could include the means to indicate the degree of effort desired by the client to be applied to selected conversion services. For example, the user could set up the export options to routinely deliver data as NITF 2.1 at a specific bit-depth precision and at a specific JPEG compression option. The interface could then provide the user options for dealing with NITF 2.0 data holdings. The NITF 2.0 data can be:

   - Delivered as-is,
   - Converted to NITF 2.1 template options if the data consists of only a single image segment, or
   - Do a best effort to convert all NITF 2.0 data with possibility of delivering corrupted data in some complex data structure instances.

d. NITF 2.1 does not directly support NITF 2.0 Label Segments and bit-mapped Symbol Segments. However, for many conversions between NITF 2.0 and NITF 2.1, the visual representation displayed to the user can remain identical in appearance even though the internal segment representations may be different. This is a result of differences in file formats that can be successfully converted from one supported segment type to another. Label Segments can be converted to Graphic/Symbol Segments using the text capabilities within CGM, and bit-mapped Symbol Segments can be converted to 1-bit-per-pixel Image Segments.

e. Following conversion services, the resulting product must faithfully represent the information content of the original data product given the requested conversion service requested by the user. Otherwise, intervention is warranted to alert the user that the conversion may result in the unexpected loss of information beyond that requested by the user. For example, a user requesting a lower resolution of an image segment expects the information loss that comes with a reduced resolution image, but they would not expect information loss of support data, image or graphic overlays, text reports or other data segments that may be in the original NITF product (file).

F.2 SUGGESTIONS/RECOMMENDATIONS

The following are suggestions and recommendations for developers. The goal is to create NITF files that are both compliant with the standards and that correctly represent the intent of the original data producer. Tables F-1 and F-2 deal with NITF file level and source data considerations. Tables F-3 through F-9 address the mapping of individual data fields within NITF 2.0 and NITF 2.1 file formats.

F.2.1 Segment Data Conversions

F.2.1.1 NITF 2.0 to NITF 2.1

NITF 2.1 compliance requires backward compatibility to read/interpret NITF 2.0 formatted data. Table F-1 is provided to assist developers in understanding the imported data fields in the conversion process (e.g., batch updates of old data holdings to ensure future interpretability, etc.), and identifies potential segment exportability considerations. Developers are discouraged from converting NITF 2.0 files containing bit-mapped symbol segments and/or label segments to NITF 2.1 files since these features are not directly supported in NITF 2.1. Converting these segment types can be accomplished, but may take a significant programming effort to do so correctly. Converting these NITF 2.0 segments to NITF 2.1 segments requires bit-mapped symbol segments to become image segments and label segments to become CGM graphic segments. This will result in requiring additional verification of data segment structures to ensure the converted segments are compliant.

Given the potential pitfalls of these types of conversions, other alternatives should be considered before implementing.

Table F-1. File Level Conversions From NITF 2.0 to NITF 2.1

Segments	**Exportability**	**Comments**
Image Segments	All	All varieties of NITF 2.0 Image Segments can be converted to NITF 2.1 with appropriate subheader adjustments. Subheader fields that need to be adjusted include: IDATIM, Security fields, ICORDS, IREPBANDn
Symbol Segments	CGM All	CGM Symbol Segments can be moved As-Is to NITF 2.1 Graphic Segments with appropriate subheader adjustments. Subheader fields that need to be adjusted include: Security fields and bounding box fields
	Bit-mapped Symbols are not supported in NITF2.1. Conversion requires change from Symbol Segment format to Image Segment format.	Bit Mapped Symbol Segments may be converted to 1-bit-per-pixel Image Segments. This conversion will require generating a new image segment subheader and perhaps look-up table(s) and a pixel mask table with transparency option. Converting files containing bit-mapped symbol segments is strongly discouraged.
Label Segments	Label Segments are not Supported in NITF 2.1. Conversion requires change from Label Segment Format to Graphic Segment Format.	Label Segment content can be converted to CGM Text Elements and placed in Graphic/Symbol Segments. This conversion will require using CGM text, auxiliary color, and transparency elements. This conversion will also require generating a new Graphic Segment subheader. Converting files containing label segments is strongly discouraged.
Text Segments	All	Text Segments can be moved As-Is with appropriate subheader adjustments. Subheader fields that need to be adjusted include: TXTALVL, TXTDT, Security fields

Table F-1. File Level Conversions From NITF 2.0 to NITF 2.1

Segments	Exportability	Comments
Data Extension Segments	All	DES segment can be moved As-Is with appropriate subheader adjustments to include the DESTAG field. For NITF 2.0, the only known producers of NITF data that use DESs are: CIB, CADRG, and DPPDB. Both the Controlled Extensions DESTAG and the Registered Extensions DESTAG are changed to the TRE_OVERFLOW DESTAG used in NITF 2.1. Unlike NITF 2.0, both controlled and registered extensions overflowing from the same data segment may be commingled in a single TRE_OVERFLOW DES for that data segment. As CIB and CADRG products are dual formatted, implementers are strongly discouraged from converting these products.

F.2.1.2 NITF 2.1 to NITF 2.0

Table F-2 is provided to help the Software Developer understand the NITF 2.1 data types that are supported in NITF 2.0, however, conversion from NITF 2.1 to NITF 2.0 is strongly discouraged.

Table F-2. File Level Conversions From NITF 2.1 to NITF 2.0

<table>
<tr><th>Segments</th><th>Exportability</th><th>Comments</th></tr>
<tr><td>Image Segments</td><td>Limited</td><td>Both Image Representation and Image Compression field values play significant roles in determining which NITF 2.1 Image Segments may successfully be converted to NITF 2.0 Image Segments.
From the perspective of IREP value, NITF 2.1 Image Segments with the following characteristics can be converted to NITF 2.0 Image Segments with appropriate subheader adjustments:
<table>
<tr><th>IREP</th><th>PVTYPE</th><th>NBPP</th><th>NBANDS</th></tr>
<tr><td>MONO</td><td>INT, B</td><td>1, 8, 16</td><td>1</td></tr>
<tr><td>RGB/LUT</td><td>INT, B</td><td>1,8</td><td>1</td></tr>
<tr><td>RGB</td><td>INT</td><td>8</td><td>3</td></tr>
<tr><td>YCbCr</td><td>INT</td><td>8</td><td>3</td></tr>
<tr><td>MULTI</td><td>INT</td><td>8, 16</td><td>4</td></tr>
</table>
From the perspective of compression code, NITF 2.1 Image Segments with the following characteristics can be converted to NITF 2.0 Image Segments with appropriate subheader adjustments:
<table>
<tr><th>Compression</th><th>PVTYPE</th><th>NBPP</th><th>NBANDS</th></tr>
<tr><td>NC</td><td>INT, B</td><td>1, 8, 16</td><td>1, 3, 4</td></tr>
<tr><td>NM</td><td>INT</td><td>8</td><td>1</td></tr>
<tr><td>JPEG DCT</td><td>INT</td><td>8, 12</td><td>1, 3</td></tr>
<tr><td>JPEG Lossless</td><td>INT</td><td>2-12</td><td>1</td></tr>
<tr><td>Downsample</td><td>INT</td><td>8</td><td>1</td></tr>
<tr><td>Bi-Level</td><td>B</td><td>1</td><td>1</td></tr>
<tr><td>VQ (C4/M4)</td><td>INT</td><td>8</td><td>1</td></tr>
</table>
</td></tr>
</table>

Table F-2. File Level Conversions From NITF 2.1 to NITF 2.0

Segments	Exportability	Comments
Graphic Segments	Limited	NITF 2.1 Graphic Segments containing only CGM attributes supported in MIL-STD 2301 may be converted into NITF 2.0 Symbol Segments with appropriate subheader adjustments. Note: The CGM Identifier element may need to be edited to reflect MIL-STD 2301. NITF 2.1 Graphic Segments containing MIL-STD 2301A CGM attributes not supported by 2301 cannot be converted into compliant NITF 2.0 files. 2301A CGM elements or attributes not compatible with NITF 2.0: - Interior Style - 3=hatch - Edge Type - 3= dot, 4= dash-dot, and 5= dash-dot-dot - Edge Visibility - 0= off - Line Type - 3= dot, 4= dash-dot, and 5= dash-dot-dot - Auxiliary color - Edge width limited to 0, 2, 4, 6 pixels in 2.0 - Transparency - Line Type dotted, dash-dot, dash-dot-dot - Polygon Sets - Character height limited to 35 pixels in 2.0 - Hatch Index
Text Segements	Limited	NITF 2.1 Text Segments with TXTFMT of STA or MTF moved As-Is with appropriate subheader adjustments NITF 2.1 Text Segments with TXTFMT of UT1 or U8S cannot be converted into a compliant NITF 2.0 file.
Data Extension Segment	None	NITF 2.1 Data Extension Segments cannot be converted into NITF 2.0 files.

F.2.2 Header/Subheader Conversions

F.2.2.1 File Header

Table F-3 describes file header to file header conversion considerations. Many fields can be mapped As-Is directly between both formats as the definitions, sizes, and values are identical. However, other fields based on CLEVEL definitions, supported data types and use of alphanumeric verse UT1 field formats require users to modify values when mapping between formats. The Mapping column in table F-3 identifies how to translate between formats.

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
FHDR/FHDR and FVER	File Type & Version	9	NITF02.00	R	Change	NITF02.10 or NSIF01.00	R
CLEVEL	Compliance/ Complexity Level	2	01-06 99 (when file exceeds 2GB limit for CLEVEL 06	R	Possible Change, based on CLEVEL definitions	03, 05, 06, 07, 09	R
SYSTYPE	System Type	4	4 Spaces (reserved)	O	Change	BF01	R
OSTAID	Originating Station ID	10	BCS-A	R	Normally As-Is but CONOPS could require	BCS-A (May not be all spaces)	R

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
					change		
FDT	File Date & Time	14	DDHHMMSSZ MONYY	R	Change in format required, CONOPS will dictate if original or new date is used	CCYYMMDDhhmmss	R
FTITLE	File Title	80	BCS-A	O	As-Is NITF 2.0 to NITF 2.1 Possible change, 2.1 to 2.0 ECS-A considerations	ECS-A (default is spaces)	R
FSCLAS	File Security Classification	1	T, S, C, R, or U	R	As-Is	T, S, C, R, or U	R
ENCRYP	Encryption	1	0 = Not Encrypted (This field must contain the value 0)	R	As-Is	0 = Not Encrypted (This field must contain the value 0)	R
FBKCG	File Background Color	3	0x00 to 0xFF For implementation considerations, these values should be limited to 0x20 to 0x7E	R	As-Is 2.0 to 2.1 Possible change 2.1 to 2.0 if unsupported NITF 2.1 values used	Unsigned Binary integer (0x00-0xFF, 0x00-0xFF, 0x00-0xFF in Red, Green, Blue order	R
ONAME	Originator's Name	24	Alphanumeric	O	As-Is 2.0 to 2.1 Possible change, 2.1 to 2.0 ECS-A considerations	ECS-A (default is all spaces)	O
OPHONE	Originator's Phone Number	18	Alphanumeric	O	As-Is 2.0 to 2.1 Possible change, 2.1 to 2.0 ECS-A considerat	ECS-A (default is all spaces)	O

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
					ions		
FL	File Length	12	Numeric	R	Possible Changes based on segment changes.	Numeric	R
HL	NITF Header Length	6	Numeric	R	Possible Changes based on segment changes.	Numeric	R
NUMI	Number of Image Segments	3	Numeric	R	Possible Changes based on segment changes.	Numeric, only 1 and 3 band products having a PVTYPE INT with an ABPP of 8 or 11-bits should be converted to NITF 2.0.	R
LISH001	Length of Nth Image Subheader	6	Numeric	C	Possible Changes based on subheader changes.	Numeric	C
LInnn	Length of Nth Image	10	Numeric	C	Possible Changes based on segment changes.	Numeric	C
NUMS	Number of Graphic Segments	3	Numeric, if bit-mapped symbol segments must change to image segments with adjustment of the number of graphic segments	R	Possible Changes based on segment changes.	Numeric, see table F-2 Graphic Segments of NITF 2.1 CGM features that should not be converted to NITF 2.0.	R
LSSH001	Length of Nth Graphic Subheader	4	Numeric	C	Possible Changes based on subheader changes.	Numeric	C
Lsnnn	Length of Nth Graphic	6	Numeric	C	Possible Changes based on segment changes.	Numeric	C

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
NUML / NUMX	Number of Label Segments	3	Numeric, if conversion required must be changed to CGM Graphics in NITF 2.1	R	Change for 2.0 to 2.1 conversion if conversion service for labels is supported.	Not allowed in NITF 2.1, must always be 000.	R
LLSH001	Length of Nth Label Subheader	4	Numeric	C		N/A	*
LLn	Length of Nth Label	3	Numeric	C		N/A	*
NUMT	Number of Text Segments	3	Numeric	R	As-Is on allowed changes.	Numeric Note: Only STA and MTF files can be converted, all other text types cannot be converted to NITF 2.0.	R
LTSH001	Length of Nth Text Subheader	4	Numeric	C	Possible Changes based on subheader changes.	Numeric	C
LTnnn	Length of Nth Text	5	Numeric	C	As-Is on allowed changes.	Numeric	C
NUMDES	Number of DES Segments	3	Numeric Note: If DESTAG marked Registered Extensions or Controlled Extensions when convert to NITF 2.1 and the DESTAG will be marked as TRE_OVERFLOW. Other values for DESTAG will not be converted	R	Changes	Numeric, Note only NITF 2.0 to NITF 2.1 changes are allowed. No NITF 2.1 files containing DES will be converted to NITF 2.0. Note: If DESTAG marked TRE_OVERFLOW and Tagged Record Extensions (TREs) supporting	R

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
						overflow are on the NTB Controlled Extension Register the DESTAG in the resulting NITF 2.0 file will be marked Controlled Extensions. If the TREs are on the NTB Registered Extension Register the DESTAG in the resulting NITF 2.0 file will be marked Registered Extensions. Other values for DESTAG will not be converted.	
LDSH001	Length of Nth DES Subheader	4	Numeric	C	Changes based on subheader format.	Numeric	C
LDnnn	Length of Nth DES	9	Numeric	C	As-Is on allowed changes	Numeric	C
NUMRES	Number of RES Segments	3	Numeric, must be 000. Segment currently not allowed.	R	As-Is	Numeric, must be 000. Segment currently not allowed.	R
UDHDL	User Defined Header Data Length	5	Numeric	R	As-Is	Numeric	R
UDHOFL	User Defined Header Overflow	3	Numeric	C	As-Is	Numeric	C
UDHD	User Defined Header Data	**	TREs	C	As-Is	TREs	C
XHDL	Extended Header Data Length	5	Numeric	R	As-Is	Numeric	R
XHOFL	Extended Header Overflow	3	Numeric	C	As-Is	Numeric	C

Table F-3. NITF Header Mappings

Field	Description	Size	Format Values NITF 2.0	Type	Mapping	Format Value NITF 2.1	Type
XHD	Extended Header Data	**	TREs	C	As-Is	TREs	C

F.2.2.2 Image Subheader

Table F-4 lists suggestions/recommendations for image to image conversions between NITF formats, if the developer has a real need to convert NITF 2.0 bit-mapped symbols to NITF 2.1 images see paragraph F-2.2.3.

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
IM	File Part Type	2	IM	R	As-Is	IM	R
IID/IID1	Image ID	10	BCS-A non-blank; User defined	R	As-Is	BCS-A non-blank; User defined	R
IDATIM	Image Date & Time	14	DDHHMMSSZ MONYY	O	As-Is for date, but format change is needed.	CCYYMMDDhh mmss	R
ISCLAS	Image Security Classification	1	T, S, C, R, or U	R	As-Is	T, S, C, R, or U	R
Security	Covered in Appendix G	166	See Appendix G	*	See Appendix G	See Appendix G	*
ENCRYP	Encryption	1	0 = Not Encrypted (This field must contain the value 0)	R	As-Is	0 = Not Encrypted (This field must contain the value 0)	R
ISORCE	Image Source	42	Alphanumeric	O	As-Is 2.0 to 2.1 Possible change, 2.1 to 2.0 ECS-A considerations	ECS-A (Default is spaces)	R
NROWS	Number of Significant Rows in image	8	00000064-00065536 (Based on CLEVEL)	R	As-Is	00000064-00065536 (Based on CLEVEL), NITF 2.1 allows larger image sizes, but conversions are restricted to this range.	R

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
NCOLS	Number of Significant Columns in image	8	00000064-00065536 (Based on CLEVEL)	R	As-Is	00000064-00065536 (Based on CLEVEL), NITF 2.1 allows larger image sizes, but conversions are restricted to this range.	R
PVTYPE	Pixel value type	3	INT, B	R	As-Is	INT, B (Other pixel value types (C & R) are allowed in NITF 2.1, but should not be converted to NITF 2.0.)	R
IREP	Image Representation	8	Alphanumeric Mono, RGB, RGB/LUT, YCbCr601, MULTI	R	As-Is	Alphanumeric Mono, RGB, RGB/LUT, YCbCr601, MULTI (Other image representations are allowed, but should not be converted.)	R
ICAT	Image Category	8	VIS, EO, IR, SAR, MS other values are allowed in Register	R	As-Is	VIS, EO, IR, SAR, MS other values are allowed in Register	R
ABPP	Actual Bits-per-pixel Per Band	2	01, 08, 11 through 16	R	As-Is, for identified values	01, 08, 11 through 16 will be converted. Additionally, 01 bit NC or NM and 12-bit NC will not be converted. Any of the other NITF 2.1 allowed values will not be converted.	R
PJUST	Pixel Justification	1	R	R	As-Is	R	R

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
ICORDS	Image Coordinate System	1	U, G, C, or N	R	Change to correct coordinate representation	U, G, N, S, D, or space	R
IGEOLO	Image Geographic Location	60	ddmmssXdddmmssY (4 times) or ggXYZmmmmmmmmmm (4 times)	C	Preserve, but format may change	±dd.ddd±ddd.ddd (4 times) ddmmssXdddmmssY(4 times) or zzBJKeeeeennnnn (four times) or zzeeeeeennnnnnn (4 times)	C
NICOM	Number of Image Comments	1	0-9	R	As-Is	0-9	R
ICOMn	Image Comment N	80	Alphanumeric	C	As-Is 2.0 to 2.1 Possible change, 2.1 to 2.0 ECS-A considerations	ECS-A (Default is spaces)	C

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
IC	Image Compression	2	NC - No Compression, NM – No Compression Mask, C1- Bi-Level, M1 – Bi-level Mask, C3 - JPEG, , M3 JPEG Mask, C5 – Lossless JPEG, M5 – Lossless JPEG Mask, I1 – down sampled JPEG Other values allowed, but will not be converted. C2 ARIDPCM not supported in NITF 2.1 and C4 – VQ, and M4 – VQ mask which are associated with CIB and CADRG products which are dual formatted and conversion will make the resulting product useless for RPF users. C3, M3 products must ensure Quant and Huff tables are embedded for conversion to NITF 2.1.	R	As-Is for allowed products, with exception of C3 NITF 2.0 products that must include Quant and Huff tables when converted to NITF 2.1.	NC - No Compression, NM – No Compression Mask, C1- Bi-Level, M1 – Bi-level Mask, C3 - JPEG, M3 JPEG Mask, C5 – Lossless JPEG, M5 – Lossless JPEG Mask, I1 – down sampled JPEG. Other NITF 2.1 allowed compressed products should not be converted.	R

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
COMRAT	Compression Rate Code	4	C1, M1 1D, 2DS, 2DH C3, M3, C5, M5, I1 xx.y Only convertible values. For C3, M3 products must ensure Quant and Huff tables are embedded for conversion to NITF 2.1.	C	As-Is	C1, M1 1D, 2DS, 2DH C3, M3, C5, M5, I1 xx.y Only convertible values.	C
NBANDS	Number of Bands	1	1, 3, or 4	R	As-Is for allowed variations	1, 3, or 4, others allowed, but will not be converted. For 4 bands only allowed variation of IREPAND01-B, IREPAND02-G, IREPAND03-R, IREPAND04- N will be converted.	R
IREPBANDn	nth Band Component Representation	2	R, G, B, N, Y, Cb, Cr, spaces	R	As-Is for like values, M converts to BCS space	M, R, G, B, N, Y, Cb, Cr, spaces	R
ISUBCATn	nth Band Subcategory	6	Alphanumeric - (Default 6 spaces)	R	As-Is	Alphanumeric - (Default 6 spaces), new values exist that will not be converted	R
IFCn	nth Band Image Filter Condition	1	N	R	As-Is	N	R
IMFLTn	nth Band STD Image Filter Code	3	Reserved - 3 spaces	R	As-Is	Reserved - 3 spaces	R

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
NLUTSn [1]	nth Band Number of LUTS	1	0, 1, or 3	C	As-Is	0, 1, or 3, other values allowed that will not be converted.	C
NELUTn	nth Band Number of LUT Entries	5	Numeric	C	As-Is	Numeric	C
LUTDn	nth Band Data of the mth LUT	**	binary data	C	As-Is	Unsigned binary data	C
ISYNC	Image Sync Code	1	0	R	As-Is	0	R
IMODE	Image Mode	1	B, P, S	R	As-Is for like values.	B, P, S, R	R
NBPR	Number of blocks per row	4	0001-0256	R	As-Is for like values.	0001-0256 Values 0257-9999 will not be converted to NITF 2.0.	R
NBPC	Number of blocks per column	4	0001-0256	R	As-Is for allowed values.	0001-0256 Values 0257-9999 will not be converted to NITF 2.0.	R
NPPBH	Number of pixels per block (horiz.)	4	0064-8192 for single blocked images For square multi-blocked images, 0032, 0064, 0128, 0256, 0512, 1024.	R	As-Is for like values.	0064-8192 Single block sizes less than 0064, and multi-block sizes other than those allowed in NITF 2.0 will not be converted without re-blocking	R
NPPBV	Number of pixels per block (vert.)	4	0064-8192 for single blocked images. For square multi-blocked images, 0032, 0064, 0128, 0256, 0512, 1024.	R	As-Is for like values.	0064-8192 Single block sizes less than 0064, and multi-block sizes other than those allowed in NITF 2.0 will not be converted without re-blocking	R
NBPP	Number of bits-per-pixel per band	2	01, 08, 12, 16	R	As-Is for like values	01 - 64	R

Table F-4. NITF Image Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
IDLVL	Display Level	3	001-999	R	As-Is	001-999 Note, conversion to 2.0 will not be done if the 2.1 segment with lowest Display Level is not located (ILOC) at 0,0.	R
IALVL	Attachment Level	3	001-998	R	As-Is	001-998	R
ILOC	Image Location	10	RRRRRCCCCC	R	As-Is	RRRRRCCCCC	R
IMAG	Image Magnification	4	Alphanumeric	R	As-Is	BCS-A	R
UDIDL	User Defined Subheader Data Length	5	Numeric	R	As-Is	Numeric	R
UDOFL	User Defined Subheader Overflow	3	Numeric	C	As-Is	Numeric	C
UDID	User Defined Subheader Data	**	TREs	C	As-Is	TREs	C
IXSHDL	Extended Subheader Data Length	5	Numeric	R	As-Is	Numeric	R
IXSOFL	Extended Subheader Overflow	3	Numeric	C	As-Is	Numeric	C
IXSHD	Extended Subheader Data	**	TREs	C	As-Is	TREs	C

F.2.2.3 Bit-Mapped Symbols to Images Subheader Requirements

This conversion is not recommended, but table F-5 shows suggestions/recommendations for converting NITF 2.0 Bit-Mapped Symbol Segments to NITF 2.1 Image Segments if/when this conversion service is required. This conversion is based on an unrotated Bit-Map symbol equal to or less than 8192 pixels horizontally and/or vertically.

Table F-5. NITF Bit-Map Symbol to Image Subheader Mappings

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
SY	File part type	2	Change to IM	IM	File Part Type	2	IM	R
SID	Symbol ID	10	To Image ID	IID1	Image ID	10	BCS-A non-blank; User defined	R
*	*	*	To all dashes.	IDATIM	Image Date & Time	14	All dashes	R
*	*	*	To all spaces	TGTID	Target ID	17	All spaces	R
SNAME	Symbol name	20	To IID2 first 20 characters, remaining are spaces.	IID2	Image IID	80	BCS-A (Default is spaces)	R
SSCLAS	Symbol security classification	1	To ISCLAS	ISCLAS	Image Security Classification	1	T, S, C, R, or U	R
Security	Covered in Appendix G	166	To image security	Security	Covered in Appendix G	166	See Appendix G	*
ENCRYP	Encryption	1	To image ENCRYP	ENCRYP	Encryption	1	0 = Not Encrypted (This field must contain the value 0)	R
*	*	*		ISORCE	Image Source	42	Alphanumeric	R
STYPE	Symbol type	1	*	*	*	*	*	*
NLIPS	Number of lines per symbol	4	Maps to both NROWS and NPPBV	NROWS	Number of Significant Rows in image	8	00000001-00008192	R
NPIXPL	Number of pixels per line	4	Maps to both NCOLS and NPPBH	NCOLS	Number of Significant Columns in image	8	00000001-00008192	R

Table F-5. NITF Bit-Map Symbol to Image Subheader Mappings

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
*	*	*	Set to B	PVTYPE	Pixel value type	3	B	R
*	*	*	To Mono or RGB/LUT based on SCOLOR	IREP	Image Representation	8	Mono, or RGB/LUT	R
*	*	*	Default to VIS	ICAT	Image Category	8	VIS	R
NBPP	Number of bits-per-pixel	1	Set both ABPP and NBPP to 01	ABPP	Actual Bits-per-pixel Per Band	2	01	R
*	*	*	Default to R	PJUST	Pixel Justification	1	R	R
*	*	*	Default to space	ICORDS	Image Coordinate System	1	space	R
*	*	*	Default to 0	NICOM	Number of Image Comments	1	0-9	R
*	*	*	NC, NM See SCOLOR for appropriate IC	IC	Image Compression	2	NC, NM	R
*	*	*	Defaults to 1	NBANDS	Number of Bands	1	1	R
*	*	*	M if IREP Mono or LU if IREP RGB/LUT	IREPBANDnn	nnth Band Component Representation	2	M, LU	R
*	*	*	Default 6 spaces	ISUBCATnn	nnth Band Subcategory	6	6 spaces	R
*	*	*	Default to N	IFCnn	nnth Band Image Filter Condition	1	N	R
*	*	*	Default 3 spaces.	IMFLTnn	nnth Band STD Image Filter Code	3	3 spaces	R
*	*	*	For Mono 0 or 3 for RGB/LUT	NLUTSnn	nnth Band Number of LUTS	1	0 or 3	C
*	*	*	For RGB/LUT will be set to 00002	NELUTnn	nnth Band Number of LUT Entries	5	Set to 00002	C

Table F-5. NITF Bit-Map Symbol to Image Subheader Mappings

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
*	*	*	Two colors based on SCOLOR	LUTDnnn	nnth Band Data of the mth LUT	*	Based on SCOLOR of R, O, B, or Y	C
*	*	*	Default to 0	ISYNC	Image Sync Code	1	0	R
*	*	*	Default to B	IMODE	Image Mode	1	B	R
*	*	*	Default to 0001	NBPR	Number of blocks per row	4	0001	R
*	*	*	Default to 0001	NBPC	Number of blocks per column	4	0001	R
*	*	*	Maps from NPIXPL	NPPBH	Number of pixels per block (horiz.)	4	0001-8192	R
			Maps from NLIPS	NPPBV	Number of pixels per block (vert.)	4	0001-8192	R
*	*	*	Default to 01	NBPP	Number of bits-per-pixel per band	2	01	R
SDLVL	Display level	3	As-Is	IDLVL	Display Level	3	001-999	R
SALVL	Attachment level	3	As-Is	IALVL	Attachment Level	3	001-998	R
SLOC	Symbol location	10	As-Is	ILOC	Image Location	10	RRRRRCC CCC	R
*	*	*	Set to 1.0	IMAG	Image Magnificatio n	4	1.0	R
*	*	*	Set to 00000	UDIDL	User Defined Subheader Data Length	5	00000	R
SLOC2	Second symbol location	10	Not used	*	*	*	*	*

Table F-5. NITF Bit-Map Symbol to Image Subheader Mappings

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
SCOLOR	Symbol color N: 0=Black, 1=White, IC=NC K: 0=Transparent, 1=Black, IC=NM W: 0=Transparent, 1=White, IC=NM R: 0=Transparent, 1=Red, IC=NM O: 0=Transparent, 1=Orange, IC=NM B: 0=Transparent, 1=Blue, IC=NM Y: 0=Transparent, 1=Yellow, IC=NM	1	Used to determine image IREP, IC, LUT, and presence of pixel mask table for transparency.	*	*	*	*	*
SNUM	Symbol number	6	Not used	*	*	*	*	*
SROT	Symbol rotation	3	Not used	*	*	*	*	*
NELUT	Number of LUT entries	3	Not used	*	*	*	*	*
SXSHDL	Extended Subheader data length	5	As-Is	IXSHDL	Extended Subheader Data Length	5	Numeric	R
SXSOFL	Extended Subheader overflow	3	As-Is	IXSOFL	Extended Subheader Overflow	3	Numeric	C
SXSHD	Extended Subheader Data	**	As-Is	IXSHD	Extended Subheader Data	**	TREs	C

F.2.2.4 NITF 2.0 Symbol Subheader to NITF 2.1 Graphic Subheader for CGM

Table F-6 shows suggestions/recommendations for mapping between NITF 2.0 Symbol subheaders and NITF 2.1 Graphic subheaders when the symbol is in CGM format.

Table F-6. Graphic Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
SY	File part type	2	SY	R	Map As-Is	SY	R
SID	Symbol id	10	Alphanumeric (May not be all spaces)	R	Map As-Is	Alphanumeric (May not be all spaces)	R
SNAME	Symbol name	20	Alphanumeric	O	Map As-Is	Alphanumeric	R
SSCLAS	Symbol security classification	1	T, S, C, R, or U	R	Map As-Is	T, S, C, R, or U	R
Security	Covered in Appendix G	166	Covered in Appendix G	O	Covered in Appendix G	Covered in Appendix G	R
ENCRYP	Encryption	1	0=NOT ENCRYPTED (This value must be 0)	R	Map As-Is	0=NOT ENCRYPTED (This value must be 0)	R
STYPE / SFMT	Symbol type	1	C=CGM	R	Map As-Is	C=CGM	R
NLIPS	Number of lines per symbol	4	0000	R	Map As-Is	*	
NPIXPL	Number of pixels per line	4	0000	R	Map As-Is	*	
NWDTH	Line width	4	0000	R	Map As-Is	*	
NBPP	Number of bits-per-pixel	1	0 for CGM symbols	R	Map As-Is	*	
SSTRUCT	Reserved	13	*	*	See previous 4 values. Previously used for describing Bit-Mapped and Object symbols.	Must be 0000000000000	
SDLVL	Display level	3	001-999	R	Map As-Is	001-999	
SALVL	Attachment level	3	000-998	R	Map As-Is	000-998	
SLOC	Symbol location	10	RRRRRCCCCC	R	Map As-Is	RRRRRCCCCC	
SLOC2	Second symbol location	10	RRRRRCCCCC	O	*	*	
SCOLOR	Symbol color	1	Hex 0x20 Space	R	*	*	

Table F-6. Graphic Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
SNUM	Symbol number	6	000000	O	*	*	
SROT	Symbol rotation	3	000	R	*	*	
NELUT	Number of LUT entries	3	000	R	*	*	
DLUT	Symbol LUT data	*	(NEVER APPEAR)	C	*	*	
SBND1	*	10	*	*	Calculate based on upper left location of Graphic Used in place of SLOC2 in NITF 2.0	RRRRRCCCCC	
SCOLOR	*	1	*	*	Map As-Is	M = Monochrome C = Color.	
SBNDS2	*	10	*	*	Calculate based on lower right location of Graphic Ten bytes are from SNUM, SROT and NELUT in NITF 2.0	RRRRRCCCCC	
SRES2	*	2	*	*	Map to 00 Last two bytes are from NELUT in NITF 2.0	Default to 00	
SXSHDL	Extended Subheader data length	5	00000-99999	R	Map As-Is	00000-99999	R
SXSOFL	Extended Subheader overflow	3	000-999	C	Map As-Is	000-999	C
SXSHD	Extended Subheader Data	**	TREs	C	Map As-Is	TREs	C

F.2.2.5 Label Subheader to Graphics Subheader Requirements

This conversion is not recommended, but table F-7 shows suggestions/recommendations for converting NITF 2.0 label annotations to NITF 2.1 CGM graphics if required. The label character(s) along with the Label Text Color (LTC) and the Label Background Color (LTB) must be used in creating the CGM graphic elements to be included in the CGM graphic segment. Since label font style, cell width, and cell height were not used in NITF 2.0, it is up to the converting application to determine CGM font and character height when converting from Labels to CGM text.

Table F-7. Label Subheader to Graphic Subheader

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
LA	File part type	2	Map to SY	SY	File part type	2	SY	R
LID	Label ID	10	Map As-Is to SID.	SID	Graphic Identifier	10	Alphanumeric (May not be all spaces)	R
*	*	*	Mapping leave all Spaces or create default.	SNAME	Graphic name	20	Alphanumeric	R
LSCLAS	Label security classification	1	As-Is	SSCLAS	Graphic security classification	1	T, S, C, R, or U	R
Security	Covered in Appendix G	166	Covered in Appendix G	Security	Covered in Appendix G	166	Covered in Appendix G	R
ENCRYP	Encryption	1	As-Is	ENCRYP	Encryption	1	0=NOT ENCRYPTED (This value must be 0)	R
*	*	*	Map Set to C	SFMT	Graphic type	1	C=CGM	R
LFS	Label font style	2	Not used.	*	*	*	*	*
LCW	Label cell width	2	Not used.	*	*	*	*	*
LCH	Label cell height	2	Not used.	*	*	*	*	*
*	*	*	Set to 0000000000000	SSTRUCT	*	*	Must be 0000000000000	R
LDLVL	Display level	3	As-Is	SDLVL	Display level	3	001-999	R
LALVL	Attachment level	3	As-Is	SALVL	Attachment level	3	000-998	R

Table F-7. Label Subheader to Graphic Subheader

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
LLOC	Label location	10	As-Is but this could be modified based on internal CGM constructs and offsets.	SLOC	Graphic location	10	RRRRRCCCCC	R
LTC	Label text color	3	Used as a direct Mapping from RGB representation of LTC field of Label Subheader to create Text Color Element RGB representation in CGM file	*	*	*	*	*

Table F-7. Label Subheader to Graphic Subheader

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
LTB	Label background color	3	Used as a Mapping from RGB representation of LTB field of Label Subheader to create Auxiliary Color and Transparency Elements of CGM file. If LTB is 0x00, 0x00, 0x00 Transparency Element is set to On and Auxiliary Color is not used. If LTB other than 0x00, 0x00, 0x00 Transparency is set to Off and RGB representation of LTB field of Label Subheader is mapped directly to Auxiliary Color..	*	*	*	*	*

Table F-7. Label Subheader to Graphic Subheader

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
*	*	*	Calculate based on the minimum value for x and y contained in the created CGM file segment, the upper left location of Graphic	SBND1	First Graphic Bound Location	*	RRRRRCC CCC	R
*	*	*	Set to C if three LTC values are not all the same. Set to M if all three LTC values are identical.	SCOLO R	Graphic Color	*	C = color M = monochro me.	R
*	*	*	Calculate based on the maximum value for x and y contained in the created CGM file segment, the lower right location of Graphic	SBNDS2	Second Graphic Bound Location	*	RRRRRCC CCC	R
*	*	*	Set to 00	SRES2	Reserved	*	Default to 00	R
LXSHDL	Extended Subheader data length	5	As-Is	SXSHDL	Extended Subheader data length	5	00000-99999	R
LXSOFL	Extended Subheader overflow	3	As-Is	SXSOFL	Extended Subheader overflow	3	000-999	C

Table F-7. Label Subheader to Graphic Subheader

Field	Description	Size	Mapping	Field	Description	Size	Format Values NITF 2.1	Type
LXSHD	Extended Subheader Data	**	As-Is	SXSHD	Extended Subheader Data	**	TREs	C

F.2.2.6 NITF 2.0 Text Subheader to NITF 2.1 Text Subheader

Table F-8 shows suggestions/recommendations for mapping Text subheaders.

Table F-8. Text Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
TE	File part type	2	TE	R	Map As-Is	TE	R
TEXTID	Text id	10/7	Alphanumeric (May not be all spaces)	R	Map first 7 bytes As-Is to NITF 2.1. Map 7 bytes NITF 2.1 to first 7 bytes of NITF 2.0.	Alphanumeric (May not be all spaces)	R
TXTALVL	*	*/3	*	*	Map NITF 2.1 3 bytes to bytes 8, 9 & 10 of NITF 2.0 TEXTID. When creating NITF 2.1 from NITF 2.0 map to 000	000-998	R
TXTDT	Text date and time	14	DDHHMMSSZ MONYY	O	Map As-Is except for format change	CCYYMMDDhh mmss	R
TXTITL	Text title	80	Alphanumeric		As-Is	Alphanumeric	
TSCLAS	Text security classification	1	T, S, C, R, or U	R	As-Is	T, S, C, R, or U	R
Security	Covered in Appendix G		Covered in Appendix G	O	Covered in Appendix G	Covered in Appendix G	R
ENCRYP	Encryption	1	0=NOT ENCRYPTED (This value must be 0)	R	As-Is	0=NOT ENCRYPTED (This value must be 0)	R

Table F-8. Text Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
TXTFMT	Text format	3	STA or MTF	R	As-Is, STA and MTF only	STA or MTF, others allowed, but will not be converted.	R
TXSHDL	Extended Subheader data length	5	00000-99999	R	As-Is	00000-99999	R
TXSOFL	Extended Subheader overflow	3	000-999	C	As-Is	000-999	C
TXSHD	Extended Subheader Data	**	Alphanumeric	C	As-Is	Alphanumeric	C

F.2.2.7 NITF 2.0 DES Subheader to NITF 2.1 DES Subheader

Table F-9 shows suggestions/recommendations for mapping DES subheader, it is recommended that only NITF 2.0 to NITF 2.1 mapping be supported.

Table F-9. DES Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
DE	File part type	2	DE	R	Map As-Is	DE	R
DESTAG	UNIQUE DES TYPE IDENTIFIER	25	Registered Extensions Or Controlled Extensions	R	Map to TRE_OVERFLOW	TRE_OVERFLOW Note: Do not attempt to map NITF 2.1 DES to NITF 2.0.	R
DESVER	VERSION OF THE DATA FIELD DEFINITION	2	01-99	R	Map As-Is	01-99	
DESCLAS	DES security classification	1	T, S, C, R, or U	R	Map As-Is	T, S, C, R, or U	R
Security	Covered in Appendix G	166	Covered in Appendix G	O	Covered in Appendix G	Covered in Appendix G	R
DESOFLW	OVERFLOWED HEADER TYPE	6	UDHD, XHD, UDID, IXSHD, SXSHD, LXSHD, TXSHD	R	Map As-Is	UDHD, XHD, UDID, IXSHD, SXSHD, TXSHD	R
DESITEM	DATA ITEM OVERFLOWED	3	000-999	R	Map As-Is	000-999	R
DESSDL	Extended Subheader data length	4	00000	R	Map As-Is	00000	R

Table F-9. DES Subheader Mappings

Field	Description	Size	Format Values NITF 2.0[1]	Type	Mapping	Format Values NITF 2.1[1]	Type
DESXSHD	Extended Subheader Data	**	Omit conditional field	C	Map As-Is	Omit conditional field	C

F.3 General Changes in Image Representation

This paragraph is a guide for potential developers to assist with imposed limitations in supported image representations, based on many low-end applications. Table 10 addresses areas of functional concern, description and considerations and recommendations in the conversion process.

Table F-10. Image Representation Conversion Considerations

Image Function	Description	Consideration/Recommendation
Bit-depth precision	The abundance of source products are greater-than-8-bit and must be down sampled to 8-bit for distribution.	The conversion process should look at the source bit-depth and do a best fit of the spread of values to the 256 samples allowed in an 8-bit product. Simply, cutting upper or lower bits is not a good representation of the source product in the resulting product.
Allowed Image Compression	Many low-end applications do not support image compression and data must be delivered as non-compressed. Additionally, some low-end applications only support non-compressed and 8-bit JPEG DCT compression.	In order to disseminate products that are useable by many low-end applications, the process must have the ability to decompress source products and deliver them as non-compressed in the desired delivery. Additionally, as some low-end NITF processers handle only non-compressed and JPEG 8-bit DCT, source JPEG 12-bit DCT products must be decompressed and exported as either non-compressed or JPEG 8-bit DCT.
Visual representation of image	Many low-end applications support only 1 and 3 band products.	Distributing processes, in order to meet the needs low-end processers, must have the ability to disseminate products as individual bands. Additionally, to applications that support 3 band products as well, the dissemination process should not only disseminate source 3 band products, but should have a means for exporting multispectral products as either a single band of any band of the multispectral source product or as a 3 band product based on a selection process of 3 bands from the source multispectral product.

Table F-10. Image Representation Conversion Considerations

Image Function	Description	Consideration/Recommendation
Interleave of pixel data	Low-end applications generally support pixel interleaving only.	The distributing applications must have the means to change the pixel interleaving of source products. The major concern here is most low-end processes support pixel interleave (NITF IMODE P), so no matter the source interleave the disseminating process must be able to provide the product in the interleave of the receiving application.
Allowed blocking (tiling) factors	Most imagery applications either do not support image blocking or support only specific blocking sizes.	As most applications support file formats that do not support blocking and for those old NITF 2.0 applications that strictly support fixed block sizes, disseminating processes must have a means to modify the source blocking factors to meet the needs of the receiving application. Note: Applications that do not allow blocking are generally limited to image sizes of 8192 x 8192 or less, so disseminating process must consider this as well.
Changes in resolution	Most non-NITF applications do not support blocking and generally have an image size limitation of 8192 x 8192.	If source products are greater than 8192 x 8192 disseminating processes must either consider reducing the resolution of the source product to created a disseminated product of no greater than 8192 x 8192. Note: It is recommended that applications that perform reducing the resolution of an image use a neighbor averaging technique.
Chipping	Most non-NITF applications do not support blocking and generally have an image size limitation of 8192 x 8192.	For source images larger 8192 x 8192 chipping is another means to provide a source product without reducing the resolution of the source product. The disseminating process can create a number of image chips at full resolution that cover the entire source product and export the chips for use by receiving applications.

F.4 NITF to JPEG, SunRaster, TIFF, GeoTIFF and JPEG2000

This paragraph is used as a guide for potential developers to assist them in the understanding of conversion of NITF 2.0 and NITF 2.1 products to other file formats, but primarily to NGA identified formats of JPEG, SunRaster, TIFF, GeoTIFF and JPEG2000. As the NITF file formats are much more robust than other formats, developers must take into consideration potential limitations based on other formats. Table 11 addresses translation/conversion concerns of the different formats.

Table F-11. Translation/Conversions Concerns

File Format	Limitations
JPEG and SunRaster, Many other potential formats have same limitations	Single Image 8-bit only Single Blocked Generally Maximum size of 8192 x 8192. No Geo-Location Support
TIFF	Single Image May be 8-bit only No Geo-Location Support Implementation may limit file size
GeoTIFF	Single Image May be 8-bit only Implementation may limit file size
JPEG2000	Possible Profile Limitations

F.4.1 NITF to JPEG or SunRaster

Table F-12 shows suggestions/recommendations and consideration for creating and mapping NITF products to JPEG and SunRaster.

Table F-12. NITF to JPEG or SunRaster

Consideration	Suggestion/Recommendation
Single or Multi Segment	If the product is an Exploited Target Product burn all segments into raster and provide an extract visual single image JPEG or SunRaster file of source NITF product. If non-Exploited Product: If single image NITF Product, save directly as a JPEG or SunRaster file. If multi image NITF Product, allow user to select individual image to be saved as a JPEG or SunRaster file.
Image Size	If image size is over 8192 x 8192. If interface does not allow Chipping/Area of Interest, product cannot be saved as a JPEG or SunRaster file. If the interface allows Chipping/Area of Interest, then the user should select an area of less than 8192 x 8192 in source NITF and save the area as a JPEG or SunRaster file. If source image less than 8192 x 8192, the image can be saved directly as JPEG or SunRaster file.
Number of Bits	If source image is other than 8-bits. If interface allows bit conversion, convert from source number of bits to 8-bits, and save the source product as a JPEG or SunRaster file. If interface does not allow bit conversion, the product cannot be saved as a JPEG or SunRaster file. If source image is 8-bits the image can be saved directly as a JPEG or SunRaster file.

F.4.2 NITF to TIFF or GeoTIFF

Table F-13 shows suggestions/recommendations and consideration for creating and mapping NITF products to TIFF and GeoTIFF.

Table F-13. NITF to TIFF or GeoTIFF

Consideration	Suggestion/Recommendation
Single or Multi Segment	If the product is an Exploited Target Product burn all segments into raster and provide an extract visual single image TIFF or GeoTIFF file of source NITF product. If non-Exploited Product: If single image NITF Product, save directly as a TIFF or GeoTIFF file. If multi image NITF Product, allow user to select individual image to be saved as a TIFF or GeoTIFF file.
Image Size If limited by individual TIFF or GeoTIFF implementation	If source image less than 8192 x 8192, the image can be saved directly as TIFF or GeoTIFF file. If no limitations on source product greater than 8192 x 8192, save source product directly as a TIFF or GeoTIFF file. If implementation limitation, if image size is great than 8192 x 8192. If interface does not allow Chipping/Area of Interest, product cannot be saved as a TIFF or GeoTIFF file. If the interface allows Chipping/Area of Interest, then the user should select an area of less than 8192 x 8192 in source NITF and save the area as a TIFF or GeoTIFF file.
Number of Bits If limited by individual TIFF or GeoTIFF implementation	If source image is 8-bits the image can be saved directly as a TIFF or GeoTIFF file. If no limitations on source product of other than 8-bits, save source product directly as a TIFF or GeoTIFF file. If source image is other than 8-bits. If interface allows bit conversion, convert from source number of bits to 8-bits, and save the source product as a TIFF or GeoTIFF file. If interface does not allow bit conversion, the product cannot be saved as a TIFF or GeoTIFF file.
Geo-Location Support	
TIFF	This is not supported in TIFF Products.

GeoTIFF	As a minimum for all source NITF products with an image segment containing Image Geographic Location (IGEOLO), the exported GeoTIFF file will contain as a minimum a GeoKeyDirectoryTag (Code 34735) GeoTIFF tag containing the coordinate system information. If source NITF products contain Geo-Location Tagged Record Extensions (TREs), the resulting GeoTIFF products will contain additional GeoTIFF tags. This will be based on mapping of TREs to associated GeoTIFF tags. The associated GeoTIFF tags to be considered are GeoDoubleParamsTag (Code 34736), GeoAsciiParamsTag (Code 34737), ModelTiepointTag (Code 33922), ModelPixelScaleTag (Code 33550), ModelTransformationTag (Code 33550), GTModelTypeGeoKey (Code 1024), GTRasterTypeGeoKey (Code 1025), GTCitationGeoKey (Code 1026), GeographicTypeGeoKey (Code 2048), GeogCitationGeoKey (Code 2049), GeogGeodeticDatumGeoKey (Code 2050), GeogPrimeMeridianGeoKey (Code 2051), GeogLinearUnitsGeoKey (Code 2052), GeogLinearUnitSizeGeoKey (Code 2053), GeogAngularUnitsGeoKey (Code 2054), GeogAngularUnitSizeGeoKey (Code 2055), GeogEllipsoidGeoKey (Code 2056), GeogSemiMajorAxisGeoKey (Code 2057), GeogSemiMinorAxisGeoKey (Code 2058), GeogInvFlatteningGeoKey (Code 2059), GeogAzimuthUnitsGeoKey (Code 2060), GeogPrimeMeridianLongGeoKey (Code 2061), ProjectedCSTypeGeoKey (Code 3072), PCSCitationGeoKey (Code 3073), ProjectionGeoKey (Code 3074), ProjCoordTransGeoKey (Code 3075), ProjLinearUnitsGeoKey (Code 3076), ProjLinearUnitSizeGeoKey (Code 3077), ProjStdParallel1GeoKey (Code 3078), ProjStdParallel2GeoKey (Code 3079), ProjNatOriginLongGeoKey (Code 3080), ProjNatOriginLatGeoKey (Code 3081), ProjFalseEastingGeoKey (Code 3082), ProjFalseNorthingGeoKey (Code 3083), ProjFalseOriginLongGeoKey (Code 3084), ProjFalseOriginLatGeoKey (Code 3085), ProjFalseOriginEastingGeoKey (Code 3086), ProjFalseOriginNorthingGeoKey (Code 3087), ProjCenterLongGeoKey (Code 3088), ProjCenterLatGeoKey (Code 3089), ProjCenterEastingGeoKey (Code 3090), ProjCenterNorthingGeoKey (Code 3091), ProjScaleAtNatOriginGeoKey (Code 3092), ProjScaleAtCenterGeoKey (Code 3093), ProjAzimuthAngleGeoKey (Code 3094), ProjStraightVertPoleLongGeoKey (Code 3095), VerticalCSTypeGeoKey (Code 4096), VerticalCitationGeoKey (Code 4097), VerticalDatumGeoKey (Code 4098), VerticalUnitsGeoKey (Code 4098).

F.4.3 NITF to JPEG2000

Table F-14 shows suggestions/recommendations and considerations for creating and mapping NITF products to JPEG2000.

Table F-14. NITF to JPEG2000

Consideration	Suggestion/Recommendation
Single or Multi Segment	Save all products using blocking factor of source NITF Product. If the product is an Exploited Target Product burn all segments into raster and provide an extract visual single image JPEG2000 file of source NITF product. If non-Exploited Product: If single image NITF Product, save directly as a JPEG2000 file. If multi image NITF Product, allow user to select single image to be saved as a JPEG2000 file. Note: The ISO for JPEG2000 allows for multi-image JPEG2000 file formatted products, but currently not defined in allowed JPEG2000 Profiles.
Geo-Location Support	This is not directly supported in JPEG2000 Products at this time. However, through the use of allowed XML Boxes in the JPEG2000 file header this could be accomplish if XML tags are defined and developed.

F.5 JPEG, SunRaster, TIFF, GeoTIFF and JPEG2000 to NITF

This paragraph is used as a guide for potential developers to assist them in the understanding of conversion of non-NITF products from other file formats, but primarily from NGA identified formats of JPEG, SunRaster, TIFF, GeoTIFF and JPEG2000. It is strongly recommended that these products be converted only to NITF 2.1. As all of these file formats are currently single image based, the resulting NITF products will only contain an image segment and in the case of GeoTIFF and JPEG2000 there is a potential for TREs in support of Geo-Location. Table F-15 addresses considerations for creating NITF products.

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
File Header					
FHDR	File Profile Name	4	NITF	R	NITF
FVER	File Version	5	02.10		02.10
CLEVEL	Compliance Level	2	03, 05, 06, 07	R	Established based on size of image.
STYPE	System Type	4	BF01	R	BF01
OSTAID	Originating Station ID	10	BCS-A (May not be all spaces)	R	Establish Value
FDT	File Date & Time	14	CCYYMMDDhhmmss	R	Date and Time file was created.
FTITLE	File Title	80	UT1 (default is all spaces)	R	Establish Value
FSCLAS	File Security Classification	1	T, S, C, R, or U	R	Set Classification based on network classification on which the application resides. Note: For these products the FSCLAS and ISCLAS will be identical.
Security	Covered in Appendix G	166	See Appendix G	*	Follow local security procedures.
ENCRYP	Encryption	1	0 = Not Encrypted (This field must contain the value 0)	R	0
FBKCG	File Background Color	3	Unsigned Binary integer (0x00-0xFF, 0x00-0xFF, 0x00-0xFF in Red, Green, Blue order	R	Establish Value
ONAME	Originator's Name	27	UT1 (default is all spaces)	O	Establish Value
OPHONE	Originator's Phone Number	18	BCS-A (default is all spaces)	O	Establish Value
FL	File Length	12	Numeric	R	Calculated based File Header, Image Subheader and Image segment.
HL	NITF Header Length	6	Numeric	R	Generally will be 000404 unless Tagged Record Extensions (TRE) added to File Header
NUMI	Number of Image Segments	3	Numeric	R	1
LISH001	Length of Nth Image Subheader	6	Numeric	C	Calculated based on fields used in Image Subheader, as a minimum will be 000439

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
LInnn	Length of Nth Image	10	Numeric	C	Calculated based on image segment size.
NUMS	Number of Graphic Segments	3	Numeric	R	0
NUMX	Reserved	3	Numeric must be 000	R	000
NUMT	Number of Text Segments	3	Numeric	R	000
NUMDES	Number of DES Segments	3	Numeric	R	000
NUMRES	Number of RES Segments	3	Numeric must be 000	R	000
UDHDL	User Defined Header Data Length	5	Numeric	R	Generally will be 00000
UDHOFL	User Defined Header Overflow	3	Numeric	C	If UDHDL 00000 not used
UDHD	User Defined Header Data	**	TREs	C	If UDHDL 00000 not used
XHDL	Extended Header Data Length	5	Numeric	R	Generally will be 00000, unless PIAPRC TRE is generated conversion source.
XHOFL	Extended Header Overflow	3	Numeric	C	If XHDL 00000 not used
XHD	Extended Header Data	**	TREs	C	If XHDL 00000 not used
Image Subheader					
IM	File Part Type	2	IM	R	IM
IID/IID1	Identification Code of Image	10	BCS-A non-blank; User defined	R	Establish Value
IDATIM	Image Date & Time	14	CCYYMMDDhhmmss	R	For JPEG and SunRaster this will be all dashes. For TIFF, GeoTIFF and JPEG2000 if date of image collection is identified use that date if not all dashes.
TGTID	Target ID	17	BBBBBBBBBBOOOOOCC	R	Generally will be spaces
ITITLE/IID2	Title of Image	80	ECS-A (Default is spaces)	R	Establish Value
ISCLAS	Image Security Classification	1	T, S, C, R, or U	R	Set Classification based on network classification on which the application resides.
Security	Covered in Appendix G	166	See Appendix G	*	Follow local security procedures.
ENCRYP	Encryption	1	0 = Not Encrypted (This field must contain the value 0)	R	0
ISORCE	Image Source	42	ECS-A (Default is spaces)	R	Establish Value

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
NROWS	Number of Significant Rows in image	8	00000064-00065536 (Based on CLEVEL), NITF 2.1 allows larger image sizes, but conversions are restricted to this range.	R	Value as store in source file format.
NCOLS	Number of Significant Columns in image	8	00000064-00065536 (Based on CLEVEL), NITF 2.1 allows larger image sizes, but conversions are restricted to this range.	R	Value as store in source file format.
PVTYPE	Pixel value type	3	INT, B (Other pixel value types (C & R) are allowed in NITF 2.1, but should not be converted to NITF 2.0.)	R	Value as store in source file format.
IREP	Image Representation	8	Alphanumeric MONO, RGB, MULTI	R	For JPEG and SunRaster this will be either MONO or RGB For TIFF, GeoTIFF and JPEG2000 will be either MONO, RGB, or MULTI
ICAT	Image Category	8	VIS, EO, IR, SAR, MS other values are allowed in Register.	R	For JPEG and SunRaster this will be VIS For TIFF, GeoTIFF and JPEG2000 if 1 or 3 bands VIS if greater than 3 bands MS
ABPP	Actual Bits-per-pixel Per Band	2	01 through 32	R	Value as store in source file format. Generally, for JPEG and SunRaster this will be 08 For TIFF, GeoTIFF the value will be either 01, 08, or 16 For JPEG2000 the value could any value from 01 to 32
PJUST	Pixel Justification	1	R	R	R
ICORDS	Image Coordinate System	1	U, G, N, S, D or (Default is spaces). Values vary between file formats correct representation must be assigned.	R	For JPEG, SunRaster and TIFF this will be a space. For GeoTIFF the value will be either G, N, S, or D For JPEG2000 the value will be either G, N, S, D, or a space.
IGEOLO	Image Geographic Location	60	±dd.ddd±ddd.ddd (4 times) ddmmssXdddmmssY(4 times) or zzBJKeeeeennnnn (four times) or zzeeeeeennnnnnn (4 times)	C	This will be populated if GeoTIFF or if JPEG 2000 and ICORDS not a space.
NICOM	Number of Image Comments	1	0-9	R	Generally will be 0

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
ICOMn	Image Comment N	80	ECS-A (Default is spaces)	C	If NICOM 0 not used.
IC	Image Compression	2	NC – No Compression, C3 - JPEG, C8 – JPEG2000	R	For all formats this should be NC, C3, or C8 Note: JPEG, SunRaster, TIFF and GeoTIFF the products have to be unpacked into an non-compressed raster and then mapped to NITF NC or compressed into NITF supported C3 or C8. For JPEG2000 if compression match NITF supported JPEG2000, the image can be placed directly into the NITF image segment. If the JPEG2000 file formatted product does not support NITF JPEG2000 it must be unpacked into an non-compressed raster and then mapped to NITF NC or compressed into NITF supported C3 or C8.
COMRAT	Compression Rate Code	4	C3 = xx.y. C8 for Numerically Lossless = Nxyz, for Visually Lossless = Vxyz, for Lossy = wxyz.	C	For an IC of NC not used. For C3 follow MIL-STD 198A. For C8 follow BPJ2K01.00.
NBANDS	Number of Bands	1	0 – 9	R	Value as store in source file format. For JPEG and SunRaster this will be either 1 or 3 For TIFF, GeoTIFF and JPEG2000 the value could any value form 1 to 9
XBANDS	Number of Multispectral Bands	1	00010 – 99999	C	For TIFF, GeoTIFF and JPEG2000 this will be present if 10 bands or greater.

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
IREPBANDnn	nnth Band Component Representation	2	M, R, G, B, spaces	R	If a single band product this will be set to M If an IREP = MULTI product all IREPBANDnn will be set to a space If an IREP = RGB product IREPBAND01 will be set to R, IREPBAND02 will be set to G, IREPBAND03 will be set to B,
ISUBCATnn	nnth Band Subcategory	6	Within the defined Image	R	Generally this will be set to spaces. However if TIFF, GeoTIFF or JPEG2000 product has stored associated information this field could be populated.
IFCnn	nnth Band Image Filter Condition	1	N	R	N
IMFLTnn	nnth Band STD Image Filter Code	3	Reserved - 3 spaces	R	Spaces
NLUTSnn	nnth Band Number of LUTS	1	0, 1 or 3, other values allowed, but will not be converted.	C	Generally will be 0
NELUTnn	nnth Band Number of LUT Entries	5	For 1 or 3 LUTS move As-Is	C	If application allows LUTs this would be populated.
LUTDnnn	nnth Band Data of the mth LUT	*	For 1 or 3 LUTS move As-Is	C	If application allows LUTs this would be populated.
ISYNC	Image Sync Code	1	0	R	0
IMODE	Image Mode	1	B, P, S, R	R	Most likely this will be B, but the processing application will set this value based on Image Mode(s) they support.
NBPR	Number of blocks per row	4	0001-0256	R	Generally will be 1, but application may choose to block image segment.
NBPC	Number of blocks per column	4	0001-0256	R	Generally will be 1, but application may choose to block image segment.
NPPBH	Number of pixels per block (horiz.)	4	0001-8192	R	Set to the block size created by process.
NPPBV	Number of pixels per block (vert.)	4	0001-8192	R	Set to the block size created by process.

Table F-15. Translation/Conversions Concerns

Field	Description	Size	Format Values NITF 2.1	Type	Values
NBPP	Number of bits-per-pixel per band	2	01 to 32	R	Value as store in source file format. Generally, for JPEG and SunRaster this will be 08 For TIFF, GeoTIFF the value will be either 01, 08, or 16 For JPEG2000 the value could any value from 01 to 32
IDLVL	Display Level	3	001-999	R	1
IALVL	Attachment Level	3	001-998	R	0
ILOC	Image Location	10	RRRRRCCCCC	R	0000000000
IMAG	Image Magnification	4	BCS-A	R	For JPEG, SunRaster, TIFF and GeoTIFF this will be set to 1.00 For JPEG2000 value as store in source file format
UDIDL	User Defined Subheader Data Length	5	Numeric	R	Generally will be 00000.
UDOFL	User Defined Subheader Overflow	3	Numeric	C	If UDIDL 00000 not used.
UDID	User Defined Subheader Data	**	TREs	C	If UDIDL 00000 not used.
IXSHDL	Extended Subheader Data Length	5	Numeric	R	Generally will be 00000, unless TREs are generated from GeoTIFF or JPEG 2000 file formats. If the GeoTIFF file contains GeoTIFF tags other than the GeoKeyDirectoryTag (Code 34735) as identified in Table F-12 under GeoTIFF the process should generate associated NITF TREs. If the JPEG2000 file contains XML boxes with Geo-Location data the process should generate associated NITF TREs
IXSOFL	Extended Subheader Overflow	3	Numeric	C	If IXSHDL 00000 not used
IXSHD	Extended Subheader Data	**	TREs	C	If IXSHDL 00000 not used

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Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

APPENDIX G

SECURITY FIELD CONVERSION/MAPPING
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
5 August 2013	Implemented new versioning scheme.	Comply with NASB instructions.

Point of Contact for this appendix: Chairman, NITFS Technical Board (NTB); ntbchair@nga.mil

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the NITFS suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with National Imagery Transmission Format (NITF) version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

G.1 INTRODUCTION

G.1.1 Purpose

Describe common practices regarding transliteration of Security Field values between versions 2.0 and 2.1 of the National Imagery Transmission Format Standard (NITFS).

G.1.2 Scope

These security field transliteration practices provide a starting point for establishing a security marking and transliteration plan for implementation of the NITFS (U.S. classification system only). They do not supplant or override security marking policies, procedures, or directives applicable to specific implementing systems or facilities. Implementers and facility managers should consult with the designated security authorities to ensure their system and/or facility security practices comply with current security policies and directives. The conversions between the NITFS and other formats (e.g., SUN Raster, TIFF, JFIF, GIF, PNG, etc.) are not addressed, since those formats have no standard metadata provisions for security markings. Proper population and transliteration of NITFS security fields is pertinent to imagery production, dissemination, archiving (libraries), exploitation, automated data guards, and their related security implementation policies.

G.1.3 Background

The security field structure and definitions in NITF 2.1 were changed from those in NITF 2.0 to accommodate Executive Order (EO) 12958. There is no direct and easy mapping of data values for all instances of possible security markings between the two field structures. Although population of security fields is very consistent from original source producers (well-known sources), security field population of derived (exploited) classified products varies greatly among operational sites. Since imagery systems are migrating from NITF 2.0 to NITF 2.1, there are present and future requirements to make imagery format conversions within the imagery community. Proper handling of the security fields is critical when performing format conversion services. The practices in this appendix were initially developed, in support of the Image Product Library (IPL) program, in response to a request for assistance from the developer.

G.1.4 Assumptions

The transliteration practices are based on the following assumptions.

G.1.4.1 The requirement for NITF 2.1 to NITF 2.0 conversions is the greatest.

G.1.4.2 It is beneficial to the community to be able to convert as much data with varying security markings as possible.

G.1.4.3 Most of the original classified NITF 2.0 data is from a group of well-known sources. Since these data sources have known and consistent means of marking security fields, a more simple set of rules for transliteration can be defined.

G.1.4.4 In the near-term most of the original classified NITF version 2.1 data will be generated by airborne sources. Early guidance to these data producers in how best to populate security fields may minimize the impact of NITF 2.1 to NITF 2.0 transliterations that operationally need to be supported.

G.1.4.5 There are now secondary producers of NITF 2.1 products that may vary widely. So preservation of data during conversions is not guaranteed, even if guidance is provided to the airborne community as mentioned above.

G.2 DISCUSSION

To facilitate format conversions, a transliteration scheme and policies are needed for the security fields. In some cases the security fields map one-for-one while in other cases the data does not readily map. As a result there are two major issues: 1) providing developers rules for making the conversions, and 2) resolving policy issues that arise from making conversions between formats where the circumstances do not allow a full and unhindered mapping of all security marking data. The following is an attempt to bring to light the conversion issues.

G.2.1 NITF 2.1 to NITF 2.0

Operationally, most NITF 2.1 data in the near term will be generated by the airborne community (primarily collateral markings), Shuttle Radar Topography Mission data (Unclassified, but limited distribution) and the commercial satellite companies (Unclassified). This situation should generally allow for direct mapping to NITF 2.0 with minor exceptions. Translation will be somewhat more complex when control system/codeword markings are needed, but the complexity can be mitigated by establishing guidelines for marking data that will facilitate transition from NITF 2.0 to NITF 2.1.

G.2.2 NITF 2.0 to NITF 2.1

Operationally, most original source classified NITF 2.0 data is from well-known sources. Generally there are only two fields that do not readily map one-for-one between an NITF 2.0 generated files and NITF 2.1. It should be possible to establish translation rules for markings that come from well-known sources.

G.2.3 Exceptions

Finally, it may be best in some complex marking cases to prohibit, through policy, some format conversions where the security fields do not all map to an acceptable degree. The disadvantage is that it may constrain the movement of data within the community. As an alternative, when a server receives a conversion request where security enhancement related data (such as downgrading information) will be lost, the user could be notified of the potential loss and be allowed to accept or refuse the converted file.

G.2.4 Recommended Practices

Table G-1 provides the recommended practices for populating NITF 2.0 security fields for compliance with EO 12958. The field specific guidelines in Table G-1 are designed to ease transliteration of NITF 2.0 security fields to NITF 2.1 security fields and postures users of NITF 2.0 for an eventual transition to NITF 2.1. Tables G-2 and G-3 outline suggested near-term transliteration practices for the NITF 2.1 to 2.0 and NITF 2.0 to 2.1 conversion cases. These practices are based on what is believed to be the preponderance of data being produced now and in the near future.

G.3 CONCLUSION

The discussion above is a brief overview of some specific problems regarding the overall security issues, it is not comprehensive on the subject. The issues and proposed practices primarily address the near-term since system developers need guidance now. Action is needed to develop long-term plans/solutions regarding the security issues of which conversions constitutes a portion.

Table G-1. NITF 2.0 Security Fields Application Guidelines for EO 12958

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	TYPE
xSCLAS	**Security Classification** This field shall contain a valid value representing the classification level of the entire file, or the applicable portion (segment) within the file. Valid values are T (=Top Secret), S (=Secret), C (=Confidential), R (= Restricted), U (=Unclassified).	1	T, S, C, R, or U	R
xSCODE	**Codewords** When applicable, this field shall contain a valid indicator of the SCI Control System and associated Sub-Category/Codewords as applicable. A hyphen character is used following a Control System identifier to link sub-category/codeword codes with the system identifier as a character string. A single slash character is used to separate SCI control system identifier strings. When this field is all spaces, no SCI Control Systems (and associated codewords) apply to the data.	40	Alphanumeric For ease of transliteration to NITF 2.1 security fields, only the first 11 characters of this field shall be populated. Therefore, abbreviations authorized for portion marking shall be used. Format Examples: AAA BB CC BB/CC/AAA BB-D/CC BB-D-EEE/CC	O
xSCTLH	**Control and Handling** When applicable, this field shall contain a valid Dissemination Control Marking. Valid values are as listed in the Control Markings Register. When this field is all spaces, no dissemination control and handling instructions apply.	40	Alphanumeric For ease of transliteration to NITF 2.1 security fields, only the first 2 characters of this field shall be populated. Examples: DS LIMDIS FO For Official Use Only OC ORCON NF NOFORN PR PROPIN RS RSEN See Control Markings Register for currently applicable codes.	O
xSREL	**Releasing Instructions** This field shall contain a valid list of countries and/or groups of countries to which the data is authorized for release. Valid items in the list are one or more of the following separated by single spaces (ASCII 32, decimal) within the field: country codes and groupings that are digraphs in accordance with the Geopolitical Entities, Names, and Codes (GENC) Standard. When this field is all spaces, no file release instructions apply.	40	Alphanumeric Digraph values indicating individual countries, or groupings of countries, (separated by space characters). See the GENC standard of valid digraphs	O

Table G-1. NITF 2.0 Security Fields Application Guidelines for EO 12958

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	TYPE
xSCAUT	**Classification Authority** This field shall contain a valid identifier (code) of the Classification Authority Type, the Classification Reason code, and shall identify the classification authority. The codes shall be in accordance with the regulations governing the appropriate security channel(s). When this field is all spaces, no file classification authority applies (i.e., xSCLAS = U or R).	20	Alphanumeric l_n_mmmmmmmmmmmmmmmm Where: l = Classification Authority Type Code (O, D, M) where: O = Original Class. Authority D = Derived, single source M = Derived, multiple sources n = Classification Reason, values A to G referencing appropriate classification reason from EO 12958. mmmmmmmmmmmmmmmmm = Identification of the classification authority.	O
xSCTLN	**Security Control Number** This field shall contain a valid security control number (alphanumeric) associated with the data. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s). When this field is all spaces, no file security control number applies.	20	Alphanumeric	O
xSDWNG	**Security Downgrade** This field shall contain a valid indicator that designates the point in time at which a declassification or downgrading action is to take place. The valid values are (1) the code 999999 when the originating agency's determination is required (OADR), and (2) the code 999998 when a specific event determines at what point declassification or downgrading is to take place. When this field is all spaces, no security downgrade/declassification condition applies.	6	Alphanumeric Spaces (xSCLAS = U or R) 999999 (OADR) 999998 (Field xSDEVT contains security downgrade/declassification information.	O

Table G-1. NITF 2.0 Security Fields Application Guidelines for EO 12958

FIELD	NAME/DESCRIPTION	SIZE	VALUE RANGE	TYPE
xSDEVT	**Downgrading Event** If the Security Downgrade field (xSDWNG) equals 999998, this field shall be present and shall contain a valid specification of the downgrade event. If this field is present and all spaces, it shall imply that an error exists. Valid values for the event specification depend on the type of event. (See value range field.)	40	Alphanumeric Six possible field structures: 1. DD_CCYYMMDD 2. DE_kkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkk 3. GD_jjjjjjjj_i 4. GE_i_kkkkkkkkkkkkkkkkkkkkkkkkkkkkkkk 5. O_OADR 6. X_hhhh Where: 1. DD = Declassify on the specified date (separated by a space). 2. DE = Declassify on the specified event description (separated by a space). 3. GD = Downgrade on the specified date followed by the downgrade classification code (S or C) (separated by spaces). 4. GE = Downgrade on the specified event description followed by the downgrade classification code (S or C) (separated by spaces). 5. O_OADR = Original classification authority determination required. 6. X = Exempt from automatic declassification followed by applicable exemption codes (X1 - X8, X251 - X259).	C

Table G-2. NITF 2.0 TO NITF 2.1 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.0)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.1	DESCRIPTION	SIZE	VALUE (generic codes used her to graphically show transliteration of data)	Remarks
xSCLASS	Security Classification	1	a	xSCLASS	Security Classification	1	a	Direct Map
				xSCLSY	Security Classification System	2	U.S.	Only U.S.
xSCODE	Codewords	40	bbbbbbbbbbbbbb bbbbbbbbbbbbbb bbbbbbbbbbb	xSCODE	Codewords	11	bbbbbbbbbbb	Problem field (15 usually used by 2.0 producers) If 2.0 field has codewords convert to corresponding digraphs allowed in 2.1. If codewords do not translate to approved digraph or exceeds 11 characters then make a no conversion decision (or manual override if human decision needed.
XSCTLH	Control and Handling	40	cccccccccccccc cccccccccccccc cccccccccc	xSCTLH	Control and Handling	2	CH	Problem Field Propose overflowing into xCLTX If a single codeword used in 2.0 field then convert to valid digraph. If there is no valid digraph or multiple digraphs then place CH and overflow digraphs, or other control and handling to xCLTX field.

Table G-2. NITF 2.0 TO NITF 2.1 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.0)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.1	DESCRIPTION	SIZE	VALUE (generic codes used her to graphically show transliteration of data)	Remarks
XSREL	Releasing Instructions	40	dddddddddddddd dddddddddddddd dddddddddddd	xSREL	Releasing Instructions	20	dddddddddddddd dddddd	2.0 producers usually populate with spaces however, potential data loss if NITF 2.1 file xREL field exceeds 20 characters. Converters may abbreviate where possible, if data is lost from NITF 2.1-field xREL then make a no conversion decision (or allow manual override if human decision needed.)
xSCAUT	Classification Authority	20	eeeeeeeeeeeeee eeeeee					Direct map to 2.1 xSCAUT
xSCTLN	Security Control Number	20	ffffffffffffffffffff					See xSCTLN below

Table G-2. NITF 2.0 TO NITF 2.1 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.0)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.1	DESCRIPTION	SIZE	VALUE (generic codes used her to graphically show transliteration of data)	Remarks
xSDWNG	Security Downgrade	6	gggggg					No matter what value is in 2.0 field xSDWNG (or when data does not map cleanly) set the 2.1 field xSDG to O for OADR to force a manual review. Could also make declass in 10 years as a default. NOTE: this option allows for a cleaner conversion back to 2.0 if done later. Need to add O as code in NITF 2.1 (xSDG) N-0105 for OADR
xSDEVT	Downgrading event	40	hhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhh					No mapping required (Usually not used) If used however data goes in to xCLTX preceded by GE_
				xSDCTP	Declassification Type	2	Default	Data usually not present in 2.0 (If a downgrade was indicated in the 2.0 file from C with no other restrictions then the declassification fields xSDCDT could be used rather then downgrade fields in the 2.1 file.
				xSDCDT	Declassification Date	8	Default	Data usually not present in 2.0

Table G-2. NITF 2.0 TO NITF 2.1 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.0)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.1	DESCRIPTION	SIZE	VALUE (generic codes used her to graphically show transliteration of data)	Remarks
				xSDCXM	Declassification Exemption	4	Default	Data usually not present in 2.0
				xSDG	Downgrade	1	Default	Map as one classification lower if a downgrade date or event in NITF 2.0. (In any case Downgrade action should be forced to a human decision)
				xSDGDT	Downgrade Date	8	Default	If date in 2.0 field xSDWNG then map to here converting 2 digit year to 4 digit year
				xCLTX	Classification Text	43	CH_ccccccccccccccccGE_hhhhhhhhhhhhhhhhhhh	Propose transliterating with data from 2.0 fields xSCTLH using code CH, and for Downgrade/declass event use CODE GE or DE to start downgrade/declass event, if data does not fit then make a no conversion decision (or let requester override and allow conversion any way)
				xSCATP	Classification Authority Type	1	Default	Data usually not present in 2.0 (If info is operationally known then this field can be populated)

Table G-2. NITF 2.0 TO NITF 2.1 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.0)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.1	DESCRIPTION	SIZE	VALUE (generic codes used her to graphically show transliteration of data)	Remarks
				xSCAUT	Classification Authority	40	eeeeeeeeeeeeeeeeeeee	Mapped from 2.0 xSCAUT
				xSCRSN	Classification Reason	1	Default	Data usually not present in 2.0 (If info is operationally known then this field can be populated)
				xSSRDT	Security Source Date	8	Default	Data usually not present in 2.0 (If info is operationally known then this field can be populated)
				xSCTLN	Security Control Number	15	Default	First fifteen chars map, potential to lose 5 characters for NITF 2.1 file NOTE: The use and value of this field are questionable as Control numbers when dealing with data files are not usable in the same manner as with paper documents. Therefore, loss of data here may not be of any consequence.

Table G-3. NITF 2.1 TO NITF 2.0 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.1)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.0	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	Remarks
xSCLASS	Security Classification	1	a	xSCLASS	Security Classification	1	A	Direct map across
xSCLSY	Security Classification System	2	bb					No map needed U.S. system assumed
xSCODE	Codewords	11	ccccccccccc	xSCODE	Codewords	40	ccccccccccc	Direct map across
xSCTLH	Control and Handling	2	dd	xSCTLH	Control and Handling	40	dd	Direct map across
xSREL	Releasing Instructions	20	eeeeeeeeeeeeeeeeeeee	xSREL	Releasing Instructions	40	eeeeeeeeeeeeeeeeeeee	Direct map across
				xSCAUT	Classification Authority	20	l_n_mmmmmmmmmmmmmmm	Data transliterated from 2.1 fields xSCATP, xSCRSN and xSCAUT
				xSCTLN	Security Control Number	20	pppppppppppppppp	Direct map across
				xSDWNG	Security Downgrade	6	999998	If any allowed code is in NITF 2.1 field xSDCTP this field always set to 999998

Table G-3. NITF 2.1 TO NITF 2.0 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.1)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.0	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	Remarks
				xSDEVT	Downgrading event	40	Examples 1. DD_gggggggg_i 2. DE_i_kkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkk 3. GD_jjjjjjjj_i 4. GE_i_kkkkkkkkkkkkkkkkkkkkkkkkkkkkk 5. O_OADR 6. X_hhhh	If xSDWNG set to 999998 _ = spaces unused portion of field is spaces also to fill out to length of 40 35 of a possible 43 alphanumeric from the NITF 2.1 field xCLTX are transliterated, should be sufficient for most data, if not possible solutions are abbreviations or truncation if intelligence is maintained. NOTE: If xSCATP and xSCRSN in 2.1 file are both spaces then this field is a direct map of the 2.1 downgrade event field xCLTX.
xSDCTP*	Declassification Type	2	ff	The code in this field determines the transliteration into the 2.0 field xSDEVT (as shown in examples 1-6 above in xSDEVT field)				
xSDCDT	Declassification Date	8	gggggggg	If code in 2.1 field xSDCTP is DD then this data is placed in 2.0 field xSDEVT (as shown in example 1 above in xSDEVT field)				
xSDCXM	Declassification Exemption	4	hhhh	If code in 2.1 field xSDCTP is X then this data is placed in 2.0 field xSDEVT (as shown in example 6 above in xSDEVT field)				
xSDG	Downgrade	1	i	If code in 2.1 field xSDCTP is DD or GD then this data is placed in 2.0 field xSDEVT (as shown in example 1 and 3 above in xSDEVT field)				
xSDGDT	Downgrade Date	8	jjjjjjjj	If code in 2.1 field xSDCTP is GD then this data is placed in 2.0 field xSDEVT (as shown in example 3 above in xSDEVT field)				
xCLTX	Classification Text	43	kkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkk	If code in 2.1 field xSDCTP is DE or GE then this data is placed in 2.0 field xSDEVT (as shown in examples 2 and 4 above in xSDEVT field)				

Table G-3. NITF 2.1 TO NITF 2.0 Security Field Transliteration/Mapping (Last updated 26 May 2000)

FIELD (2.1)	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	NITF 2.0	DESCRIPTION	SIZE	VALUE (generic codes used here to graphically show transliteration of data)	Remarks
xSCATP	Classification Authority Type	1	l	Transliterated to NITF 2.0 xSCAUT				
xSCAUT	Classification Authority	40	mmmmmmmmmm mmmmmmmmmm mmmmmmmmmm mmmmmmmmm	Partially transliterated to NITF 2.0 xSCAUT, May be able to abbreviate or create transliteration table to keep at no more than length seven.				
xSCRSN	Classification Reason	1	n	Transliterated to NITF 2.0 xSCAUT				
xSSRDT	Security Source Date	8	oooooooo	Not transliterated to NITF 2.0 file assuming not carrying forward has no adverse impact				
xSCTLN	Security Control Number	15	ppppppppppppppp					Direct Map to 2.0 field xSCTLN

* Codes allowed in NITF 2.1 field xSDCTP DD (Declassify on date), DE (Declassify on event), GD (Downgrade on date), GE (Downgrade on event), O (OADR), X (exemption)

NOTE: The example code words, digraphs and control and handling caveats listed in MIL-STD 2500B and referred to in Table G-3 above are for illustrative purposes only. Applications should support security-marking requirements according to approved security policies and guidelines applicable to the site or facility using the system.

Implementation Practices
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National Imagery Transmission Format Standard (IPON)

APPENDIX H

MULTI-IMAGE SCENE TABLE OF CONTENTS (MITOC) TAGGED RECORD EXTENSION (TRE) VERSION 1.0.0

01 August 2007

NOTICE: The MITOC TRE Specification is no longer present in the IPON and has been relocated to the Compendium of Controlled Extensions, STDI-0002-1.

Implementation Practices
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National Imagery Transmission Format Standard (IPON)

APPENDIX I

GENERATION OF REDUCED RESOLUTION NITF IMAGE FILES VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

I.1 Purpose

To provide guidance on the generation of reduced resolution images in the National Imagery Transmission Format (NITF).

I.2 Scope

This appendix discusses practices for generating NITF reduced resolution images in a manner consistent with the traditional method used by the National imagery community. This appendix only addresses single image segment NITF files.

I.3 Practices

In the following discussion the nomenclature rX is used whereby X is the power of 2 used in the reduced resolution image such that:

r0 means the original full resolution image.

r1 means a reduced resolution image where the number of rows and columns are reduced by 1/2 producing an image with 1/4 of the image display size of the full resolution image. This is referred to as a reduction of 1/2 or an IMAG of /2.

r2 means a reduced resolution image where the number of rows and columns are reduced by 1/4 producing an image with 1/8th the display size of the full resolution image. This is referred to as a reduction of 1/4 or an IMAG of /4.

I.3.1 File Name. If the file name of the reduced resolution file contains the sub-string .rX anywhere within it, the decimated files shall contain the same file name with the X replaced by the appropriate reduced resolution value. If the file name of the reduced resolution file does not contain the string .rX then the file names of the decimated files shall contain the same values as the original file with the string .rX appended to the end of the string. If the file name of the reduced resolution file contains more than one .rX sub-string, the first occurrence from left to right shall take precedence and shall be the only one modified.

I.3.2 FTITLE Field. If the FTITLE field of the reduced resolution file contains the sub-string .rX in the 41st, 42nd and 43rd character positions, the decimated files shall contain the FTITLE with the X replaced by the appropriate reduced resolution value, otherwise, the FTITLE will remain unchanged in the .rX files.

I.3.3 IMAG Field. The IMAG field shall contain the value corresponding to the reduction of the Reduced Resolution Data Set (RRDS) using the nomenclature as specified in MIL-STD 2500C.

I.3.4 ITITLE Field. The ITITLE field of the full resolution file shall be exactly duplicated in the reduced resolution image segments of the NITF files.

I.3.5 If the full resolution image segment contains more than one image band then each reduced resolution image segment shall contain the same number of image bands. The image bands of each reduced resolution image segment shall be in the same order as the full resolution file.

I.3.6 The reduced resolution files shall contain the same number of blocks per row and blocks per column as the original full resolution file.

I.3.7 The smallest block size of a reduced resolution file will be 8 rows and/or 8 columns. Note: This (8 x 8 pixel block size) is a known deviation from the NTM standard for producing RRDS.

I.3.8 If the original full resolution file contains any Support Data Extensions (SDEs) (also known as Tagged Record Extensions (TREs)) they may be present in the reduced resolution files.

I.3.9 If an application builds reduced resolution images for the sole purpose of supporting internal processing/display functions, SDEs should not be included in the file and the file naming convention should differ from the naming convention described above. The intent is to not confuse other applications that may key on the file naming convention as the indicator that the file is an NTM or NTM-like file fit for exploitation purposes.

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APPENDIX J

TACTICAL IMAGE IDENTIFIER (TII)
VERSION 1.0.0

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism
1 August 2007	All	Version 0.7 (23 March 2006) published with STDI-0005 Version 1.0, Initial Publication
1 May 2013	All	Version 2.0.0, Initial Publication
28 August 2013	All	Version 1.0.0, Published Version

Editors Notes

Date	Change	Rationale
1 December 2012	-Updated Project Code Definition - Assigned NGA as Project Code management authority - Assigned NTB responsibility as the Registry for Project Codes - Updated Program Code definition - Updated Producer Code Definition - Expanded to non-backward compatible 53-character identifier	- Completeness - Clarification - Compliance with CJCSI 3250.01
5 August 2013	Implemented NASB versioning paradigm	Compliance with NASB instructions
21 August 2013	- Reverted back to legacy 40-character identifier	Community opted to continue research and impact studies before committing to non-backward compatible 53-character identifier.

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J.1 INTRODUCTION

The increasing use of tactical sensors to collect image data over large areas of the earth poses a number of challenges for managing the resulting large data flows through the traditional Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) and the Task, Post, Process and Use (TPPU) processes. Several groups within the Intelligence Community (IC) identified shortfalls with past conventions for image identification within the tactical airborne community. Primary coordination of the new tactical image identifier (TII) has been through the DCGS Imagery Intelligence (IMINT) Integrated Product Team (IPT) and National Imagery Transmission Format Standards (NITFS) Technical Board (NTB). Comments and revisions to this specification will be managed through the NTB, which is the controlling authority for the National Imagery Transmission Format (NITF) and any future related TII issues.

J.1.1 Purpose

This appendix specifies a tactical image identification scheme with the intent to standardize the TII specification for tactical airborne programs. It provides guidance, clarification and recommended practices to allow tactical imagery producers to provide unique image identifications. It also provides common practice for updating tactical image identifiers by downstream processing systems.

J.1.2 Scope

This appendix identifies all cases in which updating/editing of the tactical identification is necessary. This specification applies to NITF 2.1 formatted data only, and in particular, to the Image Identification 2 (IID2) field in the NITF Image Segment Subheader

.

When using this TII specification, the previous Image Identifier formulation mapping partially derived from the Additional Image Identification (AIMIDx) Tagged Record Extension (TRE) shown in table E-4 of STDI-0002-1 shall not be used. AIMIDB may be phased out altogether in the future

.

The tactical identification scheme primarily applies to tactical “still” airborne imagery collectors capable of onboard processing and ground-processing systems as called out by appropriate requirements documents and program authorities. These systems/processors have the responsibility of assigning an initial image identifier when creating the primary image product.

Downstream processors (e.g. screeners, Image Product Library (IPL), an imagery exploitation application, etc.) update characters - 33-40 when creating new secondary image products for external dissemination (e.g. sent to an IPL); however, they do not edit/update the tactical identification when passing along (re-transmitting) images.

IPLs receiving NITF files with the legacy AIMIDB TRE 40-character mapping of the IID field values will not convert to the DCGS TII and are asked to use associated TREs to detect and manage received products. Furthermore, the libraries are not permitted to update to IID2, including PRODUCTION_DATIM for legacy airborne imagery. Libraries receiving NITF files with the DCGS TII should use the ACFTx TRE’s presence to determine if it is from an airborne producer.

NOTE: Neither this appendix, nor The Compendium of Controlled Extensions for the NITF, STDI-0002-1, provides definitive guidance to tactical users for file naming, population of the NITF File Header FTITLE field, derivative imagery product naming or any other relationships between them. Each individual sensor, processor, system, and/or program is left to define its own practices within their respective requirements documents.

J.1.3 Background

STDI-0002-1 appendix E, Airborne Support Data Extensions (ASDE) defines the Additional Image Identification (AIMIDx) TRE. The original intent of the AIMIDx TRE was to provide identification of the original source imagery and its associated support data. The AIMIDx is:

- A required component of all airborne imagery segments (one in each subheader of every NITF image segment).
- Used for catalog, discovery, and retrieval from standard imagery libraries, and
- The source for defining the legacy 40-character image identifier used to populate the IID2 field within the image subheader (see STDI-0002-1, table E-4).

Various tactical sensors and associated processing programs currently populate the AIMIDx TRE (and consequently the IID2 field) using different conventions and practices. Airborne sensors that generate NITF files frequently populate the AIMIDx TRE fields with the allowed default values for a variety of reasons (e.g., lack of onboard processing capability, lack of information, etc.). Individual ground/surface processors attempt to populate the missing data, sometimes resulting in confusion and duplicate IID2 field entries. This confusion impacts various imagery management systems, image libraries and automated dissemination systems causing the Tactical DCGS community to develop a new image identification convention, defined herein.

The DCGS community developed the TII solution with the intent to provide uniqueness and functionality with the least impact/disruption. This solution accommodates the Imagery Exploitation Support System’s (IESS's) 24-character (for uniqueness) and 40-character image ID constraints. This solution does not create a new AIMID TRE version. Tactical sensors and associated processing programs will continue to populate the AIMIDB TRE with valid data, and the processors will continue to edit any fields containing default values, received from the sensors. The TII changes some of the data sources used to populate the IID2 field. The TII will continue to use the AIMID values found in the Acquisition Date, Project Code, and Replay fields.

J.2 REFERENCES

MIL-STD-2500C	National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 1 October 2006.
STDI-0002-1	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 2.1, Volume 1, Tagged Record Extensions, Version 4.0, 01 August 2011.

J.3 TACTICAL IMAGE IDENTIFIER SPECIFICATION

Table J-1 shows the subfield structure of the TII and the recommended flow of TII subfield information. The identifier will be used to populate the first 40 bytes/octets of the IID2 field of each tactical NITF image segment.

J.3.1 Sub-field Information Sources

The original producer of an NITFS image segment populates the IID2 field as specified by table J-2. Generally, the original producer will be an airborne onboard image processor if it supports NITFS outputs, or a ground station image processor (e.g. CIP) or a combination thereof.

Table J-1. Tactical Image Identifier (TII) sources of subfield information

Source	TII Subfield	System Information Sent To
Reconnaissance Operations Management Exercise (ROME)	Program Code	PRISM Mission/Collection Planner GIMS
	Sortie Number	
	Project Code	
PRISM	Collection Date	Mission/Collection Planner
	Program Code	
	Sortie Number	
	Project Code	
Mission/Collection Planner	Collection Date	On-Board NITF Processor Ground NITF Processor (e.g.; CIP) IESS (via CCPM)
	Program Code	
	Sortie Number	
	Scene Number	
	Project Code	
On-Board NITF Processor	Acquisition Date	Ground NITF Processor (e.g.; CIP) or pass through to downstream systems (e.g.; IPL, screener, workstation)
	Program Code	
	Sortie Number	
	Scene Number	
	Product Number	
	Project Code	
	Replay	
	Producer Serial Number	
	Production Date and Time	
Ground NITF Processor	Acquisition Date	Downstream systems
	Program Code	
	Sortie Number	
	Scene Number	
	Producer Code	
	Product Number	
	Project Code	
	Replay	
	Producer Serial Number	
	Production Date and Time	

Sometimes the initial NITF formulation occurs at a stage in which some or not all of the data required to populate the subfields may be available to the onboard processor. In this case, the onboard processor must create a “template” ID populating those subfields for which it has the data. The processor populates fields with the defined default values (see J-4) when the actual value is not yet known.

The Common Imagery Processor (CIP) will use the following logic to populate the TII: 1) Manual Entry (via NITF Packing Plan); 2) Sensor Data (when provided/supported); and 3) Site Defaults (via the NITF Configuration File).

J.3.2 REPLAY field

The codes G01-G99 designating “reprocessed” and codes T01-T99 designating “retransmitted” are only to be used by the processor that does the original formulation of the image in NITF format, including downstream formulation of composites by screener, IPL, or exploitation application. If a sensor sends down image data in a non-NITF format to the ground processor, the ground processor will formulate the original NITF image segment and use code “000”. For multiple image scenes, the Gxx and Txx codes are only used for component images. The C01 and C02 codes are only used for composite images (overviews) of a multi-image scene. See the specification for the Multi-Image Scene Table of Contents (MITOCx) TRE.

J.3.2.1 Reprocessed image data

If the image processor needs to reprocess the raw image data and formulate another NITF image segment from the same data, then it must apply the G01 code for the first reprocessed NITF image segment, G02 for the second, and so on. Downstream processing actions (e.g. recompression, rotation, chipping, selecting specific bands, etc) to edit and resave the image segment must only update the PRODUCTION_DATIM subfield of the pre-established TII. However, if the downstream processor is formulating a brand new image (e.g. a composite overview) then an entire new TII is formulated.

J.3.2.2 Retransmitted image data

The processor originating (e.g. onboard image processor, ground station, etc.) an NITF image segment populates the REPLAY subfield with “000”. If the processing station is requested to retransmit the image, and it still has a copy of the original NITF image segment it created, then it must update the REPLAY subfield with T01 for the first retransmission, T02 for the second retransmission, etc.

If the processor does not retransmit an existing NITF image segment, but reprocesses the raw data into a new NITF image segment, then they must use the Gxx codes. The re-formulation of the image may result in different pixel values, whereas a retransmitted image should be identical to the originally formulated image data. If the ground station image processor retransmits vice reprocesses, it should use the Txx codes. In either case, the PRODUCTION_DATIM subfield will also need to be updated accordingly.

J.3.2.3 Reduced Resolution Data Sets (Rsets)

For production of Reduced Resolution data sets (Rsets) created for use with the image as a group (e.g.; to facilitate zooming), the TII PRODUCTION_DATIM will not be updated. The full resolution image and all its associated Rsets will have the same TII. However, if a specific reduced resolution image is selected or created as a stand-alone product for further dissemination, the PRODUCTION_DATIM subfield must be updated.

For instance, if the recipient of an image containing a TII produces “standard” Rsets on ingest, the PRODUCTION_DATIM does not need to be updated. However, if a user requests a non-standard Rset (an Rset other than the one created automatically on ingest), the library must update the PRODUCTION_IDATIM prior to exporting the product.

J.3.3 Immediate/Manual Scene Numbers and Re-Tasked Images

The Imagery Exploitation Support System (IESS) requires that each scene in a mission have a unique scene number. Scene numbers do not have to be sequential, only unique. Various mission/collection planners can produce ad hoc “re-tasking” or “immediate scenes” collections. In order to satisfy the downstream automated exploitation environment, there are two alternative system concept of operations (CONOPS) that mission/collection planners and on-board NITF sensors should follow when creating “re-tasked” or “immediate scenes”.

J.3.3.1 Alternative One

Alternative One is to assign scene numbers for these special cases at the end of the original mission plan. For instance, if the original mission contained 300 scenes, number re-tasking or immediate scenes starting at 301.

J.3.3.2 Alternative Two

Alternative Two is to assign either of these type scenes at a predetermined reserved set of values that are high enough to not impact any original mission plan (for instance, starting at 66,500).

J.3.4 Specification

The original producer of an NITFS image segment populates the IID2 field as specified by table J-2. Generally, the original producer will be an airborne onboard image processor if it supports NITFS outputs, or a ground station image processor (e.g. CIP) or a combination thereof.

Table J-2. Tactical Image Identifier

R = required by all original image producers

IID2 (Bytes)	Subfield Name	Subfield Description	Value Range	Type
1-7	ACQUISITION_ DATE	Acquisition Date. This is the image collection date and **not** the start of mission date or aircraft takeoff date. DD is the day of the month, MMM is a three letter abbreviation of the month, JAN, FEB,…DEC (uppercase), YY is the least significant 2 digits of the year Note: This is the same date (different format) as recorded in the Image Subheader IDATIM field.	BCS-A DDMMMYY	R
8-9	PROGRAM CODE	Derived from first two characters of the Mission Number listed in ROME Database. Secondary; first two characters of ATO (used when mission is not managed in ROME) If unknown, then use default code in table J-3.	BCS-A 0-9, A-Z (uppercase) Default value is 9Z Either 1st char is numeric and 2nd char is alphabetic, or vice versa See ROME Business Rules for instructions on how to develop Mission IDs.	R
10-11	SORTIE NO	COA 1: Assigned by Operations. Last two characters of sortie number of the month as derived from ROME. “00” indicates sortie number Unknown at time of initial processing.	BCS-A 00 (default) -99, A-Z (uppercase)	R
12-16	SCNUM	Scene Number. Identifies the current scene, and is determined from the mission plan, except for ad hoc “re-tasking” or “immediate scenes”. Scene numbers do not have to be sequential, only unique. See paragraph J.3.3 for further details.	BCS-N 00000-99999	R
17-18	PRODUCER_ CODE	DOD/DIA producer code. Uniquely defines a producer per site. Site designation.	BCS-A AA-ZZ (uppercase) Default is ZX	R

IID2 (Bytes)	Subfield Name	Subfield Description	Value Range	Type
19-24	PRODUCT_NO	Product Number. "Producer-defined" product id number which uniquely defines each product produced by a given producer. This could be a simple one-up product sequence number. E.g., the CIP Product Number is comprised of three separate subfields: a processing configuration number (1 char, 0-F), a product type id (2 chars, 01-FF), and a product sequence number (3 chars, 000-FFF); for CIP processing configuration = 1, product type id = 12, and product sequence number = 25; then the PRODUCT_NO = 10C019 (hex).	BCS-A 0-9, A-Z (uppercase)	R
25 -26	PROJECT_ CODE	COA 1: Two digit NGA assigned code defined by the Mission Nickname as listed in ROME. If unknown, use default code listed in Table J-3	BCS-A Default value is ZZ	R
27 - 29	REPLAY	Replay indicator. Indicates whether the data was reprocessed or retransmitted. See paragraph J.3.1 for additional discussion. 000: original C01: DCGS-I Look Composite C02: DCGS-I Volume Composite G01-G99: Reprocessed Image T01-T99: Retransmitted Image	BCS-A 000, C01, C02, G01-G99, or T01-T99 (uppercase)	R
30 -32	PRODUCER_SN	Producer serial number. Defines a unique instance of the primary image producer (e.g.; processor).	BCS-A 000-FFF (No space characters, uppercase) Represented as either a decimal or a hexadecimal value	R
33-40	PRODUCTION_ DATIM	Production Date and Time.	BCS-A Hexadecimal: 8-char (hex) production date/time (GMT represented in hexadecimal as elapsed time in seconds since midnight January 1, 1970. (uppercase)	R

J.4 DEFAULT FIELD VALUES

The following table identifies several fields and corresponding values that will be used as defaults by the Common Imagery Processor (CIP) as a flag to identify some information that is temporarily unknown, even though these fields are required. The default field values should only be used when the correct value is unknown at the time of initial processing. As TII is adopted by more entities the need for default values will diminish.

Table J-3. Interim TII Default Field Values

Field Name	Interim Field Value
PROGRAM_CODE	9Z
SORTIE_NO	00
PRODUCER_CODE	ZX
PROJECT_CODE	ZZ
REPLAY	000
PRODUCER_SN	000

Implementation Practices
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APPENDIX K

COMMON COLLECTION PLAN MESSAGE (CCPM) VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description
K7	TBR001	Update the System/Segment Interface Control Document for IESS 5.0, #4260023B, 10 June 2003 for CCPM Version 0.1

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
24 November 2004	Initial inclusion of CCPM in the IPON. CCPM has been published twice before in the IESS External ICD.	Provide IC level accessibility and coordination mechanism
18 July 2013	Corrected a misspelled word and a misused word.	For correctness
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

K.1 INTRODUCTION

The increasing use of tactical sensors to collect image data over large areas of the earth poses a number of challenges for managing the resulting large data flows through the traditional Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) and the Task, Post, Process and Use (TPPU) processes. Several groups within the Intelligence Community (IC) identified shortfalls with past conventions for image routing within some areas of the tactical airborne community.

A data flow alternative for single site/single mission management is being delivered via the Distributed Common Ground/Surface System-IMINT 1.2 milestone release (DCGS-I 1.2). The Common Collection Plan Message (CCPM) is part of this solution. Primary coordination of the Common Collection Plan Message has been through the DCGS IMINT IPT, the NITF Technical Board (NTB) and direct IESS-Mission/Collection Planning System (M/CPS) coordination.

Comments and revisions to this specification will be managed through the NITFS Technical Board (NTB). Lower level interface requirements regarding CCPM implementation should be handled via the NGA IESS PMO.

K.1.1 Purpose

This appendix specifies the CCPM scheme. It provides guidance, clarification and recommended practices for M/CPSs in providing the CCPM to IESS.

K.1.2 Scope

This appendix identifies development guidelines, provides the CCPM format, and establishes the system CONOPS for the 24 November 2004, version 0.1 CCPM. The 25 February 2003 initial draft version 0.1 release and the 03 June 2003 version 0.2 release of the CCPM are not documented herein as they have been superceded by the 24 November 2004 Version 0.1 release.

Lower level interface requirements for CCPM are documented in the System/Segment Interface Control Document for IESS 5.0, number 4260023B [TBR001]. This ICD and IESS 5.1.1 will be compliant with this IPON Appendix K release and Version 0.1 CCPM format.

The Mission/Collection Planning System (M/CPS) Interface to IESS is a one-way interface that provides the capability for an external airborne mission/collection planning system to send Common Collection Plan Message (CCPM) information to IESS for enhanced airborne mission support.

The CCPM applies to tactical airborne imagery M/CPSs and the IESS exploitation management systems as called out by appropriate requirements documents and program authorities. M/CPSs have the responsibility of implementing and passing the CCPM under DCGS-I 1.2 and DCGS 10.2 operations.

NOTE: Each individual M/CPS, and/or program, is left to define its own practices within their respective requirements documents especially regarding development of the optional fields of CCPM.

K.1.3 Background

In 2002 after several Technical Exchange Meetings (TEMs) and DCGS IMINT IPTs, a DCGS-I 1.2 milestone was scoped. One on the main requirements of DCGS-I 1.2 was to deliver an alternative, non-conflicting and flexible imagery data flow workflow management capability. This solution is based primarily on IESS-CIP exchanges. To enhance this operation, several "front-end" message exchanges were incorporated including CCPM. CCPM allows IESS to pre-set several data flow routings.

The external CCPM message is transmitted to establish or update in the IESS database the full scene imagery to be collected for a particular mission. The external M/CPS system transmits the external CCPM message in XML format to IESS using FTP. IESS parses and validates the message. If the message passes validation, IESS performs TIC/RIC to identify the targets with due requirements covered by each scene description identified in the message. Routing information for the scenes covering Time Critical Targets (TCTs, targets whose exploitation priority meets or exceeds the defined threshold value) and unchippable scenes (scenes from sensors for which Spot Image Request is not supported) covering targets with due requirements are stored in the database. If the CCPM is an update for a mission in progress, Product Routing Plan Messages will be sent to the CIP for all modified scenes, provided that IESS has not yet received an Exploitation Metadata Message (EMM) for that scene.

K.2 REFERENCES

4260023B System/Segment Interface Control Document for IESS 5.0, 10 June 2003

AF Multi-INT TRD Air Force Distributed Common Ground System (AF DCGS), Block No. AFDCGS-03-004 10.2 Air Force Multi-INT Technical Requirements Document, 19 September 2003

K.3 COMMON COLLECTION PLAN MESSAGE SPECIFICATION

Table K-1 shows the sub-field structure of the Common Collection Plan Message (CCPM).

Table K-1. Common Collection Plan Message (CCPM)

Field Name	Type	Size	Range	M, C or O	Remarks
MISSION REC					(START)
Project_Code	Alpha (upper case)	2		M	NGA assigned codes
Take_Off_Time	Numeric	12		M	Launch time of platform in GMT. YYMMDDhhmmss where Y = Year, M = Month, D = Day, h = Hour, m = Minute, s = Second
Program Code	Alphanumeric	2		M	Theater Code(digit) followed by Program Name(alpha)
Sortie	Alphanumeric	2		M	Sortie of the month
Message_Sequence_Number	Numeric	3	001-999	M	If Message_Sequence_Number = 001, it is a complete Collection Plan. If Message_Sequence_Number > 001 it is a delta Collection Plan relative to the last Collection Plan.
Sensor_ID	Alphanumeric	6		M	SENSOR_ID field in ACFTB TRE
MISSION REC					(END)
SCENE COUNT REC					(START)
Scene_Count	Numeric	5	00001-99999	M	Number of Scenes
SCENE COUNT REC					(END)
SCENE REC					(START) Repeated for each Scene_Count
Sensor_Mode	Numeric	3	001-999	M	MPLAN field in ACFTB TRE
Scene_Number	Numeric	5	00001-99999	M	Scene Number

Table K-1. Common Collection Plan Message (CCPM)

Field Name	Type	Size	Range	M, C or O	Remarks
Scene_ToT	Numeric	12		O	The collection date and time over target (Planned or Required) YYMMDDhhmmss where Y = Year, M = Month, D = Day, h = Hour, m = Minute, s = Second
Scene_Trans_Code	Character	1	Blank, A, C, D	M	If Message_Sequence_Number = 001: Blank If Message_Sequence_Number > 001: A = Add C = Change D = Delete
Scene_NIIRS	Numeric	3	0.0 - 9.0	O	Required minimum NIIRS with GSD
Clockwise_Coord_1	Alphanumeric	15	Lat/Long	M	Scene Corner Coord 1 Pixel(0,0) DDMMSSHDDDMMSSH where D = Degree, M = Minute, S = Second, H= Hemisphere
Clockwise_Coord_2	Alphanumeric	15	Lat/Long	M	Scene Corner Coord 2 DDMMSSHDDDMMSSH where D = Degree, M = Minute, S = Second, H= Hemisphere
Clockwise_Coord_3	Alphanumeric	15	Lat/Long	M	Scene Corner Coord 3 DDMMSSHDDDMMSSH where D = Degree, M = Minute, S = Second, H= Hemisphere
Clockwise_Coord_4	Alphanumeric	15	Lat/Long	M	Scene Corner Coord 4 DDMMSSHDDDMMSSH where D = Degree, M = Minute, S = Second, H= Hemisphere
BE COUNT REC					(START)
BE_Count	Numeric	3	000-999	M	Number of BEs
BE COUNT REC					(END)
BE REC					(START) Repeated for each BE_Count
BE_Suffix	Alphanumeric	15		C	BE and Suffix
BE_Name	Alphanumeric	38		C	Target Description
BE_Lat/Long	Alphanumeric	15	Lat/Long	C	DDMMSSHDDDMMSSH where D = Degree, M = Minute, S = Second, H= Hemisphere
BE_Elevation	Alphanumeric	8	-99999.9 to +99999.9	C	Ground Elevation in feet MSL
BE_Priority	Numeric	3	000-999	C	Exploitation Priority
BE REC					(END)
SCENE REC					(END)

M: Mandatory - must be present in all messages (required for IESS Collection Plan Processing)
C: Conditional - will be present in all messages meeting defined conditions
O: Optional - may be present in a message (anything not Mandatory or Conditional)
NOTE: Alpha entries are to be in upper case.

K.3.1 Sources of information for CCPM

M/CPSs provide IESS with the CCPM. All DCGS M/CPSs should be capable of populating all mandatory fields of the CCPM based on available standard mission/collection planning information. Populating Scene NIIRS, an optional field of CCPM, will depend on individual sensors' ability to provide this information. BE related information (conditional fields) will be dependent on the M/CPS receiving this information.

K.3.2 System CONOPS for CCPM to IESS

M/CPSs should send a CCPM for the original mission/collection pre-plan/plan. The Message Sequence Number for the original mission must be 001. The Scene Trans Code must be blank in this case. The original pre-planned mission CCPM should contain only one entry for the first two records/sections of CCPM - MISSION REC and SCENE COUNT REC - but a separate entry for each scene collection for the remaining CCPM records/sections - SCENE REC, BE COUNT REC, and BE REC (conditional sub-field).

M/CPSs should send a CCPM for each ad hoc collection. Ad hoc collections are those added, changed, or deleted from the original pre-planned/planned mission. Ad hoc collections can be "re-tasking" scene types or "immediate scene" types. Each new CCPM must be numbered sequentially under the Message Sequence Number sub-field of CCPM. For instance, the first ad hoc CCPM should have a 002 entry in the Message Sequence Number sub-field. Each new CCPM must have a "A", "D" or "C" populated in the Scene Trans Code sub-field. Collections were the basic ground coverage and targets/BEs are the same but collection angle is changed should have a "c" in the Scene Trans Code sub-field.

For each ad hoc collection, M/CPSs should contain only one entry for the first two records/sections of CCPM - MISSION REC and SCENE COUNT REC - and a separate entry for each scene collection for the remaining CCPM records/sections - SCENE REC, BE COUNT REC, and BE REC (conditional sub-field).

There are three alternatives for how to handle numbering of immediate scenes. See Appendix J, Tactical Image Identifier Specification, for alternative breakdown and details.

K.3.3 Functional Interface Specification

Common Collection Plan Message (CCPM) files, in XML format, will be transferred from an external mission/collection planning system to designated IESS directories using standard FTP, as specified by IETF-STD-0009, or POSIX compliant copy commands initiated by the external source. IESS parses and validates the XML data.

The XML schema for this interface is documented in the System/Segment ICD for IESS 5.0. Refer to the XML schema definitions in Appendix J for complete syntax information for the XML message files.

This interface supports the receipt of data message files from external sources recognized by the IESS server. Recognized FTP sources will be provided access to directories on the IESS server designated for the receipt of specific data message files. External data sources must coordinate with the agencies responsible for the IESS server to obtain the directory identification and logon information prior to transferring data files. The interface consists of one message - CCPM.

IESS will validate the Message Sequence Number in ascending order. However, this is an IESS internal validation. No error message is sent to the M/CPS. CCPM is currently a one-way interface only. If an external CCPM messages fails validation, an application status notice is created to notify the IESS user. No provision is made to correct the message.

K.3.4 IESS filename convention for the CCPM

The IESS filename convention for the CCPM file is given below:

Position	Description
1-2	Node (Organization) Code
3-7	“MCCCP”
8-13	Transmission Sequence (One Up) Number
14	“.” (period)
15-16	“OX” = Temporary, “OC” = Final

NOTES:
1. The Node Code must be configurable and may vary for each external source. The default value is “MC.”

2. The Transmission Sequence is a fixed width number that starts at 000000 and increments by 1 with every message. After 999999 it then rolls back over to 000000. The intention of this part of the file name is to keep messages from overwriting one another as they build up in the FTP directory.

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APPENDIX L

JOINT PHOTOGRAPHIC EXPERTS GROUP (JPEG) 2000 GUIDANCE
VERSION 1.0.1

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism

Editors Notes

Date	Change	Rationale
5 August 2013	Implemented new versioning paradigm.	Comply with NASB instructions

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

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4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

L.1 JPEG 2000 PROFILES

In order to promote wider interoperability of the JPEG-2000 codestream, the International Organization for Standardization (ISO) JPEG governing body (ISO/IEC JTC 1SC29/WG1) introduced codestream restrictions. The codestream restrictions are referred to as: JPEG-2000 Profile-1 and its sub-set JPEG-2000 Profile-0.

Note: The case of "No Codestream Restrictions" means conforming to the full capabilities of the JPEG-2000 Part-1 standard, commonly called JPEG-2000 Profile-2, and is not allowed and/or required of NITFS-compliant applications.

JPEG-2000 Profile-0 and JPEG-2000 Profile-1 are defined as follows:

- JEPG-2000 Profile-0 is intended for low complexity applications (i.e., cell phones, Personal Digital Assistant (PDA), and other limited systems) and all decoder systems must be compliant to JPEG-2000 Profile-0 when decoding products. Profile-0 is seldom used in NITFS products.
- JPEG-2000 Profile-1 is the common commercial application profile for fostering wider interoperability. It is expected that common appplications, web browsers, digital photographic software products, and image collection systems will be compliant to JPEG-2000 Profile-1 or its defined sub-sets.

Developers creating NITF/NSIF JPEG 2000 encoded products must develop within the parameters of the JPEG-2000 Profile-1 or the associated sub-sets of NSIF Preferred JPEG 2000 Encoding (NPJE), Exploitation Preferred JPEG 2000 Encoding (EPJE), Tactical Preferred JPEG 2000 Encoding (TJPE) or Profile-0 based on their identified development requirements. As well, all NITF/NSIF JPEG 2000 decoders must support JPEG-2000 Profile-1 and by virtue of this will be able to decode all NITF/NSIF Profile sub-sets.

Note: The BPJ2K01.10 Profile additionally supports the Large Volume Streaming Data sensors (LVSD) Preferred JPEG 2000 Encoding (LPJE), Appendix G and STANAG 7023 Preferred JPEG 2000 Encoding (SPJE). These two also allow for Profile-2; which is not allowed with NITFS/NSIF.

L.2 FORMATTING CONSIDERATIONS

Decoding:

- The NITF image subheader does not fully support all the capabilities of the ISO JPEG-2000 Profile-1 and 15444 Part 4 conformance. Should an NITF JPEG 2000 interpreter find a conflict between the image subheader and the embedded JPEG 2000 imagery segment, the values in the JPEG 2000 imagery segment will take precedence over the values in the NITF image subheader when processing and rendering the image for display.
- NITF/NSIF implementation are only required to decode Profile 1 and the supported sub-sets of NPJE, EPJE, TPJE and Profile 0. For other JPEG 2000 Profiles the implementation can choose not to decode the codestream or decode supported capabilities within non-supported Profiles so long as the decoder does not crash the application or the supported operating system. In either case the application will alert the user of the compliant decoder that they may not be able to properly decode the codestream that is outside Profile 1 supported capabilities.
- For the LPJE, Appendix G and SPJE, Appendix H, JPEG 2000 Profile 1; decoders are only required to support decoding if the products fit the constraints of JPEG 2000 Profile 1.
- When a decoder encounters a NITF/NSIF JPEG 2000 minimal interchange format (JP2) product; at a minimum, it will decode the codestream and supported boxes within the JP2

header. If JP2 boxe(s) are not supported; the application will alert the user of the decoder, the box types are present and not supported.

Encoding:

- For interoperability considerations, developers of the LPJE and SPJE must understand interoperability concerns when these products are outside the bounds of JPEG 2000 Profile 1.
- The BPJ2K01.10 Profile provides support for the JP2 File Format, however to foster interoperability, it is recommended that encoders only use the JPC codestream within NITF/NSIF products for fostering interoperability. The JP2 File Format should not be used to replace or hide information that should be placed in the NITF/NSIF format.
- Implementers need to give due consideration of the format features as they relate to the NITF/NSIF format. Information should not be included in JPEG 2000 formats that conflict with information in the NITF/NSIF format.

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Implementation Practices
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APPENDIX M

MULTIPLE IMAGE SEGMENT IMAGERY
VERSION 1.0.0

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism
1 May 2013	All	Initial draft for community review
28 August 2013	All	initial publication

Editors Notes

Date	Change	Rationale

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M.1 AIRBORNE

Sensors or the ground processors generating a National Imagery Transmission Format (NITF)-formatted file from the sensor's native format frequently package multiple images into one NITF file with multiple image segments. Several alternatives exist for producing multiple-image segment products within the Airborne community. One frame sensor, CA-279, produces an NITF file containing a decimated image, a compressed full resolution image, and a text segment. See Figure T-1. The decimated image is a reduced resolution overview of the accompanying full resolution image. Each image segment contains its associated Tagged Record Extensions (TREs).

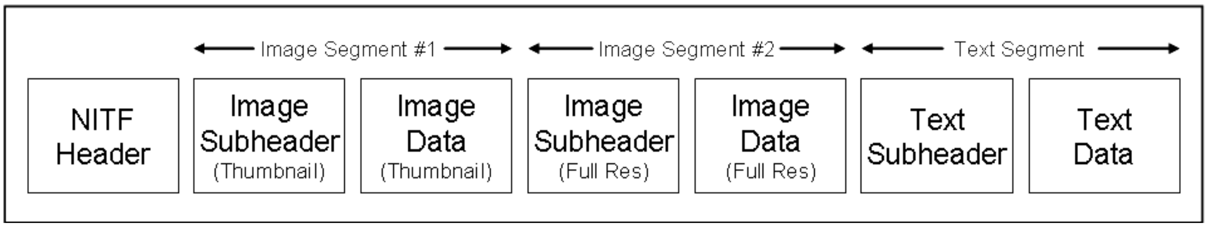


Figure M-1. CA-279 Imagery Files

Options also exist for packaging multiple different images within one NITF file. One alternative is to generate an NITF file containing multiple image segments, each with its own set of associated TREs, and mosaic the images together. For example, an imagery analyst exploiting imagery may display several different images of one area of interest at his workstation. The geographic area of the individual images may overlap, abut, or have uncovered space between the images. The exploitation application the analyst uses to save his work may generate a multiple image segment file with each image segment containing a source image with its associated TREs. The application may mosaic the individual image segments together in the NITF common coordinate system based on the values within the Image Subheader ILOC field. A variation on this approach uses the attachment and/or display levels to mosaic the image segments together.

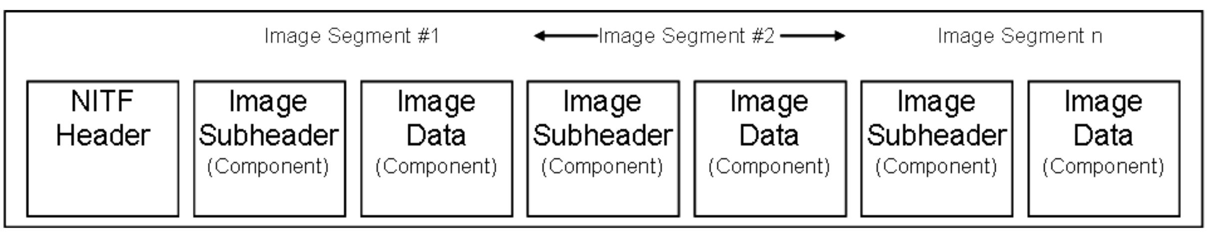


Figure M-2. Mosaicked Components

In order to more efficiently manage the vast amount of imagery generated by advanced sensors, while preserving access to the individual images and their associated as-collected support data for timely exploitation and precision targeting, the Airborne community developed the multi-image scene table of content (MITOC) paradigm. The MITOC TRE is used to describe the organization of image segments grouped within a volume. Several Airborne sensors and ground processors implement a version of the paradigm. Figure T-3 shows Distributed Common Ground/Surface System (DCGS) implementation output type E. The first image segment contains a composite overview and the other image segments contain the component images comprising the composite. The first image segment is intended to serve as a table of contents for the images comprising the volume. The image data included in the first image segment includes the four corners of the composite and the corner points of the components. The component four corner points are the earth coordinates corresponding with the image pixel array corner locations of the component image. The image data accompanying the volume composite should contain an ACFTB and AIMIDB reflecting characteristics of the composite image. The image data within each subsequent image segment contain the TREs associated with that image segment.

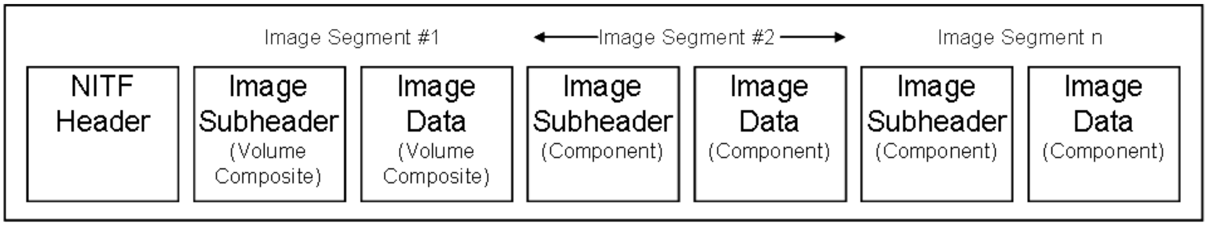


Figure M-3. DCGS Implementation Output Type E

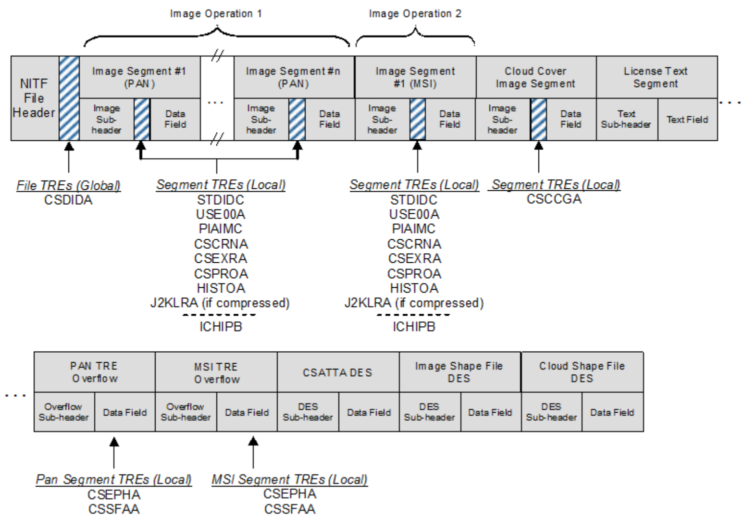
M.2 Multiple Image-Segmented Imaging Operations

M.2.0 General. The purpose of this section is to offer general guidance regarding some of the increasingly complex NITF file constructs that are being encountered in various imagery communities. In this section, NITF files with multiple image (IM) segments, without a MITOC, will be discussed (note: mosaicked imagery employing the MITOC concept is addressed elsewhere in this document). Some communities have implemented some, none, or all of what is addressed in this discussion. Although some commercial terminology and TREs are used in the file construct example, it should be considered a notional presentation, with the commercial references used to make the presentation more realistic and easily understood. To use generic terms would lose realism and may lead to additional and unnecessary confusion.

M.2.1 Overview. In the multiple-image segments file construct example, below, numerous NITF file segments are present. Each segment has its own distinct data contents and purpose. It should be noted that although this construct is possible within the confines of the NITF Version 2.1 Commercial Dataset Requirements Document (NCDRD), the commercial data providers and the National Geospatial-Intelligence Agency (NGA) have, as of this writing, elected to not mix different imaging operations (i.e., Panchromatic and Multispectral Imagery (MSI)) in the same NITF file. The segments of primary importance in this discussion are those of the imagery variety. It is important to note there are three different types of imagery within this example: panchromatic, MSI, and cloud cover grid. It should be pointed out that only panchromatic and MSI are typically intended for visual renditions. The cloud cover grid is not intended for display (but may be at the discretion of the user). It is offered to describe cloud cover over the dataset's geographic area/footprint of the Pan and/or MSI imagery.

M.2.2 Specific Segments and Descriptions

M.2.2.1 NITF File Header. Information contained within the NITF header is considered global and applicable to the entire file. In addition to the typical header field contents, this construct includes one TRE that applies to the entire dataset: CSDIDA. There are other cases where additional TREs, such as those within the DIGEST family, may be present in the XHD field of the NITF file header. They too would be considered global and apply to the entire dataset.



Note: This is a notional file construct that somewhat resembles the NCDRD specification in an attempt to offer some realism.

Figure M-4. Multiple image-segmented file

M.2.2.2 Panchromatic Imaging Operation. The entire panchromatic image collection is contained in more than one NITF image segments. One or more of three segmentation criteria had to have been met for this action to occur:

- The expected number of bytes in the compressed segment exceeds the NITF image segment data volume limit (10^{10}-2 bytes); or
- The number of tiles exceeds the JPEG 2000 limit of 16382 tiles in a code stream with one Tile Length Marker (TLM); or
- The number of rows in the image segment exceeds the NITF 2.1 Image Location (ILOC) offset limit (99,999 pixels). The ILOC limit of 99,999 lines per segment may be ignored for the last portion of a multi-segmented imaging operation.
  When placed end-to-end in accordance with IDLVL, IALVL, and ILOC information within the respective image subheaders, and rendered properly in a viewing application, the resulting display should appear seamless as if it had been one contiguous set of pixels from a single data store (vice multiple image segment stores).

Panchromatic TREs are local to the entire imaging operation. Except for the ICHIPB, all TREs are replicated and placed in the IXSHD area of each image subheader, regardless of the number of panchromatic image segments needed to hold the entire imaging operation. In the case of the ICHIPB, it depicts pixel coverage information for only the respective image segment in which it is placed. That is, it's output product cornerpoint values will depict the size of the respective image's coverage and the full image cornerpoints will depict where within the entire imaging operation those pixels appear. The ICHIPB

FI_ROW_nn and FI_COL_nn fields will contain values that depict the dimensions of the entire imaging operation.

Some products may contain TREs which might exceed storage limitations if placed in the image subheaders. In such cases, the TRE_OVERFLOW DES is used to store these TREs. If the image segment that is overflowing contains the entire imaging operation, the traditional overflow rules apply: (1) the IXSOFL states the DES instance to which it overflows, and (2) the corresponding DESOFLW and DESITEM fields identify the image segment area and instance from which the TREs are overflowing. In the case of the multi-segment, panchromatic image above, a single TRE_OVERFLOW DES is used to store TREs for all of the panchromatic image segments comprising the entire imaging operation. This condition has been termed a Many-to-One TRE_OVERFLOW DES condition. That is, the entire imaging operation (many image segments) is overflowing to one TRE_OVERFLOW DES. In this case, the Many-to-One rules apply: (1) the IXSOFL field in each of the corresponding panchromatic image segments will denote the same DES instance to which they are all overflowing, and (2) the corresponding DESOFLW and DESITEM fields identify the image segment area and the first image instance from which the TREs are overflowing. In the notional example above, all panchromatic IXSOFL fields will contain 001 (first DES instance in the file) and the DESOFLW and DESITEM fields in the panchromatic TRE_OVERFLOW DES will contain IXSHD (area overflowing) and 001 (file instance of the first panchromatic image segment), respectively.

M.2.2.3 MSI Imaging Operation. The MSI imaging operation consists of an image whose spatial array is small enough to fit within the bounds of a single image segment without invoking any of the segmentation rules presented in paragraph M.2.2, above. As a general rule, MSI imaging operations will never be so large as to require segmentation.

Like the panchromatic image, the TREs are contained in the MSI segment's IXSHD field and are local to just the MSI image segment. The MSI image segment also contains TREs which might exceed storage limitations if placed in the image subheaders. Like the panchromatic segment, TRE_OVERFLOW DES is used to store these TREs, and since there is only one image segment needed to hold the MSI imaging operation, the traditional overflow rules apply.

M.2.2.4 Cloud Cover Segment. The cloud cover segment is virtually independent of the other imagery within the file, except for its association with the sensor to which it is registered. It is not typically rendered by the application upon initial ingest due to its NODISPLY image representation assignment, but may be subsequently visualized through user intervention.

M.2.2.5 Other Miscellaneous Segments. The remaining DES (CSATTA, Image Shape, and Cloud Shape) and text (License) segments play no specific or unusual role with respect to the multiple image segment concept. They offer additional information about space vehicle attitude, polygonal representations of respective image and cloud coverages, and Commercial Data Provider licensing information related to imagery contained in the NITF dataset.

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Implementation Practices
of the
National Imagery Transmission Format Standard (IPON)

APPENDIX N

NITF TRE LIFECYCLE / SUPPORT DATA EXTENSION LIFECYCLE Version 1.0.0

01 October 2008

TBD/TBR Listing

Page Number	TBD/TBR	Description
N-11	TBD0002	RSM-related lifecycle considerations for common library processes

Change Log

Date	Pages Affected	Mechanism
1 May 2013	All	Initial draft for community review
28 August 2013	All	Initial Publication

Editors Notes

Date	Change	Rationale

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

N.1 INTRODUCTION

N.1.1 Purpose

This Implementation Practices of the National Imagery Transmission Format Standards (NITFS) (IPON) appendix provides guidance for the addition, removal, and maintenance of National Imagery Transmission Format (NITF) Tagged Record Extensions (TREs). Its purpose is to assist Program Managers, users, and developers in understanding the NITF packaging of data included in products and systems.

N.1.2 Scope

This appendix is applicable to any program generating and or interpreting NITF imagery containing TREs. This appendix will help avoid interoperability issues by providing a recommended practice for using and maintaining NITF TREs. It will address the majority of all NITF controlled extensions and the guidance provided will be primarily organized into TRE families.

N.1.3 Background

In many cases, NITF TRE specifications do not address who, when, how and why the specified TRE should be maintained throughout its lifecycle. Typically TRE(s) are developed for and by the community intending on initially populating the metadata. Addressing how the TRE should be processed throughout its life is rarely considered and/or documented. As a result of this oversight, users often apply their own methods for TRE maintenance; consequently not all users choose the same method, causing interoperability issues. Due to many reported issues and the necessity for community awareness, this volume will attempt to provide the guidance necessary for the maintenance of most existing TREs. All new TRE(s) should specifically address TRE maintenance within its specification.

N.2 DISCUSSION

NITF TREs were initially grouped into families which represent the community that developed the TRE and those desiring the use of the imagery types. Today, many TREs are developed and supported by many user communities, resulting in family groupings to be not totally clear. Those TREs that continue to be affiliated with a family grouping will be identified later in this document.
This appendix will address the four primary actions that happen to TREs throughout its lifecycle.

1. Adding a TRE to an image/file initially
2. Removing a TRE that was present upon receipt
3. Updating a TRE that was present upon receipt
4. Passing on a TRE that was present upon receipt

This appendix will discuss the affect of each primary action on all TRE families and/or TREs. The table at the end of this appendix depicts additional information based on what the Joint Interoperability Test Command NITF Compliance Test and Evaluation Facility members have observed throughout the years. The first column of the table lists all of the TRE in alphabetical order. The next eight columns, grouped together under the sub-column header “Documentation” lists the document the TRE is documented in. The next four columns, grouped under the sub-column header “Lifecycle” depict the TRE at four distinct areas within the imagery/data flow perspective: producer, disseminator/library, exploiter, and end-user. The next four columns are grouped together under the sub-column header “TRE Type”. The “TRE Type comprises four areas: source exploitation, source information, processing updates, and historical information. The next four columns are grouped together under the sub-column header “Image Type”. The “Image Type” comprises four areas: unprocessed, preprocessed, geo-referenced, and ortho-rectified. The last eight columns are grouped together under the sub-column header “Image Pixel Processing”. The “Image Pixel Processing” is further dissected into eight areas: spatial chipped, spectral chipped, image compression, image rotation, image magnification, image sharpening, image dynamic range adjustment, and image bit mapping.

NOTE: This appendix does not yet include the information contained in The National System for Geospatial-Intelligence Product Description Document, Base Document, 17 May 2012 (NSGPDD) which superceded the AGIPDD. The NSGPDD is classified and may also impact communities other than those using National Support Data Extensions (NDSEs).

N.2.1 ASDE

The Airborne Support Data Extensions (ASDEs) are the set of defined NITF TREs used by the airborne community for Electro-Optical (EO), Hyperspectral (HSI), Infrared (IR), Multispectral (MSI) and Synthetic Aperture Radar (SAR) sensor platforms. Some TREs are required based on type of platform and others are optional regardless of type. See STDI-0002, table E-1. These TREs are generated by the originator of the image, i.e. along with the NITF file on-board the platform or upon receipt of the data by a ground station. Since they provide sensor parameters and geometry, they are NOT generated by a downstream exploitation application or similar process, simply because the information needed to populate them is often only known by the sensor/platform developer. Their intent is to describe the as-collected imagery. The general rule is to maintain all ASDEs when disseminating and/or exploiting the imagery. However, there are some operations which may require updating ASDEs or adding TREs. For example, STDI-0002 paragraph E.2.7. specifies certain ASDE fields must be updated when generating reduced resolution data sets if the image subheader image magnification (IMAG) field is not updated. Also, it is strongly recommended that downstream users/exploiters add an ICHIPB TRE when chipping an image; instead of recalculating the ASDEs.

N.2.1.1 Deviations

N.2.1.1.1 The BLOCKA ASDE is an optional extension for all sensor platform types. Its purpose is to provide a higher precision for the imagery corner points of the image array than that provided in the image subheader IGEOLO coordinate fields. Unlike the other ASDEs, BLOCKA is not always populated by the originator of the NITF image and can be populated by a downstream user. Regardless of when BLOCKA is initially populated, care must be taken to ensure the coordinates provided are consistent with the original as-collected image array just as all the other ASDEs must be. If BLOCKA is populated after the original NITF image is, it must be populated “as-if” it was originally populated with the other required TREs and as-collected imagery. Upon producing an image chip, some vendors either update the existing BLOCKA or if a BLOCKA is not present to begin with, add a new BLOCKA that reflects the chip corner coordinates. The latter case, i.e., adding a new BLOCKA referencing chip corners is NOT the recommended practice, as it impacts the recipient of the chip. The resulting chip would contain ASDEs that reference the parent image, but the BLOCKA references the chip; leaving downstream users wondering which TREs reference the parent and which reference the chip. All ASDEs should reflect the as-collected imagery, even for image chips; exception to this would be the option to recalculate ALL ASDEs for image chipping, which is allowed, but NOT recommended.

N.2.1.1.2 Although still listed as an ASDE, the Moving Target Information Report (MTIRPx) ASDE is no longer recommended and is superseded by the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) 4607, NATO Ground Moving Target Indicator Format (GMTI).

N.2.1.1.3 The Engineering Data (ENGRDA) TRE is not a specific ASDE, however, some sensor developers in their developmental phase also generate an ENGRDA TRE (see STDI-0002, appendix N). The ENGRDA provides the sensor developer additional sensor information NOT needed for mensuration. The ENGRDA TRE may be maintained or removed from airborne imagery by downstream users. Its usefulness may have expired.

N.2.1.1.4 Once an exploiter rectifies an image, the ASDEs are no longer applicable but may be carried with the file as a strictly informational extension since the sensor collection geometry is no longer relevant. However, there may be other reasons to maintain the accompanying ASDEs. For example, the organization or site’s concept of operations (CONOPS) may mandate their retention. Also, some libraries may profile the imagery prior to ingest and reject any imagery recognized as airborne which do not contain the expected ASDEs.

N.2.2 Commercial SDE

NGA published the NGA NITF version 2.1 Commercial Dataset Requirements Document (NCDRD) focusing on the commercial imagery products and associated extensions. Other documents containing TREs are also identified in the NCDRD, for example, the Digest Geographic Information Exchange Standard (DIGEST).

N.2.2.1 DIGEST: Annex D contains TREs supporting the commercial products community are used to convey the metadata for geographic reference description, source description and quality description. DIGEST TREs are present in commercial "rectified" products. The four TREs supported by the commercial community are GEOPSB, PRJPSB, GEOLOB and MAPLOB.

N.2.2.2 STDI-0002: The NCDRD document also address a few common TREs from the Compendium of controlled Extensions for NITF (STDI-0002). Those TREs are: HISTOA, PIAIMC, STDIDC, RPC00B, STREOB, USE00A and ICHIPB

N.2.2.3 Geo-positioning: Commercial products can contain multiple extensions providing pixel geo-positioning capability. Those extensions are: RPC00B, CSEXRA, GEOLOB and MAPLOB TREs. Pixel geo-positioning can also be displayed using the IGEOLOB values in the image sub-header. Many applications supporting these TREs have established a priority order to do so. Registered applications routinely select the RPC00B followed by the GEOLOB or MAPLOB, followed by the IGEOLOB in the image subheader and finally, by the CSEXRA TRE. Some registered exploitation applications may only support data from one geo-positioning entry of the three geo-positioning extensions.

N.2.2.4 Informational TREs: There are a few commercial TREs that are considered informational. Many are populated to provide imagery client communities specific fields to query imagery archive libraries on. Example TREs are CSDIDA (data content), CSPROA, (processing information) CSCRNA, corner footprint) CSSFAA, (sensor detector type) STDIDC, (image information) CSATTA, (sensor attitude) J2KLRA (support info for JPEG 2000 compression), and HISTOA, (history of softcopy processing). Many of these TREs are maintained throughout the supporting files lifecycle. However, the HISTOA may require update events as the file progresses to the end user. The J2KLRA TRE is applied to the image file when the data is compressed. It will be absent when the data is not compressed. Present guidance is not to have the TRE present unless the data is compressed.

N.2.2.5 Exploitation TREs: The commercial programs also employ exploitation TREs, in fact, they provide three different sets to choose from.

- RPC00B (Rapid Positioning Capability) TRE is the most common for exploitation applications to support. This TRE is supported not only by the commercial programs but also the airborne communities. It contains rational function polynomial coefficients and normalization parameters. The image source community generates this TRE and it is maintained throughout the lifecycle of the image data it supports. When applications chip an area of interest (AOI) from the original image product, an ICHIPB TRE must accompany the RPC00B. STDI-0002-1, Appendix B addresses the ICHIPB TRE The ICHIPB provides the receiving application the location of the AOI chip within the original image footprint.
- CSEXRA (Exploitation Reference Data) This TRE provides exploitation support data, acquisition, environment, measured ground sample distance values, performance, multi-mate/stereo, and processing history parameters. The data contained in the CSEXRA TRE is informational about pre-processed imagery, and unlike the other exploitation TREs it is used predominately in commercial imagery.
- DIGEST Refer to Section N-2.4 for DIGEST TRE lifecycle.

N.2.2.6 Chipped commercial products: Programs requiring AOI products derived from an original commercial product must recognize the following:

- DIGEST TREs GEOLOB and MAPLOB must be updated to support the AOI chip. No ICHIPB extension should accompany this rectified image product.
- An ICHIPB TRE must be present to support the AOI and the RPC00B and CSEXRA TREs.
- The ICHIPB TRE is a required extension when an exploitation application "chips" out an AOI from an original product, but must NOT be employed with rectified products with the GEOLOB and MAPLOB DIGEST TREs. They are only to represent and support the AOI pixel data.

N.2.3 DPPDB/CIB

Digital Point Positioning Data Base (DPPDB) and Controlled Image Base (CIB) imagery are "end user" products derived from collected and processed raster products. CIB products are datasets of orthophotos, made from rectified monochrome national and commercial imagery. DPPDB products are accurately controlled stereo image based products with support data and Compressed ARC Digitized Raster Graphics (CADRG) that is primarily created for targeting. Each are considered end user products and should not be processed further, as it would ultimately affect the entire data set. STDI-0002 provides information on the TREs supporting these end user products.

N.2.4 GEOSDE

The GEOSDEs supported by the NITF are identified in STANAG 7074, Digital Geographic Information Exchanges Standard, DIGEST Version 1.2A. Part 2 Annex D. DIGEST TREs focus specifically on the image segment data. GEOSDEs are used within Imagery Interchange Format (IIF) to convey the DIGEST metadata such as geographic reference description, source description and quality description. The following are DIGEST TRE descriptions. Those marked with an * are presently supported in NITF and NSIF products:

- ***GEOPS** for geo-referencing parameters including datums, ellipsoids;
- ***PRJPS** for geo-referencing parameters defining projections;
- ***GEOLO** for image, raster, or matrix data rectified consistently with geographic (lat/long) coordinate systems;
- ***MAPLO** for image, raster, or matrix data rectified consistently with cartographic (E,N) coordinate systems;
- **REGPT** for registration points in either geographic or cartographic systems;
- **GRDPS** for non-rectified image, raster, or matrix data that is positioned using a location grid;
- **BNDPL** for an accurate geographic location of the significant part of the image.
- ***ACCPO** for horizontal and vertical accuracy over regions for which the definitions are constant;
- ***ACCHZ** for horizontal accuracy when the vertical accuracy varies across the region for which horizontal accuracy is constant;
- ***ACCVT** for vertical accuracy when the horizontal accuracy varies across the region for which vertical accuracy is constant;
- **SNSPS** for sensor parameters;
- **SOURC** for map source information;
- **FACCB** for Attribute FACC Code definition.

N.2.4.1 Applicable

DIGEST TREs apply to the image pixel data within the file. All rectified digital imagery products should contain DIGEST TREs, to include commercial NITF 2.1 geo-referenced and ortho-rectified products. The following is typical for commercial products:

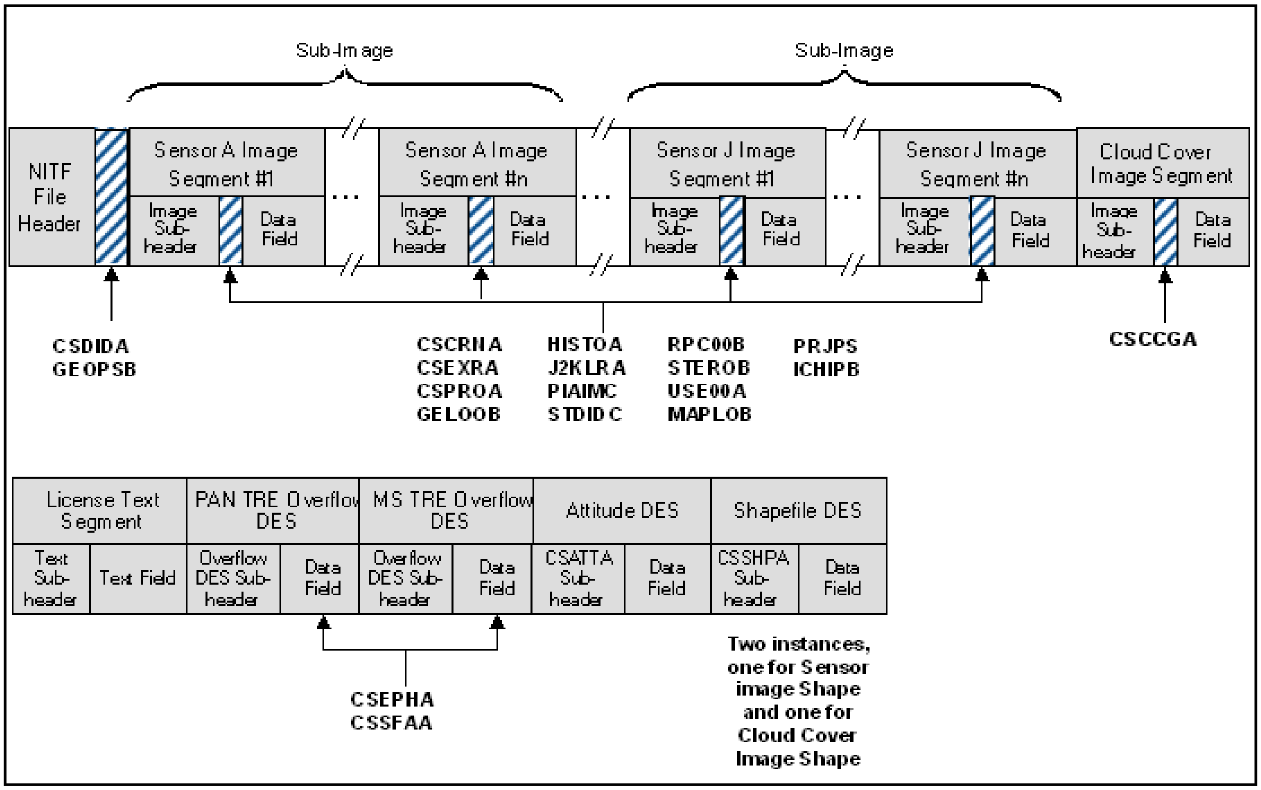

Figure N-1. Commercial NITF 2.1 File Layout

N.2.4.2 Lifecycle

When downstream applications perform a cut or chip function to an AOI from an image segment containing DIGEST TREs, the following TREs contain field values that must be “updated” to support that AOI.

- **GEOLOB** Longitude of Reference Origin (LSO) and the Latitude of Reference Origin (PSO) fields
- **MAPLOB** Easting of Reference Origin (LSO) and the Northing of Reference Origin (PSO)

Table 3-1 contains TREs typically contained in commercial products:

Table N-1. Common TRE Found in Commercial Products

TRE	Product Type	TRE Location	Lifecycle
GEOPSB	Geographic, Cartographic	NITF Header	Maintain with file or sub-files
PRJPSB	Geographic, Cartographic	NITF Header	Maintain with file or sub-files
GEOLOB	Geographic	Image sub header	Update when producing a sub image from original
MAPLOB	Cartographic	Image sub header	Update when producing a sub image from original

As identified in the table above, a produced image file may not contain a GEOLOB and MAPLOB TRE in the same image segment header.

N.2.5 PIAE

There are two PIAE TRE categories, Profile for Imagery Access Image Support Extensions and Profile for Imagery Archives Extensions. The "Access" extensions are early in the digital imagery program designed to support imagery library cataloging. Many early library interfaces used the PIAE TREs exclusively for discovering ingested imagery library data. Today's digital library data models continue to support the "Access" extension suite and also updated PIAE "Archive" versions. Both categories provide the same imagery related information.

N.2.5.1 Applicability
The community recommendation for employing PIAEs is to populate the imagery file with the latest version, those addressed as "Archive" extensions.

N.2.5.2 Lifecycle

When PIAEs are first generated supporting a digital image product they present additional information related to the image. They also may provide information regarding the image collection source, quality and other image conditions. PIAEs continue to be a major contributor to library data model cataloging. The PIAEs when present should be maintained “as is” throughout the life of the original or sub-sets of the original image.

N.2.6 RPF

The Raster Product Format is a standard data structure for geospatial databases composed of rectangular arrays of pixel values (e.g. in digitized maps or images) in compressed or uncompressed form. RPF is intended to enable application software to use the data in RPF format on computer readable interchange media directly without further manipulations or transformation. Paragraph 2.3 provides additional information regarding RPF output products as well as MIL-STD 2411, RASTER PRODUCT FORMAT.

N.2.7 RSM

The Replacement Sensor Model (RSM) TREs are defined and documented in the RSM TRE Specification for NITF 2.1 document. The specification contains detailed information such as requirements, formats and capabilities, for the eight RSM TREs that provide image support data from sensor models. Replacement Sensor Model Tagged Record Extensions Specification for NITF 2.1, dated 14 January 2013 contains additional information on the RSM program.

N.2.7.1 Applicability

A set of RSM TREs is associated with the image data field in an image segment of an NITF 2.1 file. The TREs are placed in the corresponding image subheader and continued in the overflow area, if necessary. The entire set of RSM TREs may also be placed directly into the overflow area. This data supports any imaging sensor, including commercial and tactical sensors. RSM image support data for a specific sensor and specific image can be generated by any sensor model developer. Inputs to this process are the original sensor model’s image support data, and outputs are the RSM image support data in the form of TREs. Consequently, the only sensor model required by receiving users is the RSM. The RSM TREs are interpreted by any RSM interpreter developed in accordance with the specification. The RSM interpreter is able to read the RSM TREs and provide useful ground and/or image information with the use of a polynomial and/or grid, error statistics and adjustable parameters to the users.

N.2.7.2 Lifecycle

RSM TREs are produced by a production processor interpreting original support data and processing that data into RSM support data. This process removes the original sensor characteristics and applies a comparable sensor model. Updates to RSM TRE sets are communicated and linked through the EDITION and IID fields in the RSM TREs, therefore it is important to follow the guidelines listed below for generation and/or interpretation of updated RSM data.

- If two RSM TRE sets both have spaces in the IID field, they should be considered as corresponding to different (and unknown) original full images by an image exploitation process.
- If the relationship between the image data files and the original full image is not provided in the NITF file, such as an ICHIPB TRE, the image data field in the image segment associated with the RSM TRE set is assumed to be identical to the original full image.
- In some cases, an image provider may divide an original full image into multiple image data fields and assign a different original full image ID to each as a matter of convenience for storage and future dissemination. As a word of caution, it is pointed out that this is not an optimal procedure regarding performance of potential down-stream multi-image geopositioning or triangulation solutions that simultaneously involve more than one of these image data fields. The optimal approach is for the image provider to assign the same original full image ID to all the image data fields, and to place each in its own image segment with a common RSM TRE set.
- RSM TREs are not to be used if an NITF image segment contains multiple “scan blocks”, under the premise that the sensor operational parameters may change discontinuously between blocks in such a way that a single original sensor model and corresponding set of image support data would not be adequate for geospatial mensuration and triangulation. Alternatively, if each of these scan blocks is placed in a different image segment, an RSM representation is allowed. However, a different original full image should be used for each scan block.
- Multiple images associated with the same original full image may exist, therefore their RSM TRE sets differ, as indicated by different values in their edition fields. An example of this situation would be one image corresponding to unadjusted RSM support data, where the other corresponds to adjusted RSM support data.
- Multiple images associated with the same original full image are contained in different NITF image segments, assuming that an updated RSM TRE set is not placed into the same image segment that contains the initial RSM TRE set.
- Images associated with different original full images but common support data processing (e.g., triangulation) do not have the same value for the edition field. Thus, when images associated with different original full images but the same triangulation are to be identified, a triangulation id provided in the RSMDCA/B, RSMAPA/B and RSMECA/B TREs is used for identification.

There are primarily two types of updates: triangulation and re-mapping.

Triangulation adjusts the RSM support data which results in the generation of non-zero RSM adjustable parameters applicable to the RSM image domain of the associated original full image. The adjustable parameter values are placed into an RSMAPA/B TRE. Typically, a direct error covariance is also generated and placed into an RSMDCA/B TRE. The triangulation process requires the use of one or more images in addition to the associated image. The error covariance is built dependent on the number of images used in the triangulation, and the number of adjustable parameters for each of those images. For example, if 3 images were used in the triangulation process, and each image had 6 adjustable parameters, the resulting error covariance would be delivered as an 18x18 matrix. Therefore, the more images used in the triangulation, the larger the error covariance matrix. The following general guidelines are provided if triangulation is performed. The updated RSM TRE set would contain the same TREs as the initial RSM TRE set with the following exceptions:

- It includes the new RSMAPA/B and RSMDCA/B TREs.
- If the initial RSM TRE set contained a previous RSMDCA or RSMECA covariance TRE, it is removed.
- The updated RSM TRE set must share a new, unique value for the EDITION field contained in all of its TREs. If there are multiple image data fields associated with the original full image, the updated RSM TRE set is placed into each corresponding image segment.
- It is recommended the resultant NITF file (containing the updated RSM TRE set) not contain the initial RSM TRE set.

Many different processes are possible during triangulation, involving multiple images and multiple correlated groups. A more detailed description of these processes can be found in Appendix C of the RSM Specification, available on the NTB website.

The second way of updating RSM TREs is simply “re-mapping”, or chipping, an image data field into one or multiple smaller image data fields. Or, more generally, the update simultaneously remaps multiple image data fields associated with the original full image into different image data fields. This process is intended to support more efficient interpretation by intended downstream users. Regardless whether one or multiple data fields are re-mapped, the updated RSM TRE Set placed into a new image segment associated with a new image data field may contain the same TREs as the original RSM TRE set, with the exception of a new value for the EDITION field. The fact that the updated RSM TRE set may now have a larger RSM image domain than may be required has no adverse affect on any subsequent image interpretation. Note the above re-mapping process need not be performed exclusively by down-stream users. An image provider may perform this task as well. The following general guidelines are provided if re-mapping is performed:

- The updated RSM TRE set must share a new, unique value for the EDITION field contained in all of its TREs. If there are multiple image data fields associated with the original full image, the updated RSM TRE set is placed into each corresponding image segment.
- It is recommended that the resultant NITF file (containing the updated RSM TRE set) does not contain the initial RSM TRE set.

It is important to note the possibility of updating RSM data that has previously been updated. The resulting data would be treated as if the data has not been updated before, meaning the TREs would be edited accordingly and the EDITION fields modified to communicate the newest updates.

N.2.8 NSDE

The NSDEs are defined and documented in NGA's STDI-0001, National Support Data Extensions for National Imagery Transmission Format version 2.0. Contained therein are the fit, form, and range conditions under which each NSDE will adhere when required to be generated and included in the NITF file. The circumstances under which specific NSDEs are generated, and included in the NITF file, are contained in Imagery Intelligence (IMINT) community's NNTM product specification, S2035A, National Imagery Transmission Format Implementation Requirements Document (NITFIRD). (Note: The guidance offered in this section applies only to NTM products "proper" and does not apply to other programs such as Advanced Geospatial Intelligence (AGI) products which make partial use of NSDEs and, in some cases, may contain recalculated metadata which supports image reprocessing inherent to the AGI program, as opposed to the metadata contents from the original image collection). Also, refer to the NSGPDD which superceded the AGIPDD.

N.2.8.1 Applicability

The NITFIRD scope and applicability is limited to a finite number of segments. For those segments identified in the NITFIRD, NSDE generation will apply as stated therein. The NTM community is unique in that while NITF products are available directly from the source, it is more common to encounter another file format, Transmission Format Requirements Document (TFRD), as a source file to be used in the creation of the NTM NITF file. In general, TFRD files are used predominantly for dissemination from the production source, to archive and dissemination (A&D) segments, and ultimately the exploitation workstation/analyst level. At any stage in the enterprise, it is possible to encounter the creation of a NITF file from TFRD. As such, the myriad of NTM "producer" possibilities is infinite and creates a potential testing dilemma when any given segment takes a TFRD source to create a NITF product. In those cases where a segment is not listed as a producer in the NITFIRD, an assessment of the test candidate will be made to determine which NITFIRD segment best matches its characteristics. Test design will be based upon this assessment and tailored, if necessary. The NSDE content of NITF products produced from TFRD will be the same as those in NITF products originating at a NITFIRD production source.

N.2.8.2 Lifecycle

There is no formal documentation dictating how NSDEs are to be maintained and retained beyond original creation; however, through the years, the practice to consider NSDEs and their contents as "sacred" has prevailed. That is, once created, NSDEs will not be altered, updated, recalculated, or otherwise modified or removed, provided the employing CONOPs warrants the need for exploitation and/or mission needs that are beyond what are known as unintelligent, "happy snap" products. The originator of the NITF file is responsible for correctly creating the NITF file and NSDEs. All subsequent processing segments (chips, archival, retrieval, chips of chips, etc.) are responsible for maintaining the integrity of the metadata for the life of the original product and those new products spawned from it. In the absence of a CONOPs to the contrary, all NSDEs will be retained unadulterated so as to always support an "intelligent" NITF product.

N.2.9 FIA

Future Imagery Architecture (FIA) Tagged Record Extensions (TREs) are defined and documented in the Imagery Intelligence (IMINT) community's S4017, FIA Data Provider Element (DPE) Data Requirements Document (FDDRD) and STDI-0004, NGA FIA Data Definition Document (NFDDD). Each document contains the fit, form, range, and conditions under which each TRE will adhere when required to be generated and included in the NITF file. The circumstances under which specific TREs are generated at the source, and included in the NITF file, are contained in the FDDRD. TRE responsibilities incumbent upon A&D segments are addressed in the NFDDD.

N.2.9.1 Applicability

As written, the scope and applicability of the FDDRD and NFDDD is limited to a finite number of segments. Specifically, the FDDRD applies only to initial TRE generation and NITF file production by the FIA DPE. A&D segments, such as NGA's National Geospatial Library (NGL), associated Command Information Library (CIL), Image Product Library (IPL), and the Information Dissemination Services - Direct Delivery (IDS-D) will subscribe to the requirements of the NFDDD.

N.2.9.2 Lifecycle

The FIA program has not yet reached Initial Operating Capability (IOC), but it has matured to the point that specifications and products are relatively stable and is generally following the NTM paradigm. That is, TRE metadata is considered "sacred" -- not to be altered, updated, recalculated, or otherwise modified or removed, provided the employing CONOPs warrants the need for exploitation and/or "intelligent" mission needs. TREs created by the FIA DPE are passed downstream to an A&D segment and will be retained in their original state, except for the FIA-unique targeting TRE specifically addressed in the NFDDD. The A&D segment will also create and insert a FIA-unique, customer information TRE into the NITF dataset prior to release to the customer IAW the NFDDD. There is no formal documentation which dictates how FIA TREs are to be maintained and retained beyond original creation and A&D processing; however, the NTM practice of carrying TREs forward unchanged, in the absence of CONOPs to the contrary, has been promoted and seemingly embraced as the defacto practice.

N.2.10 AGI

As of July 2007, the Advanced Geospatial Intelligence (AGI) program is still in its infancy, and as such, products and specifications continue to evolve as of this writing. Given these facts, and considering some of the unique conditions inherent to some of the products and their TRE contents, addressing the AGI program in this document is being held in abeyance, indefinitely, until program maturation yields a firmer community paradigm. The products were originally described by the AGI Product Description Document (AGIPDD); later replaced by the NSGPDD.

N.2.11 Additional TRE Information

N.2.11.1 HISTOA: The HISTOA TRE is presently associated with commercial satellite imagery products. The purpose of the HISTOA TRE is to provide an image's pixel processing history. Through the lifecycle of the image it is associated with the HISTOA TRE and should be updated whenever the pixel data has been modified. A key event example is the TRE should be updated is when a compression process has been applied to the image pixel data. STDI-0002 addresses the pixel processing the HISTOA TRE supports.

N.2.11.2 ICHIPB: The ICHIPB TRE is important to those communities producing or requiring AOI chips or cut outs of original imagery products containing an RPC00A or B TRE. The ICHIPB identifies the specific pixel location of the chipped product to the original image. Knowing the specific location will allow the receiving exploitation application to continue to use the original RPC TRE. The ICHIPB also supports the NCDRD CSC TREs. The ICHIPB should NOT be present for DIGEST TREs. DIGEST TREs will always represent the pixel data they are associated with.

N.2.11.3 RPC

N.2.11.4 IOMAPA

N.2.11.5 ATTPTA

N.2.11.6 BCKGDA

N.2.11.7 ENGRDA

N.2.11.8 J2KLRA

N.2.11.9 MITOCA

N.2.11.10 NBLOCA

N.2.11.11 RMPKIB …(supersedes RMPKIA)

N.2.11.12 THESDA

N.2.11.13 TXML1A (supersedes AGIPHA)

	DOCUMENTATION								LIFECYCLE				TRE TYPE				IMAGE TYPE		
	STDI-0001	STDI-0002	STDI-0006	MIL-STD-2411	MIL-PRF-89034	DIGEST	RSM (Draft)	BPJ2K	Producer	DE / Library	Exploiter	End User	Source Exploitation	Source Info.	Processing Updates	Historical Info.	Unprocessed	Preprocessed	Geo-Referenced
ACCHZ						X			C	M	RUM	UI	ES	--	--	--	--	--	--
ACCPO						X			C	M	RUM	UI	ES	--	--	--	--	--	--
ACCVT						X			C	M	RUM	UI	ES	--	--	--	--	--	--
ACFTA		X							C	CDD	UI	UI	--	SI	--	--	SIT	SIT	SIT
ACFTB		X							C	CDD	UI	UI	--	SI	--	--	SIT	SIT	SIT
ACI35A	X								C	CDD	UI	UI	--	SI	--	--	SIT	SIT	SIT
AIMIDA		X							C	CDD	UI	UI	--	SI	--	--	SIT	SIT	--
AIMIDB		X							C	CDD	UI	UI	--	SI	--	--	SIT	SIT	--
BANDSA		X							C	M	UI	UI	--	SI	--	--	SIT	SIT	SIT
BANDSB		X							C	M	UI	UI	--	SI	--	--	SIT	SIT	SIT
BCKGDA		X							C	M	UI	UI	--	SI	--	--	SIT	SIT	SIT
BLOCKA		X							C	M	UI	UI	--	SI	--	--	SIT	SIT	SIT
BNDPLB						X			C	CDD	UI	UI	ES	--	--	--	--	--	SIT
CMETAA		X							C	M	UI	UI	ES	--	--	--	SIT	SIT	--
CSATTA			X						C	CDD	RUM	UI	--	SI	--	--	--	SIT	SIT
CSCCGA			X						C	CDD	RUM	UI	ES	--	--	--	--	SIT	SIT
CSCRNA			X						C	CDD	RUM	UI	ES	--	--	--	--	SIT	SIT
CSD31A	X								C	M	UI	I	ES	--	--	--	SIT	SIT	--
CSDIDA			X						C	CDD	RUM	UI	--	SI	--	--	--	SIT	SIT
CSEPHA			X						C	CDD	RUM	UI	--	SI	--	--	--	SIT	SIT
CSEXRA			X						C	CDD	RUM	UI	ES	SI	--	--	--	SIT	SIT
CSPROA			X						C	CDD	RUM	UI	--	SI	--	--	--	SIT	SIT
CSSFAA			X						C	CDD	RUM	UI	ES	--	--	--	--	SIT	SIT

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Implementation Practices
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APPENDIX O

COMMON NITFS REFERENCES FOR TACTICAL IMAGERY
Version 1.0.0

28 August 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism
1 May 2013	All	Initial draft for community review
28 August 2013	All	Initial Publication

Editors Notes

Date	Change	Rationale

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the standard for the formatting and exchange of digital imagery and imagery-related products between members of the Intelligence Community. The Intelligence Community is made up of the Department of Defense (DoD) and other departments or agencies of the United States Government as defined by Executive Order 12333.

2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the National Imagery Transmission Format (NITF) suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with NITF version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

O.1 REFERENCES

The Joint Interoperability Test Command (JITC) National Imagery Transmission Format (NITF) Compliance Test and Evaluation Facility frequently receives questions regarding the NITF and North Atlantic Treaty Organization (NATO) Secondary Image Format (NSIF) suite of standards as it applies to the airborne/tactical community. Therefore, the team compiled the following list of references as a cursory guide for programs and developers seeking to generate/use NITFS-compliant tactical imagery. The list is not intended to be all-inclusive; rather, it is meant to provide a starting point and an appreciation for the numerous standards, implementation profiles, and other reference documents available that may be applicable.

O.1.1 Product Formats

- MIL-STD-2500A, National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 22 August 1997.
- MIL-STD-2500C, National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 01 May 2006.
- STANAG 4545, NATO Secondary Imagery Format (Version 2.0); Promulgation date: 06 May 2013.
- BIIF PROFILE NSIF01.01, Information Technology - Computer Graphics and Image Processing -Registered Graphical Item, Class: BIIF Profile - NATO Secondary Imagery Format (NSIF) Version 01.01, ISO/IEC June 2008
- STANAG 4607, NATO Ground Moving Target Indicator Format (GMTIF), Edition 3, 14 September 2010.

O.1.2 Implementation Profiles for Tactical EO and EO Related Systems and Products

- NGA.IP.0002_1.0, National Imagery Transmission Format Standard, Version 2.1, Implementation Profile for High Resolution Elevation (HRE) Products, Version 1.0, 23 October 2009.
- NGA.IP.0003_1.0, National Imagery Transmission Format Standard, Version 2.1, Implementation Profile for Tactical Light Detection and Range (LiDAR) Systems, Version 1.0, 07 September 2010.
- NGA.IP.0006_1.0, National Imagery Transmission Format Standard, Version 2.1, Implementation Profile for Tactical Hyperspectral Imagery (HSI) Systems, Version 1.0, 27 July 2011

O.1.3 Implementation Profiles for Tactical SAR Systems and Products

- NGA.STND.0024-1_1.0, Sensor Independent Complex Data (SICD), Volume 1, Design and Implementation Description Document, Version 1.0, 28 September 2011
- NGA.STND.0024-2_1.0, Sensor Independent Complex Data (SICD), Volume 2, File Format Description Document, Version 1.0, 01 August 2011
- NGA.STND.0024-3_1.0, Sensor Independent Complex Data (SICD), Volume 3, Image Projections Description Document, Version 1.0, 07 October 2011
- NGA.STND.0025-1_1.0, Sensor Independent Derived Data (SIDD), Volume 1, Design and Implementation Description Document, Version 1.0, 01 August 2011
- NGA.STND.0025-2_1.0, Sensor Independent Derived Data (SIDD), Volume 2, File Format Description Document, Version 1.0, 01 August 2011
- NGA.STND.0025-3_1.0, Sensor Independent Derived Data (SIDD), Volume 3, Image Projections Description Document, Version 1.0, 01 August 2011

O.1.5 Controlled Support Data Extensions

- STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 4.0, Volume 1, Tagged Record Extensions (TRE), 01 August 2011.
- The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format Version 4.0, Volumes 2, Data Extension Segments (DES) 03 December 2012.
- STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST), Edition 2.1, September 2000.

O.1.6 Product Compression

- BPJ2K01.10 - Information technology - Computer graphics and image processing - registered graphical item - Class: BIIF Profile - BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10)
- 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, Notice 2, 14 March 1997, Notice 3, 01 March 2001, and Notice 4, 31 March 2010.

O.1.7 Product graphics

- MIL-STD 2301 - Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 12 October 1994.
- MIL-STD 2301A - Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 05 June 1998.
- BPCGM01.00 - Information Technology - Computer Graphics and Image Processing - Registered Graphical Item, Class: BIIF Profile - Computer Graphics Metafile Version 01.00 (BPCGM01.00)

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Implementation Practices
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APPENDIX P

SENSRA IMPLEMENTATIONS
VERSION 1.0.0

28 AUGUST 2013

TBD/TBR Listing

Page Number	TBD/TBR	Description

Change Log

Date	Pages Affected	Mechanism
01 May 2013	All	Initial Publication of NGA.STDI-0005_2_0_0_IPON,appendix P, SENSRA Implementations
28 August 2013	All	Resolved five TBDs from previous version.

Editors Notes

Date	Change	Rationale

FOREWORD

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2. Members of the NITFS Technical Board (NTB) compiled these practices as an aid to those involved with the implementation and use of the NITFS. The content is based upon common practices, procedures, and guidelines used in fielded systems that have successfully implemented the NITFS. To meet a wide range and variety of imagery-related functional requirements, the NITFS has many combinations of implementation options to select from. Those implementing the NITFS should select and apply common practices to meet operational requirements whenever practicable
.

3. The DoD and members of the Intelligence and Geospatial Community are committed to interoperability of systems used for formatting, transmitting, receiving, exchanging, and processing imagery and imagery-related information. These practices describe the application of the NITFS suite of standards in support of interoperability among systems within the National System for Geospatial Intelligence (NSG), systems that interface with the NSG, and commercial systems that implement the NITFS.

4. The suite of standards that comprise the NITFS has evolved over time to meet the requirements of user systems. These practices address implementation topics for the NITFS associated with National Imagery Transmission Format (NITF) version 1.1, NITF version 2.0, and NITF version 2.1. Many of these practices are also suitable for use with Standardization Agreement 4545, North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF). The NSIF01.00 and NSIF01.01 profiles of ISO/IEC 12087-5, Basic Image Interchange Format document NITF version 2.1, NSIF version 1.0, and NSIF version 1.01.

5. Beneficial comments (recommendations, additions, and/or deletions) and other pertinent data that may be of use in improving this document should be addressed to Joint Interoperability Test Command, ATTN: NITFS Test Facility, P.O. Box 12798, Fort Huachuca, AZ 85670-2798.

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P.1. Introduction

This introduction provides the purpose, scope, and background for the appendix. The appendix documents, for legacy systems, the standard-defined implementation and some known alternative implementations for storing metadata in the now-deprecated SENSRA tagged record extension (TRE). Programs should provide their SENSRA implementation documentation to the NITFS Technical Board (NTB) Chair at ntbchair@nga.mil. No new or emerging implementations of the SENSRA TRE should exist, as SENSRB superseded SENSRA and became the required TRE for airborne optical imagery in 2011. SENSRB is defined in *STDI-0002-1, Appendix Z: SENSRB*.

P.1.1. Purpose

This appendix documents standard and non-standard legacy implementations of the now-deprecated SENSRA TRE. Because imagery with the legacy SENSRA implementations will continue to exist into the future, this documentation may be beneficial for those still needing to exploit that imagery.

P.1.2. Scope

The deviations from the standard-defined implementation of SENSRA are expected primarily in the sensor attitude (or orientation) angles. At the present, this appendix only addresses these deviations – where the angles are reported according to non-standard (albeit useful) definitions. These alternative definitions are provided here to allow proper exploitation of this imagery.

P.1.3. Background

For more than a decade SENSRA was a required TRE for airborne optical imagery. The definitions of the SENSRA fields are included in STDI-0002-1, Appendix E: Airborne Support Data Extensions (ASDE). Field values from SENSRA, in combination with values from the ACFTB TRE (another ASDE), provided much of the sensor metadata typically needed to mensurate geolocations of objects imaged by the sensor (the data needed to compute image-to-ground coordinate transformations).

An important part of the metadata is the sensor's pointing orientation. The sensor pointing angle fields in SENSRA are assigned traditional sounding names (SENSOR_YAW, SENSOR_PITCH, and SENSOR_ROLL), but unfortunately their definitions do not perfectly represent those of the traditional angular values. Furthermore, the SENSRA sensor angle definitions completely preclude the possibility of quantifying any rotation about the sensor's line of sight. This latter shortcoming eventually led to the inception of the updated and much-expanded TRE – SENSRB.

The standard SENSRA angle definitions involve the projection of the sensor line-of-sight ray onto the platform's principal planes (see P-3. Standard SENSRA Sensor Angle Definitions). As defined, these angles ***do not*** necessarily correspond with the system angles for the sensor (the instrumented gimbal, mirror, or rotation angles). Conversely, the sensor's system angles often *do* correspond with the traditional angular values *implied* by the SENSRA field names (Yaw, Pitch, and Roll). This inconsistency between angle definition and field naming has led to various non-standard SENSRA implementations.

In many cases, the sensor system's angles (or other angles derived from them) – even though they don't fit the standard's definitions – are stored under the traditionally corresponding SENSRA field names. In other words, instrumented system angles (such as the sensor's gimbal, mirror, or rotation angles) might be stored in the SENSRA fields, which more or less correspond with their traditional names, even though the SENSRA standard angle definitions require the populating of those fields with the non-traditional, projection-based angles.

This appendix illustrates the standard-defined (projection-based) sensor angles. It then documents known examples of the non-standard, alternative implementations.

P.2. REFERENCES

STDI-0002-1 The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS), Volume 1: Tagged Record Extensions;

- Appendix E: Airborne Support Data Extensions (ASDE), version 2.1/change notice 1. 01 August 2011
- Appendix Z: General Electro-Optical (Visible, Infrared, Multi- and Hyperspectral) Sensor Parameters (SENSRB) Tagged Record Extension (TRE), version 1.0. 29 December 2010

P.3. Standard SENSRA Sensor Angle Definitions

The SENSRA sensor angles are defined to be relative to the platform reference frame (X_P-Y_P-Z_P). Their definitions are available in *STDI-0002-1, Appendix E: ASDE* as part of the "SENSRA Format Description." The angles are illustrated here in figure P-1 for completeness.

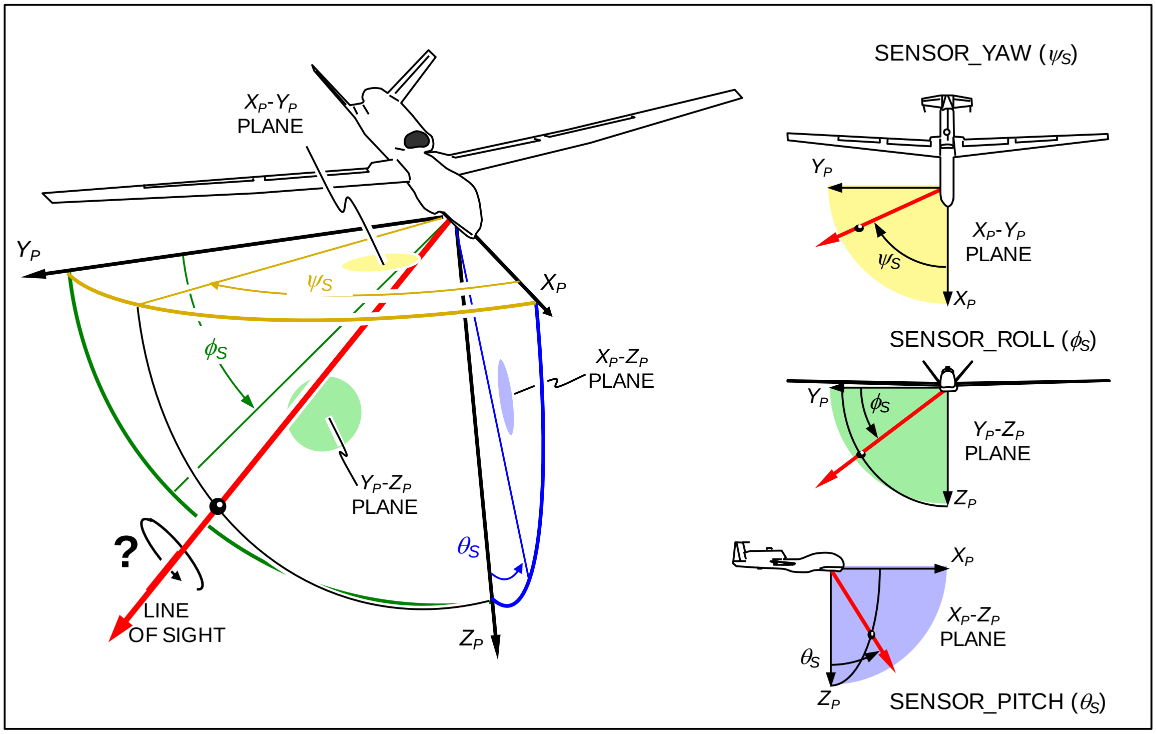

Figure P-1. Illustration of Standard SENSRA Sensor-Angle Definitions.

As can be seen from figure P-1, the SENSRA sensor angle values – yaw (ψ_s), roll (ϕ_s), and pitch (θ_s) – utilize the projections of the line-of-sight ray (red) onto the principal platform planes – X_P-Y_P (yellow), Y_P-Z_P (green), and X_P-Z_P (blue); respectively. The standard-defined angular values are then measured from the designated platform axis to the appropriate line-of-sight projection. These standard-defined angles are *not* generally equivalent to angles that would be available or relevant to the actual sensor system. Furthermore, the set of SENSRA-defined sensor angles is not adequate to completely define the sensor's attitude – since it cannot quantify any rotation about the line-of-sight ray. The sensor angles, which aretypically available to the system and which do completely define the sensor's attitude as needed for geopositioning, are accommodated for in SENSRB (see *STDI-0002-1, Appendix Z: SENSRB*).

A non-standard implementation occurs when a SENSRA TRE producer chooses (accidently or consciously) to store in the SENSRA sensor angle fields any non-standard angles (such as the sensor's system angles*) rather than the above standard-defined, projection-based angles.

P.4. Non-Standard SENSRA Sensor Angle Implementations

Various SENSRA implementers store the sensor's system angles* in the SENSRA fields. Some implementers store other derived angles in the SENSRA fields.

In some cases, the system angles are stored in the SENSRA fields with the traditionally corresponding name – even though these angular values do not fit the projection-based SENSRA sensor angle definitions. These non-standard implementations might more accurately represent the physical sensing system, when compared to the standard implementation. In other cases, a non-standard implementation is needed to quantify a rotation about the sensor's line of sight – which cannot be done with the projection-based SENSRA sensor angle definitions. In either case, the stored angles are *not* the standard-defined angles illustrated previously in figure P-1. And, if not properly documented, these implementations will be subject to possible misinterpretation by the TRE exploiter.

This section documents some known examples of these non-standard alternative implementations. Non-standard systems are briefly described and their implementations are explained. Examples of the non-standard implementations are also provided. For comparison sake, some examples show the standard SENSRA or SENSRB implementations might have been applied in the same situations.

As additional examples of non-standard implementations are encountered, they should also be documented in this appendix by contacting the NTB Chair.

Eventually, these non-standard implementations may be categorized by types and organized in this document accordingly. In this release of the appendix, however, the implementations are presented individually by sensor system.

P.4.1. Shared Airborne Reconnaissance Pod (SHARP)

This sub-section (1) describes the SHared Airborne Reconnaissance Pod (SHARP) system, (2) illustrates how SHARP sensor angles conform to and differ from the standard SENSRA sensor definitions, and (3) provides examples of how the SHARP sensor angles are stored in the SENSRA sensor angle fields.

P.4.1.1. SHARP System Description.

SHARP is carried on the F/A-18E/F Super Hornet tactical aircraft. This pod-contained system is carried on the aircraft's centerline station as shown in Figure P-2. SHARP can be fitted with either of two cameras, one for medium- and the other for high-altitude operations: CA-279M and CA-279H, respectively. With either camera, SHARP can utilize two detector arrays simultaneously to provide both visible-light and infrared capabilities.

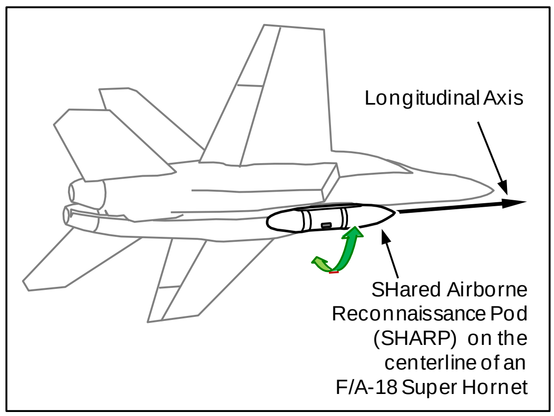

Figure P-2. SHARP on an F/A-18.

With this implementation, the SHARP value of SENSOR_ROLL is in agreement with SENSRA's standard definition regardless of the mirror rotation or aircraft orientation. SHARP's implementation of SENSOR_ ROLL conforms to the SENSRA standard.

* These might be angles taken from gimbal or mirror positions or from known, digitally-applied rotations.

P.4.1.2. SHARP Sensor Angles.

The SHARP sensor system is mounted mid-pod on a gimbal that can be rotated normal to the pod's longitudinal axis. Thus during level flight, the sensor can be pointed to the right or left of or directly below the aircraft – or anywhere in between. The sensor's possible sight lines sweep out the lower portion of a plane approximately normal to the aircraft's direction of flight and parallel to the aircraft's Y_P-Z_P plane, as shown in figure P-3 (left side). Additionally, a mirror is used to aim the sensor some variable angle slightly forward of or slightly behind the plane swept out by the gimbal's right-left rotation – as shown on the right side of the figure.

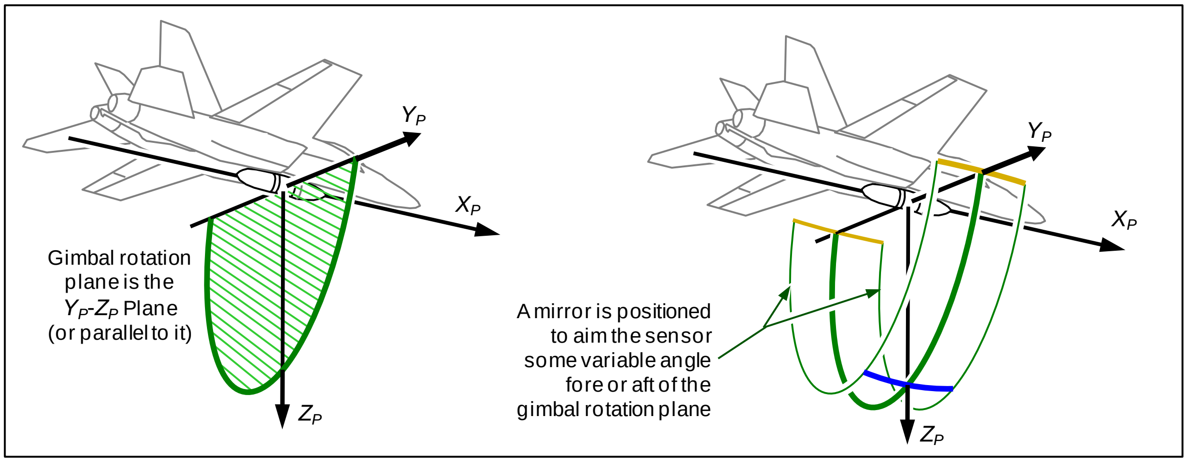

Figure P-3. SHARP Field of Regard. The sensor can be aimed right and left using a gimbal rotation. A sight fore or aft sensor pointing angle is using a system-mounted mirror.

P.4.1.2.1. Sensor Roll.

As can be seen from Figure P-3, the right-left rotation of the gimbal is equivalent to SENSRA's standard-defined SENSOR_ROLL – if the gimbal angle is measured from the right wing downward. This is true for wings-level flight. However, with a banking (rolling) aircraft, another level of complexity is introduced.

The SHARP sensor system includes its own inertial measurement unit (IMU). The IMU senses and commands the camera rotation (right-left) relative to the local horizontal. Because SENSRA's SENSOR_ROLL is defined as relative to the platform, any platform roll is algebraically subtracted from the IMU-commanded rotation before it is stored in SENSRA's SENSOR_ROLL field. This concept is illustrated in figure P-4 for two situations where the aircraft is rolling but the sensor IMU maintains the following stabilized pointing directions:

- along the horizontal (toward the horizon) to the aircraft's left (IMU-sensed right-left rotation of 180°)
- straight down (IMU-sensed right-left rotation of 90°).

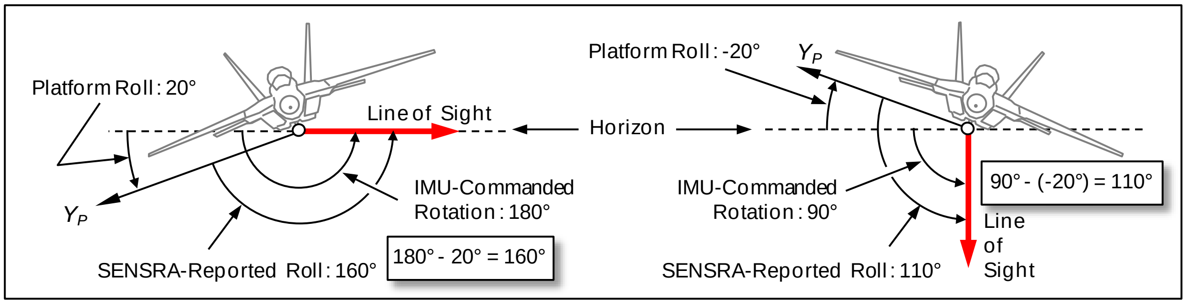

Figure P-4. Two SHARP Examples with Aircraft Roll.

With this implementation, the SHARP value of SENSOR_ROLL is in agreement with SENSRA's standard definition regardless of the mirror rotation or aircraft orientation. SHARP's implementation of SENSOR_ ROLL conforms to the SENSRA standard.

P.4.1.2.2. Sensor Yaw and Pitch.

The SHARP values of SENSOR_YAW and SENSOR_PITCH do not generally conform to the SENSRA sensor angle definitions. The following paragraphs explain why this is the case.

Figure P-5 shows how the mirror rotation would have affected the SENSRA-defined sensor yaw and pitch angles. For example, if the right-left rotation of the gimbal were set to look directly along the left or right wing (parallel to the Y_P axis), the SENSRA-defined SENSOR_YAW angle could have been obtained from the mirror angle. (The sensor yaw angle would differ from the mirror angle magnitude by exactly ±90°.) If, however, the gimbal were set to look downward (parallel to the Z_P axis), the mirror angle would have been the SENSRA-defined SENSOR_ PITCH angle. Furthermore, at any other gimbal angle (other than aligned with the Y_P or Z_P axes), the mirror angle would have contributed **proportionately** to both the SENSRA-defined SENSOR_YAW *and* SENSOR_PITCH angles – much like the line-of-sight vector shown earlier in Figure P-1 contributes to both the standard-defined SENSOR_YAW and SENSOR_PITCH.

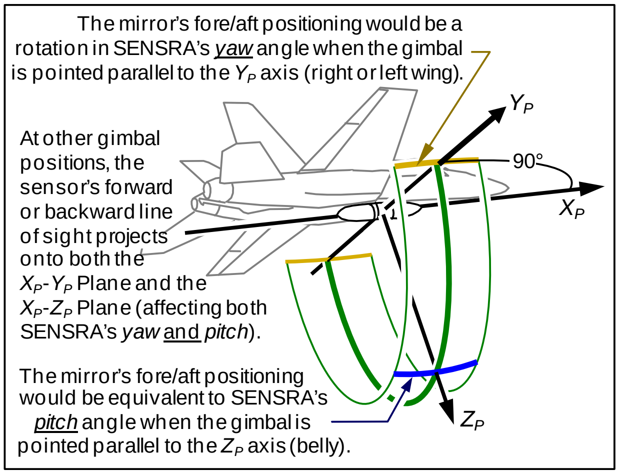

Figure P-5. Effect of Mirror Rotation on the SENSRA standard-defined Sensor Yaw and Pitch Angles.

To preserve the actual mirror position angle (rather than obscuring it in some combination of the line-of-sight projections), the SHARP system chose to fix SENSOR_PITCH at zero (0°) and report SENSOR_YAW as the mirror position angle relative to +90° – regardless of the right-left rotation angle.

P.4.1.3. SHARP Sensor Angle Examples.

Table P-1 provides the SHARP-implementation sensor angles for various sensor orientations (gimbal and mirror positions). For comparison sake, the table also includes how the same orientations would be reported according to the standard SENSRA and SENSRB definitions. The same sample orientations are illustrated in figure P-6 (on the following page) with the SHARP-implementation sensor angle values shown again.

Table P-1. SHARP-Implementation Sensor Angles for Various Sensor Orientations. SHARP-implementation values are shown for SENSRA's SENSOR_PITCH (θ_S), SENSOR_ROLL (ϕ_S), and SENSOR_YAW (ψ_S). For comparison, the corresponding standard-defined angle values for SENSRA and SENSRB are shown for the same orientations.

Gimbal Rotation (from right to left wing)	**SHARP Implementation** (as stored in SENSRA)			**SENSRA** (as defined by the standard)			**SENSRB** (sensor angle model of ***type 2***)		
	mirror position			mirror position			mirror position		
	5° Aft	0°	5° Fore	5° Aft	0°	5° Fore	5° Aft	0°	5° Fore
0°	θ_S: 0° ϕ_S: 0° ψ_S: 95°	θ_S: 0° ϕ_S: 0° ψ_S: 90°	θ_S: 0° ϕ_S: 0° ψ_S: 85°	θ_S: -90° ϕ_S: 0° ψ_S: 95°	θ_S: 0° ϕ_S: 0° ψ_S: 90°	θ_S: 90° ϕ_S: 0° ψ_S: 85°	α: -90° β: -5° γ: 0°	α: -90° β: 0° γ: 0°	α: -90° β: 5° γ: 0°
45°	θ_S: 0° ϕ_S: 45° ψ_S: 95°	θ_S: 0° ϕ_S: 45° ψ_S: 90°	θ_S: 0° ϕ_S: 45° ψ_S: 85°	θ_S: -7.08° ϕ_S: 45° ψ_S: 97.1°	θ_S: 0° ϕ_S: 45° ψ_S: 90°	θ_S: 7.08° ϕ_S: 45° ψ_S: 82.9°	α: -45° β: -5° γ: 0°	α: -45° β: 0° γ: 0°	α: -45° β: 5° γ: 0°
90°	θ_S: 0°	θ_S: 0°	θ_S: 0°	θ_S: -5°	θ_S: 0°	θ_S: 5°	α: 0°	α: 0°	α: 0°

Gimbal Rotation (from right to left wing)	**SHARP Implementation** (as stored in SENSRA) mirror position 5° Aft	0°	5° Fore	**SENSRA** (as defined by the standard) mirror position 5° Aft	0°	5° Fore	**SENSRB** (sensor angle model of ***type 2***) mirror position 5° Aft	0°	5° Fore
	ϕ_S : 90° ψ_S : 95°	ϕ_S : 90° ψ_S : 90°	ϕ_S : 90° ψ_S : 85°	ϕ_S : 90° ψ_S : 180°	ϕ_S : 90° ψ_S : 0°	ϕ_S : 90° ψ_S : 0°	β : -5° γ : 0°	β : 0° γ : 0°	β : 5° γ : 0°
135°	θ_S : 0° ϕ_S : 135° ψ_S : 95°	θ_S : 0° ϕ_S : 135° ψ_S : 90°	θ_S : 0° ϕ_S : 135° ψ_S : 85°	θ_S : -7.08° ϕ_S : 135° ψ_S : -97.1°	θ_S : 0° ϕ_S : 135° ψ_S : -90°	θ_S : 7.08° ϕ_S : 135° ψ_S : -82.9°	α : 45° β : -5° γ : 0°	α : 45° β : 0° γ : 0°	α : 45° β : 5° γ : 0°
180°	θ_S : 0° ϕ_S : 180° ψ_S : 95°	θ_S : 0° ϕ_S : 180° ψ_S : 90°	θ_S : 0° ϕ_S : 180° ψ_S : 85°	θ_S : -90° ϕ_S : 180° ψ_S : -95°	θ_S : 0° ϕ_S : 180° ψ_S : -90°	θ_S : 90° ϕ_S : 180° ψ_S : -85°	α : 90° β : -5° γ : 0°	α : 90° β : 0° γ : 0°	α : 90° β : 5° γ : 0°

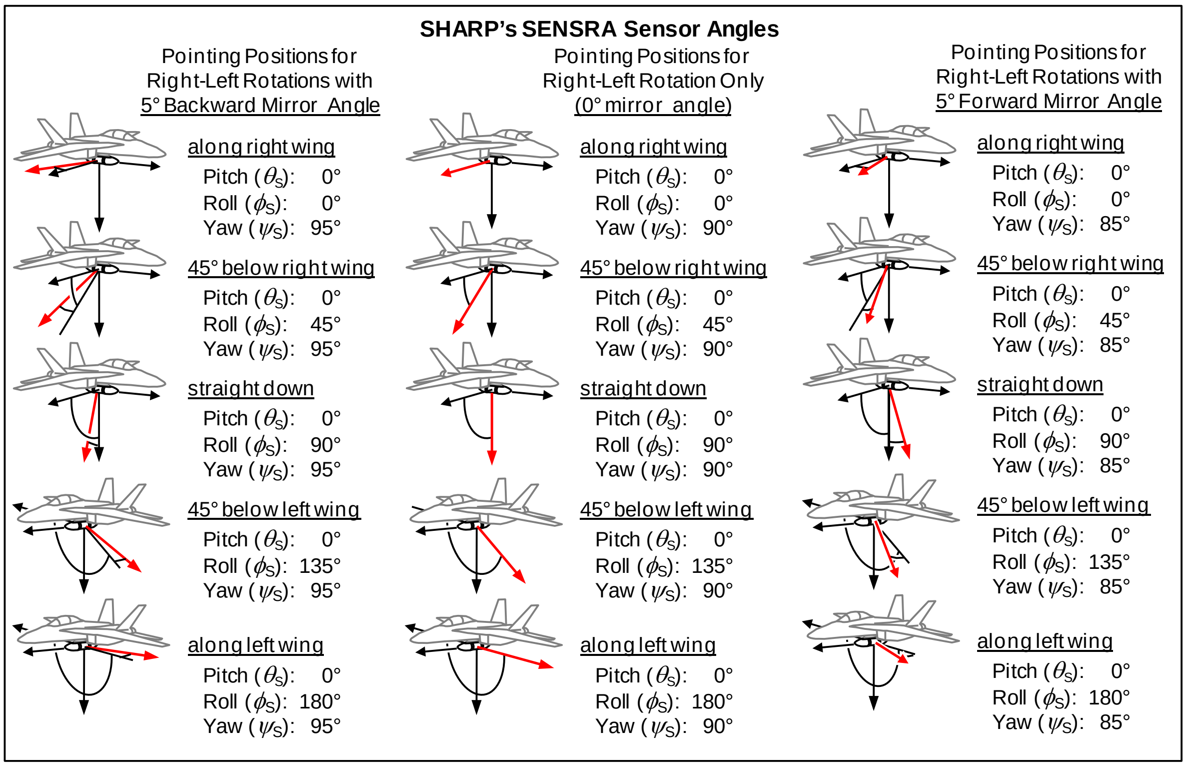

Figure P-6. SHARP Implementation Sensor Angles for Various Sensor Orientations. The sensor angle values shown are for the SHARP implementation and are the same as those given in the leftmost third of table P-1. The illustrated forward and backward mirror angles are exaggerated in the illustrations for clarity.

P.4.2. Advanced Targeting Forward-Looking Infrared (ATFLIR) Pod

This sub-section (1) describes the Advanced Targeting Forward-Looking Infrared (ATFLIR) pod, (2) illustrates how ATFLIR sensor angles conform to and differ from the standard SENSRA sensor definitions, and (3) provides examples of how the ATFLIR sensor angles are computed and stored in the SENSRA sensor angle fields.

P.4.2.1. ATFLIR System Description.

The ATFLIR (AN/ASQ-228) is a multi-sensor targeting and navigation system carried on the F/A-18 Hornet and Super Hornet tactical aircraft. The pod is carried on the aircraft's "cheek" fuselage station just behind

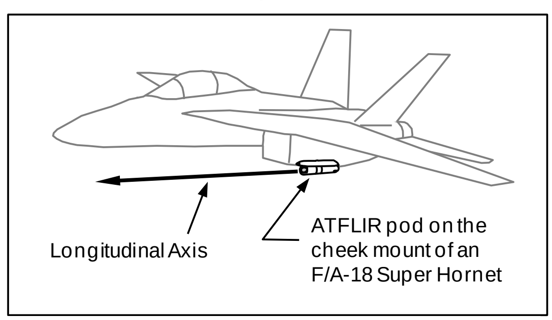

Figure P-7. ATFLIR Pod on an F/A-18.

the jet intake as shown in figure P-7. ATFLIR incorporates infrared and low-light video sensors.* Either video type can be selected and viewed aboard the aircraft. The F/A-18 is capable of capturing still images from either of the two video sensors and then producing a corresponding NITF file for transmission and subsequent exploitation.

The ATFLIR video sensors are mounted near the front of the pod on a two-gimbal system as shown in figure P-8. The outer gimbal rotates about the longitudinal axis of the pod. The inner gimbal rotates about an axis normal to the pod's longitudinal axis. A third rotation about the sensor's line of sight is applied digitally to provide a stable display for the aircrew.

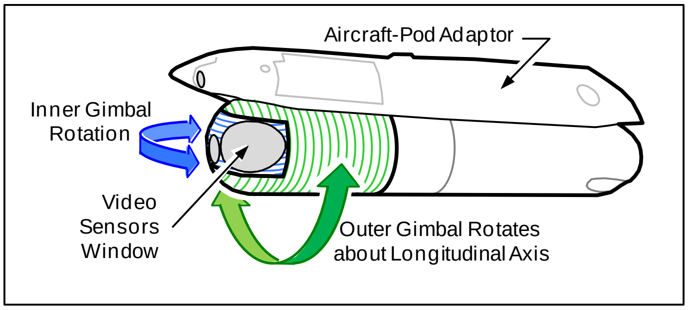

Figure P-8. ATFLIR's Two-Gimbal Sensor System

P.4.2.2. ATFLIR Sensor Angles.

At any given time the ATFLIR reports to the aircraft the relationship between the display coordinate frame and inertial or local-horizontal (North-East-Down – NED) coordinate frame. This is done by providing the values of the nine-element direction cosine matrix (rotation matrix) between the two frames. . The two related coordinate frames are illustrated schematically in figure P-9, where the *N*, *E*, and *D* axes represent the local-horizontal frame and the X_D, Y_D, and Z_D axes represent the coordinate frame for the displayed image.

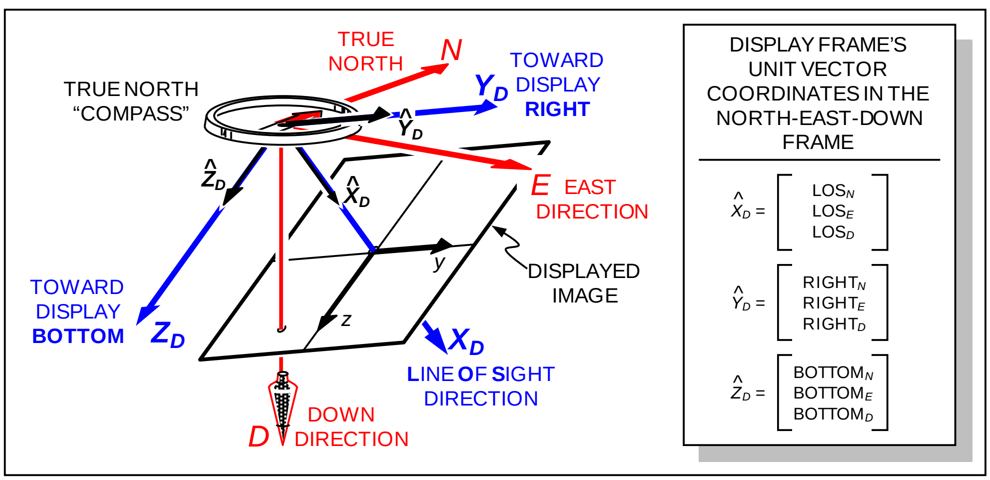

Figure P-9. ATFLIR's Display and North-East-Down Coordinate Frame Relationships.

The direction cosine matrix relating the two coordinate frames is dynamically computed on board the pod and accounts for several factors including mounting irregularities, platform and pod flexures, and

* The system also includes a laser rangefinder/target designator and a laser spot tracker.

boresight corrections; as well as the more obvious contributors – the aircraft attitude, the two gimbal angles, and the digital rotation angle. Despite the internal complexity of the direction cosine matrix computations with so many factors, the resulting nine matrix elements which are passed to the aircraft simply represent the NED coordinates of the three display-frame unit vectors as shown in the above figure. Thus, the coordinate frames relationship is as shown mathematically in Equation P-1:

$$\begin{bmatrix} N \\ E \\ D \end{bmatrix} = \mathbf{C}_{I/D} \begin{bmatrix} X_D \\ Y_D \\ Z_D \end{bmatrix} = [\hat{\mathbf{X}}_D \quad \hat{\mathbf{Y}}_D \quad \hat{\mathbf{Z}}_D] \begin{bmatrix} X_D \\ Y_D \\ Z_D \end{bmatrix} = \begin{bmatrix} LOS_N & RIGHT_N & BOTTOM_N \\ LOS_E & RIGHT_E & BOTTOM_E \\ LOS_D & RIGHT_D & BOTTOM_D \end{bmatrix} \begin{bmatrix} X_D \\ Y_D \\ Z_D \end{bmatrix} \tag{P-1}$$

The same numerical elements of the resulting rotation matrix ($\mathbf{C}_{I/D}$) could have been obtained by the use of three sequential Euler rotations, as illustrated in Figure P-10 and as expressed in Equation P-2.

$$\mathbf{C}_{I/D} = \mathbf{M}_\psi^{\mathrm{T}} \mathbf{M}_\theta^{\mathrm{T}} \mathbf{M}_\phi^{\mathrm{T}} \tag{P-2}$$

where
$$\mathbf{M}_\psi = \begin{bmatrix} \cos\psi & \sin\psi & 0 \\ -\sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix},$$

$$\mathbf{M}_\theta = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix}, \text{ and}$$

$$\mathbf{M}_\phi = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & \sin\phi \\ 0 & -\sin\phi & \cos\phi \end{bmatrix}.$$

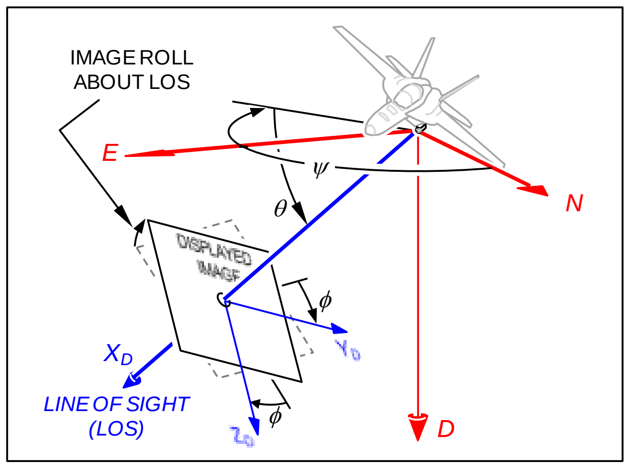

Figure P-10. Equivalent ATFLIR Euler Angle Rotations. A negative (downward) value of θ is illustrated; the other angles (ψ and ϕ) are positive as shown.

These three Euler angles (like the $\mathbf{C}_{I/D}$ matrix itself) are not related at all to the platform's coordinate frame, as would be the SENSRA-defined angles. Furthermore, they are not the physical gimbal or digital rotation angles. They are simply three rotation angles that would produce the equivalent relationship between the local-horizontal coordinate frame (*N*, *E*, *D*) and the displayed-image coordinate frame (X_D, Y_D, Z_D), as reported by the ATFLIR-computed $\mathbf{C}_{I/D}$ matrix.

Since the computed elements of the $\mathbf{C}_{I/D}$ matrix are provided by the ATFLIR system, the equivalent Euler angle rotations can be calculated using the element-by-element equivalences shown in Equations P-3.

$$\mathbf{C}_{I/D} = \begin{bmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{bmatrix}$$

$$= \mathbf{M}_\psi^{\mathrm{T}} \mathbf{M}_\theta^{\mathrm{T}} \mathbf{M}_\phi^{\mathrm{T}} = \begin{bmatrix} \cos\psi\cos\theta & \cos\psi\sin\theta\sin\phi - \sin\psi\cos\phi & \cos\psi\sin\theta\cos\phi + \sin\psi\sin\phi \\ \sin\psi\cos\theta & \sin\psi\sin\theta\sin\phi + \cos\psi\cos\phi & \sin\psi\sin\theta\cos\phi - \cos\psi\sin\phi \\ -\sin\theta & \cos\theta\sin\phi & \cos\theta\cos\phi \end{bmatrix} \tag{P-3}$$

Therefore, $$\theta = \arcsin(-m_{31}),$$

$\phi = \arctan\left({}^{m_{32}}/_{m_{33}}\right)$,* and
$\psi = \arctan\left({}^{m_{21}}/_{m_{11}}\right)$.*

The three equivalent Euler rotation angles that are calculated from the $\mathbf{C}_{I/D}$ matrix using Equations P-3 are then stored in the SENSRA angle fields respectively as SENSOR_PITCH (θ), SENSOR_ROLL (ϕ), and SENSOR_YAW (ψ). Again, these angle values do not use the SENSRA standard definitions nor are they relative to the platform coordinate frame. The ATFLIR implementation does, however, provide the complete relationship between the local-horizontal and displayed-image coordinate frames as illustrated in Figure P-10. This relationship is needed to use the imagery for geopositioning purposes, where the SENSRA standard angles would have been insufficient.

P.4.2.3. ATFLIR Sensor Angle Examples.

This section provides illustrative examples of ATFLIR's SENSRA angle implementation. It also explains how the ATFLIR sensor angles are accommodated in SENSRA's replacement TRE, SENSRB.

For each of the examples, table P-2 shows the ATFLIR direction cosine matrix and the equivalent Euler rotation angles as they would be stored in SENSRA. The appropriate standard-defined SENSRA angle values are impossible to provide for the examples, as the standard-defined angles cannot represent ATFLIR's image rotation (ϕ) about the line of sight.

Table P-2. ATFLIR-Implementation Sensor Angles for Notional Sensor Orientation Cases. For each notional $\mathbf{C}_{I/D}$ matrix, the SENSOR_PITCH, SENSOR_ROLL, and SENSOR_YAW angles are given as they would be stored in the ATFLIR implementation.

$\mathbf{C}_{I/D}$ Matrix Values			ATFLIR's SENSRA Angles	$\mathbf{C}_{I/D}$ Matrix Values			ATFLIR's SENSRA Angles
Case #1				***Case #2***			
0.3237	0.8051	-0.4970	PITCH: asin(-m_{31}) = –40°	0.8067	-0.5590	-0.1917	PITCH: asin(-m_{31}) = –10°
-0.6943	0.5590	0.4533	ROLL: atan2(m_{32},m_{23}) = 15°	0.5649	0.8247	-0.0278	ROLL: atan2(m_{32},m_{23}) = –5°
0.6428	0.1983	0.7399	YAW: atan2(m_{21},m_{11}) = –65°	0.1736	-0.0858	0.9811	YAW: atan2(m_{21},m_{11}) = 35°
Case #3				***Case #4***			
-0.7500	0.2702	0.6038	PITCH: asin(-m_{31}) = –30°	-0.6634	-0.2179	0.7158	PITCH: asin(-m_{31}) = –40°
-0.4330	-0.8905	-0.1394	ROLL: atan2(m_{32},m_{23}) = –25°	0.3830	-0.9207	0.0747	ROLL: atan2(m_{32},m_{23}) = 25°
0.5000	-0.3660	0.7849	YAW: atan2(m_{21},m_{11})= –150°	0.6428	0.3237	0.6943	YAW: atan2(m_{21},m_{11}) = 150°

The examples of table P-2 are illustrated in figure P-11. Although notional aircraft orientations are shown for each of the cases, in the ATFLIR implementation the platform orientation is irrelevant as the direction cosine matrix ($\mathbf{C}_{I/D}$) and the equivalent Euler rotation angles relate the displayed-image coordinate frame (X_D, Y_D, Z_D) directly to the local-horizontal coordinate frame (N, E, D), not the platform coordinate frame (X_P, Y_P, Z_P). Although, this platform-independent implementation is not allowed by the *standard* SENSRA field definitions, it is easily accommodated within SENSRB.

* In the actual implementation a four-quadrant solution is obtained using the two element arguments and an "`atan2`" function with a range from -180° to 180°.

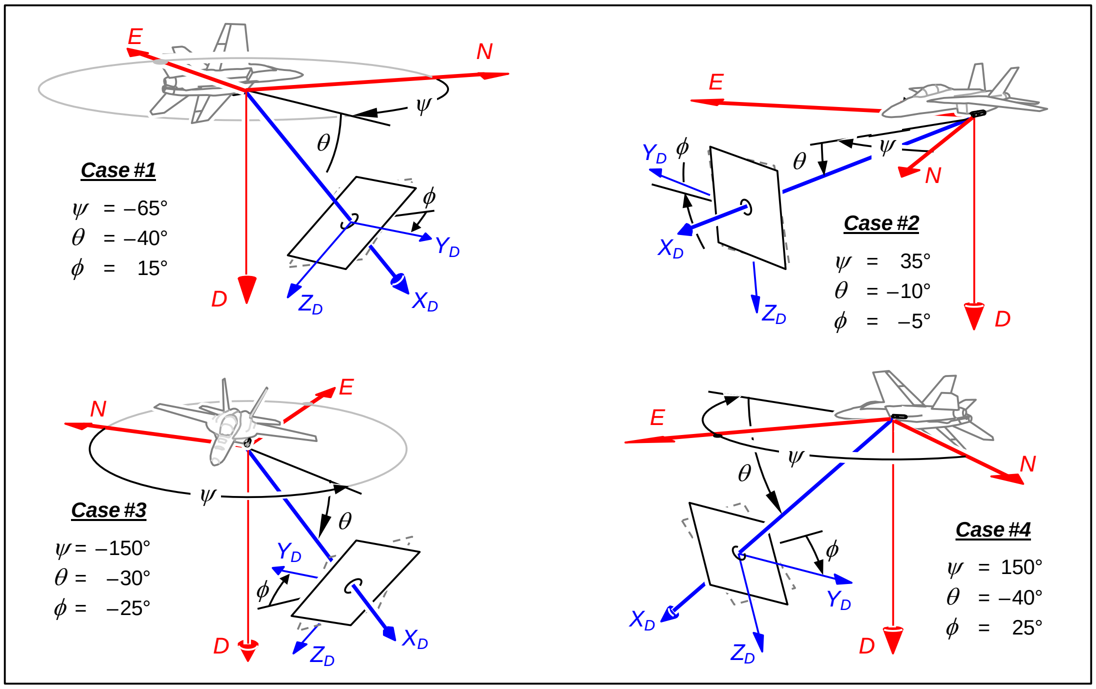

Figure P-11. Notional Sensor Orientation Cases for the Tabular ATFLIR-Implementation Examples.

The rotation angle values used in the ATFLIR's non-standard SENSRA implementation, as shown in table P-2 or figure P-11, are exactly standard compliant in SENSRB's Attitude Euler Angles module, with the SENSOR_ANGLE_MODEL specified as "1" and the PLATFORM_ RELATIVE flag set to "N". Even better, the direction cosine matrix ($\mathbf{C}_{I/D}$) elements themselves can be stored directly* in SENSRB's Attitude Unit Vectors module. Examples of this are provided in table P-3 using the cases from table P-2 or figure P-11.

* Some sign changes must be applied to the ATFLIR matrix elements because the SENSRB direction cosine matrix relates the local-horizontal coordinate frame (*N*, *E*, *D*) to the image coordinate frame (X_I, Y_I, Z_I) rather than the "displayed" image coordinate frame (X_D, Y_D, Z_D) – where $X_I = Y_D$, $Y_I = –Z_D$, and $Z_I = –X_D$. The definitions for the SENSRB direction cosine matrix elements are available in *STDI-0002-1, Appendix Z: SENSRB*.

.

Table P-3. Equivalent SENSRB Standard Implementations for the Notional ATFLIR Examples.

$C_{I/D}$ Matrix Values			SENSRB Euler Angle Implementation				SENSRB Unit Vector Implementation			
			SENSOR_ANGLE_		PLATFORM_		Image Coordinate System*			
Case #1										
X_D	Y_D	Z_D	MODEL:	1	RELATIVE:	N		X_I	Y_I	Z_I
0.3237	0.8051	-0.4970	1:	– 65.00°	HEADING:	347.34°	NORTH	0.8051	0.4970	-0.3237
-0.6943	0.5590	0.4533	2:	– 40.00°	PITCH:	2.48°	EAST	0.5590	-0.4533	0.6943
0.6428	0.1983	0.7399	3:	15.00°	ROLL:	– 38.62°	DOWN	0.1983	-0.7399	-0.6428
Case #2										
X_D	Y_D	Z_D	MODEL:	1	RELATIVE:	N		X_I	Y_I	Z_I
0.8067	-0.5590	-0.1917	1:	35.00°	HEADING:	39.26°	NORTH	-0.5590	0.1917	-0.8067
0.5649	0.8247	-0.0278	2:	– 10.00°	PITCH:	1.85°	EAST	0.8247	0.0278	-0.5649
0.1736	-0.0858	0.9811	3:	– 5.00°	ROLL:	0.46°	DOWN	-0.0858	-0.9811	-0.1736
Case #3										
X_D	Y_D	Z_D	MODEL:	1	RELATIVE:	N		X_I	Y_I	Z_I
-0.7500	0.2702	0.6038	1:	– 150.00°	HEADING:	251.04°	NORTH	0.2702	-0.6038	0.7500
-0.4330	-0.8905	-0.1394	2:	– 30.00°	PITCH:	0.78°	EAST	-0.8905	0.1394	0.4330
0.5000	-0.3660	0.7849	3:	– 25.00°	ROLL:	– 5.37°	DOWN	-0.3660	-0.7849	-0.5000
Case #4										
X_D	Y_D	Z_D	MODEL:	1	RELATIVE:	N		X_I	Y_I	Z_I
-0.6634	-0.2179	0.7158	1:	150.00°	HEADING:	133.84°	NORTH	-0.2179	-0.7158	0.6634
0.3830	-0.9207	0.0747	2:	– 40.00°	PITCH:	– 11.43°	EAST	-0.9207	-0.0747	-0.3830
0.6428	0.3237	0.6943	3:	25.00°	ROLL:	– 29.67°	DOWN	0.3237	-0.6943	-0.6428

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