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Title

Geographic information/Geomatics

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Introductory note

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Geographic information — Metadata — Part 2: Extensions for imagery and gridded data

Information géographique — Métadonnées — Partie 2: Métadonnées pour les images et les matrices

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19115-2 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

ISO 19115 consists of the following parts, under the general title *Geographic information — Metadata*:

— *Geographic information — Metadata*

— *Part 2: Extensions for imagery and gridded data*

Introduction

Imagery and gridded data are important information sources and products used within a geospatial environment by geographic information systems. The production of imagery and gridded data follows one or more process chains that begin with remote sensing data, scanned maps, or other sensing methods and end with the creation of the end data products. The production process needs to be documented in order to maintain quality control over the end products. In addition, metadata about the geometry of the measuring process and the properties of the measuring equipment needs to be retained with the raw data in order to support the production process.

Within the suite of ISO geographic information standards, ISO 19115 defines the guidelines for describing geographic information and services. While the ISO 19115 Metadata model does provide some provisions for imagery and gridded data, the requirements were not fully developed at the time ISO 19115 was drafted. To permit the development of ISO 19115 to proceed, inclusion of metadata definitions for imagery and gridded data was deferred until the framework for these data was more fully specified within the suite of ISO geographic information standards. In ISO 19130 “Geographic information — Sensor and data model for imagery and gridded data”, a generic and standardized sensor model and a data model for all existing and known sensors in the field of geographic information/geomatics is being developed. ISO 19130 provides an informative annex listing metadata for several sensor types. Additionally, other standards that implement metadata for imagery and gridded data have been surveyed and are described in ISO/TR 19121 "Geographic information — Imagery and gridded data".

The object of this International Standard is to provide the additional structure to describe the derivation of geographic imagery and gridded data. This structure is intended to augment the existing Metadata standard described in ISO 19115.

Geographic information — Metadata — Part 2: Extensions for imagery and gridded data

1 Scope

This International Standard extends the existing geographic Metadata standard by defining the schema required for describing imagery and gridded data. It provides information about the properties of the measuring equipment used to acquire the data, the geometry of the measuring process employed by the equipment, and the production process used to digitize the raw data. This extension deals with metadata needed to describe the derivation of geographic information from raw measurements, including the properties of the measuring system, and the numerical methods and computational procedures used in the derivation. The metadata required to address coverage data in general is addressed sufficiently in the general part of 19115.

2 Conformance

2.1 Conformance requirements

Metadata shall be provided as specified in Clause 6 and Annexes A and B.

User-defined metadata shall be defined and provided as specified in ISO 19115:2003, Annex C.

Any metadata claiming conformance with this International Standard shall pass the requirements described in the abstract test suite presented in ISO 19115:2003, Annex D.

2.2 Metadata Profiles

Any profile conforming to this International Standard shall conform to the rules in ISO 19115:2003, Clause C.6.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 19103, *Geographic information — Conceptual schema language*

ISO 19115:2003, *Geographic information — Metadata*

ISO 19130, *Geographic information — Sensor and data models for imagery and gridded data*

ISO/IEC 11179 (all parts), *Information technology — Specification and standardization of data elements*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

5 Abbreviated terms

IDL Interface Definition Language

OCL Object Constraint Language

UML Unified Modeling Language

6 Requirements

6.1 Metadata for geospatial imagery and gridded data requirement

ISO 19115 identifies the metadata required to describe digital geographic data. This part of ISO 19115 extends the metadata identified in ISO 19115 and identifies the metadata required to describe digital geospatial imagery and gridded data. ISO 19115 identifies some of the metadata for imagery and gridded data and this part of ISO 19115 builds upon that foundation. ISO 19115 describes metadata composed of multiple Metadata Sections (UML Packages) containing one or more Metadata Entities (UML classes). This part of ISO 19115 specifies the additional Metadata Entities used to describe geospatial imagery and gridded data and the Metadata Sections identified in ISO 19115.

6.2 Imagery and gridded data metadata packages

Metadata package and entity relationship in Figure 1 illustrates the layout of the packages described in ISO 19115:2003 and in this part of ISO 19115. Only the packages with extensions are shown. The ISO 19115:2003 UML model diagrams and data dictionary for each package are fully specified in ISO 19115:2003. The additional metadata for geospatial imagery and gridded data is fully specified in the UML model diagrams and data dictionary for each additional package, which can be found in Annex A and Annex B, respectively. If a discrepancy between the two annexes exists, Annex A shall be considered authoritative.

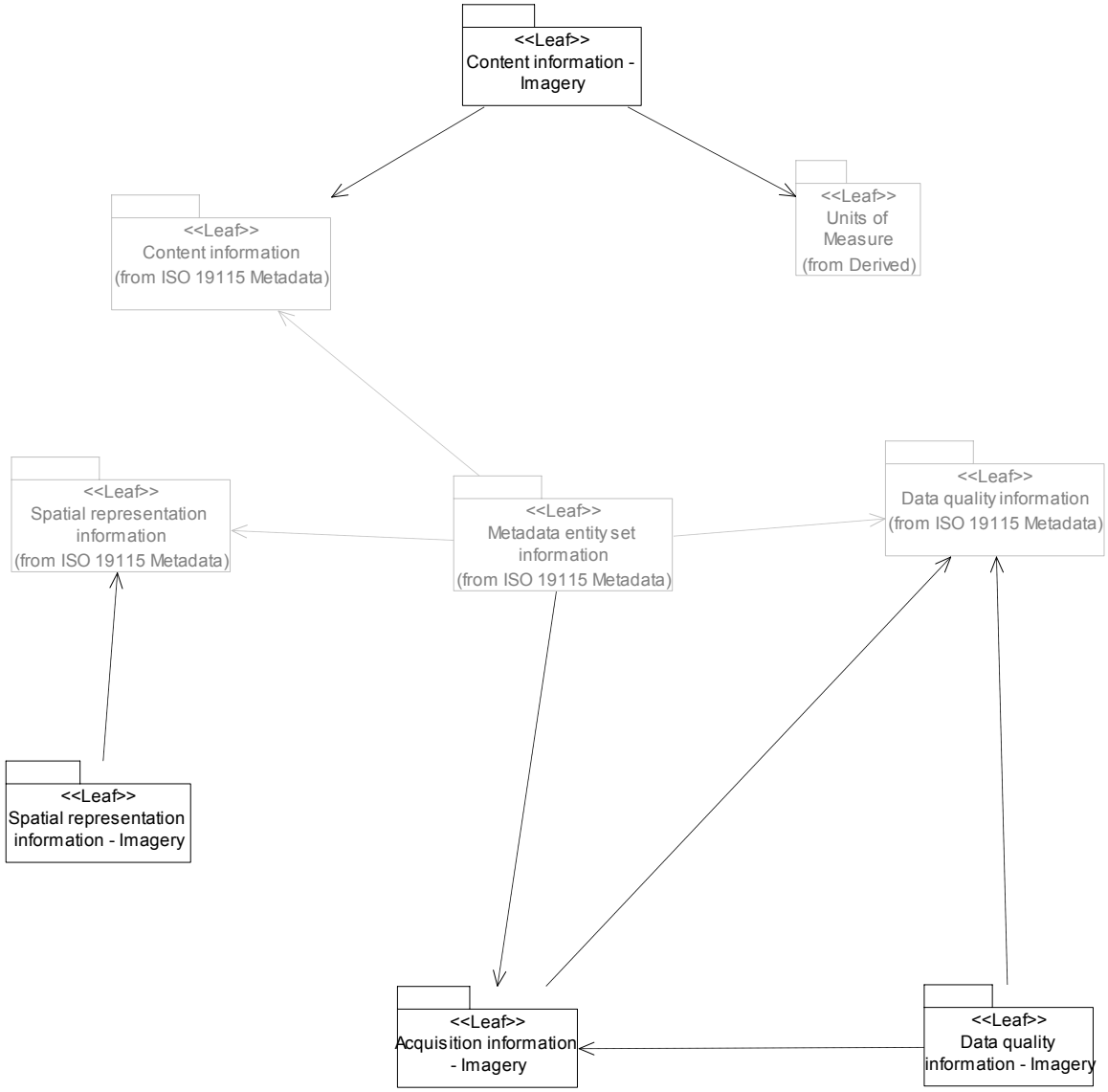

Figure 1 — Metadata packages

To ensure global uniqueness of class names, ISO/TS 19103 (6.10) requires that all class names be defined with a bi-alpha prefix. ISO 19115:2003 prefixes MD (Metadata), CI (Citation), DQ (Data quality), EX (Extent), and LI (Lineage). To differentiate between ISO 19115:2003 and entities of this part of ISO 19115, this part uses different prefixes. The prefixes used are MI (Metadata for imagery and gridded data), LE (Lineage extended) and QE (Data quality extended). The prefix is followed by an underscore character ('_') in the entities names in this part, as is the convention of ISO 19115:2003.

Table 1 — Externally defined UML classes

Identifier	Package	Standard
CI	Citation	ISO 19115
DQ	Data Quality	ISO 19115
EX	Extent	ISO 19115
GM	Geometry	ISO 19107
LE	Lineage Extensions for Imagery	ISO 19115-2
LI	Lineage	ISO 19115
MD	Metadata	ISO 19115
MI	Metadata Extensions for Imagery	ISO 19115-2
MX	Metadata – XML schema implementation	ISO 19139
QE	Data quality – Extensions for imagery	ISO 19115-2
SD	Sensor Data	ISO 19130

6.2.1 Imagery and gridded data package descriptions

6.2.1.1 Metadata Entity Set information

An additional package of metadata is specified here. MI_Metadata is a specified subclass of MD_Metadata and aggregates the optional entity MI_AcquisitionInformation.

6.2.1.2 Data quality information

The data quality package is defined in ISO 19115 as a container of a general assessment of the quality of the dataset. In addition, the package contains information about the sources and production processes used in producing a dataset, which is of particular importance for imagery and gridded data. The following classes have been added in this part of ISO 19115:

— QE_CoverageResult is a specified subclass of DQ_Result and aggregates information required to report data quality for a coverage. From ISO 19115, the classes MD_SpatialRepresentation, MD_CoverageDescription, and MD_Format are aggregated as part of the coverage data quality result. In addition, an association with MX_DataFile (defined in ISO/TS 19139) provides a means to identify a complete report of the quality of the coverage

— QE_Usability is a specified subclass of DQ_Element used to provide user specific quality information about a dataset's suitability for a particular application

— LE_ProcessStep is a specified subclass of LI_ProcessStep and contains additional information on the history of the algorithms used and processing performed to produce the data. LE_ProcessStep aggregates the following entities:

  — LE_Processing, describes the procedure (such as software used, parameters, and processing documentation) by which the algorithm was applied to generate the data from the source data. LE_Processing aggregates LE_Algorithm, which describes the methodology used to derive the data from the source data

  — LE_ProcessStepReport identifies external information describing the processing of the data

  — LE_Source, is a specified subclass of LI_Source and describes the output of a process step

6.2.1.3 Spatial representation information

The spatial representation package contains information concerning the mechanisms used to represent spatial information. MI_GeorefencingDescription is a specified subclass of MD_Georeferenceable that contains addition information used to support georectification of the data. MI_GeoreferencingDescription is an aggregation of the following entities:

— MI_Georectified is a specified subclass of MD_Georectified that contains check point information to further specify georectification details of the imagery or gridded data. MI_Georectified aggregates SD_GCP from ISO 19130 to provide the checkpoint location information

— MI_Georeferenceable is a specified subclass of MD_Georeferenceable that includes additional information that can be used to geolocate the data. MI_Georeferenceable aggregates SD_GeolocationInformation from ISO 19130 to provide this additional information

6.2.1.4 Content information

This package is defined in ISO 19115:2003, and this part of ISO 19115 expands on the information content that can be used to describe the content of a coverage dataset.

— MI_Band is a specified class of MD_Band defining additional attributes for specifying properties of individual wavelength bands in the dataset.

— MI_ImageDescription is a specified subclass of MD_ImageDescription used to aggregate MI_RangeElementDescription

— MI_CoverageDescription is a specified subclass of MD_CoverageDescription used to aggregate MI_RangeElementDescription

— MI_RangeElementDescription provides identification of the range elements used in a coverage dataset

6.2.1.5 Acquisition Information

This package is particular to this international standard and provides details specific to the acquisition of imagery and gridded data. MI_AcquisitionInformation is an aggregate of the following entities:

— MI_Instrument, designations of the measuring instruments used to acquire the data

— MI_Operation, designations of the overall data gathering program to which the data contribute

— MI_Platform, designations of the platform from which the data were taken

— MI_Objective, the characteristics and geometry of the intended object to be observed

— MI_Requirement, the user requirements used to derive the acquisition plan

— MI_Plan, the acquisition plan that was implemented to acquire the data

Two additional classes are required to provide information on the acquisition of the data. These are:

— MI_Event, describes a significant event that occurred during data acquisition. An event can be associated with an operation, objective, or platform pass

— MI_PlatformPass, identifies a particular pass made by the platform during data acquisition. A platform pass is used to provide supporting identifying information for an event and for data acquisition of a particular objective.

6.3 Unified Modeling Language (UML) diagrams

Annex A provides the metadata schemas in the form of Unified Modeling Language (UML) class diagrams. These diagrams illustrate the extension entities defined in this part of the standard and augments the UML diagrams in ISO 19115. Only the packages that have been extended from ISO 19115 are included in Annex A. Combined with the data dictionary in Annex B and the UML diagrams and data dictionary in ISO 19115, this part of ISO 19115 fully defines the total abstract model for metadata.

6.4 Data dictionary

Annex B contains the element and entity definitions for the metadata schemas defined in this part of the standard. This dictionary, in conjunction with the diagrams presented in Annex A and in combination with the UML diagrams and data dictionary presented in Part 1, serve to fully define the total abstract model for metadata.

Codelists and their values provided in this International Standard are normative. User extensions to codelists shall follow the rules as described in ISO 19115, Annex C and ISO/IEC 11179-6. ISO/IEC 11179-6 defines the information to be specified, conditions to be fulfilled, and procedures to be followed for registering data elements.

Annex A
(normative)

Imagery and gridded data metadata schemas

A.1 Metadata UML models

Metadata for describing geographic data and geospatial imagery and gridded data is defined using an abstract object model in the Unified Modeling Language (UML). The diagrams in the following sub-clauses provide views, which are portions of the total abstract model for metadata. Each diagram defines the extensions for a metadata section (UML package) of related entities, elements, data types, and code lists augmenting the corresponding metadata section in ISO 19115. Related entities, which are defined in another diagram, are shown with elements suppressed and the defining package specified under the entity name in parenthesis. Throughout the following models, entities may have mandatory and/or optional elements and associations. In some cases, optional entities may have mandatory elements; those elements become mandatory only if the optional entity is used.

Entities, elements and associations shown in light grey are defined in their entirety in 19115:2003. They are shown here for informational purposes.

A.2 Imagery and gridded data metadata package UML diagrams

A.2.1 Metadata entity set – Extension

Figure A.1 defines the extension to the MD_Metadata class for imagery and gridded data. The MI_Metadata class extends the MD_Metadata class used to provide information about the metadata. The extension provided through MI_Metadata adds an association to the MI_AcquisitionInformation class, the root class of the Acquisition Information package. The data dictionary for this extension can be found in B.2.1.

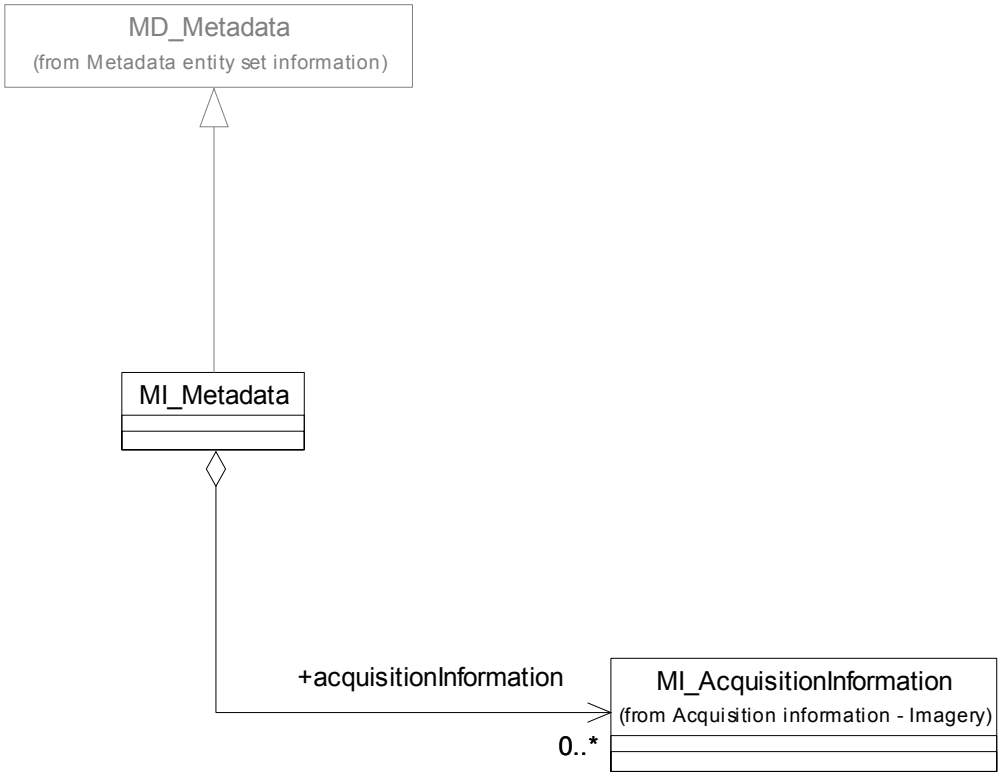

Figure A.1 — Metadata entity set extension

A.2.2 Data quality information

A.2.2.1 Extension to data quality result to support coverage quality

Figure A.2 defines an extended metadata class required to specify the reported quality for coverage data. The additional elements provide information about the representation of the quality result documenting the data in the dataset. The data dictionary for this diagram is located in B.2.2.

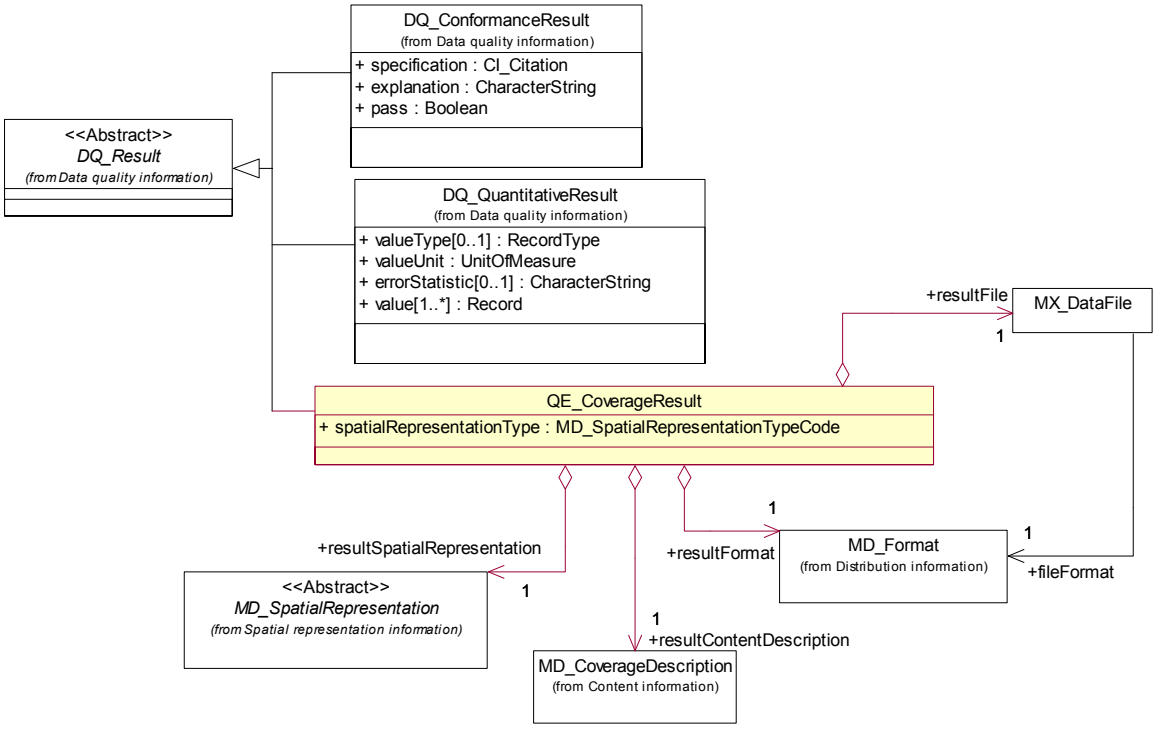

Figure A.2 — Data quality result

The specification of **DQ_CoverageResult** is simply based on existing concepts form ISO 19115 and ISO 19139:

— the coverage result has a spatial representation which, in some cases, can be exactly the same as the resource spatial representation or may differ (e.g., coverage result computed on a vector database or coverage result using a sample of the resource). The construct used to describe the spatial representation of the coverage result is the **MD_SpatialRepresentation** class. The ***resultSpatialRepresentation*** property is mandatory but can be implemented as a reference to the instance of **MD_SpatialRepresentation** related to the resource.

— the coverage result has a content description. The construct used to describe the content of the result coverage is **MD_CoverageDescription**. The resulting coverage will often be defined by the distribution of a single attribute over the result coverage domain, but it is anticipated that the range type of the result coverage can comprise many attributes.

— the coverage result has a format which is expressed through the **MD_Format** class.

— the coverage result is associated to a data file containing the coverage result data. The construct used to describe the result coverage data file is **MX_DataFile** (from ISO 19139).

A.2.2.2 Lineage information

Figure A.3 defines the extended metadata classes required to specify the lineage of imagery and gridded data datasets. The additional elements provide information about the processing of the raw data that was performed to produce the data in the dataset. The data dictionary for this diagram is located in B.2.2.

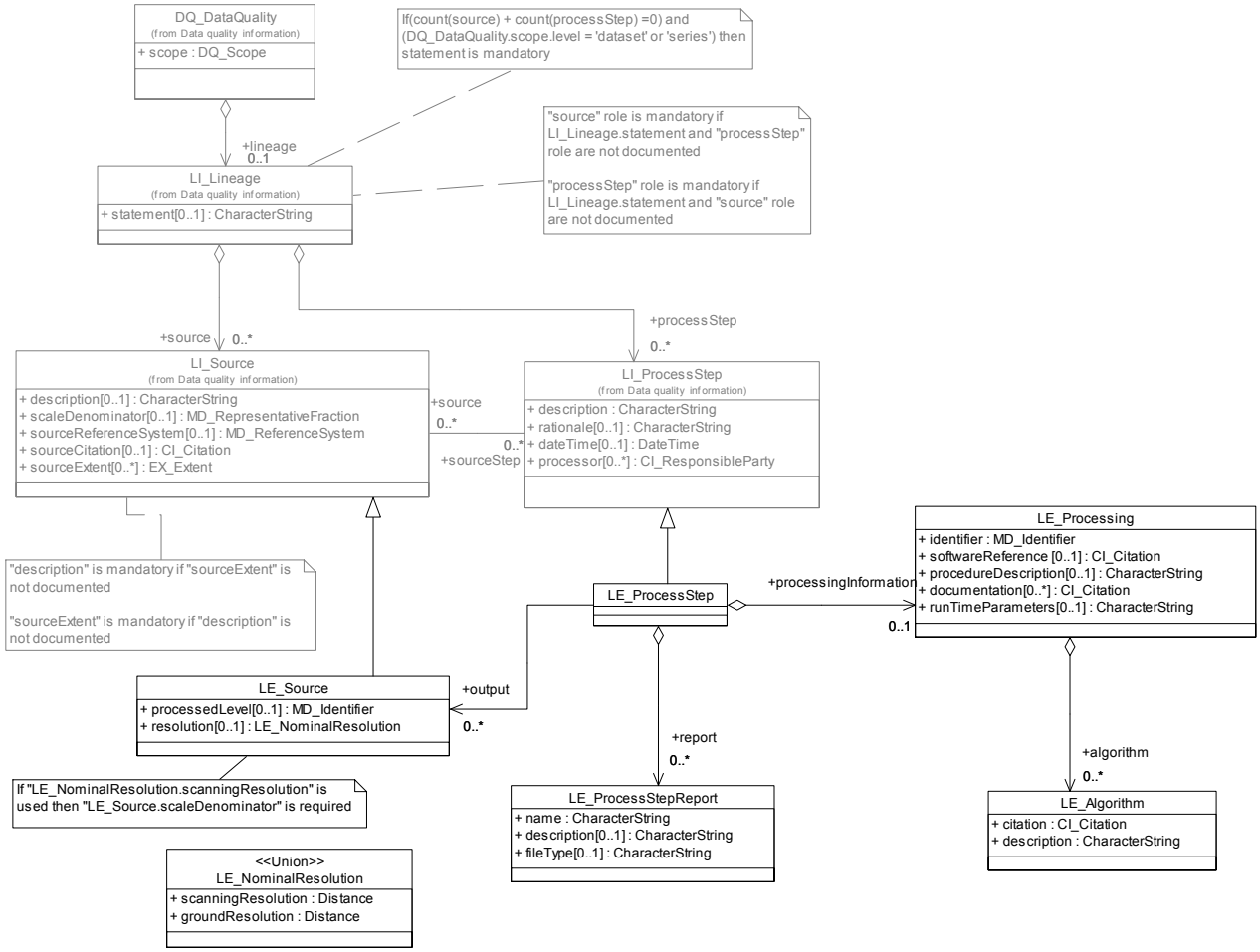

Figure A.3 — Data quality information – Lineage

A.2.3 Extension to data quality classes and subclasses

Figure A.4 defines an extended metadata class required to provide information on the usability of a dataset. Usability provides information about the dataset indicating that it can be used in a specific user context. This data quality measure differs from those specified in the base standard in that it provides a measure of the data quality complimentary to those in the base standard but containing a set of measures specific to a user's requirements. The data dictionary for this diagram is located in B.2.2.

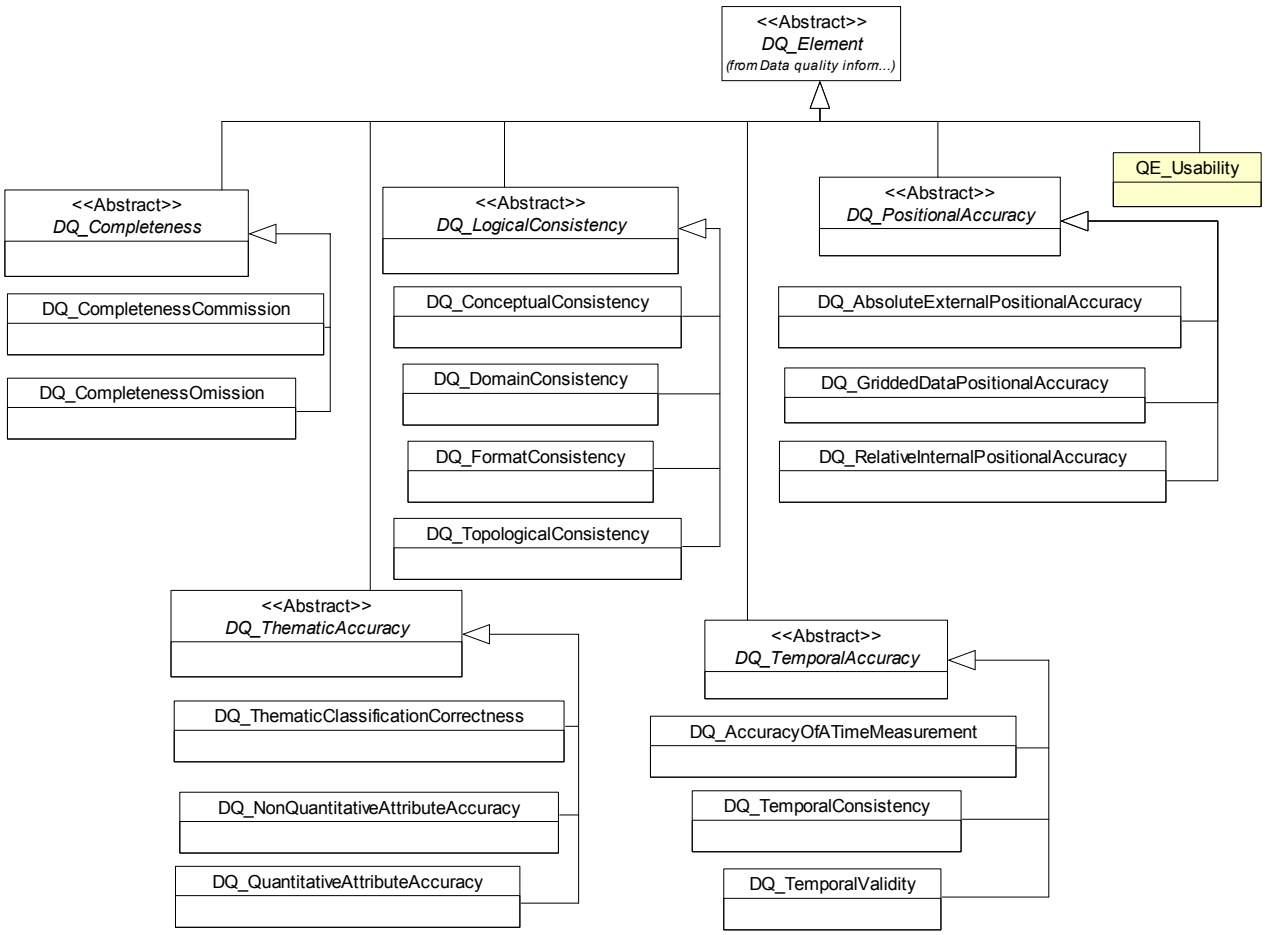

Figure A.4 — Extension to data quality subclasses

A.2.4 Spatial representation information

Figure A.5 defines the extended metadata classes required to specify the spatial representation for imagery and gridded data. The data dictionary for this diagram is located in B.2.2.8.

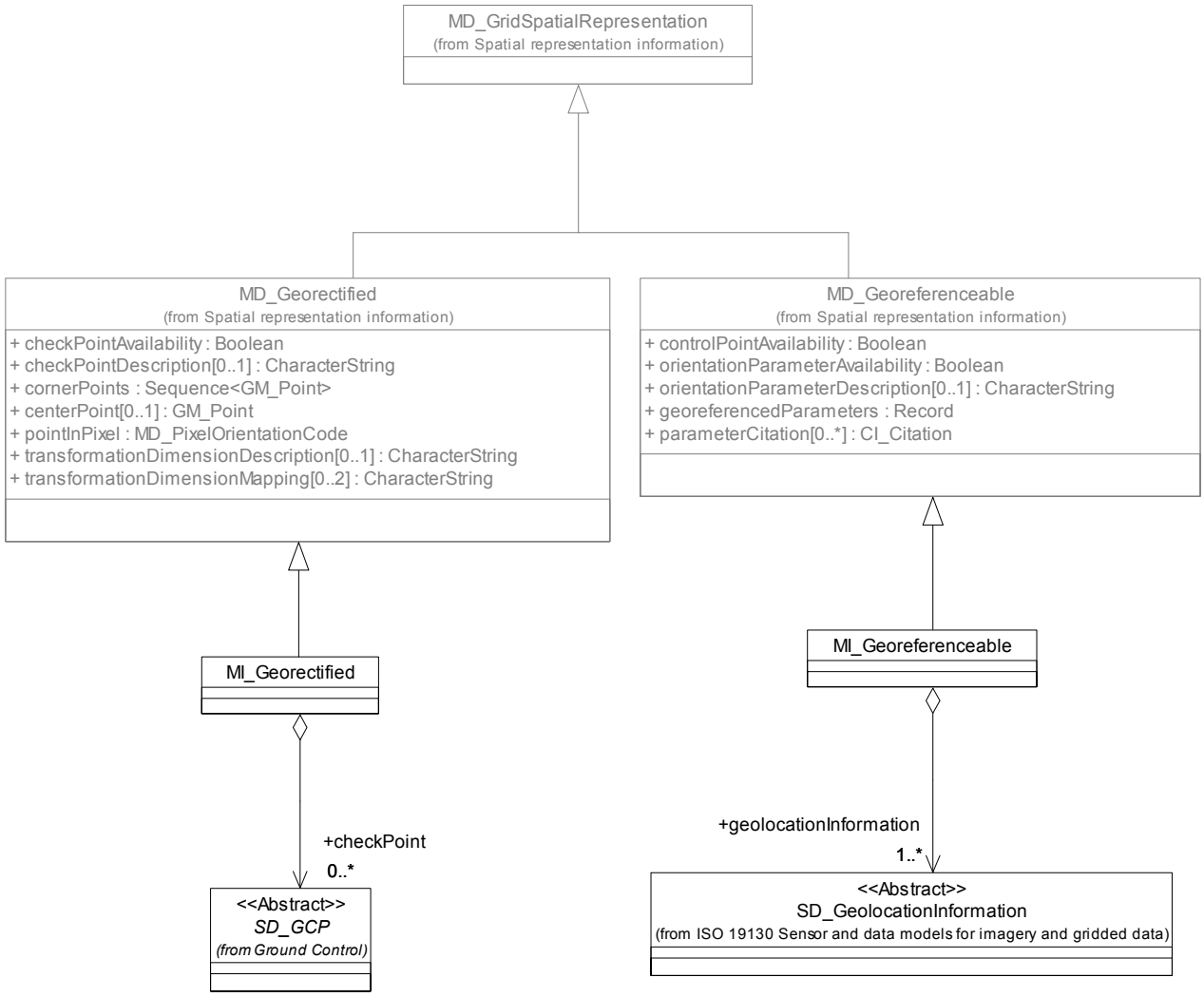

Figure A.5 — Spatial representation information

A.2.5 Content information

Figure A.6 defines the extended metadata classes required to describe the content of imagery and gridded data datasets. The data dictionary for this diagram is located in B.2.4.

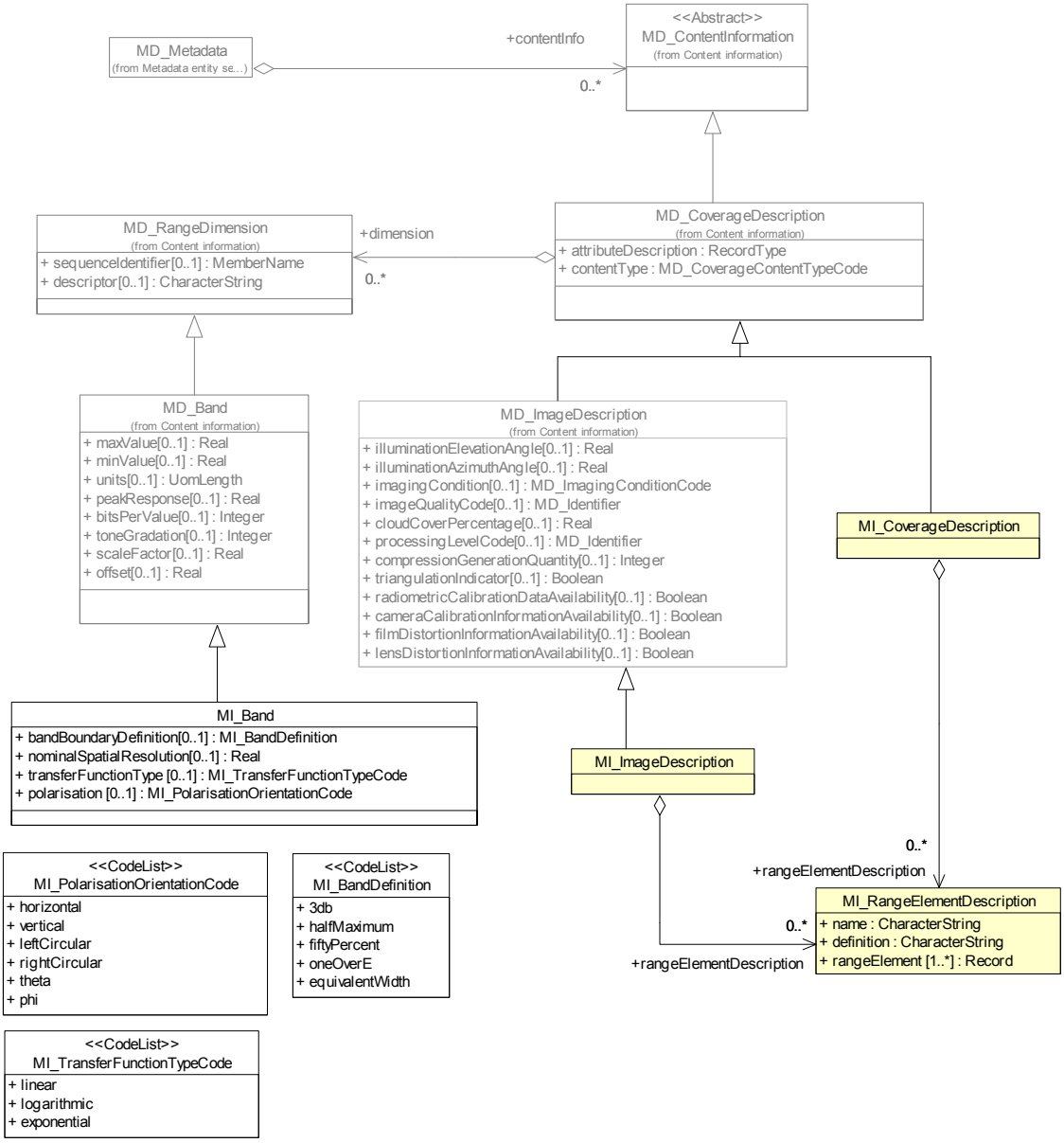

Figure A.6 — Content information

A.2.6 Acquisition Information

A.2.6.1 Acquisition Overview

Figure A.5 defines an overview of the extended metadata classes required to define the acquisition of imagery and gridded datasets. The data dictionary for this diagram can be found in B.2.5.

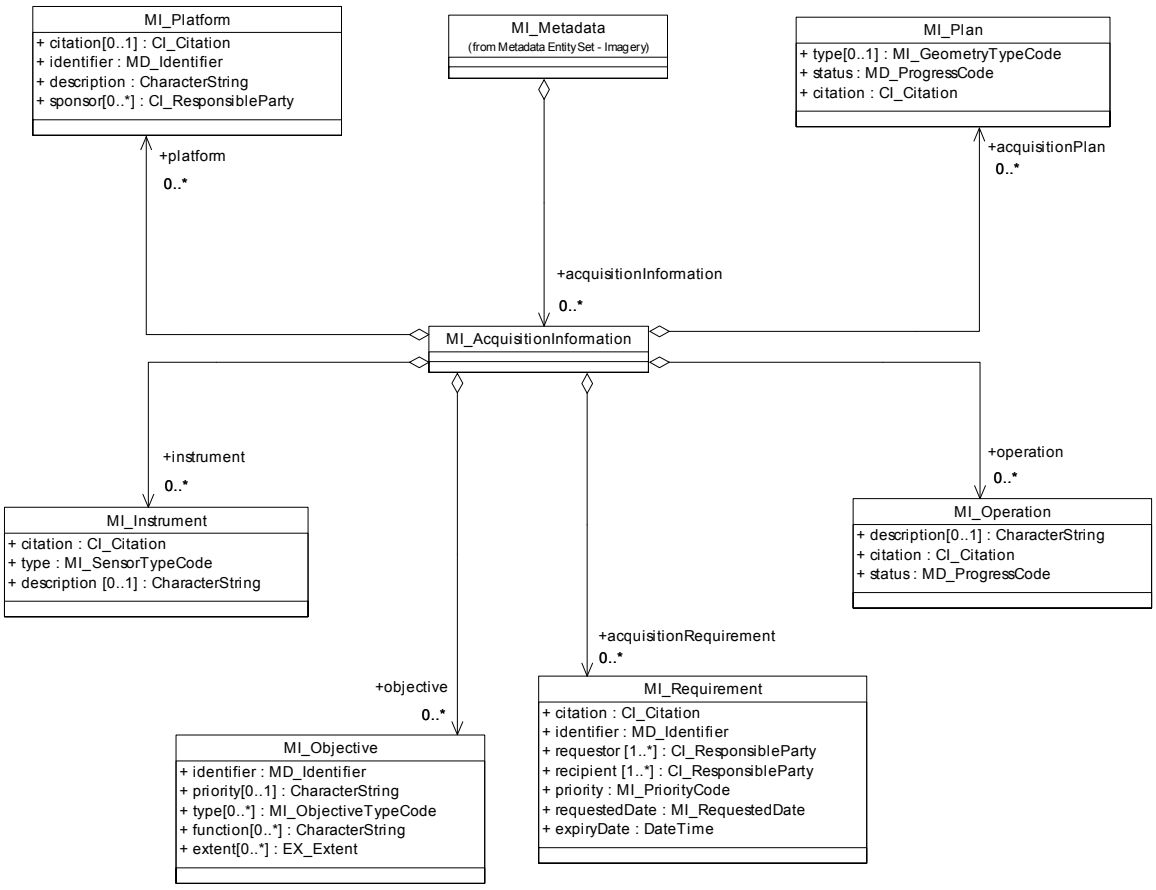

Figure A.7 — Acquisition Overview

A.2.6.2 Acquisition Details

Figure A.6 defines, in detail, the extended metadata classes necessary to define the acquisition of imagery and gridded datasets. The data dictionary for this diagram can be found in B.2.5.

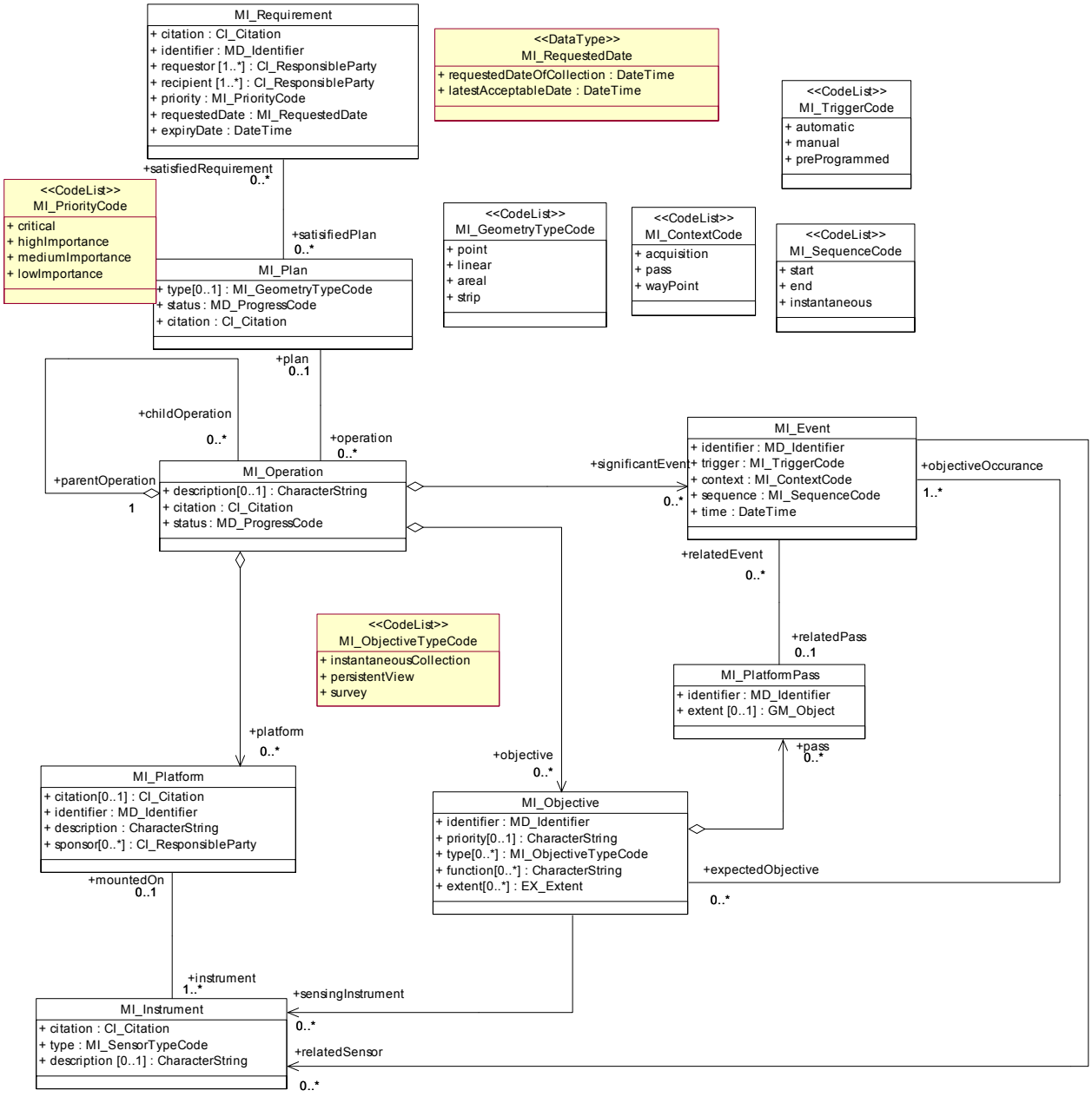

Figure A.8 — Acquisition Details

Annex B
(normative)

Imagery and gridded data metadata data dictionary

B.1 Data dictionary overview

Refer to ISO 19115:2003 for description of layout.

B.2 Imagery and gridded data metadata package data dictionaries

B.2.1 Metadata entity set information - Extension

- UML model shown in Figure A.1.

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
1.	MI_Metadata	IMetadata	root entity that defines information about imagery or gridded data	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Metadata)	Line 2
2.	*Role name*: acquisitionInformation	acquistionInfo	provides information about the acquisition of the data	O	N	Association	MI_AcquisitionInformation

B.2.2 Data quality information

B.2.2.1 Coverage result

- UML model shown in Figure A.2.

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
3.	QE_CoverageResult	CoverageResult	result of a data quality measure organising the measured values as a coverage	Use obligation from referencing object	Use maximum occurrence from referencing object	Specialised class (DQ_Result)	Lines 3 to 8
4.	spatialRepresentationType	spaRepType	method used to spatially represent the coverage result	M	1	Class	MD_Spatial RepresentationTypeCode <<CodeList>> (ISO 19115, B.5.26)
5.	*Role name:* resultSpatial Representation	resSpaRep	provides the digital representation of data quality measures composing the coverage result	M	1	Class	MD_Spatial Representation <<Abstract>> (ISO 19115, B.2.6)
6.	*Role name:* resultContentDescription	resCntDesc	provides the description of the content of the result coverage, i.e. semantic definition of the data quality measures	M	1	Class	MD_CoverageDescription (ISO 19115, B.2.8.1)
7.	*Role name:* resultFormat	resFmt	provides information about the format of the result coverage data	M	1	Class	MD_Format (ISO 19115, B.2.10.4)

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
8.	*Role name:* resultFile	resFile	provides information about the data file containing the result coverage data	M	1	Class	MX_DataFile (ISO 19130, B.2.3,3)

B.2.2.2 Lineage extensions

- UML model shown in Figure A.3.

B.2.2.2.1 Algorithm

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
9.	LE_Algorithm	Algorithm	details of the methodology by which geographic information was derived from the instrument readings	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_Processing)	Lines 10 and 11
10.	citation	algId	information identifying the algorithm and version or date	M	1	Class	<<DataType>> CI_Citation
11.	description	algDesc	information describing the algorithm used to generate the data	M	1	CharacterString	Free text

B.2.2.3 Nominal resolution

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
12.	LE_NominalResolution	NomRes	distance between adjacent pixels	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	Lines 13 and 14
13.	scanningResolution	scanRes	distance between adjacent pixels in the scan plane	M	1	Class	<<Type>> Distance
14.	groundResolution	groundRes	distance between adjacent pixels in the object space	M	1	Class	<<Type>> Distance

B.2.2.4 Processing

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
15.	LE_Processing	Procsg	comprehensive information about the procedure(s), process(es) and algorithm(s) applied in the process step.	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_ProcessStep)	Lines 16 to 21
16.	identifier	procInfoId	information to identify the processing package that produced the data	M	1	Class	<<DataType>> MD_Identifier
17.	softwareReference	procInfoSwRef	reference to document describing processing software	O	1	Class	<<DataType>> CI_Citation
18.	procedureDescription	procInfoDesc	additional details about the processing procedures	O	1	CharacterString	Free text
19.	documentation	procInfoDoc	reference to documentation describing the processing	O	N	Class	<<DataType>> CI_Citation
20.	runTimeParameters	procInfoParam	parameters to control the processing operations, entered at run time	O	1	CharacterString	Free text
21.	*Role name*: algorithm	algorithm	details of the methodology by which geographic information was derived from the instrument readings	O	N	Association	LE_Algorithm

B.2.2.5 Process step

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
22.	LE_ProcessStep	DetailProcStep	information about an event or transformation in the life of the dataset including details of the algorithm and software used for processing	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (SD_SubImage)	Lines 12 to 25
23.	*Role name*: output	procStepOut	product generated as a result of the process step	O	N	Association	LE_Source

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
24.	*Role name*: processingInformation	procInfo	comprehensive information about the procedure by which the algorithm was applied to derive geographic data from the raw instrument measurements, such as datasets, software used, and the processing environment	O	1	Association	LE_Processing
25.	*Role name*: report	procReport	report generated by the process step	O	N	Association	LE_ProcessStepReport

B.2.2.6 Process Step Report

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
26.	LE_ProcessStepReport	ProcStepRep	report of what occurred during the process step	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_ProcessStep)	Lines 27 to 29
27.	name	procRepName	name of the processing report	M	1	CharacterString	Free text
28.	description	procRepDesc	textual description of what occurred during the process step	O	1	CharacterString	Free text
29.	fileType	procRepFilTyp	type of file that contains that processing report	O	1	CharacterString	Free text

B.2.2.7 Source extensions

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
30.	LE_Source	SourceExt	information on source of data sets for processing step	Use obligation from referencing object	Use maximum occurrence from referencing object	Specialised Class (LI_Source)	Lines 31 and 32
31.	processedLevel	procLevel	processing level of the source data	O	1	Class	<<DataType>> MD_Identifier
32.	resolution	procResol	distance between two adjacent pixels	O	1	Class	<<Union>> LE_NominalResolution
NOTE If LE_Source.resolution.scanningResolution is specified, then LE_Source.scaleDenominator (inherited from LI_Source) is required.							

B.2.2.8 Data quality element extension for usability

- UML model shown in Figure A.4.

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
33.	QE_Usability	Usability	degree of adherence of a dataset to a specific set of user requirements	Use obligation from referencing object	Use maximum occurrence from referencing object	Specialised class (DQ_Element)	

B.2.3 Spatial representation information

B.2.3.1 Introduction

- UML model shown in Figure A.5

B.2.3.2 Georectified – Extensions

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
34.	MI_Georectified	IGeorect	extends georectified grid description to include associated checkpoints	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Georectified)	Line 35
35.	*Role name*: checkPoint	chkPt	geographic references used to validate georectification of the data	O	N	Association	SD_GCP

B.2.3.3 Georeferenceable – Extensions

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
36.	MI_Georeferenceable	IGeoref	description of information provided in metadata that allows the geographic or map location raster points to be located	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Georeferenceable)	Line 37
37.	*Role name*: geolocationInformation	geolocInfo	information that can be used to geolocate the data	M	N	Association	SD_GeolocationInformation

B.2.4 Content information

B.2.4.1 Introduction

- UML model shown in Figure A.6.

B.2.4.2 Wavelength band information

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
38.	MI_Band	BandExt	extensions to electromagnetic spectrum wavelength description	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Band)	Lines 39 to 42
39.	bandBoundaryDefinition	bBndDef	designation of criterion for defining maximum and minimum wavelengths for a spectral band	O	1	Class	<<CodeList>> MI_BandDefinition
40.	nominalSpatialResolution	bndRes	smallest distance between which separate points can be distinguished, as specified in instrument design	O	1	Real	Real
41.	transferFunctionType	scalXfrFunc	transform function to be used when scaling a physical value for a given element	O	1	Class	<<CodeList>> MI_TransferFunctionType Code
42.	polarisation	polarisation	polarisation of the transmitter or detector	O	1	Class	<<CodeList>> MI_PolarisationOrientation Code

B.2.4.3 Coverage and image description – Extensions

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
43.	MI_CoverageDescription	CCovDesc	information about the content of a coverage, including the description of specific range elements	Use obligation from referencing object	Use maximum occurrence from referencing object	Specialised class (MD_Coverage Description)	Line 44
44.	*Role name*: rangeElementDescription	cRgEltDesc	provides the description of the specific range elements of a coverage	O	N	Class	MI_RangeElement Description

45.	MI_ImageDescription	ICovDesc	information about the content of an image, including the description of specific range elements	Use obligation from referencing object	Use maximum occurrence from referencing object	Specialised class (MD_ImageDescription)	Line 46
46.	*Role name*: rangeElementDescription	iRgEltDesc	provides the description of the specific range elements of an image	O	N	Class	MI_RangeElement Description
47.	MI_RangeElement Description	RgEltDesc	description of specific range elements	Use obligation from referencing object	Use maximum occurrence from referencing object	Class	Lines 48 to 50
48.	name	rgEltName	designation associated with a set of range elements	M	1	CharacterString	Free text
49.	definition	rgEltDef	description of a set of specific range elements	M	1	CharacterString	Free text
50.	rangeElement	rgElt	specific range elements, i.e. range elements associated with a name and definition defining their meaning	M	N	Class	Record (ISO 19115, B.4.3)

B.2.5 Acquisition Information

B.2.5.1 General

- UML model shown in Figure A.7.

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
51.	MI_AcquisitionInformation	PltfrmInstId	designations for the measuring instruments and their bands, the platform carrying them, and the mission to which the data contributes	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Metadata)	Lines 52 to 57
52.	*Role name*: acquisitionPlan	acquisPlan	identifies plan implemented by the acquisition	O	N	Association	MI_Plan
53.	*Role name*: acquisitionRequirement	acquisReq	identifies requirement the data acquisition is intended to satisfy	O	N	Association	MI_Requirement
54.	*Role name*: instrument	instrId	general information about the instrument used in data acquisition	C / if sensor used in the collection of the data?	N	Association	MI_Instrument

55.	*Role name*: objective	objId	identification of the area or object to be sensed	O	N	Association	MI_Objective
56.	*Role name*: operation	missionId	general information about the platform from which the data were taken	C / if the data was collected as part of a mission?	N	Association	MI_Operation
57.	*Role name*: platform	platformId	general information about an identifiable activity which provided the data	C / if platform used in the collection of the data?	N	Association	MI_Platform

B.2.5.2 Event identification

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
58.	MI_Event	Event	identification of a significant collection point within an operation	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Operation)	Lines 59 to 66
59.	identifier	evtId	event name or number.	M	1	Class	<<DataType>> MD_Identifier
60.	trigger	evtTrig	initiator of the event.	M	1	Class	<<CodeList>> MI_TriggerCode
61.	context	evtCntxt	meaning of the event.	M	1	Class	<<CodeList>> MI_ContextCode
62.	sequence	evtSeq	relative time ordering of the event.	M	1	Class	<<CodeList>> MI_SequenceCode
63.	time	evtTime	time the event occured.	M	1	Class	<<Type>> DateTime
64.	*Role name*: expectedObjective	evtObj	objective or objectives satisfied to an event.	O	N	Association	MI_Objective
65.	*Role name*: relatedPass	evtPass	pass during which an event occurs.	O	1	Association	MI_PlatformPass
66.	*Role name*: relatedSensor	evtSnsr	instrument or instruments for which the event is meaningful.	O	N	Association	MI_Instrument

B.2.5.3 Instrument identification

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
67.	MI_Instrument	PltfrmInstId	designations for the measuring instruments	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	Lines 68 to 71
68.	citation	instNam	complete citation of the instrument	M	1	Class	<<DataType>> CI_Citation
69.	type	instType	code describing the type of instrument	M	1	Class	<<CodeList>> MI_SensorTypeCode
70.	description	instDesc	textual description of the instrument	O	1	CharacterString	Free text
71.	*Role name*: mountedOn	instPlatform	platform the instrument is mounted on	O	1	Association	MI_Platform

B.2.5.4 Objective information

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
72.	MI_Objective	TargetId	describes the characteristics, spatial and temportal extent of the intended object to be observed	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information, MI_Operation)	Lines 73 to 80
73.	identifier	targetId	registered code used to identify the objective	M	1	Class	<<DataType>> MD_Identifier
74.	priority	trgtPriority	priority applied to the target	O	1	CharacterString	Free text
75.	type	trgtType	collection technique for the objective	O	N	Class	<<CodeList>> MI_ObjectiveTypeCode
76.	function	trgtFunct	function performed by or at the objective	O	N	CharacterString	Free text
77.	extent	trgtExtent	extent information including the bounding box, bounding polygon, vertical and temporal extent of the objective	O	N	Class	<<DataType>> EX_Extent
78.	*Role name*: objectiveOccurance	trgtEvt	event or events associated with objective completion.	M	N	Association	MI_Event
79.	*Role name*: pass	trgtPass	pass of the platform over the objective	O	N	Association	MI_PlatformPass

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
80.	*Role name*: sensingInstrument	trgtInstr	instrument which sensed the objective data	O	N	Association	MI_Instrument

B.2.5.5 Operation information

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
81.	MI_Operation	MssnId	designations for the operation used to acquire the dataset	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information, MI_Operation)	Lines 82 to 89
82.	description	mssnDesc	description of the mission on which the platform observations are made and the objectives of that mission	O	1	CharacterString	Free text
83.	citation	pltMssnNam	identification of the mission	M	1	Class	<<DataType>> CI_Citation
84.	status	mssnStatus	status of the data acquisition	M	1	Class	<<CodeList>> MD_ProgressCode
85.	*Role name*: childOperation	subMission	sub-missions that make up part of a larger mission	O	N	Association	MI_Operation
86.	*Role name*: objective	mssnObj	object(s) or area(s) of interest to be sensed	O	N	Association	MI_Objective
87.	*Role name*: parentOperation	parentMission	heritage of the operation	M	1	Association	MI_Operation
88.	*Role name*: plan	mssnPlan	plan satisifed by the operation	O	1	Association	MI_Plan
89.	*Role name*: platform	mssnPltfrm	platform (or platforms) used in the operation	O	N	Association	MI_Platform
90.	*Role name*: significantEvent	mssnSigEvt	record of each event occuring during an operation	O	N	Association	MI_Event

B.2.5.6 Plan information

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
91.	MI_Plan	PlanId	designations for the planning information related to meeting requirements	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	Lines 91 to 95
92.	type	planType	manner of sampling geometry the planner expects for collection of the objective data	O	1	Class	<<CodeList>> MI_GeometryTypeCode
93.	status	planStatus	current status of the plan (pending, completed, etc.)	M	1	Class	<<CodeList>> MD_ProgressCode
94.	citation	planReqId	identification of authority requesting target collection	M	1	Class	<<DataType>> CI_Citation
95.	*Role name*: operation	planOper	identifiction of the activity or activities that satisfy a plan	O	N	Association	MI_Operation
96.	*Role name*: satisfiedRequirement	planReq	requirement satisified by the plan	O	N	Association	MI_Requirement

B.2.5.7 Platform identification

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
97.	MI_Platform	PltfrmId	designation of the platform used to acquire the dataset	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information, MI_Operation)	Lines 97 to 101
98.	citation	pltNam	complete citation of the platform	C / if shortName not specified?	1	Class	<<DataType>> CI_Citation
99.	identifier	pltId	unique identification of the platform.	M	1	Class	<<DataType>> MD_Identifier
100.	description	pltfrmDesc	narrative description of the platform supporting the instrument	M	1	CharacterString	Free text
101.	sponsor	pltfrmSpnsr	organization responsible for building, launch, or operation of the platform	O	N	Class	<<DataType>> CI_ResponsibleParty
102.	*Role name*: instrument	pltInstr	instrument(s) mounted on a platform	M	N	Association	MI_Instrument

B.2.5.8 Platform pass identification

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
103.	MI_PlatformPass	PlatformPass	identification of collection coverage	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Objective)	Lines 103 to 105
104.	identifier	passId	unique name of the pass	M	1	Class	<<DataType>> MD_Identifier
105.	extent	passExt	area covered by the pass	O	1	Class	<<Type>> GM_Object
106.	*Role name*: relatedEvent	passEvt	occurrence of one or more events for a pass	O	N	Association	MI_Event

B.2.5.9 Request date range

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
107.	MI_RequestedDate	ReqstDate	range of date validity	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 107 to 108
108.	requestedDateOf Collection	collectDate	preferred date and time of collection	M	1	Class	<<Type>> DateTime
109.	latestAcceptableDate	latestDate	latest date and time collection must be completed	M	1	Class	<<Type>> DateTime

B.2.5.10 Requirement information

	Name	Short Name	Definition	Obligation	Max Occurrence	Data Type	Domain
110.	MI_Requirement	Requirement	requirement to be satisfied by the planned data acquisiion	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	
111.	citation	reqRef	identification of reference or guidance material for the requirement	M	1	Class	<<DataType>> CI_Citation
112.	identifier	reqId	unique name, or code, for the requirement	M	1	Class	<<DataType>> MD_Identifier
113.	requestor	requestor	origin of requirement	M	N	Class	<<DataType>> CI_ResponsibleParty
114.	recipient	recipient	person(s), or body(ies), to recieve results of requirement	M	N	Class	<<DataType>> CI_ResponsibleParty
115.	priority	reqPri	relative ordered importance, or urgency, of the requirement	M	1	Class	<<CodeList>> MI_PriorityCode
116.	requestedDate	reqDate	required or preferred acquisition date and time	M	1	Class	<<DataType>> MI_RequestedDate
117.	expiryDate	reqExpire	date and time after which collection is no longer valid	M	1	Class	<<Type>> DateTime
118.	*Role name*: satisifiedPlan	reqPlan	plan that identifies solution to satisfy the requirement	O	N	Association	MI_Plan

B.3 Codelists and enumerations

B.3.1 Introduction

The classes in this part that are stereotyped <<Codelist>> and <<Enumeration>> can be found below. These two stereotype classes do not contain "obligation / condition", "maximum occurrence", "data type", and "domain" attributes. Classes stereotyped as <<Enumeration>> are closed (not extendable). Classes stereotyped as <<Codelist>> are extendable as documented in ISO 19115, Annex C and F.

B.3.2 MI_BandDefinition <<Codelist>>

	Name	Domain Code	Definition
1.	MI_BandDefinition	BndDef	designation of criterion for defining maximum and minimum wavelengths for a spectral band
2.	3db	001	width of a distribution equal to the distance between the outer two points on the distribution having power level half of that at the peak
3.	halfMaximum	002	
4.	fiftyPercent	003	
5.	oneOverE	004	
6.	equivalentWidth	005	

B.3.3 MI_ContextCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_ContextCode		
2.	acquisition	001	event related to a specific collection
3.	pass	002	event related to general collection
4.	wayPoint	003	event related to a navigational manoeuvre

B.3.4 MI_GeometryType <<Codelist>>

	Name	Domain Code	Definition
1.	MI_GeometryTypeCode		
2.	point	001	single geographic point of interest
3.	linear	002	extended collection in a single vector
4.	areal	003	collection of a geographic area definded by a polygon (coverage)
5.	strip	004	series of linear collections grouped by way points

B.3.5 MI_ObjectiveTypeCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_ObjectiveTypeCode		temporal persistance of collection objective
2.	instantaneousCollection	001	single instance of collection
3.	persistentView	002	multiple instances of collection
4.	survey	003	comparative collection

B.3.6 MI_PolarizationOrientationCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_PolarisationOrientationCode		
2.	horizontal	001	
3.	vertical	002	
4.	leftCircular	003	
5.	rightCircular	004	
6.	theta	005	
7.	phi	006	

B.3.7 MI_PriorityCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_PriorityCode		ordered list of priorities
2.	critical	001	of decisive importance
3.	highImportance	002	requires resources to be made available
4.	mediumImportance	003	normal operation priority
5.	lowImportance	004	to be completed when resources are available

B.3.8 MI_SequenceCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_SequenceCode		
2.	start	001	beginning of a collection
3.	end	002	end of a collection
4.	instantaneous	003	collection without a significant duration

B.3.9 MI_TransferFunctionTypeCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_TransferFunctionTypeCode		
2.	linear	001	
3.	logarithmic	002	
4.	exponential	003	

B.3.10 MI_TriggerCode <<Codelist>>

	Name	Domain Code	Definition
1.	MI_TriggerCode		
2.	automatic	001	event due to external stimuli
3.	manual	002	event manually instigated
4.	preProgrammed	003	event instigated by planned stimuli

Annex C
(normative)

Conformance

TBD

Annex D
(informative)

Georeferenceable dataset metadata application profile

EDITOR'S NOTE: In compiling the information for this document, there appear to be at least two broad groupings of imagery and gridded (remote sensed) data: georeferenceable data (raw or near raw data that has not be georectified) and georectified data. This annex and the next have been put in as placeholders in the event that it is desirable to define an application profile (either informative or normative) for these two groupings. One area that comes to mind is in spatial representation where georeferenceable data requires control points and other parametric data in order to process the data for georectification. Once the data has been georectified, the metadata required for the georectified dataset is different, yet it is desirable to retain the georefereencing information of the original dataset. These annexes could be used to illustrate how the georeferencing information is ideally maintained in the metadata for a georectified dataset (in the lineage metadata?). Also, would acquisition and sensor calibration information for the raw sensor data be maintained in the same metadata sections, or would this information be retained in the data quality – lineage section as well?

Annex E
(informative)

Georectified dataset application profile

TBD

Annex F
(informative)

Imagery Acquisition and Usage Discussion

F.1 Introduction

The following use cases present examples of the how geospatial imagery is used. The purpose of this information is to describe the business requirements for imagery metadata.

F.2 Operational Scenario for GLIMS

The goal of Global Land Ice Measurements from Space (GLIMS) is to inventory the world's glaciers, mainly as polygons representing glacier boundaries, and, where possible, to derive area vs. elevation histograms and surface flow vectors.

Analyses will be done on satellite imagery, primarily from the ASTER instrument, on the Terra platform, and Landsat. Some analyses will be performed on historical data coming from scanned maps. ASTER is the primary instrument because it was scheduled to acquire images over regions of interest with gains selected to maximize detail over ice and snow. ASTER has 3 sensor systems (VNIR, SWIR and TIR) as well as 2 telescopes (one VNIR band in the backward-looking telescope to allow for same-orbit stereoscopy).

Data are archived at EROS Data Center in NASA's EOSDIS Core System, with a plethora of metadata (hundreds of attributes).

The ASTER imagery used in the GLIMS analyses is Level 1b, where radiometric corrections have been applied and the data are gridded to a UTM projection. However, the images have not been orthorectified. Some analyses are performed on non-orthorectified images, while, since DEM extraction is possible, some analyses are performed on orthos. The GLIMS database has a field to specify whether the image used was orthorectified or not.

DEM generation utilizes the nadir- and aft-looking VNIR band 3. A rigorous sensor model is constructed from the sensor geometry and the satellite ephemeris data. If there are no GCPs available a "relative" DEM can be produced.

Flow vectors are derived from a sequence of images (ASTER has been flying since Dec. 1999). Orthorectification is always done first, but since often these scenes are in remote areas without GCPs, absolute positional accuracy is not high. However, images are coregistered and tied to the DEM using surface features.

ASTER and Landsat imagery already have a full compliment of data which I could supply and someone could do a cross walk with.

The GLIMS analyses, which are vector data, also have the metadata defined and I could supply an ERD and data dictionary. The metadata and vectors are all stored in the same spatially-enable relational database.

F.3 Photogrammetry Requirements

F.3.1 Planning of the photo-flight

Today **a photo-flight** is planned with a level of detail that determines every photostation with an accuracy of 1m in each dimension. The user interface includes a map-display and a pilot-guidance-system.

F.3.2 Data capture

The sensed data includes the digital images – since last year –, the GPS- und IMU-readings, time stamps, and weather conditions.

F.3.3 Data qualification

The aerotriangulation is a mathematical model that calculates the six exterior orientation parameters of each image based on common points that link the images (tie points), the camera-parameters (interior orientation), GPS- and IMU-readings, and ground control points. The process also reveals a detailed insight in the geometric quality (uncertainty) of the model and every involved parameter.

A stereo-model is a combination of two images that allow a 3D-data point measurement. A stereo-model is the base for 3D-applications. With the help of a computer a 3D-point can be derived from three or more images too, though that setup cannot be viewed by a human. Typical results of the 3D-measurement are 3D vector-data and Digital Elevation Models (DEMs).

3D vector-data are usually measured in conjunction with a CAD- or mapping-system. The link is established with a driver-software.

A DEM is often considered as having 2½ dimensions because there is exactly one elevation value defined for one planar position (coverage). Irregularly distributed points are usually combined to a TIN (triangulated irregular network). For a better representations of the terrain breaklines and other geometric items are used. There exist a number of different concepts to derive a smooth surface from those data. The data of a DEM typically come from Lidar-measurements, stereo-image correlation, and digitization of analogue maps. Newer applications such as 3D town visualization use wire-frame models.

An orthophoto is an image of a scene in which height parallaxes and perspective distortions have been removed to a certain extent. An orthophoto-mosaics is a combination of two or more neighbouring orthophotos where the borderlines have been made invisible.

The **3D visualization** is a well accepted photogrammetrical product of today. It includes a 3D-model of any level of detail and a dynamic observer and/or dynamic content.

F.3.4 Data storage and distribution

Data-related parameters a generated continuously during the workflow. **A data-history** keeps a comprehensive record of those parameters.

Digital photogrammetry and the use of digital aerial cameras in particular generates **data volumes** that reach one TeraByte per day or more. They impose new challenges on all steps of the work-flow.

F.3.5 Lidar project

A Lidar-project typically differs from a photogrammetrical project in its large volumes of vector-data (points) and in the specialized software that allows the derivation of high-quality DEM-products from those data.

F.3.6 Radar project

Mapping of surfaces using **radar-data** is still a rarely applied technique. However, it is in operation and it requires a specific set of parameters.