**Paper for Consideration by TSMAD27**

**Information Paper – Expansion of work on S-121 (Maritime Limits and Boundaries)**

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| ***Submitted by:*** | Canadian Hydrographic Service (CHS) |
| ***Executive Summary:*** | In and Expansion of the work started by Geoscience Australia, Canada has been building a detailed product specification for Maritime Limits and Boundaries, and in that work have developed a series of comments on that product specification to be shared for further feedback. |
| ***Related Documents:*** | TSMAD26/DIPWG5-11.10A Draft Maritime Boundary Exchange Specification |
| ***Related Projects:*** | Development of S-121 Maritime Limits and Boundaries |

**Introduction / Background**

Canada supports the development of S-121 and associated standards. This contribution comments on the Australian document dated May 2013 TSMAD26/DIPWG5-11.10A, Draft Maritime Boundary Exchange Specification.

# Analysis/Discussion

The following comments have been developed with the intent of furthering the product specification started by Geoscience Australia and pertain to specific sections.

**Comment CAN-1: Section 4.5 - Geometry - Paragraph 3**
Because of the legal nature of the Maritime Limits and Boundary (MLBs), it is important that feature types be of a distinct and consistent geometry and should therefore not allow mixed geometry (Point, Line, Area) for a single object type. The use of distinct objects would benefit the general use of the standard, but most importantly would facilitate the comparison and assessment through agreed computation methods. Any ambiguity of the meaning and definition of the MLBs objects must be avoided, to guaranty proper legal interpretation, which means that objects cannot be of multiple geometric types.
Therefore we suggests that the statement "*a combination of feature type allow state to apply feature level attribution if required*" should be replaced with a statement that says "*maritime limits and boundaries are of consistent defined type as defined in the object catalogue. Combination features may be constructed through aggregation of defined feature types, but features types are allowed only one type of geometry.*" For the Maritime Limits and Boundaries (MLBs) standard, it is important to have a rigid consistency to ensure that line type features are always lines and the same shall hold for points or zones.

**Comment CAN-2: General Undescribed Super Structure**
The legal nature of MLBs requires an underlining consistency to be defined for the whole data structure. The proposed structure is to define three types of objects, "*conceptual_point*" types, "*conceptual_delineation*" types and "*conceptual_zone*" types.
These objects could take on the following attributes:
"*conceptual_point*"

- "*pnttyp"*: Point type attribute which defines *("defined", "densified", "computed", "construction")*

"*conceptual_delineation*"

- *"deltyp"*: Delineation type attribute which defines *("boundary", "limit", "construction")*
- *"delphy"*: Delineation physical type attribute which defines *("terrestrial", "intertidal", "aquatic")*

"*conceptual_zone*"

- *"verdom"*: Zone vertical domain attribute which defines *("airspace", "water column", "subsoil", "seabed_land surface")*
- "*zontyp*": Zone type attribute which defines *("defined", "computed", "construction")*.

These abstract objects can be used for the MLBs objects and would provide distinct category for each implemented object types. These three abstract types are realised by three additional abstract types "*point"*, "*delineation"* and "*zone"*. These three abstract implementation types could be the root types for all of the other objects in the S-121 standard. These root types could then inherit from abstract stereotyped groups of attributes. The groups could be using: a common part of the Attribute Set B from S-57 "*AttributeSetB*", all of the "*AttributeSetC*" taken from S-57, a newly built "*legal_aspects*" attribute group, and a "*management_aspects"* attribute for management and verification purposes. Note that "*AttributeSetA*" is also stereotyped, but tends to be unique per object. Certain unique attributes are also associated from "*AttributeSetB*" per object.
The reason for organising the objects in this way is to ensure that points, delineation and zones are clearly associated with only geometric points, curves (lines) or surfaces (areas) and the additional attributes required to manage and establish the legal aspects have proper inheritance. Stereotyping the attributes insures their consistency in groups, and is in alignment with the object oriented approach.

**Comment CAN-3: Integration with S-100 (S-57)**
Because the Maritime Limits and Boundaries (MLBs) serve several purposes, the S-121 standard is expected to be used to support many use cases. One of the purposes is to drive national chart production in S-100 or S-57 and support chart production through the provision of the official and accurate MLBs data. A second use is to support internal and external client needs, such as to provide a standalone set of limits and boundaries to be used for other purposes, such as political maps, treaty negotiations. Another use is to support legal issues, which requires the provision of additional data such a construction lines or any other information supporting the verification of the validity of the data in a court of law. A final requirement is to provide information to the general public.
To achieve this, additional objects and attributes are required beyond those defined in S-57 / S-100 catalogue. Some of these address particularly the UNCLOS requirements. Others such as construction lines are needed to support requirements. The maintenance of these construction objects as a permanent part of the data structure assists maintenance, reproducibility, verification and visualisation of the resulting information. The linkage between objects and construction objects is retained.
The document needs to be extended to include a structured object catalogue supporting legal aspects, maintenance requirements, and other uses, as well as support for S-101 and S-57 chart production.
The definition of two different groups of objects is proposed: enhanced S-57 objects (with additional attributes, to support legal and internal aspects) and MLB (Maritime, Limits and Boundaries) objects which all include these attributes. This concept can be extended in other IHO product specs to address other domain areas (Navigation or Environment).

**Comment CAN-4: Hydrographic Datums**
Accurate referencing is of great importance to geodesy and should be well supported. Currently a few of the reference systems are described in the Hydrographic dictionary S-32, and some are provided as attribute values for "*HORDAT*" and "*VERDAT*", while other reference systems used by various nations are not described at all. Therefore, Canada suggest that all hydrographic datum used by any IHO nation should be included in the S-100 object register and the IHO dictionary S-32.
Because the European Petroleum Survey Group (EPSG) codes are not the source for the definition of any horizontal datum and serves only has a code helping to identify the datum. We must be very careful in how we refer to the authoritative source. ISO has been trying to establish an international register for geographic code and register for nearly 10 years and has yet not got an agreement. IHO may act as an authority for some hydrographic information such as the vertical datum defined in S-32 (and the S-100 object catalogue), however the absolute source must always be referenced. The reference to using the EPSG code must be rewritten to indicate that it is only an optional code that can be used to identify the datum.
The use of the EPSG code is practical and useful but not authoritative. The OPG, Oil and Gas Producers Association (successor of the EPSG), states this themselves. They explicitly do not take responsibility for these datums, but leave it to the referenced authority.

**Comment CAN-5:** Section **1.3 - Spatial Extent - Description**
Based on which vertical datum is used reference to adjacent land is sometimes important, therefore specifying that the S-121 standard be limited to Marine area only is limiting. This comment is made specially to address portrayal of associated land, or any intertidal areas.
Another example refers to the baseline which uses normal baselines (shorelines). The shoreline is both a marine and terrestrial feature, which is better defined as a bounded zone which is an intertidal object.

**Comment CAN-6: Section 3 - Data product identification - Topic Category**
Is there any benefit in categorizing boundaries as a "human dimension" especially since some boundaries are natural and others are human constructs? It is much better to simply record the source of any particular boundary. Therefore we believe the term human dimension should be removed from the S-121 document.

**Comment CAN-7: Realised curves (Point objects)**
Canada agrees to the approach presented in the Australian document. The use of "*densified"* point to make and guaranty proper representation of curves is beneficial. Nonetheless, we suggest that additional point attributes be used. In the current S-121 proposition, only "*densified*" and "*defined*" points attributes are mentioned. The Maritime Limits and Boundary objects would also greatly benefit from the use of "*computed*" and "*construction*" point attributes. The "*computed*" points are important points resulting from geodetic computations and are distinct from "*densified*" points. The computation of these points is supported by approved geodetic methodologies defined in legal documents such as UNCLOS. The "*construction"* points are other points that may be used to support computations, testing, and so forth. Normally these points would not show in the official Maritime Limits and Boundary objects, but could very well be seen in a construction object entity. They are needed is certain use cases such as those supporting legal proceedings.

**Comment CAN-8: Section 12 - Feature Types, and Section 13.1 - Baseline**
The baseline object described in the Australian document combines several concepts and needs to be extended to include other concepts.
Because the Straight Baselines represents lines crossing water bodies and because the Normal Baselines represents a realisation of the shoreline (drying rock or low tide elevations included), for logical consistency to the object's nature, Canada suggests that the baseline objects have three subtypes being "*Normal Baseline*", "*Straight Baseline*" and "*Junction Baseline*".
It is proposed that the "*Normal Baseline"* would have to have a vertical reference (*VERDAT*). The vertical reference system that will be used for Canada would be either "*LLWLT"* or "*HHWLT".*

- "*LLWLT"*: Lower Low Water Large Tide
- "*HHWLT"*: Higher High Water Large

This latter case (HHWLT) would be used only when no low tide level is available.
The "*Straight Baseline*" would have six attribute types ("*Straight baseline"*, "*Archipelagic Baseline"*, "*Bay Closing Line"*, "*Delta and Unstable Coast Baseline"*, "*Historic Bay Closing Line"*, and "*River Mouth Closing Line")*. These entities are all described as per Article 76 of the Law of the Sea.
The "*Junction Baseline*" is a constructed line used to link different dataset elements. This construction line does not have any impact on the delineation of Maritime Limits and Boundaries. It simply links data elements within a data set together, e.g.: linking a drying rock (point) to the shoreline.

**Comment CAN-9: Section 13.2 - Maritime Zones**
The category of Maritime Zone or Limits lists six attributes. Canada would like to propose two changes: one is to change the name of the sixth attribute named "*continental shelf*". The use of "*extended continental shelf"* would be more appropriate because the use of continental shelf by itself refers to the physical geological feature, not the one described in the Article 76 of UNCLOS. The second change would be to use the object [Maritime Zones] (mlbzon) as a general collection objet for a number of sub-objects (components). The reason for using objects rather than attributes is because a number of these concepts have already been defined as objects within S-57, UNCLOS and elsewhere. These are distinct geographic entities that deserve to be at the object level and they do have distinct attribute e.g.: vertical domaine "verdom". Thus, the Maritime Zones components would be : *"The Area (unarea)", the "High Sea Area (highse)" , "Extented Continental Shelf (ecszne)", "Exclusive Economic Zone (EXEZNE)", "Contiguous Zone (CONZE)", "Territorial Sea (TESARE)", "Archipelagic water (arcwtr)", "Internal Water (intwtr)",* "*Fishing zone (FSHZNE)", "Land zone (Subtype of LNDARE)", and "Inland water (inlwtr)".*

- The "*Fishing Zone"* is defined as listed in the Article 76.
- The "*Land zone" is similar to the "LNDARE object is S-57 but also relates to a common vertical reference the "Land zone" encompass* all the land area within a nation's vertical reference, in Canada case we would use the *"LLWLT"*.
- The "*UN Area"* is the renamed equivalent of the "*The Area*" described in the Article 76, which is deemed clearer.
- The "*High Sea Area"* is defined as listed in the Article 76.

**Comment CAN-10: Section13.3 - Maritime Boundary**

The current definition of Maritime Boundary is not adequate. First a vertical jurisdiction attribute cannot logically apply to a boundary line which separates two zones, each of which may have a distinct vertical jurisdiction. Furthermore, other delineations have to be considered. The proposed structure would use an abstract object call "*delineation*" and allows several real objects to be established that share the concept of being a delineation type (line) object. The attributes used to create such objects are ("*boundary", "limit",* and *"construction")* and *("terrestrial", "intertidal"* and *"aquatic").*

Several objects are required to be defined. The structure that must be addressed is defined in the UNCLOS. This structure can be summarized as follow. The "*Land Area*" is adjacent to the territorial sea ("*TESARE"*), which is adjacent to the exclusive economic zone ("EXEZNE"), which is adjacent to the extended continental shelf ("ecszne"), which also adjacent to the "The Area" ("unarea"). Each of these adjacent zone carry attributes describing the vertical jurisdiction ("*airspace*", "*water column*", "*seabed_land surface*" and "*subsoil*"). Between each of these zones is a delineation (line). These delineations may be "*boundary*", "*limit*" or "*construction*" ("*deltyp*"), and be "terrestrial", "intertidal", or "aquatic" ("*delphy*").

A "*boundary"* is between two legal jurisdictions, e.g. two countries; whereas, a "*limit*" is within a single legal jurisdiction, e.g. the territorial sea and the exclusive economic zone of a single country. The reason why such a clear distinction is important is to enable the identification of those delineations that involves more than one party. The third type of delineation called "*construction*", is defined so that these objects can be maintained as part of the dataset and used to assist in repeatability of calculation and support legal arguments.

Finally the delineation physical attributes "delphy" forces the physical description and separation of the objects based on their physical nature. Such a description also supports more complex object construction such as zones.

**Final comment:**

Canada is willing to participate in a cooperative effort to advance the completion of the IHO S-121 standard and other related standards.

**Recommendations**

It is recommended that GeoScience Australia, take into consideration Canada's comments and enter into open dialog with Canada to further the development of the S-121, Maritime Limits and Boundaries product specification.

It is also recommended that OEM's and member states take into consideration the comments specified above and provide Canada and Australia any relevant feedback to further this development.

**Justification and Impacts**

Canada is in the process of further refining the S-121 product specification and would like to work with GeoScience Australia to ensure the developed specification meets the needs of both countries.

**Action Required of SNPWG**

TSMAD and DIPWG are invited to:

a. Note this report and provide feedback to Canada and Australia on the comments herein.