Ice Information for Electronic Navigation Systems

A presentation to the

IHO TRANSFER STANDARD MAINTENANCE AND APPLICATION DEVELOPMENT WORKING GROUP (TSMAD)

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Ice In ECDIS Overview

- Vision
- History
- Expert Team on Sea Ice
- Ice Object Catalogue
- IHO Registry
- CIS-CCG-ICAN Pilot Project
- AARI-Transas Development
- Next Steps

Ice In ENCs Vision

- In the polar and sub-polar seas, ice is a major hazard to safe navigation. The integration of real time or near real-time ice information into ENCs is an important and natural step
  - Currently, mariners get ice information in a variety of ways that are external to their Electronic Navigation Chart Systems
  - Integrating ice information into the ENCS would improve the efficiency and safety of navigation by making it easier to plan routes to avoid hazardous ice conditions

Ice In ENCs - History

1992   S57 Object Catalogue Workshop - Ottawa
1995   Standards for Ice Information in ECDIS Workshop - Ottawa
- Ice Object Catalogue Ver 1.0

1996   ECDIS in Ice Navigation Workshop – Hamburg
- Ice Object Catalogue, Ver 2.0

1999   The ECDIS Ice Chart Project, SevenCs AG & Co.
2000   Ice In ECDIS Workshop – St. John's, NFLD
- Ice Object Catalogue, Version 3.0

2002   Integration of Sea Ice into ECDIS, UNB Project
2005   IHO Ice Register (Draft)
2005   IICWG Interoperability Data Formats Workshop
- Trial implementation of Ice Objects catalogue
- Catalogue revised to be consistent with other standards

Ice In ENCs – History (cont)

2007   JCOMM Expert Team on Sea Ice (ETSI)
- Ice Object Catalogue Version 4.0
- ETSI accepts ownership of Ice Register; approves Register management process

2007   IHO approves ETSI as owner of ICE Register
- IHO Register of Marine Information Objects goes on-line

2008   CIS pilot project to produce S-57 files representing daily ice charts in eastern Canada
- Ice Objects Catalogue Ver 4.1
- CARIS contracted to produce Ice MIO Product Specification

2009   AARI & Transas develop end-to-end capability to display AARI ice charts on Transas ECDIS
- Ice Objects Catalogue Ver 5.0

2010   Steps to harmonize Canadian and Russian work
- Ice Objects Catalogue Ver 5.1

Ice In ENCs – History (cont)

2009-2010 MetOcean information in ENC
- WMO Secretariat developed a draft Catalogue for MetOcean information in ENC
- ETMSS-III (October 2010) held general discussion on e-navigation concept, MetOcean Catalogue and its implementation in S-100
- WMO GRiB format is proposed for supporting gridded data

2010-2012 JCOMM SFSPA Project #33: Ice Information in ENCs
- **Expected Outcomes:**
  - Standard for Exchange File; Ice Objects Catalogue 5.0, Presentation Schemes, Data Structure, File Naming Conventions
  - **Demonstration Suite for JCOMM-IV (May 2012)**
- **Key Activities:**
  - Harmonize the standards documents that have been developed in parallel by CIS and AARI/Transas
  - Develop data and software package as a demonstration
- **Timeline/milestones:**
  - June 2011: harmonize standards
  - June 2012: demonstration package
- **ETs, Other Organizations and participants:**
  - ETSI, experts from TRANSAS, IHO

Expert Team on Sea Ice (ETSI)

- Sub-group of JCOMM – WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology
  - http://www.jcomm.info/
- Representatives of national ice services of Argentina, Canada, China, Denmark, Finland, Germany, Norway, Russian Federation (chair), USA + invited experts
  - Meets every 2 years
- International Ice Charting Working Group (IICWG)
  - Technical advisory body to ETSI
  - Meets annually

Ice Objects Catalogue

Ice Object Class	Acronym	Code
Polygon		
Sea Ice	SEAICE	30 300
	LACICE	30 301
Iceberg Area	BRGARE	30 302
Fast Ice	I_FAST	30 303
Separate Giant Floe	I_FLOE	30 304
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
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
Jammed Brash Barrier	JMDBRR	30 362
Stage of Melt	STGMLT	30 363
Snow Cover	SNWCVR	30 364
Strips and Patches	STRPTC	30 365
Grounded Hummock	I_GRHM	30 366

Ice Objects Catalogue

Acronym:	**SEAICE**
Code:	30300
subset 'Attribute_A':	NOBJNM; OBJNAM; ICEACT; ICEAPC; ICESOD; ICEFLZ; ICESPC; ICELVL; ICECST; ICEFTY; ICEDSP; ICEDDR; ICERCN; ICERFQ; ICERMH; ICERXH; ICERDV; ICEKCN, ICEKFQ, ICEKMD, ICEKXD, ICEFCN; ICETCK; ICEMAX; ICEMIN; ICETTY; ICEMLT; ICESCN; ICESCT; ICEDOS; ICELST; ICELFQ; ICELOR;ICELWD; IA_SFA; IA_SFB; IA_SFC; IA_FFA; IA_FFB; IA_FFC; IA_RCN; IA_FCN; IA_SNG; IA_MLT; IA_PLG; IA_HLG; IA_CST; IA_DUG; SYMINS; SMINSR
subset 'Attribute_B':	INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;
subset 'Attribute_C':	RECDAT; RECIND; SORDAT; SORIND;
Geometric Primitive:	Area
Definition:	Sea Ice is an area at sea that is covered, in whole or in part, with ice.
References:	"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States. "Ice in ECDIS Workshop," June 3-4, 2000, St. John's, Canada.
	"WMO Sea-Ice Nomenclature and International System of Sea-Ice Symbols", WMO Publication No. 259, Suppl. No. 5, 1989
	"SIGRID-3: A Vector Archive Format for Sea Ice Charts", JCOMM Technical Report No. 23, 2004
Distinction:	LACICE
Remarks:	
Change from Version 4.1:	New attributes added

IHO Registry of Hydrographic Related Features

- Ice Information is conceived as a Marine Information Overlay
  - Layer on top of hydrographic charts that can easily be turned on and off
  - Portrayal is more flexible than if the information is integrated with the hydrographic information
  - Ice Objects are managed in the IHO Registry of Registers
    - Hydro, Ice, IENC, NPUB, etc

IHO - HYDROGRAPHIC REGISTRY

Hydrographic related Feature Data Dictionaries

Data Dictionaries

HYDRO
Feature Index
Attribute Index
Enumeration Index
Information Index

ICE
Feature Index
Attribute Index
Enumeration Index
Information Index

OEF
Feature Index
Attribute Index
Enumeration Index
Information Index

IENC
Feature Index
Attribute Index
Enumeration Index
Information Index

NPUB
Feature Index
Attribute Index
Enumeration Index
Information Index

ICE Features

Valid   Invalid   Superseded   Retired

AlphaCode	Name	Status	Date Accepted	Date Amended	Use Type
BRGARE	Iceberg Area	Valid	0000-00-00	2010-08-22	Geo
BRGLNE	Iceberg Limit	Valid	0000-00-00	2010-08-22	Geo
FLOBRG	Floeberg	Valid	0000-00-00	2010-08-22	Geo
I_CRAC	Line of Ice Crack	Valid	0000-00-00	2010-09-02	Geo
I_FLOE	Separate Giant Floe	Valid	0000-00-00	2010-08-26	Geo
I_FRAL	Line of Ice Fracture	Valid	0000-00-00	2010-09-02	Geo
I_GRHM	Grounded Hummock	Valid	0000-00-00	2010-09-02	Geo
I_LEAD	Line of Ice Lead	Valid	0000-00-00	2010-08-26	Geo
I_RIDG	Line of Ice Ridge	Valid	0000-00-00	2010-08-26	Geo
ICEBRG	Iceberg	Valid	0000-00-00	2010-08-22	Geo
ICECOM	Ice Compacting	Valid	0000-00-00	2010-08-22	Geo
ICEDFT	Ice Drift	Valid	0000-00-00	2010-08-22	Geo
ICEDIV	Ice Divergence	Valid	0000-00-00	2010-08-22	Geo
ICEFRA	Ice Fracture	Valid	0000-00-00	2010-08-22	Geo
ICEKEL	Ice Keel/Bummock	Valid	0000-00-00	2010-08-22	Geo
ICELEA	Ice Lead	Valid	0000-00-00	2010-08-22	Geo
ICELNE	Ice Edge	Valid	0000-00-00	2010-08-22	Geo
ICERDG	Ice Ridge/Hummock	Valid	0000-00-00	2010-08-22	Geo
ICERFT	Ice Rafting	Valid	0000-00-00	2010-09-21	Geo

Data Dictionaries

HYDRO
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Information Index

ICE Feature

Feature Details

AlphaCode:	BRGARE
Name:	Iceberg Area
Alias:	Unspecified
camelCase:	AreaBerg
Use Type:	Geo
Definition:	An Iceberg Area is an area at sea in which icebergs, bergy bits, or growlers are present
Source Reference:	Unspecified
Source:	ETSI Ice Objects Catalogue V5.0
Similarity:	Identical
Int1:	Unspecified ▼
M4:	Unspecified ▼
Remarks:	Since a "Floeberg" is, by WMO definition, composed of sea ice and not glacial ice, floebergs have been excluded from the above definition of "Iceberg Area". Floebergs are not included in the associated IIP or CIS area product.
Status:	Valid
Accepted:	0000-00-00
Amended:	2010-08-22
Distinction:	Unspecified

Management Details

AlphaCode:	BRGARE
Status:	Final
Proposal:	Supersession
Submitting Organization:	JCOMM ETSI
Proposed Change:	Update Source Doucument and camelcase name; and to add new Attributes.
Justification:	To conform with ETSI Ice Objects Catalogue V5.0
Proposed:	2010-08-22
Disposed:	2010-08-22
Disposition:	Accepted
Successor:	Unspecified
Predecessor:	BRGARE
Decision:	Unspecified
Reg Manager:	Unspecified
Control Body Notes:	Unspecified

Recommended Attributes

NOBJNM OBJNAM IA_BCN IA_BFM IA_BUH ICEBNM ICEBSZ

This Feature Data Dictionary does not mandate the use of any attributes. The attributes listed here are recommended as being relevant to this particular feature. However, for some applications, certain attributes may be designated as mandatory for specific feature classes. These attributes must be listed in the appropriate product specification.

CIS-CCG-ICAN Pilot Project

- "Proof of concept"
- Ice Objects Catalogue version 4.0. taken as a base
  - Minor difficulties resolved with update to Ver 4.1
- Subset of Ice Objects reflecting the most important parameters for mariners
  - Not all Ice Objects included in product
- Ice attributes encoded in ice chart in accordance with WMO sea ice nomenclature
- Presentation via ICAN Aldebaran standard user definable zones as proxy for ice areas
  - No custom coding on ENCS
  - Visualization did not conform to WMO sea ice symbology

Canadian Ice Chart displayed on ICAN ENCS
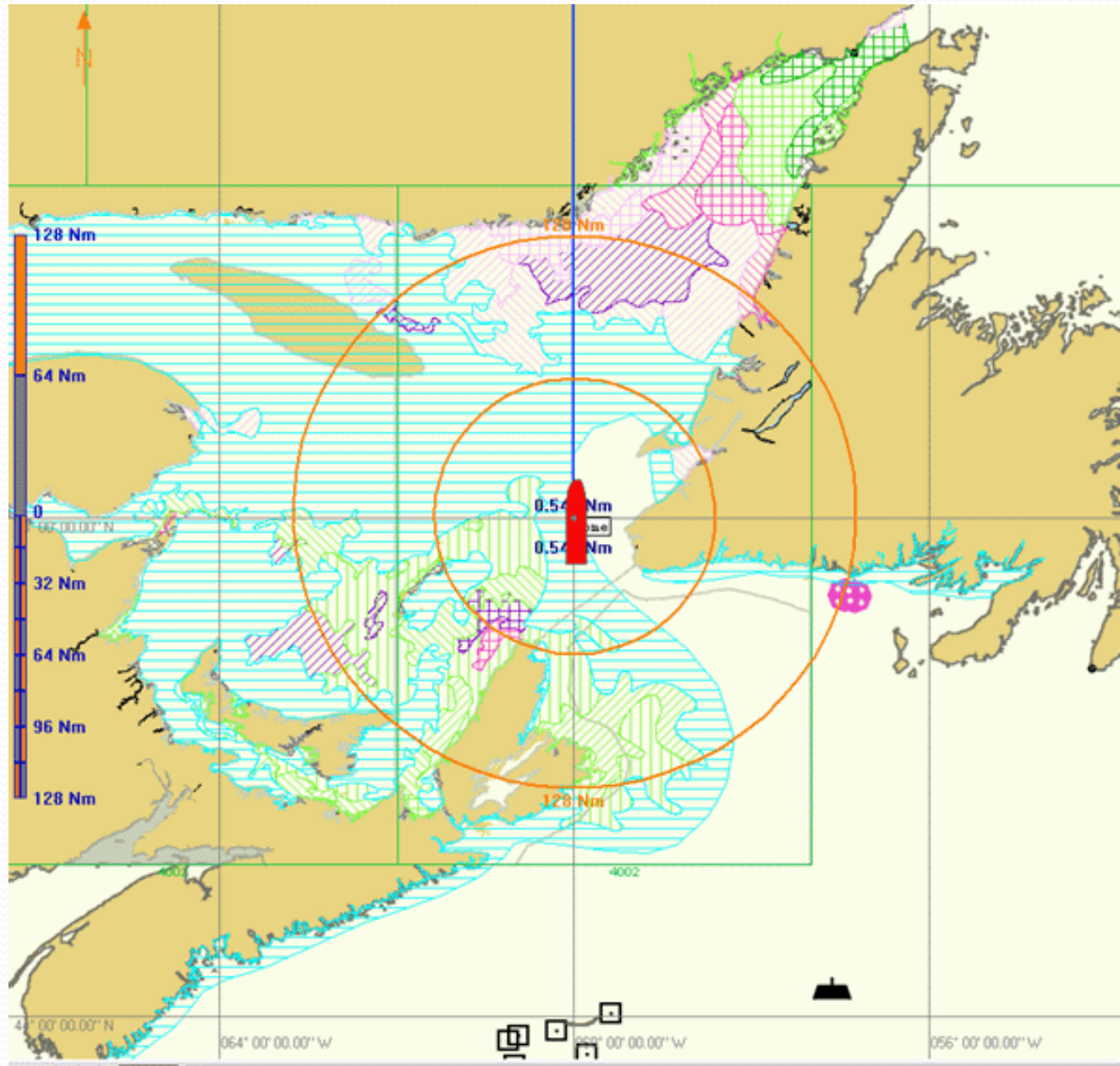
Canadian Ice Chart displayed on ICAN ENCS
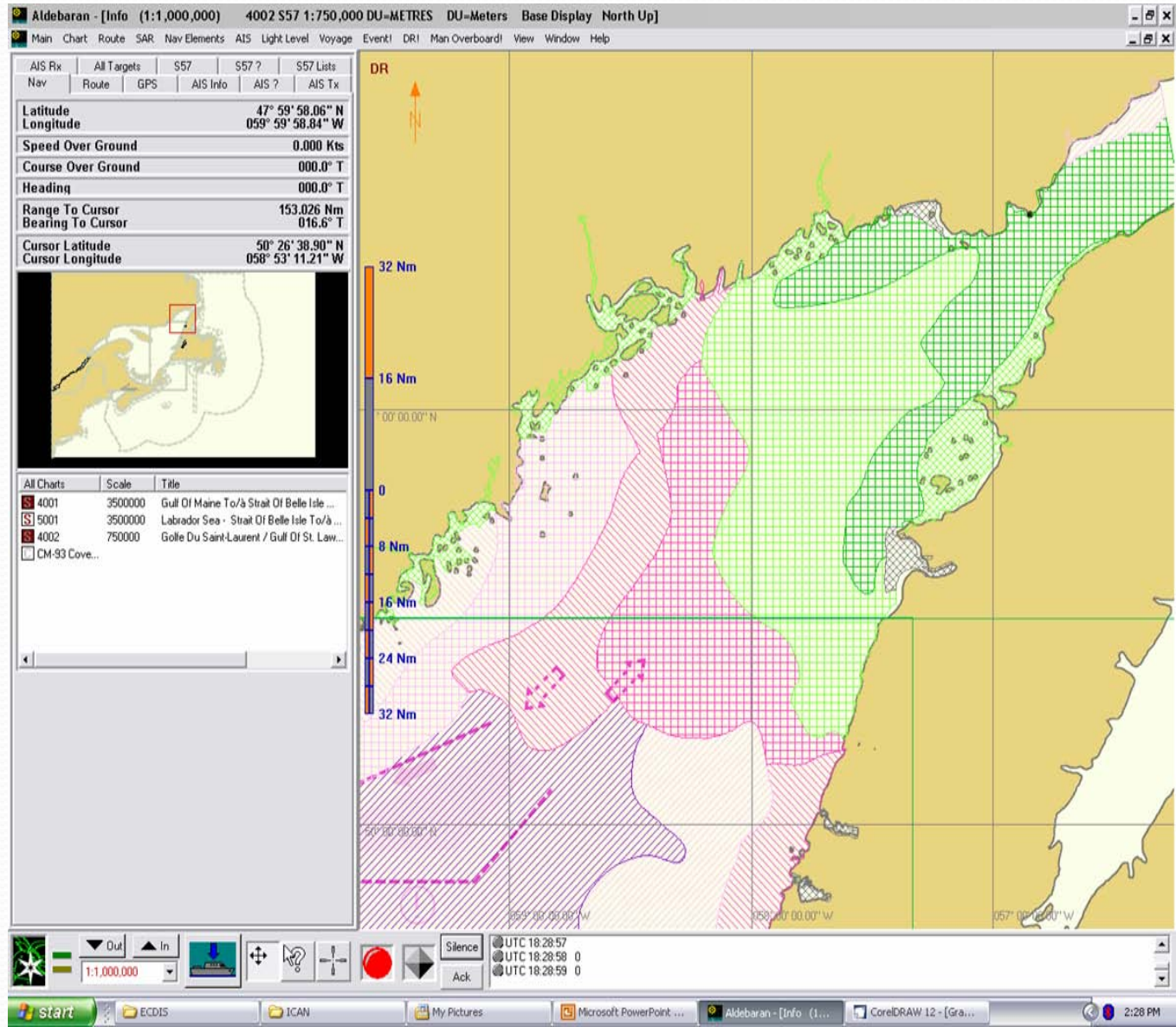
AARI-Transas Development

- "End-to-end" demonstration
- Ice Objects Catalogue version 4.0. taken as a base
  - Additional Objects and Attributes added – update Ver 5.0
- Ice attributes encoded in ice chart in accordance with Russian national nomenclature
- Presentation rules defined in pseudo IHO S-52 Presentation library lookup tables
  - "SEAICE","ICEACT92ICEAPC?,?,?IA_SFA?/?,?/?,?/?IA_SFB?/?,?/?, ?/?A_SFC?/?,?/?,?/?","SY(ICEBEL03);SY(ICENMB10)
  - ECDIS switch to allow presentation in either WMO international symbology or Russian national symbology
- Support for satellite imagery
- Near real-time data updates

S-57 Ice charts

S-57 ice charts are displayed in ECDIS in conformity with Russian

and International display regulations
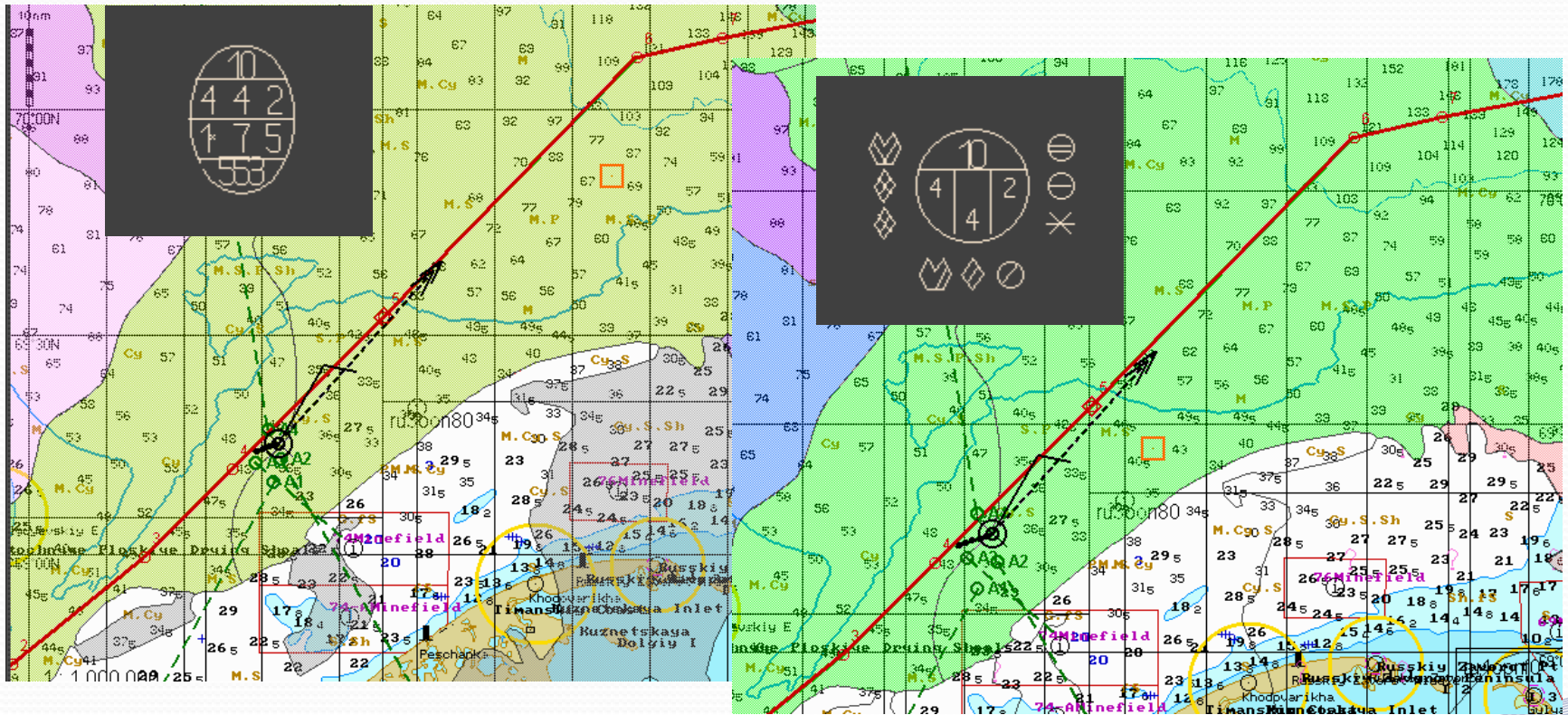
Ice data management

Main info panel consists of 4 pages

- Actual Ice Charts;
- Forecast Ice Charts;
- Raster Satellite Images;
- Recommended routes;
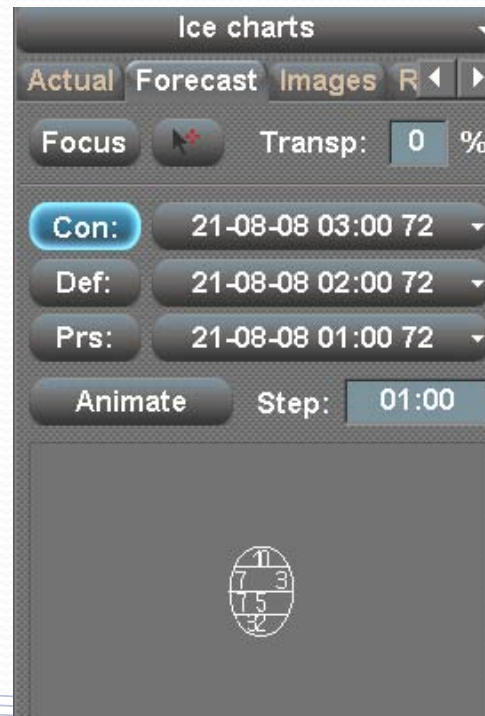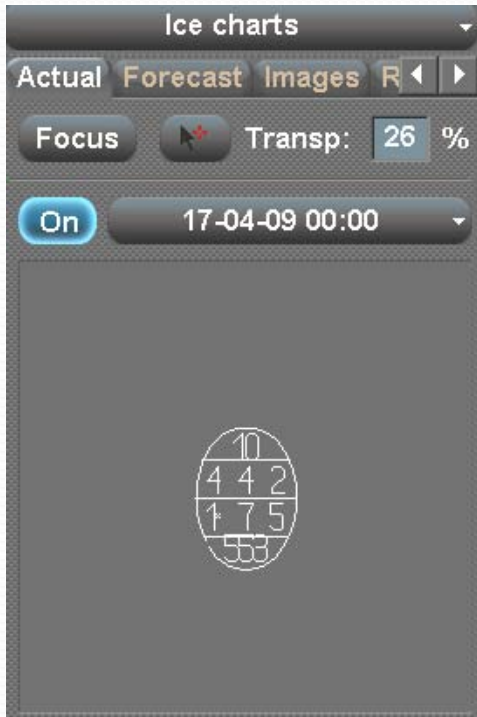
Ice charts in ECDIS

- Provides an operator with the combined navigational and meteorological information;

- Allows simultaneous display of up to 6 different semi-transparent layers:
    - NOAA images;
    - RadarSat images;
    - EOS images;
    - Actual S-57 ice chart;
    - Forecast S-57 chart;
    - Recommended route;
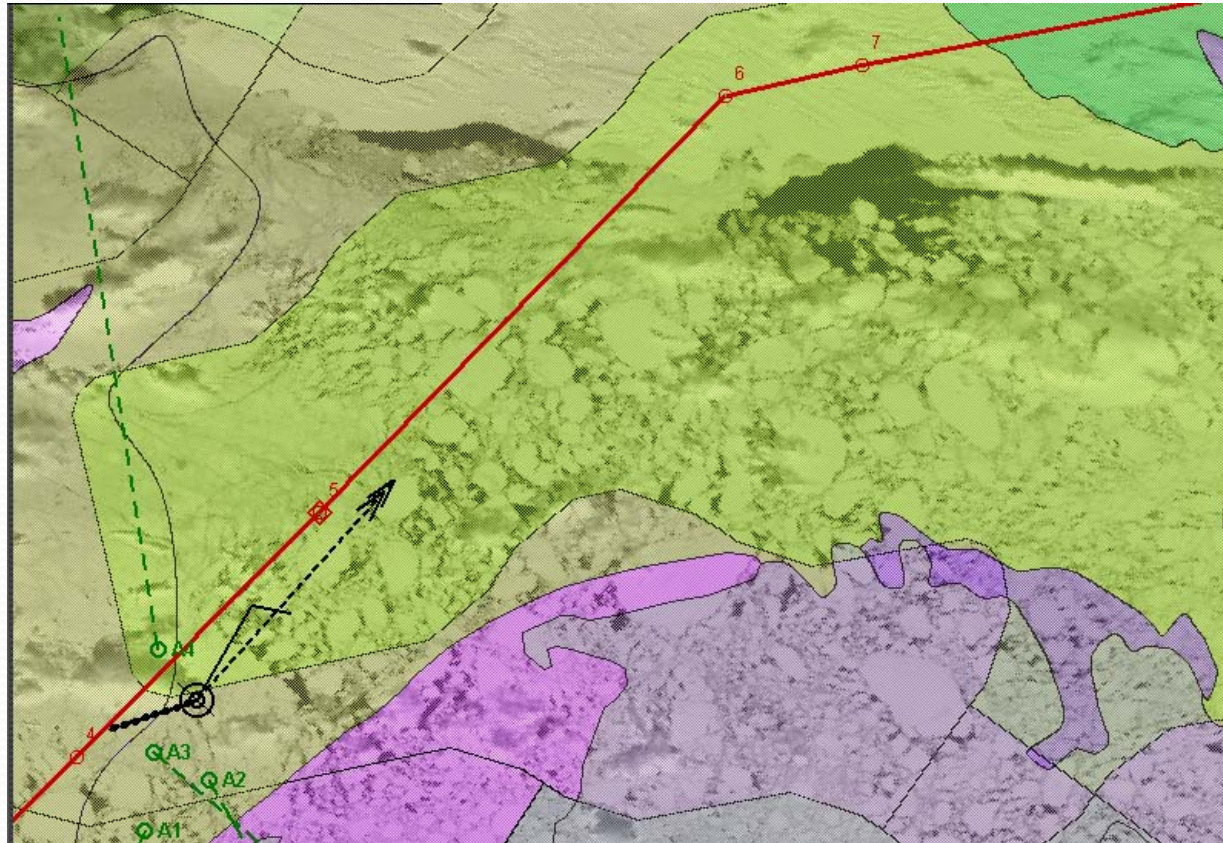
Data Delivery

- The required ice data are located on the AARI servers;
- A standard ship borne communication unit is used:
  - DHS Connector software – notifies about new data available;
  - DHS Terminal software – downloads data from AARI servers;

TRANSAS
SETS THE STANDARD
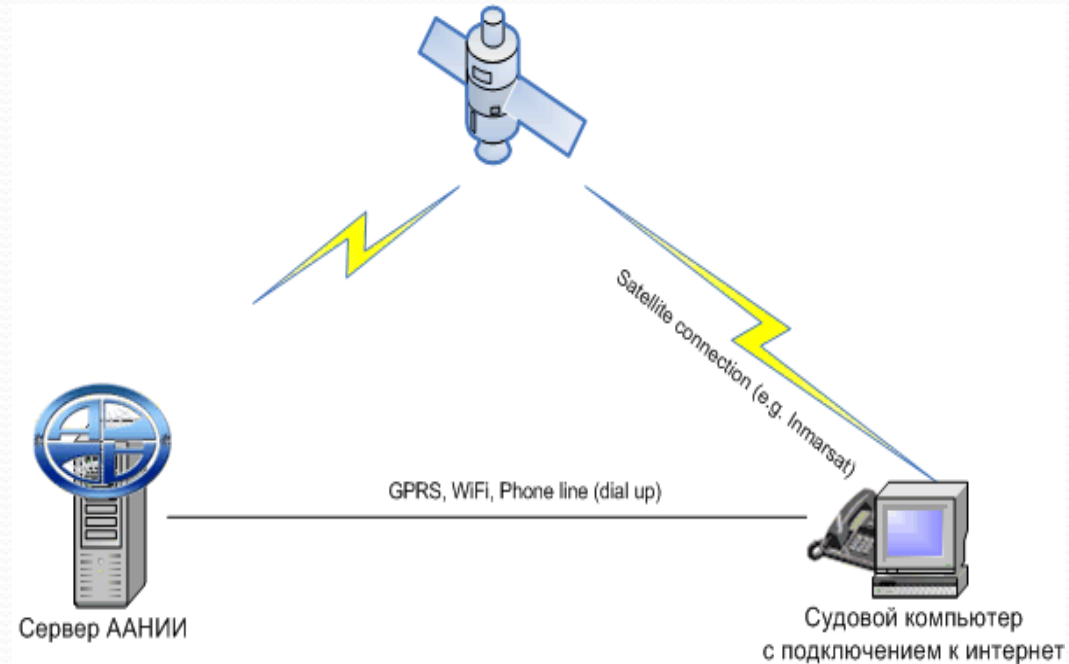
AARI ice chart for NE Kara Sea displayed in ECDIS system aboard icebreaker "Rossiya" (October 2010) with International and Russian display standards

AARI ice chart for Vilkitskiy Strait with superimposed ENVISAT ASAR imagery displayed in ECDIS system aboard icebreaker "Rossiya" (October 2010)

Work Currently in Progress

- Rationalization / simplification of Ice Objects Catalogue Version 5.0
  - Some duplicate/overlapping attributes to be resolved
  - Some definitions to be refined
  - Target completion for Spring 2011
- Draft S-1xx Product Specification
  - Merge / harmonize Canadian and Russian work to date
  - Codify portrayal, naming conventions, file structure rules based on AARI/Transas work
  - Submit to Registry - target mid-2011
- Portrayal & Metadata Registers
  - Submit to Registry – target end of 2011

TSMAD Guidance Needed

- Envisage Ice Product Specification as having 3 levels:
  - "Ice Free" - for the great majority of ships that never want to encounter ice
    - Minimal ice information – ice edge, Limit of All Known Ice in North Atlantic
  - "Ice Capable" –for ships that transit ice-encumbered areas under guidance from authorities
    - General ice information – concentration, thickness, floe size
  - "Icebreaker" – for ships that make their own way through ice
    - Most detailed level of ice information
- The levels would all be upwards compatible!

TSMAD Guidance (cont)

- Is this multi-level vision appropriate?
- Should this be codified as one product specification with multiple levels?
  - Or are three separate specifications better?
- Options for presentation?
  - Should we be prescriptive or allow flexibility in portrayal of ice information
    - Recognizing that there may be many good ideas not yet considered
- How do we consult with ECDIS/ENCS manufacturers?
  - Who do we consult with?
  - Level of consultation required?

Next Steps

- Define distribution and encryption means
  - S-63, data media, updating methods
- Register standard at IHO as S-1xx
  - Follow procedures in IHO S-99
- ECNS manufacturers develop software to accept ice data
  - Produce test data sets
  - Conduct trials
- National ice services develop capability and begin production of S-1xx data files
  - Make available to service providers or directly to end users
  - Service providers could collect the data from national providers and deliver to ECDIS as regular subscription
- Determine optimal way to support JCOMM ETMSS in implementing the MetOcean Catalogue and standardizing the WMO formats for gridded data (GRIB etc) for S-1xx

Comments?
Advice?

Thanks for your attention and assistance