Hydrographic Services and Standards Committee

Report of the JCOMM Expert Team on Sea Ice

**Provision of improved marine weather information
in graphical formats: practices for sea ice (SIGRID-
3/"Ice Objects Catalogue"/S-411)**

Dr Vasily Smolyanitsky, JCOMM ETSI chair

Arctic and Antarctic Research Institute (AARI),

St.Petersburg, Russia

Principal activities and achievements

- In the polar and sub-polar seas, ice is a major hazard to safe navigation and a 'media' for [ice] navigation; Integration of real time or near real-time ice information into ENCs (Electronic Navigation Chart systems) is an important and natural step, in particular in view of the increasing E-Navigation and a way to deliver binary products

- In 2007, the WMO-IOC JCOMM Expert Team on Sea Ice (ETSI) approved the "Ice Object Catalogue" ver. 4.0 (ETSI-3) as a basement for sea ice information support using IHO S-57 as a transport format; from the same year by agreement with IHO TSMAD, ETSI becomes the formal body responsible for the Catalogue with WMO Secretariat as co-manager of the catalogue with the ICE Register put on-line in the Registry database.

- In 2008 the Canadian Ice Service (CIS) undertook a pilot project to produce S-57 format files containing ice information suitable for display on ENCS while in 2009, Arctic and Antarctic Research Institute (AARI), St. Petersburg, Russia started working with Transas, Russia to develop an end-to-end capability to display AARI ice charts on Transas ECDIS – specifically for use on AARI research icebreakers but with commercial potential for the Northern Sea Route.

- From 2010 (ETSI-4) a special JCOMM Services and Forecasting Program Area (SFSPA) Project "Support and enhance ENC/ECDIS for ice navigation" becomes a part of JCOMM intersessional plan

Principal activities and achievements

* In 2012 harmonization of Canadian / Russian expertise including rationalization and simplification of Ice Objects Catalogue was completed with the "Ice Objects Catalogue" ver. 5.1 developed and registered in IHO Registry of Registries. Formal report to TSMAD-24 was delivered (IHB, 7-11 May 2012) and discussion on a place for Ice Objects Catalogue and Presentation Library in the IHO S-100 family of formats was held.

* In May 2012 a demonstration suite based on sea-ice in S-57 format support was developed and presented to JCOMM-IV session

* IHO Hydrographic Services and Standards Committee (HSSC) on its 5th meeting in November 2013 assigned the JCOMM/ETSI with the specification of S-100 based product.

* In 2013 the German Ice Service, BSH, on behalf of ETSI finalized a draft version of S-411 in consultation with IHO-TSMAD with progressive reports presented to the 13th and 14th sessions of International Ice Charting Working Group in October 2012 and October 2013.

* In March 2014 the ETSI (ETSI-5) discussed and approved the JCOMM/IHO S-411 "Ice Information Product Specification" ver. 1.0 along with a next "Ice Objects Catalogue" ver. 5.2 with electronic versions of the documents posted at JCOMM (http://jcomm.info) TD section.

* From August 2014 the S-411 are under implementation (as a SDK or a part of ECDIS) by the ECDIS manufactures

Briefs on sea ice transport formats (SIGRID-3, Ice Objects Catalogue and S-411)

✦ "WMO Sea Ice Nomenclature" (WMO No.259) is a top level sea ice harmonization standard,

✦ Transport standards categories include:
- Standards for Ice charting
  - "SIGRID-3: a vector archive format for sea ice georeferenced information and data" (WMO/TD-No. 1214) and "Ice chart colour standard" (WMO/TD-No. 1215)
- Standards for ice (sea, fresh-water) display in ECDIS:
  - Ice Object Catalogue (version 5.2, May 2014) and Ice Information Product Specification Edition 1.1.0, June 2014 Special Publication JCOMM S-411
- WMO GRiB and NetCDF to support sea ice and METOCEAN gridded data and numerical models

SIGRID-3 / Color standard	Ice Objects Catalogue	S-411
• Contains all ice parameters needed in ice chart • Vector-based "shape files" (polygons, lines, points) • Color standard provides rules for ice chart display • Not compatible with ECDIS (S-411)	• Basic building block of S-411 • Describes ice objects and attributes equivalent to codes of SIGRID-3 • Defines *what* ice information can be used in S-411	• Defines how ice information is displayed on an ECDIS • Ice information exchange standard of the S-100 family • Basic structure the same as S-57 • Includes a Portrayal Standard which defines the appearance of an ice object

"Ice objects Catalogue" summary

JCOMM
Expert Team on Sea Ice

Electronic Chart Systems
Ice Objects Catalogue
Version 5.2

May 1, 2014

Approved by the JCOMM Expert Team on Sea Ice at its 5th Meeting

Prepared by:
John Falkingham, ENC Ice Objects Task Group Leader

Secretariat of the World Meteorological Organization – Geneva – Switz
2014

- ✦ The latest version 5.2 adopted in March 2014 as JCOMM TR-80

- ✦ Includes 3 polygone, 9 linear and 16 point Ice objects Classes

- ✦ Includes 57 Ice features attributes

Ice Object Class	Acronym	Code
Polygon		
Sea Ice	SEAICE	30 300
Lake Ice	LACICE	30 301
Iceberg Area	BRGARE	30 302
Polyline		
Ice Edge	ICELNE	30 320
Iceberg Limit	BRGLNE	30 321
Limit of Open Water	OPNLNE	30 322
Limit of All Known Ice	LKILNE	30 323
Line of Ice Ridge	I_RIDG	30 324
Line of Ice Lead	I_LEAD	30 325
Line of Ice Fracture	I_FRAL	30 326
Line of Ice Crack	I_CRAC	30 327
Jammed Brash Barrier	JMDBRR	30 362

Point		
Ice Compacting	ICECOM	30 350
Ice Lead	ICELEA	30 351
Iceberg	ICEBRG	30 352
Floeberg	FLOBRG	30 353
Ice Thickness	ICETHK	30 354
Ice Shear	ICESHR	30 355
Ice Divergence	ICEDIV	30 356
Ice Ridge/Hummock	ICERDG	30 357
Ice Keel/Bummock	ICEKEL	30 358
Ice Drift	ICEDFT	30 359
Ice Fracture	ICEFRA	30 360
Ice Rafting	ICERFT	30 361
Stage of Melt	STGMLT	30 363
Snow Cover	SNWCVR	30 364
Strips and Patches	STRPTC	30 365
Grounded Hummock	I_GRHM	30 366

"S-411 Ice Information Product Specification" summary
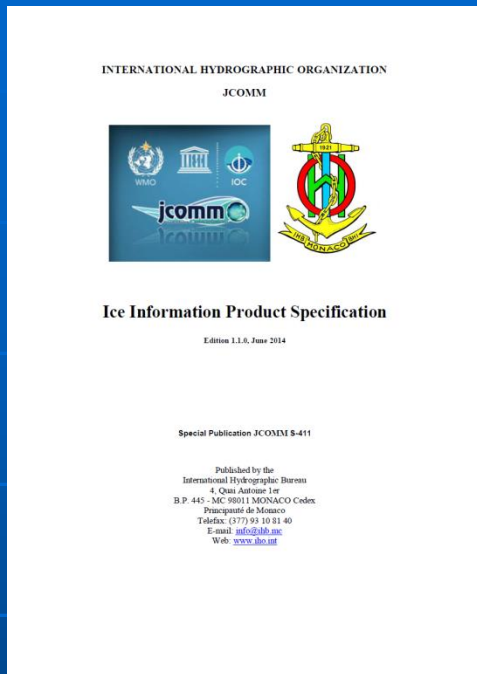
- Development was led by the BSH as a part of JCOMM/ETSI. It was adopted as version 1.0 by JCOMM ETSI-5, March 2014 with the latest version 1.1.0 (June 2014), published as as JCOMM TR-81
- The S-411 is fully based on the IHO S-100 framework specification, Geography Markup Language (GML), Encoding Standard and the ISO 19100 series of standards.
- It is a vector product specification that is primarily intended for encoding the extent and nature of Sea Ice for navigational purpose.
- The application schema of ice information product contains 28 feature types with their attributes, enumerations, is based on the Ice Objects Catalogue (Version 5.1) and can be found in the ICE domain of the IHO Registry. The full schema as XML Schema File included in Annex B – Data Product format (encoding).
- Ice information datasets use S-100 Level 3a geometry which supports 0-, 1-, and 2-dimentional objects (points, line strings, polygons)
- The portrayal specification is based on Styled Layer Descriptors (SLD), follows OGC standards and supports 3 polygon portrayals, one according to the vessels ice capabilities, the second and third one being the WMO ice concentration/stages of development colour codes. Portrayals for line and point objects follow the WMO symbology and are implemented using SVG-graphics.
- Besides future ECDIS SDKs, the S-411 data could actually be read and presented using open source GIS software (e.g. QGis) with python scripts from the national ice services available to convert shapefiles, specially SIGRID-3 files, into the S-411 format.

Future work programme

- Formal management of Ice Objects Catalogue and S-411

- Interact with ENCs manufacturers and OGC to develop software to accept ice data

- Support National ice services to develop capability and to begin production of S-4xx data files

- Support implementation of MetOcean Catalogue as S-412

Action requested of HSSC

- Note S-411 ver. 1.1.0, JCOMM TR-81
- Support for JCOMM ETSI activities/direction