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## **URNs of definitions in ogc namespace**

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## i. Preface

NOTE The previous version of this document was numbered 04-077r1, now renumbered 05-010 after approval and final editing in 2005.

This Recommendation Paper specifies Universal Resource Names (URNs) for definitions in the “ogc” URN namespace. This document specifies the formats used by these URNs, plus a set of specific URNs for specific definitions. These definitions should be used wherever applicable by implementations of various OGC Implementation Specifications, including GML, WMS, WFS, and WCS.

Most of the current contents of this document were agreed on by the ad-hoc OGC working group on OWS harmonization, initiated at the June 2003 OGC meeting. The current editors of the various OWS interface Implementation Specifications have participated in this OWS harmonization group.

Suggested additions, improvements, and comments on this specification are welcome and encouraged. Such suggestions may be submitted to the editor by email message. Extensive and/or multiple changes can be suggested by making changes in an edited copy of this document. If you choose to submit suggested changes by editing this document, please make your suggested changes with change tracking on.

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### iii. Revision history

Date	Release	Editor	Primary clauses modified	Description
2004-12-17	0.0.0	Arliss Whiteside	All	Initial version
2005-01-07	0.0.0	Arliss Whiteside	7.1, 7.2	Adds information on referencing EPSG coordinate axis objects
2005-01-26	1.0.0	Arliss Whiteside	Cover, i, 7.1, 7.2	Removed information on referencing EPSG coordinate axis objects, edited as approved Recommendation Paper

### iv. Changes to the OGC Abstract Specification

The OGC™ Abstract Specification does not require changes to accommodate the technical contents of this document.

### v. Future work

Improvements in this document are desirable to:

- a) Add more and complete existing examples in Clause 7
- b) Specify additional URNs in Clause 8
- c) Specify meanings of additional URNs in Annex A

## Foreword

This document includes one normative annex: Annex A.

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

## **Introduction**

This document specifies Universal Resource Names (URNs) to be used for definitions in the “ogc” URN namespace. These definitions include definitions of Coordinate Reference Systems (CRSs) and related objects, as specified in OGC Abstract Specification Topic 2: Spatial referencing by coordinates. This document specifies the formats used by these URNs, including formats that can reference any definition recorded in the EPSG database. This document also specifies URNs for some specific definitions.

## URNs of definitions in ogc namespace

### 1 Scope

This document specifies Universal Resource Names (URNs) in the “ogc” URN namespace to be used for definitions. These definitions include definitions of Coordinate Reference Systems (CRSs) and related objects, as specified in OGC Abstract Specification Topic 2: Spatial referencing by coordinates. This document specifies the formats used by these URNs, including formats that can reference any definition recorded in the EPSG database. This document also specifies URNs for some specific definitions.

This document specifies URN formats for several uses, currently including referencing definitions of:

- a) Single objects
- b) Not-completely-specified objects
- c) Combined objects

Most XML attributes and elements with the anyURI data type that reference definitions, in all approved and draft OGC Implementation Specifications, can use a URN value in the “ogc” URN namespace. Such a URN shall be used when a URL cannot be used to electronically access that definition, by all clients and servers that may need to reference that definition.

The “ogc” definition URNs specified here should be used wherever applicable by implementations of all approved and draft OGC Implementation Specifications, including GML, WMS, WFS, and WCS. Additional definition URNs in the “ogc” URN namespace will be specified in other OGC documents.

### 2 Conformance

Conformance with this specification shall be checked using all the relevant tests specified in each separate specification that normatively references this specification, and specifically references the applicable parts of this specification.

### 3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this document. For dated references, subsequent

amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

IETF RFC 2141 (May 1997), *URN Syntax*, R. Moats  
<<http://www.ietf.org/rfc/rfc2141.txt>>

IETF RFC 2396 (August 1998), *Uniform Resource Identifiers (URI): Generic Syntax*, Berners-Lee, T., Fielding, N., and Masinter, L., eds.,  
<<http://www.ietf.org/rfc/rfc2396.txt>>

OGC 03-105r1, *OpenGIS Geography Markup Language (GML) Implementation Specification*, Version 3.1.0

OGC 04-013r4, *A URN namespace for the Open Geospatial Consortium (OGC)*, draft

OGC 04-024, *Geographic information — Web Map Service interface*, v1.3.0

OGC 04-046r3, *The OpenGIS Abstract Specification, Topic 2: Spatial Referencing by Coordinates*, October 2003

OGC 04-092r4, *OpenGIS Geography Markup Language (GML) Implementation Specification Schemas*, Version 3.1.1

OGC 05-008, *OGC Web Services Common Specification*, Version 1.0.0

W3C Recommendation January 1999, *Namespaces In XML*,  
<http://www.w3.org/TR/2000/REC-xml-names>.

W3C Recommendation 04 February 2004, *Extensible Markup Language (XML) 1.0* (Third Edition), <http://www.w3.org/TR/REC-xml>

W3C Recommendation 2 May 2001: *XML Schema Part 0: Primer*,  
<http://www.w3.org/TR/2001/REC-xmlschema-0-20010502/>

W3C Recommendation 2 May 2001: *XML Schema Part 1: Structures*,  
<http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/>

W3C Recommendation 2 May 2001: *XML Schema Part 2: Datatypes*,  
<http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/>

In addition to this document, this specification includes several normative XML document files. These files will be posted online at the URL <http://schemas.opengespatial.net/definitions/>. These XML files are also bundled with the present document. In the event of a discrepancy between the bundled and online versions of the XML files, the online files shall be considered authoritative.

## 4 Terms and definitions

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

### 4.1

#### **client**

software component that can invoke an **operation** from a **server**

### 4.2

#### **interface**

named set of operations that characterize the behaviour of an entity [ISO 19119]

### 4.3

#### **operation**

specification of a transformation or query that an object may be called to execute [ISO 19119]

### 4.4

#### **parameter**

variable whose name and value are included in an operation **request** or **response**

### 4.5

#### **request**

invocation of an **operation** by a **client**

### 4.6

#### **response**

result of an **operation**, returned from a **server** to a **client**

### 4.7

#### **server**

#### **service instance**

a particular instance of a **service** [ISO 19119 edited]

### 4.8

#### **service**

distinct part of the functionality that is provided by an entity through interfaces [ISO 19119]

capability which a service provider entity makes available to a service user entity at the interface between those entities [ISO 19104 terms repository]

### 4.9

#### **version**

version of an Implementation Specification (document) and XML Schemas to which the requested operation conforms

## 5 Conventions

### 5.1 Symbols (and abbreviated terms)

CRS	Coordinate Reference System
EPSG	European Petroleum Survey Group
GML	Geography Markup Language
ISO	International Organization for Standardization
OGC	Open Geospatial Consortium
OWS	OGC Web Service, or Open Web Service
TBD	To Be Determined
TBR	To Be Reviewed
URI	Universal Resource Identifier
URL	Uniform Resource Locator
URN	Universal Resource Name
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
XML	Extensible Markup Language
1D	One Dimensional
2D	Two Dimensional
3D	Three Dimensional

### 5.2 Document terms and definitions

The following specification terms and definitions are used in this document:

- a) shall – verb form used to indicate a requirement to be strictly followed to conform to this specification, from which no deviation is permitted
- b) should – verb form used to indicate desirable ability or use, without mentioning or excluding other possibilities
- c) may – verb form used to indicate an action permissible within the limits of this specification
- d) can – verb form used for statements of possibility
- e) informative – a part of a document that is provided for explanation, but is not required
- f) normative – a part of a standards document that is required

- g) annex – an auxiliary part of a document, called an “appendix” in United States English
- h) clause – a major part of a document, called a “section” or “paragraph” in United States English
- i) subclause – a secondary part of a clause or annex, called a “subsection” in United States English

## 6 Background

The URNs specified herein provide one way to reference a CRS in GML or in OGC Web Services (OWS) operation requests and responses. One frequent use will be referencing the CRS for a server input or output; another use will be referencing the CRS for a feature geometry or bounding box. These URNs are used to identify the referenced CRS, not to transfer a definition of that CRS. Most of this material is also applicable to referencing CRS components and Coordinate Operations and their components, often referred to as objects.

NOTE 1 Subclause C.14 of [OGC 05-008] summarizes many of the requirements considered when specifying how to reference CRSs.

Document [OGC 05-108] specifies that each specific OWS shall always reference a CRS by using a XML attribute or element with the type anyURI. Such an anyURI value can be used to reference a CRS whether the definition of that CRS is included in the same data transfer, is NOT included in the same data transfer, cannot be electronically accessed, or can be electronically accessed.

NOTE 2 In XML Schemas, the anyURI data type is the standard way to briefly reference (or cite) something specified elsewhere. XML attributes with the type anyURI include the GML 3.1.1 defined attributes named gml:srsName, gml:uom, xlink:href, and gml:codeSpace.

When using a XML attribute or element with the type anyURI to reference a CRS, CRS-related, or other object, that URI shall have a value which uses one of two alternative URI formats:

- a) Universal Resource Locator (URL), with standard form. The URL format should be used whenever the referenced definition is known to be electronically available using this standard URL.
- b) Universal Resource Name (URN), with a specified form. The URN format shall be used whenever the referenced definition is not, or might not be, available using a URL. This URN shall reference data that is specified by some “authority” and is “well-known” to both client and server software, including multiple clients and multiple servers.

NOTE 3 Two widely-used forms of URI are URL and URN. We are specifying using URNs as the way of citing CRS-related definitions that are "well-known" but are not adequately electronically available using a URL.

Subclause 10.3.2 of the OWS Common specification [OGC 05-108] specifies when and how to use URLs to reference a CRS or CRS-related object. Use of URNs is expected to be more common than use of URLs, and specific OWS Implementation Specifications are expected to specify many standard URN values.

## 7 URN formats for definitions in ogc namespace

### 7.1 URN format for single objects

For all XML attributes and elements with the anyURI data type, a URN value in the “ogc” URN namespace can be used to reference a definition specified in that URN namespace. When referencing the definition of a single object, a URN value for an anyURI data type shall have the form:

```
urn:ogc:def:objectType:authority:version:code
```

The “urn”, “ogc”, “def”, and six “:” parts of this URN are fixed. The “ogc” part shall be the registered namespace authority for all URNs used by the OGC. The “def” part shall be the fixed category label which identifies all the OGC URNs that reference object definitions. The “objectType” part shall be an OGC-specified unique-identifier of the type of the referenced definition.

NOTE 1 The “ogc” part denotes the namespace authority in a URN, and the value used should be registered with IANA. Until the “ogc” or other value is so registered by the OGC, the “x-ogc” value should be used, where the “x” denotes an experimental namespace.

The “authority” part shall be the OGC-specified abbreviation for the authority organization that specified the referenced definition. The optional “version” part shall be the version of the authority or code for the referenced definition. The “code” part shall be a unique identifier of the referenced definition, as specified by the referenced authority. The “code” part can be human-understandable, provided that it is unique for that authority, version, and objectType. In this use, all textual parts of URN values shall be case-insensitive.

The “authority” part identifies an authority recognized by the OGC. The OGC recognizes the European Petroleum Survey Group as an authority, with the abbreviation “EPSG”. The OGC also recognizes itself as one or more authorities, here using “OGC” as the one current authority abbreviation. The OGC must specify the “code” values defined by the “OGC” authority, and Clause 8 of this document specifies some of these codes. However, additional OGC codes can be specified in specific OGC Implementation Specifications and Recommendation Papers.

The “version” part of these URNs can be omitted when the referenced definition does not have a version, and the referenced definition is not specific to an authority version. When included, the “version” shall be recorded in the format specified by the authority, sometimes “N.N.N” or “N.N”, where each “N” stands for an integer. No “v” or other version prefix shall be included.

The “objectType” part is required, and the allowed “objectType” values shall include:

- a) crs, for all coordinate reference systems
- b) datum, for all datums
- c) meridian, for all prime meridians
- d) ellipsoid, for all ellipsoids
- e) cs, for all coordinate systems
- f) axis, for all coordinate system axes
- g) coordinateOperation, for all coordinate operations
- h) method, for all operation methods
- i) parameter, for all operation parameters
- j) group, for all operation parameter groups
- k) derivedCRSType, for all derived CRS type codes
- l) verticalDatumType, for all vertical datum type codes
- m) pixelInCell, for all PixelInCell codes
- n) rangeMeaning, for all range meaning codes
- o) axisDirection, for all axis direction codes
- p) uom, for all units of measure

Except for the “uom” value, all values listed above refer to concepts specified in Abstract Specification Topic 2 [OGC 04-046r3].

Specializing the above, the URN value for an anyURI that references one object in the European Petroleum Survey Group (EPSG) database shall have the form:

```
urn:ogc:def:objectType:EPSG:version:code
```

In this case, the “authority” part of a URN shall be “EPSG”. The “code” part of a URN should be the EPSG “code” unique identifier of the referenced definition. Alternately, the “code” part of a URN can be the EPSG “name” unique identifier. The “version” part shall be included in this case, since the EPSG sometimes deprecates and replaces existing definitions.

NOTE 2 The EPSG does not make any substantive changes to existing entries. However, if a record is found to be incorrect, that record is deprecated and replaced. When this is done, the deprecation field of the deprecated record is changed from “no” to “yes”. (In some implementations, “no” may be “0” or “false”, and “yes” may be “1” or “true”). If we do not include the EPSG dataset version and the record has been deprecated, you will not know whether the reference relates to the record before or after it was deprecated.

An example URN value for CRS 26986 specified by version 6.3 of the EPSG database is:

```
urn:ogc:def:crs:EPSG:6.3:26986
```

An example URN value for the “WGS 84 longitude-latitude” CRS specified in Subclause B.3 of WMS 1.3 (previously referenced as “CRS:84”) is:

```
urn:ogc:def:crs:OGC:1.3:CRS84
```

## 7.2 URN format for not-completely-specified objects

A URN can also be used to reference a not-completely-specified object, which is specified without the values of a few identified parameters. In this case, the URN value includes the values for each identified parameter. When referencing an object with two unspecified parameters, a URN value for an anyURI data type shall have the form:

```
urn:ogc:def:objectType:authority:version:code:value1:value2
```

NOTE 1 Not-completely-specified objects are very useful when many similar objects are needed, especially when the possible values of the distinguishing parameters cannot be enumerated.

EXAMPLE 1 Subclause 6.7.3.4 and Annex B of WMS 1.3.0 specify five not-completely-specified map projections, where the parameters specify the central meridian, etc.

EXAMPLE 2 Clause 7 of [OGC 05-012] specifies two not-completely-specified unrectified image CRSs, where the single parameter specifies the image identifier.

In this URN form, the values for the previously-identified parameters are added to the URN form for a single object, as specified above. The obvious variations on the URI form can be used when one or three parameters are unspecified. The object identified by the “authority”, “version”, and “code” must be completely specified with the exception of the values for a few clearly identified parameters. Whenever such a parameter value requires a unit of measure (uom), the uom for that parameter shall be specified by the referenced not-completely-specified object.

An example URN value for the Auto Orthographic CRS 42003 specified in Subclauses 6.7.3.4 and B.9 of WMS 1.3.0 is:

```
urn:ogc:def:crs:OGC:1.3:AUTO42003:1:-100:45
```

NOTE 2 Additional examples of not-completely-specified objects are specified in Subclauses B.7, B.8, B.10, and B.11 of WMS 1.3.0, and in Subclauses C.3 and C.4 of [OGC TBD].

## 7.3 URN references to combined objects

### 7.3.1 Overview

In some cases, it is useful to reference two or more well-known objects that are combined. Such combining of two or more well-known objects shall only be used when all of the following conditions are true:

- a) The objects being combined are correct for the combination being formed, as these objects are specified in [OGC 04-046r3] for CRS-related objects.

- b) This combination of objects is not an existing well-known object, such as specified in the EPSG database.

NOTE 1 If combining two or more well-known objects, please ask if this combination will be frequently used. If combining only EPSG codes because EPSG has not populated this combination, please send a request for this combination to the EPSG if this combination is likely to be frequently used. Similarly, if combining OGC codes, by themselves or with EPSG codes, please suggest that this combination be added to the OGC codes, if this combination is likely to be frequently used.

- c) The objects being combined are all in the “ogc” URN namespace, preferably all defined by the same authority (e.g., EPSG or OGC).

NOTE 2 If objects specified by different authorities are combined, there is higher risk that these objects are not compatible. For example, some authorities might specify objects different from [OGC 04-046r3].

- d) Using a URN for the combination is desirable, since it is not convenient to combine these objects in an XML document based on GML, and then reference this document using a URL (as specified in Subclauses 10.3.1 and 10.3.2 of [OGC 05-108]).

Combining two or more well-known objects shall be done by concatenating the object references in one URN. That is, a URN can concatenate the URNs of the two individual well-known objects, using the URN form:

```
urn:ogc:def:objectType,objectType:authority:version:code,
objectType:authority:version:code
```

Similarly, a URN can concatenate the URNs of the three individual well-known objects, using the URN form:

```
urn:ogc:def:objectType,objectType:authority:version:code,
objectType:authority:version:code,objectType:authority:version
:code
```

NOTE 3 When URNs are concatenated like this, the combined object is implicitly defined, and is not assigned a separate object “code”. That is, the defined object is anonymous.

In a concatenated URN, the first “objectType” is the type of the combined object. Combined references in a URN can be used for defining several types of objects, as specified by specific Implementation Specifications, including for:

- a) Compound coordinate reference systems
- b) Concatenated operations
- c) Projected and derived coordinate reference systems
- d) Combining a datum and a coordinate system into a coordinate reference system
- e) Objects defined by specific Implementation Specifications

The first four combinations listed above are described in the following subclauses.

### 7.3.2 URN combined references for compound coordinate reference systems

A URN reference to combined objects can be allowed for any compound coordinate reference system (CompoundCRS) that combines two or three well-known CRSs. In this case, the URN shall concatenate the URNs of the two or three individual well-known CRSs. This combining is allowed only when all the conditions specified in Subclause 7.3.1 are met.

The URNs of the individual well-known CRSs shall be listed in the same order in which the individual coordinate tuples are combined to form the CompoundCRS coordinate tuple. All the “objectType” values shall be “crs”.

EXAMPLE The URN value for combining the EPSG 27700 and EPSG 5701 CRSs is:

```
urn:ogc:def:crs,crs:EPSG:6.3:27700,crs:EPSG:6.3:5701
```

### 7.3.3 URN combined references for concatenated operations

A URN reference to combined objects can be allowed for any concatenated coordinate operation (ConcatenatedOperation) that combines two or more well-known coordinate operations. In this case, the URN shall concatenate the URNs of the two or more well-known coordinate operations. This combining is allowed only when all the conditions specified in Subclause 7.3.1 are met.

NOTE 1 In particular, the coordinate operations concatenated must meet the stated constraint: The sequence of operations is constrained by the requirement that the source coordinate reference system of step (n+1) must be the same as the target coordinate reference system of step (n). The source coordinate reference system of the first step and the target coordinate reference system of the last step are the source and target coordinate reference system associated with the concatenated operation.

NOTE 2 In a well-known dataset, a CoordinateOperation may be registered only in one direction, with the reverse operation being implied. This means that the roles of source and target CRS may have to be swapped if an implied-reverse CoordinateOperation is included in a ConcatenatedOperation. In this case, the swapped source and target CRS shall satisfy the above constraint.

The URNs of the individual coordinate operations shall be concatenated in the order of coordinate operation application. The “objectType” values shall all be “coordinateOperation”.

EXAMPLE The URN value for combining the EPSG XXXX and EPSG YYYYY coordinate operations is:

```
urn:ogc:def:coordinateOperation,coordinateOperation:EPSG:6.3:XXXX,coordinateOperation:EPSG:6.3:YYYY
```

### 7.3.4 URN combined references for projected or derived CRSs

A URN reference to combined objects can be allowed for any projected coordinate reference system (ProjectedCRS) that combines a well-known GeographicCRS and a well-known (defined by) Conversion. In this case, the URN shall concatenate the URNs of the one well-known CRS, one well-known Conversion, and one well-known CartesianCS. This combining is allowed only when all the conditions specified in Subclause 7.3.1 are met.

Similarly, a URN reference to combined objects can be allowed for any derived coordinate reference system (DerivedCRS) that combines a well-known base CRS, a well-known CoordinateSystem, and a well-known (defined by) Conversion.

The URNs of the individual components of the projected or derived CRS shall be listed in the order of GeographicCRS, CS, and then Conversion. The four “objectType” values shall be “crs”, “crs”, “cs”, and “coordinateOperation”.

**EXAMPLE** The URN value for combining the EPSG XXXX CRS, EPSG YYYY CS, and EPSG ZZZZ Conversion to define a custom projected or derived CRS is:

```
urn:ogc:def:crs,crs:EPSG:6.3:XXXX,cs:EPSG:6.3:YYYY,coordinateOperation:EPSG:6.3:ZZZZ
```

### 7.3.5 URN combined references for datum and coordinate system

A URN reference to combined objects can be allowed for a coordinate reference system that combines a well-known datum with a well-known coordinate system. In this case, the URN shall concatenate the URNs of one well-known datum and one well-known coordinate system. This combining is allowed only when all the conditions specified in Subclause 7.3.1 are met.

The URNs of the individual components shall be listed in the order of datum and then coordinate system. The three “objectType” values shall be “crs”, “datum” and “cs”.

**EXAMPLE** The URN value for combining the EPSG XXXX datum and EPSG YYYY coordinate system to define a custom CRS is:

```
urn:ogc:def:crs,datum:EPSG:6.3:XXXX,cs:EPSG:6.3:YYYY
```

## 8 URN values for definitions in ogc namespace

### 8.1 Introduction

This clause specifies URNs for some specific object definitions defined by the OGC. Additional definitions in the “ogc” URN namespace will be specified in other OGC documents. For example, more URNs are specified in Subclause 7.1 of Recommendation Paper [OGC 05-012].

**NOTE** Many examples of “ogc” URN use for object definitions are contained in the GML examples in Annex A of this document, in Clause 7 of [OGC 05-012], and in Clause 6 of [OGC 05-011].

### 8.2 CRS definitions

The definitions of Coordinate Reference Systems (CRSs) defined by the OGC shall use the URNs listed in Table 1. The URN parts shown as “99” and “8888” represent numbers that shall be substituted for the specified parameter values. All of these CRSs are defined in Annex B of WMS 1.3 [OGC 04-024].

**Table 1 — URNs for CRSs defined by OGC**

URN	CRS name	Definition reference
urn:ogc:def:crs:OGC:1.3:CRS1	Map CS	B.2 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:CRS84	WGS 84 longitude-latitude	B.3 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:CRS83	NAD27 longitude-latitude	B.4 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:CRS27	NAD83 longitude-latitude	B.5 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:CRS88	NAVD 88	B.6 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:AUTO42001:99:8888	Auto universal transverse mercator	B.7 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:AUTO42002:99:8888	Auto transverse mercator	B.8 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:AUTO42003:99:8888	Auto orthographic	B.9 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:AUTO42004:99:8888	Auto equiarectangular	B.10 in OGC 04-024
urn:ogc:def:crs:OGC:1.3:AUTO42005:99	Auto Mollweide	B.11 in OGC 04-024

### 8.3 CRS code list values definitions

The definitions of the standard values for the five CodeList stereotyped classes specified in Tables 9, 31, 32, 37, and 39 of OGC Abstract Specification Topic 2 [OGC 04-046r3] shall use the URNs listed in Tables 2 through 6. The definitions of these values shall be as specified in the XML documents in Subclauses A.2 through A.6.

**Table 2 — URNs for derivedCRSType values**

URN	Value	Brief definition
urn:ogc:def:derivedCRSType:OGC:1.0:geographic	geographic	A coordinate reference system based on an ellipsoidal approximation of the geoid.
urn:ogc:def:derivedCRSType:OGC:1.0:vertical	vertical	A coordinate reference system used for recording of heights or depths.
urn:ogc:def:derivedCRSType:OGC:1.0:geocentric	geocentric	A coordinate reference system with the origin at the centre of mass of the earth.
urn:ogc:def:derivedCRSType:OGC:1.0:engineering	engineering	A contextually local coordinate reference system.
urn:ogc:def:derivedCRSType:OGC:1.0:image	image	An engineering coordinate reference system applied to locations in images.
urn:ogc:def:derivedCRSType:OGC:1.0:temporal	temporal	A reference system used for the recording of time.

**Table 3 — URNs for verticalDatumType values**

URN	Value	Brief definition
urn:ogc:def:verticalDatumType:OGC:1.0:geoidal	geoidal	Zero value of vertical axis approximates a constant potential surface, usually the geoid.
urn:ogc:def:verticalDatumType:OGC:1.0:depth	depth	Zero value of vertical axis has meaning for purpose which measurements are used for
urn:ogc:def:verticalDatumType:OGC:1.0:barometric	barometric	Atmospheric pressure is basis for the definition of origin of vertical axis
urn:ogc:def:verticalDatumType:OGC:1.0:otherSurface	otherSurface	Other variations to above three vertical datum types.

**Table 4 — URNs for pixelInCell values**

URN	Value	Definition
urn:ogc:def:pixelInCell:OGC:1.0:cellCenter	cellCenter	The origin of the image coordinate system is at the centre of a grid cell or image pixel.
urn:ogc:def:pixelInCell:OGC:1.0:cellCorner	cellCorner	The origin of the image coordinate system is at the corner of a grid cell, or half-way between the centres of adjacent image pixels.

**Table 5 — URNs for rangeMeaning values**

URN	Value	Brief definition
urn:ogc:def:rangeMeaning:OGC:1.0:exact	exact	Any value between and including minimumValue and maximumValue is valid.
urn:ogc:def:rangeMeaning:OGC:1.0:wraparound	wraparound	The axis is continuous with values wrapping around at the minimumValue and maximumValue.

**Table 6 — URNs for axisDirection values**

URN	Value	Brief definition
urn:ogc:def:axisDirection:OGC:1.0:north	north	Axis positive direction is north.
urn:ogc:def:axisDirection:OGC:1.0:northNorthEast	northNorthEast	Axis positive direction is approximately north-north-east.
urn:ogc:def:axisDirection:OGC:1.0:northEast	northEast	Axis positive direction is approximately north-east.
urn:ogc:def:axisDirection:OGC:1.0:eastNorthEast	eastNorthEast	Axis positive direction is approximately east-north-east.
urn:ogc:def:axisDirection:OGC:1.0:east	east	Axis positive direction is $\pi/2$ radians clockwise from north.
urn:ogc:def:axisDirection:OGC:1.0:eastSouthEast	eastSouthEast	Axis positive direction is approximately east-south-east.
urn:ogc:def:axisDirection:OGC:1.0:southEast	southEast	Axis positive direction is approximately south-east.
urn:ogc:def:axisDirection:OGC:1.0:southSouthEast	southSouthEast	Axis positive direction is approximately south-south-east.
urn:ogc:def:axisDirection:OGC:1.0:south	south	Axis positive direction is $\pi$ radians clockwise from north.
urn:ogc:def:axisDirection:OGC:1.0:southSouthWest	southSouthWest	Axis positive direction is approximately south-south-west.
urn:ogc:def:axisDirection:OGC:1.0:southWest	southWest	Axis positive direction is approximately south-west.
urn:ogc:def:axisDirection:OGC:1.0:westSouthWest	westSouthWest	Axis positive direction is approximately west-south-west.
urn:ogc:def:axisDirection:OGC:1.0:west	west	Axis positive direction is $3\pi/2$ radians clockwise from north.
urn:ogc:def:axisDirection:OGC:1.0:westNorthWest	westNorthWest	Axis positive direction is approximately west-north-west.
urn:ogc:def:axisDirection:OGC:1.0:northWest	northWest	Axis positive direction is approximately north-west.

URN	Value	Brief definition
urn:ogc:def:axisDirection:OGC:1.0:northNorthWest	northNorthWest	Axis positive direction is approximately north-north-west.
urn:ogc:def:axisDirection:OGC:1.0:up	up	Axis positive direction is up relative to gravity.
urn:ogc:def:axisDirection:OGC:1.0:down	down	Axis positive direction is down relative to gravity.
urn:ogc:def:axisDirection:OGC:1.0:geocentricX	geocentricX	Axis positive direction is in the equatorial plane from centre of modelled earth towards intersection of equator with prime meridian.
urn:ogc:def:axisDirection:OGC:1.0:geocentricY	geocentricY	Axis positive direction is in equatorial plane from centre of the modelled earth towards intersection of equator and meridian $\pi/2$ radians eastwards from prime meridian.
urn:ogc:def:axisDirection:OGC:1.0:geocentricZ	geocentricZ	Axis positive direction is from centre of modelled earth parallel to its rotation axis and towards its north pole.
urn:ogc:def:axisDirection:OGC:1.0:future	future	Axis positive direction is towards the future.
urn:ogc:def:axisDirection:OGC:1.0:past	past	Axis positive direction is towards the past.
urn:ogc:def:axisDirection:OGC:1.0:columnPositive	columnPositive	Axis positive direction is towards higher pixel column.
urn:ogc:def:axisDirection:OGC:1.0:columnNegative	columnNegative	Axis positive direction is towards lower pixel column.
urn:ogc:def:axisDirection:OGC:1.0:rowPositive	rowPositive	Axis positive direction is towards higher pixel row.
urn:ogc:def:axisDirection:OGC:1.0:rowNegative	rowNegative	Axis positive direction is towards lower pixel row.
urn:ogc:def:axisDirection:OGC:1.0:displayRight	displayRight	Axis positive direction is right in display.
urn:ogc:def:axisDirection:OGC:1.0:displayLeft	displayLeft	Axis positive direction is left in display.
urn:ogc:def:axisDirection:OGC:1.0:displayUp	displayUp	Axis positive direction is towards top of approximately vertical display surface.
urn:ogc:def:axisDirection:OGC:1.0:displayDown	displayDown	Axis positive direction is towards bottom of approximately vertical display surface.

#### 8.4 Unit-of-measure (uom) definitions

The definitions of some units-of-measure which are defined by the OGC shall use the URNs listed in Table 7. The definitions of these units shall be as specified in the XML document in Subclause A.7. Most of these units are also specified by the EPSG, as listed.

**Table 7 — URNs for units-of-measure**

OGC URN	Meaning	Quantity type	EPSG URN
urn:ogc:def:uom:OGC:1.0:degree	Angular degree	angle	urn:ogc:def:uom:EPSG:6.3:9102
urn:ogc:def:uom:OGC:1.0:radian	Angular radian	angle	TBD
urn:ogc:def:uom:OGC:1.0:metre	Length metre	length	urn:ogc:def:uom:EPSG:6.3:9001
urn:ogc:def:uom:OGC:1.0:unity	unitless ratio of two quantities with the same units	scale factor	urn:ogc:def:uom:EPSG:6.3:8805

## Annex A (normative)

### GML dictionaries of OGC definitions

#### A.1 Introduction

This annex provides XML documents that specify the definitions of some of the objects assigned “ogc” URN values in Clause 8. All of these definitions are encoded in XML using the gml:Dictionary element from dictionary.xsd of GML 3.1.1. These XML documents shall be used when GML 3.1.1 is used to encode these definitions.

These XML-encoded document files are bundled in a zip file with this document. These XML files will be posted online at the URL <http://schemas.opengespatial.net/definitions/>, in a lower level directory used for this Version of this document. In the event of a discrepancy between the bundled and online versions of these XML files, the online files shall be considered authoritative.

A server may reference an exact copy of these documents located elsewhere, as long as they are readily accessible by clients. For example, it may be desirable to place the referenced documents on the same network server as an OWS instance, since that decreases the number of points of possible network failure. Such local copies should be organized into directories similar to <http://schemas.opengespatial.net/>. The server owner shall insure that any such local copies are kept up-to-date with respect to the authoritative files at <http://schemas.opengespatial.net/>.

#### A.2 Definitions of derivedCRSType values

The definitions of the derivedCRSType standard values used in defining DerivedCRSs shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```
<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
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.opengis.net/gml
gml/3.1.1/base/dictionary.xsd" gml:id="DerivedCRSTypeDictionary">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26-->
  <name>Derived CRS type standard values</name>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="geographic">
      <description>A coordinate reference system based on an
ellipsoidal approximation of the geoid; provides an accurate
representation of the geometry of geographic features for a large
portion of the earth's surface. </description>
```

```

    <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">geographic</name>
    </Definition>
  </dictionaryEntry>
  <dictionaryEntry>
    <Definition gml:id="vertical">
      <description>A coordinate reference system used for recording
of heights or depths. Vertical CRSs make use of the direction of
gravity to define the concept of height or depth, but the relationship
with gravity may not be straightforward. </description>
      <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">vertical</name>
      </Definition>
    </dictionaryEntry>
    <dictionaryEntry>
      <Definition gml:id="geocentric">
        <description>A coordinate reference system with the origin at
the centre of mass of the earth. A geocentric CRS deals with the
earth's curvature by taking a 3D spatial view. </description>
        <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">geocentric</name>
        </Definition>
      </dictionaryEntry>
      <dictionaryEntry>
        <Definition gml:id="engineering">
          <description>A contextually local coordinate reference system;
which can be divided into two broad categories:
- earth-fixed systems applied to engineering activities on or near the
surface of the earth;
- CRSs on moving platforms such as road vehicles, vessels, aircraft, or
spacecraft. </description>
          <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">engineering</name>
          </Definition>
        </dictionaryEntry>
        <dictionaryEntry>
          <Definition gml:id="image">
            <description>A derived CRS used like an engineering coordinate
reference system applied to locations in images. </description>
            <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">image</name>
            </Definition>
          </dictionaryEntry>
          <dictionaryEntry>
            <Definition gml:id="temporal">
              <description>A reference system used for the recording of
time. </description>
              <name
codeSpace="urn:ogc:def:derivedCRS:OGC:1.0:">temporal</name>
              </Definition>
            </dictionaryEntry>
          </Dictionary>

```

### A.3 Definitions of verticalDatumType values

The definitions of the verticalDatumType standard values used in defining VerticalDatums shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```
<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/gml
gml/3.1.1/base/dictionary.xsd" gml:id="VerticalDatumType">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26-->
  <name>Vertical Datum Type standard values</name>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="geoidal">
      <description>The zero value of the associated vertical
coordinate system axis is defined to approximate a constant potential
surface, usually the geoid. Such a reference surface is usually
determined by a national or scientific authority, and is then a well-
known, named datum. </description>
      <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">geoidal</name>
    </Definition>
  </dictionaryEntry>
  <dictionaryEntry>
    <!-- ===== -->
    <Definition gml:id="depth">
      <description>The zero point of the vertical axis is defined by
a surface that has meaning for the purpose which the associated
vertical measurements are used for. For hydrographic charts, this is
often a predicted nominal sea surface (i.e., without waves or other
wind and current effects) that occurs at low tide. </description>
      <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">depth</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="barometric">
      <description>Atmospheric pressure is the basis for the
definition of the origin of the associated vertical coordinate system
axis. </description>
      <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">barometric</name>
    </Definition>
  </dictionaryEntry>
  <dictionaryEntry>
    <!-- ===== -->
    <Definition gml:id="otherSurface">
      <description>In some cases, e.g. oil exploration and
production, a geological feature, such as the top or bottom of a
geologically identifiable and meaningful subsurface layer, is used as a
vertical datum. Other variations to the above three vertical datum
types may exist and are all included in this type. </description>
```

```

    <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">otherSurface</name>
    </Definition>
  </dictionaryEntry>
</Dictionary>

```

#### A.4 Definitions of pixelInCell values

The definitions of the pixelInCell standard values used in defining ImageDatums shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```

<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/gml
gml/3.1.1/base/dictionary.xsd" gml:id="PixelInCellDictionary">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26-->
  <name>PixelInCell standard values</name>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="cellCenter">
      <description>The origin of the image coordinate system is at
the centre of a grid cell or image pixel. </description>
      <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">cellCenter</name>
    </Definition>
  </dictionaryEntry>
  <dictionaryEntry>
    <!-- ===== -->
    <Definition gml:id="cellCorner">
      <description>The origin of the image coordinate system is at
the corner of a grid cell, or half-way between the centres of adjacent
image pixels. </description>
      <name
codeSpace="urn:ogc:def:pixelInCell:OGC:1.0:">cellCorner</name>
    </Definition>
  </dictionaryEntry>
</Dictionary>

```

#### A.5 Definitions of rangeMeaning values

The definitions of the rangeMeaning standard values used in defining CoordinateAxes shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```

<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/gml
gml/3.1.1/base/dictionary.xsd" gml:id="RangeMeaningDictionary">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26 -->
  <name>Range Meaning standard values</name>
  <!-- ===== -->

```

```

<dictionaryEntry>
  <Definition gml:id="exact">
    <description>Any value between and including minimumValue and
maximumValue is valid. </description>
    <name
codeSpace="urn:ogc:def:rangeMeaning:OGC:1.0:">exact</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="wraparound">
    <description>The axis is continuous with values wrapping
around at the minimumValue and maximumValue. Values with the same
meaning repeat modulo the difference between maximumValue and
minimumValue. </description>
    <name
codeSpace="urn:ogc:def:rangeMeaning:OGC:1.0:">wraparound</name>
  </Definition>
</dictionaryEntry>
</Dictionary>

```

## A.6 Definitions of axisDirection values

The definitions of the axisDirection standard values used in defining CoordinateAxes shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```

<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/gml
gml/3.1.1/base/dictionary.xsd" gml:id="AxisDirectionDictionary">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26-->
  <name>Axis Direction standard values</name>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="north">
      <description>Axis positive direction is north. In a geographic
or projected CRS, north is defined through the geodetic datum. In an
engineering CRS, north may be defined with respect to an engineering
object rather than a geographical direction. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">north</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="northNorthEast">
      <description>Axis positive direction is approximately north-
north-east. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">northNorthEast</name
>
    </Definition>

```

```

</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="northEast">
    <description>Axis positive direction is approximately north-
east. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">northEast</name>
  </Definition>

</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="eastNorthEast">
    <description>Axis positive direction is approximately east-
north-east. </description>
    <name codeSpace="urn:opengis:def:axisDirection:OGC:1.0:"/>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="east">
    <description>Axis positive direction is pi/2 radians clockwise
from north. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">east</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="eastSouthEast">
    <description>Axis positive direction is approximately east-
south-east. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">eastSouthEast</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="southEast">
    <description>Axis positive direction is approximately south-
east.</description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">southEast</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="southSouthEast">
    <description>Axis positive direction is approximately south-
south-east. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">southSouthEast</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->

```

```

<dictionaryEntry>
  <Definition gml:id="south">
    <description>Axis positive direction is pi radians clockwise
from north. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">south</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="southSouthWest">
    <description>Axis positive direction is approximately south-
south-west. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">southSouthWest</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="southWest">
    <description>Axis positive direction is approximately south-
west. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">southWest</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="westSouthWest">
    <description>Axis positive direction is approximately west-
south-west. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">westSouthWest</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="west">
    <description>Axis positive direction is 3pi/2 radians
clockwise from north. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">west</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="westNorthWest">
    <description>Axis positive direction is approximately west-
north-west. </description>
    <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">westNorthWest</name>
  </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
  <Definition gml:id="northWest">

```

```

        <description>Axis positive direction is approximately north-
west.</description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">northWest</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="northNorthWest">
        <description>Axis positive direction is approximately north-
north-west. </description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">northNorthWest</name
>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="up">
        <description>Axis positive direction is up relative to
gravity. </description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">up</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="down">
        <description>Axis positive direction is down relative to
gravity. </description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">down</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="geocentricX">
        <description>Axis positive direction is in the equatorial
plane from the centre of the modelled earth towards the intersection of
the equator with the prime meridian. </description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">geocentricX</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="geocentricY">
        <description>Axis positive direction is in the equatorial
plane from the centre of the modelled earth towards the intersection of
the equator and the meridian pi/2 radians eastwards from the prime
meridian. </description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">geocentricY</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>

```

```

    <Definition gml:id="geocentricZ">
      <description>Axis positive direction is from the centre of the
modelled earth parallel to its rotation axis and towards its north
pole. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">geocentricZ</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="future">
      <description>Axis positive direction is towards the future.
</description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">future</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="past">
      <description>Axis positive direction is towards the past.
</description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">past</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="columnPositive">
      <description>Axis positive direction is towards higher column
numbers. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:1.0:">columnPositive</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="columnNegative">
      <description>Axis positive direction is towards lower pixel
column numbers. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">columnNegative</name
>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="rowPositive">
      <description>Axis positive direction is towards higher row
numbers. </description>
      <name
codeSpace="urn:opengis:def:axisDirection:1.0:">rowPositive</name>
    </Definition>
  </dictionaryEntry>
  <!-- ===== -->
  <dictionaryEntry>
    <Definition gml:id="rowNegative">

```

```

        <description>Axis positive direction is towards lower pixel
row numbers. </description>
        <name codeSpace="urn:opengis:def:axisDirection:OGC:1.0:"/>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="displayRight">
        <description>Axis positive direction is right in display.
</description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">displayRight</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="displayLeft">
        <description>Axis positive direction is left in display.
</description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">displayLeft</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="displayUp">
        <description>Axis positive direction is towards top of
approximately vertical display surface.
</description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">displayUp</name>
        </Definition>
</dictionaryEntry>
<!-- ===== -->
<dictionaryEntry>
    <Definition gml:id="displayDown">
        <description>Axis positive direction is towards bottom of
approximately vertical display surface.
</description>
        <name
codeSpace="urn:opengis:def:axisDirection:OGC:1.0:">displayDown</name>
        </Definition>
</dictionaryEntry>
</Dictionary>

```

## A.7 Definitions of units-of-measure

The definitions of the some commonly used unit-of-measure (uom) values shall be the same as can be XML encoded in the GML 3.1.1 dictionary:

```

<?xml version="1.0" encoding="UTF-8"?>
<Dictionary xmlns="http://www.opengis.net/gml"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"

```

```

xsi:schemaLocation="http://www.opengis.net/gml
gml/3.1.1/base/coordinateReferenceSystems.xsd"
gml:id="UnitsDictionary">
  <!-- Primary editor: Arliss Whiteside. Last updated 2005-01-26 -->
  <description>Example GML Dictionary of unit
definitions.</description>
  <name>Units Dictionary</name>
  <dictionaryEntry>
    <ConventionalUnit gml:id="degree">
      <name>degree</name>
      <name codeSpace="urn:ogc:def:parameter:EPSG:6.3:">9102</name>
      <name codeSpace="urn:ogc:def:uom:OGC:1.0:">degree</name>
      <quantityType>angle</quantityType>
      <conversionToPreferredUnit uom="#radian">
        <factor>1.74532925199433E-02</factor>
      </conversionToPreferredUnit>
    </ConventionalUnit>
  </dictionaryEntry>
  <dictionaryEntry>
    <BaseUnit gml:id="radian">
      <name>radian</name>
      <quantityType>angle</quantityType>
      <unitsSystem xlink:href="urn:ogc:ToBeSupplied"/>
    </BaseUnit>
  </dictionaryEntry>
  <dictionaryEntry>
    <BaseUnit gml:id="metre">
      <name>metre</name>
      <name codeSpace="urn:ogc:def:parameter:EPSG:6.3:">9001</name>
      <name codeSpace="urn:ogc:def:uom:OGC:1.0:">metre</name>
      <quantityType>length</quantityType>
      <unitsSystem xlink:href="urn:ogc:SI"/>
    </BaseUnit>
  </dictionaryEntry>
  <dictionaryEntry>
    <BaseUnit gml:id="unity">
      <name>unity</name>
      <name codeSpace="urn:ogc:def:uom:EPSG:6.3:">8805</name>
      <name codeSpace="urn:ogc:def:uom:OGC:1.0:">unity</name>
      <quantityType>scale factor</quantityType>
      <unitsSystem xlink:href="urn:ogc:ToBeSupplied"/>
    </BaseUnit>
  </dictionaryEntry>
</Dictionary>

```

## **Bibliography**

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- [4] OGC 05-012, Recommended XML/GML 3.1.1 encoding of image CRS definitions
- [5] OGC 05-013, Web Coordinate Transformation Service Implementation Specification, draft
- [6] OGC 05-014, Image CRSs for IH4DS