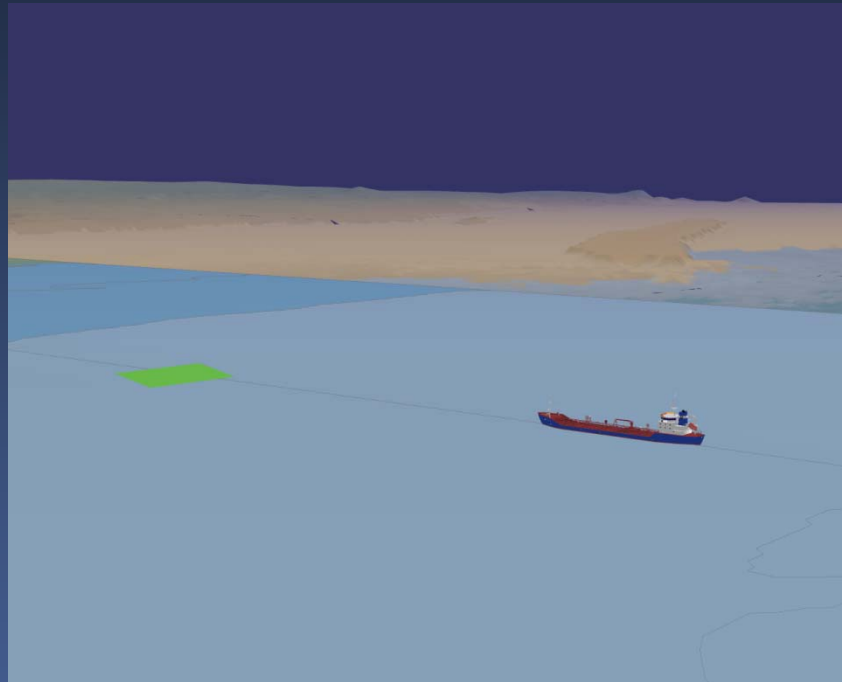


# New generation of electronic chart system with the



## 4-D Chart

# Technologies available today

## ➤ On board the ship

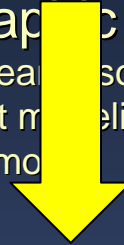
- DGPS
- ECD
- AIS System

## ➤ Hydrographic service

- Multi-beam sounders
- Current measurement
- Squat measurement

## ➤ On the market

- Computer high performance
- Data transport system
- Integration ECD process



## Calculation process

### ➤ Calculation module

- Position control (x, y) and prevision
- Time and dynamic progression control (t)
- Net under keel control (z)
- Real time and prevision (x,y,z)
- Integration data process

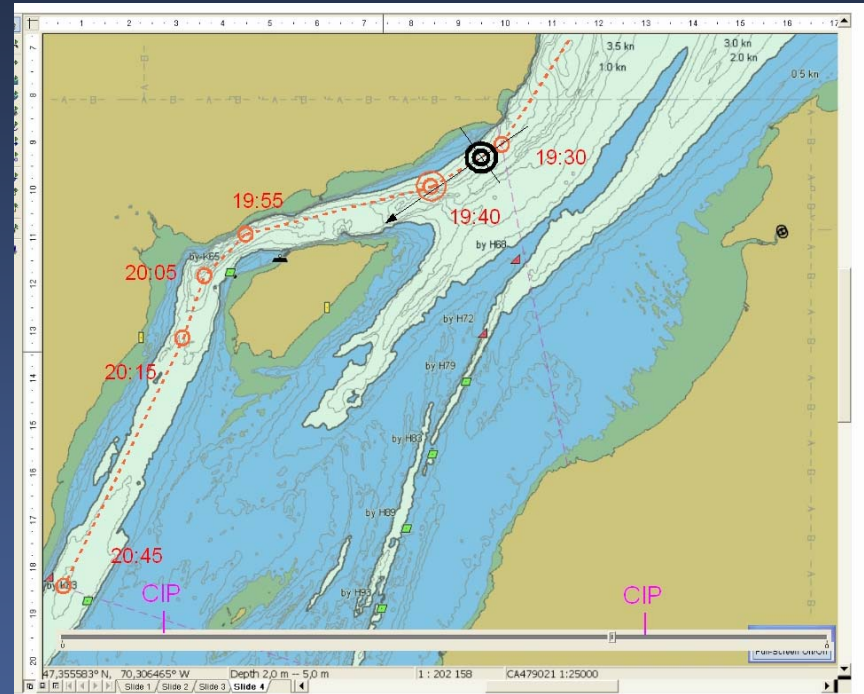


## Developpement of application

- I-ETA (Improved Estimate Time to Arrival)
- Net-underkeel clearance real time and prevision
- 4-D Chart System

# I-ETA : « Control of the time (t) »

- Calculation of the passage time
  - Acquire current data from CHS
  - Acquire ship information from AIS system
  - Calculation of the speed on the water
  - Application of a wind correction
  - Application of operationnel constraints
  - Application of the previous transit
  - Calcul of the ETA on the transit
- Presentation of the results
  - Display on the transit
  - Display by numeric picture
  - Use of sliders with time scale on the ECD



# I-ETA: Emerald Star upbound light ship



- Acquire speed on the water
  - AIS Laboratory of Maritime Innovation
  - Localisation in front of Rimouski
  - Result 16.35 knots

- Start the calculation at:
  - Grande Bergeronne passage
  - 18h 16m UTC september 22

- Caculation with the model
  - Bergeronne to St-Nicolas
    - Model time 7h 41 m
    - Real time 7h 35 m
    - Diff. 6

Localisation	Modèle	Réel	Dif. Minute	Différence
Départ	16:18	16:18	00:00	0,00%
Bergeronne	16:34	16:35	00:01	0,10%
CIP - Haut Fond Prince	17:08	17:09	00:01	0,10%
CIP - Île Blanche	17:32	17:37	00:05	0,47%
Cap à l'Aigle	18:47	18:56	00:09	0,79%
CIP-Cap aux Oies	19:50	19:57	00:07	0,58%
Île aux Coudres	20:20	20:26	00:06	0,49%
CIP - Cap Maillard (montant)	20:52	20:59	00:07	0,56%
Sault aux Cochons	21:03	21:09	00:06	0,47%
Anse aux Bardeaux	21:16	21:20	00:04	0,31%
CIP Cap Brulé	21:28	21:32	00:04	0,31%
Traverse Nord	21:37	21:40	00:03	0,23%
Pointe St-Jean	22:15	22:17	00:02	0,15%
CIP - St-Laurent	22:36	22:35	00:01	-0,07%
Beaumont	22:43	22:43	00:00	0,00%
CIP Ste-Pétronille (montant)	22:53	22:53	00:00	0,00%
Lévis	22:56	22:56	00:00	0,00%
Beauport	23:02	23:01	00:01	-0,07%
CIP Québec	23:09	23:05	00:04	-0,29%
Pte Deschambault	23:39	23:36	00:03	-0,21%
St-Nicolas	23:52	23:46	00:06	-0,42%
Fin	23:59	23:53	00:06	-0,42%
<b>Total</b>	<b>07:41</b>	<b>07:35</b>	<b>00:06</b>	<b>-1,32%</b>





# I-ETA: Emerald Star downbound load

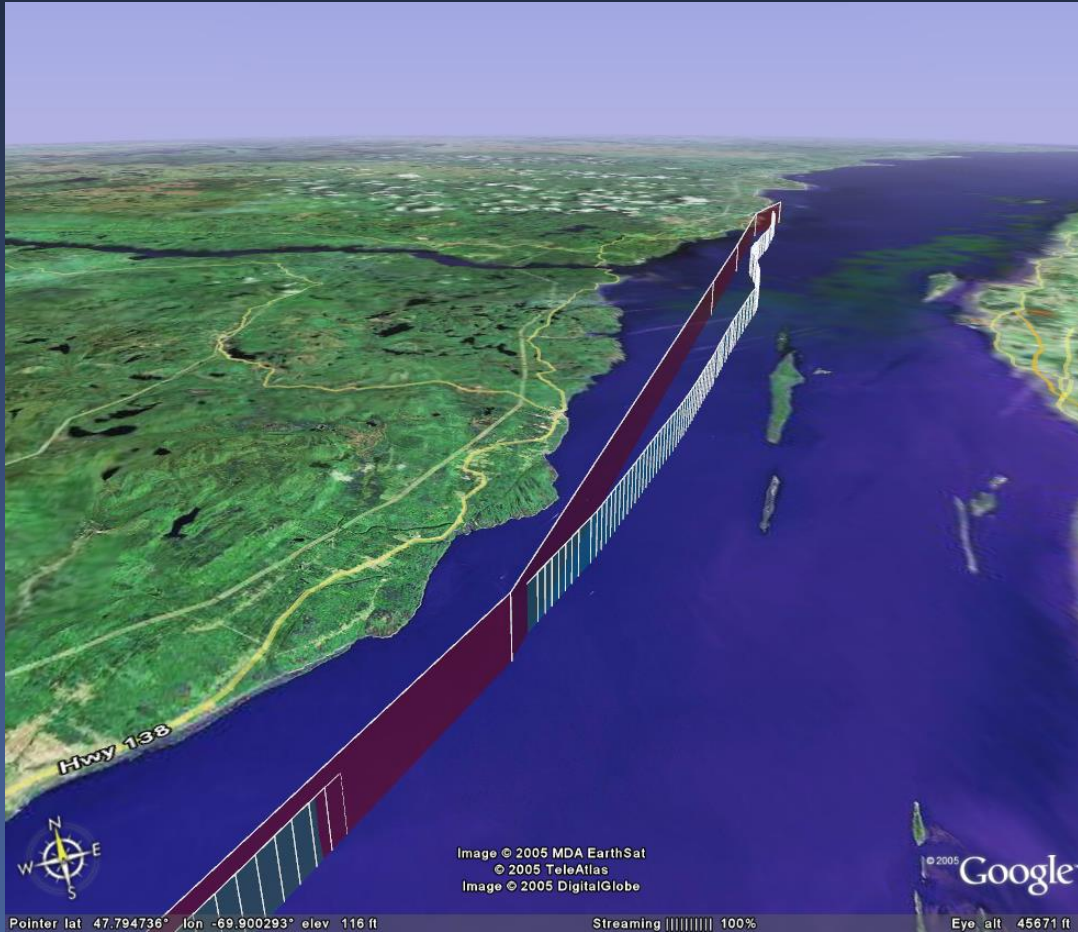


- Acquire speed on the water
  - AIS INNAV
  - Area of Cap à l'aigle
  - Result: 12.8 Knots
  
- Starting point
  - Lévis passage
  - September 15th at 00h 25m UTC
  
- Calculation with the model
  - Lévis to Bergeronne
    - Model time 09:33
    - Real time 09:32
    - Diff. 1 min

Localisation	Modèle	Réel	Dif. Minute	Différence
Départ	00:25	00:25	00:00	0,00%
Lévis	00:27	00:28	00:01	3,57%
CIP Ste-Pétronille (montant)	00:31	00:32	00:01	3,12%
Beaumont	00:43	00:44	00:01	2,27%
CIP - St-Laurent	00:51	00:54	00:03	5,56%
Pointe St-Jean	01:14	01:16	00:02	2,63%
Traverse Nord	02:03	02:05	00:02	1,60%
CIP Cap Brulé	02:15	02:18	00:03	2,17%
Anse aux Bardeaux	02:32	02:34	00:02	1,30%
Sault aux Cochons	02:49	02:51	00:02	1,17%
CIP - Cap Maillard (montant)	03:04	03:07	00:03	1,60%
Île aux Coudres	04:09	04:16	00:07	2,73%
CIP-Cap aux Oies	05:05	05:08	00:03	0,97%
Cap à l'Aigle	06:32	06:31	00:01	-0,26%
CIP - Île Blanche	07:54	07:59	00:05	1,04%
CIP - Haut Fond Prince	08:26	08:30	00:04	0,78%
Bergeronne	09:00	09:10	00:10	1,82%
Fin	09:33	09:32	00:01	-0,17%
<b>Total</b>	<b>09:08</b>	<b>09:07</b>	<b>00:01</b>	<b>-0,18%</b>

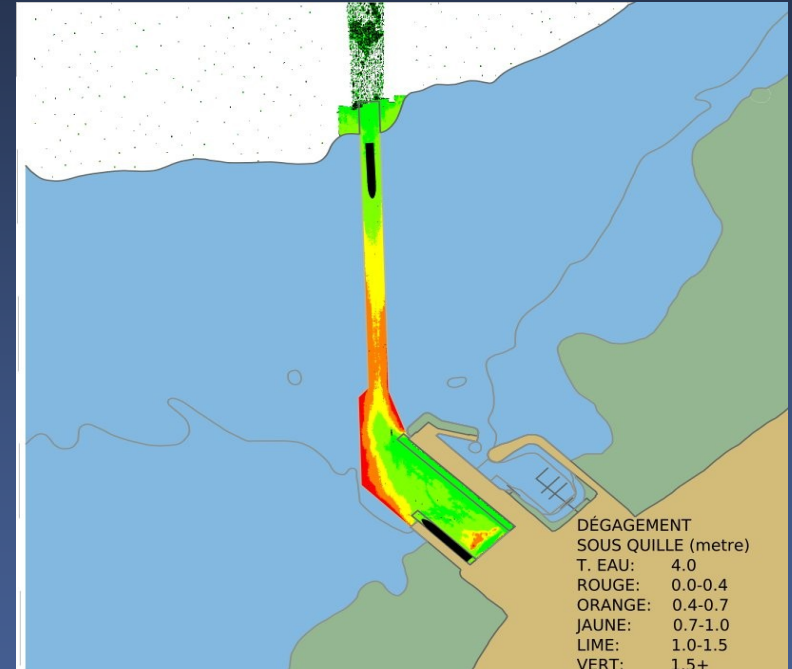


# I-ETA : variation du transit



# Static underkeel clearance : «Controle of z»

- Calculation of the underkeel clearance
  - Ship draft
  - Real time water level
  - High density bathymetric data
  - Calculation in estimated and real time
- Presentation of the results
  - Colloration of the canal
  - Reproduction of the ship shape
  - Real time and estimated time
  - Possibility to use a time scale





# *Static underkeel clearance :*

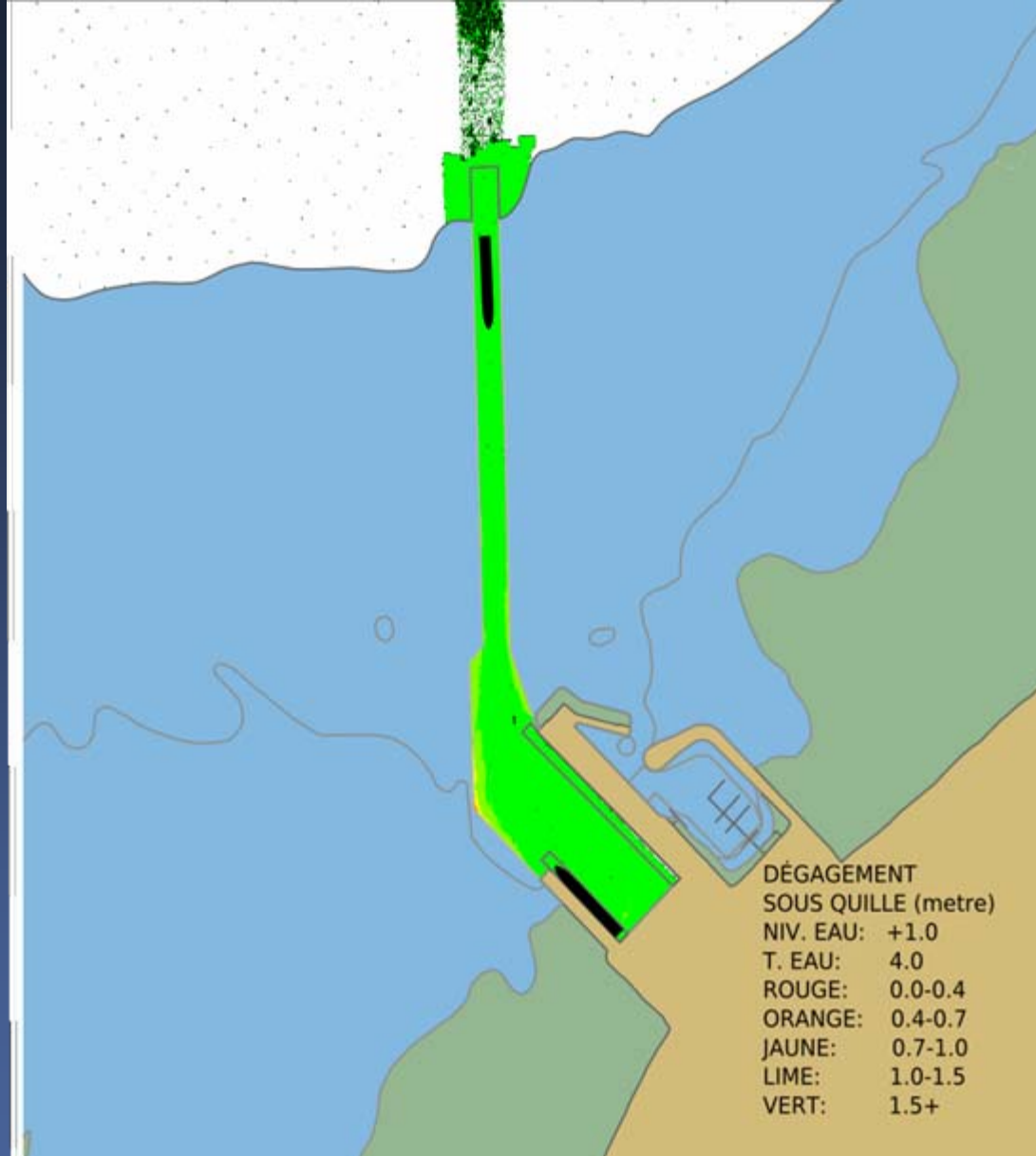
## *«real time and prevision»*

- Bench test on Rimouski harbour
  - Problematic of deepness
  - Tidal system
  - Traffic handicap by the draft
- Data acquisition
  - High density bathymetric data
  - Real time water level
  - Draft and ship shape
- Presentation of the results
  - Electronic chart display
  - ECD system to chose



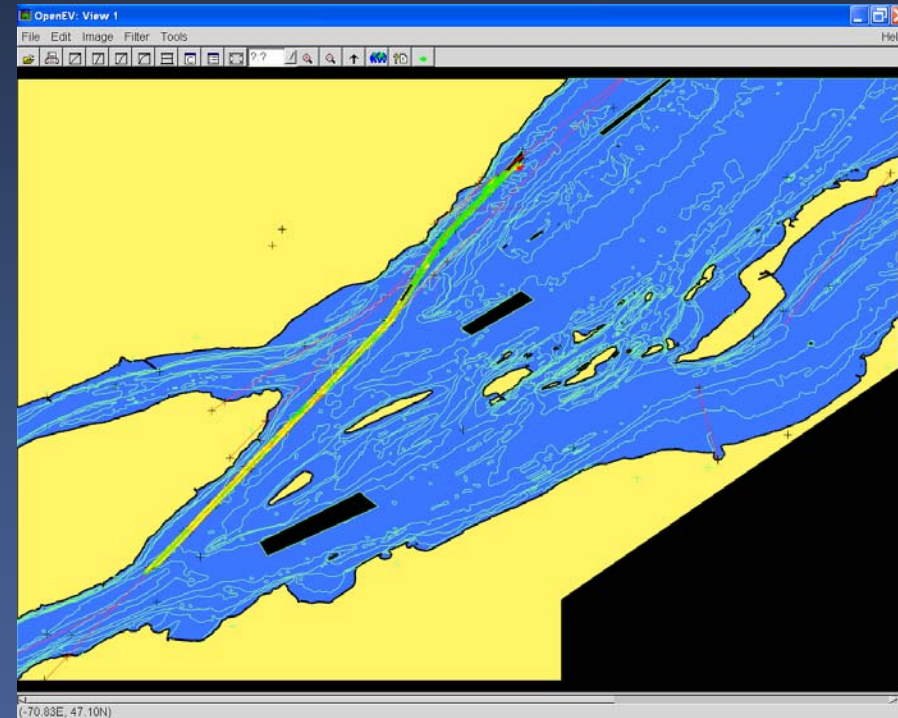


12:00  
13:30  
15:00  
16:30  
18:00  
19:30  
21:00  
22:30  
24:00



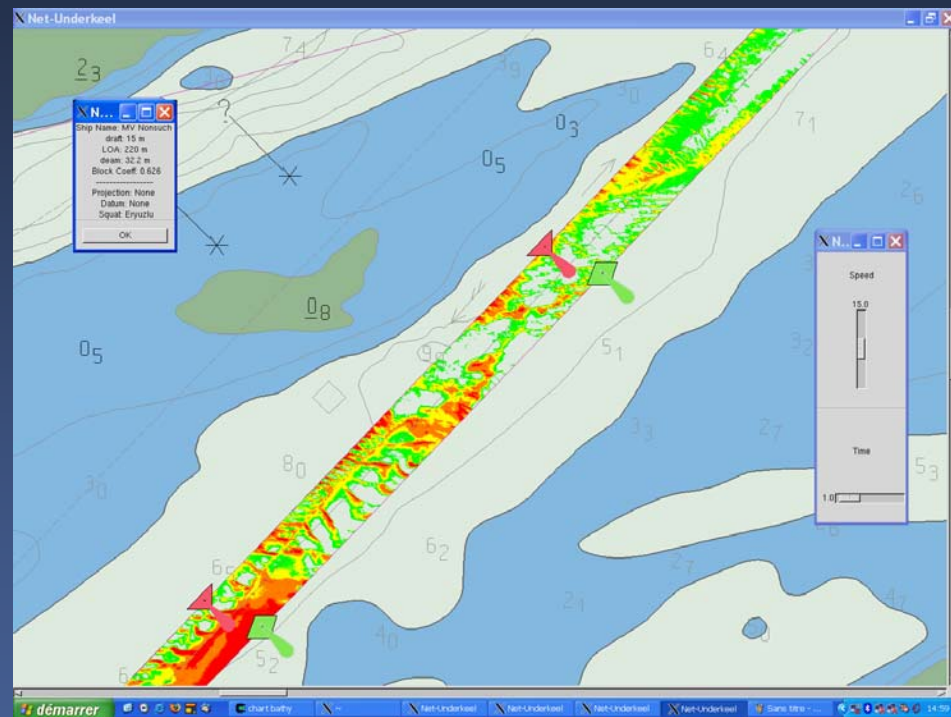
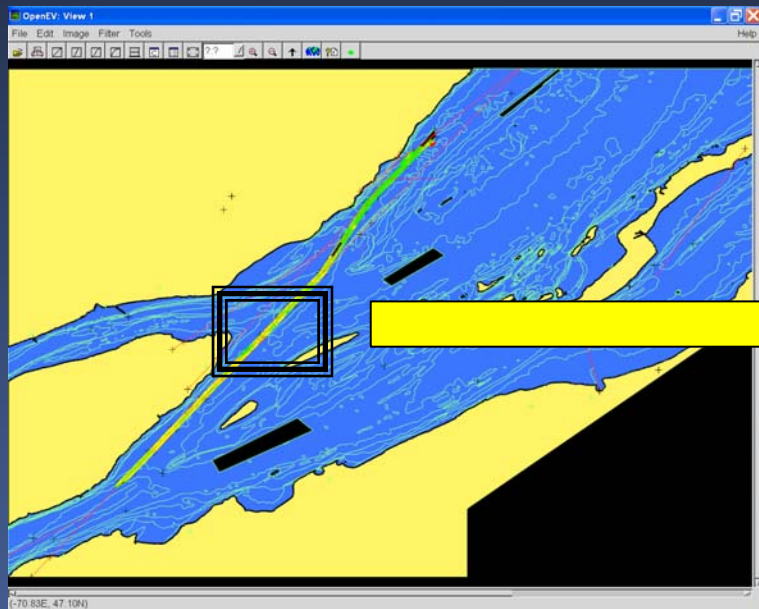
# *Underkeel clearance dynamic : «4 D-Chart »*

- Calculation of the under keel clearance
  - Ship draft
  - Squat effect
  - Real time water level
  - High density bathymetric data
  - Calculation in real time or estimated time
- Presentation of the results
  - Coloration of the canal
  - Reproduction of the ship shape
  - Real time and prevision
  - Possibility to use a time scale



# Net-underkeel:

«The dynamic under keel clearance»





# «4 D-Chart»

