

# Formation and Research in Hydrography

# Formation et recherche en hydrographie



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DÉPARTEMENT DES SCIENCES GÉOMATIQUES  
UNIVERSITÉ LAVAL



# PRESENTATION OVERVIEW

- Academic Programs in Geomatics
- Hydrography = Marine Geomatics
- Research in Navigation and Hydrography
- History of Hydrography Teaching
  - at Laval University
  - in New France (Nouvelle-France)



# GEOMATICS PROGRAMS

<b>Undergraduate</b>	<ul style="list-style-type: none"> <li>➤ <b>Bachelor's degree in geomatics sciences</b> Access to the Ordre des arpenteurs-géomètres du Québec</li> <li>➤ <b>Bachelor's degree in geomatics engineering</b> Access to the Ordre des ingénieurs du Québec</li> </ul>
<b>Master's</b>	<ul style="list-style-type: none"> <li>➤ <b>Master's degree in geomatics sciences</b> <ul style="list-style-type: none"> <li>• Master's degree with thesis (research)</li> <li>• Professional master's with concentration : <ul style="list-style-type: none"> <li>– <i>Geoinformatics</i></li> <li>– <i>Territorial and land management</i></li> <li>– <i>Applied geomatics</i></li> </ul> </li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>➤ <b>MBA in geomatics sciences</b> offered jointly with the faculty of administrative sciences and the École nationale d'administration publique</li> </ul>
	<ul style="list-style-type: none"> <li>➤ <b>Master's in environmental biogeosciences</b> in collaboration with the departments of geography, geology, geological engineering, and biology</li> </ul>
	<ul style="list-style-type: none"> <li>➤ <b>Short programs</b> <ul style="list-style-type: none"> <li>• Microprogram in fundamental geomatics</li> <li>• Microprogram in advanced geomatics</li> </ul> </li> </ul>
<b>Doctorate</b>	<ul style="list-style-type: none"> <li>➤ <b>Doctorate in geomatics sciences (Ph.D.)</b></li> </ul>



# HYDROGRAPHY = MARINE GEOMATICS

Design

Surveying

Planning

Geodesy

Acquisition

GPS

Processing

Photogrammetry

Modelling

Remote Sensing

Visualization

Digital Mapping

Analysis

GIS

Updating

Spatial DB

Fusion

Cadastre

Quality control

Economics

Dissemination

Environment

Management

Health & Safety

Hydrography



Marine Geomatics

- 4 year bachelor programs
- 120 credits (about 40 courses)
- 1 course = 3 h (lecture) and 2 h (laboratory) per week
- Major engineering projects (4<sup>th</sup> year)
- 3 Field surveys (1 week each)
- Summer industry internships (practical trainings)
- International student exchanges (1-3 semesters)



## Examples of internships and jobs (in hydrography):

CHS, CCG, CIDCO, Port of Montreal, Hydro-Quebec,

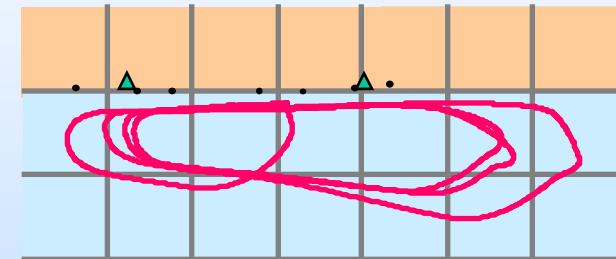
Entreprises N. Juneau inc., Verreault Navigation, ...



[www.scg.ulaval.ca](http://www.scg.ulaval.ca)

# HYDROGRAPHY COURSE DESCRIPTION

- Content : *History of hydrography. Hydrographic survey standards. Planning of hydrographic projects. Nautical charts. Conventional navigation methods. GPS kinematic positioning. INS and acoustic positioning. Vertical reference frames. Ocean tides and currents. Bathymetric surveys and soundings.*

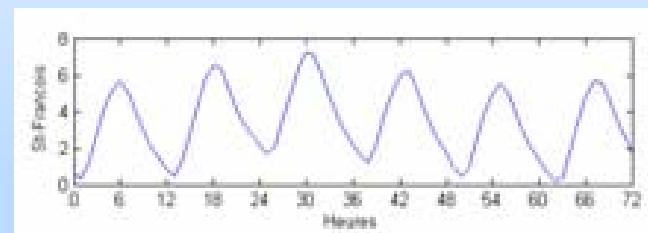


- Practical works (laboratory):

ECDIS features; GPS kinematic data processing;

Tidal analysis and interpolation;

Bathymetric data processing and analysis.

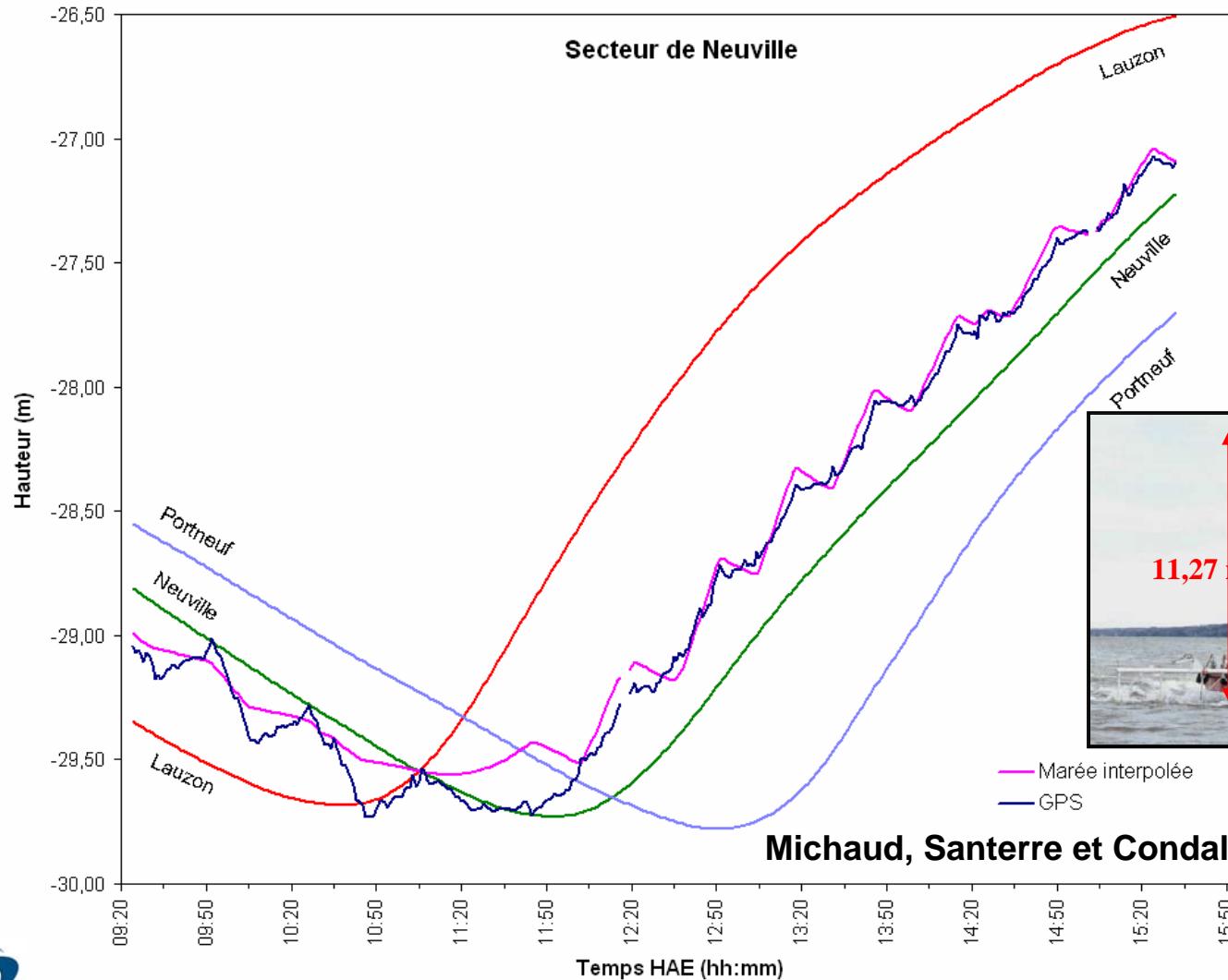


- CHS (Mont-Joli) and CIDCO (Rimouski) visits
- CCG Speaker from the Quebec Region Office

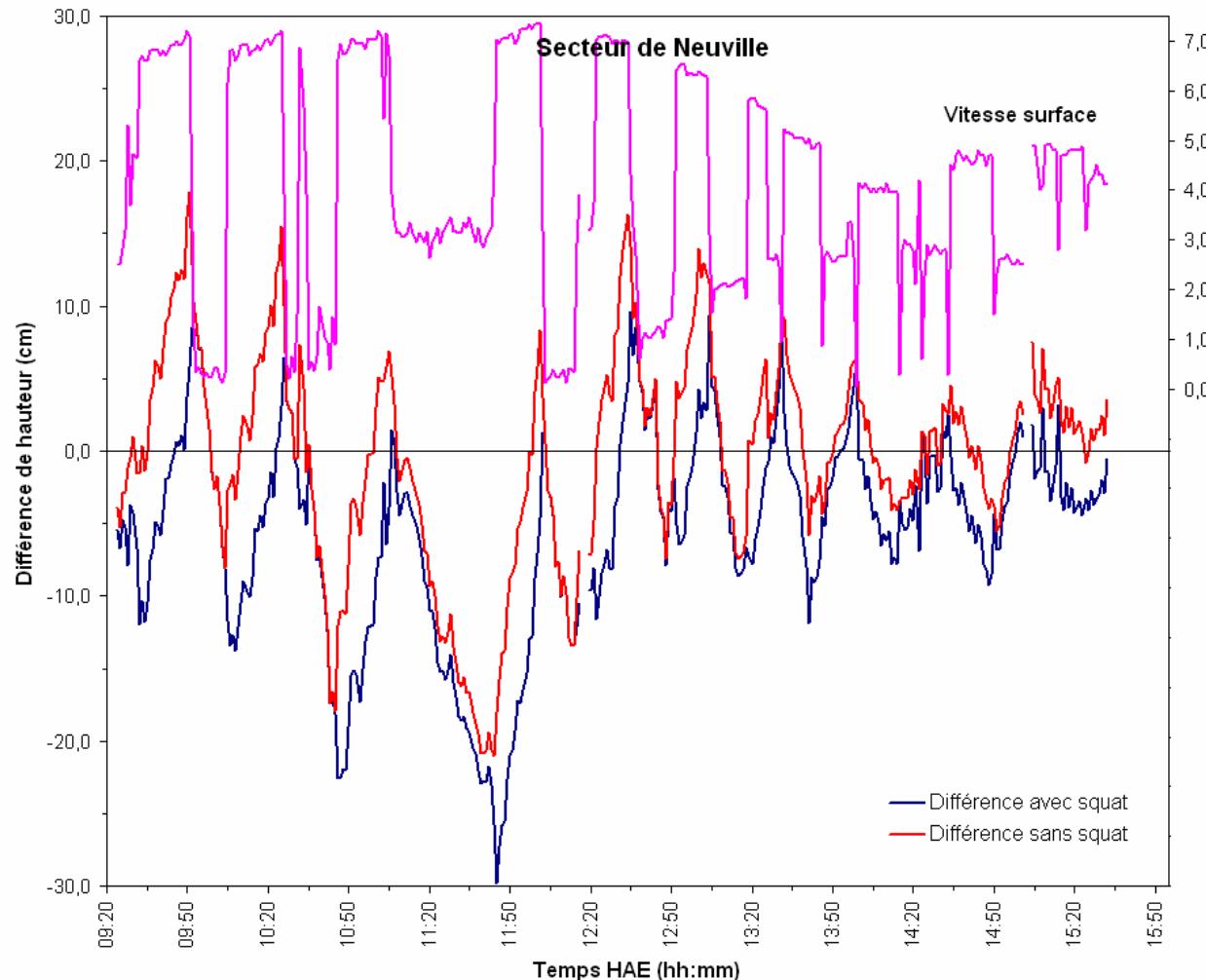


# RESEARCH PROJECT: WATER LEVEL WITH GPS

## Comparison of GPS (ellipsoidal) heights and interpolated water levels from SINECO (COWLIS) tide gauges



## Difference of GPS (ellipsoidal) heights and interpolated water levels from SINECO (COWLIS) tide gauges



Not corrected for squat

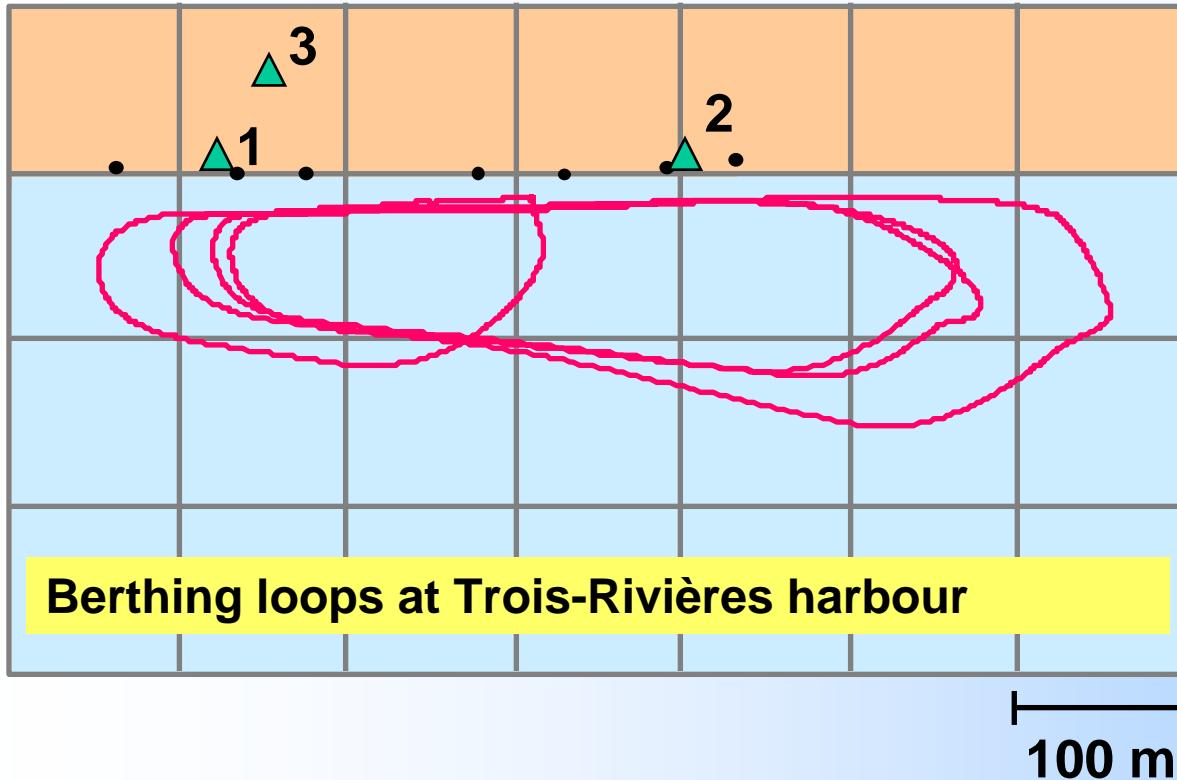
(cm)	Total	Ebb	Flood
Mean	-5.6	-9.1	-3.1
RMS	±7.1	±8.5	±4.5
RSS	±9.1	±12.5	±5.5

Corrected for squat

(cm)	Total	Ebb	Flood
Mean	-0.5	-2.6	1.1
RMS	±7.3	±9.2	±5.2
RSS	±7.4	±9.5	±5.3

# RESEARCH PROJECT: GPS SHIP BERTHING

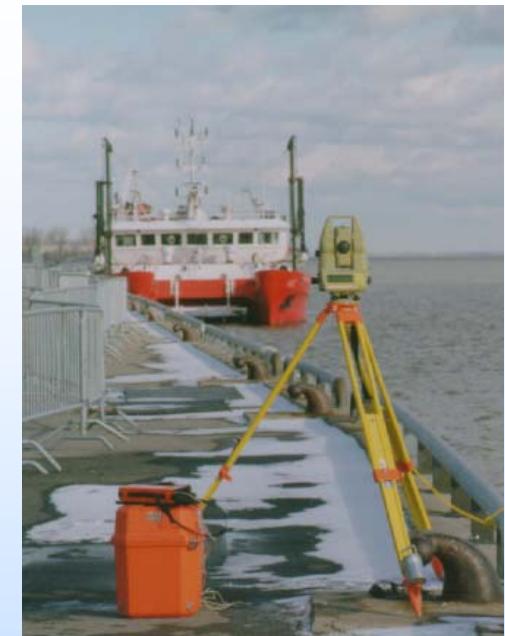
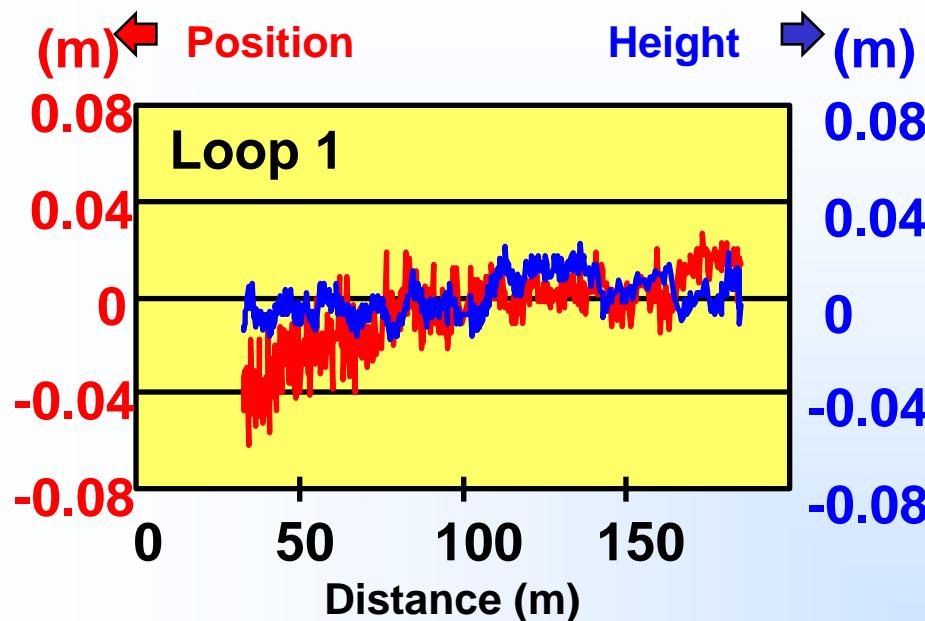
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**Ueno et Santerre**

# RESEARCH PROJECT: GPS SHIP BERTHING

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Difference (GPS – Total Station)

(cm)	Position		Height	
	Mean	RMS	Mean	RMS
Loop 1	-0.6	±1.7	-0.6	±0.9
Loop 2	-1.1	±4.8	-0.6	±1.0
Loop 3	2.4	±5.7	0.2	±1.4

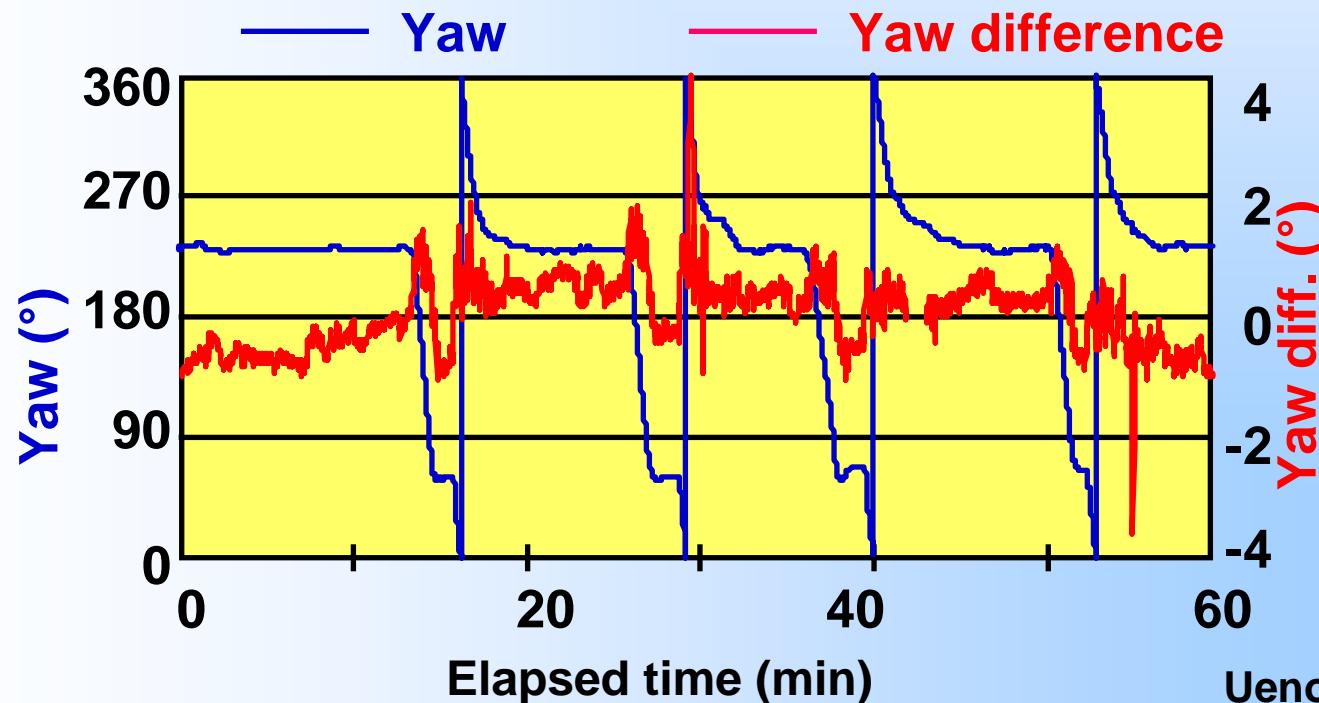
# RESEARCH PROJECT: GPS SHIP BERTHING

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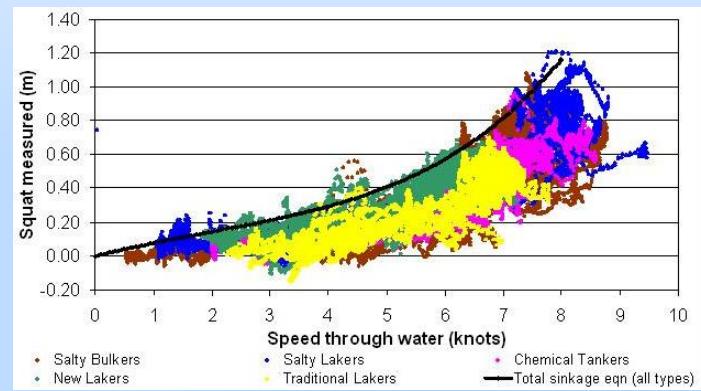
## Differences (GPS-TSS or Gyro)

	Mean	RMS
Roll	-0.05°	±0.44°
Pitch	-0.18°	±0.34°
Yaw	0.01°	±0.60°



# OTHER RESEARCH PROJECTS

- Processing and filtering of bathymetric data
- Kriging and Voronoi interpolation of bathymetric data
- Kalman filtering of tidal data
- Analysis of SINECO tidal data
- Determination of river high water line
- Precise GPS navigation (GEOIDE NCE project)
- Ship squat determination using RTK-GPS
- Multi-antenna GPS attitude determination
- GPS-PPP (Precise Point Positioning)



N.B.: M.Sc. and Ph.D. theses can be written in French or English

# OTHER RESEARCH PROJECTS

- Presentations at the CHC 2010



- Naouraz Brahim, Sylvie Daniel, Didier Guériot. *Reconstruction tridimensionnelle de scènes sous-marines à partir d'images acoustiques.*

(3D reconstruction of underwater scenes using acoustic imagery).

Wednesday, June 23th PM, session 8B

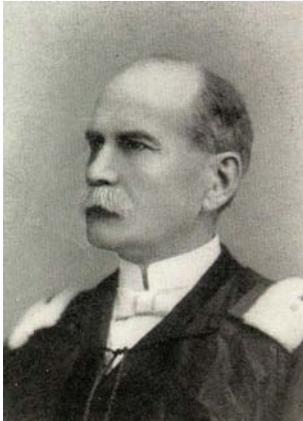
- Mathieu Rondeau, Stéphane Roche. *Le WikiSIG: Un outil de cartographie participative appliquée à l'espace maritime.*

(WikiSIG: A participative mapping tool applied to the maritime context)

Wednesday, June 23th PM, session 9

# DEPARTMENT HISTORY

- Established in 1907 (*École d'arpentage* – Surveying School)
  - Total of 2155 bachelors, 315 Master and 60 Ph.D. degrees
  - Formal hydrography course established in the 1950's
  - Hydrography topics included in the Surveying (*Topométrie*) course since 1907
  - Currently, 12 Hydrographers working at CHS-IML have graduated from our Department



- Currently, 190 undergraduate students, 40 M.Sc. and 20 Ph.D. students
- Full time personnel: 18 professors, 3 research assistants and 2 technicians
- Research activities at the CRG (Centre for Research in Geomatics)
- GEOIDE NCE Head Office and Scientific Director at Laval University
- One of our professors is a member of the CIDCO scientific committee
- A hydrographer from CHS (Mont-Joli) is the external member of the Geomatics Engineering program committee



# HYDROGRAPHY TEACHING IN NEW FRANCE

- Collège de Québec (1635 - 1775); building destroyed in 1878
  - Formation of pilots, hydrographers, land surveyors



- Hydrography professors (1671-1759) :

**Boutet, Franquelin, Joliet, Deshayes, Silvy, Lebrun, de Lauzon,  
Guignas, Deslandes, Ailloux, Messaïger, de Bonnécamps**

- Louis Jolliet, *Hydrographe du Roi* (from 1697 to 1700)
  - Born in Québec, co-discoverer of the Mississippi River

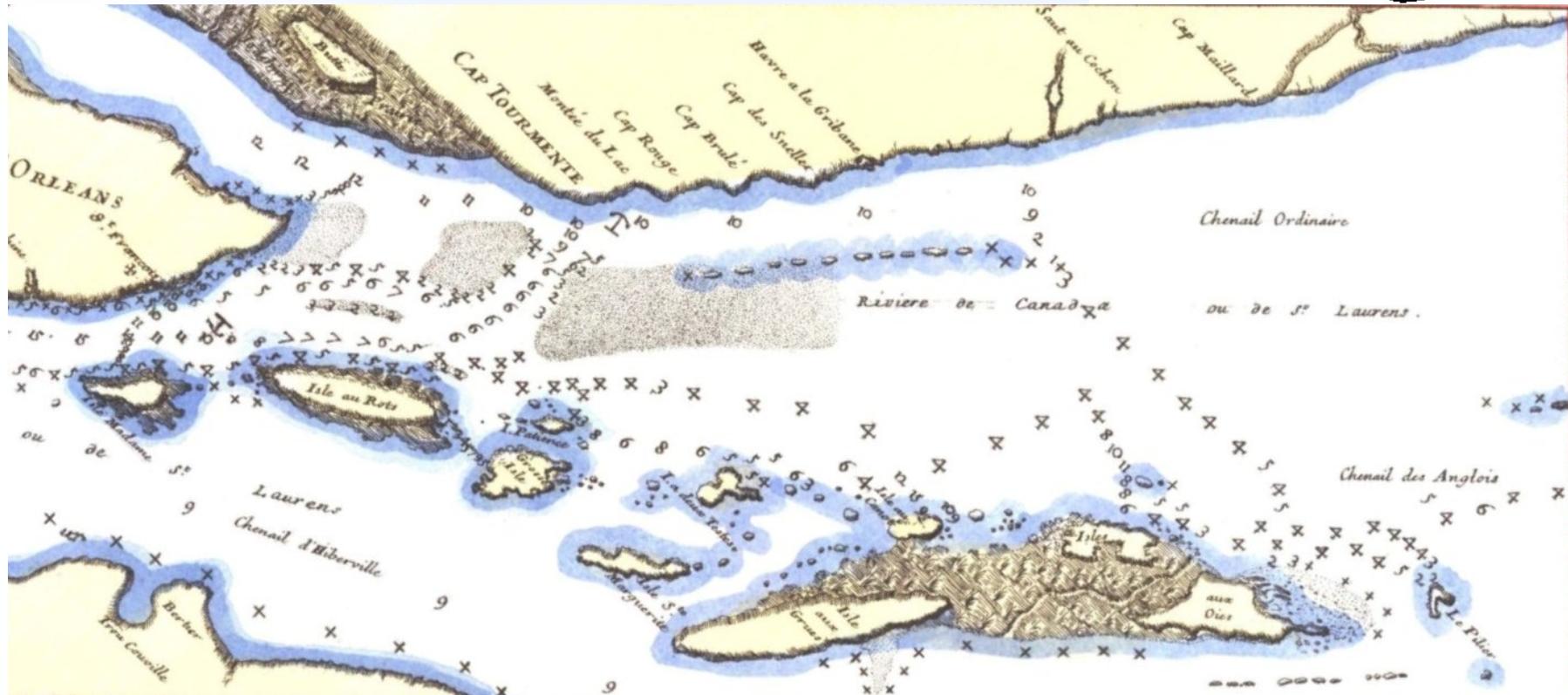


Louis Jolliet

A handwritten signature of the name "Louis Jolliet" in cursive script, with a horizontal line underneath it.

Jean Deshayes, *Hydrographe du Roi* (from 1702 to 1706)

## La Grande Rivière du Canada (1715) *Deshayes*



Source: Bibliothèque et Archives nationales du Québec ([www.banq.qc.ca](http://www.banq.qc.ca))

## Located at Pavillon Casault, Laval University



[http://www.scg.ulaval.ca/gps-rs/en/History/exposition\\_en.htm](http://www.scg.ulaval.ca/gps-rs/en/History/exposition_en.htm)  
or <http://www.fig.net/hsm/collections.htm>

- Virtual visit on Google Earth of special interest sites related to Hydrography in Quebec City



- Academic programs flyers
- Research project posters
- Museum artefacts



# FURTHER INFORMATION



Visit our Web sites:

- Laval University: [www.ulaval.ca](http://www.ulaval.ca)
- Geomatics Department: [www.scg.ulaval.ca](http://www.scg.ulaval.ca)
- GPS group: [www.scg.ulaval.ca/gps-rs/](http://www.scg.ulaval.ca/gps-rs/)
- CRG: [www.crg.ulaval.ca](http://www.crg.ulaval.ca)
- GEOIDE NCE: [www.geoide.ulaval.ca](http://www.geoide.ulaval.ca)

