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OGC® OWS-5 Engineering Report: Local MSD Implementation Profile (GML 3.2.1)

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Preface

This document contains a data content specification for Local Mission Specific Data (MSD) and is based on the GEOINT Structure Implementation Profile (GSIP) developed by the NGA. This document defines the GML 3.2.1 (ISO 19136) encoding requirements for Local MSD. The structure of the document is based on ISO 19131 (Geographic Information – Data Product Specification).

The Local Mission Specific Data Data Content Specification (DCS) was developed as part of the Open Geospatial Consortium (OGC) Interoperability Program.

OGC employs a variety of innovative techniques to enable developers and integrators to rapidly and efficiently test, validate, and document specifications based on user requirements. One technique that is part of the Interoperability Program is the Open Web Services (OWS) Testbed. This document was developed as part of the testing, evaluation and implementation process, within the OWS phases 4 and 5 (OWS-4, OWS-5), designed to evaluate the encoding of MSD in Geography Markup Language (GML) as well as test the use of MSD within a web services architecture.

Suggested additions, changes, and comments on this draft report are welcome and encouraged. Such suggestions may be submitted by email message or by making suggested changes in an edited copy of this document.

The changes made in this document version, relative to the previous version, are tracked by Microsoft Word, and can be viewed if desired. If you choose to submit suggested changes by editing this document, please first accept all the current changes, and then make your suggested changes with change tracking on.

Forward

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1 Introduction

1.1 Scope

This OGC® document specifies the content and format for Local Mission Specific Data (Local MSD) as it is encoded in Geography Markup Language version 3.2.1. This document will either directly define or define through reference the content and format requirements when encoding Local MSD in GML.

NOTE This document provides a description of the content, accuracy, data format, and design of Local MSD data collections and is based on the current draft of ISO 19131, the forthcoming ISO standard for data product specifications for geographic information products.

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1.2 Security classification of specification

This document is UNCLASSIFIED.

1.3 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

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1.4 Revision history

Date	Release	Editor	Primary clauses modified	Description
2008-05-13	0.0.1	Clemens Portele	all	initial document based on OWS-4 IPR (07-027r1)
2008-05-15	0.0.2	Clemens Portele	all	edits based on comments by Paul Birkel

2 Conformance

Local MSD data encoded in GML shall conform to the GML 3.2.1 conformance class defined in GML 3.2.1 Subclause 2.5, i.e. pass all conformance tests in GML 3.2.1 Annex A.3. The GML application schema referenced shall be an exact copy of the NAS GML Application Schema version 2.5 (draft) conforming to all constraints associated with the Local MSD profile.

Local MSD data shall fulfill all mandatory requirements stated in Clause 7. In particular, features, attributes, enumerants and associated geometries for Local MSD shall be in conformance with those identified within the National System for Geospatial Intelligence Application Schema and the Local MSD profile of that application schema.

Dataset and feature level metadata shall be in conformance with ISO 19115:2003 and ISO 19115/Cor.1:2006 and shall be encoded following the rules and definitions found in ISO/TS 19139:2007.

3 References

The following documents are referenced in this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

GEOINT Structure Implementation Profile, Version 2.5 (draft)

NOTE 1 This document can be obtained after adoption from http://www.gwg.nga.mil/index.html?content=stds_regs

NOTE 2 The GEOINT Structure Implementation Profile (GSIP) contains the NSG Application Schema (NAS), the NSG Feature Concept Dictionary (NFDD) and the NSG Entity Catalogue (NEC).

Topographic Feature Extraction Guide for Regional and Local Data (TFEG-RL), Version 1.0

NOTE 3 This document is not yet published.

ISO/TS 19103:2005, *Geographic Information – Conceptual Schema Language*

NOTE 4 This document can be obtained from the International Organisation for Standardisation.

ISO 19109:2004, *Geographic Information – Rules for Application Schemas*

NOTE 5 This document can be obtained from the International Organisation for Standardisation.

ISO 19136:2007, *Geographic Information – Geography Markup Language (GML)*

NOTE 6 This document can be obtained from the Open Geospatial Consortium Inc. or the International Organisation for Standardisation.

ISO/TS 19139:2007, *Geographic Information – Metadata – XML Schema Implementation*

NOTE 7 This document can be obtained from the International Organisation for Standardisation.

GEOINT Structure Implementation Profile Schema Processing ER, OGC document 08-078

NOTE 8 This document can be obtained from the Open Geospatial Consortium Inc.

NSG Metadata Implementation Specification (NMIS) – Part 2 – XML Exchange Schema, version 1.0

NOTE 9 This document can be obtained from http://www.gwg.nga.mil/index.html?content=stds_regs

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

4 Terms and definitions

4.1
data product specification
detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to and used by another party [ISO 19131]

4.2
data content specification
detailed description of a class of data, **datasets** or **dataset series** together with additional information that will enable members of that class to be created, supplied to and used by another party

NOTE 1 A data content specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a class of datasets. It may be used for production, sales, end-use or other purpose.

NOTE 2 A data content specification is not directly associated with a specific data collection, dataset, or dataset series.

4.3

Mission Specific Data (MSD)

MSD provides the required geospatial detail (at the needed density/resolution and accuracy) and features and/or attributes to meet specialized mission needs. MSD can be of many types – to include elevation data, imagery, or vector features.

4.4

Global Mission Specific Data (Global MSD)

Low density global coverage of essential features used for strategic planning and monitoring. This data is the underlying layer of feature data that will be intensified into mission specific data. Global data depicts only the general character of the terrain and features of considerable prominence. These features change rarely or slowly. Global information supports initial planning level and reference data views.

4.5

Regional Mission Specific Data (Regional MSD)

Medium density regional coverage used for operational planning to meet mission requirements. Regional Mission Specific Data will have the same geometry as Local Mission Specific Data, but different (less) content. It is responsiveness data which is mission dependent and requirements driven. These features change rarely or slowly and include lines of communication consisting of transportation networks (road, railway, pipeline, air and waterway), communications networks and power distribution networks.

4.6

Local Mission Specific Data (Local MSD)

High density local coverage of focused areas used to meet specific geospatial requirements. Local MSD has more densification and greater detail than regional data (more feature classes, attributes, and attribute values). It is responsiveness data, which has mission dependent requirements and is usually time-sensitive. It is generally used for planning and operations of a tactical nature. The level of detail is sufficient for infantry and reconnaissance units to navigate in various environments.

4.7

Specialized Mission Specific Data – Urban (Specialized MSD – Urban)

Very high density local coverage of focused areas used to meet specific geospatial requirements. Used for special operations and disaster relief. Urban data encompasses greater detail (density, accuracy, and resolution), or additional features and/or attributes to meet greater operation requirements. It is a responsiveness data, which is mission dependent, requirements-driven, and usually time-sensitive.

4.8

National System for Geospatial Intelligence Entity Catalog (NEC)

The National System for Geospatial Intelligence Entity Catalog (NEC) is a collection of GEOINT data requirements as determined by NSG partners. The NEC serves as the Logical Data Model (LDM) from which specific data content can be physically implemented. The data content outlined in Mission Specific Data conforms to the latest version of the NEC.

4.9

GEOINT Structure Implementation Profile (GSIP)

Defines the methods for identifying and encoding Geospatial Intelligence (GEOINT) data in the National System for Geospatial Intelligence (NSG). The GSIP integrates the conceptual schemas from the ISO/TC 211 19100 series of standards for modeling. The GSIP also draws on the relevant content standards, specifications and profiles from the Digital Geospatial Information Working Group (DGIWG), International Hydrographic Organization (IHO), International Civil Aviation Organization (ICAO), as well as others with the intent to unify multiple domain-specific content models.

5 Abbreviated terms

DFDD	DGIWG Feature Data Dictionary
FACC	Feature Attribute Coding Catalog
GML	Geography Markup Language
ISO	International Organization for Standardisation
MSD	Mission Specific Data
NAS	NSG Application Schema
NEC	NSG Entity Catalog
NFDD	NSG Feature Data Dictionary
NGA	National Geospatial-Intelligence Agency
NSG	National System for Geospatial-Intelligence
OGC	Open Geospatial Consortium
UML	Unified Modeling Language
WFS	Web Feature Service
WGS	World Geodetic System
XML	eXtended Markup Language

6 Overview

Mission Specific Data (MSD) provides the required geospatial detail (at the needed density/resolution and accuracy) and features and/or attributes to meet specialized mission needs. MSD can be of many types – to include elevation data, imagery, or vector features.

Local Mission Specific Data (Local MSD) is extracted to support high-density local coverage of focused areas used to meet specific geospatial requirements. Local MSD has more densification and greater detail than regional data (more feature classes, attributes, and attribute values). It is responsiveness data, which has mission dependent requirements and is usually time-sensitive. It is generally used for planning and operations of a tactical nature. The level of detail is sufficient for infantry and reconnaissance units to navigate in various environments.

Local MSD is equivalent in data content to what was formerly known as MSD3. It is equivalent to the content of 1:50K and 1:100K products including Harbor / Approach / Coastal Charts. While the scale and content correlates to current Topographic Line Map (TLM) products, they are not a one-for-one match. Local MSD will utilize data from existing NGA data stores. Local MSD contains three themes that consist of aeronautical data pulled from the Aeronautical Digital Data Environment (ADDE); topographic data pulled from the Geospatial Intelligence Feature Database (GIFD); hydrographic data pulled from Digital Navigation Chart (DNC) products. All three are compiled separately, then de-conflated, and merged.

The exact feature, attribute and geometry requirements for a Local MSD extraction are mission specific. However, the framework for all MSD levels is defined as part of the National System for Geospatial-Intelligence Application Schema (NAS) version 2.5 (draft). The data stores used as source for data collection do not represent the latest version of the NAS that defines Local MSD therefore mapping tables are created to transform existing data structures to NAS-compliant data.

Local MSD is not to be used for navigation purposes, but supports navigation, mission planning, initial preparation of the battlefield (IPB), etc.

7 Formal data product specification

7.1 General remark

This clause contains a description of the Local MSD Data Content Specification based on the formal structure of ISO 19131.

7.2 Specification scope

In principle, a data content specification may not be homogeneous across the whole data content, but may vary for different parts of the data. Given that Local MSD extraction is a user driven requirement not all Local MSD data collections will contain exactly the same features, and/or attributes. For Local MSD, however, the same specification scope applies to all parts of the data content specification that are described in the subsequent sub-clauses.

Scope identification	local_msd
Level	Dataset
Level name	*not applicable*

Extent	*not applicable* (scope is the full dataset)
Level description	*not applicable*
Coverages	*not applicable* (scope is the full dataset)

7.3 Data product identification

The information items in this subclause are used to identify a Local MSD data product.

Title	Local Mission Specific Data
Abstract	High-density local coverage of focused areas used to meet specific user driven geospatial requirements. Greater densification and detail than Regional MSD (more feature classes, attributes, and attribute values). It is responsiveness data, which has mission dependent requirements and is usually time-sensitive. It is generally used for planning and operations of a tactical nature.
Topic categories	- biota - boundaries - climatologyMeteorologyAtmosphere - economy - elevation - environment - farming - geoscientificInformation - health - imageryBaseMapsEarthCover - inlandWaters - intelligenceMilitary - location - oceans

	- planningCadastre - society - structure - transportation - utilitiesCommunication
Geographic description	The geographic area covered by Local MSD extractions will vary from dataset to dataset.
Alternate title	Local MSD
Purpose	Responsiveness data, which has mission dependent requirements and is usually time-sensitive. It is generally used for planning and operations of a tactical nature.
Spatial representation type	vector
Spatial resolution	1:50,000 to 1:100,000
Supplemental information	*not applicable*

7.4 Data content and structure

Local MSD is a feature-based product. Content information is described in terms of an application schema, an entity catalog and a feature concept dictionary.

An overview of the Local MSD feature types, their properties (attributes and association roles) and their grouping into packages is included as Annex A.

The process of creating the application schema and feature catalog consists of the following steps which are described in detail in the document "GSIP Schema Processing ER (OGC 08-078)":

- Local MSD is a subset of the National System for Geospatial-Intelligence Application Schema (NAS).
- The content of the NAS plus information which subset of the NAS belongs to Local MSD (or other data content specifications) as well as other relevant information is represented in the NEC.
- A script developed by NGA is used to automatically create the NAS as a ISO 19109 Application Schema in UML from the NEC. The UML model is a Rational Rose or Eclipse model.

- The UML model is exported from Rational Rose as a XMI 1.0 file (XMI provides a vendor independent XML encoding of a UML model).

- Using the open source ShapeChange tool (http://www.interactive-instruments.de/ShapeChange/) for UML-to-GML-Application-Schema conversions (UGAS), a GML 3.2.1 application schema of the NAS is derived automatically from the XMI file. The tool documentation includes one document describing the mapping rules from UML to GML application schemas as implemented by the tool. A second document describes the implementation of the ShapeChange tool, its installation and guidelines for using the tool.

Application schema	The application schema provides the formal description of the data structure and content. It is a conceptual model, described using UML as the conceptual schema language in accordance with ISO 19109 (*Geographic information — Rules for Application Schemas)* and ISO/TS 19103 (*Geographic information — Conceptual Schema Language)*. The NAS application schema can be obtained as a Rational Rose UML model at the URL of the GEOINT Structure Implementation Profile (GSIP), see clause 4. Only a subset of the full NAS is part of Local MSD. The constraints imposed by Local MSD on the full NAS are documented in Annex A.
Entity catalog	The entity catalog provides the semantics of all feature and other information entity types, together with their attributes and attribute value domains and association types between entity types contained in the application schema. The entity catalog is realized in accordance with ISO 19110 (*Geographic information — Methodology for feature cataloguing)* and is encoded as a Microsoft Excel Workbook. All information entity types are treated as feature types in the catalog. The feature types, attribute types and attribute value domains are derived from the NSG Feature Data Dictionary (NFDD). The NFDD is based on the DGIWG Feature Data Dictionary (DFDD) with some national extensions. The Local MSD feature catalogue can be obtained as an Excel workbook at the URL of the GEOINT Structure Implementation Profile (GSIP), see clause 4. A tabular overview of the Local MSD entity types and their properties is included as Annex A.

GSIP also provides a loose grouping mechanism, called “Views”. There are currently about 100 views defined that are related to Local MSD. Information entities, in particular feature types, are associated with one or more views, and those views are organized into groups. Entity views are provided as a means to organize subsets of the NAS for the purposes of inspecting "similar entities".

Views are also encoded as DDMS metadata elements which can be registered and published in a registry. This allows clients to discover them and use them, for example, to create queries of all features that are part of that view.

NOTE Views are NOT "coverages" in the sense of coverages in existing FACC based data product specifications and do not in any manner affect the content of the NSG FC.

The views are listed in Annex B.

7.5 Reference systems

Reference systems used in Local MSD data provide a reference frame for spatial and temporal coordinate values.

Spatial reference system	The use of WGS84 geographic coordinates for horizontal coordinates and Mean Sea Level (MSL) for vertical coordinates is mandated.
Temporal reference system	Gregorian calendar

For attribute values that are associated with a unit of measure, the unit of measure is specified in the documentation of the respective attribute.

7.6 Data quality

Local MSD datasets have to meet the data quality requirements as described in this subclause. The data quality requirements for the three “themes” of data source that make up Local MSD, aeronautical, topographic and hydrographic are defined and verified during the data collection phase of these three individual themes. These requirements are defined by the respective production elements. The data quality requirements for Local MSD following the data deconfliction and merging are described in accordance with ISO 19113 (*Geographic information - Quality principles*) and include a statement on acceptable conformance quality levels defined by the mission specific user requirements. The data conformance to these mission specific quality requirements will be reported based on adherance to the data quality measures as defined in ISO 19114 (*Geographic information — Quality evaluation procedures*) and ISO/TS 19138 (*Geographic information - Data quality measures*).

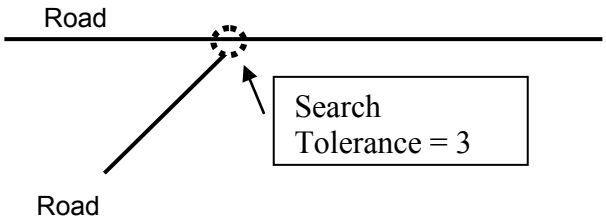
Metadata reporting of data quality for Local MSD will be done in accordance with the ISO documents described above. Reporting will be done for only those data quality measures where measurements are actually completed and will be based on the user-defined set of quality requirements for the mission specific extraction. This DCS does not attempt to define the acceptable values for data quality, but rather defines the mechanism for reporting the results.

A formal definition of data quality information is given in ISO 19131 Annex E.4, which provides a UML model and the corresponding data definitions.

An absolute horizontal positional accuracy for Local MSD feature data has been established as 23 Meters Circular Error. No linear positional accuracy requirement has been predefined for Local MSD. However, user defined requirements may identify an alternative acceptable positional accuracy. Local MSD extractions will report on the positional accuracy of the feature data in conformance with ISO 19115 metadata and measured in conformance with ISO/TS 19138 data quality measures.

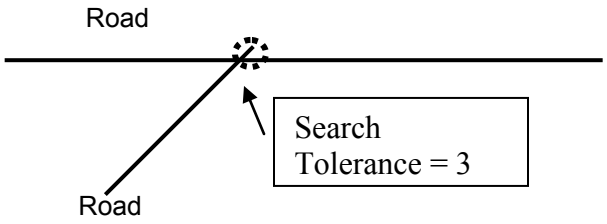
Regional MSD requirements include the ability to support network analysis. Local MSD being a densification of a Regional MSD is therefore expected to also support network analysis. Given this requirement an evaluation of the data content to support topology is necessary. ISO 19138 *Data Quality Measures* provides guidelines on topological consitency measures, examples 1 and 2 below describe measures to evaluate connectivity requirements.

EXAMPLE 1

Name	number of missing connections due to undershoots
Alternative name	Undershoots
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of items in the dataset, within the parameter tolerance, that are mismatched due to undershoots
Description	
Parameter	search distance from the end of a dangling line
Data quality value type	integer
Data quality value structure	
Source reference	
Example	
Measure identifier	23

EXAMPLE 2

Name	number of missing connections due to overshoots
Alternative name	overshoots
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count

Definition	count of items in the dataset, within the parameter tolerance, that are mismatched due to overshoots
Description	
Parameter	search distance from the end of a dangling line
Data quality value type	integer
Data quality value structure	
Source reference	
Example	
Measure identifier	24

While no absolute horizontal or linear positional accuracy requirement has been predefined for Local MSD, user defined requirements will likely identify a minimum acceptable positional accuracy. However, Local MSD extractions will report on the positional accuaracy of the data regardless of an established requirement. Reporting of positional accuracy will be in conformance with ISO 19115 metadata and measured in conformance with ISO/TS 19138 data quality measures.

EXAMPLE 3

Name	absolute circular error at 90% significance level of biased data
Alternative name	ACE
Data quality element	Positional Accuracy
Data quality subelement	Absolute or External Accuracy
Data quality basic measure	Not Applicable
Definition	The absolute horizontal accuracy of the data's coordinates, expressed in terms of circular error at 90% probability given

	that a bias is present.
Description	A comparison of the data (source) and the control (reference) is calculated in the following manner: 1. Calculate the absolute error in the horizontal dimension at each point: $\Delta Hi = \sqrt{(sourceX_i - referenceX_i)^2 + (sourceY_i - referenceY_i)}$ for $i = 1 \ldots N$ 2. Calculate the mean horizontal error: $\mu_H = \left(\sum \Delta H_i\right) / N$ 3. Calculate the standard deviation of the horizontal errors: $\sigma_H = \sqrt{\sum (\Delta H_i - \mu_H)^2 / (N-1)}$ 4. Calculate the ratio of the absolute value of the mean error to the standard deviation: $ratio = |\mu_H| / \sigma_H$ 5. If $ratio > 1.4$, then $k = 1.2815$ 6. If $4.1 \leq ratio$, then calculate k, the ratio of the mean to the standard deviation, using a cubic polynomial fit through the tabular values as defined in the *CRC Handbook of Tables for Probability and Statistics* $k = 1.6435 - (0.999556 \times ratio) + (0.923237 \times ratio^2) - (0.282533 \times ratio^3)$ 7. Compute CE90 for the source: $CE90_{source} = |\mu_H| + (k \times \sigma_H)$ 8. Compute absolute CE90:

	$CE90_{abs} = \sqrt{CE90_{reference}^{2} + CE90_{source}^{2}}$
Parameter	Sample size: minimum of 30 points is normally used but may not always be possible depending on identifiable control points. For feature level attribution sample 10% of the feature population.
Data quality value type	Measure
Data quality value structure	–
Source reference	1. Department of Defense: Standard Practice: Mapping, Charting and Geodesy Accuracy: MIL-STD-600001: dated 26 February 1990. (U.S.) 2. CRC Handbook of Tables for Probability and Statistics, second edition, 1966, 1968, International Standard Book No. 0-87819-692-7
Example	–
Measure identifier	49

EXAMPLE 4

Name	absolute linear error at 90% significance level of biased vertical data
Alternative name	ALE
Data quality element	Positional Accuracy
Data quality subelement	Absolute or External Accuracy
Data quality basic measure	Not Applicable
Definition	The absolute vertical accuracy of the data's coordinates, expressed in terms of linear error at 90% probability given that a bias is present.
Description	A comparison of the data (source) and the control (reference) is calculated in the following manner: 1. Calculate the absolute error in the vertical dimension at

	each point: $\Delta V_i = dataV_i - controlV_i \qquad$ for $i = 1 \ldots N$ 2. Calculate the mean vertical error: $\overline{\delta V} = \frac{1}{N}\sum_{i=1}^{N}\delta V_i$ 3. Calculate the standard deviation of the vertical errors: $\sigma_V = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\delta V_i - \overline{\delta V})^2}$ 4. Calculate the ratio of the absolute value of the mean error to the standard deviation: $ratio = \lvert\mu_V\rvert / \sigma_V$ 5. If $ratio > 1.4$, then $k = 1.2815$ Else $k = 1.6435 - (0.999556 \times ratio) + (0.923237 \times ratio^2) - (0.282533 \times ratio^3)$ 6. Compute LE90 for the data layer: $LE90_{data} = \lvert\mu_V\rvert + (k \times \sigma_V)$ 7. Compute absolute LE90: $LE90_{abs} = \sqrt{LE90_{data}^{\ 2} + LE90_{control}^{\ 2}}$
Parameter	Sample size: minimum of 30 points is normally used but may not always be possible depending on identifiable control points. For feature level attribution sample 10% of the feature population.
Data quality value type	Measure
Data quality value structure	–
Source reference	1. Department of Defense: Standard Practice: Mapping,

	Charting and Geodesy Accuracy: MIL-STD-600001: dated 26 February 1990. (U.S.) 2. CRC Handbook of Tables for Probability and Statistics, second edition, 1966, 1968, International Standard Book No. 0-87819-692-7
Example	–
Measure identifier	51

7.7 Data capture

Local MSD will utilize data from existing NGA data stores. Local MSD contains three themes that consist of aeronautical data pulled from the Aeronautical Digital Data Environment (ADDE); topographic data pulled from the Geospatial-Intelligence Feature Database (GIFD); hydrographic data pulled from Digital Navigation Chart (DNC) products. All three are compiled separately, then deconflated, and merged.

Local MSD will then be densified to meet specific user-defined geospatial requirements.

Rules for densified data capture for extraction are defined in the Topographic Feature Extraction Guide for Regional and Local Data (TFEG-RL). The primary purpose for developing the TFEG-RL is to provide a logical approach to extraction that will support collection of digital data and population of a product-neutral digital database. The guidance document is intended to standardize the feature extraction process, promote a consistent approach to data collection for NGA and NGA digital data producers and reduce "clutter" as a result of over-collection.

NOTE The NAS profile covered by the TFEG-RL differs from the Local MSD profile.

7.8 Data maintenance

There is no predescribed maintenance cycle identified for mission specific data.

However, the NGA Foundation-Based Operations Strategic Implementation Plan which provides an assessment of NGA's ability to enable GEOINT by reviewing the key enablers of technology, metrics, corporate communication, governance, processes, standards, and workforce development clearly identifies a need for a data maintenance strategy. Development of a coordinated production strategy for NGA that encompasses a repeatable business process for developing agency data production and maintenance plans (i.e.annual and multi-year plans) is required.

7.9 Portrayal

This sub-clause is a placeholder for a future specification of the portrayal rules for Local MSD data.

7.10 Data product delivery

This document specifies the rules for data delivery of Local MSD using GML 3.2.1 as an encoding and Web Feature Service (WFS) as a service interface.

NOTE 1 In the future, additional delivery formats may be added to this document, e.g. ESRI Shapefile, ESRI Personal Geodatabase, other relational database output, WMS layers based on portrayal rules, etc.

This delivery mechanism targets the on-demand use of up-to-date information from the GKB-F or other online-accessible data repositories in cases where network connection is available.

The NAS GML Application Schema is a GML application schema according to GML 3.2.1 and is further described in Annex C.

The Web Feature Service version that currently supports GML 3.2.1 is WFS 1.1.0 with the candidate corrigendum specified in OGC document 08-042.

Delivery medium information

Units of delivery	Feature (with associated information entities)
Transfer size	*not applicable*
Medium name	Online via Web Feature Service 1.1 The following additional requirements apply: - Web Feature Services that only deliver data shall support the Basic Xlink WFS profile. The use of Xlinks shall be limited to links within the dataset. - Web Feature Services that have to receive updated data shall support the Transactional Xlink WFS profile. The use of Xlinks shall be limited to links within the dataset. - HTTP POST shall be supported for all operations. NOTE: It is expected that support for HTTP SOAP will be a future requirement.

	- All HTTP connections shall use HTTPS. - Every property that has a GML object as its value that is not a feature shall have the object embedded inline. The only exception is when an object occurs multiple times in an XML document when the first occurance shall be embedded inline and the other instances shall be referenced using a bare name Xpointer referencing the gml:id value in the same document (e.g., xlink:href="#fe_132"). Note that this approach has been taken due to limitations in the Web Feature Services which only provides limited support for objects that are not features. - Every property that has a feature as its value shall not embed the feature inline, but used a xlink:href reference. - The DescribeFeatureType operation shall maintain all annotations as currently included in the GML application schema. - The WFS shall announce that it accepts and delivers the Local MSD profile of the NAS using its metadata. The response to the GetCapabilities operation shall include for each feature type a MetadataURL element with the type "19139" and the format "text/xml". The referenced metadata entity shall be encoded in accordance with ISO/TS 19139 where contentInfo property includes a feature catalogue description and the featureCatalogueCitation property with citation with the identifier with the code "http://metadata.dod.mil/mdr/ns/GSIP/~~schema~~dcs/lmd/0.9.0". NOTE: More detailed requirements, e.g. on minimum filter capabilities, may be added at a later time.
Other delivery information	*not applicable*

Delivery format information

Format name	NAS GML Application Schema
Version	2.5 (draft)

Specification	The NAS GML Application Schema is described in Annex C.
File structure	*not applicable*
Language	English
Character Set	utf8

The general rules how the conceptual application schema in UML is mapped to the GML Application Schema is specified in the document “GSIP Schema Processing”.

7.11 Additional information

7.11.1 General remarks

This subclause includes any other aspects of Local MSD data not provided elsewhere in this document.

7.11.2 Security classification of data

The information contained in Local MSD datasets varies in classification depending on the geographic location and collection requirements of the data. The classification for every feature or feature property that is not UNCLASSIFIED is attached as feature level metadata to the respective data element.

7.11.3 Registers/registries

Information that is important to interpret the data is maintained in registers and which may be made online accessible through the DoD Metadata Registry (https://metadata.dod.mil/mdr/) or an OGC Catalogue Service according to the ebXML RIM Application Profile. This includes

- CRS register: The coordinate reference system is referenced from data using a unique identifier. The CRS registry contains a full description of every coordinate reference system that may be used in Local MSD data.

  If coordinate reference systems are used that are contained in the EPSG register then these can be referenced using URNs in the OGC namespace using the guidance in OGC document 07-092r1, Definition identifier URNs in OGC namespace version 1.1.2, http://portal.opengeospatial.org/files/?artifact_id=24045). Similarly, if other organizations like NGA or DGIWG set up such a CRS register, then the coordinate reference systems registered there can be used as well.

- Units register: Units of measurements are referenced from data using a unique identifier. The units registry contains a full description of every unit that may be used in Local MSD data.

The same comment made for coordinate reference systems and registers maintained by third parties applies to units as well.

- NSG Entity Catalog: In some delivery formats, data elements may be encoded using shortnames or codes that are defined in the NSG Entity Catalog. This may be done due to limitations of the delivery format (i.e. character limitations in current GIS software) or to reduce the size of encoded data. In this case, it is required to access the contents of the NSG Entity Catalog to understand the meaning of a particular data item, for example, the meaning of a code of an enumerant in a coded attribute value domain.

- GSIP View registry: Views do not have an impact on the Local MSD application schema or any Local MSD dataset. However, views are useful to provide user friendly access to MSD data. MSD data includes a larger number of feature types and views allow access to groups of feature types based on categories. This involves accessing views from a registry in order to compile WFS queries that select feature based on views.

As this applies to all GSIP-based data content specifications in the same way, more detailed information is provided in the document “GSIP Schema Processing”.

7.12 Metadata

Local MSD implements metadata at the dataset and feature levels. These metadata shall be implemented in conformance with NSG Metadata Implementation Specification (NMIS) – Part 2 – XML Exchange Schema, version 1.0.

All data delivery of Local MSD data (through a WFS or otherwise) shall include the appropriate dataset and feature level *discovery* metadata encoded according to NSG Metadata Implementation Specification (NMIS) – Part 2 – XML Exchange Schema, version 1.0.

Annex A

8 Annex: List and definitions of entity types and properties

The definitions of the Local MSD entity and data types and their properties are documented in the XML documents included with this document. The XML documents are associated with stylesheets that support browsing the documents using a web browser (e.g., Internet Explorer version 6 or later, Firefox version 2). This

The root document is "index.lmsd.definitions.xml". For every type (entity or data type) in the Local MSD profile of the NAS, one document is provided defining the type in detail.

To be added

Annex B

9 Annex: Views

Table of view groups and views to be added

Annex C

10 Annex: NAS GML Application Schema

The NAS GML Application Schema is organised into the following XML Schema documents[1]:

Schema document	Definition/description
NAS.xsd	This application schema defines the conceptual model for identifying and encoding all data in the U.S. National System for Geospatial-Intelligence (NSG). NOTE It specifically addresses selected ISO standards for modeling features and surfaces (coverages), drawing on relevant military standards, specifications and profiles established by the Digital Geospatial Information Working Group (DGIWG). This is the root schema document of the application schema that shall be referenced from any NAS GML document in its schemaLocation attribute. This schema document contains no schema components itself but includes all the other schema documents below.
nasAerodrome.xsd	Aerodrome: Information about an area specifically designed and constructed for landing, accommodating, and launching military or civilian aircraft.
nasAeronauticalAtn.xsd	Aeronautical Aids to Navigation: Denote all of the various electronic components of equipment, housing, and utilities that provide positional information for direction or assisting the navigation of airborne aircraft. NOTE Aids to Navigation are found at airfields and in other locations along the air routes. Aids to Navigation are also called NAVAIDS.
nasAgricultural.xsd	Agricultural: Agriculture includes all activities and man-made features involved in the raising of crops and animals, for food and non-food purposes.
nasBoundaries.xsd	Boundaries: Natural or artificial division between two areas.
nasCultural.xsd	Cultural: Features on the landscape that have been constructed by man. NOTE Excepted are the groups 'Transportation', 'Ports and Harbours', 'Population', and their related features.
nasDatatypes.xsd	Datatypes: Datatypes that are either basic types or that are used by multiple packages.

[1] List to be updated after publication of NAS 2.5.

nasElevation.xsd	Elevation: Elements that show the vertical distance above or below a datum (the height above or below a specific reference point).
nasGeodesyGeophysics.xsd	Geodesy and Geophysics: Pertaining to geophysical properties of the Earth.
nasHydrographicAtn.xsd	Hydrographic Aids to Navigation: Any device external to a vessel intended to be of assistance to a navigator. NOTE Assistance that is provided will aid in the determination of position, charting safe courses, or provide a warning to dangers or obstructions to navigation.
nasInformation.xsd	Information: Abstract and/or non-feature modeling entities. EXAMPLE Metadata and information collections.
nasInlandWater.xsd	Inland Water: Inland hydrography includes those natural (both fresh and saline) or manmade features, of which water is constituent part and which fall within the landside limits of the mean high water shoreline.
nasMaritimeLimits.xsd	Maritime Limits: An area or route defining the extent of a safe passage for vessels or where certain activities or factors of significance to navigation and/or operation apply.
nasMilitaryStructures.xsd	Military Installations and Defensive Structures: Military areas and support facilities and structures used to prevent or resist enemy attacks.
nasOceanEnvironment.xsd	Ocean Environment: Ocean Environment deals with the location and nature of the shorelines of the world's oceans and the characteristics of the area seaward of the shoreline to include manmade or natural features which could be hazards to navigation.
nasPhysiography.xsd	Physiography: The natural features of the Earth's surface as well as their formations. EXAMPLE Snow and ice regions, landforms and exposed surface materials.
nasPopulation.xsd	Population: A concentration of structures and buildings serving as dwellings or zones of occupancy and usually in conjunction with a well defined road or street pattern. NOTE The term applies to developed areas where more than one family or family group lives as a community.
nasPortsHarbours.xsd	Ports and Harbours: Ports are settlements with installations for handling waterborne shipping. Harbours are areas where the anchorage and shore are protected from the sea and storms by natural or man-made barriers. NOTE Areas that do not have this protection but, are still suitable for vessel anchorage are called open anchorages or roadsteads. A good harbor must have deep water, adequate protection from storms, enough space to accommodate large numbers of vessel, and a shoreline that can be developed as a port and as a site for industry. Harbors may be situated on

	the sea, estuaries, or inland lakes and rivers.
nasTransportation.xsd	Transportation: Principal means of overland movement of people and goods from one location to another. EXAMPLE Roads, railroads, bridges and associated features.
nasVegetation.xsd	Vegetation: The vegetation view refers to the various types of plant life or lack thereof indigenous to an area.

The XML Schema documents are provided with this document; they can also be accessed (once the NAS version 2.5.0 is published) at

https://metadata.dod.mil/mdr/ns/GSIP/schema/nas/2.5.0

The NAS GML Application Schema conforms to the following conformance classes of GML 3.2.1:

- "All GML application schemas"
- "GML application schemas converted from an ISO 19109 Application Schema in UML"
- "GML application schemas defining Features and Feature Collections"

The GML profile used by the NAS GML Application Schema is specified in the document “GEOINT Structure Implementation Profile Schema Processing ER”. The GML profile conforms to the following conformance classes of GML 3.2.1:

- "All GML profiles"
- "Geometric primitives (Spatial) – 0-dimensional"
- "Geometric primitives (Spatial) – 0/1-dimensional"

  Both the curve interpolation types linear and arc3Points are used by elements of the profile and have to be supported by implementations.
- "Geometric primitives (Spatial) – 0/1/2-dimensional"
- "Geometric complexes (Spatial) – 0/1-dimensional"
- "Geometric complexes (Spatial) – 0/1/2-dimensional"

Implementations processing Local MSD data encoded in GML shall conform to the following conformance clauses from GML 3.2.1:

- "All software implementations"

- "Support for remote simple Xlinks"
- "Support for nillable properties"
- "Support for units of measurement"
- "Metadata properties"
- "Support for GML profiles in instance validation"
- "Writing GML" (if the implementation is intended to write Local MSD data)
- "Reading GML" (if the implementation is intended to read Local MSD data)

In addition, the GML profile supported by such implementations shall be a superset of the NSG GML profile.