



Fisheries and Oceans  
Canada

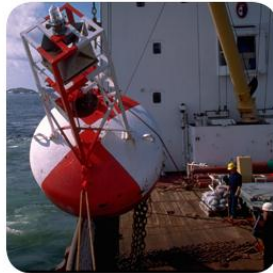
Pêches et Océans  
Canada

Canadian  
Coast Guard

Garde côtière  
canadienne



Safety First, Service Always



# The Canadian Experience

*E-Navigation Underway 2013 - Copenhagen*

# Overview



- **Canada's Vision**
- **Overall Principles**
- **Historical Development**
- **Key Accomplishments**
- **Development & Implementation Process**
- **Concept of Operations**
- **Moving Forward**
- **IMO vs Canada process**

***“Widespread use of e-Navigation in Canada by mariners and shore authorities for greater marine safety, security, efficiency and environmental protection.”***



# What Does e-Navigation Mean for Canada?



*“Accurate and reliable navigational information [provided by **e**lectronic means] used by vessels and authorities ashore to support **e**ffective decision-making, minimize human error, and **e**nhance communications.”*



**Groundings were the most frequent type of shipping accident reported in Canada during 2005-2009**

*The MV Clipper Adventurer grounded near Kugluktuk, Nunavut, in 2010*

Photo: The Canadian Press (Internet)

# Overall Principles



## **Six principles apply to the development and implementation of e-Navigation in Canada:**

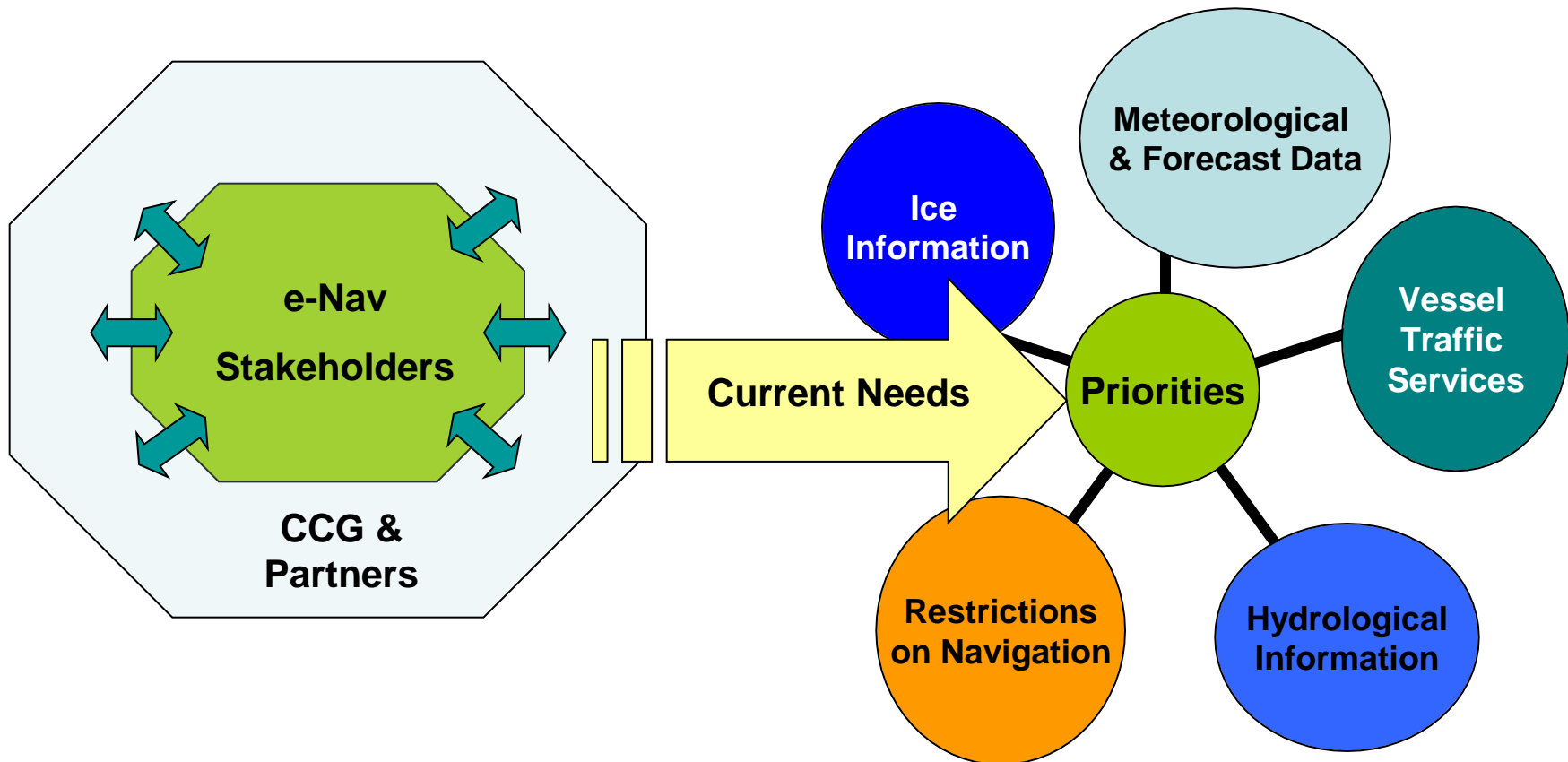
1. Safety-of-Life, Property, and the Protection of Marine Environment
2. Applicable to all Categories of Mariners
3. Cooperation with the International Community
4. Contribution to Marine Transportation Efficiency
5. User Consultation
6. Inter-departmental Coordination



# e-Navigation in Canada



**Bottom-up approach:** CCG along with its partners first consulted mariners to identify their needs and priorities.



# Historical Development – 2000/2008



- **A number of e-Navigation initiatives have already been conducted in Canada to improve marine safety, security, and efficiency.**
- **Initiatives were successful because of the collaboration of various key players:**
  - Port Authorities
  - Government Agencies
  - St. Lawrence Seaway Corporation
  - Canadian Maritime Pilots Association
  - Shipping Industry
  - Private Sector

# SmartBay – Placentia Bay



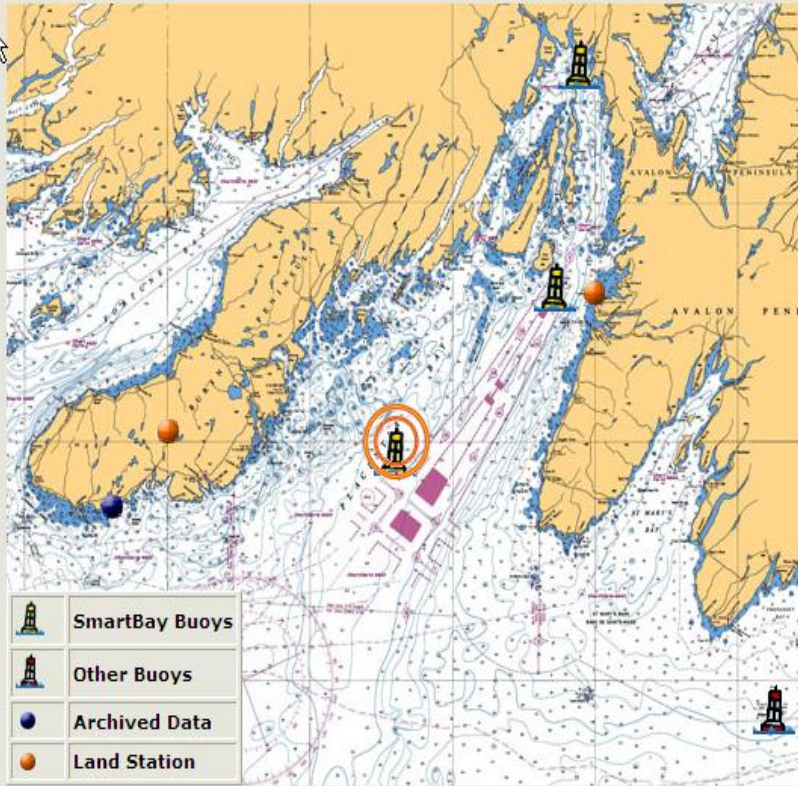
**SmartBay**  
PLACENTIA BAY, NEWFOUNDLAND

Local: Thursday, November 3, 2011 14:49:45  
UTC: Thursday, November 3, 2011 18:49:45

Better Information.... Better Decisions

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**Buoy Data** [About Our Buoys](#)



**Mouth of Placentia Bay**

[STATION INFO](#) [HISTORY](#) [SITE FORECAST](#) [DATA REQUEST](#)

**Time Now:** 03-Nov-2011 14:50 NDT  
**Time of Data:** 03-Nov-2011 14:22 NDT

Latitude: 46° 58.8919' N  
Longitude: 054° 41.2991' W

Avg Wind Speed: 13 knots  
Peak Wind Speed: 16 knots  
Wind From: WSW  
Air Temperature: 6.9 °C  
Dew Point: Currently Unavailable Humidity: Currently Unavailable  
Barometric Pressure: 101.6 kPa Trend: **DOWN**

Sea Surface Temperature: 7 °C  
Current Velocity (0.5 m depth): 0.8 knots  
Current Toward: 187 ° True (S)  
Significant Wave Height: 1 m ( 3.4 ft )  
Maximum Wave Height: 1.7 m ( 5.5 ft )  
Waves From: 217 ° True (SW)  
Peak Wave Period: 4.4 sec

[SmartBay Buoys](#)  
[Other Buoys](#)  
[Archived Data](#)  
[Land Station](#)

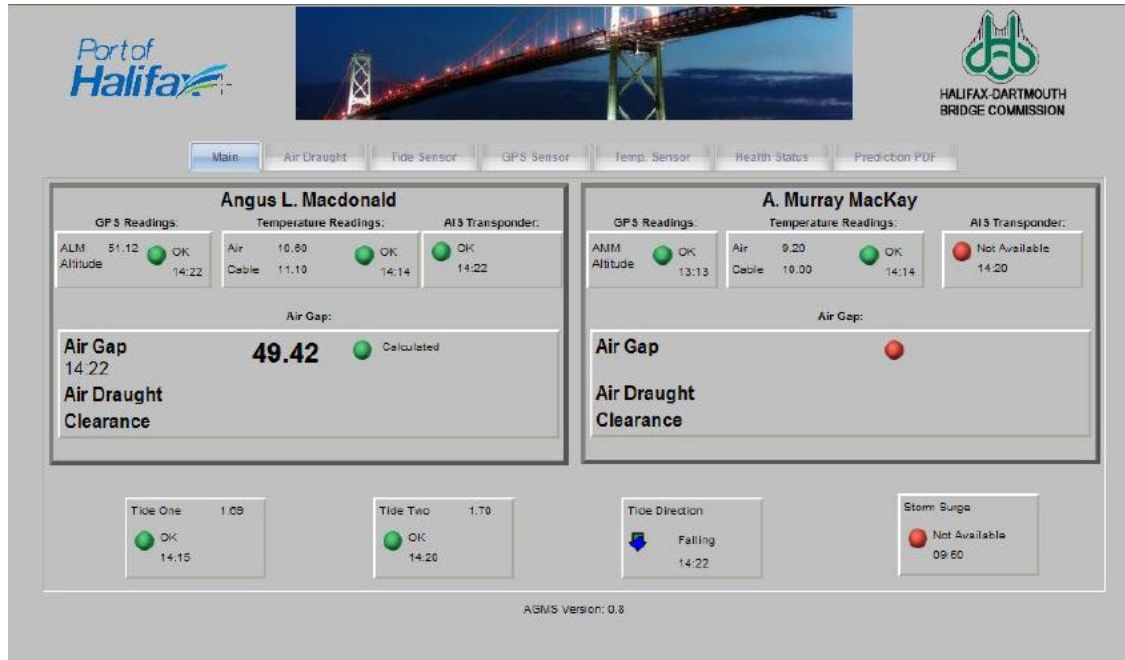
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- AIS buoys
- Seabed mapping view
- Real-time and archived data available to develop weather and sea-state forecasts
- Website with public access

[www.smartbay.ca](http://www.smartbay.ca)



# Bridge Air Gap in major ports



- Continuous monitoring of bridge heights using tide gauges and differential GPS.
- Port of Halifax calculates the air gap clearance of vessels and provides info to pilots.
- In addition, an AIS unit is located at the center of the bridge for better positioning of ships.



# Marinfo on the St. Lawrence River



Fisheries and Oceans  
Canada

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Canada

Canadian Coast Guard

www.gcc-ccg.gc.ca

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CCG - MarInfo

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Major Issues  
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Our Partners

Notships Shoals Buoy Tending Icebreaking Fleet Activities Map Interface

## Shoals in the Commercial Channels

**Warning:** The shoals catalogued here are those that are found in or along the banks of the commercial channels, in the zones under jurisdiction of the **Canadian Coast Guard - Navigable Waterways Management** division. The shoals located in zones that are under other jurisdictions are covered in the [Written notices to shipping](#).

- [Shoals queries by sector](#)
- [Catalog of shoals for Montreal to Quebec](#)
- [Catalog of shoals for Traverse du Nord](#)
- [All active shoals sorted by date](#)

**E** Pêches et Océans / Fisheries and Oceans  
Canada / Canada  
Garde côtière / Coast Guard

**Q5152/10**  
2010-10-08

**RÉGION DU QUÉBEC / QUÉBEC REGION**  
Trois-Rivières à Québec / Trois-Rivières to Québec

### Courbe Anse de Grondines

Position oentroide du haut-fond  
Center position of the shoal  
46-31-51.7 N  
72-11-15.6 W

Point de référence à proximité  
Reference point near by  
Bouée / Buoy D56

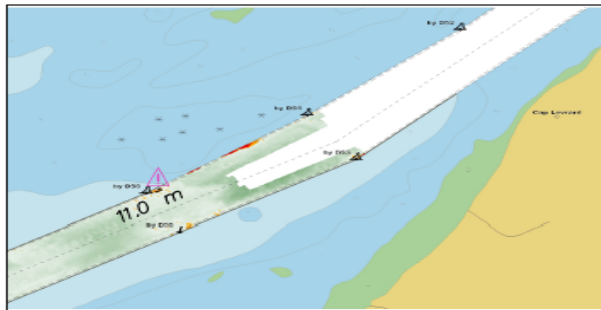
Dimension du haut-fond  
Shoal Dimension  
Longitudinale / Longitudinal  
Transversale / Transverse

Profondeur / Depth  
**10.9 m (zcr/d)**

### Carte / Chart 1314

Espace libre de chenal  
Free space of channel  
Côte Nord / North side  
Côte Sud / South side

Profondeur maintenue à  
Maintained depth at  
**11.0 m**



- Use of common navigation software shared by pilots and Coast Guard using Portable Pilot Units (PPU's).
- Pilots download up-to-date operational data from website on the state and conditions of the waterways:
  - Notice to Shipping (broadcast and written)
  - Shoals and Bottom surveys
  - Buoy-tending
  - Icebreaking
  - Coast Guard Fleet operations
- Real-time water level info broadcast via AIS message.

Weather Tides Charts

Proactive Disclosure

Date modified : 2008-12-0

Notices

Gestion des Voies Navigables  
Waterways Management



Service Hydrographique du Canada  
Canadian Hydrographic Service

# AIS Messages on the St. Lawrence Seaway



## GREAT LAKES ST. LAWRENCE SEAWAY SYSTEM

### Sector Environmental Summary-Welland

As of: 11 04, 15:08

| Short Name | Date Time        | Water Level(m) | Water Temp (deg C) | Wind Speed (km/hr) | Wind Direction | Air Temperature (deg C) |
|------------|------------------|----------------|--------------------|--------------------|----------------|-------------------------|
| L1N        | 2011-11-04 15:00 | 74.8           |                    | 4                  | NE             |                         |
| L1N        | 2011-11-04 14:00 | 74.712         |                    | 3                  | N              |                         |
| L1N        | 2011-11-04 13:00 | 74.736         |                    | 4                  | N              |                         |
| L1N        | 2011-11-04 12:00 | 74.713         |                    | 3.17               | N              |                         |
| L1N        | 2011-11-04 11:00 | 74.69          |                    | 4.17               | NE             |                         |
| L1N        | 2011-11-04 10:00 | 74.73          |                    | 8.17               | E              |                         |
| L1N        | 2011-11-04 09:00 | 74.732         |                    | 8.83               | NE             |                         |
| L1N        | 2011-11-04 08:00 | 74.725         |                    | 8                  | E              |                         |
| L1N        | 2011-11-04 07:00 | 74.719         |                    | 11.67              | ENE            |                         |
| L1N        | 2011-11-04 06:00 | 74.717         |                    | 11.83              | ENE            |                         |
| L1N        | 2011-11-04 05:00 | 74.722         |                    | 11.67              | ENE            |                         |
| L1N        | 2011-11-04 04:00 | 74.729         |                    | 12.83              | NE             |                         |
| L1N        | 2011-11-04 03:00 | 74.712         |                    | 11.83              | ENE            |                         |
| L1N        | 2011-11-04 02:00 | 74.738         |                    | 12.67              | NE             |                         |
| L1N        | 2011-11-04 01:00 | 74.725         |                    | 9.67               | N              |                         |
| L1N        | 2011-11-04 00:00 | 74.729         |                    | 9.33               | N              |                         |
| L1N        | 2011-11-03 23:00 | 74.742         |                    | 8.33               | N              |                         |
| L1N        | 2011-11-03 22:00 | 74.742         |                    | 8.83               | N              |                         |
| L1N        | 2011-11-03 21:00 | 74.731         |                    | 8.67               | NE             |                         |
| L1N        | 2011-11-03 20:00 | 74.726         |                    | 9.5                | N              |                         |
| L1N        | 2011-11-03 19:00 | 74.733         |                    | 8.5                | NE             |                         |
| L1N        | 2011-11-03 18:00 | 74.736         |                    | 7.67               | N              |                         |
| L1N        | 2011-11-03 17:00 | 74.741         |                    | 4.83               | N              |                         |
| L1N        | 2011-11-03 16:00 | 74.725         |                    | 4.67               | N              |                         |
| L1N        | 2011-11-03 15:00 | 74.714         |                    | 6                  | N              |                         |
| L01        | 2011-11-04 15:00 |                | 10.98              |                    |                |                         |
| L01        | 2011-11-04 14:00 |                | 10.89              |                    |                |                         |
| L01        | 2011-11-04 13:00 |                | 10.89              |                    |                |                         |
| L01        | 2011-11-04 12:00 |                | 10.87              |                    |                |                         |
| L01        | 2011-11-04 11:00 |                | 10.89              |                    |                |                         |

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- Each lock within the Seaway broadcasts real-time information on:
  - Lock order
  - Water levels
  - Weather data including visibility
- Information is available via AIS Messages and from the Internet (i.e., both 'push and pull')



# Avadept in the Pacific Region



 Fisheries and Oceans Canada  
Pêches et Océans Canada  
Coast Guard Garde côtière

(WD)


## AVADEPTH Water Depth Forecasting for the Fraser River

AVADEPTH - forecasts of available water depths for vessels navigating the Fraser South Arm Channel.





- Website provides info to mariners :
  - Determination of maximum draft and best sailing times.
  - S-57 ENC updates
  - Forecasts of available water depths
  - Water current flow
- Available to river pilots, Port Metro Vancouver, and shipping companies


 [Current Channel Conditions](#)


 [Daily Depths](#)


 [Transit Window](#)

 [Hydrograph](#)


 [Predicted Water Levels](#)


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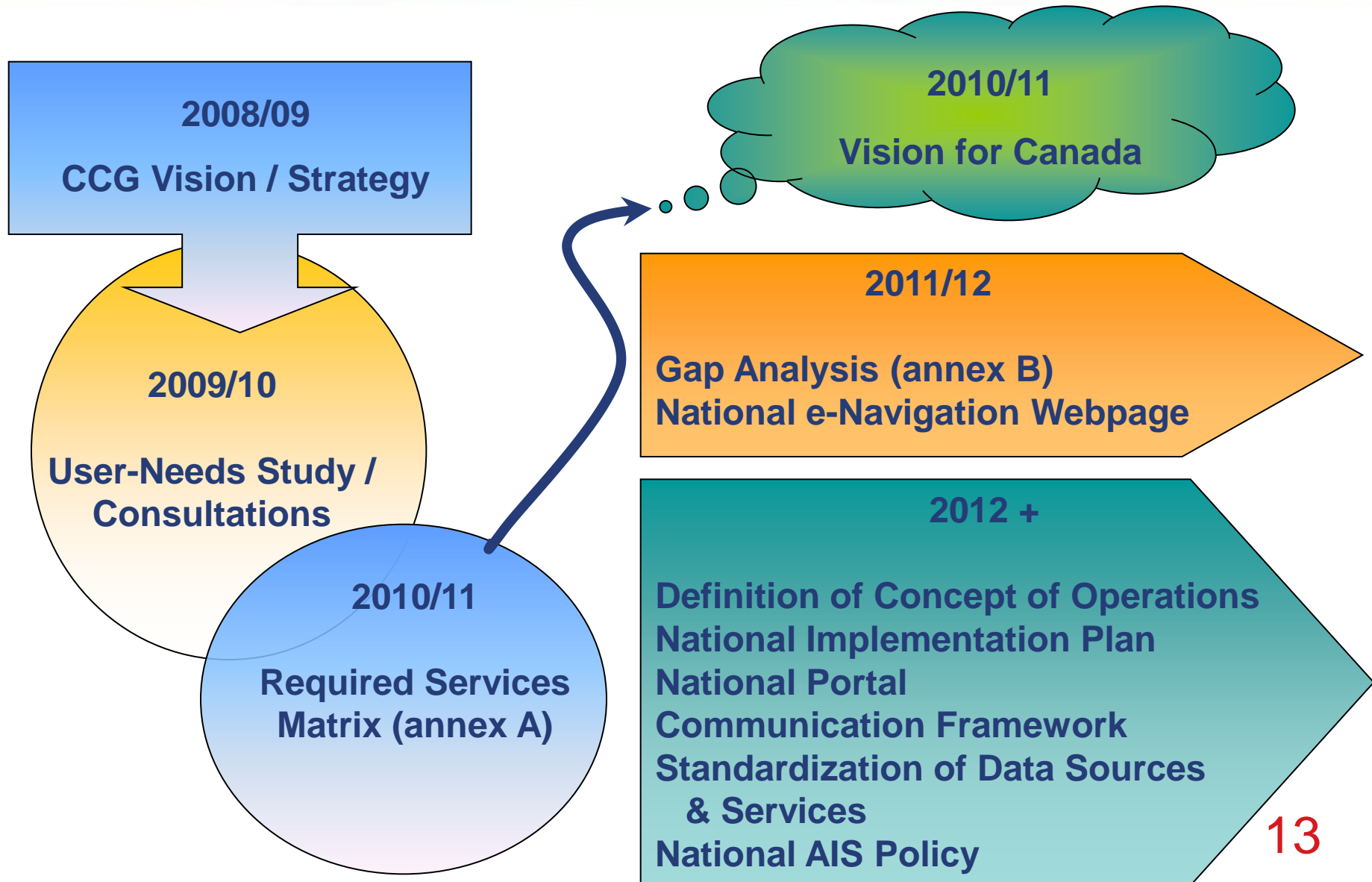
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# Development & Implementation Process



# Concept of Operations



- **User driven !!**
- **‘Open Government’ concept**
  - Concentrating our effort to offer services and data in electronic format for specific Maritime Service Portfolios
  - Data available 24/7
- **One national portal**
  - Single point of access
  - Confirmation of ‘official’ information
  - Posting info, data and links
- **AIS Network**
  - Broadcast data and up-to-date information
- **Technology / tools to be developed by Industry**

# Moving Forward



e-Navigation will be a reality in Canada and abroad, sooner or later...



**but mariners in Canada want e-navigation NOW**

- During consultations, mariners communicated that the development and implementation process at the international level is far too complicated and cumbersome.
  - **Canadian mariners believe we can make it happen -- now, without waiting for IMO and IALA.**
- Canada intends to work in parallel - moving forward to implement e-Navigation, but will continue to work on the international side to ensure that our system is in line with international direction.

# IMO vs Canada process



|      | IMO  | Canada  |
|------|--|---|
| 2006 | <ul style="list-style-type: none"> <li>- e-Nav concept first introduced</li> <li>- draft Strategy for Development and Implementation of e-Nav started</li> </ul>   |   |
| 2007 | <ul style="list-style-type: none"> <li>- e-Nav WG and CG formed to define the scope of e-Nav, and to develop an e-Nav Strategy, implementation framework, and work program</li> </ul>  | <p><b>e-Nav Workshop of Federal Govt. Stakeholders</b></p> <ul style="list-style-type: none"> <li>- initial scope/development of Canadian e-Nav Strategy; CCG becomes lead agency</li> </ul>  |
| 2008 | <ul style="list-style-type: none"> <li>- Germany &amp; Canada develop/conduct <b>World-wide e-Nav User Needs Survey</b></li> </ul>   | <p><b>Canadian e-Nav User Needs Survey</b></p> <ul style="list-style-type: none"> <li>- used same questionnaire as IMO, but included direct interviews with both providers &amp; users</li> </ul>   |
| 2009 | <ul style="list-style-type: none"> <li>- "Strategy for Development and Implementation of e-Navigation" approved</li> <li>- review shipboard and shore-based user needs</li> <li>- identified functions and services to support shipboard and shore-based user needs</li> </ul>   | <p><b>Required Services Matrix</b></p> <ul style="list-style-type: none"> <li>- using results of User Needs Survey, identified what e-Nav services are required for the main navigation areas in Canada</li> </ul>  |
| 2010 | <ul style="list-style-type: none"> <li>- e-Nav <b>Gap Analysis</b> process starts</li> <li>- review and consolidate process of completing initial Gap Analysis</li> </ul>  | <p><b>Gap Analysis</b></p> <ul style="list-style-type: none"> <li>- describes what are the current 'gaps' in electronic services that need to be provided in order to achieve e-Nav throughout Canada</li> </ul>  |
| 2011 | <ul style="list-style-type: none"> <li>- continue initial <b>Gap Analysis</b></li> <li>- conduct cost-benefit and risk analysis</li> <li>- investigate overarching e-Nav architecture</li> <li>- draft outline for final Strategy Implementation Plan</li> </ul>   | <p><b>"e-Navigation in Canada"</b></p> <ul style="list-style-type: none"> <li>- inter-departmental vision/strategy document approved</li> <li><b>Concept of Operations</b> drafted; includes 3 phases:                             <ul style="list-style-type: none"> <li>Voyage Planning</li> <li>Voyage</li> <li>Post-Voyage</li> </ul> </li> </ul> |
| 2012 | <ul style="list-style-type: none"> <li>- <b>Gap Analysis</b> finalized; continue conducting cost-benefit and risk analysis</li> <li>- overarching e-Nav architecture approved</li> <li>- continue development of detailed architecture, <b>MSPs</b>, usability guidelines, risk control options, and guidelines for harmonization of testbeds</li> </ul> | <p><b>Maritime Service Portfolio (MSP) → National Portal</b></p> <ul style="list-style-type: none"> <li>- transition current e-Nav related services into a MSP that is provided via a National Portal</li> </ul>  |
| 2013 | <ul style="list-style-type: none"> <li>- continue current work program</li> <li>- develop detailed ship and shore architecture</li> <li>- draft Strategy Implementation Plan</li> </ul>  | <p><b>Development of an National AIS Policy</b></p> <ul style="list-style-type: none"> <li>- determine what, how, and where e-Nav data and services will be provided via AIS.</li> </ul>  |
| 2014 | <p><b>Complete the process for Development and Implementation of e-Navigation</b></p>  | <p><b>Align national e-Nav services with IMO e-Nav Development and Implementation Plan</b></p>  |



# Next Steps

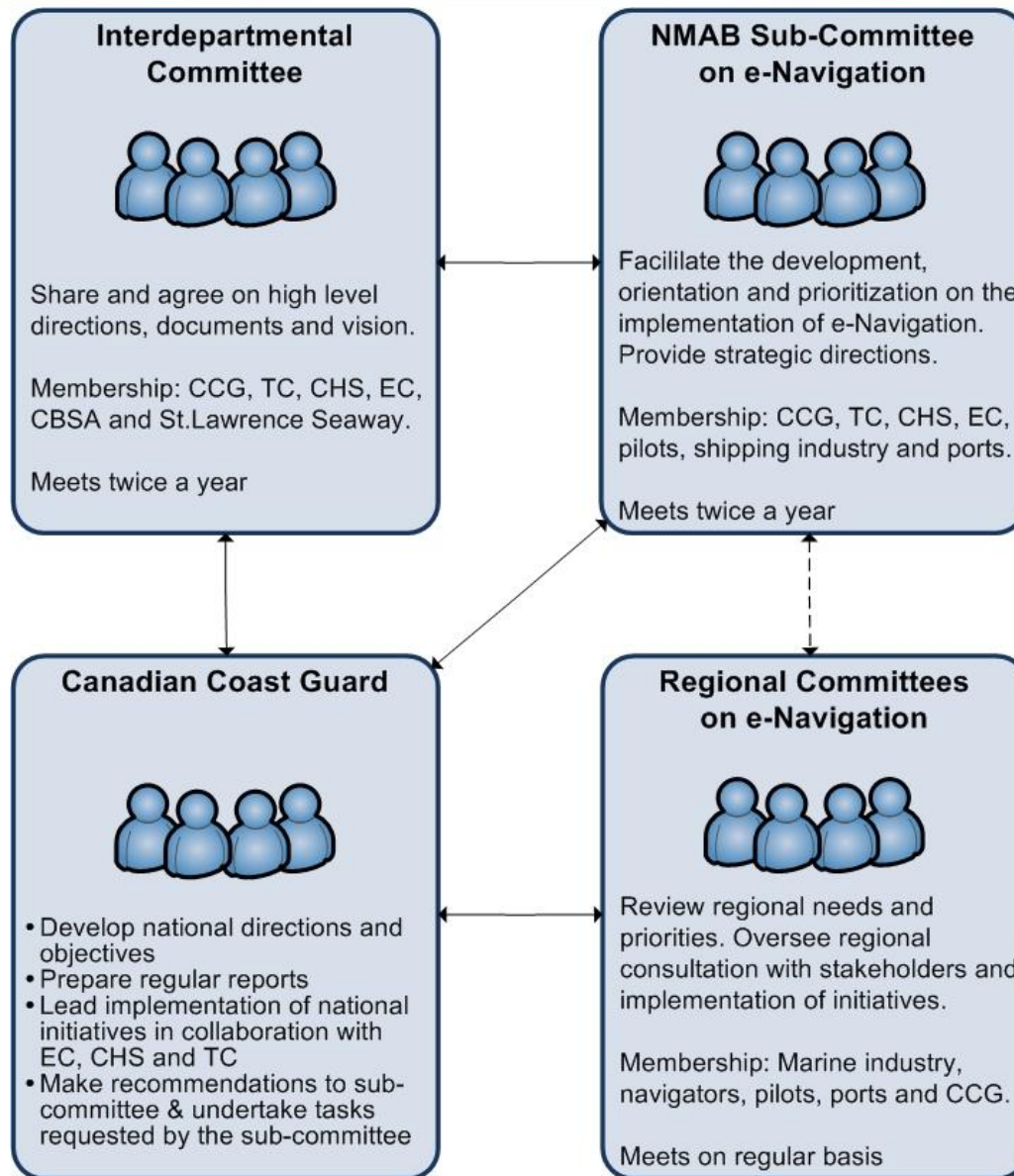


- **CCG will create a national e-Navigation portal for Canada**
- **Continue to work closely with international organizations to develop and coordinate e-Navigation components**
  - Equipment standards, regulatory framework, training, technical architecture, common maritime data structure, operational policies, communications technology, how to portray e-Nav information, etc.
- **Canada's success to date, has been due to collaboration and communication with key partners and stakeholders.**

 **Continued progress is dependent on frequent communication with stakeholders.**

- Canadian Maritime Advisory Committee (CMAC)
- 2013 Mariners Workshop (6-7 Feb 2013, Vancouver)
- National Marine Advisory Board (NMAB) – Sub-Comm on e-Navigation

# Governance



# Stakeholders



## Federal Government

- **Canadian Hydrographic Service**
  - Charts updates, Hydrological data
- **Transport Canada**
  - Route, Traffic separation, Security
  - Regulations
- **Environment Canada**
  - Meteorological, Hydrographic & Ice data
- **St. Lawrence Seaway Management Corporation**
  - AIS info, Lock orders
- **Canadian Border Services Agency**
  - One stop reporting
- **DFO Science**
  - Restricted areas, Fish farms
- **Canadian Coast Guard**
  - Aids to navigation, Vessel Traffic Services
  - Restriction on navigation, survey results, Search and Rescue, Environmental Response
- **Port Authorities**

## Maritime User Community

- **Shipping Companies**
- **Pilots**
- **Masters and mates**

## Private Sector

- **Navigation equipment manufacturers**
- **Software and equipment developers**

## International organisations

- **IALA**
- **IMO**
- **USCG**

# Annex A - Canadian e-Navigation Required Services Matrix



|  |  | June 1st, 2012  |               | Canadian e-Navigation Users Needs Study → Required Services Matrix |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
|--|--|---|---------------|--|-------------|------------------------------------|-------------|-----------------------------------|------------------------------|-------------|--------|---------|-------------|---------------|------------------------------|-------------|--------------------------|-------------|---|--|
|  |  | Navigational Areas →  |               | Atlantic   |             | St. Lawrence Gulf                  |             | St. Lawrence River                |                              | Great Lakes |        | Pacific |             | Arctic        |                              |             |                          |             |   |  |
|  |  | Sub-Areas →   |               | Coastal Area   | Major Ports | From Cabot Strait to Les Escoumins | Major Ports | From les Escoumins to Québec City | From Québec City to Montréal | Major Ports | Seaway | Lakes   | Major Ports | Coastal Areas | Interior Waters (see note 1) | Major Ports | ≤ 75° North (See note 2) | > 75° North |   |  |
| Navigation Safety Services                           | Category                                       | Data to be available electronically                                     | Survey Item # |  |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
| Environmental Information                            | Meteorological (Observation and Forecast data) | Wind (speed & Direction)  | 2.1           | M  | H           | M                                  | H           | M                                 | M                            | M           | H2     | H       | H1          | H2            | H2                           | H1          | H                        | H           |   |  |
|  |  | Visibility  | 2.1           | L  | H           | L                                  | M           | L                                 | M                            | L           | L      | H2      | M           | H1            | M                            | H           | M-H                      | M-H         | L |  |
|  |  | Weather (e.g.fog, rain, snow)   | 2.1           | M  | H           | L                                  | L           | L-M                               | L                            | L-M         | L      | H2      | M           | H1            | L                            | H           | M-H                      | M-H         | L |  |
|  |  | Wave (height & direction)   | 2.1           | H  | H           | L                                  | L           | L                                 | L-M                          | L           | M      | M       | M           | M             | H                            | M           | M                        | H           | H |  |
|  |  | Air temperature   | 2.1           | H  | H           | L                                  | L           | L                                 | L-M                          | L           | M      | M       | M-H         | L             | L                            | L           | L                        | H           | M |  |
|  |  | Water temperature   | 2.1           | H  | H           | L                                  | L           | L                                 | L-M                          | L           | L      | L       | L           | L             | L                            | L           | L                        | L           | L |  |
|  |  | Atmospheric pressure  | 2.1           | H2   | H           | L                                  | L           | L-M                               | L                            | L           | L      | L       | L           | L             | L                            | L           | L                        | L-M         | M |  |
|  |  | Weather warnings (e.g. gale, storm, hurricane, tsunami, freezing spray) | 2.1           | H2   | H           | L                                  | M           | L                                 | L-M                          | M           | M-H    | L       | M           | H3            | H2                           | H1          | H                        | H           | H |  |
|  |  | METAREAS (new)  |               |  |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
|  |  | Ice charts  |               | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
|  |  | Ice forecasts   |               | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
|  |  | Ice advisories  |               | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
|  |  | Ice Routing   | 2.1           | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
|  |  | Ice webcams (new)   |               | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
|  |  | Ice Bulletins (new)   |               | H2   | H           | H                                  | H           | M                                 | M                            | M           | L-M    | M       | H           | M             | N/A                          | N/A         | N/A                      | H           | H |  |
| Iceberg Bulletins (new)                              |  | H2  | H             | H  | H           | M                                  | M           | M                                 | L-M                          | M           | H      | M       | N/A         | N/A           | N/A                          | H           | H                        |             |   |  |
| Real-time tide                                       | 2.1  | L   | H             | L  | H           | H1                                 | H1          | L-H                               | N/A                          | N/A         | n/a    | L       | M           | H             | M-H                          | H           | H                        |             |   |  |
| Forecast tide  | 2.1  | L   | H             | L  | H           | H1                                 | H1          | M-H                               | N/A                          | N/A         | n/a    | L       | M           | H             | H                            | H           | H                        |             |   |  |
| Real-time water level                                | 2.1  | L   | H             | L  | H           | H1                                 | H1          | M-H                               | R                            | M-H         | H      | L       | M           | H             | H                            | M-H         | L                        |             |   |  |
| Forecast water level                                 | 2.1  | L   | H             | L  | H           | H1                                 | H1          | H                                 | H                            | H           | H      | L       | M           | H             | H                            | M-H         | L                        |             |   |  |
| Predicted water level (new)                          |  |   |               |  |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
| Real-time current (speed & direction)                | 2.1  | L   | H             | L  | M           | H                                  | M-H         | L-H                               | M                            | H           | M      | L       | H           | H1            | M                            | M           | L                        |             |   |  |
| Forecast current (speed & direction)                 | 2.1  | L   | H             | L  | M           | H                                  | M-H         | L-H                               | M                            | H           | M      | L       | H           | H             | M                            | L           | L                        |             |   |  |
| Status of aids to navigation                         | 2.1  | H2  | H             | L  | M           | M                                  | M-H         | L-M                               | H2                           | M           | H2     | L       | H2          | H1            | M-H                          | L-M         | L                        |             |   |  |
| Buoy tending (winter vs summer buoys)                |  | L   | H             | L  | L           | L                                  | L-M         | L-M                               | H2                           | M           | H2     | N/A     | N/A         | N/A           | L                            | L           | L                        |             |   |  |
| Status of GPS & DGPS                                 | 2.1  | M   | H             | H  | H           | H                                  | M-H         | M-H                               | M-H                          | M-H         | M-H    | H       | H           | H             | H                            | M-H         | M-H                      |             |   |  |
| Electronic Charts (new)                              |  |   |               |  |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
| Charts updates                                       |  | H2  | H             | L  | L           | L                                  | L           | L-H                               | L-M                          | M           | M      | L       | L           | H             | H                            | H           | M-H                      |             |   |  |
| Sailing Directions updates                           |  | L   | L             | L  | L           | L                                  | L           | L                                 | L                            | L-M         | L-M    | L       | L           | L             | M                            | M           | M-H                      |             |   |  |
| Construction works (bridge, dredging, hydro)         | 2.1  | L   | L             | L  | M           | L                                  | M-H         | M                                 | M-H                          | M           | M-H    | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Temporary restricted areas (marine events, regattas) | 2.1  | L   | L             | L  | M           | L                                  | M-H         | M-H                               | M-H                          | M-H         | M-H    | L       | L           | H             | L                            | L           | L                        |             |   |  |
| Channel Bottom monitoring                            |  | L   | L             | L  | H           | H                                  | H           | H                                 | H                            | H           | L-M    | H       | L           | L-M           | H                            | L           | L                        |             |   |  |
| H/D bathy  |  |   |               |  |             |                                    |             |                                   |                              |             |        |         |             |               |                              |             |                          |             |   |  |
| Uncharted hazards, shoals, wrecks or dangers         |  | H2  | H2            | M  | H           | H1                                 | H1          | H                                 | H                            | H           | H      | L       | L-M         | H             | H                            | H           | H                        |             |   |  |
| Bridge & Cables air gap                              | 2.1  | L   | H1            | L  | H           | H                                  | H           | H                                 | M-H                          | L-M         | M-H    | N/A     | H           | H             | H                            | L           | L                        |             |   |  |
| Bridge open / closed                                 | 2.1  | n/a   | H             | N/A  | N/A         | N/A                                | N/A         | N/A                               | H1                           | M           | H1     | L       | L           | H             | L                            | L           | L                        |             |   |  |
| Fairway closed                                       | 2.1  | L   | H             | L  | L           | L                                  | L           | L-H                               | L-M                          | M           | L-M    | M       | L           | L             | L                            | L           | L                        |             |   |  |
| Harbour closed                                       | 2.1  | L   | L             | L  | L           | L                                  | L           | L-H                               | L                            | M           | L-M    | M       | L           | L             | L                            | L           | L                        |             |   |  |
| Security operations                                  |  | L   | M             | L  | L           | L                                  | L           | L-H                               | L                            | M           | L-M    | M       | TBD         | TBD           | TBD                          | L           | L                        |             |   |  |
| Anchorage assignment                                 | 2.1  | L   | H             | L  | L           | L                                  | L-M         | L-M                               | L-M                          | L-M         | L-M    | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Berthing assignment                                  | 2.1  | L   | H             | L  | L           | L                                  | L-M         | L                                 | L-M                          | L           | L-M    | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Lock order   | 2.1  | L   | N/A           | L  | L           | L                                  | L-M         | L-M                               | H1                           | N/A         | N/A    | N/A     | N/A         | N/A           | N/A                          | L           | L                        |             |   |  |
| Very large / special vessel movements                | 3.2  | H   | H             | L  | L           | L                                  | L-H         | L-H                               | M                            | M           | M      | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Vessel meeting / passing                             |  | L   | L             | L  | L           | L                                  | L           | L-H                               | M                            | L           | M      | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Route advisories                                     | 2.1  | L   | L             | L  | L           | L                                  | L           | L-M                               | L                            | M           | L-M    | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Navarea messages                                     |  | L   | L             | L  | L           | L                                  | L           | L                                 | L                            | L           | L      | L       | L           | L             | L                            | M-H         | H                        |             |   |  |
| Navtex messages                                      |  | L   | L             | L  | L           | L                                  | L           | L                                 | L                            | L           | L      | L       | L           | L             | L                            | M-H         | H                        |             |   |  |
| Notice to shipping                                   |  | M   | H             | L  | L           | L                                  | L           | L                                 | L-M                          | H           | H      | H       | L           | H             | H                            | M-H         | H                        |             |   |  |
| Auto Reporting (new)                                 |  |   |               |  |             |                                    |             |                                   |                              |             |        |         | TBD         | TBD           | TBD                          | L           | L                        |             |   |  |
| One Stop Window for Reporting                        |  | M   | H             | M  | M           | M                                  | M           | M                                 | M                            | M           | M      | M       | H           | H             | H                            | M           | M                        |             |   |  |
| Automatic Identification System(AIS)                 | 1.6  | M   | H             | L  | H           | H                                  | H           | H                                 | H                            | H           | H      | H       | TBD         | TBD           | TBD                          | L           | L                        |             |   |  |
| Security level                                       |  | L   | L             | L  | L           | L                                  | L           | L-M                               | L                            | H           | L-M    | L       | L           | L             | L                            | L           | L                        |             |   |  |
| Pilot stations                                       | 2.1  | H   | H             | L  | L           | L                                  | L           | L                                 | L                            | M           | M      | M       | N/A         | N/A           | N/A                          | L           | L                        |             |   |  |
| Procession order                                     | 2.1  | L   | L             | L  | L           | L                                  | L           | L-M                               | L                            | M           | M      | M       | N/A         | N/A           | N/A                          | L           | L                        |             |   |  |
| SAR Operations                                       | 2.1  | M   | M             | L  | L           | L                                  | L           | L-M                               | L                            | H           | H      | H       | M           | M             | M                            | M-H         | L-M                      |             |   |  |
| Emergency  | Environmental Response                         | Environmental Response Ops  |               | L  | M           | L                                  | L           | L                                 | L-M                          | L           | H      | H       | H           | M             | M                            | M           | M                        | L           |   |  |
| Maritime Communications                              | Ship/Shore / Shore-Ship                        | High volume of traffic communications                                   | 1.1           | M  | H           |                                    |             |                                   | H                            | M           | M      | M       | M           | L             | H                            | H           | H                        |             |   |  |
|  |  | Internet  |               | L  | H           | M                                  | M           | M                                 | M                            | M-H         | M      | M       | M           | L             | L                            | H           | L-M                      | M           |   |  |
|  |  | Wi-Fi   | 1.2           | L  | H           | M                                  | M           | M                                 | M                            | M           | H      | M       | M           | L             | L                            | H           | L                        | L           |   |  |
|  |  | Satellite Broadband   | 1.2           | H  | H           | H                                  | H           | H                                 | H                            | H           | L-H    | M       | L-H         | L-M           | L                            | L           | L                        | L-M         |   |  |
| Human/Interface Machine                              | Navigational Display                           | Mobile Phone  | 1.2           | M  | H           | M                                  | M           | M                                 | M                            | M           | L-M    | L-M     | L-M         | L             | M                            | H           | L                        | M           |   |  |
|  |  | VHF / HF  |               | H  | H           | H                                  | H           | H                                 | H                            | H           | M-H    | M-H     | M-H         | H             | H                            | H           | M-H                      | M-H         |   |  |
| Technical and Operational Enhancements               | Redundancy for GNSS                            | PPU/Supplemental display  | 2.5           | H  | H           | H                                  | H           | H                                 | H                            | H           | H1     | H1      | H1          | H             | H                            | H           | H                        | L           |   |  |
|  |  | ECDIS   | 2.5           | H  | H           | H                                  | H           | H                                 | H                            | H           | H      | H       | H           | H             | H                            | H           | H                        | L           |   |  |

Rate → Rank → Prioritize by Navigational area



# Annex B - Gap Analysis – Ice charts (example)



| Canadian e-Navigation Users Needs Study → Required Services Matrix → Gap Analysis |               |  |   |   |                          |  |                              |  |  |       |  |               |                 |  |  |             |
|---|---------------|--|---|---|--------------------------|--|------------------------------|--|--|-------|--|---------------|-----------------|--|--|-------------|
| Navigational Areas →  |               | Atlantic   |   | St.Lawrence Gulf  |                          | St.Lawrence River  |                              |  | Great Lakes  |       |  | Pacific       |                 |  | Arctic   |             |
| Sub-Areas →   |               | Coastal Area   | Major Ports                             | From Cabot Strait to Les Escoumins  | Major Ports              | From les Escoumins to Québec City  | From Québec City to Montréal | Major Ports                                | Seaway   | Lakes | Major Ports                                    | Coastal Areas | Interior Waters | Major Ports                            | ≤ 75° North  | > 75° North |
| Data to be available electronically   | Survey Item # |  | St.Jonn's, Halifax, Saint John Argentia |   | Belledune, NB, Sept Iles |  |                              | Saguenay, Quebec, Trois-Rivieres, Montreal |  |       | Hamilton, Oshawa, Toronto, ThunderBay, Windsor |               |                 | Prince Rupert, Port Alberni, Vancouver |  |             |
| Ice charts  |               | H2   | H                                       | H   | H                        | M  | M                            | L-M  | M  | H     | M  | N/A           | N/A             | N/A                                    | H  | H           |
|   | Who           | <p><b>CIS</b> - will generate the ice charts to make it available to particular clients and to the four CCG Ice offices.<br/> <b>CCG</b>- Ice offices St.John's &amp; Halifax</p>  |   | <p><b>CIS</b> - Ice forecasters &amp; Ice Analysts will work on the ice charts to make it available to particular clients and to the four CCG Ice offices.<br/> <b>CCG</b>- Ice offices St.John's, Halifax &amp; Québec</p>   |                          | <p><b>CIS</b>- Ice forecasters &amp; Ice Analysts will work on the ice charts to make it available to particular clients and to the four CCG Ice offices.<br/> <b>CCG</b>- Ice Office Quebec</p>   |                              |  | <p><b>CIS</b>- Ice forecasters &amp; Ice Analysts will work on the ice charts to make it available to particular clients and to the four CCG Ice offices.<br/> <b>CCG</b> - Ice Office Samia</p>   |       |  | N/A           | N/A             | N/A                                    | <p><b>CIS</b>- Ice forecasters &amp; Ice Analysts will work on the ice charts to make it available to particular clients and to the four CCG Ice offices.<br/> <b>CCG</b>- Ice Office Samia</p>  |             |
|   | How           | <p><b>CIS</b> - Data in the form of (electronic files (pdf) or charts (gif)) clients will recd products via e-mail, fax or internet.<br/> <b>CCG</b>- (St.Johns) Distribution of charts to clients via MCTS with using Ecareg system, email, fax and voice.<br/> (Mar) Distribution of charts to clients via MCTS using Ecareg system, email, fax and voice.</p> |   | <p><b>CIS</b> - Data in the form of (electronic files(pdf) or charts (gif)) clients will recd products via e-mail, fax or internet.<br/> <b>CCG</b>- (St.Johns) Distribution of charts to clients via MCTS with using Ecareg system, email, fax and voice. (Mar) Distribution of the ice charts via MCTS using Ecareg system(pdf) &amp; email, Fax<br/> (Qc) Distribution of the ice charts to clients via Internet site Marinfo, MCTS communications, email &amp; fax.</p> |                          | <p><b>CIS</b>- Data in the form of (electronic files(pdf) or charts (gif)) clients will recd products via e-mail, fax or internet.<br/> <b>CCG</b>- (Qc)- Distribution of the ice charts to clients via Internet site Marinfo, MCTS communications, email &amp; fax.</p> |                              |  | <p><b>CIS</b>- Data in the form of (electronic files(pdf) or charts(gif) clients will recd products via e-mail, fax or internet.<br/> <b>CCG</b>- (C&amp;A) Distribution of the ice charts to clients via FTP site, MCTS comms, telephone conference directly with clients &amp; USCG,e email &amp; fax.</p> |       |  | N/A           | N/A             | N/A                                    | <p><b>CIS</b>- Data in the form of (electronic files(pdf) or charts(gif) clients will recd products via e-mail, fax or internet.<br/> <b>CCG</b>- (C&amp;A) distribution of the ice charts to clients via Nordreg Canada, email &amp; fax.</p> |             |