

	<pre> <complexContent> <extension base="gml:CurveType"> <sequence> <group ref="aixm:CurvePropertyGroup"/> </sequence> </extension> </complexContent> </complexType> <group name="CurvePropertyGroup"> <sequence> <element name="horizontalAccuracy" type="aixm:ValDistanceType" nillable="true" minOccurs="0"/> <element name="annotation" type="aixm:NotePropertyType" nillable="true" minOccurs="0" maxOccurs="unbounded"/> </sequence> </group> </pre>
<p>Example</p>	<pre> <aixm:Curve ... gml:id="CUR002"> <gml:segments> <gml:GeodesicString interpolation="geodesic"> <gml:posList>39.42916667 47.36333334 39.426818 47.353277 38.87277778 46.54722222</gml:posList> </gml:GeodesicString> </gml:segments> <aixm:annotation> <aixm:Note gml:id="N001"> <aixm:translatedNote> <aixm:LinguisticNote gml:id="N002"> <aixm:note lang="ENG">along the state border with Islamic Republic of Iran</aixm:note> </aixm:LinguisticNote> </aixm:translatedNote> </aixm:Note> </aixm:annotation> </aixm:Curve> </pre>

AIXM ElevatedCurve – Documentation

The XML Schema implementation of the *AIXM ElevatedCurve* type is given by the *aixm:ElevatedCurve* XSD element and *aixm:ElevatedCurveType* XSD complex type, documented in the following table.

XSD Element	aixm:ElevatedCurve
Type	aixm:ElevatedCurveType
BaseType	aixm:CurveType
Restriction	<i>None</i>
Usage	To define centerlines (e.g. of a seaplane ramp site) and extent (e.g. of a guidance line).
Definition	An AIXM elevated curve which extends (AIXM) Curve with

	properties that represent the vertical position (elevation, datum, accuracy).
Comments	<i>None</i>
Used in	Used in some AIXM features. Can also be used as a substitute for AIXM Curve.
XML Schema File	AIXM_Features.xsd
XML Schema Component	<pre> <element name="ElevatedCurve" type="aixm:ElevatedCurveType" substitutionGroup="aixm:Curve"/> <complexType name="ElevatedCurveType"> <complexContent> <extension base="aixm:CurveType"> <sequence> <group ref="aixm:ElevatedCurvePropertyGroup"/> <element name="extension" minOccurs="0" maxOccurs="unbounded"> <complexType> <choice> <element ref="aixm:AbstractElevatedCurveExtension"/> </choice> <attributeGroup ref="gml:OwnershipAttributeGroup"/> </complexType> </element> </sequence> </extension> </complexContent> </complexType> <group name="ElevatedCurvePropertyGroup"> <sequence> <element name="elevation" type="aixm:ValDistanceVerticalType" nillable="true" minOccurs="0"/> <element name="geoidUndulation" type="aixm:ValDistanceSignedType" nillable="true" minOccurs="0"/> <element name="verticalDatum" type="aixm:CodeVerticalDatumType" nillable="true" minOccurs="0"/> <element name="verticalAccuracy" type="aixm:ValDistanceType" nillable="true" minOccurs="0"/> </sequence> </group> </pre>
Example	<pre> <aixm:ElevatedCurve ... gml:id="CUR002"> <gml:segments> <gml:GeodesicString interpolation="geodesic"> <gml:posList>39.42916667 47.36333334 39.426818 47.353277 38.87277778 46.54722222</gml:posList> </pre>

	<pre> </gml:GeodesicString> </gml:segments> <aixm:elevation uom="FT">365</aixm:elevation> </aixm:ElevatedCurve> </pre>
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AIXM Surface – Documentation

The XML Schema implementation of the *AIXM Surface* type is given by the *aixm:Surface* XSD element and *aixm:SurfaceType* XSD complex type, documented in the following table.

XSD Element	aixm:Surface
Type	aixm:SurfaceType
BaseType	gml:SurfaceType
Restriction	<i>None</i>
Usage	To define horizontal projection (e.g. of an airspace volume) and extent (e.g. of a circling area), among others.
Definition	An AIXM surface derived from GM_Surface and extended to include Horizontal Accuracy Properties.
Comments	<i>None</i>
Used in	Used in some AIXM features. Can also be used as a substitute for GM_Surface / gml:Surface.
XML Schema File	AIXM_Features.xsd
XML Schema Component	<pre> <element name="Surface" type="aixm:SurfaceType" substitutionGroup="gml:Surface"/> <complexType name="SurfaceType"> <complexContent> <extension base="gml:SurfaceType"> <sequence> <group ref="aixm:SurfacePropertyGroup"/> </sequence> </extension> </complexContent> </complexType> <group name="SurfacePropertyGroup"> <sequence> <element name="horizontalAccuracy" type="aixm:ValDistanceType" nillable="true" minOccurs="0"/> <element name="annotation" type="aixm:NotePropertyType" nillable="true" minOccurs="0" maxOccurs="unbounded"/> </sequence> </group> </pre>
Example	<pre> <aixm:Surface ... gml:id="S001" srsName="urn:ogc:def:crs:EPSG::4326"> <gml:patches> <gml:PolygonPatch> <gml:exterior> </pre>

	<pre> <gml:Ring> <gml:curveMember> <aixm:Curve gml:id="C002"> <gml:segments> <gml:GeodesicString> <gml:posList>52.20611 5.2875 52.18917 5.29889 52.19117 5.3289 52.20611 5.2875</gml:posList> </gml:GeodesicString> </gml:segments> </aixm:Curve> </gml:curveMember> </gml:Ring> </gml:exterior> </gml:PolygonPatch> </gml:patches> </aixm:Surface> </pre>
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AIXM ElevatedSurface – Documentation

The XML Schema implementation of the *AIXM ElevatedSurface* type is given by the *aixm:ElevatedSurface* XSD element and *aixm:ElevatedSurfaceType* XSD complex type, documented in the following table.

XSD Element	aixm:ElevatedSurface
Type	aixm:ElevatedSurfaceType
BaseType	aixm:SurfaceType
Restriction	<i>None</i>
Usage	Usually to define the extent (e.g. of a taxiway element) but also to define aviation boundaries (e.g. of an airport heliport) or the area of an airport hot spot.
Definition	An AIXM elevated surface which extends (AIXM) Surface with properties that represent the vertical position (elevation, datum, accuracy).
Comments	<i>None</i>
Used in	Used in some AIXM features. Can also be used as a substitute for AIXM Surface.
XML Schema File	AIXM_Features.xsd
XML Schema Component	<pre> <element name="ElevatedSurface" type="aixm:ElevatedSurfaceType" substitutionGroup="aixm:Surface"/> <complexType name="ElevatedSurfaceType"> <complexContent> <extension base="aixm:SurfaceType"> <sequence> <group ref="aixm:ElevatedSurfacePropertyGroup"/> <element name="extension" minOccurs="0" maxOccurs="unbounded"> </pre>

	<pre> <complexType> <choice> <element ref="aixm:AbstractElevatedSurfaceExtension"/> </choice> <attributeGroup ref="gml:OwnershipAttributeGroup"/> </complexType> </element> </sequence> </extension> </complexContent> </complexType> <group name="ElevatedSurfacePropertyGroup"> <sequence> <element name="elevation" type="aixm:ValDistanceVerticalType" nillable="true" minOccurs="0"/> <element name="geoidUndulation" type="aixm:ValDistanceSignedType" nillable="true" minOccurs="0"/> <element name="verticalDatum" type="aixm:CodeVerticalDatumType" nillable="true" minOccurs="0"/> <element name="verticalAccuracy" type="aixm:ValDistanceType" nillable="true" minOccurs="0"/> </sequence> </group> </pre>
Example	<pre> <aixm:ElevatedSurface ... gml:id="S001" srsName="urn:ogc:def:crs:EPSG::4326"> <gml:patches> <gml:PolygonPatch> <gml:exterior> <gml:Ring> <gml:curveMember> <aixm:Curve gml:id="C002"> <gml:segments> <gml:GeodesicString> <gml:posList>52.20611 5.2875 52.18917 5.29889 52.19117 5.3289 52.20611 5.2875</gml:posList> </gml:GeodesicString> </gml:segments> </aixm:Curve> </gml:curveMember> </gml:Ring> </gml:exterior> </gml:PolygonPatch> </gml:patches> <aixm:elevation uom="M">1000</aixm:elevation> </aixm:ElevatedSurface> </pre>

DirectPosition / gml:pos – Documentation

The XML Schema implementation of the *DirectPosition* type (see ISO 19107:2003, section 6.4.1) is given by the *gml:pos* XSD element and *gml:DirectPositionType* XSD complex type (see ISO 19136:2007, section 10.1.4.1 and D.2.3.4), documented in the following table.

XSD Element	gml:pos
Type	gml:DirectPositionType
BaseType	<i>none</i>
Restriction	<i>The srsDimension, axisLabel and uomLabels attributes should not be used in AIXM geometries.</i>
Usage	Defines the coordinates of a position in a given CRS.
Definition	Direct position instances hold the coordinates for a position within some coordinate reference system (CRS). Since direct positions, as data types, will often be included in larger objects (such as geometry elements) that have references to CRS, the srsName attribute will in general be missing, if this particular direct position is included in a larger element with such a reference to a CRS. In this case, the CRS is implicitly assumed to take on the value of the containing object's CRS. If no srsName attribute is given, the CRS shall be specified as part of the larger context this geometry element is part of, typically a geometric object like a point, curve, etc.
Comments	This is one of the key basic types, used to define geometric position values – for example the location of a point.
Used in	Used in the definition of various geometry types, such as GM_Point, GM_Envelope, GM_Position, GM_LineString, GM_Arc, GM_Circle, ArcByCenterPoint and CircleByCenterPoint.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre><complexType name="DirectPositionType"> <simpleContent> <extension base="gml:doubleList"> <attributeGroup ref="gml:SRSReferenceGroup"/> <attribute name="count" type="positiveInteger"/> </extension> </simpleContent> </complexType> <element name="pos" type="gml:DirectPositionType"/></pre>
Example	<gml:pos>46.1 3.2</gml:pos>

GM_Object / gml:AbstractGeometry – Documentation

The XML Schema implementation of the *GM_Object* type (see ISO 19107:2003, section 6.2.2) is given by the *gml:AbstractGeometry* XSD element and *gml:AbstractGeometryType* XSD complex type (see ISO 19136:2007, section 10.1.3), documented in the following table.

XSD Element	gml:AbstractGeometry
Type	gml:AbstractGeometryType
BaseType	gml:AbstractGMLType
Restriction	<i>The srsDimension, axisLabel and uomLabels attributes should not be used in AIXM geometries.</i>
Usage	Represents the parent of all geometry types.
Definition	The gml:AbstractGeometry element is the abstract head of the substitution group for all geometry elements. This includes predefined and user-defined geometry elements. NOTE: the CRS of the geometry can be defined locally (in the geometry itself) but also globally (i.e. external to the geometry).
Comments	All geometry types defined in this profile, including the AIXM geometry types, ultimately derive from gml:AbstractGeometry.
Used in	Used as (direct or indirect) parent type for GM_Point, GM_Curve, GM_Surface, and thus also the derived AIXM geometry types.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre> <element name="AbstractGeometry" type="gml:AbstractGeometryType" abstract="true" substitutionGroup="gml:AbstractGML"/> <complexType name="AbstractGeometryType" abstract="true"> <complexContent> <extension base="gml:AbstractGMLType"> <attributeGroup ref="gml:SRSReferenceGroup"/> </extension> </complexContent> </complexType> <attributeGroup name="SRSReferenceGroup"> <attribute name="srsName" type="anyURI"/> <attribute name="srsDimension" type="positiveInteger"/> <attributeGroup ref="gml:SRSInformationGroup"/> </attributeGroup> <attributeGroup name="SRSInformationGroup"> <attribute name="axisLabels" type="gml:NCNameList"/> <attribute name="uomLabels" type="gml:NCNameList"/> </attributeGroup> </pre>

Example	<i>not applicable, because GM_Object is an abstract type</i>
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GM_Point / gml:Point – Documentation

The XML Schema implementation of the *GM_Point* type (see ISO 19107:2003, section 6.3.11) is given by the *gml:Point* XSD element and *gml:PointType* XSD complex type (see ISO 19136:2007, section 10.3.1), documented in the following table.

XSD Element	gml:Point
Type	gml:PointType
BaseType	gml:AbstractGeometricPrimitiveType
Restriction	The use of the child element “gml:coordinates” is deprecated. Use “gml:pos” instead.
Usage	Use to identify a geographic point.
Definition	A Point is defined by a single coordinate tuple. The direct position of a point is specified by the pos element which is of type DirectPositionType.
Comments	In AIXM applications the reference to a gml:Point (or subtype, such as aixm:Point) that is given in an XML instance document via an xlink:href may point to an AIXM feature instead of the gml:Point. A GML application may mark this as an error. However, in AIXM applications this can be used to model that the current value of the point property depends on the location of another aeronautical feature (e.g. a Navaid).
Used in	Used as parent type for AIXM Point. Also used in a number of geometry types.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre> <element name="Point" type="gml:PointType" substitutionGroup="gml:AbstractGeometricPrimitive"/> <complexType name="PointType"> <complexContent> <extension base="gml:AbstractGeometricPrimitiveType"> <sequence> <choice> <element ref="gml:pos"/> <element ref="gml:coordinates"/> </choice> </sequence> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:Point srsName="urn:ogc:def:crs:EPSG::4326" ... gml:id="IDX"> <gml:pos>46.1 3.2</gml:pos> </gml:Point> </pre>

GM_Envelope / gml:Envelope – Documentation

The XML Schema implementation of the *GM_Envelope* type (see ISO 19107:2003, section 6.4.3) is given by the *gml:Envelope* XSD element and *gml:EnvelopeType* XSD complex type (see ISO 19136:2007, section 10.1.4.6), documented in the following table.

XSD Element	gml:Envelope
Type	gml:EnvelopeType
BaseType	-
Restriction	The use of the child elements "gml:coordinates" and "gml:pos" has been deprecated. The explicitly named properties "lowerCorner" and "upperCorner" shall be used instead.
Usage	Used in <i>gml:boundedBy</i> property of a feature or feature collection to provide its overall spatial extent as a bounding box. The Envelope may also provide the CRS information for contained geometries.
Definition	Envelope defines an extent using a pair of positions defining opposite corners in arbitrary dimensions. The first direct position is the "lower corner" (a coordinate position consisting of all the minimal ordinates for each dimension for all points within the envelope), the second one the "upper corner" (a coordinate position consisting of all the maximal ordinates for each dimension for all points within the envelope).
Comments	<i>none</i>
Used in	gml:boundedBy property of AIXM feature or feature collection
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre> <element name="Envelope" type="gml:EnvelopeType" substitutionGroup="gml:AbstractObject"/> <complexType name="EnvelopeType"> <choice> <sequence> <element name="lowerCorner" type="gml:DirectPositionType"/> <element name="upperCorner" type="gml:DirectPositionType"/> </sequence> <element ref="gml:pos" minOccurs="2" maxOccurs="2"/> <element ref="gml:coordinates"/> </choice> <attributeGroup ref="gml:SRSReferenceGroup"/> </complexType> </pre>
Example	<pre> <gml:Envelope ... srsName="urn:ogc:def:crs:EPSG::4326"> <gml:lowerCorner>46.1 3.2</gml:lowerCorner> <gml:upperCorner>54.9 15.7</gml:upperCorner> </gml:Envelope> </pre>

GM_PointRef / gml:pointProperty – Documentation

The XML Schema implementation of the *GM_PointRef* type (see ISO 19107:2003, section 6.4.2) is given by the *gml:pointProperty* XSD element and *gml:PointPropertyType* XSD complex type (see ISO 19136:2007, section 10.3.2), documented in the following table.

XSD Element	gml:pointProperty
Type	gml:PointPropertyType
BaseType	<i>none</i>
Restriction	<i>none</i>
Usage	Used to reference an existing point.
Definition	<p>A property that has a point as its value domain may either be an appropriate geometry element encapsulated in an element of this type or an XLink reference to a remote geometry element (where remote includes geometry elements located elsewhere in the same document). Either the reference or the contained element shall be given, but neither both nor none.</p> <p>This property element either references a point via the XLink-attributes or contains the point element. pointProperty is the predefined property which may be used by GML Application Schemas whenever a GML feature has a property with a value that is substitutable for gml:Point.</p>
Comments	The GML implementation of GM_PointRef supports not only the pure reference to a point but also including a point directly.
Used in	Used in the definition of various geometry types.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre><complexType name="PointPropertyType"> <sequence minOccurs="0"> <element ref="gml:Point"/> </sequence> <attributeGroup ref="gml:AssociationAttributeGroup"/> <attributeGroup ref="gml:OwnershipAttributeGroup"/> </complexType> <element name="pointProperty" type="gml:PointPropertyType"/></pre>
Example	<code><gml:pointProperty xlink:href="#P001"/></code>

GM_Position / gml:geometricPositionGroup – Documentation

The XML Schema implementation of the *GM_Position* type (see ISO 19107:2003, section 6.4.5) is given by the *gml:geometricPositionGroup* XSD group (see ISO 19136:2007, section 10.1.4.3 and D.2.3.4), documented in the following table.

XSD group	<code>gml:geometricPositionGroup</code>
Type	<i>NA</i>
BaseType	<i>NA</i>
Restriction	<i>none</i>
Usage	Allows the identification of a position either directly as a coordinate or indirectly as a reference to a <code>GM_Point</code> .
Definition	GML supports two different ways to specify a geometric position: either by a direct position (a data type) or a point (a geometric object). <ul style="list-style-type: none"> • <code>gml:pos</code> elements are positions that are —owned by the geometric primitive encapsulating this geometric position. • <code>gml:pointProperty</code> elements contain a point that may be referenced from other geometry elements or reference another point defined elsewhere (reuse of existing points).
Comments	Relevant in this profile only in the XML Schema Implementation of <code>GM_GeodesicString</code> .
Used in	The XML Schema Implementation of the <code>GM_GeodesicString</code> type.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre><group name="geometricPositionGroup"> <choice> <element ref="gml:pos"/> <element ref="gml:pointProperty"/> </choice> </group></pre>
Example	<pre><gml:GeodesicString> <!-- start of group --> <gml:pos>39.42916667 47.36333334</gml:pos> <gml:pos>39.426818 47.353277</gml:pos> <gml:pointProperty xlink:href="#POXYZ"/> <!-- end of group --> </gml:GeodesicString></pre>

GM_PointArray / `gml:posList` – Documentation

The XML Schema implementation of the `GM_PointArray` type (see ISO 19107:2003, section 6.4.6) is given by the `gml:posList` XSD element and `gml:DirectPositionListType` XSD complex type (see ISO 19136:2007, section 10.1.4.2 and D.2.3.4), documented in the following table.

Note: the `gml:geometricPositionListGroup` XSD group is an alternative XML Schema implementation of `GM_PointArray` defined by GML. However, in GML it is only used in the definition of `PointGrid`, which is irrelevant for this profile.

XSD Element	<code>gml:posList</code>
Type	<code>gml:DirectPositionListType</code>
BaseType	<i>none</i>
Restriction	<i>none</i>

Usage	To encode a sequence of direct positions.
Definition	<p><code>gml:posList</code> instances (and other instances with the content model specified by <code>DirectPositionListType</code>) hold the coordinates for a sequence of direct positions within the same coordinate reference system (CRS). If no <code>srName</code> attribute is given, the CRS shall be specified as part of the larger context this geometry element is part of, typically a geometric object like a point, curve, etc.</p> <p>NOTE: It is expected that the attribute <code>srName</code> will be specified at the direct position level only in rare cases.</p> <p>The optional attribute <code>count</code> specifies the number of direct positions in the list. If the attribute <code>count</code> is present then the attribute <code>srDimension</code> shall be present, too.</p> <p>The number of entries in the list is equal to the product of the dimensionality of the coordinate reference system (i.e. it is a derived value of the coordinate reference system definition) and the number of direct positions.</p>
Comments	<i>none</i>
Used in	Used in the XML Schema Implementation of <code>GM_LineString</code> , <code>GM_Arc</code> , <code>GM_Circle</code> , <code>ArcByCenterPoint</code> , <code>CircleByCenterPoint</code> , <code>GM_GeodesicString</code> and <code>GM_Geodesic</code> .
XML Schema File	(./ISO_19136_Schemas/) <code>geometryBasic.xsd</code>
XML Schema Component	<pre><complexType name="DirectPositionListType"> <simpleContent> <extension base="gml:doubleList"> <attributeGroup ref="gml:SRSReferenceGroup"/> <attribute name="count" type="positiveInteger"/> </extension> </simpleContent> </complexType> <element name="posList" type="gml:DirectPositionListType"/></pre>
Example	<code><gml:posList>39.42916667 47.36333334 39.426818 47.353277 38.87277778 46.54722222</gml:posList></code>

gml:AbstractCurve – Documentation

The XML Schema implementation of the *GML AbstractCurve* type is given by the *gml:AbstractCurve* XSD element and *gml:AbstractCurveType* XSD complex type (see ISO 19136:2007, section 10.4.1), documented in the following table.

XSD Element	gml:AbstractCurve
Type	<code>gml:AbstractCurveType</code>
BaseType	<code>gml:AbstractGeometricPrimitiveType</code>
Restriction	<i>none</i>

Usage	Abstract type defined by GML as supertype for all curve types.
Definition	The AbstractCurve element is the abstract head of the substitution group for all (continuous) curve elements.
Comments	<i>none</i>
Used in	As supertype for gml:Curve, gml:OrientableCurve and gml:CompositeCurve. Also used in the content model of gml:OrientableCurve, gml:CompositeCurve and gml:Ring. Consequently, the GML encoding is not a direct mapping of the ISO 19107 GM_Curve.
XML Schema File	(./ISO_19136_Schemas/) geometryBasic.xsd
XML Schema Component	<pre><element name="AbstractCurve" type="gml:AbstractCurveType" abstract="true" substitutionGroup="gml:AbstractGeometricPrimitive"/> <complexType name="AbstractCurveType" abstract="true"> <annotation> <documentation>gml:AbstractCurveType is an abstraction of a curve to support the different levels of complexity. The curve may always be viewed as a geometric primitive, i.e. is continuous.</documentation> </annotation> <complexContent> <extension base="gml:AbstractGeometricPrimitiveType"/> </complexContent> </complexType></pre>
Example	<i>not applicable because the type is abstract</i>

GM_Curve / gml:Curve – Documentation

The XML Schema implementation of the *GM_Curve* type (see ISO 19107:2003, section 6.3.16) is given by the *gml:Curve* XSD element and *gml:CurveType* XSD complex type (see ISO 19136:2007, section 10.4.5), documented in the following table.

XSD Element	gml:Curve
Type	gml:CurveType
BaseType	gml:AbstractCurveType
Restriction	<i>none</i>
Usage	To represent spatial properties of aeronautical features with 1D shape (e.g. the centerline of an airspace corridor) but also the boundaries of a 2D shape (e.g. the exterior of an airspace).
Definition	<p>A curve is a 1-dimensional primitive. Curves are continuous, connected, and have a measurable length in terms of the coordinate system.</p> <p>A curve is composed of one or more curve segments. Each curve segment within a curve may be defined using a different</p>

	<p>interpolation method. The curve segments are connected to one another, with the end point of each segment except the last being the start point of the next segment in the segment list.</p> <p>The orientation of the curve is positive.</p> <p>The element “segments” encapsulates the segments of the curve.</p>
Comments	The orientation of a curve can be inverted using an <code>OrientableCurve</code> as wrapper.
Used in	Used as parent type for AIXM Curve. Can be used in the definition of a surface boundary.
XML Schema File	(./ISO_19136_Schemas/) <code>geometryPrimitives.xsd</code>
XML Schema Component	<pre> <element name="Curve" type="gml:CurveType" substitutionGroup="gml:AbstractCurve"/> <complexType name="CurveType"> <complexContent> <extension base="gml:AbstractCurveType"> <sequence> <element ref="gml:segments"/> </sequence> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:Curve srsName="urn:ogc:def:crs:EPSG::4326" ... gml:id="IDX"> <gml:segments> <gml:GeodesicString> <gml:posList>lat_P1 long_P1 lat_P2 long_P2</gml:posList> </gml:GeodesicString> <gml:ArcByCenterPoint gml:id="A01"> <gml:pos>lat_P3 long_P3</gml:pos> <gml:radius uom="m">radius</gml:radius> <gml:startAngle uom="deg">calculated_start_angle</gml:startAngle> <gml:endAngle uom="deg">calculated_end_angle</gml:endAngle> </gml:ArcByCenterPoint> <gml:GeodesicString> <gml:posList>lat_P4 long_P4 lat_P5 long_P5</gml:posList> </gml:GeodesicString> </gml:segments> </gml:Curve> </pre>

GM_CurveSegment / gml:AbstractCurveSegment – Documentation

The XML Schema implementation of the *GM_CurveSegment* type (see ISO 19107:2003, section 6.4.9) is given by the *gml:AbstractCurveSegment* XSD element and

gml:AbstractCurveSegmentType XSD complex type (see ISO 19136:2007, section 10.4.7.1), documented in the following table.

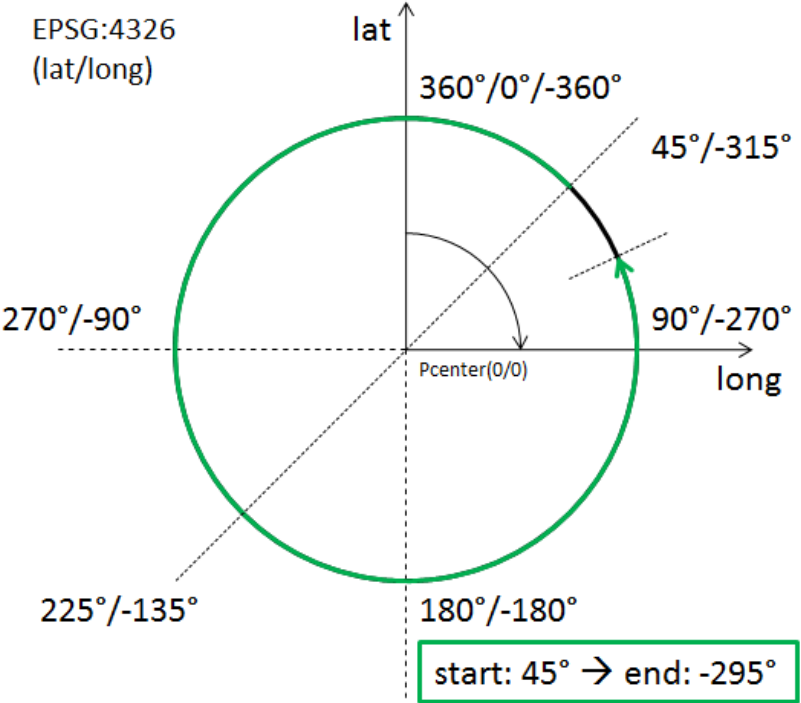
NOTE: *GM_CurveSegment* is the abstract parent of a number of curve segment types.

XSD Element	gml:AbstractCurveSegment
Type	gml:AbstractCurveSegmentType
BaseType	-
Restriction	<i>none</i>
Usage	Abstract type that is the supertype for all curve segment types.
Definition	<p>A curve segment defines a homogeneous segment of a curve. The attributes <i>numDerivativesAtStart</i>, <i>numDerivativesAtEnd</i> and <i>numDerivativesInterior</i> specify the type of continuity as specified in ISO 19107:2003, 6.4.9.3.</p> <p>The <i>AbstractCurveSegment</i> element is the abstract head of the substitution group for all curve segment elements, i.e. continuous segments of the same interpolation mechanism.</p> <p>All curve segments shall have an attribute <i>interpolation</i> with type <i>gml:CurveInterpolationType</i> specifying the curve interpolation mechanism used for this segment. This mechanism uses the control points and control parameters to determine the position of this curve segment.</p>
Comments	<i>none</i>
Used in	Curve
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="AbstractCurveSegment" type="gml:AbstractCurveSegmentType" abstract="true" substitutionGroup="gml:AbstractObject"/> <complexType name="AbstractCurveSegmentType" abstract="true"> <attribute name="numDerivativesAtStart" type="integer" default="0"/> <attribute name="numDerivativesAtEnd" type="integer" default="0"/> <attribute name="numDerivativeInterior" type="integer" default="0"/> </complexType> </pre>
Example	<i>not applicable, because GM_CurveSegment is an abstract type</i>

gml:ArcByCenterPoint – Documentation

The XML Schema implementation of the *GML ArcByCenterPoint* type (see ISO 19136:2007, section D.3.7) is given by the *gml:ArcByCenterPoint* XSD element and *gml:ArcByCenterPointType* XSD complex type (see ISO 19136:2007, section 10.4.7.10), documented in the following table.

XSD Element	gml:ArcByCenterPoint
Type	gml:ArcByCenterPointType
BaseType	gml:AbstractCurveSegmentType
Restriction	The use of the child elements “gml:pointRep” as well as “gml:coordinates” is deprecated. The child element “gml:posList” is allowed by ISO 19136, but if used it shall contain only one position that represents the center of the arc.
Usage	Typical construct for arcs used in the definition of airspace borders in the AI domain.
Definition	This variant of the arc requires that the points on the arc shall be computed instead of storing the coordinates directly. The single control point is the center point of the arc plus the radius and the bearing at start and end. This representation can be used only in 2D. The element radius specifies the radius of the arc. The element startAngle specifies the bearing of the arc at the start. The element endAngle specifies the bearing of the arc at the end. The interpolation is fixed as "circularArcCenterPointWithRadius". Since this type describes always a single arc, the attribute "numArc" is fixed to "1". The content model follows the general pattern for the encoding of curve segments.
Comments	<i>See the main body of the document for further details about the angle measurement convention, angle value ranges, arc direction, arc interpolation, mapping rules as well as recommended units of measurements.</i>
Used in	As child of GM_CurveSegment to represent a segment of a GM_Curve .
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="ArcByCenterPoint" type="gml:ArcByCenterPointType" substitutionGroup="gml:AbstractCurveSegment"/> <complexType name="ArcByCenterPointType"> <complexContent> <extension base="gml:AbstractCurveSegmentType"> <sequence> <choice> <choice> <element ref="gml:pos"/> <element ref="gml:pointProperty"/> element ref="gml:pointRep"/> </choice> <element ref="gml:posList"/> element ref="gml:coordinates"/> </choice> <element name="radius" type="gml:LengthType"/> <element name="startAngle" type="gml:AngleType" minOccurs="0"/> </pre>

	<pre> <element name="endAngle" type="gml:AngleType" minOccurs="0"/> </sequence> <attribute name="interpolation" type="gml:CurveInterpolationType" fixed="circularArcCenterPointWithRadius"/> <attribute name="numArc" type="integer" use="required" fixed="1"/> </extension> </complexContent> </complexType> </pre>
Example	<p>Assuming an arc defined by its center point as well as start and end angle as shown in the following diagram:</p>  <p>Then the GML encoding in an <code>ArcByCenterPoint</code> is as follows (in a left-handed CRS):</p> <pre> <gml:ArcByCenterPoint ... numArc="1"> <gml:pos>0 0</gml:pos> <gml:radius uom="m">1000</gml:radius> <gml:startAngle uom="deg">45.0</gml:startAngle> <gml:endAngle uom="deg">-295.0</gml:endAngle> </gml:ArcByCenterPoint> </pre>

gml:CircleByCenterPoint – Documentation

The XML Schema implementation of the *GML CircleByCenterPoint* type (see ISO 19136:2007, section D.3.7) is given by the *gml:CircleByCenterPoint* XSD element and *gml:CircleByCenterPointType* XSD complex type (see ISO 19136:2007, section 10.4.7.11), documented in the following table.

XSD Element	gml:CircleByCenterPoint
Type	gml:CircleByCenterPointType
BaseType	gml:ArcByCenterPointType
Restriction	Only the circle center position as well as the radius can be defined. The use of the child elements “gml:pointRep” as well as “gml:coordinates” is deprecated. The child element “gml:posList” is allowed by ISO 19136, but if used it shall contain only one position that represents the center of the circle.
Usage	To define the geometry of a circular airspace in the AI domain.
Definition	A gml:CircleByCenterPoint is a gml:ArcByCenterPoint with identical start and end angle to form a full circle. Again, this representation can be used only in 2D.
Comments	Use of CircleByCenterPoint is recommended only in the definition of an interior and/or exterior surface boundary – like an airspace boundary – with circular shape. In that case, the direction of the boundary is implied and automatically complies with ISO 19107 rules (exterior boundary is encoded counter clockwise while any interior boundary is encoded clockwise; for further information. If gml:CircleByCenterPoint was used in conjunction with other curve segments to define a curve then the direction (clockwise / counter-clockwise) of the CircleByCenterPoint is not well-defined by GML.
Used in	As child of ArcByCenterPoint to represent the segment of a GM_Curve that forms a circle.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="CircleByCenterPoint" type="gml:CircleByCenterPointType" substitutionGroup="gml:ArcByCenterPoint"/> <complexType name="CircleByCenterPointType"> <complexContent> <restriction base="gml:ArcByCenterPointType"> <sequence> <choice> <choice> <element ref="gml:pos"/> <element ref="gml:pointProperty"/> element ref="gml:pointRep"/> </choice> <element ref="gml:posList"/> element ref="gml:coordinates"/> </choice> <element name="radius" type="gml:LengthType"/> </sequence> </restriction> </complexContent> </complexType> </pre>
Example	<gml:CircleByCenterPoint ... numArc="1">

	<pre><gml:pos>0 0</gml:pos> <gml:radius uom="m">1000</gml:radius> </gml:CircleByCenterPoint></pre>
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GM_Arc / gml:Arc – Documentation

The XML Schema implementation of the *GM_Arc* type (see ISO 19107:2003, section 6.4.15) is given by the *gml:Arc* XSD element and *gml:ArcType* XSD complex type (see ISO 19136:2007, section 10.4.7.6), documented in the following table.

XSD Element	gml:Arc
Type	gml:ArcType
BaseType	gml:ArcStringType (not documented in this profile because use of ArcString is not foreseen by this profile)
Restriction	The value domain of attribute "numArc" is fixed to "1". Use of the child elements "gml:pointRep" and "gml:coordinates" is deprecated.
Usage	To define an arc that is given via three control points – usually to define a curve segment.
Definition	An Arc is an arc string with only one arc unit, i.e. three control points including the start and end point. As arc is an arc string consisting of a single arc, the attribute "numArc" is fixed to "1".
Comments	The direction of the Arc is implicitly provided by the order of its control points. Use of GM_Arc is also known as "arc by edge". Although not extensively used at present in the aviation domain, it is expected that its usage will increase, with the corresponding diminishing of ArcByCenterPoint. GM_Arc is simpler and less open to interpretation than ArcByCenterPoint.
Used in	As child of GM_ArcString, usually to represent a segment of a GM_Curve.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre><element name="Arc" type="gml:ArcType" substitutionGroup="gml:ArcString"/> <complexType name="ArcType"> <complexContent> <restriction base="gml:ArcStringType"> <sequence> <choice> <choice minOccurs="3" maxOccurs="3"> <element ref="gml:pos"/> <element ref="gml:pointProperty"/> element ref="gml:pointRep"/> </choice> <element ref="gml:posList"/> element ref="gml:coordinates"/> </sequence> </restriction> </complexContent> </complexType></pre>

	<pre> </choice> </sequence> <attribute name="numArc" type="integer" fixed="1"/> </restriction> </complexContent> </complexType> </pre>
Example	<pre> <gml:Arc ...> <gml:posList>0 0 1 1 0 2</gml:posList> </gml:Arc> </pre>

GM_Circle / gml:Circle – Documentation

The XML Schema implementation of the *GM_Circle* type (see ISO 19107:2003, section 6.4.16) is given by the *gml:Circle* XSD element and *gml:CircleType* XSD complex type (see ISO 19136:2007, section 10.4.7.7), documented in the following table.

XSD Element	gml:Circle
Type	gml:CircleType
BaseType	gml:ArcType
Restriction	Use of the child elements “gml:pointRep” and “gml:coordinates” is deprecated.
Usage	To define a circle that is given via three control points – usually to define the boundary of a circular airspace.
Definition	A Circle is an arc whose ends coincide to form a simple closed loop. The three control points shall be distinct non-co-linear points for the circle to be unambiguously defined. The arc is simply extended past the third control point until the first control point is encountered.
Comments	Other than CircleByCenterPoint, Circle has a well defined direction.
Used in	As child of GM_Arc, usually to represent a segment of a GM_Curve that forms a circle.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="Circle" type="gml:CircleType" substitutionGroup="gml:Arc"/> <complexType name="CircleType"> <complexContent> <extension base="gml:ArcType"/> </complexContent> </complexType> </pre>
Example	<pre> <gml:Circle ...> <gml:posList>0 1 -1 0 0 -1</gml:posList> </gml:Circle> </pre>

GM_GeodesicString / gml:GeodesicString – Documentation

The XML Schema implementation of the *GM_GeodesicString* type (see ISO 19107:2003, section 6.4.12) is given by the *gml:GeodesicString* XSD element and *gml:GeodesicStringType* XSD complex type (see ISO 19136:2007, section 10.4.7.20), documented in the following table.

XSD Element	gml:GeodesicString
Type	gml:GeodesicStringType
BaseType	gml:AbstractCurveSegmentType
Restriction	<i>none</i>
Usage	Used for the encoding of straight lines on the earth surface.
Definition	A sequence of geodesic segments. The number of control points shall be at least two. interpolation is fixed as "geodesic". The content model follows the general pattern for the encoding of curve segments.
Comments	GeodesicString is the default encoding for straight lines recommended by this document. The more compact form of representing the control points of a GeodesicString is achieved via the gml:posList element.
Used in	As child of GM_CurveSegment to represent a segment of a GM_Curve.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="GeodesicString" type="gml:GeodesicStringType" substitutionGroup="gml:AbstractCurveSegment"/> <complexType name="GeodesicStringType"> <complexContent> <extension base="gml:AbstractCurveSegmentType"> <choice> <element ref="gml:posList"/> <group ref="gml:geometricPositionGroup" minOccurs="2" maxOccurs="unbounded"/> </choice> <attribute name="interpolation" type="gml:CurveInterpolationType" fixed="geodesic"/> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:GeodesicString ...> <gml:posList>39.42916667 47.36333334 39.426818 47.353277 38.87277778 46.54722222</gml:posList> </gml:GeodesicString> </pre>

GM_Geodesic / gml:Geodesic – Documentation

The XML Schema implementation of the *GM_Geodesic* type (see ISO 19107:2003, section 6.4.13) is given by the *gml:Geodesic* XSD element and *gml:GeodesicType* XSD complex type (see ISO 19136:2007, section 10.4.7.21), documented in the following table.

XSD Element	gml:Geodesic
Type	gml:GeodesicType
BaseType	gml:GeodesicStringType
Restriction	<i>none</i>
Usage	To define a straight line on the earth surface – usually to define a curve segment.
Definition	A GM_Geodesic consists of two distinct positions joined by a geodesic curve. The control points of a GM_Geodesic shall all lie on the geodesic between its start point and end point. Between these two points, a geodesic curve defined from the ellipsoid or geoid model used by the coordinate reference system may be used to interpolate other positions. Any other point in the controlPoint array must fall on this geodesic.
Comments	Geodesic is a particular case of the more general concept of “GeodesicString”.
Used in	As child of GM_GeodesicString, usually to represent a segment of a GM_Curve.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="Geodesic" type="gml:GeodesicType" substitutionGroup="gml:GeodesicString"/> <complexType name="GeodesicType"> <complexContent> <extension base="gml:GeodesicStringType"/> </complexContent> </complexType> <element name="Geodesic" type="gml:GeodesicType" substitutionGroup="gml:GeodesicString"/> <complexType name="SurfaceType"> <complexContent> <extension base="gml:AbstractSurfaceType"> <sequence> <element ref="gml:patches"/> </sequence> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:Geodesic ...> <gml:posList>39.42916667 47.36333334 38.87277778 46.54722222</gml:posList> </gml:Geodesic> </pre>

GM_LineString / gml:LineStringSegment – Documentation

The XML Schema implementation of the *GM_LineString* type (see ISO 19107:2003, section 6.4.10) is given by the *gml:LineStringSegment* XSD element and *gml:LineStringSegmentType* XSD complex type (see ISO 19136:2007, section 10.4.7.4), documented in the following table.

XSD Element	gml:LineStringSegment
Type	gml:LineStringSegmentType
BaseType	gml:AbstractCurveSegmentType
Restriction	Use of the child elements “gml:pointRep” and “gml:coordinates” is deprecated.
Usage	Use to represent a curve segment that is composed of line segments with linear interpolation.
Definition	A LineStringSegment is a curve segment that is defined by two or more control points including the start and end point, with linear interpolation between them. The content model follows the general pattern for the encoding of curve segments.
Comments	In order to represent a parallel (line between locations with same latitude), a GM_LineString with CRS EPSG:4326 should be used for encoding. In order to represent a rhumbline whereas the two consecutive latitudes are different, a GM_LineString with a “Mercator” projected CRS like EPSG:3395 should be used. The more compact form of representing the control points of a GM_LineString is achieved via the gml:posList element.
Used in	As child of GM_CurveSegment to represent a segment of a GM_Curve.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="LineStringSegment" type="gml:LineStringSegmentType" substitutionGroup="gml:AbstractCurveSegment"/> <complexType name="LineStringSegmentType"> <complexContent> <extension base="gml:AbstractCurveSegmentType"> <sequence> <choice> <choice minOccurs="2" maxOccurs="unbounded"> <element ref="gml:pos"/> <element ref="gml:pointProperty"/> <element ref="gml:pointRep"/> </choice> <element ref="gml:posList"/> <element ref="gml:coordinates"/> </choice> </sequence> <attribute name="interpolation" type="gml:CurveInterpolationType" fixed="linear"/> </extension> </complexContent> </complexType> </pre>

	</complexType>
Example	<pre><gml:LineStringSegment ...> <gml:posList> 40.05 45.88972222 40.06 46.93333333</gml:posList> </gml:LineStringSegment></pre>

GM_Surface / gml:Surface – Documentation

The XML Schema implementation of the *GM_Surface* type (see ISO 19107:2003, section 6.3.17) is given by the *gml:Surface* XSD element and *gml:SurfaceType* XSD complex type (see ISO 19136:2007, section 10.5.10), documented in the following table.

XSD Element	gml:Surface
Type	gml:SurfaceType
BaseType	gml:AbstractSurfaceType
Restriction	<i>none</i>
Usage	Defines the basic structure of a surface, which is a composition of one or more surface patches.
Definition	A Surface is a 2-dimensional primitive and is composed of one or more surface patches as specified in ISO 19107:2003, 6.3.17.1. The surface patches are connected to one another.
Comments	The direction of interior and exterior boundaries has to comply with ISO 19107 rules. More specifically, the exterior must be encoded counter clockwise while any interior boundary must be encoded clockwise; for further information.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre><element name="Surface" type="gml:SurfaceType" substitutionGroup="gml:AbstractSurface"/> <complexType name="SurfaceType"> <complexContent> <extension base="gml:AbstractSurfaceType"> <sequence> <element ref="gml:patches"/> </sequence> </extension> </complexContent> </complexType></pre>
Used in	Used as supertype for AIXM Surface.
Example	<pre><gml:Surface ... gml:id="IDX" srsName="urn:ogc:def:crs:EPSG::4326"> <gml:patches> <gml:PolygonPatch> <gml:exterior> <gml:Ring> <gml:curveMember> <gml:Curve gml:id="C002"> <gml:segments> <gml:GeodesicString></pre>

	<pre> <gml:posList>52.20611 5.2875 52.18917 5.29889 52.19117 5.3289 52.20611 5.2875</gml:posList> </gml:GeodesicString> </gml:segments> </gml:Curve> </gml:curveMember> </gml:Ring> </gml:exterior> </gml:PolygonPatch> </gml:patches> </gml:Surface> </pre>
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GM_SurfacePatch / gml:AbstractSurfacePatch – Documentation

The XML Schema implementation of the *GM_SurfacePatch* type (see ISO 19107:2003, section 6.4.34) is given by the *gml:AbstractSurfacePatch* XSD element and *gml:AbstractSurfacePatchType* XSD complex type (see ISO 19136:2007, section 10.5.12.1), documented in the following table.

XSD Element	gml:AbstractSurfacePatch
Type	gml:AbstractSurfacePatchType
BaseType	<i>none</i>
Restriction	<i>none</i>
Usage	Represents the parent of all surface patch types – only the GM_Polygon child type is currently used in the encoding of AIXM surface patches.
Definition	<p>A surface patch defines a homogenous portion of a surface.</p> <p>The AbstractSurfacePatch element is the abstract head of the substitution group for all surface patch elements describing a continuous portion of a surface.</p> <p>All surface patches shall have an attribute interpolation (declared in the types derived from gml:AbstractSurfacePatchType) specifying the interpolation mechanism used for the patch using gml:SurfaceInterpolationType.</p>
Comments	<i>none</i>
Used in	GM_Surface
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="AbstractSurfacePatch" type="gml:AbstractSurfacePatchType" abstract="true"/> <complexType name="AbstractSurfacePatchType" abstract="true"/> </pre>
Example	<i>not applicable because the type is abstract</i>

GM_Polygon / gml:PolygonPatch – Documentation

The XML Schema implementation of the *GM_Polygon* type (see ISO 19107:2003, section 6.4.36) is given by the *gml:PolygonPatch* XSD element and *gml:PolygonPatchType* XSD complex type (see ISO 19136:2007, section 10.5.12.4), documented in the following table.

XSD Element	gml:PolygonPatch
Type	gml:PolygonPatchType
BaseType	gml:AbstractSurfacePatchType
Restriction	<i>Interior patches are not allowed for aeronautical data</i>
Usage	Used to represent the patch(es) of an AIXM Surface.
Definition	A gml:PolygonPatch is a surface patch that is defined by a set of boundary curves and an underlying surface to which these curves adhere. The curves shall be coplanar and the polygon uses planar interpolation in its interior. interpolation is fixed to "planar", i.e. an interpolation shall return points on a single plane. The boundary of the patch shall be contained within that plane.
Comments	The direction of interior and exterior boundaries has to comply with ISO 19107 rules. More specifically, the exterior must be encoded counter clockwise while any interior boundary must be encoded clockwise; for further information. GM_Ring should be used to represent and encode the exterior/interior of a GM_Polygon.
Used in	As child of GM_SurfacePatch to represent the surface patch(es) of a GM_Surface.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="PolygonPatch" type="gml:PolygonPatchType" substitutionGroup="gml:AbstractSurfacePatch"/> <complexType name="PolygonPatchType"> <complexContent> <extension base="gml:AbstractSurfacePatchType"> <sequence> <element ref="gml:exterior" minOccurs="0"/> <element ref="gml:interior" minOccurs="0" maxOccurs="unbounded"/> </sequence> <attribute name="interpolation" type="gml:SurfaceInterpolationType" fixed="planar"/> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:PolygonPatch ...> <gml:exterior> <gml:Ring> <gml:curveMember> <gml:Curve gml:id="C002"> <gml:segments> </pre>

	<pre> <gml:GeodesicString> <gml:posList>52.20611 5.2875 52.18917 5.29889 52.19117 5.3289 52.20611 5.2875</gml:posList> </gml:GeodesicString> </gml:segments> </gml:Curve> </gml:curveMember> </gml:Ring> </gml:exterior> </gml:PolygonPatch> </pre>
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gml:AbstractRing – Documentation

The XML Schema implementation of the *GML AbstractRing* type is given by the *gml:AbstractRing* XSD element and *gml:AbstractRingType* XSD complex type (see ISO 19136:2007, section 10.5.6), documented in the following table.

XSD Element	gml:AbstractRing
Type	gml:AbstractRingType
BaseType	<i>none</i>
Restriction	<i>none</i>
Usage	Represents the supertype for the GML encoding of the GM_Ring type and its subtypes.
Definition	An abstraction of a ring to support surface boundaries of different complexity. The AbstractRing element is the abstract head of the substitution group for all closed boundaries of a surface patch.
Comments	At the moment, the only substitute for gml:AbstractRing foreseen by this profile is GM_Ring / gml:Ring.
Used in	The definition of the exterior/interior of a surface boundary
XML Schema File	(./ISO_19136_Schemas/) geometryBasic2d.xsd
XML Schema Component	<pre> <element name="AbstractRing" type="gml:AbstractRingType" abstract="true" substitutionGroup="gml:AbstractObject"/> <complexType name="AbstractRingType" abstract="true"> <sequence/> </complexType> </pre>
Example	<i>not applicable because the type is abstract</i>

GM_Ring / gml:Ring – Documentation

The XML Schema implementation of the *GM_Ring* type (see ISO 19107:2003, section 6.3.6) is given by the *gml:Ring* XSD element and *gml:RingType* XSD complex type (see ISO 19136:2007, section 10.5.11.1), documented in the following table.

XSD Element	gml:Ring
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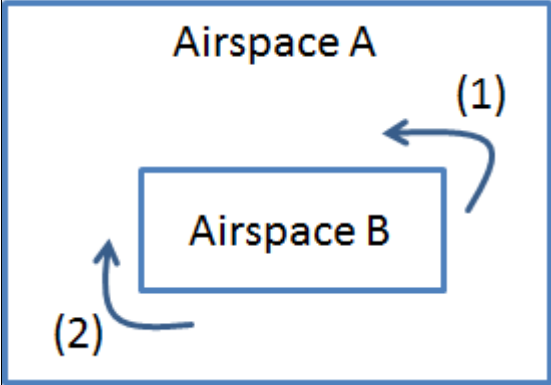
Type	<code>gml:RingType</code>
BaseType	<code>gml:AbstractRingType</code>
Restriction	<i>none</i>
Usage	Used to represent the exterior/interior of a surface boundary.
Definition	<p>A ring is used to represent a single connected component of a surface boundary as specified in ISO 19107:2003, 6.3.6.</p> <p>Every <code>gml:curveMember</code> references or contains one curve, i.e. any element which is substitutable for <code>gml:AbstractCurve</code>. In the context of a ring, the curves describe the boundary of the surface. The sequence of curves shall be contiguous and connected in a cycle. If provided, the <code>aggregationType</code> attribute shall have the value "sequence".</p>
Comments	<p>In the special case that there is only one curve member in a Ring, the curve member itself needs to form a cycle. For example, if a Ring is formed by a <code>GeodesicString</code>, then the first and last position element of that <code>GeodesicString</code> must be equal in order to form a cycle. The <code>CircleByCenterPoint</code> type automatically forms a cycle.</p> <p>In AIXM applications airspace boundaries may be based on national borders or on other geographical features, such as shorelines, rivers etc. The encoding of such <code>GeoBorders</code> can be achieved using annotations (for applications where a text remark is sufficient) or using references (for applications where a true reference needs to be preserved). The former approach depends on the use of <code>aixm:Curve</code> as curve member, the latter requires either a local reference to a curve or an abstract reference to a remote feature.</p>
Used in	The definition of the exterior/interior(s) of a <code>Polygon</code> .
XML Schema File	<code>(./ISO_19136_Schemas/) geometryPrimitives.xsd</code>
XML Schema Component	<pre> <element name="Ring" type="gml:RingType" substitutionGroup="gml:AbstractRing"/> <complexType name="RingType"> <complexContent> <extension base="gml:AbstractRingType"> <sequence> <element ref="gml:curveMember" maxOccurs="unbounded"/> </sequence> <attributeGroup ref="gml:AggregationAttributeGroup"/> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:Ring ...> <gml:curveMember> <gml:Curve gml:id="CUR001"> <gml:segments> <gml:LineStringSegment interpolation="linear"> <gml:posList> 40.05 45.88972222 40.05 </pre>

	<pre> 46.93333333</gml:posList> </gml:LineStringSegment> <gml:GeodesicString interpolation="geodesic"> <gml:posList>40.05 46.93333333 39.42916667 47.36333334</gml:posList> </gml:GeodesicString> </gml:segments> </gml:Curve> </gml:curveMember> <gml:curveMember xlink:href="#CRV002" xlink:title="along the state border with Islamic Republic of Iran"/> <gml:curveMember xlink:href="#CRV003" xlink:title="along the state border with Armenia"/> </gml:Ring> </pre>
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GM_OrientableCurve / gml:OrientableCurve – Documentation

The XML Schema implementation of the *GM_OrientableCurve* type (see ISO 19107:2003, section 6.3.14) is given by the *gml:OrientableCurve* XSD element and *gml:OrientableCurveType* XSD complex type (see ISO 19136:2007, section 10.4.6), documented in the following table.

XSD Element	gml:OrientableCurve
Type	gml:OrientableCurveType
BaseType	gml:AbstractCurveType
Restriction	<i>none</i>
Usage	To invert the orientation of another curve.
Definition	<p>OrientableCurve consists of a curve and an orientation. If the orientation is "+", then the OrientableCurve is identical to the baseCurve. If the orientation is "-", then the OrientableCurve is related to another AbstractCurve with a parameterization that reverses the sense of the curve traversal.</p> <p>The property gml:baseCurve references or contains the base curve, i.e. it either references the base curve via the XLink-attributes or contains the curve element. A curve element is any element which is substitutable for gml:AbstractCurve. The base curve has positive orientation.</p> <p>NOTE This definition allows for a nested structure, i.e. an gml:OrientableCurve may use another gml:OrientableCurve as its base curve.</p>
Comments	<p>OrientableCurve can be used to invert the direction of a curve inside a gml:Ring. OrientableCurve is not foreseen to be used often. However, there is one use case that would require OrientableCurve: If an already established curve – for example from the border of an existing airspace – is used by reference in the definition of another airspace then there may be a need to invert the direction of that</p>

	<p>referenced curve. For example, one airspace (A) has a hole which is another airspace (B). In that particular case, the boundary of B is encoded counter-clockwise. However, to be included as an interior boundary in A that direction would need to be inverted (to ensure that the interior of A is encoded clockwise) which is not possible without an OrientableCurve wrapper if the curve members of the boundary of B are to be referenced. The following diagram illustrates the setup:</p>  <p>(1) Exterior of Airspace B, encoded counter-clockwise (2) Interior of Airspace A, encoded clockwise.</p> <p>Even though in AIXM the AirspaceVolume element is used to aggregate an airspace made of parts, a client may like to see the horizontal projection of the airspace aggregation described in GML, for which the OrientableCurve may then be used.</p>
Used in	As member of a Ring, CompositeCurve or another OrientableCurve.
XML Schema File	(/ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="OrientableCurve" type="gml:OrientableCurveType" substitutionGroup="gml:AbstractCurve"/> <complexType name="OrientableCurveType"> <complexContent> <extension base="gml:AbstractCurveType"> <sequence> <element ref="gml:baseCurve"/> </sequence> <attribute name="orientation" type="gml:SignType" default="+"/> </extension> </complexContent> </complexType> <element name="baseCurve" type="gml:CurvePropertyType"/> </pre>
Example	<pre> <gml:Ring ...> <gml:curveMember> <gml:OrientableCurve gml:id="IDX" orientation="-"> </pre>

	<pre> <gml:baseCurve xlink:href="#CUR001"/> </gml:OrientableCurve> </gml:curveMember> </gml:Ring> </pre>
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GM_CompositeCurve / gml:CompositeCurve – Documentation

The XML Schema implementation of the *GM_CompositeCurve* type (see ISO 19107:2003, section 6.6.5) is given by the *gml:CompositeCurve* XSD element and *gml:CompositeCurveType* XSD complex type (see ISO 19136:2007, section 11.2.2.2), documented in the following table.

XSD Element	gml:CompositeCurve
Type	gml:CompositeCurveType
Base Type	gml:AbstractCurveType
Restriction	<i>none</i>
Usage	To represent a curve as a combination of other curves.
Definition	<p>A gml:CompositeCurve is represented by a sequence of (orientable) curves such that each curve in the sequence terminates at the start point of the subsequent curve in the list.</p> <p>gml:curveMember references or contains inline one curve in the composite curve.</p> <p>The curves are contiguous, the collection of curves is ordered. Therefore, if provided, the aggregationType attribute shall have the value "sequence".</p> <p>NOTE This definition allows for a nested structure, i.e. a gml:CompositeCurve may use, for example, another gml:CompositeCurve as a curve member.</p>
Comments	CompositeCurve supports a simple aggregation of curves. This can be used to combine existing curves by reference (xlink:href), for example to ensure consistency in use of common boundaries (or segments thereof).
Used in	As member of a Ring, OrientableCurve or CompositeCurve.
XML Schema File	(./ISO_19136_Schemas/) geometryPrimitives.xsd
XML Schema Component	<pre> <element name="CompositeCurve" type="gml:CompositeCurveType" substitutionGroup="gml:AbstractCurve"/> <complexType name="CompositeCurveType"> <complexContent> <extension base="gml:AbstractCurveType"> <sequence> <element ref="gml:curveMember" maxOccurs="unbounded"/> </sequence> <attributeGroup ref="gml:AggregationAttributeGroup"/> </extension> </complexContent> </complexType> </pre>

	<pre> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:CompositeCurve ... gml:id="IDX"> <gml:curveMember xlink:href="#CRV001"/> <gml:curveMember xlink:href="#CRV002"/> <gml:curveMember xlink:href="#CRV003"/> </gml:CompositeCurve> </pre>

TM_GeometricPrimitive / gml:AbstractTimeGeometricPrimitive – Documentation

The XML Schema implementation of the *TM_GeometricPrimitive* type (see ISO 19108:2002, section 5.2.3) is given by the *gml:AbstractTimeGeometricPrimitive* XSD element and *gml:AbstractTimeGeometricPrimitiveType* XSD complex type, documented in the following table.

XSD Element	gml:AbstractTimeGeometricPrimitive
Type	gml:AbstractTimeGeometricPrimitiveType
BaseType	gml:AbstractTimePrimitiveType
Restriction	<i>Only the Gregorian calendar with UTC times is allowed in the aeronautical domain.</i>
Usage	Represents the supertype of geometric primitives in the temporal dimension: the instant and the period. Allows the definition of the temporal reference system, if the default is not used.
Definition	A temporal geometry shall be associated with a temporal reference system through the frame attribute that provides a URI reference that identifies a description of the reference system. Following ISO 19108, the Gregorian calendar with UTC is the default reference system, but others may also be used.
Comments	<i>none</i>
Used in	Used as direct parent type for TM_Instant and TM_Period.
XML Schema File	temporal.xsd
XML Schema Component	<pre> <element name="AbstractTimeGeometricPrimitive" type="gml:AbstractTimeGeometricPrimitiveType" abstract="true" substitutionGroup="gml:AbstractTimePrimitive"/> <complexType name="AbstractTimeGeometricPrimitiveType" abstract="true"> <complexContent> <extension base="gml:AbstractTimePrimitiveType"> <attribute name="frame" type="anyURI" default="fixed"="#ISO-8601"/> </extension> </complexContent> </complexType> <element name="AbstractTimePrimitive" </pre>

	<pre> type="gml:AbstractTimePrimitiveType" abstract="true" substitutionGroup="gml:AbstractTimeObject"> </element> <complexType name="AbstractTimePrimitiveType" abstract="true"> <complexContent> <extension base="gml:AbstractTimeObjectType"> <sequence> <element name="relatedTime" type="gml:RelatedTimeType" minOccurs="0" maxOccurs="unbounded"/> </sequence> </extension> </complexContent> </complexType> <complexType name="AbstractTimeObjectType" abstract="true"> <complexContent> <extension base="gml:AbstractGMLType"/> </complexContent> </complexType> </pre>
Example	<i>not applicable, because the GML realization of TM_GeometricPrimitive is an abstract type</i>

TM_Instant / gml:TimeInstant – Documentation

The XML Schema implementation of the TM_Instant type (see ISO 19108:2002, section 5.2.3.2) is given by the gml:TimeInstant XSD element and gml:TimeInstantType XSD complex type, documented in the following table.

XSD Element	gml:TimeInstant
Type	gml:TimeInstantType
BaseType	gml:AbstractTimeGeometricPrimitiveType
Restriction	<i>none</i>
Usage	Used to represent an identifiable position in time.
Definition	An instant is a zero-dimensional geometric primitive that represents position in time. It is equivalent to a point in space. In practice, an instant is an interval whose duration is less than the resolution of the time scale.
Comments	Each TimeInstant shall contain one gml:timePosition
Used in	Used as a child of gml:validTime and aixm:featureLifetime. Also used in gml:TimePeriod element, as a child element of gml:begin and gml:end.
XML Schema File	temporal.xsd
XML Schema Component	<pre> <complexType name="TimeInstantType" final="#all"> <complexContent> <extension </pre>

	<pre>base="gml:AbstractTimeGeometricPrimitiveType"> <sequence> <element ref="gml:timePosition"/> </sequence> </extension> </complexContent> </complexType></pre>
Example	<pre><gml:TimeInstant gml:id="IDX"> <gml:timePosition>2010-01- 23T14:00:00Z</gml:timePosition> </gml:TimeInstant></pre>

TM_Period / gml:TimePeriod – Documentation

The XML Schema implementation of the TM_Period type (see ISO 19108:2002, section 5.2.3.3) is given by the gml:TimePeriod XSD element and gml:TimePeriodType XSD complex type, documented in the following table.

XSD Element	gml:TimePeriod
Type	gml:TimePeriodType
BaseType	gml:AbstractTimeGeometricPrimitiveType
Restriction	The use of child element gml:begin and gml:end are out of scope for AIXM. Use gml:beginPosition and gml:endPosition instead.
Usage	Used to represent an extent in time. <i>In this profile, the beginPosition is considered included in the time interval and the endPosition is considered excluded from the time interval. This is particularly important for temporal queries.</i>
Definition	The period is a one-dimensional geometric primitive that represents extent in time. The period is equivalent to a curve in space. Like a curve, it is an open interval bounded by beginning and end points (instants), and has length (duration). Its location in time is described by the temporal positions of the instants at which it begins and ends; its duration equals the temporal distance between those two temporal positions.
Comments	none
Used in	Used as a child element of gml:validTime and aixm:featureLifetime
XML Schema File	temporal.xsd
XML Schema Component	<pre><complexType name="TimePeriodType"> <complexContent> <extension base="gml:AbstractTimeGeometricPrimitiveType"> <sequence> <choice> <element name="beginPosition" type="gml:TimePositionType"/> <del element name="begin" type="gml:TimeInstantPropertyType"/> </choice> </sequence> </extension> </complexContent> </complexType></pre>

	<pre> </choice> <choice> <element name="endPosition" type="gml:TimePositionType"/> <element name="end" type="gml:TimeInstantPropertyType"/> </choice> <group ref="gml:timeLength" minOccurs="0"/> </sequence> </extension> </complexContent> </complexType> </pre>
Example	<pre> <gml:TimePeriod gml:id="IDX"> <gml:beginPosition>2010-01- 23T14:00:00Z</gml:beginPosition> <gml:endPosition>2010-12-23T14:00:00Z</gml:endPosition> </gml:TimePeriod> </pre>

GML Simple Types

The GML profile for aeronautical data also includes a number of simple types, such as NilReasonType, SignType, CodeType, etc. These are copied as such from the corresponding GML schema files in order to have a valid gml321forAIXM.xsd schema file.

Deprecated GML 3.2.1 items

The elements and attributes that are deprecated in GML 3.2.1 (such as gml:coordinates, gml:remoteSchema attribute of the gml:AssociationPropertyGroup, etc. are not included in the profile either.

Annex G - Bibliography

The following documents contain information that was considered in the writing of this document:

[ANNEX 15] ICAO Annex 15 (14th Edition) – Aeronautical Information Services

[AIXM 4.5-5.1] [AIXM 4.5 to AIXM 5.1 Mapping Guidelines \(version 1.1\)](#)

[EPSG CRS] [European Petroleum Survey Group Geodesy Parameters](#)

[UCUM] [Unified Code of Units of Measure](#)

Annex H – Revision History

Date	Release	Author	Paragraph modified	Description
2012-03-22	1.0	Aviation Domain Working Group members	All	Initial version
2015-02-12	1.1	Aviation Domain Working Group members	All	Reorganisation of the document, some content was moved in Annexes. Further work on the GML profile. Added missing ISO 19108 elements. Guidelines for the use of other CRS than EPSG:4326. Removed the possibility of using abstract remote references for Point, as there is no real use case for that. Added some considerations about TimeSlice synchronisation in relation with abstract feature references. Explicit forbid the dynamic redefinition (with xsi:type) for geometrical elements.