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Executive Summary

Metadata is structured information about data. The purpose of the AIXM metadata analysis is to recommend a metadata model and content for AIXM 5.0. The initial assumptions of the study were:

1. Metadata should focus on traceability, i.e., the source, originator, measurement equipment
2. Datums go into the GML (Geographic Markup Language) CRS (Coordinate Reference System)
3. Accuracies are properties within the feature data
4. Vertical information, such as altitudes and datums, are GML properties

The AIXM metadata analysis referenced the following resources:

1. The Airport Mapping Exchange Schema metadata and UML class diagrams (EUROCONTROL)
2. International Standardization Organization (ISO) 19115 (Geographic information – Metadata) and 19139 (Geographic information – Metadata – XML Schema Implementation)
3. Content Standard for Digital Geospatial Metadata – Metadata Ad Hoc Working Group, Federal Geographic Data Committee, FGDC-STD-001-1998
4. Content Standard for Digital Geospatial Metadata Workbook, Version 2.0 - Federal Geographic Data Committee, May 1, 2000
5. FAA Advisory Circular 150/5300-18 – General Guidance and Specifications for Submission of Aeronautical Surveys to NGS (National Geodetic Survey)
6. The Geospatial Working Group (GWG) Recommended Core Data Dictionary for NGA (National Geospatial-Intelligence Agency) Geospatial Metadata
7. Final Draft Report – February 2006, Hydrographic Information Harmonization Working Group (HIHWG) – recognized by the Digital Geographic Information Working Group (DGIWG) and the International Hydrographic Organization (IHO) (via NGA)
8. AIXM and AIXM 5 Exchange Model goals, requirements and design (DRAFT), AIXM 5 Technical Working Group, February 2006

A profile is a set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards that are necessary for accomplishing a particular function.¹ The metadata profile discussed in this white paper identifies a minimum practical set of desirable elements required to describe information exchanged via AIXM. The International Standardization Organization has defined a comprehensive metadata standard, ISO 19115: 2003 Geographic Information-Metadata. ISO 19115 was developed by Technical Committee ISO/TC 211, Geographic

¹ Final Draft Report – February 2006, Hydrographic Information Harmonization Working Group (HIHWG)

information/Geomatics to define general-purpose metadata in the field of geographic information.² ISO19115 is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets, rather than for recurrent messages such as AIXM messages. Hence, the structure of the AIXM metadata profile is based on ISO19115, but not intended to be a substitution for ISO 19115 nor does it completely conform to ISO19115.

As the goal of AIXM is to exchange all types of aeronautical information internationally in a standardized format, we strongly recommend that the data producer send metadata along with each AIXM message. Our challenge is that an AIXM message will contain information on one or more features including the properties of and relationships between those features. Examples of AIXM features include Runway Direction, Instrument Landing System, and Terminal Procedures. In most instances, the metadata for each of these features will differ. We are recommending a metadata profile for AIXM 5.0 that defines a metadata model for each feature within a message in addition to a metadata model for the entire message. This methodology differs from that discussed in the several papers on metadata standards and mapping efforts that were part of our literature review. Most of those papers described data domains that were more homogeneous in nature and generally had only one data source.

As we encourage the usage of AIXM 5.0 to exchange aeronautical information, we also encourage the data producers to include metadata about their message within the message as well as metadata for each feature timeslice³ within the feature section of the AIXM message. As we begin to implement AIXM 5.0, we understand that some metadata information may not be available. The decision to include metadata within the AIXM message is optional. However, if the data producer elects to send metadata, it must conform to the profile presented in this white paper. The profile includes six models:

1. Metadata for the AIXM message
2. Metadata for an AIXM feature
3. Metadata for an AIXM feature timeslice
4. Constraint information
5. Citation and Responsible Party information
6. Data Quality information

This white paper summarizes the recommended metadata properties for AIXM 5.0, and describes each metadata model via a UML (universal modelling language) class diagram. The data dictionary for each model is presented in Appendices A through F.

² International Standardization Organization 19115, Geographic Information – Metadata, May 2003

³ A timeslice refers to the GML TimeSlice model which "encapsulates the time varying properties of a dynamic feature" [AIXM and AIXM 5 Exchange Model goals, requirements and design (DRAFT), AIXM 5 Technical Working Group, February 2006]. In AIXM, each feature is modeled with timeslice properties that can describe the state of the feature at any point in time. This is an important feature in aeronautical data, especially as applied to Notices to Airmen (NOTAMs).

Metadata can be easily captured and it is highly recommended that it be sent with an AIXM message. To demonstrate, we include in Appendix H, a case study example of metadata for an AIXM message pertaining to a Temporary Flight Restriction. In this example, the AIXM message contains three features - airspace, navigationalAid and organizationService. We present a table of mandatory metadata elements according to the AIXM metadata profile.

Author's Note: This June 2007 revision of the AIXM 5.0 Metadata Profile includes the following suggestions:

- 1) Add a metadata field to capture authentication of electronic signatures.
 - a. Requested by Military Operations personnel at the AIXM 5.0 Users Conference – February 2007.
 - b. Resolved by adding new metadata element - *digitalCertificate: character1* under the **Responsible Party** class.
- 2) Add a metadata field to capture the certification level of the resource of the feature data. For example is the supplier certified under DO200A criteria, or CHAIN compliant or ISO compliant, i.e. ISO9001:2000 certified.
 - a. Requested by the AIXM technical team at the AIXM technical meeting – March 29, 2007.
 - b. Resolved by adding new metadata element – *processCertification: character1* under the **Citation** class.
- 3) Move *dataIntegrity* from Feature Metadata level to the Feature Timeslice level since each timeslice of data within a given feature could have a different data integrity value.
 - a. Requested by the AIXM technical team at the AIXM technical meeting – March 29, 2007.
 - b. Resolved by deleting the *dataIntegrity: decimal* attribute from the **FeatureMetadata** class and adding the *dataIntegrity: decimal* attribute to the **FeatureTimeSliceMetadata** class.
- 4) Update metadata profile to include positional resolution.
 - a. Requested by the AIXM technical team at the AIXM technical meeting – March 29, 2007.
 - b. Resolved by adding new metadata elements – *horizontalResolution: decimal* and *verticalResolution: decimal* as attributes under the **FeatureTimeSliceMetadata** class. The definition of these elements is based on the ICAO Annex 15 definition of resolution: The number of units or digits to which a measured or calculated value is expressed and used.

1.0 Background

The new release of AIXM (AIXM 5.0; first candidate released December 2006) needs a defined metadata profile. Metadata is information about data. Metadata provides information about a particular dataset, such as the origin of the data, the citation for the resources, an abstract, the purposes, credits, the status and points of contact. As the goal of AIXM is to exchange all types of aeronautical information internationally in a standardized format, we strongly recommend that the data producer send metadata along with each AIXM message. Our challenge is that an AIXM message will contain information on one or more features including the properties of and relationships between those features. Examples of AIXM features include Runway Direction, Instrument Landing System, and Terminal Procedures. In most instances, the metadata for each of these features will differ. We are recommending a metadata profile for AIXM 5.0 that defines a metadata model for each feature within the message in addition to a metadata model for the entire message. This methodology differs from that discussed in the several papers on metadata standards and mapping efforts that were part of our literature review. Most of those papers described data domains that were more homogeneous in nature and generally had only one data source.

A profile is a set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards that are necessary for accomplishing a particular function.⁴ The metadata profile discussed in this white paper identifies a minimum practical set of desirable elements required to describe information exchanged via AIXM. The AIXM metadata profile is intended to provide source information about the responsible parties of the AIXM message and individual feature timeslices, overview (abstract) and traceability information. It also provides information about the restrictions on the access and use of the AIXM message, and data on the quality of certain attributes within feature timeslices.⁵

The International Standardization Organization (ISO) has defined a comprehensive metadata standard, ISO 19115: 2003 Geographic Information-Metadadata. ISO 19115 was developed by Technical Committee ISO/TC 211, Geographic information/Geomatics, to define general-purpose metadata in the field of geographic information.⁶ ISO19115 is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets. The essential purpose of a catalogue service is to enable a user to locate, access, and make use of resources in an open, distributed system by providing facilities for retrieving, storing, and managing many kinds of resource descriptions.⁷ The purpose of AIXM is to exchange recurrent messages and move the state of information updates from less static to more dynamic. Hence, the structure of the AIXM metadata profile is based on ISO19115, but not intended to be a substitution for ISO 19115 nor does it completely conform to ISO19115.

⁴ Final Draft Report – February 2006, Hydrographic Information Harmonization Working Group (HIHWG)

⁵ For definition of timeslice, see footnote 3.

⁶ International Standardization Organization 19115, Geographic Information – Metadata, May 2003

⁷ OpenGIS® Catalogue Services — ebRIM (ISO/TS 15000-3) profile of CSW, Copyright © 2006. Open Geospatial Consortium, Inc. (The ebXML registry information model (ebRIM))

As we encourage the usage of AIXM 5.0 to exchange aeronautical information, we also encourage the data producers to include metadata about their message within the message as well as metadata for each feature timeslice within the feature section of the AIXM message. As we begin to implement AIXM 5.0, we understand that some metadata information may not be available. The decision to include metadata within the AIXM message is optional. However, if the data producer elects to send metadata, it must conform to the profile presented in this white paper. The profile includes six models that will be discussed in separate sections as follows:

1. Metadata for the AIXM message
2. Metadata for an AIXM feature
3. Metadata for an AIXM feature timeslice
4. Constraint information
5. Citation and Responsible Party information
6. Data Quality information

This white paper summarizes the recommended metadata properties for AIXM 5.0, and describes each metadata model via a UML (universal modelling language) class diagram. The data dictionary for each model is presented in Appendices A through F.

Metadata can be easily captured and it is highly recommended to send with an AIXM message. To demonstrate, refer to the case study example of metadata for an AIXM message pertaining to a Temporary Flight Restriction included in Appendix H. In this example, the AIXM message contains three features - airspace, navigationalAid and organizationService. We present a table of mandatory metadata elements according to the AIXM metadata profile.

2.0 Literature Review

Our approach to defining a metadata profile included:

- Conducting an extensive review of the proposed features in AIXM 5.0 and of the available literature on metadata
- Holding meetings and interviews with metadata subject matter experts
- Developing UML (universal modelling language) class diagrams of proposed models of the metadata profile

We have taken steps to ensure that our profile is compliant with the ISO metadata standards when applicable. Our models will consider and potentially incorporate any core geospatial metadata and metadata properties for aeronautical data recommended by reputable sources such as NGA (National Geospatial-Intelligence Agency).

There is a harmonization effort evolving between AICM (Aeronautical Information Conceptual Model), AMDB (Aerodrome Mapping Database) Standardization, and AirMAT (Air Modelling Advisory Team). The current AMDB deliverables are based on an Aerodrome Mapping Exchange Model (AMXM) and a derived Aerodrome Mapping Exchange XML Schema (AMXM), both developed by EUROCONTROL.⁸ The AirMAT data standard is part of the Federal Geographic Data Committee (FGDC) Framework Data Standard and was used to drive the structure of the database repository for the FAA Airport Surveying-GIS Program.⁹ Due to these efforts, we have extended our profile to include certain metadata elements that are critical to AMDB and/or AirMAT.

Table 1 below summarizes some of the documentation reviewed in our analysis:

Table 1 – Resource Documents

Title	Source
ISO 19115 – <i>Geographic Information – Metadata</i>	International Standards Organization
ISO 19139 – <i>Geographic Information – Metadata – XML Schema Implementation</i>	International Standards Organization
Airport Mapping Exchange Schema Version 1.1 Primer	EUROCONTROL
Airport Mapping Database Metadata Class Diagrams	http://www.eurocontrol.int/ais/amdb/html
AIXM-GML Metadata Handling	Galdos Systems
Annex 15 – Aeronautical Information Services – Amendment 33	ICAO – International Civil Aviation Organization

⁸ <http://www.eurocontrol.int/ais/amdb/index.htm>

⁹ <http://airports-gis.faa.gov/airport/home.htm>

Final Draft Report – February 2006	Hydrographic Information Harmonization Working Group (HIHWG) – recognized by the Digital Geographic Information Working Group (DGIWG) and the International Hydrographic Organization (IHO)
GWG MFG Recommended Core Data Dictionary for NSG Geospatial Metadata	Geospatial Working Group – Metadata Focus Group (via NGA)
Specification of MGCP Metadata TRD1 v1.0	Multinational Geospatial Co-production Program (via NGA)
FAA Advisory Circular 150/5300-18 – General Guidance and Specifications for Submission of Aeronautical Surveys to NGS (National Geodetic Survey)	Federal Aviation Administration, Office of Airports Safety and Standards
Content Standard for Digital Geospatial Metadata – FGDC-STD-001-1998	Metadata Ad Hoc Working Group, Federal Geographic Data Committee
Content Standard for Digital Geospatial Metadata Workbook, Version 2.0	Federal Geographic Data Committee, May 1, 2000
AICM and AIXM 5 Exchange Model goals, requirements and design (DRAFT)	AIXM 5 Technical Working Group, February 2006

2.1 Compliance with ISO19115

The International Standardization Organization (ISO) has defined a comprehensive metadata standard, ISO 19115: 2003 Geographic Information-Metadata. ISO 19115 defines over 400 metadata elements, which include a group of core metadata elements required to identify a dataset, typically for catalogue purposes. This list contains metadata elements answering the following questions: “Does a dataset on a specific topic exist (‘what’)?”, “For a specific location (‘where’)?”, “For a specific date or period (‘when’)?” and “A point of contact to learn more about or order the dataset (‘who’)?”

ISO 19115 was developed by the geospatial community for describing metadata applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets, rather than for recurrent messages such as AIXM messages. Hence, the structure of the AIXM metadata profile is based on ISO19115, but does not completely conform to ISO19115. The only element that is designated as mandatory core metadata for geographic datasets per ISO19115, but not included as mandatory in the AIXM metadata profile, is *topic category*. For AIXM messages, the topic category will always primarily be aeronautical information which falls under the transportation category listed in Annex B.5.27 (MD_TopicCategoryCode) of ISO19115. It

would be redundant to state the topic category with every AIXM message exchange; hence, it is omitted from AIXM metadata.

In addition to the core elements, additional information is required to describe aeronautical information exchange data, and it has therefore been necessary to include extended metadata elements in the AIXM metadata profile. In Appendix G, we include a data dictionary describing the rationale for adding new metadata elements or entities that are not included in ISO19115.

A metadata entity in ISO19115 is defined as a set of metadata elements describing the same aspect of data. This is equivalent to a class in UML terminology.¹⁰ As will be described in Section 4, on the metadata model UML class diagrams, the classes named using prefix MD (Metadata) or CI (Citation) or DQ (Data Quality) indicate inclusion of, or association with (subset of), ISO19115 classes. For example, CI_Citation is a metadata entity defined in ISO19115 with 13 metadata elements. In the AIXM metadata profile, we recommend only two of those 13 metadata elements or attributes for the Citation class. Hence, the UML class diagram will show an association between class Citation and ISO19115 entity CI_Citation. To maintain consistency with the naming convention used in feature classes throughout the Aeronautical Information Conceptual Model (AICM), the AIXM metadata profile does not name any of the extended metadata elements and entities with two letter prefixes.

2.2 Comparison to Content Standard for Digital Geospatial Metadata

The Federal Geographic Data Committee (FGDC) endorsed Content Standard for Digital Geospatial Metadata - FGDC-STD-001-1998 (version 2.0) in June 1998 prior to the release of ISO19115. As of the latest update published October 2005, FGDC is currently conducting a study on the US implementation of the ISO metadata standard.¹¹ They express the need to add international elements such as the *language* of the dataset and metadata, and to add the elements *vertical extent* and *topic category* (similar to FGDC mandatory *Keyword* element). The study will also determine how to change the condition on several mandatory elements. The current FGDC standard designates 42 mandatory elements versus the seven (7) mandatory core data elements in ISO19115. Given that the FGDC is reviewing their metadata model and given that the FGDC model intends to become ISO19115 conformant, we did not consider the structure of the FGDC standard for the current version of the AIXM metadata profile.

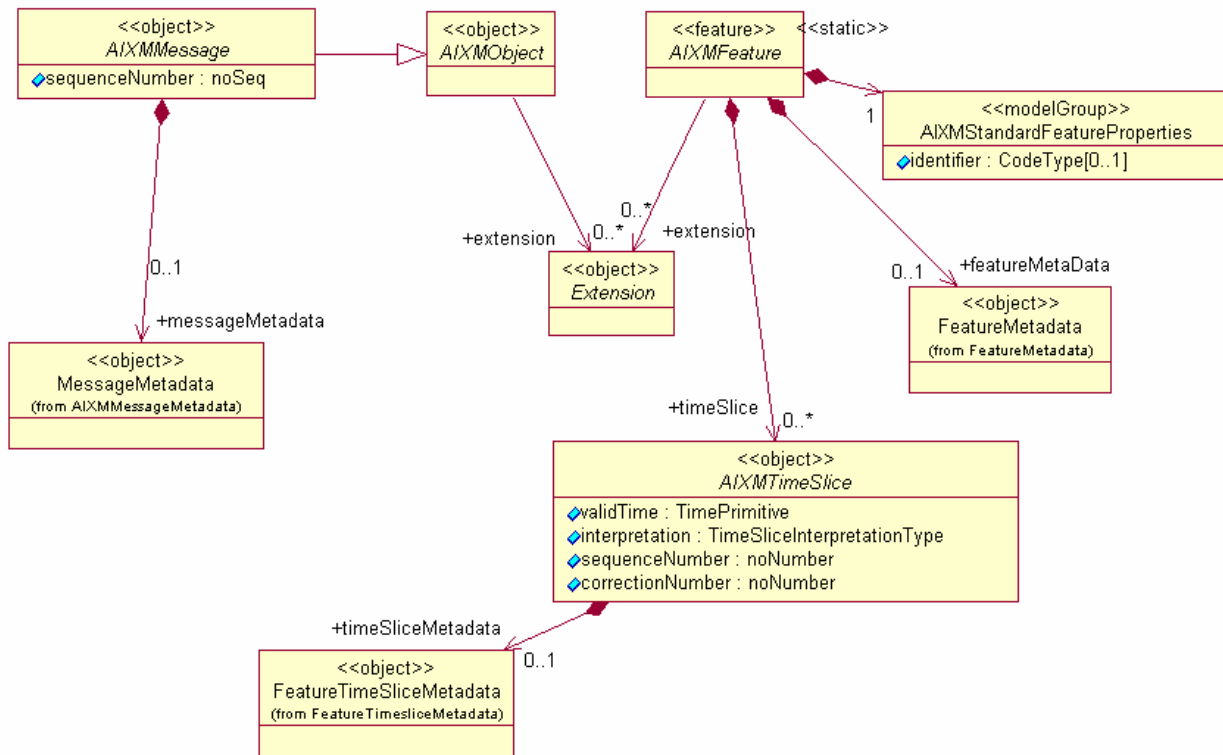
¹⁰ International Standardization Organization 19115, Geographic Information – Metadata, May 2003

¹¹ <http://www.fgdc.gov/metadata/geospatial-metadata-standards>

3.0 AIXM Metadata Profile Overview

Figure 1 below is a UML class diagram of the AbstractAIXM package which provides the building blocks for creating AIXM Features incorporating temporality, extensibility and feature relationships.¹² We include notes to indicate where metadata should be included within the AIXM package. We recommend a profile for metadata about the message, metadata about each feature within the message, and metadata about each timeslice within a feature.

Figure 1 – AbstractAIXM Package



¹² AICM and AIXM 5 Exchange Model goals, requirements and design (DRAFT), AIXM 5 Technical Working Group, February 2006 [www.aixm.aero]

3.1 Mandatory Metadata

At this juncture, it is not a mandatory requirement to include metadata within an AIXM message. However, if the sender or data producer decides to include metadata, it must conform to the AIXM metadata profile. Within the profile, there are only a few elements that are designated as mandatory. Table 2 lists the mandatory data elements. In fact, most of the elements included in the AIXM metadata profile may be autogenerated. For example, *abstract* could be generated from the data. An *abstract* for a message that includes *airSpace*, *navigationalAid* and *organizationService* features, should extract the feature titles from within the message and list them in the *abstract*.¹³

Table 2 includes the name of the mandatory element and its description, as well as how it maps to the ISO19115 standard. For core geographic datasets per ISO19115, (M) indicates that the element is mandatory and (C) indicates that the element is conditionally mandatory. For reference, in the third column of the table, we include the short name of the element and the row number corresponding to Annex B.2 (Metadata package data dictionaries) of ISO19115. For example, *dateStamp* from the *MessageMetadata* class is the date on which the metadata for the AIXM message was compiled. The *dateStamp* element is mandatory for geographic datasets per ISO19115, referred to as *mdDateSt*, and can be found in row 9 of Annex B.2 in ISO19115. For those elements that are not in ISO19115, we state the justification for a data element extension.¹⁴

Table 2 – Mandatory AIXM Metadata Elements

Mandatory AIXM Metadata Element	Description	Mapping to ISO19115
MessageMetadata > dateStamp	Date on which the metadata for the AIXM message was compiled.	ISO 19115 (M) mdDateSt (9)
FeatureTimeSliceMetadata > dateStamp	Date on which the metadata for the feature timeslice was compiled.	ISO 19115 (M) mdDateSt (9)
MessageMetadata > Contact > individualName	Name of the responsible party, given name, title separated by a delimiter. If organization or system name not available, must	ISO 19115 (C) rpIndName (375)

¹³ An example included in Appendix H.

¹⁴ Refer to Appendix G.

FeatureTimeSliceMetadata > Contact > individualName	include individual name.	
MessageMetadata > Contact > systemName	Name of the responsible system (i.e, database, or repository that transmitted or compiled info). If organization or individual name not available, must include system name.	ISO19115 data element extension - Needed a new element within the responsible party class to describe the responsible system.
FeatureTimeSliceMetadata > Contact > systemName		
MessageMetadata > Contact > organizationName	Name of the responsible organization. If individual or system name not available, must include organization name.	ISO19115 (C) rpOrgName (376)
FeatureTimeSliceMetadata > Contact > organizationName		
MessageMetadata > Contact > positionName	Role or position title of the responsible party. Only list one position using the following prioritization if more than one of individual, system and organization are provided: 1. individual name, 2. system name 3. organization name.	ISO19115 (M) rpPosName (377)
FeatureTimeSliceMetadata > Contact > positionName		
MessageMetadata > Contact > role	Function performed by the responsible party. Only list one role code using the following prioritization if more than one of individual,	ISO19115 (M) role (379)

FeatureTimeSliceMetadata > Contact > role	system and organization are provided: 1. individual name, 2. system name 3. organization name.	
MessageMetadata > messageIdentificationInfo > abstract	Brief narrative summary on the contents of the AIXM message. Contents can include multiple features and operating instructions on how to use the feature data.	ISO19115 (M) idAbs(25)
MessageMetadata > messageIdentificationInfo > language	The language used within the AIXM message. Follows ISO639-2. Best practice recommends the language to be English.	ISO19115 (M) dataLang (39). In ISO19115, language has multiplicity. We restrict domain to 1 language in AIXM model.
FeatureTimeSliceMetadata > featureIdentificationInfo > abstract	Brief narrative summary on the contents of the feature timeslice data. Contents can include operating instructions on how to use the timeslice data.	ISO19115 (M) idAbs(25)
FeatureTimeSliceMetadata > featureIdentificationInfo > citation > title	Name by which the resource of the feature timeslice data is known.	ISO19115 (M) resTitle (360)
FeatureTimeSliceMetadata > featureIdentificationInfo > citation > date	Reference date for the resource of the feature timeslice data.	ISO19115 (M) resRefDate (362)
FeatureTimeSliceMetadata > featureIdentificationInfo > citation > dateType	Event used for the reference date.	ISO19115 (M) refDateType (395)

3.2 Example of Mandatory Metadata Schema

AIXM metadata should be included within the AIXM message and not sent as a separate file. Placement of the metadata should be at the beginning of the information being exchanged. For example, metadata about the message should appear just before the message information. The message may contain several features: the metadata about each feature should appear prior to the start of the respective feature information. The feature information may be a series of timeslices. If so, the metadata about each timeslice should appear before the start of the respective timeslice information. Figure 2 gives an example of the structure of an AIXM message including only the mandatory metadata elements proposed in this AIXM metadata profile. The AIXM message example selected is the encoding of an obstacle with point-type geometry.¹⁵ The encoding contains the definition of a single timeslice of type “baseline”, valid from 01 Jan 1985. The metadata is highlighted in bold.

Figure 2 – Mandatory Metadata Elements within AIXM Message Structure

(Beginning of AIXM message)

```
<MessageMetadata>
  <dateStamp>2006-05-15T17:00:00Z</dateStamp>
  <contact>
    <individualName>Christian Grothe</individualName>
    <positionName>Research Assistant at FSR/TUD, responsible for compiling sets of
aeronautical data to AIXM messages</positionName>
    <role>distributor</role>
  </contact>
  <messageIdentificationInfo>
    <abstract>This AIXM message only contains an obstacle timeslice of type “baseline”,
valid from 01 Jan 1985</abstract>
    <language>en</language>
  </messageIdentificationInfo>
</MessageMetadata>

<?xml version="1.0" encoding="UTF-8"?>

<FeatureMetadata>
  (no mandatory elements in this portion of the profile)
</FeatureMetadata>

<Obstacle xmlns="http://www.aixm.aero" xmlns:gml="http://www.opengis.net/gml"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
```

¹⁵ Visit www.aixm.aero for more information on the AIXM Obstacle model. Example from section 4.2.1 – “Antenna” type obstacle of the AIXM 5 Obstacle Model Proposal.

```

xsi:schemaLocation="http://www.aixm.aero AIXM-GML-ObjectTypes.xsd"
gml:id="ID000000">
  <identifier codeSpace="http://www.aixm.aero/Amswell">EA001</identifier>
  <gml:validTime>
    <gml:TimePeriod>
      <gml:beginPosition>1985-01-01T00:00:00</gml:beginPosition>
      <gml:endPosition indeterminatePosition="unknown"/>
    </gml:TimePeriod>
  </gml:validTime>
  <timeSlice>
  <FeatureTimeSliceMetadata>
    <dateStamp>2006-05-12T12:00:00Z</dateStamp>
    <contact>
      <organizationName>Institute of Flight Systems and Automatic Control
      (FSR)</organizationName>
      <positionName>Institute at Technische Universität Darmstadt
      (TUD)surveying and supplying aeronautical data</positionName>
      <role>originator</role>
    </contact>
    <featureIdentificationInfo>
      <abstract> Baseline timeslice for obstacle with point-type geometry –
      the Donlon antenna</abstract>
      <citation>
        <title>xNOTAM study</title>
        <date>2006-05-10T17:00:00Z</date>
        <dateType>revision</dateType>
      </citation>
    </featureIdentificationInfo>
  </FeatureTimeSliceMetadata>

  <ObstacleTimeSlice gml:id="ID000002">
    <gml:validTime>
      <gml:TimePeriod>
        <gml:beginPosition>1985-01-01T00:00:00</gml:beginPosition>
        <gml:endPosition indeterminatePosition="unknown"/>
      </gml:TimePeriod>
    </gml:validTime>
    <interpretation>BASELINE</interpretation>
    <name>Donlon</name>
    <type>antenna</type>
    <markingPattern>painted - vertical bands</markingPattern>
    <markingFirstColour>RED</markingFirstColour>
    <markingSecondColour>WHI</markingSecondColour>
    <constructionStatus>COMPLETED</constructionStatus>
    <groupOfObstacles>N</groupOfObstacles>
  </ObstacleTimeSlice>

```

```

<remark>A fictitious obstacle</remark>
<madeOf>
  <ObstaclePart gml:id="ID000004">
    <verticalExtent uom="FT">104</verticalExtent>
    <elevationAccuracy uom="FT">5</elevationAccuracy>
    <hasPointShape>
      <ElevatedPoint srsDimension="2"
        srsName="WGS84" gml:id="ID000005">
        <gml:pos>52.352718 -
          31.852205</gml:pos>
        <horizontalAccuracy
          uom="FT">10</horizontalAccuracy>
        <elevation uom="FT">255</elevation>
        <geoidUndulation uom="FT">-
          25</geoidUndulation>
        <verticalDatum>EGM-96</verticalDatum>
        <verticalAccuracy
          uom="FT">5</verticalAccuracy>
      </ElevatedPoint>
    </hasPointShape>
  </ObstaclePart>
</madeOf>
<isEffective>
  <TimeTable gml:id="ID000006">
    <workingHoursCode>H24</workingHoursCode>
  </TimeTable>
</isEffective>
</ObstacleTimeSlice>
</timeSlice>
</Obstacle>

```

(end AIXM message)

The only element that is designated as mandatory core metadata for geographic datasets per ISO19115, but not included as mandatory in the AIXM metadata profile, is *topic category*. For AIXM messages, the topic category will always primarily be aeronautical information which falls under the transportation category listed in Annex B.5.27 (MD_TopicCategoryCode) of ISO19115. It would be redundant to state the topic category with every AIXM message exchange; hence, it is omitted from AIXM metadata.

4.0 AIXM Metadata Profile Models

The profile includes six models that will be discussed in separate sub-sections as follows:

- 4.1 Metadata for the AIXM message
- 4.2 Constraint information
- 4.3 Metadata for an AIXM feature
- 4.4 Metadata for an AIXM feature timeslice
- 4.5 Citation and Responsible Party information
- 4.6 Data Quality information

Each sub-section describes the metadata model via a UML (universal modelling language) class diagram, and includes the appendix reference for the corresponding data dictionary.¹⁶

4.1 Metadata to include about the AIXM message

Figure 3 below is the UML class diagram for the metadata to include at the beginning of an AIXM message. The MessageMetadata class outlines the elements to include regarding the actual metadata. It is associated with the class MD_Metadata from ISO19115. It includes two new metadata elements not defined in ISO19115 - *cyclicRedundancyCheckMessage* and *noteCRCMessage*.

cyclicRedundancyCheckMessage is the value or string of alphanumeric characters usually generated by a cyclic redundancy check (CRC) algorithm. Best practice recommends that the algorithm consider all tags and data content within the AIXM message. When the data receiver applies a CRC algorithm to the message, a different CRC indicates that a tag or data content within the message has been changed since the sender generated the original CRC.

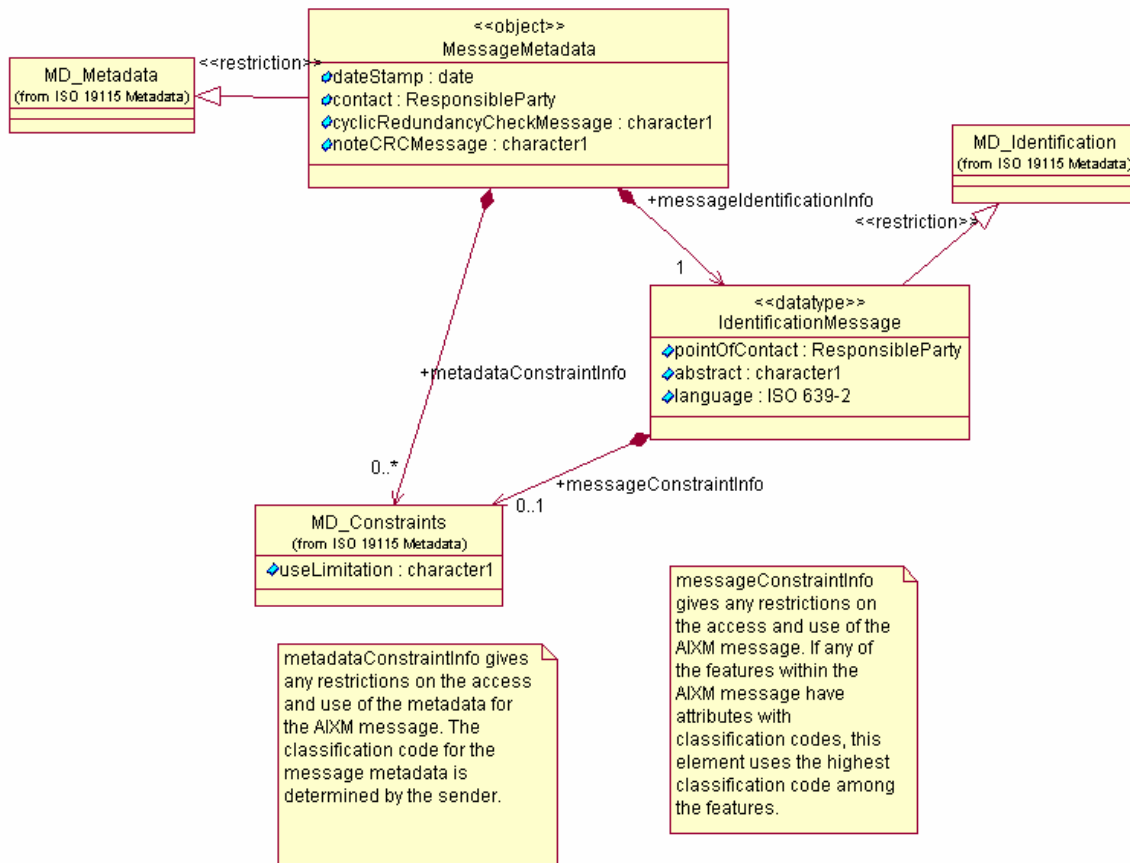
noteCRCMessage is included to provide the ability to relay information to the data receiver if necessary about the CRC calculation. For example, using this data element, the sender can document the tags and data content considered in the cyclic redundancy check. In section 4.7, we describe more detailed information on the cyclic redundancy check algorithm.

The IdentificationMessage class outlines the elements to include as it pertains to the data in the AIXM message, and it is associated with the MD_Identification class from ISO19115. The relationships between these associated classes are labelled restriction since the AIXM classes are a subset of and/or include varied attributes from the ISO19115 parent classes. Both IdentificationMessage and MessageMetadata are related to MD_Constraints from ISO19115 via the roles messageConstraintInfo and metadataConstraintInfo, respectively. In subsequent sections, we will explain how AIXM uses MD_Constraints and a modification of the ISO19115

¹⁶ In the UML diagrams, many of the elements are defined as character1. character1 is a string of letters and/or numbers constained by ([A-Z][0-9])+([\+\/-]*([A-Z][0-9])+)*

CI_ResponsibleParty class. The data dictionary for the MessageMetadata class is located in Appendix A.

Figure 3 – Metadata to include about the AIXM message



4.2 Constraint Information

The UML class diagram for constraint information is displayed in Figure 4. The role *messageConstraintInfo* describes any restrictions on the access and use of the AIXM message. If any of the features within the message have attributes with classification codes such as restricted, confidential, top secret, etc. (as listed in the class-codelist *ClassificationCode*), the classification code for the feature captures the highest classification code among the attributes. In turn, *messageConstraintInfo* captures the highest classification code among the features. Hence, the class diagrams for AIXM feature data have been updated to include the classification code attribute.

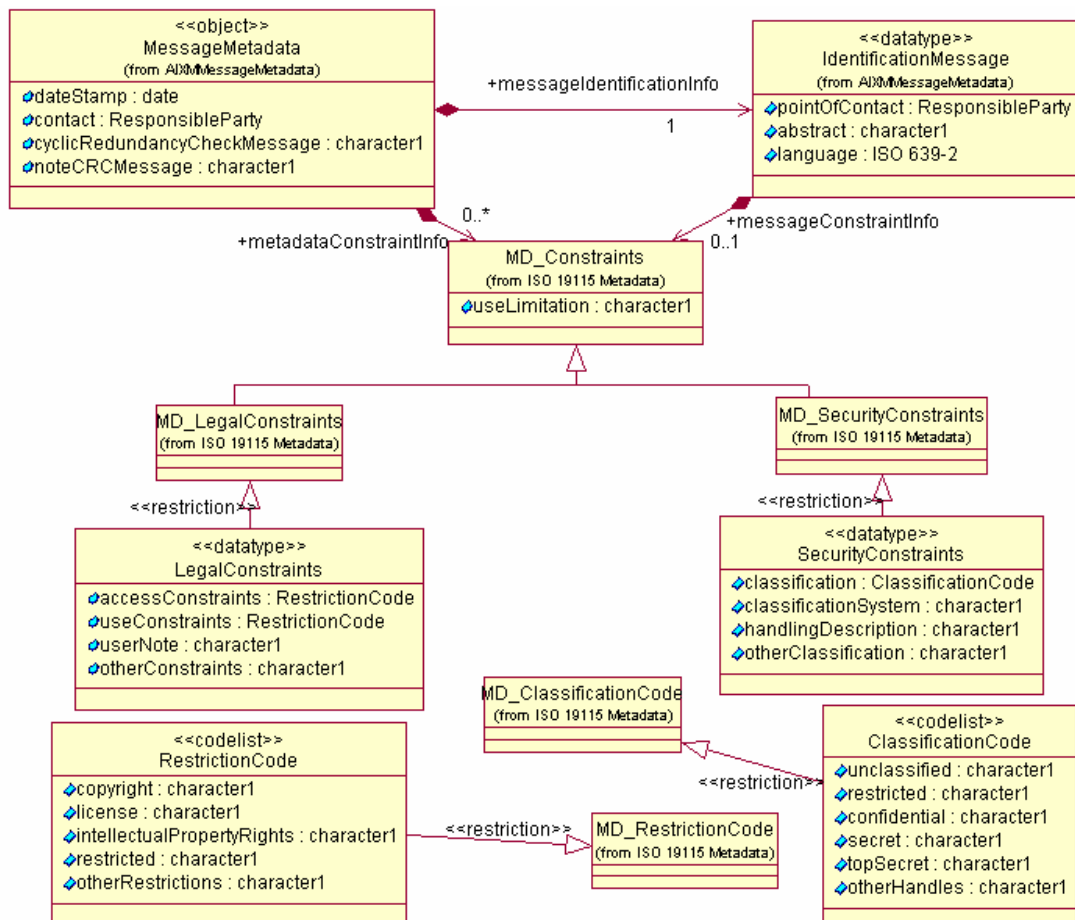
The role *metadataConstraintInfo* describes any restrictions on the access and use of the metadata for the AIXM message. The classification code for this role is determined by the sender or data producer. Both *messageConstraintInfo* and *metadataConstraintInfo* are similar to the role *metadataConstraints* relating MD_Metadata to MD_Constraints in ISO19115. Since, the AIXM metadata profile defines two constraint roles from two different parent entities, we include these new role names to distinguish between the two.

Classes *LegalConstraints* and *SecurityConstraints* fall under the constraints grouping of metadata. These classes are variations of the ISO19115 MD_LegalConstraints and MD_SecurityConstraints classes, respectively, which are associated with MD_Constraints. Within the *LegalConstraints* class, *accessConstraints* and *useConstraints* are defined by the *RestrictionCode* codelist. *RestrictionCode* is a subset of ISO19115 MD_RestrictionCode since we elected to use only some of the codes referenced in Annex B.5.24 of ISO19115.

Within the *SecurityConstraints* class, classification is defined by the *ClassificationCode* codelist. *ClassificationCode* is an extension of ISO19115 MD_ClassificationCode (reference Annex B.5.11 of ISO19115) since we added a new classification, *otherHandles*, to the code list. If classification equals *otherHandles*, then AIXM metadata must include the *otherClassification* element within *SecurityConstraints*. *otherClassification* describes the name of the other handling restriction on the AIXM message or metadata for the AIXM message not explicitly listed under *ClassificationCode* codelist.

The data dictionary for the Constraint Information is located in Appendix F.

Figure 4 – Constraint Information Metadata



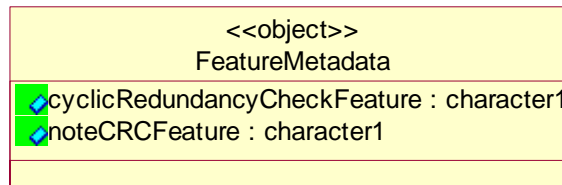
4.3 Metadata Included with a Feature

Figure 5 is the UML class diagram for the metadata to include at the beginning of an AIXM feature. The FeatureMetadata class includes two elements about the data within an AIXM feature.

cyclicRedundancyCheckFeature is also a new metadata element since this attribute is not defined in ISO19115. *cyclicRedundancyCheckFeature* is the value or string of alphanumeric characters usually generated by a cyclic redundancy check (CRC) algorithm. Best practice recommends that the algorithm consider all tags and data elements within the feature data. When the data receiver applies the CRC algorithm to the feature data, a different CRC indicates that a tag or data element within the feature data has been changed since the sender generated the original CRC. *noteCRCFeature* is another attribute that is not defined in ISO19115. We include this new metadata element to provide the ability to relay information to the data receiver if necessary about the CRC calculation. For example, using this data element, the sender can document the tags and data elements considered in the cyclic redundancy check. In section 4.7, we describe more detail on the cyclic redundancy check algorithm.

The data dictionary for the FeatureMetadata class is located in Appendix B.

Figure 5 – Metadata to include about an AIXM feature



4.4 Metadata Included with a Feature Timeslice

Figure 6 is the UML class diagram for the metadata to include at the beginning of each AIXM feature timeslice. The FeatureTimeSliceMetadata class includes the elements to reference the party responsible for the metadata information about the feature timeslice, and the date on which the metadata for the feature timeslice was compiled. FeatureTimeSliceMetadata class also contains five new metadata elements not defined in ISO19115 – *measureClass*, *measEquipClass*, *dataIntegrity*, *horizontalResolution* and *verticalResolution*.

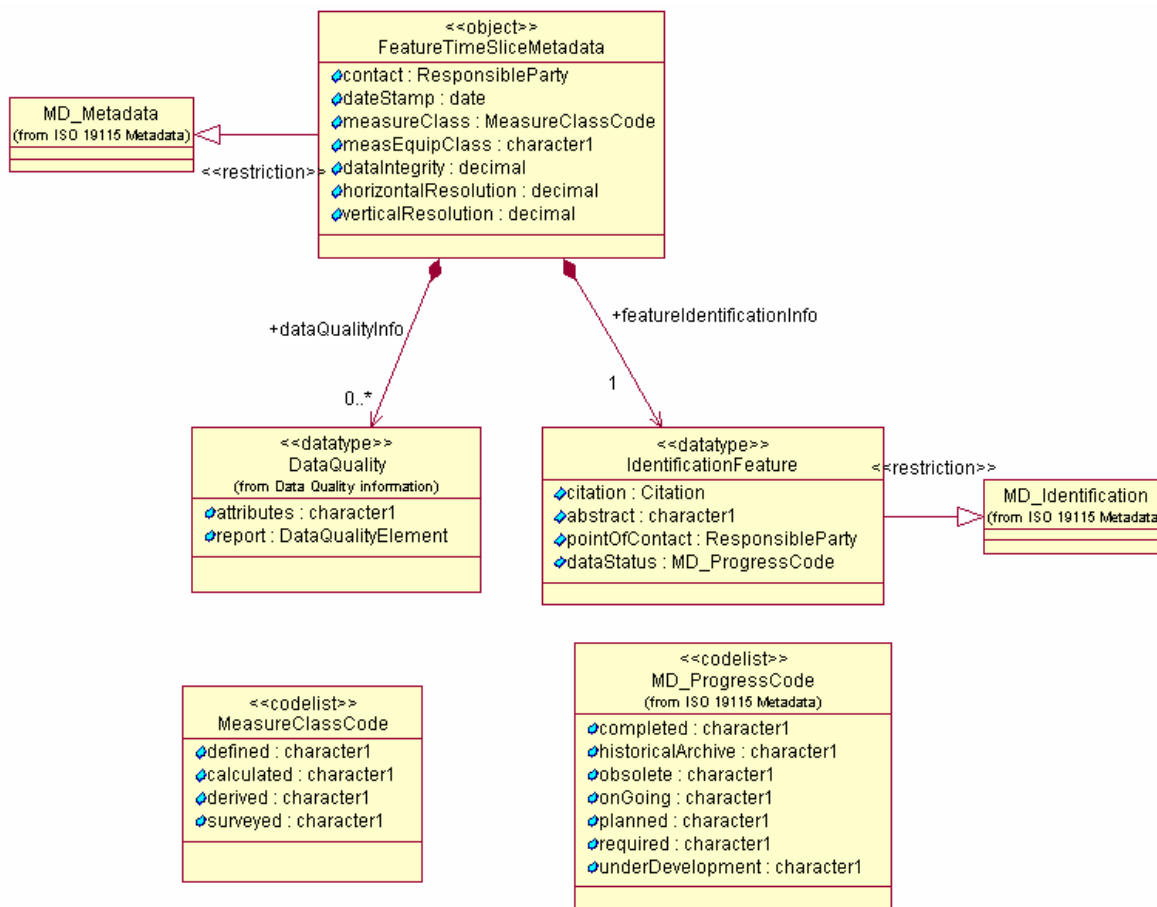
measureClass gives information about how many measurements within the feature timeslice data were captured, and *measEquipClass* is where the sender can describe the equipment used to capture any measurements within the feature timeslice. *measureClass* contains the string from class-codelist MeasureClassCode. *dataIntegrity* is a degree of assurance that an aeronautical data element and its value has not been lost or altered since the data origination or authorized amendment.¹⁷ For example, the *dataIntegrity* value for an error rate of 5 errors in 10000 is equal to $1 - (5/10000) = 0.9995$. *horizontalResolution* and *verticalResolution* refers to the coordinates. Using the ICAO Annex 15 definition of resolution: The number of units or digits to which a measured or calculated value is expressed and used. For example, *horizontalResolution* equal to .001 implies that the horizontal component of a given coordinate value can be expressed to the 1/1000 decimal place. And similarly for *verticalResolution*.

FeatureTimeSliceMetadata is associated with the class MD_Metadata from ISO19115. The IdentificationFeature class pertains to the data in the AIXM timeslice and is associated with the MD_Identification class from ISO19115. The relationships between these associated classes are labelled restriction since the AIXM classes are a subset of and/or include varied attributes from the ISO19115 parent classes. Due to AirMAT-AICM metadata harmonization, we include data element *dataStatus* under IdentificationFeature to give the status of the source of the feature timeslice data. This element is similar to ISO19115 *status* which maps to the codelist MD_ProgressCode referenced in Annex B.5.23 of ISO19115.

FeatureTimeSliceMetadata is related to a modification of DQ_DataQuality from ISO19115. In subsequent sections, we will explain how AIXM uses DataQuality and a modification of the ISO19115 CI_ResponsibleParty class. The data dictionary for the FeatureTimeSliceMetadata class is located in Appendix C.

¹⁷ Annex 15 – Aeronautical Information Services – Amendment 33, International Civil Aviation Organization, July 2004, pg. 3-2 (chapter 3, second page)

Figure 6 – Metadata to include about an AIXM feature timeslice



4.5 Citation and Responsible Party Information

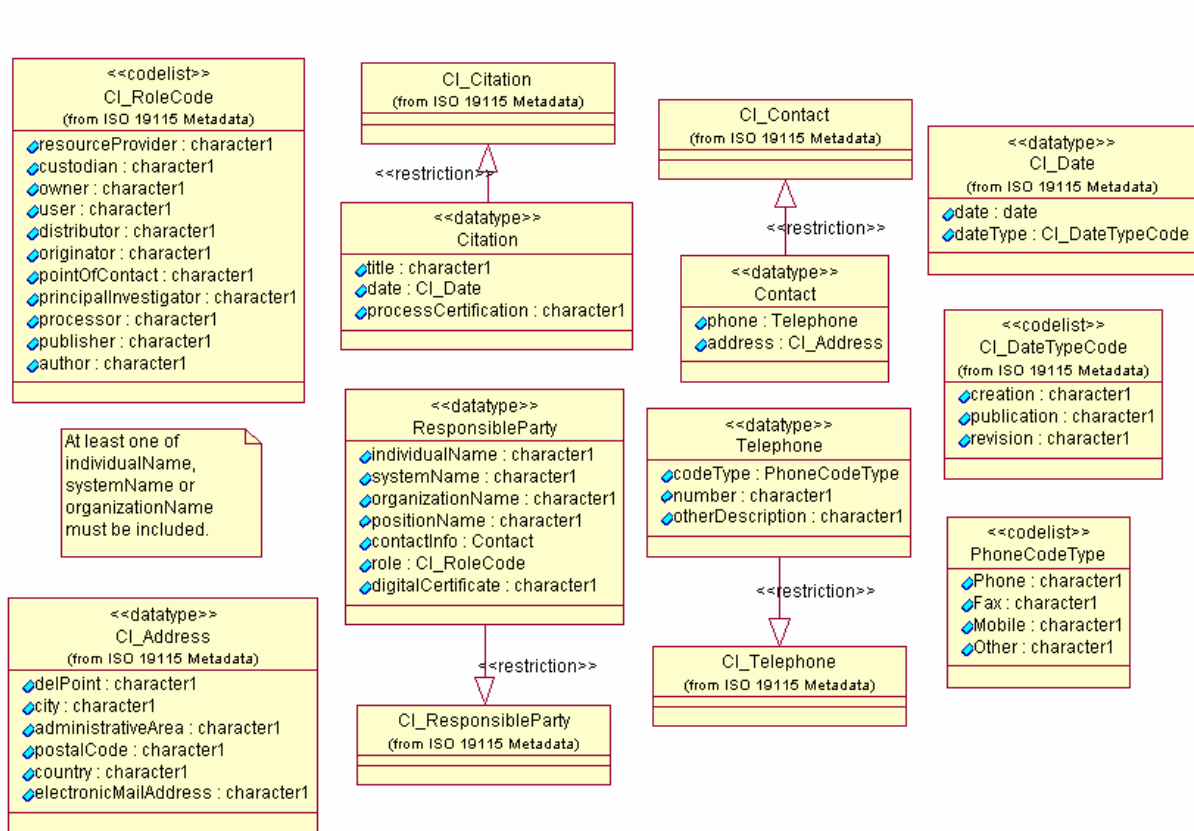
The UML class diagram for citation and responsible party information is displayed in Figure 7. The class ResponsibleParty is essentially the same as the CI_ResponsibleParty class from ISO19115 except we add two new data elements: *systemName* as a place to describe the responsible system, i.e., database or repository that transmitted or compiled AIXM information; and *digitalCertificate*, a field to capture an electronic signature authentication information. Also, the ISO19115 class maps data element *contactInfo* to the class CI_Contact, whereas the AIXM version of the responsible party class maps data element *contactInfo* to the class Contact. The Contact class contains less information than the ISO19115 CI_Contact class. Within the Contact class, data element *address* is the same as in ISO19115 which maps to the CI_Address class. However, data element *phone* maps to the class Telephone, whereas the ISO19115 *phone* points to CI_Telephone. Hence, the UML class diagram reflects the restricted associations between Contact and CI_Contact, and Telephone and CI_Telephone.

Within the Telephone class, we define new metadata elements *codeType*, *number* and *otherDescription*. *codeType* returns the string from a new class-codelist PhoneCodeType which lists the types of contact phone numbers for the responsible party. *number* captures the phone number corresponding to the PhoneCodeType. If PhoneCodeType **Other** is selected, the metadata must include a description of a telephone number other than phone, fax or mobile under *otherDescription*.

The Citation class is associated with CI_Citation from ISO19115 because it is a subset of the CI_Citation class. Citation only includes three data elements *title*, *date*, and a new data element *processCertification*. *date* points to the CI_Date class as defined in ISO19115. *processCertification* should be used to indicate the certification level of the resource of the feature data. For example is the supplier certified under DO200A criteria, CHAIN compliant or ISO compliant, i.e. ISO9001:2000 quality management system certified.

The data dictionary for the Citation and Responsible Party Information is located in Appendix D.

Figure 7 – Citation and Responsible Party Information Metadata



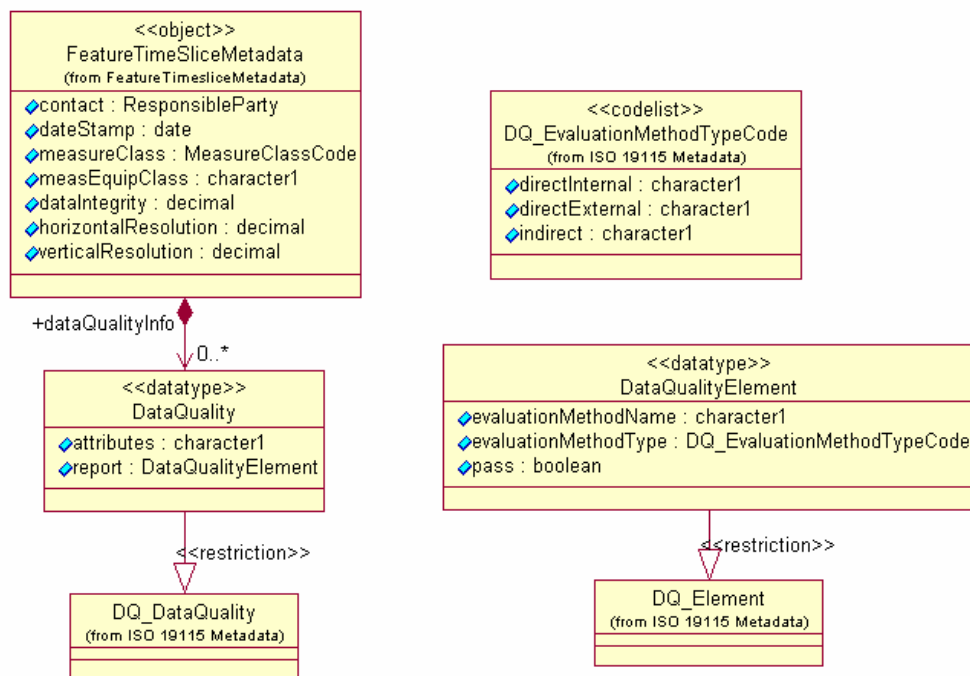
4.6 Data Quality Information

The UML class diagram for data quality information is displayed in Figure 8. This class describes the quality of data within a feature timeslice. The quality of data may vary by attribute or set of attributes. Hence, we include ISO19115 data element *attributes* which is a set data type¹⁸ to list the attributes to which the metadata element *report* applies.

Data element *report* maps to class *DataQualityElement* associated with *DQ_Element* which contains ISO19115 elements *evaluationMethodDescription* and *pass*. To conform to the AirMAT-AICM metadata harmonization, we added a new metadata element *evaluationMethodName* to give the name of the evaluation method used on the given *attributes*.

The data dictionary for the Data Quality Information is located in Appendix E.

Figure 8 – Data Quality Information Metadata



¹⁸ As defined in Annex B.4.7 of ISO19115.

4.7 Cyclic Redundancy Check Algorithm

The CRC algorithm is used in numerous systems to verify the integrity of the information during data transmission. If the computed CRC bits are different from the original (transmitted) CRC bits, then an error has occurred in the transmission. If they are identical, it can be assumed that no error occurred (there is a 1 in 4 billion chance that two different bit streams have the same CRC32).

The idea is that the data bits are treated as a data polynomial and the CRC bits represent the remainder of the division of the data polynomial by a fixed, known polynomial (called the CRC polynomial). The CRC32 polynomial used here is the ICAO-approved CRC32Q which is defined as follows:

$$1 + x + x^3 + x^5 + x^7 + x^8 + x^{14} + x^{16} + x^{22} + x^{24} + x^{31} + x^{32}$$

In a binary representation, where the coefficients are represented by a logical 1 we have:

```
11010101100000101000001010000001
```

For the calculation of the value of the CRC in AIXM messages, the bit stream used is composed through the concatenation of the XML fields concerned.¹⁹ Hence, in the Feature metadata, a data polynomial is generated by concatenating all of the tags and data content within the feature, which includes all of the tags and data content of each feature timeslice, and applying an ASCII function to convert the data string to its binary representation. That binary representation is then divided by the CRC32Q polynomial and the resulting remainder is the CRC bit value referred to as *cyclicRedundancyCheckFeature*.

For the Message metadata, a data polynomial is generated by concatenating all of the tags and data content within the message which includes all of the tags and data content of each feature and each of their respective timeslices. An ASCII function is applied to the string to convert to its binary representation which is then divided by the CRC32Q polynomial. The resulting remainder is the CRC bit value referred to as *cyclicRedundancyCheckMessage*.

To illustrate, we applied a sample Java code²⁰ for implementing the CRC algorithm to the AIXM message in Figure 2. We include the encoding in Figure 9 below. In addition to the mandatory AIXM metadata elements, we include in the schema *cyclicRedundancyCheckMessage*, *noteCRCMessage*, *cyclicRedundancyCheckFeature* and *noteCRCFeature*.

¹⁹ AIXM Primer, edition 4.5, European Air Traffic Management, March 20, 2006

²⁰ Appendix B – CRC Java Code, AIXM Primer, edition 4.5, European Air Traffic Management, March 20, 2006

Figure 9 – Mandatory Metadata Elements and CRC Bit Values within AIXM Message Structure

(Beginning of AIXM message)

```
<MessageMetadata>
  <dateStamp>2006-05-15T17:00:00Z</dateStamp>
  <contact>
    <individualName>Christian Grothe</individualName>
    <positionName>Research Assistant at FSR/TUD, responsible for compiling sets of
    aeronautical data to AIXM messages</positionName>
    <role>distributor</role>
  </contact>
  <cyclicRedundancyCheckMessage>11011101011011001110110110011001</cyclicRedundancy
  CheckMessage>
  <noteCRCMessage>Quotient used was string of all tags and data content within the
  message metadata and data, feature metadata and data, and feature timeslice metadata
  and data. Divisor used is ICAO-approved CRC32Q </noteCRCMessage>
  <messageIdentificationInfo>
    <abstract>This AIXM message only contains an obstacle timeslice of type “baseline”,
    valid from 01 Jan 1985</abstract>
    <language>en</language>
  </messageIdentificationInfo>
</MessageMetadata>

<?xml version="1.0" encoding="UTF-8"?>

<FeatureMetadata>
  <cyclicRedundancyCheckFeature>01010000011011101100111011001011
  </cyclicRedundancyCheckFeature>
  <noteCRCFeature>Quotient used is string of all tags and data content within the
  feature metadata and data, and its feature timeslice metadata and data. Divisor used
  is ICAO-approved CRC32Q </noteCRCFeature>
</FeatureMetadata>

<Obstacle xmlns="http://www.aixm.aero" xmlns:gml="http://www.opengis.net/gml"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.aixm.aero AIXM-GML-ObjectTypes.xsd"
gml:id="ID000000">
  <identifier codeSpace="http://www.aixm.aero/Amswell">EA001</identifier>
  <gml:validTime>
    <gml:TimePeriod>
      <gml:beginPosition>1985-01-01T00:00:00</gml:beginPosition>
      <gml:endPosition indeterminatePosition="unknown"/>
    </gml:TimePeriod>
  </gml:validTime>
</Obstacle>
```

```

    </gml:TimePeriod>
  </gml:validTime>
  <timeSlice>
  <FeatureTimeSliceMetadata>
    <dateStamp>2006-05-12T12:00:00Z</dateStamp>
    <contact>
      <organizationName>Institute of Flight Systems and Automatic Control
      (FSR)</organizationName>
      <positionName>Institute at Technische Universität Darmstadt
      (TUD)surveying and supplying aeronautical data</positionName>
      <role>originator</role>
    </contact>
    <featureIdentificationInfo>
      <abstract> Baseline timeslice for obstacle with point-type geometry –
      the Donlon antenna</abstract>
      <citation>
        <title>xNOTAM study</title>
        <date>2006-05-10T17:00:00Z</date>
        <dateType>revision</dateType>
      </citation>
    </featureIdentificationInfo>
  </FeatureTimeSliceMetadata>

  <ObstacleTimeSlice gml:id="ID000002">
    <gml:validTime>
      <gml:TimePeriod>
        <gml:beginPosition>1985-01-01T00:00:00</gml:beginPosition>
        <gml:endPosition indeterminatePosition="unknown"/>
      </gml:TimePeriod>
    </gml:validTime>
    <interpretation>BASELINE</interpretation>
    <name>Donlon</name>
    <type>antenna</type>
    <markingPattern>painted - vertical bands</markingPattern>
    <markingFirstColour>RED</markingFirstColour>
    <markingSecondColour>WHI</markingSecondColour>
    <constructionStatus>COMPLETED</constructionStatus>
    <groupOfObstacles>N</groupOfObstacles>
    <remark>A fictitious obstacle</remark>
    <madeOf>
      <ObstaclePart gml:id="ID000004">
        <verticalExtent uom="FT">104</verticalExtent>
        <elevationAccuracy uom="FT">5</elevationAccuracy>
        <hasPointShape>

```

```

<ElevatedPoint srsDimension="2"
srsName="WGS84" gml:id="ID000005">
  <gml:pos>52.352718 -
  31.852205</gml:pos>
  <horizontalAccuracy
uom="FT">10</horizontalAccuracy>
  <elevation uom="FT">255</elevation>
  <geoidUndulation uom="FT">-
  25</geoidUndulation>
  <verticalDatum>EGM-96</verticalDatum>
  <verticalAccuracy
uom="FT">5</verticalAccuracy>
  </ElevatedPoint>
  </hasPointShape>
</ObstaclePart>
</madeOf>
<isEffective>
  <TimeTable gml:id="ID000006">
    <workingHoursCode>H24</workingHoursCode>
  </TimeTable>
</isEffective>
</ObstacleTimeSlice>
</timeSlice>
</Obstacle>

```

(end AIXM message)

5.0 Conclusion

As we encourage the usage of AIXM 5.0 to exchange aeronautical information, we also encourage the data producers to include metadata about their message within the message as well as metadata for each feature timeslice within the feature section of the AIXM message. As we begin to implement AIXM 5.0, we understand that some metadata information may not be available. However, most of the elements included in the AIXM metadata profile may be autogenerated. For example, *abstract* could be generated from the data. An *abstract* for a message that includes airspace, navigationalAid and organizationService features, should extract the feature titles from within the message and list them in the *abstract*. The decision to include metadata within the AIXM message is optional. However, if the data producer elects to send metadata, it must conform to the profile presented in this white paper. The profile includes six models that were discussed in separate sections:

1. Metadata for the AIXM message
2. Metadata for an AIXM feature
3. Metadata for an AIXM feature timeslice
4. Constraint information
5. Citation and Responsible Party information
6. Data Quality information

This white paper summarizes the recommended metadata properties for AIXM 5.0, and describes each metadata model via a UML (universal modelling language) class diagram. The data dictionary for each model is presented in Appendices A through F.

Metadata can be easily captured and it is highly recommended to send with an AIXM message. To demonstrate, refer to the case study example of metadata for an AIXM message pertaining to a Temporary Flight Restriction included in Appendix H. In this example, the AIXM message contains three features - airspace, navigationalAid and organizationService. We present a table of mandatory metadata elements according to the AIXM metadata profile.

6.0 References

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7.0 Glossary

AICM – Aeronautical Information Conceptual Model

AirMAT – Air Modelling Advisory Team

AIXM – Aeronautical Information Exchange Model

AMDB – Aerodrome Mapping Database

AMXM – Aerodrome Mapping Exchange Model

CRS – Coordinate Reference System

DGIWG – Digital Geographic Information Working Group

FAA – Federal Aviation Administration

FGDC – Federal Geographic Data Committee

GWG – Geospatial Working Group

GIS – Geographic Information System

GML – Geographic Markup Language

HIHWG – Hydrographic Information Harmonization Working Group

ICAO – International Civil Aviation Organization

IHO – International Hydrographic Organization

ISO – International Standardization Organization

NGA – National Geospatial-Intelligence Agency

NGS – National Geodetic Survey

UML – Universal Modelling Language

8.0 Appendices

Appendix A – Data Dictionary for Metadata to include about AIXM Message

Appendix B – Data Dictionary for Metadata to include with AIXM Feature

Appendix C – Data Dictionary for Metadata to include with AIXM Feature Timeslice

Appendix D – Data Dictionary for Citation and Responsible Party Metadata

Appendix E – Data Dictionary for Data Quality Metadata

Appendix F – Data Dictionary for Constraints Information

Appendix G – Data Dictionary for Extended Metadata Elements and Entities

Appendix H – Metadata Case Study Example

Appendix A - Data Dictionary for Metadata to include about AIXM Message

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C conditional)	Max Occurrence (* indicate s infinite)
1	MessageMetadata					
2		MessageMetadata		This is the initial core metadata table for the AIXM message. The message may contain multiple features and instructions on operating the features. Including metadata with an AIXM message is optional, but if it is included, it should conform to this profile.	O	1
3			dateStamp : Date	Date on which the metadata for the AIXM message was compiled. (ISO19115 - mdDateSt (9))	M	1
4			cyclicRedundancyCheckMessage : Character1	CRC is the value or string of alphanumeric characters usually generated by a cyclic redundancy check algorithm. Best practice recommends that the algorithm consider all tags and data elements within the AIXM message. When the receiver applies a CRC algorithm to the message, a different CRC indicates that a tag or data element within the message has been changed since the sender generated the original CRC.	O	1
5			noteCRCMessage : Character1	The sender can document the tags and data elements considered in the cyclic redundancy check.	O	1
6			contact : ResponsibleParty	References the party responsible for the metadata information about the AIXM message. (ISO19115 - mdContact (8))	M	*
7			messageIdentificationInfo : IdentificationMessage	This data type references the abstract and language for and party responsible for submitting the AIXM message.	M	1
8			metadataConstraintInfo: MD_Constraints	Restrictions on the access and use of the metadata for the AIXM message. (ISO19115 - Consts (67))	O	*
9		IdentificationMessage		This data type references the abstract and language for and party responsible for submitting the AIXM message.	M	1
10			pointOfContact : ResponsibleParty	References the party responsible for submitting the AIXM message. (ISO19115 - idPoC (29))	O	*
11			abstract : Character1	Brief narrative summary on the contents of the AIXM message. Contents can include multiple features and operating instructions on how to use the feature data. [ISO19115 - idAbs(25)] Best practices recommend the abstract written in English.	M	1
12			language : Character1	The language used within the AIXM message. [ISO19115 - dataLang (39)] follows ISO639-2. Best practices recommends the language to be English.	M	1
13			messageConstraintInfo: MD_Constraints	Restrictions on the access and use of the AIXM message. (ISO19115 - Consts (67))	O	1

Appendix B – Data Dictionary for Metadata to include with AIXM Feature

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
14	FeatureMetadata					
15		FeatureMetadata		This is the metadata table for the feature within an AIXM message. Each feature contains the feature ID, the effective begin and end time for the data and the feature timeslice (i.e., the feature data pertaining to the given time range). There is separate metadata pertaining to the feature data associated with the timeslice. The metadata at the feature level only includes a CRC for the feature data and a value for the data integrity of the feature data.	O	*
16			cyclicRedunancyCheckFeature : Character1	CRC is the value or string of alphanumeric characters usually generated by a cyclic redundancy check algorithm. Best practice recommends that the algorithm consider all tags and data content within the feature. When the receiver applies a CRC algorithm to the feature data, a different CRC indicates that a tag or data element within the feature data has been changed since the sender generated the original CRC.	O	1
17			noteCRCfeature : Character1	Used to document the methodology used to generate CRC.	O	1

Appendix C – Data Dictionary for Metadata to include with AIXM Feature Timeslice

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, I, M - mandatory, C -)	Max Occurrence (* indicates infinite)
18	FeatureTimeSliceMetadata					
19		FeatureTimeSliceMetadata		This is the metadata table for the feature timeslice within an AIXM message. Each feature has a timeslice property that designates when feature information is/has been updated. The metadata pertaining to the feature data will be associated with the timeslice. Including metadata with an AIXM feature timeslice is optional, but if it is included, it should conform to this profile.	O	*
20			contact : ResponsibleParty	References the party responsible for the metadata information about the feature. (ISO19115 - mdContact (8))	M	*
21			dateStamp : Date	Date on which the metadata for the feature was compiled. (ISO19115 - mdDateSt (9))	M	1
22			measureClass : MeasureClassCode	Gives information about how any measurements within the feature were captured. (Not in ISO19115)	O	1
23			measEquipClass : Character1	The equipment used to capture any measurements within the feature. (Not in ISO19115) reference ISO19130 when available	O	1
24			dataIntegrity : decimal	A degree of assurance that an aeronautical data and its value has not been lost or altered since the data origination or authorized amendment. For example, the dataIntegrity value for an error of 5 in 10000 is equal to $(1 - [5/10000]) = .9995$	O	1
25			horizontalResolution : decimal	Horizontal resolution of the coordinates. Using the ICAO Annex 15 definition of resolution: The number of units or digits to which a measured or calculated value is expressed and used. e.g., .001 implies that the horizontal component of a given coordinate value can be expressed to the 1/1000 decimal place.	O	1
26			verticalResolution : decimal	Vertical resolution of the coordinates. Using the ICAO Annex 15 definition of resolution: The number of units or digits to which a measured or calculated value is expressed and used. e.g., .001 implies that the vertical component of a given coordinate value can be expressed to the 1/1000 decimal place.	O	1

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C -)	Max Occurrence (* indicates infinite)
27			dataQualityInfo : DataQuality	Quality information for the data specified by a data quality scope. (ISO19115 - DataQual (78))	O	*
28			featureIdentificationInfo : IdentificationFeature	This data type references the abstract, citation and party responsible for the feature timeslice data.	M	1
29		IdentificationFeature		This data type references the abstract, citation and party responsible for the feature timeslice data.	M	1
30			citation : Citation	Citation data for the resource of the feature data.	M	1
31			abstract : Character1	Brief narrative summary on the contents of the feature data. Contents can include operating instructions on how to use the feature data. [ISO19115 - idAbs(25)] Best practices recommend the abstract written in English.	M	1
32			dataStatus : MD_ProgressCode	Due to AirMAT-AICM metadata harmonization, we include data element dataStatus under IdentificationFeature to give the status of the feature timeslice data	O	1
33			pointOfContact : ResponsibleParty	References the party responsible for the AIXM feature data (ISO19115 - idPoC (29)) If data not included, assume same responsible party as the metadata for the feature.	O	*
34		MeasureClassCode		New codelist to describe source of any measurements in the feature data.	O	1
35			defined : Character1	A measurement by definition. No surveying or calculation involved.	O	1
36			calculated : Character1	Actual measurement captured and or calculated based on other measurements.	O	1
37			surveyed : Character1	Measurement value captured via survey.	O	1
38			derived : Character1	Measurement value derived (approximated or estimated.)	O	1
39		MD_ProgressCode		Same as ISO19115 B.5.23. Gives status of the feature timeslice data.	O	1
40			completed : Character1	Production of the data has been completed	O	1
41			historicalArchive : Character1	Data has been stored in an offline storage facility	O	1
42			obsolete : Character1	Data is no longer relevant	O	1
43			onGoing : Character1	Data is continually being updated	O	1
44			planned : Character1	Fixed date has been established upon or by which the data will be created or updated	O	1
45			required : Character1	Data needs to be generated or updated	O	1
46			underDevelopment : Character1	Data is currently in the process of being created	O	1

Appendix D – Data Dictionary for Citation and Responsible Party Metadata

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
47	Citation and Responsible Party Info					
48		ResponsibleParty		Identification of and means of communication with, person(s), system(s) and organizations associated with the dataset. (ISO19115 - RespParty (374))	M	*
49			individualName : Character1	Name of the responsible party, given name, title separated by a delimiter. If organization or system name not available, must include individual name. (ISO19115 - rpIndName (375))	C	1
50			systemName : Character1	Name of the responsible system (i.e. database, or repository that transmitted or compiled info). If organization or individual name not available, must include system name. (similar to ISO19115 - rpIndName (375))	C	1
51			organizationName : Character1	Name of the responsible organization. If individual or system name not available, must include organization name. (ISO19115 - rpOrgName (376))	C	1
52			positionName : Character1	Role or position title of the responsible party. Only list one position using the following prioritization if more than one of individual, system and organization are provided: 1. individual name, 2. system name 3. organization name. (ISO19115 - rpPosName (377))	M	1
53			contactInfo : Contact	Address and Phone info of the responsible party. (ISO19115 - rpCntInfo (378))	O	1
54			role : CI_RoleCode	Function performed by the responsible party. Only list one role code using the following prioritization if more than one of individual, system and organization are provided: 1. individual name, 2. system name 3. organization name. (ISO19115 - role (379))	M	1
55			digitalCertificate : character1	Metadata field to capture an electronic signature authentication information.	O	1
56		CI_RoleCode		This codelist gives the possible roles for the responsible party. Must select only one role. Only list one role code using the following prioritization if individual, system and organization are all provided: 1. individual name, 2. system name 3. organization name. (ISO19115 - role (379))(ISO19115 - B.5.5)	M	1
57			resourceProvider : Character1	Party that supplies the resource.	O	1

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
58			custodian : Character1	Party that accepts accountability and responsibility for the data and ensures appropriate care and maintenance of the resource.	O	1
59			owner : Character1	Party that owns the resource.	O	1
60			user : Character1	Party who uses the resource.	O	1
61			distributor : Character1	Party who distributes the resource.	O	1
62			originator : Character1	Party who created the resource.	O	1
63			pointOfContact : Character1	Party who can be contacted for acquiring knowledge about or acquisition of the resource.	O	1
64			principalInvestigator : Character1	Key party responsible for gathering information and conducting research.	O	1
65			processor : Character1	Party who has processed the data in a manner such that the resource has been modified.	O	1
66			publisher : Character1	Party who published the resource.	O	1
67			author : Character1	Party who authored the resource.	O	1
68		Contact		Information required to enable contact with the responsible party (ISO19115 - Contact (387))	O	1
69			phone : Telephone	Telephone numbers at which the responsible party may be contacted. (similar to ISO19115 - cntPhone (388))	O	*
70			address : CI_Address	Physical address and email address at which the responsible party may be contacted. (similar to ISO19115 - cntAddress (389))	O	*
71		Telephone		Telephone numbers for contacting the responsible party. (ISO19115 - Telephone (407))	O	*
72			codeType: PhoneCodeType	Code for type of telephone number for responsible party. (Derived from ISO19115)	O	*
73			number : Character1	The phone number corresponding to the PhoneCodeType.	O	*
74			otherDescription : Character1	If PhoneCodeType Other is selected, must include a description of other.	C	*
75		PhoneCodeType		List of codes for type of contact phone numbers or email address.	O	*
76			Phone : Character1	Phone number where party can be reached.	O	*
77			Fax : Character1	Fascimile machine phone number.	O	*
78			Mobile : Character1	Mobile or cellular phone number.	O	*
79			Other : Character1	other contact category	O	*
80		CI_Address		Location of the responsible party. (ISO19115 - Address (380))	O	*

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
81			delPoint : Character1	Address line for the location. (ISO19115 - delPoint (381))	O	*
82			city : Character1	City of the location. (ISO19115 - city (382))	O	1
83			administrativeArea : Character1	State, province of the location. (ISO19115 - adminArea (383))	O	1
84			postalCode : Character1	Zip or other postal code. (ISO19115 - postCode (384))	O	1
85			country : Character1	Country of the physical address. (ISO19115 - country (385))	O	1
86			electronicMailAddress : Character1	Address of the electronic mailbox of the responsible organization or individual (ISO19115 - eMailAdd (386))	O	*
87		Citation		Standardized resource reference for the feature data. (ISO19115 - citation (359))	M	1
88			title : Character1	Name by which the resource of the feature data is known. (ISO19115 - resTitle (360))	M	1
89			date : CI_Date	Reference date for the resource of the feature data. (ISO19115 - resRefDate (362))	M	*
90			processCertification : Character1	Use this metadata field to indicate the certification level of the resource of the feature data. For example is the supplier certified under DO200A criteria. Or CHAIN compliant or ISO compliant, i.e. ISO9001:2000 quality management system certified.	O	*
91		CI_Date		Reference date for the feature data and event used to describe it. (ISO19115 - DateRef (393))	M	*
92			date : Date	Reference date for the resource of the feature data. (ISO19115 - date (394))	M	*
93			dateType : CI_DateTypeCode	Event used for the reference date. (ISO19115 - refDateType (395))	M	*
94		CI_DateTypeCode		Identification of when a given event occurred. (ISO19115 - B.5.2 CodeList)	M	*
95			creation : Character1	Date identifies when the resource of the feature data was brought into existence. (ISO19115 - B.5.2)	O	*
96			publication : Character1	Date identifies when the resource for the feature data was issued. (ISO19115 - B.5.2)	O	*
97			revision : Character1	Date identifies when the resource for the feature data was examined or re-examined and improved or amended. (ISO19115 - B.5.2)	O	*

Appendix E – Data Dictionary for Data Quality Metadata

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
98	Data Quality information					
99		DataQuality		Quality information for the data specified by a set of attributes. (ISO19115 - DataQual (78))	O	*
100			attributes : Character1	Set of attributes to which the data quality information applies. (ISO19115 - attribSet (150))	O	1
101			report : DataQualityElement	Quantitative quality information for the data specified by the attributes. (variation of ISO19115 - dqReport (80))	O	*
102		DataQualityElement		Aspect of quantitative quality information. We modify the DQ_Element class in ISO19115 by using a subset of data elements, a data element from the DQ_Result class, and adding a new metadata element. (dQElement (99))	O	*
103			evaluationMethodName : Character1	The name of the method used to evaluate quality of the given attribute set (i.e., dataset). (Not in ISO19115)	O	1
104			evaluationMethodType : DQ_EvaluationMethodTypeCode	Type of method used to evaluate quality of the dataset (ISO19115 - evalMethType (103))	O	1
105			pass : Boolean	Indication of the outcome of evaluating the dataset against a specified acceptable conformance quality level where 0 = fail and 1 = pass.	M	1
106		DQ_EvaluationMethodTypeCode		Annex B.5.6 from ISO19115. Type of method for evaluating an identified data quality measure.	O	1
107			directInternal : Character1	Method of evaluating the quality of a dataset based on inspection of items within the dataset, where all data required is internal to the dataset being evaluated.	O	1
108			directExternal : Character1	Method of evaluating the quality of a dataset based on inspection of items within the dataset, where reference data external to the dataset being evaluated is required.	O	1
109			indirect : Character1	Method of evaluating the quality of a dataset based on external knowledge.	O	1

Appendix F – Data Dictionary for Constraints Information

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (Optional, Mandatory, Conditional)	Max Occurrence (* indicates infinite)
110	Constraint information					
111		MD_Constraints		Restrictions on the access and use of the AIXM message or metadata for the AIXM message. (ISO19115 - Consts (67))	O	*
112			useLimitation : Character1	Limitation affecting the fitness for use of the AIXM message or metadata for the AIXM message. Example, "not to be used for navigation" (ISO19115 - useLimit (68))	O	*
113		LegalConstraints		Restrictions and legal prerequisites for accessing and using the AIXM message or metadata for the AIXM message. (ISO19115 - LegConsts (69))	O	*
114			accessConstraints : RestrictionCode	Access constraints applied to assure the protection of privacy or intellectual property , an any special restrictions or limitations on obtaining the AIXM message or metadata for the AIXM message. (ISO19115 - accessConsts(70))	O	*
115			useConstraints : RestrictionCode	Constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or warnings on using the AIXM message or metadata for the AIXM message. (ISO19115 - useConsts(71))	O	*
116			userNote : Character1	Explanation of the application of the legal constraints or other restrictions and legal prerequisites for obtaining and using the AIXM message or metadata for the AIXM message (ISO19115 - userNote (75))	O	1
117			otherConstraints : Character1	Other restrictions and legal prerequisites for accessing or using the AIXM message or metadata for the AIXM message. If accessConstraints or useConstraints equals otherRestrictions, then must include this element. (ISO19115 - othConsts (72))	C	*
118		RestrictionCode		ISO19115 - B.5.24 (only elected to use some of the codes)	O	*
119			copyright : Character1	Exclusive right to the publication, production, or sale of the rights of data within the AIXM message, or the use of the data granted by law for a specified period of time to the data receiver or distributor (similar to ISO19115 B.2.24 definition)	O	*
120			license : Character1	Formal permission to do something	O	*
121			intellectualPropertyRights : Character1	Rights to financial benefit from and control of distribution of non-tangible property that is a result of creativity	O	*
122			restricted : Character1	Withheld from general circulation or disclosure	O	*
123			otherRestrictions : Character1	Limitation not listed	O	*

#	Metadata section	Metadata entity	Metadata element	Documentation (The ISO19115 reference refers to the row and element from ISO19115 Annex B)	Condition (O - optional, M - mandatory, C - conditional)	Max Occurrence (* indicates infinite)
124		SecurityConstraints		Handling restrictions imposed on the AIXM message or metadata for the AIXM message for national security or similar security concerns. (ISO19115 - SecConsts (73))	O	*
125			classification : ClassificationCode	Name of the handling restrictions on the AIXM message or metadata for the AIXM message. Mandatory if MD_SecurityConstraints object used. If any of the features within the AIXM message have attributes with classification codes, this element in reference to the AIXM message uses the highest classification code among the features.[The classification code for the message metadata is determined by the sender] (similar to ISO19115 - class (74))	M	1
126			classificationSystem : Character1	Name of the classification system (ISO19115 - classSys (76))	O	1
127			handlingDescription : Character1	Additional information about the restrictions on handling the AIXM message or metadata for the AIXM message (ISO19115 - handDesc (77))	O	1
128			otherClassification : Character1	Other handling restriction on the AIXM message or metadata for the AIXM message. If classification equals otherHandles, then must include this element. (ISO19115 - not included, need element extension)	C	*
129		ClassificationCode		ISO19115 - B.5.11 (similar, added otherHandles)	M	1
130			unclassified : Character1	Available for general disclosure	O	1
131			restricted : Character1	Not for general disclosure	O	1
132			confidential : Character1	Available for someone who can be entrusted with information	O	1
133			secret : Character1	Kept or meant to be kept private, unknown, or hidden from all but a select group of people	O	1
134			topSecret : Character1	Of the highest secrecy	O	1
135			otherHandles : Character1	Classification not listed	O	1

Appendix G – Data Dictionary for Extended Metadata Elements and Entities²¹

ref #	Name	Obligation /Condition	Data Type	Max Occurrence	Parent Entity	Rule	Rationale
2	MessageMetadata	O	Class	1		New Metadata entity	AIXM message metadata needed a variation of the ISO19115 MD_Metadata class.
4	cyclicRedundancyCheckMessage	O	character1	1	MessageMetadata	New Metadata element	Attribute is not defined in ISO19115. When the receiver applies a CRC algorithm to the message, a different CRC indicates that a tag or data element within the message has been changed since the sender generated the original CRC.
5	noteCRCMessage	O	character1	1	MessageMetadata	New Metadata element	Attribute is not defined in ISO19115. Need ability to relay information to the data receiver if necessary about the CRC calculation.
7	Role name: messageIdentificationInfo	M	Association	1	MessageMetadata	New Metadata association	Similar to the role: identificationInfo from MD_Metadata to MD_Identification. However, this role imposes a more restrictive domain (1 vs. 1..*) Since, we define two identification roles from two different parent entities, we need to distinguish.
8	Role name: metadataConstraintInfo	O	Association	*	MessageMetadata	New Metadata association	Similar to the role: metadataConstraints from MD_Metadata to MD_Constraints. Since, we define two constraint roles from two different parent entities, we need to distinguish.
9	IdentificationMessage	M	Class	1	MessageMetadata	New Metadata entity	Falls under the identification grouping of metadata. This class is a variation of the ISO19115 MD_Identification class.
12	language	M	character1; follows ISO639-2	1	IdentificationMessage	Imposed more restrictive domain	In ISO19115, language falls under MD_DataIdentification and has multiplicity. We omit multiplicity in AIXM model.

ref #	Name	Obligation /Condition	Data Type	Max Occurrence	Parent Entity	Rule	Rationale
13	Role name: messageConstraintInfo	O	Association	1	IdentificationMessage	New Metadata association	Similar to the role: resourceConstraints from MD_Identification to MD_Constraints. Since, we define two constraint roles from two different parent entities (one with a more restrictive domain), we need to distinguish.
15	FeatureMetadata	O	Class	*		New Metadata entity	AIXM feature metadata needed a variation of the ISO19115 MD_Metadata class.
16	cyclicRedundancyCheckFeature	O	character1	1	FeatureMetadata	New Metadata element	Attribute is not defined in ISO19115. When the receiver applies a CRC algorithm to the feature, a different CRC indicates that a tag or data element within the feature has been changed since the sender generated the original CRC.
17	noteCRCfeature	O	character1	1	FeatureMetadata	New Metadata element	Attribute is not defined in ISO19115. Need ability to relay information to the data receiver if necessary about the CRC calculation.
19	FeatureTimeSliceMetadata	O	Class	*		New Metadata entity	AIXM feature timeslice metadata needed a variation of the ISO19115 MD_Metadata class.
22	measureClass	O	character1	1	FeatureTimeSliceMetadata	New Metadata element	Attribute is not defined in ISO19115. Returns the string from class MeasureClassCode
23	measEquipClass	O	character1	1	FeatureTimeSliceMetadata	New Metadata element	Attribute is not defined in ISO19115, but recommended for AIXM metadata profile.
24	dataIntegrity	O	decimal	1	FeatureTimeSliceMetadata	New metadata element	Attribute is not defined in ISO19115.
25	horizontalResolution	O	decimal	1	FeatureTimeSliceMetadata	New metadata element	Attribute is not defined in ISO19115.
26	verticalResolution	O	decimal	1	FeatureTimeSliceMetadata	New metadata element	Attribute is not defined in ISO19115.
28	Role name: featureIdentificationInfo	M	Association	1	FeatureTimeSliceMetadata	New Metadata association	Similar to the role: identificationInfo from MD_Metadata to MD_Identification. However, this role imposes a more restrictive domain (1 vs. 1..*) Since, we define two identification roles from two different parent entities, we need to distinguish.

ref #	Name	Obligation /Condition	Data Type	Max Occurrence	Parent Entity	Rule	Rationale
29	IdentificationFeature	M	Class	1	FeatureTimeSliceMetadata	New Metadata entity	Falls under the identification grouping of metadata. This class is a variation of the ISO19115 MD_Identification class.
30	citation	M	character1	1	IdentificationFeature	New Metadata element	This citation points to Citation class whereas the ISO19115 citation points to CI_Citation
32	dataStatus	O	Code List	1	IdentificationFeature	New Metadata element	Similar to status element in ISO19115. Needed a new element to specify status of feature timeslice data.
34	MeasureClassCode	O	Code List	1	FeatureTimeSliceMetadata	New Metadata codelist elements	AIXM metadata model needs a codelist to describe the source of any measurements in the feature data.
48	ResponsibleParty	M	Class	*	MessageMetadata	New Metadata entity	Falls under the citation and responsible party grouping of metadata. This class is a variation of the ISO19115 CI_ResponsibleParty class.
50	systemName	C	character1	1	ResponsibleParty	New Metadata element	Needed a new element within the responsible party class to describe the responsible system.
53	contactInfo	O	Class	1	ResponsibleParty	New Metadata entity	This contactInfo points to Contact class whereas the ISO19115 contactInfo points to CI_contact
55	digitalCertificate	O	character1	1	ResponsibleParty	New Metadata element	Needed a new element within the responsible party class to capture authentication information for an electronic signature.
68	Contact	O	Class	1	ResponsibleParty	New Metadata entity	Contact class contains less information than the ISO19115 CI_Contact
69	phone	O	Class	*	Contact	New Metadata entity	This phone points to Telephone whereas the ISO19115 phone points to CI_Telephone
71	Telephone	O	Class	*	Contact	New Metadata entity	Telephone is a variation of the ISO19115 CI_Telephone
72	codeType	O	character1	*	Telephone	New Metadata elements	Needed a new element within the telephone class to describe the type of telephone number.

ref #	Name	Obligation /Condition	Data Type	Max Occurrence	Parent Entity	Rule	Rationale
73	number	O	character1	*	Telephone	New Metadata element	Needed a new element within the Telephone class to capture the actual telephone number.
74	otherDescription	C	character1	*	Telephone	New Metadata element	Needed a new element within the telephone class to capture the description of a telephone number other than phone, fax or mobile.
75	PhoneCodeType	O	Code List	*	ResponsibleParty	New Metadata codelist elements	Needed a new codelist within the responsible party class to describe responsible party telephone numbers.
87	Citation	M	Class	1	IdentificationFeature	New Metadata entity	Citation class contains less information than the ISO19115 Cl_Citation
99	DataQuality	O	Class	*	FeatureTimeSliceMetadata	New Metadata entity	Falls under the data quality grouping of metadata. This class is a variation of the ISO19115 DQ_DataQuality class.
102	DataQualityElement	O	Class	*	DataQuality	New Metadata entity	Falls under the data quality grouping of metadata. This class is a variation of the ISO19115 DQ_Element class.
103	evaluationMethodName	O	character1	1	DataQualityElement	New Metadata element	To conform with AirMAT, added element to describe name of evaluation method.
113	LegalConstraints	O	Class	*	MD_Constraints	New Metadata entity	Falls under the constraints grouping of metadata. This class is a variation of the ISO19115 MD_LegalConstraints class.
118	RestrictionCode	O	Code List	*	LegalConstraints	New Metadata codelist elements	RestrictionCode is a subset of MD_RestrictionCode
124	SecurityConstraints	O	Class	*	MD_Constraints	New Metadata entity	Falls under the constraints grouping of metadata. This class is a variation of the ISO19115 MD_SecurityConstraints class.

ref #	Name	Obligation /Condition	Data Type	Max Occurrence	Parent Entity	Rule	Rationale
128	otherClassification	C	character1	*	SecurityConstraint	New Metadata element	Needed a new element within the SecurityConstraints class to capture name of other handling restriction not listed under ClassificationCode codelist.
129	ClassificationCode	M	Code List	1	SecurityConstraint	New Metadata codelist elements	ClassificationCode is an extension of MD_ClassificationCode

²¹ The ref # references the row number from the tables found in Appendices A through F. This table is based on Annex I.4 of ISO19115.

Appendix H – Metadata Case Study Example

Metadata Use Case – Temporary Flight Restriction²²

NOTAM Number :FDC 6/5862
Issue Date :April 20, 2006 at 13:05 UTC
Location :Vidalia, Georgia near DUBLIN VORTAC (DBN)
Beginning Date and Time :April 27, 2006 at 21:00 UTC
Ending Date and Time :April 30, 2006 at 22:00 UTC
Reason for NOTAM :Due to aerial demonstrations by the Canadian Snowbirds and U.S. Air Force A-10 teams
Type :Airshow
Replaced NOTAM(s) :N/A
Pilots May Contact :Jacksonville (ZJX) Center, 904-549-1537

Affected Area(s)

Airspace Definition:
TFR Center: 32.2 nautical miles from DUBLIN VORTAC(DBN) on the 134 radial (Latitude: 32°11'33"N, Longitude: 82°22'19"W)
Radius: 5 nautical miles
Altitude: From the surface up to and including 15300 feet MSL

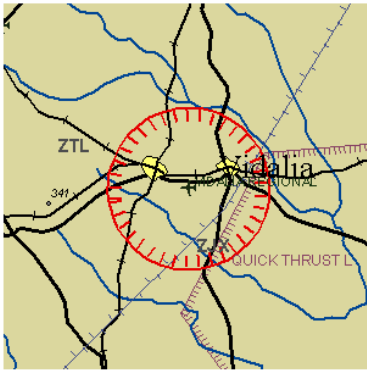
Effective Date(s):
April 27, 2006 at 21:00 UTC - April 27, 2006 at 23:30 UTC
April 28, 2006 at 17:00 UTC - April 28, 2006 at 21:00 UTC
April 29, 2006 at 16:00 UTC - April 29, 2006 at 22:00 UTC
April 30, 2006 at 16:00 UTC - April 30, 2006 at 22:00 UTC

Operating Restrictions and Requirements

No pilots may operate an aircraft in the areas covered by this NOTAM (except as described).

Unless authorized by ATC.

Other Information:
ARTCC: ZTL - Atlanta Center
Point of Contact: George Cline
Telephone 336-337-8183
Authority: Title 14 CFR section 91.145



[Click for Large Map](#)
[Click for Sectional](#)
[NOTAM Text](#)

- **Metadata for AIXM Message**
 - Airshow TFR
- **Metadata for each of the 3 features**
 - Airspace
 - NavigationalAid
 - OrganizationAuthority

²²Visit <http://tfr.faa.gov> for a current listing of United States Temporary Flight Restrictions. The XML schema for each TFR is based on AIXM 3.3.

The table below lists the mandatory metadata elements and entities with respect to the AIXM message and each of the features. N/A indicates that a metadata element or entity is not applicable. We also include some non-mandatory metadata elements for example purposes.

Metadata entity	Metadata element	AIXM message	Feature 1 - Airspace	Feature 2 - NavigationalAid (VOR - TACAN)	Feature 3 - OrganizationAuthority
MessageMetadata		<i>The dataset or package also known as AIXM message may contain multiple features and instructions on operating the features.</i>	N/A	N/A	N/A
	dateStamp : Date	12-May-06	N/A	N/A	N/A
	contact : ResponsibleParty	<i>References the party responsible for the metadata information about the AIXM message. (ISO19115 - mdContact (8))</i>	N/A	N/A	N/A
	individualName : character1	Kim Barnette	N/A	N/A	N/A
	organizationName : character1	Federal Aviation Administration	N/A	N/A	N/A
	positionName : character1	Research analyst working on AIXM metadata analysis and TFR Builder project	N/A	N/A	N/A
	role : CI_RoleCode	PointOfContact	N/A	N/A	N/A

IdentificationMessage		<i>This data type references the abstract and language for and party responsible for submitting the AIXM message.</i>	N/A	N/A	N/A
pointOfContact : ResponsibleParty		<i>References the party responsible for submitting the AIXM message. (ISO19115 - idPoC (29))</i>	N/A	N/A	N/A
systemName : character1		TFR Repository	N/A	N/A	N/A
organizationName : character1		Federal Aviation Administration	N/A	N/A	N/A
positionName : character1		TFR Repository collects data used to create a TFR from a designated user; stores the data; and submits the data for publication at the user's request to the United States NOTAMs Office.	N/A	N/A	N/A
role : CL_RoleCode		Custodian	N/A	N/A	N/A
codeType : PhoneCodeType		Other	N/A	N/A	N/A
number : character1		800-333-4567	N/A	N/A	N/A
otherDescription : character1		TFR Repository Help Desk Phone Line	N/A	N/A	N/A

		This message includes the temporary flight restriction information for a 91.145 airshow. It is being sent from the TFR repository to NES for review and issuance by the United States NOTAMs Office. It is composed of the features: Airspace, NavigationalAid, OrganizationAuthority.			
	abstract : character1		N/A	N/A	N/A
	language : character1	English	N/A	N/A	N/A
	FeatureTimeSliceMetadata	N/A	<i>Each feature has a timeslice property that designates when feature information is/has been updated. The metadata pertaining to the feature data will be associated with the timeslice.</i>		
	contact: ResponsibleParty	N/A	<i>References the party responsible for the metadata information about the feature. (ISO19115 - mdContact (8))</i>		
	individualName : character1	N/A	Kim Barnette	Kim Barnette	Kim Barnette
	organizationName : character1	N/A	Federal Aviation Administration	Federal Aviation Administration	Federal Aviation Administration
	positionName : character1	N/A	Research analyst working on AIXM metadata analysis and TFR Builder project	Research analyst working on AIXM metadata analysis and TFR Builder project	Research analyst working on AIXM metadata analysis and TFR Builder project
	role : CI_RoleCode	N/A	PointOfContact	PointOfContact	PointOfContact

	dateStamp : Date	N/A	12-May-06	12-May-06	12-May-06
	measureClass : MD_MeasureClassCode	N/A	defined	derived	not included
	measEquipClass : character1	N/A	not included	radar	not included
	IdentificationFeature	N/A	<i>This data type references the abstract, citation and party responsible for the feature timeslice data.</i>		
	citation : CI_Citation	N/A	<i>Citation data for the resource of the feature data.</i>		
	title : character1	N/A	FAA Airspace and Rules TFR Creator	National Airspace System Resources database	FAA Airspace and Rules TFR Creator
	Date : Date	N/A	2006-04-20T10:47:36	18-Apr-06	2006-04-20T10:47:36
	dateType : CI_DateTypeCode	N/A	creation	published	creation
	abstract : character1	N/A	This feature is the description of the airspace for the 91.145 airshow temporary flight restriction. The data is being sent from the TFR repository to NES for review and issuance by the United States NOTAMs Office.	This feature is the description of the navigational aids for the 91.145 airshow temporary flight restriction. The data is being sent from the TFR repository to NES for review and issuance by the United States NOTAMs Office.	This feature is the description of the NOTAM service organizations and authorities for the 91.145 airshow temporary flight restriction. The data is being sent from the TFR repository to NES for review and issuance by the United States NOTAMs Office.

	pointOfContact : ResponsibleParty	N/A	<i>References the party responsible for the AIXM feature data (ISO19115 - idPoC (29)) If data not included, assume same responsible party as the metadata for the feature.</i>		
	individualName : character1	N/A	P. Gallant	National Airspace System Resources	P. Gallant
	organizationName : character1	N/A	Federal Aviation Administration - Airspace and Rules	Federal Aviation Administration - Aeronautical Information Services	Federal Aviation Administration - Airspace and Rules
	positionName : character1	N/A	As an FAA authorized TFR creator, I use geographic information (latitude/longitude, elevation, and radius) to construct airshow/sporting event TFRs and submit them to USNOF for issuance.	The single authoritative government source for storing, maintaining and disseminating aeronautical data concerning the United States and its territories to support real-time aviation activities.	As an FAA authorized TFR creator, I construct airshow/sporting event TFRs, appended with point of contact and FAA coordination facility information and submit them to USNOF for issuance.
	role : CL_RoleCode	N/A	PointOfContact	Publisher	PointOfContact