IHO S-121 Update

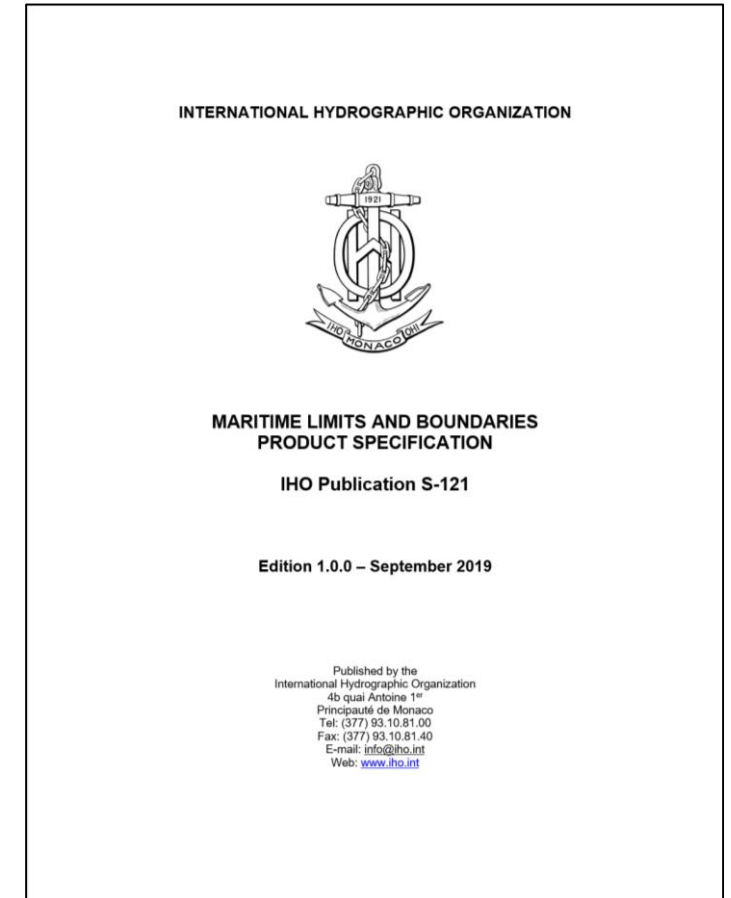**jonathan pritchard**
jonathan.pritchard@iictechnologies.com

NEW PATHS. NEW APPROACHES

The development of IHO S-121 under the S-100 framework for the modelling and representation of UNCLOS core features presents some challenges to the standards development process, both semantically and technically. This presentation will demonstrate some of the aspects of the standard's development under the S-100 framework and the crossover into broader use within the OGC architectural framework. We will also offer some reflections on the process of constructing a data structure and standard capable of reflecting an international convention, similar to the discharge of SOLAS obligations through IHO S-57 and S101.
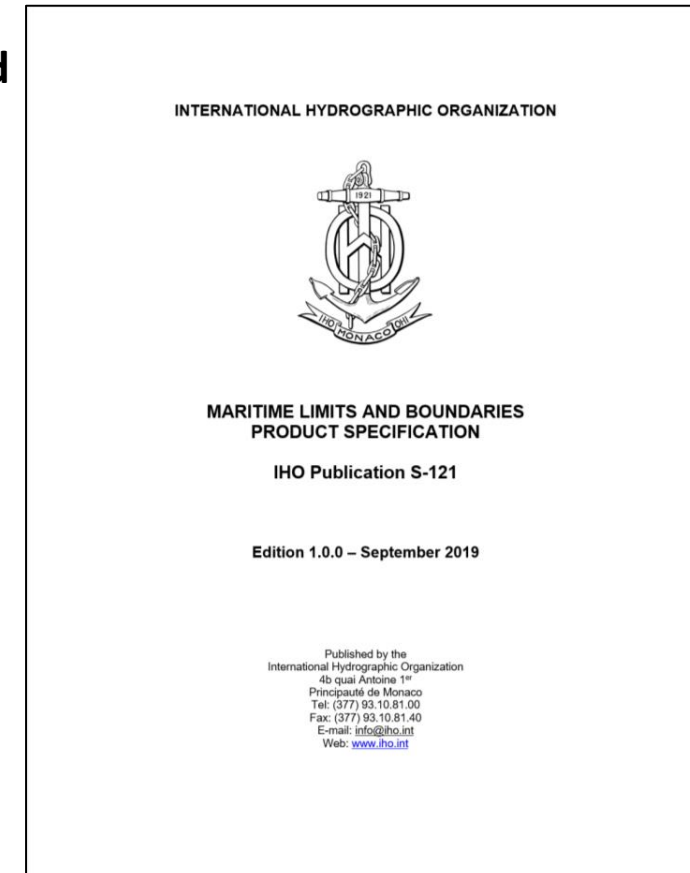
Contents

- Motivations and General Principles

- A Tour of the standard and its components

- Current Status

- Some Examples

- Observations and Perspectives

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

MARITIME LIMITS AND BOUNDARIES
PRODUCT SPECIFICATION

IHO Publication S-121

Edition 1.0.0 – September 2019

Published by the
International Hydrographic Organization
4b quai Antoine 1er
Principauté de Monaco
Tel: (377) 93.10.81.00
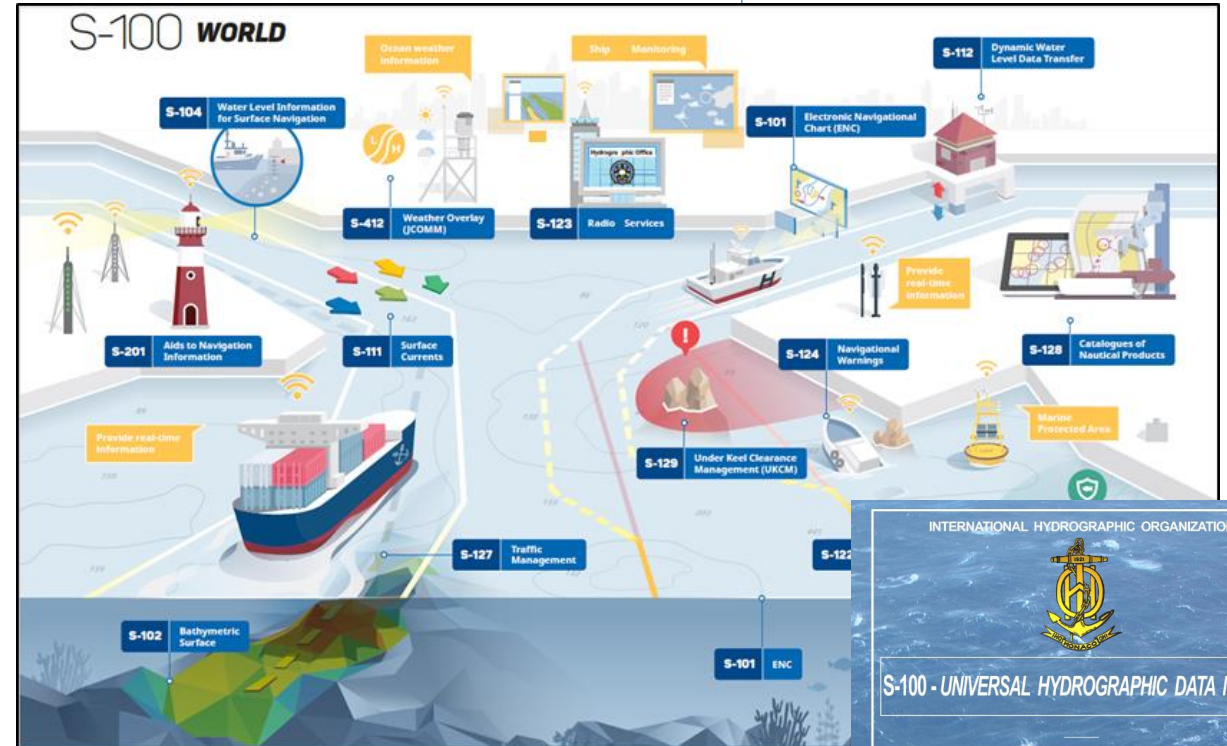Fax: (377) 93.10.81.40
E-mail: info@iho.int
Web: www.iho.int

Background, History and status

- "…paragraph 6 of United Nations, General Assembly resolution 59/24 of 17 November 2004 which "requests the Secretary-General to **improve the existing geographic information system for the deposit by States of charts and geographical coordinates** concerning maritime zones, including lines of delimitation in particular by implementing, **in cooperation with relevant international organizations**, <u>technical standards</u> for the collection, storage and dissemination of the information deposited, in order to **ensure compatibility among the Geographic Information System, electronic nautical charts, and other systems** developed by these organizations."

- "improve" isn't defined…. Generally though – this is taken to mean
  - Establishing the S-100 product specification for Maritime Limits and Boundaries (MLB)
  - which is "…to establish a framework of sourced and versioned objects for communicating in a digital form the geographic extents of some maritime zones…."

- Development by the S-121 Project Team (within the S-100 WG)

- Simple "Use Cases"
  - Exchange between parties
  - Facilitating deposit in accordance with the convention

- Version 1.0.0 reviewed and published End of September 2019

- Parallel initiative within Open Geospatial Consortium (OGC) project to implement, test and demonstrate.
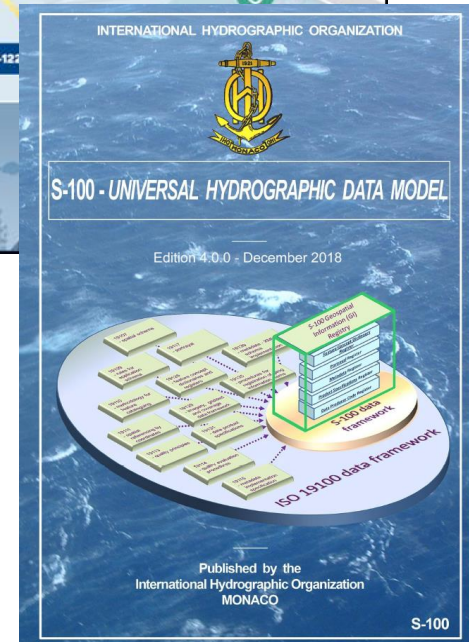
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Development of an IHO product specification.

- S-100 Product Specification is composed of:
  - A model
  - Features
  - A way of grouping them together - "aggregation"
  - Metadata to describe them
  - Other elements
    - Unique identifiers
    - "Geometry"
  - Entries in the IHO geospatial registry

- Driving Principles
  - Openness
  - Interoperability
  - Domain Specific
    - Clarity
    - "Driven by UNCLOS"

- How
  - IHO Process for Standards development
  - v1.0.0
  - + testing + development = v2.0.0

- S-100 Universal Hydrographic Data Model
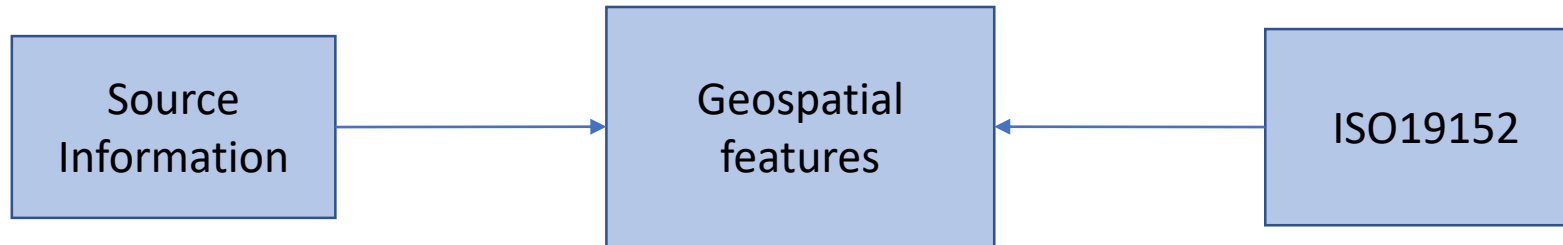- Framework Standard
- Edition 4.0.0

S-121 basic structure: Three Packages

```
┌─────────────┐         ┌─────────────┐         ┌─────────────┐
│   Source    │────────▶│  Geospatial │◀────────│   ISO19152  │
│ Information │         │   features  │         │             │
└─────────────┘         └─────────────┘         └─────────────┘
```

Three main components (packages):
1. A model of features representing a subset of those defined in UNCLOS together with generic features.
2. Optional mechanisms to "hook" into ISO19152 Land Administration Domain Model through Rights, Responsibilities and Restrictions structures to enable integrated marine cadastre
3. A set of ISO compatible features for representing source documentation.

S-121 Packages: Geospatial Features

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│   Source     │─────▶│  Geospatial  │◀─────│  ISO19152    │
│ Information  │      │   features   │      │              │
└──────────────┘      └──────────────┘      └──────────────┘
```

- Core of standard
- A definition of individual "features" and their "attributes"
- S-121 contains features used and/or defined within the Convention
- Simple representation with minimum attribution

IHO S-121 Maritime Limits and Boundaries features:
- **Points**
  - Baseline Points
  - Boundary Points
  - Limit Points
- **Baselines**
  - Normal
  - Straight
  - Archipelagic
  - Low Tide Elevation
  - River Mouth
  - Reef
  - Bay
  - Port
- **Boundaries**
  - Boundary
  - International Boundary
- **Limits**
  - Territorial Sea
  - Contiguous Zone
  - Exclusive Economic Zone
  - Continental Shelf
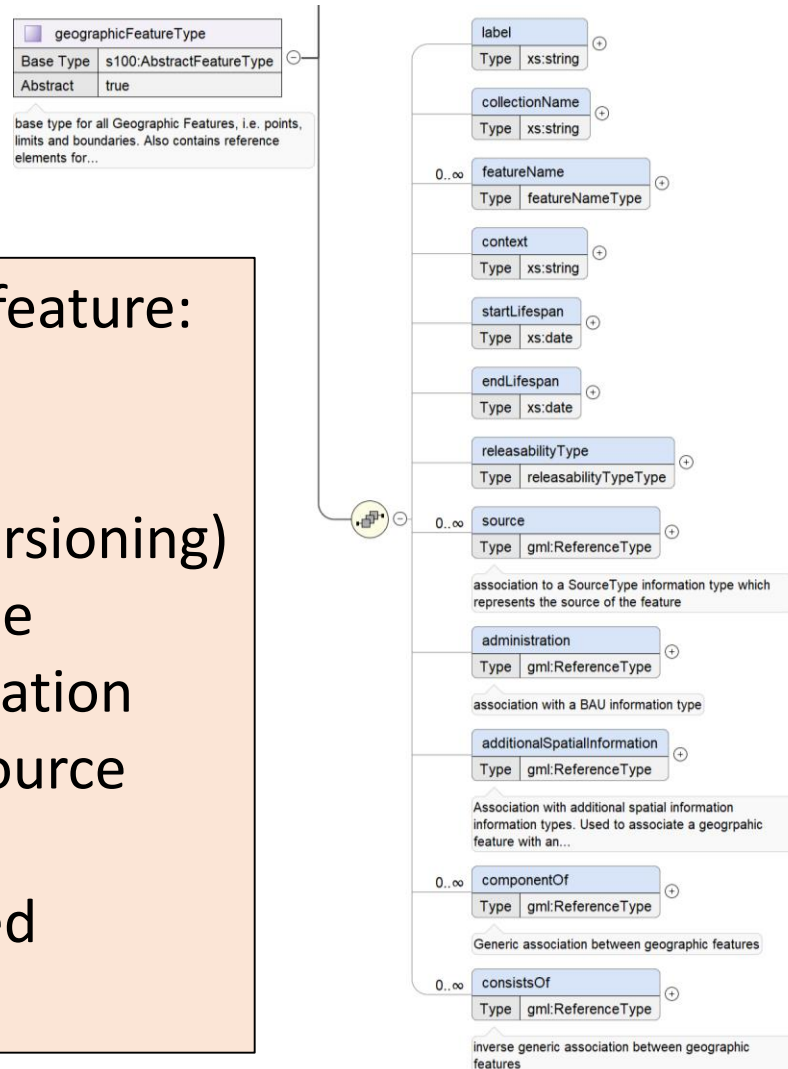 - Roadstead
  - Strait

Zones:
- Internal Waters
- Archipelagic Waters
- Territorial Sea
- Contiguous Zone
- Exclusive Economic Zone
- Continental Shelf
- Roadstead
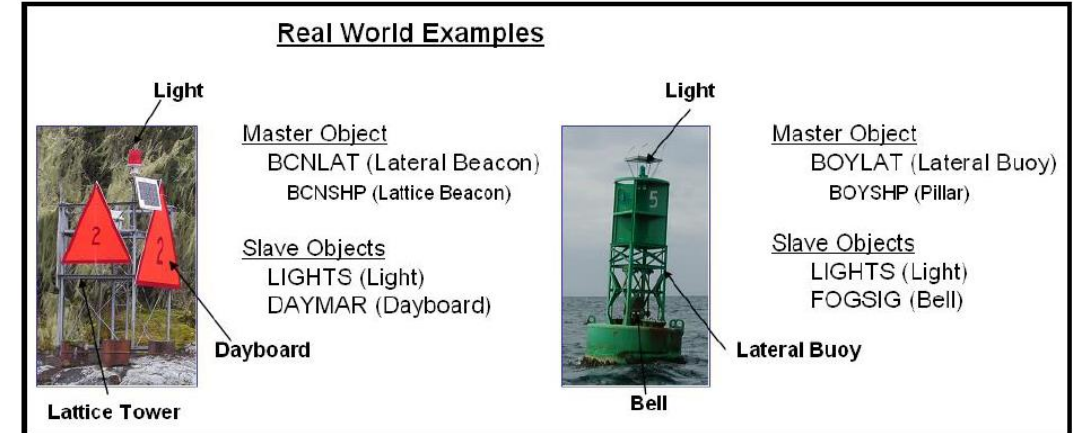- High Sea
- The Area
- Joint Development Area

feature
    abstraction of real-world phenomena
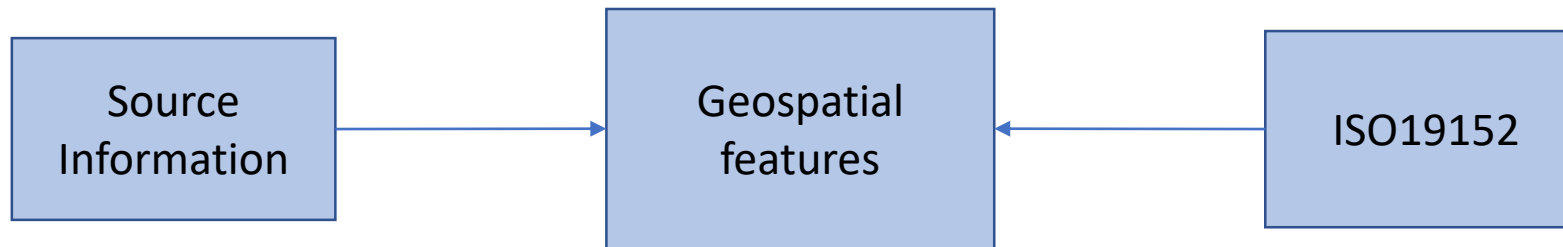
Simplicity of S-121 geospatial features

Core of an S-121 feature:
- Identifier
- Name
- Lifespan (for versioning)
- Collection Name
- "status" information
- Reference to Source
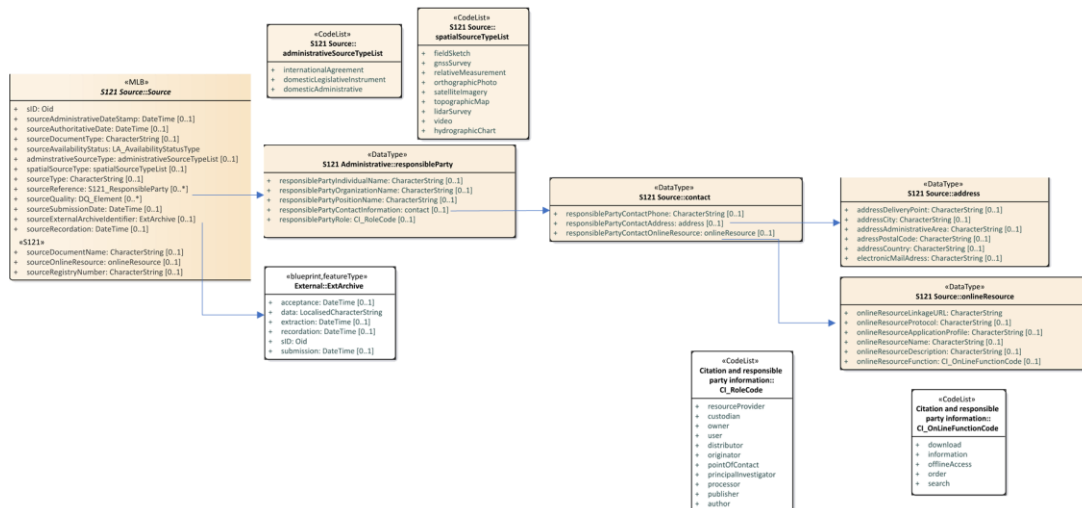- Geometry
  - Documented
  - Spatial

Real World Examples

vs: ENC Aids to Navigation Model

Optional Package 1: Source

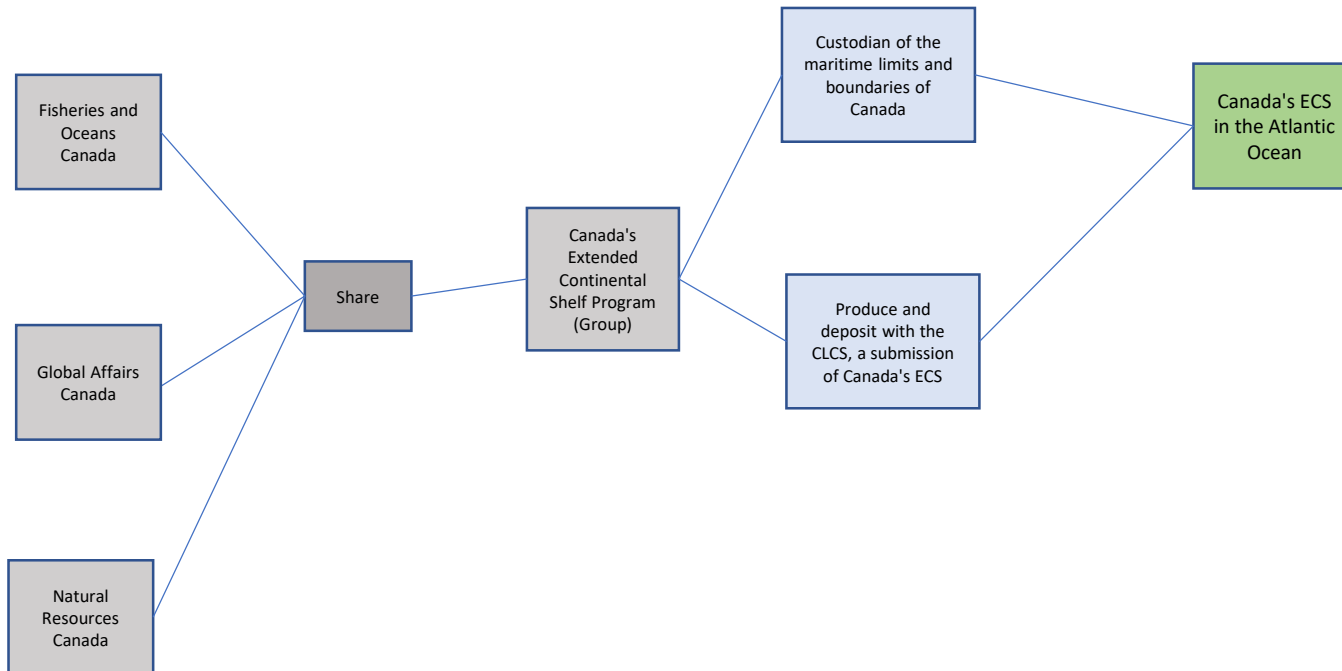**Comprehensive ability to record source information from documentation, legislation**

• Comprehensive ability to record source information from documentation, legislation
• Modelled on ISO structures, compatible (hopefully) with existing systems, framework for creation of new systems
• Feature level – individual features can be associated with source documentation records.
• Components:
  • Document name, registration number, dates
  • Responsible Party
  • Source Document Type

ISO19115 Data Structures for recording source documentation

Optional Package 2: LADM

- Defines Features which can be used to model the interrelationships between S-121 geospatial features, defined Parties and their associated Rights, Restrictions and Responsibilities
- Compatible with ISO19152 Land Administration Domain Model

Under the banner of "Canada's Extended Continental Shelf in the Atlantic Ocean", Fisheries and Oceans Canada, Global Affairs Canada and Natrural Resources Canada have a Shared Group, Canada's Extended Continental Shelf Program with joint responsibilities to "produce and deposit with the CLCS, a submission of Canada's ECS as "Custodian of the maritime limits and boundaries of Canada"

S121 Example 0: A single feature

Textual representation of Location

```
<s121:additionalSpatialInformation gml:id="ad1">
     <s121:locationByText>58° 37'.642 5° 00'.295</s121:locationByText>
     <s121:referenceSystem>World Geodetic System 1984 Datum (WGS84)</s121:referenceSystem>
</s121:additionalSpatialInformation>

<s121:BaselinePoint gml:id="b1">
     <s100:featureObjectIdentifier>
        <s100:agency>GB</s100:agency>
        <s100:featureIdentificationNumber>2</s100:featureIdentificationNumber>
        <s100:featureIdentificationSubdivision>1</s100:featureIdentificationSubdivision>
     </s100:featureObjectIdentifier>
     <s121:label>1</s121:label>
     <s121:featureName>
        <s121:language>en</s121:language>
        <s121:Name>Cape Wrath</s121:Name>
     </s121:featureName>
     <s121:additionalSpatialInformation xlink:href="ad1"/>
     <s121:geometry>
        <gml:Point gml:id="b1g" srsName="urn:ogc:def:crs:OGC:1.3:CRS84">
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        </gml:Point>
     </s121:geometry>
</s121:BaselinePoint>
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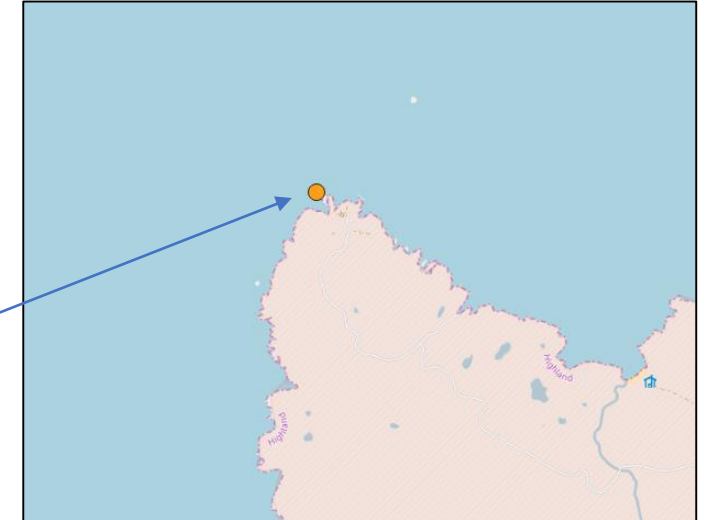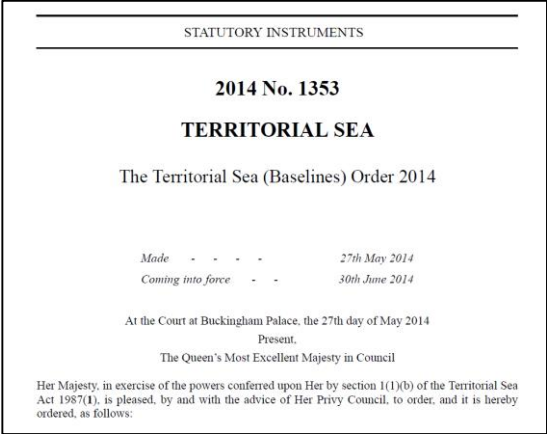
id

name

STATUTORY INSTRUMENTS

2014 No. 1353

TERRITORIAL SEA

The Territorial Sea (Baselines) Order 2014

Made - - - 27th May 2014
Coming into force - - 30th June 2014

At the Court at Buckingham Palace, the 27th day of May 2014
Present,
The Queen's Most Excellent Majesty in Council

Her Majesty, in exercise of the powers conferred upon Her by section 1(1)(b) of the Territorial Sea Act 1987(1), is pleased, by and with the advice of Her Privy Council, to order, and it is hereby ordered, as follows:

	Latitude North	Longitude West	
1	58° 37'.642	5° 00'.295	Cape Wrath

58.62736666666667   5.0049166666666665

```xml
<s121:Source gml:id="src1">
    <s121:responsibleParty>
      <s121:responsiblePartyOrganisationName>United Kingdom Hydrographic Office
      </s121:responsiblePartyOrganisationName>
    </s121:responsibleParty>
    <s121:sourceDocumentName>The Territorial Sea (Baselines) Order 2014</s121:sourceDocumentName>
    <s121:sourceRegistryNumber>2014 No. 1353</s121:sourceRegistryNumber>
    <s121:sourceAvailabilityStatus>Document Available</s121:sourceAvailabilityStatus>
    <s121:administrativeSourceType>Domestic Legislative
Instrument</s121:administrativeSourceType>
    <s121:label>The Territorial Sea (Baselines) Order 2014</s121:label>
    <s121:sourceSubmissionDate>2019-01-01</s121:sourceSubmissionDate>
    <s121:sourceRecordationDate>2019-01-01</s121:sourceRecordationDate>
  </s121:Source>

<s121:additionalSpatialInformation gml:id="ad1">
    <s121:locationByText>58° 37'.642 5° 00'.295</s121:locationByText>
    <s121:referenceSystem>World Geodetic System 1984 Datum (WGS84)</s121:referenceSystem>
  </s121:additionalSpatialInformation>

<s121:BaselinePoint gml:id="b1">
    <s121:label>1</s121:label>
    <s121:featureName>
      <s121:language>en</s121:language>
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    </s121:featureName>
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    <s121:additionalSpatialInformation xlink:href="a1"/>
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        <gml:pos>-5.0049166666666665 58.62736666666667</gml:pos>
      </gml:Point>
    </s121:geometry>
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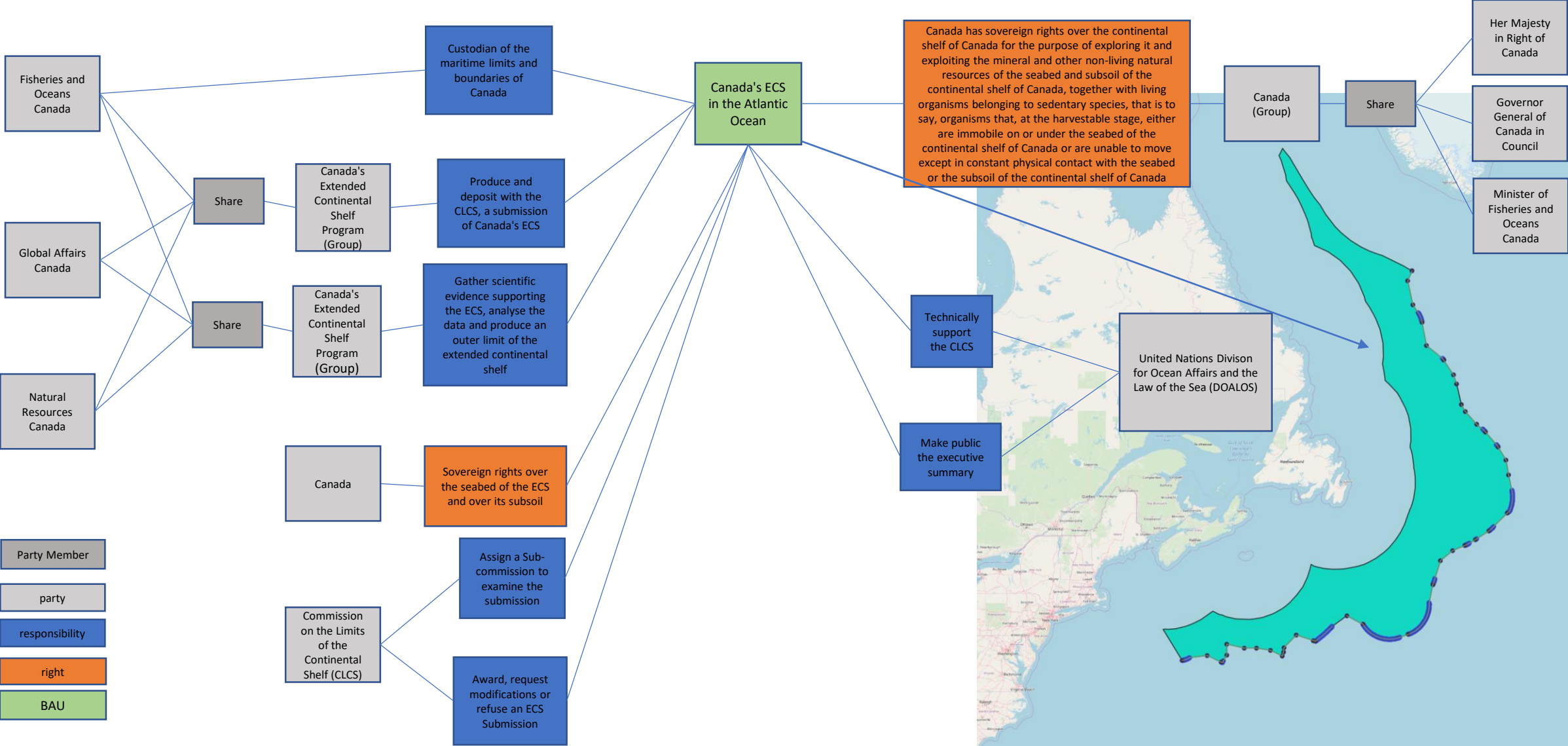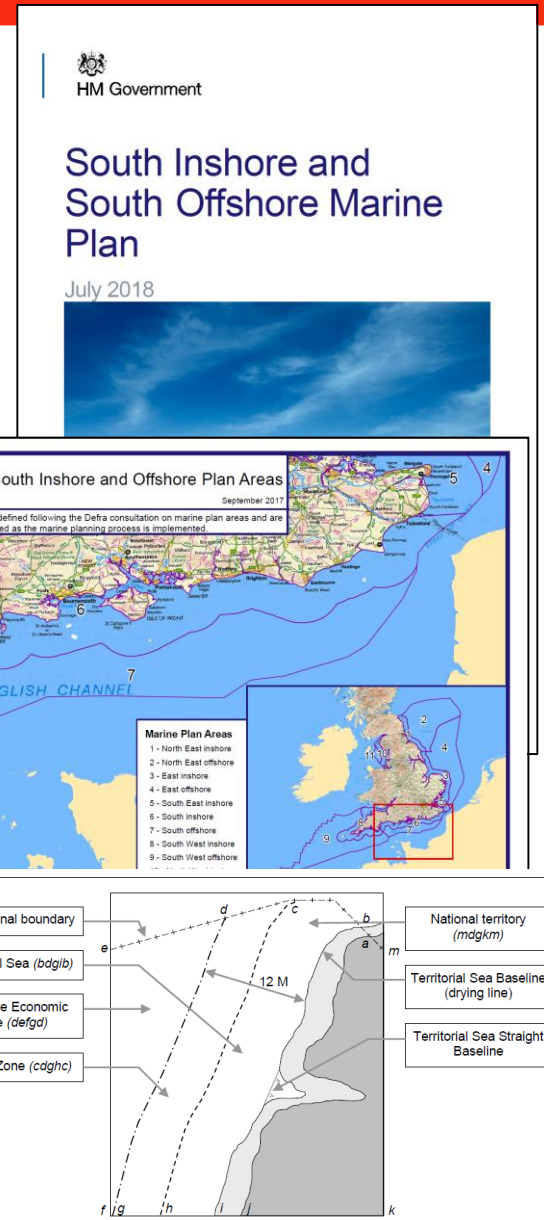
S121 Example1: Feature And Source documentation

S121 Example2 – LADM in the Maritime Domain

Fisheries and Oceans Canada

Custodian of the maritime limits and boundaries of Canada

Canada's ECS in the Atlantic Ocean

Canada has sovereign rights over the continental shelf of Canada for the purpose of exploring it and exploiting the mineral and other non-living natural resources of the seabed and subsoil of the continental shelf of Canada, together with living organisms belonging to sedentary species, that is to say, organisms that, at the harvestable stage, either are immobile on or under the seabed of the continental shelf of Canada or are unable to move except in constant physical contact with the seabed or the subsoil of the continental shelf of Canada

Canada (Group)

Share

Her Majesty in Right of Canada

Governor General of Canada in Council

Minister of Fisheries and Oceans Canada

Share

Canada's Extended Continental Shelf Program (Group)

Produce and deposit with the CLCS, a submission of Canada's ECS

Global Affairs Canada

Share

Canada's Extended Continental Shelf Program (Group)

Gather scientific evidence supporting the ECS, analyse the data and produce an outer limit of the extended continental shelf

Natural Resources Canada

Technically support the CLCS

United Nations Divison for Ocean Affairs and the Law of the Sea (DOALOS)

Make public the executive summary

Canada

Sovereign rights over the seabed of the ECS and over its subsoil

Assign a Sub-commission to examine the submission

Commission on the Limits of the Continental Shelf (CLCS)

Award, request modifications or refuse an ECS Submission

Legend

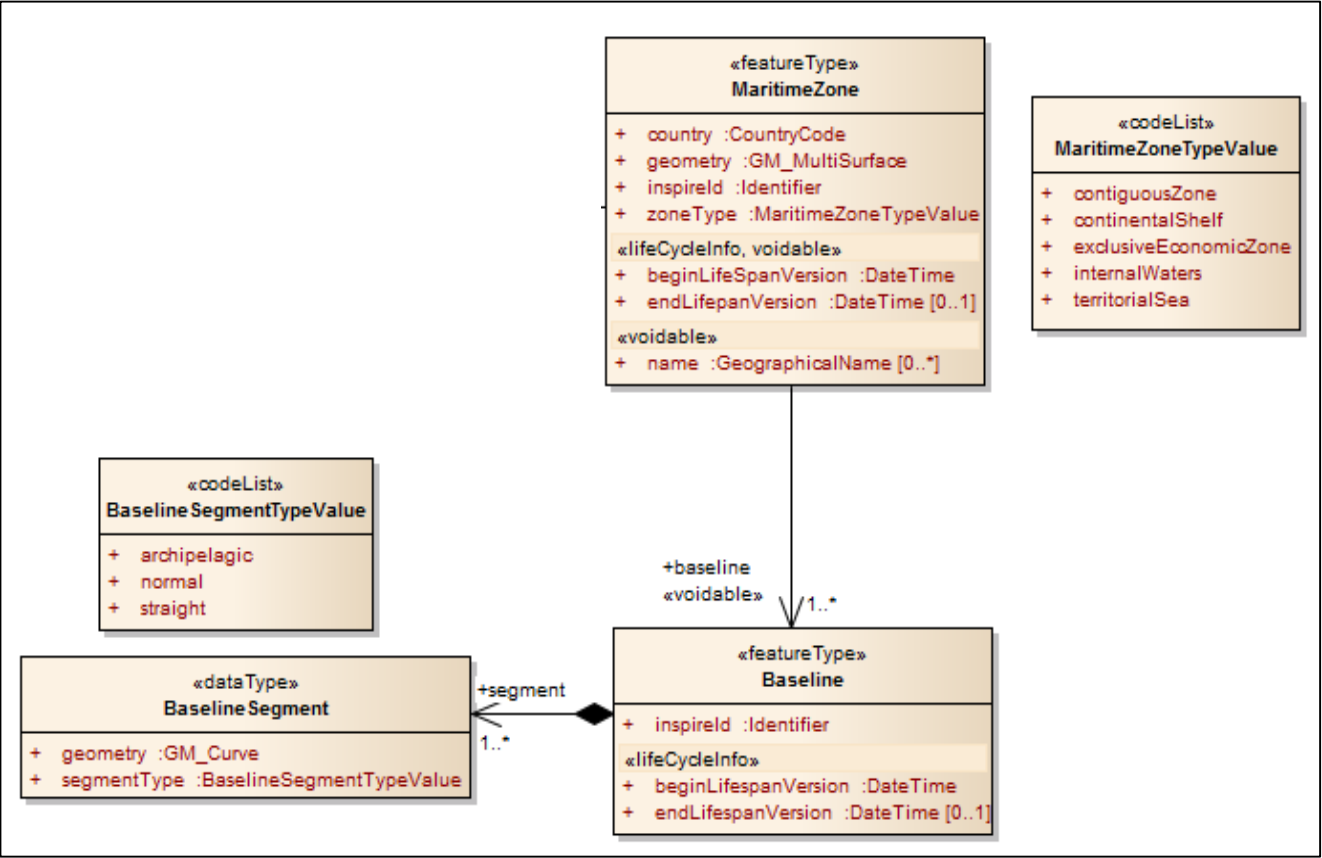- Party Member
- party
- responsibility
- right
- BAU

Some Reflections on Standards:

- Standard is capable of supporting emerging "requirements" in marine spatial planning and broader georegulation

- Features defined by S-121 are used in many other spheres of activity

- Interoperability is key:
  - Software
    - Exchange of data reliably and completely.
  - Data
    - "Semantic interoperability"
    - Spatial interoperability.
  - Organisational interoperability
    - Issues of definition, duplication and omission.

- Publishing the standard does not solve these challenges.

Semantic Interoperability: INSPIRE example

Some Reflections on Standards:

- "Clarity is infectious" – if you make one part of a complex ecosystem clear it accentuates the contrast with other parts. e.g. duplication which now exists in the geospatial registry with charting, e.g. Territorial Sea Areas…

- A standard is no good if no one uses it. So….. Interoperability
  - Of Software
  - Of Data.

- "but what does it do?" – the difficulties of communication…

- Pick your tools well. Reuse where you can
  - Geometry and topology
  - Multi-Lingual Naming
  - Metadata and Source information

- What Next?

- Work within IHO – feedback to S-100 and other groups.

S-121 EXAMPLE DATASET