BS EN ISO 19152-3:2024

BSI Standards Publication

# Geographic information — Land Administration Domain Model (LADM)

Marine georegulation

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# National foreword

This British Standard is the UK implementation of EN ISO 19152-3:2024. It is identical to ISO 19152-3:2024. Together with BS EN ISO 19152-1:2024, it supersedes BS EN ISO 19152:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/36, Geographic information.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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## European foreword

This document (EN ISO 19152-3:2024) has been prepared by Technical Committee ISO/TC 211 "Geographic information/Geomatics" in collaboration with Technical Committee CEN/TC 287 “Geographic Information” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2025, and conflicting national standards shall be withdrawn at the latest by January 2025.

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

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The text of ISO 19152-3:2024 has been approved by CEN as EN ISO 19152-3:2024 without any modification.

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# Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 287, *Geographic Information,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement), and in collaboration with the International Hydrographic Organization (IHO).

This edition of ISO 19152-3, together with all other parts in the ISO 19152 series, cancels and replaces the first edition (ISO 19152:2012), which has been technically revised. This document is a new part to the ISO 19152 series and makes no changes to the original ISO 19152:2007.

A list of all parts in the ISO 19152 series can be found on the ISO website.

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# Introduction

ISO 19152:2012 specifically addressed the land registration aspects of land administration. This document (ISO 19152-3:2023) introduces the broader term "georegulation", which addresses any area of geographic information in which rights, restrictions or responsibilities (RRR) can be applied. Georegulation is the activity of delimiting and asserting control over geographical spaces through regulations. This document allows the objects of georegulation to be documented in a systematic and consistent manner. Although the broader term "georegulation" is used throughout the document, the main element of the title of the document remains “Land Administration Domain Model” to retain compatibility with the previous edition of the document.

This document addresses georegulation in the marine environment. Rights and obligations created by georegulation share a basic structure, as described in ISO 19152-1. Marine activity, including transportation, resource extraction and food production (fishing and marine aquaculture), is of great importance. Different rights and obligations can exist on the surface, in the water column and on the seabed. The model defined in this document can be used for marine cadastres as well as other use cases (such as conservation areas, living resources and fishery management areas, non-living resources management areas, seabed tenure, etc.), and to describe data in support of the United Nations Convention on the Law of the Sea (UNCLOS)[27] or other conventions, e.g. administrative areas described in support of safe navigation under the International Convention for the Safety of Life At Sea (SOLAS).[28]

The oceans are of importance to all humankind, and specific areas along coastlines are under the jurisdiction of nation states. The jurisdiction of coastal states extends to certain maritime zones. Users and states have rights, restrictions and responsibilities in specific zones. The area beyond coastal states’ zones is without exercise or claim of sovereignty and the rights regarding the resources are vested in mankind.[27] In specific cases there are private rights, such as the rights associated with fishing or resource extraction. Some individuals can have property rights on land adjacent to water potentially extending into the area covered by water. This can be described in a marine cadastre, described using the structures available in this document.

International marine rights are addressed in international treaties globally through UN conventions and between nations; in particular, the United Nations Convention on the Law of the Sea (UNCLOS).[27] Marine safety and navigation are addressed by the International Maritime Organization (IMO) international convention on Safety Of Life At Sea (SOLAS) 1974.[28] Other international conventions, treaties and national laws establish rights and obligations.

The International Hydrographic Organization is an international standards development organization that specializes in the marine space. It develops standards for safe navigation, marine jurisdictions, oceanography and other aspects of the marine space in close cooperation with other international organizations such as the UN DOALOS[29] and ISO. In particular it supports several UN conventions such as the UNCLOS[27] and the SOLAS[28] conventions in cooperation with the UN IMO.[30] Alignment between ISO International Standards for the marine space and the IHO is important.

United Nations’ Sustainable Development Goal 14C and United Nations’ General Assembly Resolution A/RES/59/24 directed the IHO to provide technical standards for maritime zones. The IHO supports standards development for oceanography, marine science and the UN SOLAS and the UNCLOS conventions.[31] In particular, as part of the S-100 Universal Hydrographic Data Model,[18] IHO has developed a series of standards and specifications that address the marine space.[32] These include IHO S-121[20] on maritime limits and boundaries and IHO S-122[33] on marine protected areas.

A characteristic of georegulation objects in the marine space is that their geometry structure can need to be aligned with IHO S-100[18] and ISO 19107. As such, there can be different “feature” types. This is in alignment with the way "feature" is defined in the general feature model from ISO 19109 and the approach to feature cataloguing defined in ISO 19110. For their geographic information aspects, the IHO suite of hydrographic standards is based on many of the ISO/TC 211 suite of Geographic Information documents, through S-100. S-121[20] on maritime limits and boundaries directly supports the UNCLOS[27] and is built upon the ISO 19152 series. Due to the close links between S-121[20] and the ISO 19152 series, this document makes direct reference to S-100 and S-121.

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Since many of the rights and restrictions in the marine space come either from international or bi-national treaties, or national proclamations or laws, within the context of georegulation, it can be necessary to express the text or preamble of a treaty or law. A "governance" object has therefore been added to the administrative structure in this document to allow legal text to be associated with an administrative unit. In many cases the parties involved in rights, restrictions and responsibilities (RRR) relationships in the marine space are nations. This means that the code lists of types of parties and administrative units defined in other parts of the ISO 19152 series will not necessarily apply. Unique code lists have been defined to address the marine space. Further, treaties are often the reference source for both the administrative and spatial aspects, so the distinction between types of sources has been eliminated.

The ISO 19152 series is a general abstract model for Land Administrative Domain Model (LADM) systems. It provides a uniform way of describing national or other systems. The ISO 19152 series is implemented through profiles, such as country profiles, in accordance with ISO 19106. S-121[20] is a profile for the description of marine limits and boundaries (MLB) in the context of support for the SOLAS[28] and the UNCLOS[27] conventions supported by the IHO series of standards. This document has two conformance classes, one that directly supports the S-121 profile, and the other more general conformance class that supports other aspects of marine georegulation. The profile for MLB is defined in S-121. The support of other aspects of marine georegulation will require the development of specific profiles to address these other areas.

This document is a derived work, developed under a cooperative agreement with the IHO, based on S-121[20] and used with permission.

In accordance with the ISO/IEC Directives, Part 2, 2018, Rules for the structure and drafting of International Standards, in International Standards the decimal sign is a comma on the line. However, the General Conference on Weights and Measures (Conférence Générale des Poids et Mesures) at its meeting in 2003 passed unanimously the following resolution:

"The decimal marker shall be either a point on the line or a comma on the line."

In practice, the choice between these alternatives depends on customary use in the language concerned. In the technical areas of geodesy and geographic information it is customary for the decimal point always to be used, for all languages. That practice is used throughout this document.

NOTE The direction of positive rotation used in this document is positive in a counter clockwise direction in alignment with ISO 19109 and ISO 19107. The IHO S-100 series of standards makes use of "Heading Orientation" which is positive in a clockwise direction. The user needs to be aware of this difference.

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# Geographic information — Land Administration Domain Model (LADM) —

## Part 3:
## Marine georegulation

## 1 Scope

This document specifies the concepts and structure for standardization for georegulation in the marine space.

This document addresses the information structures related to management of legal spaces (such as the international maritime limits and boundaries, marine living and non-living resources management areas, marine conservation areas, etc.) and their related rights and obligations.

This document establishes the common elements and basic schema to structure marine georegulation information system. It builds upon the common components defined in ISO 19152-1.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19152-1, *Geographic information — Land Administration Domain Model (LADM) — Part 1: Generic conceptual model*

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19152-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1.1**
**boundary**
<marine_georegulation> delimitation between two or more zones

Note 1 to entry: A boundary involves two or more parties.

Note 2 to entry: Adapted from Reference [20].

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**3.1.2**
**curve**
1-dimensional geometric primitive, representing the continuous image of a line

Note 1 to entry: The boundary of a curve is the set of points at either end of the curve. If the curve is a cycle, the two ends are identical, and the curve (if topologically closed) is considered to not have a boundary. The first point is called the start point, and the last is the end point. Connectivity of the curve is guaranteed by the "continuous image of a line" clause. A topological theorem states that a continuous image of a connected set is connected.

[SOURCE: ISO 19136-1:2020, 3.1.17]

**3.1.3**
**limit**
<marine_georegulation> curve that defines a boundary or extent of a zone

Note 1 to entry: A limit involves one party.

Note 2 to entry: Adapted from Reference [20].

**3.1.4**
**marine**
relating to navigation or shipping or relating to or connected with the sea or used, or adopted for use at sea

Note 1 to entry: Sometimes called "maritime", but maritime is more frequently applied to that which borders on the sea.

[SOURCE: Reference [22]]

**3.1.5**
**marine cadastre**
management tool which spatially describes, visualizes and realizes formally and informally defined boundaries and associated rights, restrictions and responsibilities in the marine environment

Note 1 to entry: In addition to boundaries, a marine cadastre can also address locations, limits, baselines, zones and spaces.

Note 2 to entry: A marine cadastre is a type of georegulation related to property registration as addressed in ISO 19152-2 where the concept of “land” is extended to include “over water”.

Note 3 to entry: Adapted from Reference [17].

**3.1.6**
**marine georegulation**
expression of a right, restriction or responsibility for one or more parties or group parties for a spatial location, boundary, zone or space in the marine domain

**3.1.7**
**maritime**
bordering on, or concerned with, or related to the sea

[SOURCE: Reference [22]]

## 3.2 Abbreviated terms

| | |
|---|---|
| BAUnit | basic administrative unit |
| CRS | coordinate reference system |
| DOALOS | Division of Ocean Affairs and the Law of the Sea, office of legal affairs, United Nations |
| ENC | Electronic Nautical Chart |
| GIS | geographic information system |

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| | |
|---|---|
| guid | globally unique identifier |
| IALA | International Association of marine aids to navigation and Lighthouse Authorities |
| IETF | Internet Engineering Task Force |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization of the United Nations |
| LADM | Land Administration Domain Model |
| MLB | marine limits and boundaries |
| MRN | Maritime Resource Name |
| Oid | object ID |
| RRR | right, restriction, responsibility |
| SOLAS | International Convention on Safety of Life at Sea |
| UML | Unified Modelling Language |
| UNCLOS | United Nations Convention on the Law Of the Sea |
| uom | units of measure |
| URI | Uniform Resource Identifier |
| URN | Uniform Resource Name |

# 4 Conformance

## 4.1 Conformance requirements and testing

Conformance to this document consists of alignment with the requirements established in 4.3 and 4.4. The abstract test suite given in Annex A describes a methodology which shall be used for testing conformance to these requirements.

## 4.2 Conformance classes

Two conformance classes are identified in this document:

— one for the description of a LADM marine georegulation system in support of maritime limits and boundaries for the UNCLOS

— one in support of other marine georegulation domain areas as outlined in Annex B.

The conformance class for a marine georegulation system in support of maritime limits and boundaries for the UNCLOS[27] provides a general model that is used by S-121.[20] This includes code lists and other structures, such as the governance class MG_Governance and the attribute type Marine Resource Name (MRN) as defined in S-100,[18] and geometry constraints to align with S-101.[19] The more general conformance class for other types of marine georegulation permits but does not require the use of the code lists and other structures specific to maritime limits and boundaries for the UNCLOS. These code lists and structures can be extended, or other code lists and structures can be included. Where compatibility is desirable between data products that conform with conformance class 1 and extensions that conform with conformance class 2, it is desirable that extensions be used. These two conformance classes are not mutually exclusive, but rather by making use of extensions it is possible to support both conformance criteria. Support

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for the geometric constraints described in 7.2 is required for any marine georegulation data product that supports compatibility with the S-100-based suite of Electronic Nautical Chart (ENC) navigation standards.

### 4.3 Conformance class 1 — Marine limits and boundaries in support of the UNCLOS

**Requirement 1:** The description of a LADM marine georegulation schema in support of maritime limits and boundaries for the UNCLOS using this document (ISO 19152-3) shall consist of a set of UML classes with associated attributes that make use of or subtype the classes defined in Clause 8 including the code lists defined in 8.4.6, 8.4.7, 8.5.4, 8.5.14.7, 8.8.16, 8.8.27, 8.8.34, and 8.8.35, the attribute Marine Resource Name defined in 8.3 and the geometry constraints defined in 7.2 which are enumerated in Annex B.

NOTE The IHO standard S-121[19] conforms to conformance class 1 of this document.

### 4.4 Conformance class 2 — General marine georegulation

**Requirement 2**: The description of a LADM marine georegulation schema for general application, such as for marine cadastre or any of the other marine contexts described in Annex B using this document (ISO 19152-3) shall consist of a set of UML classes with associated attributes that make use of or subtype the classes defined in Clause 8. This allows for other marine georegulation application areas to be addressed that are not covered in S-121[20] or in the UNCLOS.[27] For example, seabed resource extraction would be an area that can be addressed by this conformance class. However, to do this, all of the code list values that pertain to this other application area would need to be defined as part of the specification of that application. The code lists, the attribute Marine Resource Name and the geometry constraints identified in conformance class 2 are optional and can be replaced with other code lists and geometric constraints.

## 5 Notation

The conceptual schema specified in this document is described using the Unified Modelling Language (UML), following the guidance of ISO 19103. The description of the types of relationships, such as subtyping, inheritance, and realization are described in ISO 19103, not in this document.

Several model elements used in this schema are defined in other ISO geographic information International Standards. By convention within some ISO/TC 211 documents, names of UML classes, with the exception of basic data type classes, include a two-letter prefix that identifies the document and the UML package in which the class is defined. This provides a global unique name for the class. UML classes defined in this document have the two-letter prefix of MG. The two-letter prefix of LA is used for ISO 19152-1 and ISO 19152-2 to support backward compatibility. Table 1 lists the other International Standards and packages in which UML classes used in this document have been defined.

**Table 1 — Sources of externally defined UML classes**

| Prefix | Document | Part |
|---|---|---|
| CI | ISO 19115-1 | Metadata — Fundamentals |
| DQ | ISO 19157-1 | Data quality — General requirements |
| GM | ISO 19107 | Spatial schema |
| LA | ISO 19152-1 | Generic conceptual model |
| LA | ISO 19152-2[a] | Land registration |
| MG | ISO 19152-3 | Marine georegulation |

[a] Under preparation. Stage at the time of publication ISO/DIS 19152-2:2024.

NOTE ISO 19157-1 and ISO 19107 have dropped the prefixes GM and DQ, relying on context for the uniqueness of class names. However, the prefixes are still used in the older versions of these documents, which are still referenced by some external standards, such as versions of S-100.[18] Retaining the prefixes in Table 1 provides an understanding of the meaning of these prefixes when they are encountered. They are required for backward compatibility.

The following stereotypes are used to identify attributes that apply to specific conformance classes.

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<<MLB>> — This stereotype applies to attributes that are specific to conformance class 1 relating to maritime limits and boundaries in accordance with S-121.[20]

<<MRN>> — This stereotype applies to attributes used to carry the Maritime Resource Name, which is a specific identifier managed by the IHO and defined for the S-100 suite of standards, including S-121.[20]

## 6 Context

The purpose of this document is to establish a structure for the description of georegulation in the marine space.

Jurisdictions in the marine space can be different from those on land and can be covered by international conventions such as the UN Convention on the Law of the Sea (UNCLOS).[27] The UNCLOS defines the marine zones and the rights and duties of a country regarding those zones. Other treaties and agreements between nations and national instruments define specific aspects of georegulation in the maritime space, including, among other subjects, fisheries, passage, exploration and exploitation.

Although georegulation in the marine space can be different from land administration, the same underlying structure of rights, restrictions and responsibilities (RRR) established in ISO 19152-1 apply. There can be different rights assigned to the seafloor, the water column and the surface within different zones. An example is the “right of innocent passage” as described in the UNCLOS, Article 17 which is subject to restrictions as described in Article 19.[27] However, in some cases, individuals or corporations can also have rights, such as the fishing rights or exploration rights granted by nations in their waters or multilateral bodies. In some nations, property rights on land adjacent to water can extend into areas covered by water and property rights can exist in the water.

In the international context, some RRRs in the marine space derive from treaties between nations, where the nations are the parties. Other RRRs can derive from national instruments such as laws or government declarations. RRRs can also derive from marine property rights expressed using a marine cadastre. International treaties and national instruments or other sources can be referenced using the “source” construct described in ISO 19152-1. However, it is sometimes necessary to include the associated legal text in the marine space georegulation dataset. In order to accommodate this, a “Governance” object has been added to the structure in this document to contain legal text that is associated with an administrative unit. Often treaties and national marine regulations serve as both the administrative and spatial source.

This document uses a feature-oriented approach for spatial geometry in alignment with the general feature model defined in ISO 19109. Features are defined in accordance with ISO 19110. The features can be locations, limits, zones or spaces with associated spatial geometry as defined in ISO 19107. For example, a Base Line Point is a specific type of location represented as a point geometry. A zone such as the Exclusive Economic Zone [UNCLOS Part V][27] is represented as an area with surface geometry. A specific type of limit such as the “Outer Limit of the Territorial Sea"[UNCLOS Article 4][27] is represented as a line with curve geometry. This approach is similar to the approach taken in many other areas of geographic information and is fully supported by the ISO/TC 211 geometry model specified in ISO 19107.

There is a close relationship between marine georegulation as defined in this document and S-121.[20] The IHO has developed S-100[18] based on many of the ISO/TC 211 documents: it forms a profile of those documents applicable to the marine space, in particular in terms of the geometry, feature model, quality, metadata, coverage, portrayal and encoding specified. S-100 is quite broad, allowing for a number of specific product specifications to be developed addressing different areas related to safe navigation, oceanography and marine georegulation. However, S-100 does make specific selections with respect to spatial geometry and feature relations. These constraints allow for rigorous testing of marine Electronic Chart Display Information Systems to comply with the UN International Marine Organization (IMO) regulations.

The IHO series of standards referred to in this document support several UN conventions, in particular, the International convention for the Safety of Life at Sea (SOLAS)[28] and the UN Convention on the Law of the Sea (UNCLOS).[27] The SOLAS convention addresses safe navigation and the UNCLOS addresses maritime space and associated rights and responsibilities. Further to this, S-121[20] addresses the requirements of the Division of Ocean Affairs and the Law of the Sea, Office of Legal Affairs, United Nations (DOALOS)[29] for Maritime Limits and Boundaries. S-121 is based on the structures defined in ISO 19152-1 for RRR and party, making use of the Universal Hydrographic Model from S-100. The geometry and other constraints defined in S-100 also apply to S-121.

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This document (ISO 19152-3) is broader than S-121, addressing additional marine georegulation application areas beyond international maritime limits and boundaries. However, to remain compatible with S-121 it abides by the same constraints as defined in S-100.

# 7 Feature and attribute structure

## 7.1 Structural overview

ISO 19152-1 describes a high-level model that establishes the basic structures for all aspects of land administration/georegulation. This document (ISO 19152-3) describes the specific model related to georegulation in the marine space. The marine space is diverse and includes marine limits and boundaries, navigation, resource management, oceanography, bathymetry and aspects of climatology such as tides and currents. Marine geographic information systems make use of the full spectrum of capabilities available in the geometry, general feature model, metadata, quality, encoding, portrayal, registration and the general aspects of land administration established in the ISO/TC 211 suite of geographic information documents. Some of these areas require the administration of rights, restrictions and responsibilities in a similar manner to the administration of land. In fact, in some cases it is more complex, where different rights or restrictions apply to different levels in the water column. For example, navigational rights can exist on the surface with fishing rights in the water column and mining rights on the bottom. These rights can apply to different parties and have complex interrelations.

The high-level conceptual model for marine georegulation is based on the general feature model defined in ISO 19109 and aligns with the conceptual model defined in S-100[18] with the addition of the rights, restrictions, responsibilities and parties structure defined in this document. There are many different types of features that occur in the marine space, including locations represented by point geometric spatial attributes, limits represented by geometric curves, zones represented by surface geometric spatial attributes and spaces represented by surface spatial attributes with height (or depth) as an attribute. The geometric primitives are defined in ISO 19107. This document (ISO 19152-3), which addresses the marine space, makes use of the subset of the spatial primitives defined in ISO 19107 that are also used in the S-100 Universal Hydrographic Model (S-100 Part 7 – Spatial Schema). This ensures alignment between the IHO standards and other uses of marine georegulation based on this document. In all aspects related to this document there is full compatibility with S-100.[18]

## 7.2 Geometry structure

IHO establishes certain constraints on the geometry used under S-100.[18] These represent a subset of the broader set of geometric primitives allowed in ISO 19107. The S-100-defined external constraints are given below. Product specifications developed in accordance with this document can be a profile of ISO 19107 and S-100.

NOTE 1 The following text is adapted from S-121:2019, 4.2.3.[20] In order to follow ISO editorial practice, the word “must” has been removed and each clause phrased as a description. References to internal figures within the S-121 document have been removed.

a) Each curve references a start and end point (they can be the same).

b) Curves shall not self-intersect.

c) Areas are represented by a closed loop of curves beginning and ending at a common point.

d) In the case of areas with holes, all internal features’ geometric boundaries are completely contained within the external geometric boundary and the internal geometric boundaries do not intersect each other or the external geometric boundary. Internal geometric boundaries can touch other internal boundaries or the external geometric boundary tangentially (that is at one point).

e) The outer boundary of a surface shall be in a clockwise direction (surface to the right of the curve) and the curve orientation positive. The inner geometric boundary of a surface is in a counter-clockwise direction (surface to the right of the curve) and the curve orientation shall be negative.

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This document follows list items a) to d) above, which conform to ISO 19107. However, in order to conform to ISO 19107, this document does not follow list item e). In data conforming to this document, the outer boundary of a surface is in a counter-clockwise direction and any inner boundaries are in a clockwise direction.

NOTE 2 The IHO S-100 series of standards makes use of “Heading Orientation” which is positive in a clockwise direction around the outside of a geometric boundary, as indicated in list item e) above. This is different from the convention used in the ISO/TC 211 documents, which use “Mathematical Orientation” which is positive in a counter-clockwise direction. This is an important distinction that could cause confusion. ISO 19152-3 operates using “Mathematical Orientation” which is positive in a counter-clockwise direction, consistent with all other ISO/TC 211 documents.

S-121[20] is constrained to 0, 1 and 2 dimensional features (points, curves and surfaces) as defined by S-100 Part 7.[18] The constraint is:

f) Only the geometry types Point, MultiPoint, Curve, Surface, Coverage, Curve (arcByCentrePoint and circleByCentrePoint) are used. MultiPoint is only used for hydrographic soundings and Coverage is limited to bathymetry and tides and currents. There is no Volume primitive used. This approach aligns with IHO S-100 and is needed for alignment with the IHO suite of standards. A volume is constructed out of a Surface primitive with a height attribute. This is commonly referred to as 2 1/2 Dimensions (i.e. 2 Dimensions with height as an attribute). These constraints permit a planar graph topology to be constructed. Also, Curve is constrained to be defined as a series of vertices, or one of two specific arcs (arcByCentrePoint and circleByCentrePoint). Systems that implement IHO standards for use at sea are required to undergo marine equipment conformance testing. Limiting the number of possible spatial primitives makes conformance testing possible.

This document allows but does not enforce the constraint expressed in list item f).

NOTE 3 Following this constraint in a product specification developed in accordance with this document allows for the inclusion of data from IHO S-121 to be used with other data products defined by IHO. This is the case for conformance clause 1 of this document. Other product specifications conforming to conformance clause 2 of this document are permitted to use any geometry structure permitted in ISO 19107 including the survey geometry structure used in some other parts of the ISO 19152 series.

## 7.3 Packages of ISO 19152-3 (this document)

This document makes use of the core packages defined in ISO 19152-1 together with a package addressing marine georegulation. The base package for this document is "ISO 19152-3 Edition 1 Marine Georegulation". This package has four subpackages, "MG_PartySection", “MG_Administrative", MG_SpatialUnit" and "MG_Source". These packages are realizations of the equivalent packages in ISO 19152-1. The package relationship structure is illustrated in Figure 1.

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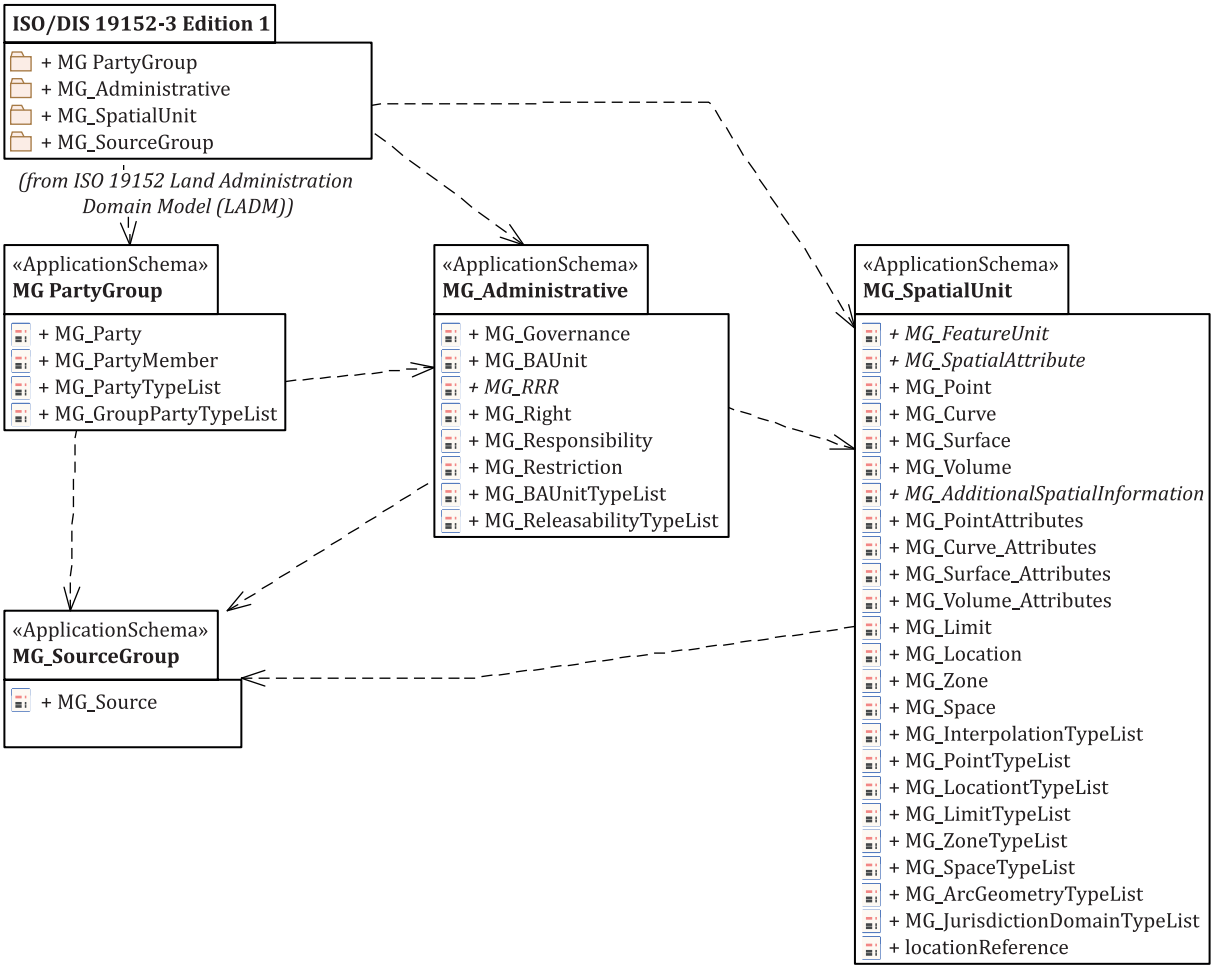


**Figure 1 — Packages of the core LADM and marine georegulation**

# 8 Marine georegulation application schema

## 8.1 Marine georegulation elements

This document describes an application schema model for managing rights, restrictions and responsibilities for georegulation within the marine space within the context of the LADM and also in alignment with the S-100 Universal Hydrographic Model and the IHO standard S-121 on Maritime Limits and Boundaries.[20]

The Marine Georegulation Application Schema uses the same feature and attribute model as defined in ISO 19110 and ISO 19126 and in S-100.[18] Feature types, attribute types and listed values for code lists and enumerations have their definitions recorded in a feature concept dictionary register in accordance with ISO 19126. These feature concepts are then used to construct a particular feature catalogue in accordance with ISO 19110 for a product specification defined in accordance with ISO 19131. This allows for different product specifications to be developed by various organizations to address different application areas within the marine space. This is also the normal process of the development of product specifications in accordance with ISO 19131.

For S-121,[20] the feature concept dictionary is established by the IHO as a register in accordance with ISO 19135-1. The IHO Geospatial Information Registry[21] is available online and as a document from the IHO. The ISO 19110-conformant feature catalogue for S-121 is available as Annex A to the S-121 document.

S-121 addresses maritime limits and boundaries. For other uses within the marine space, other feature catalogues and product specifications can be developed. For those application areas governed by the IHO, feature concepts are recorded in the IHO Geospatial Information Registry.[21] If other organizations or

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nations develop applications addressing georegulation within the marine space they would similarly need to develop a feature catalogue (with or without a feature concept dictionary) and a product specification based on this document (ISO 19152-3).

ISO 19152-1 defines a structure to represent RRR, parties, sources and basic administrative units (BAUnits). This structure acts as a set of thematic attributes by reference. Complex structures can be modelled using these components, where different rights or restrictions apply to different levels in the water column. For example, navigational rights can exist on the surface with fishing rights in the water column and mining rights on the bottom. These rights can apply to different parties and have complex interrelations. This attribute structure can be shared. For example, several of the features in a marine georegulation data set can describe sovereign rights, and have common sources. This information only needs to be described once in the appropriate RRR, party or source object.

Another attribute structure inherited from ISO 19152-1 is the capability to version features. Versioning allows for individual features to be revised using a start and end date. An alternative approach is to version entire datasets using metadata. Both versioned features and versioned data sets can be used together.

Figure 2 shows the overall marine georegulation application schema model. The feature unit derives directly from ISO 19152-1 and takes on attributes defined in a feature catalogue established in accordance with ISO 19110. The spatial attribute type class takes on the spatial attribute types of MG_Point, MG_Curve, MG_Surface or MG_Volume. These spatial attributes take their geometry from ISO 19107 types Point, Curve and Surface.

This feature and attribute structure has a relationship to MG_Source, meaning that source information can be provided on any feature or spatial attribute. Features can also have a relationship to a BAUnit type feature. This allows RRR to be described and associated to parties or group parties. These can also be sourced.

The MG_Party is a non-spatial object. Individual parties are identified by the attribute values of the party features.

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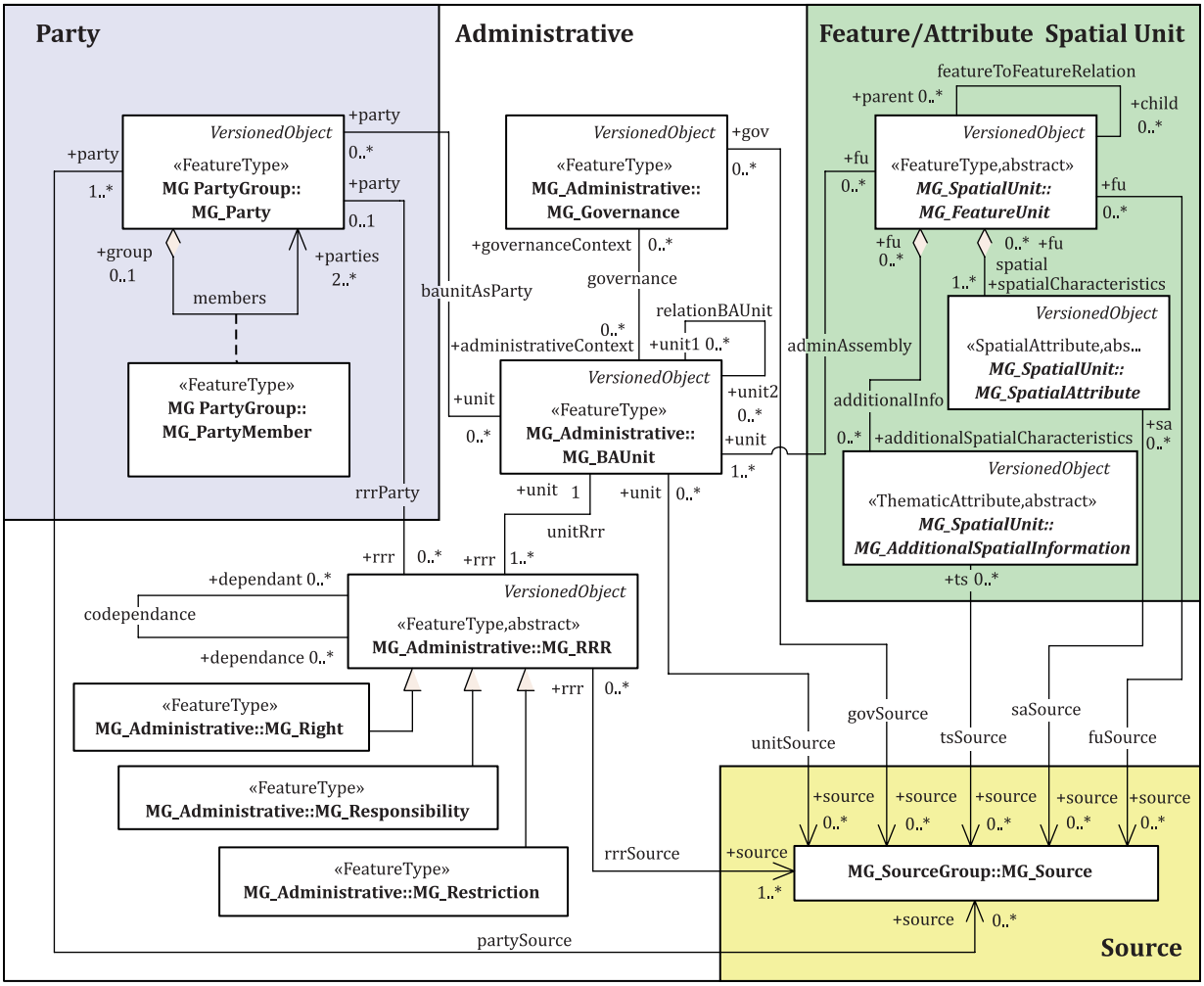


**Figure 2 — Marine georegulation application schema model**

Figure 2 shows the overall structure of the marine georegulation application schema. The four identified group sections correspond to the packages inherited from ISO 19152-1 with the feature structure from ISO 19109 and ISO 19110 implementing the spatial unit identified in ISO 19152-1. In addition, the MG_ Governance class has been included to augment the administrative group section.

## 8.2 Inherited core packages

The three packages from ISO 19152-1, Administrative, Party and Spatial Unit, are inherited by this document. The classes from each of these packages are specialized in this document to add attributes. This means that new classes need to be defined, realizing the inherited classes. These new classes take on names beginning with "MG_" to distinguish them from the core classes. There is only one package in this document, so all of the core elements are inherited into this one UML package.

The S-100 standard[18] introduces an optional attribute called a Maritime Resource Name (MRN). Adding this attribute to almost all classes in this document means that the whole structure is realized and all classes need to be named as "MG_" type classes. In fact, this makes it simpler to distinguish what is defined in this document and what is defined in the core model in ISO 19152-1.

## 8.3 MRN

For data management, there is sometimes a need for the global identification of some objects. The Maritime Resource Name (MRN) is an optional identifier in the marine space that is a permanent global identifier. Use of this identifier allows marine space management. The use of the MRN is required in conformance class 1 as described in 4.3.

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