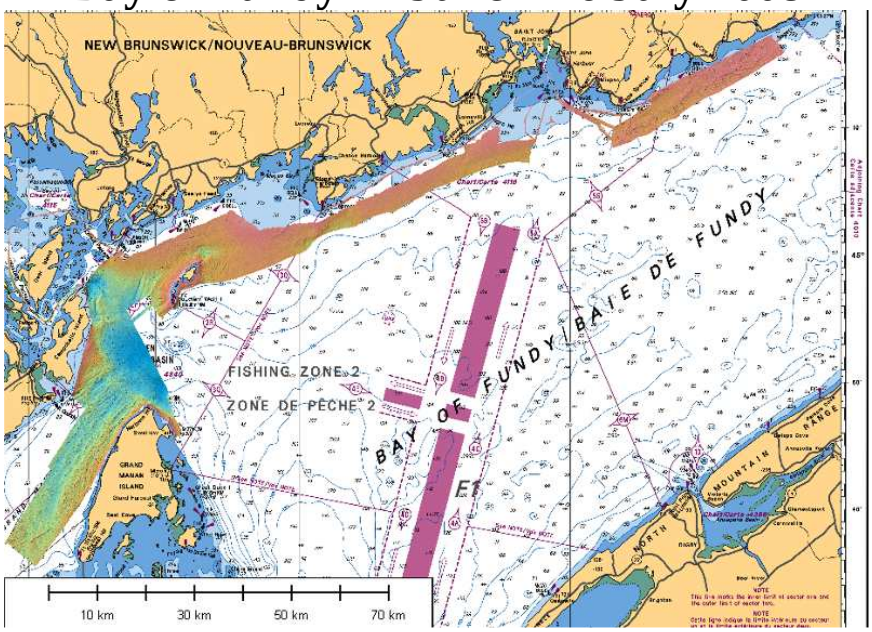
**GEOLOGICAL SURVEY OF CANADA**
**OPEN FILE 6227**

# Cruise Report Creed 2008030
# Bay of Fundy 22 June – 26 July 2008




**D.R Parrott, D. Beaver, S. Hayward and E. Patton**

**2010**

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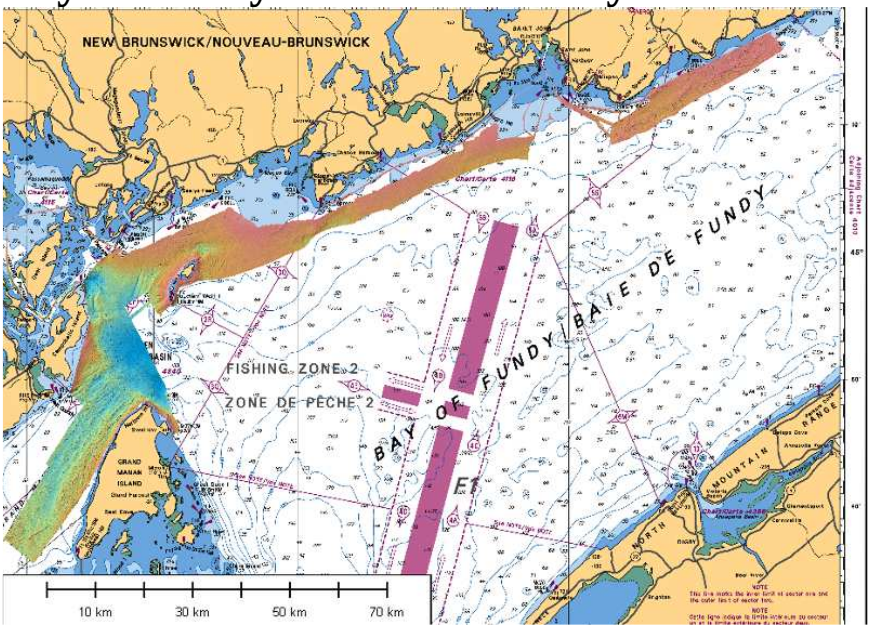


**D.R Parrott, D. Beaver, S. Hayward and E. Patton**

## 2010



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## Background

The Geological Survey of Canada (GSC), part of Natural Resources Canada (NRCan), is producing a series of maps showing the bathymetry, seafloor backscatter, and surficial geology throughout the Bay of Fundy. Survey *Creed 2008030* was conducted from 22 June to 26 July, 2008, and collected multibeam bathymetry, multibeam backscatter, sub-bottom profiler and geomagnetic data in the Bay of Fundy. This was the fourth in a series of cruises planned for the area.

Survey *Creed 2008030* was conducted using the CCGS *Frederick G. Creed* (Figure 1) operated out of the Institute Maurice Lamontagne (IML) in Mont-Joli (Québec). (An old newspaper article on the acceptance trials performed on the vessel is included as Appendix V.) The vessel was equipped with a Kongsberg EM1002 multibeam bathymetry system, Knudsen 3.5 kHz sounder and a Marine Magnetics SeaSpy marine magnetometer. Data were collected in the Bay of Fundy, as shown in Figure 2. The vessel operated out of Saint John and Grand Manan, NB.

Previous surveys in the Bay of Fundy (Fader et al., 1977; Amos et al., 1992; Parrott et al., 2000; Parrott et al., 2007a; Parrott et al., 2007b) have collected a variety of geophysical and multibeam bathymetry data, samples, and photographs. These data will be integrated with the multibeam bathymetry coverage from this survey to generate new surficial geology maps for the bay.

Figure 1. Multibeam bathymetry, sub-bottom profiler and magnetic data were collected using the CCGS *Frederick G. Creed* equipped with a Kongsberg EM1002 multibeam bathymetry system.

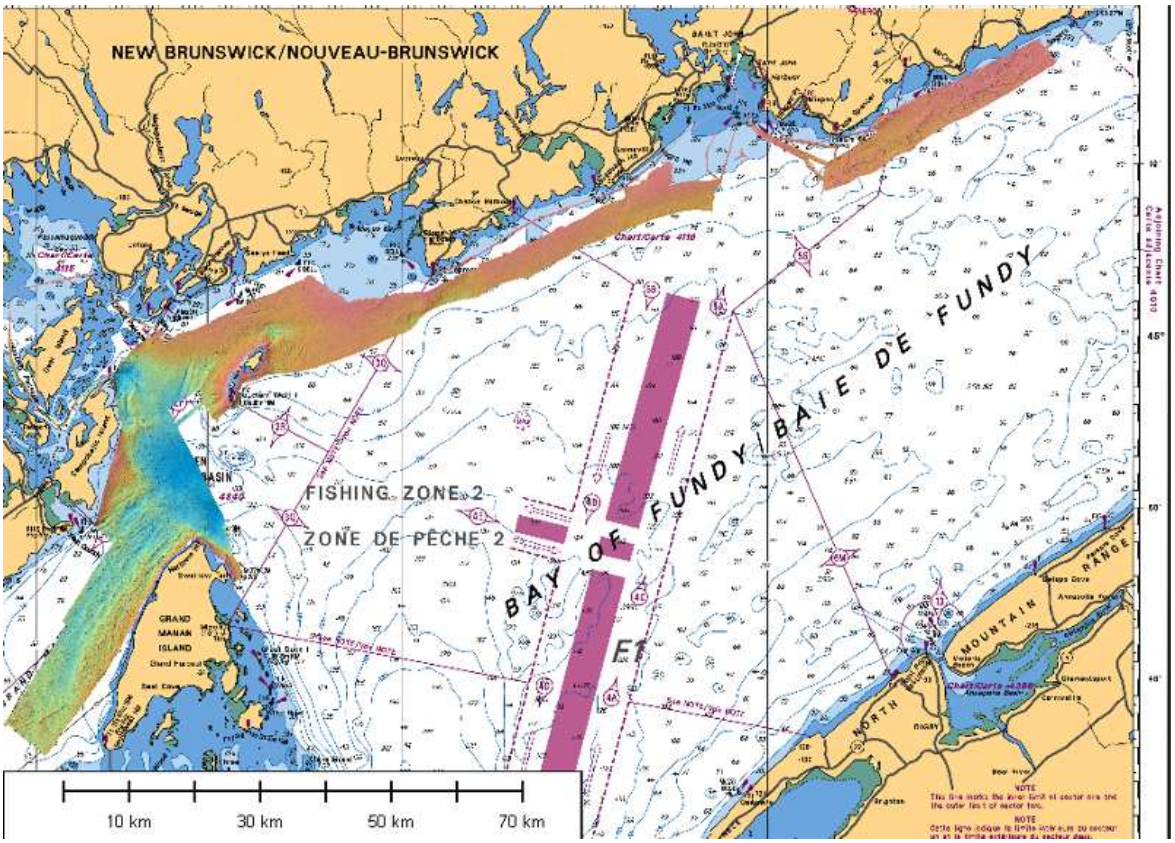

Figure 2. Multibeam bathymetry coverage in the Bay of Fundy collected during surveys Creed 2008030.

## Data Acquisition and Processing

The following equipment was used during survey Creed IML 2008030:

- Kongsberg EM1002 multibeam bathymetry system
- Knudsen 320M echo sounder
- Brooke Ocean Technology Moving Vessel Profiler MVP100
- Sea-Spy Magnetometer
- Caris HIPS multibeam bathymetry data cleaning software running on Windows XP

### Multibeam Bathymetry

Multibeam bathymetric data were collected using a Kongsberg EM1002 multibeam bathymetry system mounted in the CCGS *Frederick G. Creed* (Figure 1). The EM1002 system uses a 95 kHz transducer with 111 beams with a beamwidth of $2.0^{o}$ x $2.3^{o}$. The system provides a depth resolution of 1 cm with an accuracy of 5 cm RMS. A nadir beam ensonifies an area of approximately 2.25 $m^2$ at 50 metres water depth.

Survey lines were run to provide overlapping swaths with the previous line with 120% to 150% percent coverage of the seafloor in water depths greater than about 100 metres. The multibeam swath width was set as the lesser of either 250 m port and starboard or the swath width corresponding to $120^{o}$ angular sector (in other words swath width corresponding to 3.46 times the water depth). In water depths greater than 145 m, the swath width was held steady at 500 m. The multibeam bathymetry coverage is shown in Figure 2.

During the survey, data were processed using version 6.1 of the CARIS HIPS data cleaning program (by CARIS Limited, Fredericton, NB) on Windows XP workstations to remove spurious soundings and navigation data, and to apply the OmniStar tidal corrections and TrueHeave (logged separately on the POS-MV computer). CARIS HIPS was also used to grid survey lines immediately after they were completed to check data quality especially for motion and refraction artifacts. 5-metre and 30-metre grids were constructed using the "swath-angle" option for weighting soundings in the gridding process. The colour coding of depths was generally set for a 0-225 metre range, illuminated from an azimuth of 315 degrees and at an angle of 45 degrees. A vertical exaggeration of 10 was applied to the data.

**Navigation and Attitude**

The vessel used an Applied Analytics Corporation POS-MV 320 attitude sensing system with integrated differential GPS navigation system to determine the position and attitude. The system integrates data from an inertial measurement unit and differential GPS signals. The POS-MV uses a Kalman filter to improve the heading estimate to $0.05^{o}$ - $0.1^{o}$. Vessel attitude is measured using an inertial measurement unit to provide an accuracy of $0.0003^{o}$ for pitch, roll and heading. More information on this system can be found at www.applanix.com. For this survey, Real Time Kinematic corrections were received from the OmniStar system using a NovAtel receiver, which were used to provide a supplemental input to the POS-MV system. The POS-MV estimated the accuracy of positioning at about 0.2 m for Latitude, 0.2 m for Longtitude and 0.3 m for Altitude for most of the survey when using the OmniStar signals.

Problems were encountered with both the Regulus navigation system and the Brooke Ocean Technologies MVP when the POS-MV monitor was started before either of these systems. It appears that the POS-MV program latched on to the UDP port on the network which prevents the other programs from accessing it, if POS-MV is started first. The POS-MV monitor program should be started last on computers where other programs require access to the navigation strings.

**OmniSTAR**

With recent advancements in GPS positioning precision, a vessel's height above the earth's reference ellipsoid can be determined for any point during transit. The multibeam bathymetry data collected during this survey were corrected for tidal heights using OmniSTAR, a wide-area differential GPS service provided by the Fugro group of companies. More information is available at www.omnistar.com. The Real Time Kinematic corrections were received from the OmniStar system using a NovAtel receiver which provided a theoretical horizontal accuracy of 0.03 metres and a height accuracy of 0.07 metres.

**Knudsen 320M echo sounder**

Sub-bottom profiler data were collected with a Knudsen 320M sounder operating a single element 3.5 kHz transducer array installed in a ballast tank in the port pontoon. More information on the sounder is available on the company website at http://www.knudsenengineering.com/ASP/Products/Products.asp. Data were stored in KEB (Knudsen Extended Binary) and SEG-Y formats and viewed using the Knudsen PostSurvey program. Information of the format and the program are available at http://www.knudsenengineering.com/ASP/Support/Download.asp.

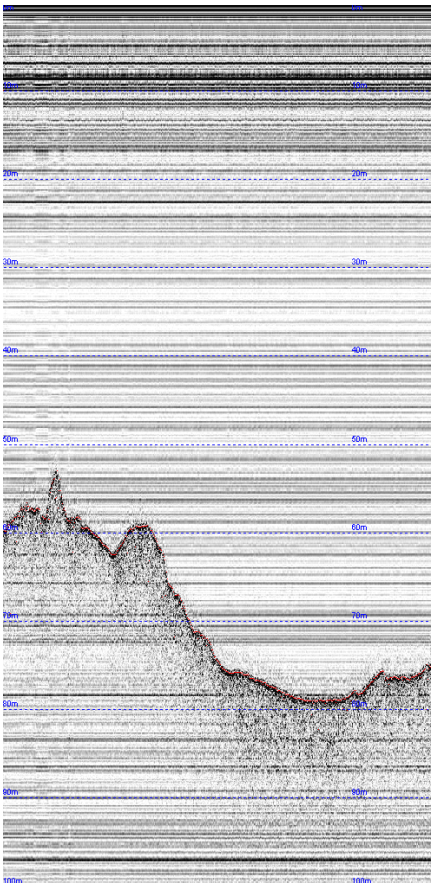

Figure 3. Example of 3.5 kHz data collected with the Knudsen 320B sounder with a power level of 2, 1.5 msec chirp, and a processing gain of 2. Note the coherent noise on the record.

The timestamp in the headers of the data recorded by the Knudsen echo sounder was synchronized to UTC using the NMEA ZDA string output from the POS-MV. The PC clock on the recording computer was manually synchronized to GPS time.

The sub-bottom profiler data were corrected for vessel heave using a digital signal from the POS-MV system. The Knudsen 320B echosounder was configured with a pulse length of 1.5 msec used for the chirp signal, with the power level set at 2, processing gain at 2 with Automatic Gain Control enabled, TVG at "20logR" (20 times Logarithm Range).

**SeaSpy Magnetometer**

This survey used the Marine Magnetics SeaSpy Magnetometer. The fish was towed at an average depth of 1 metre below the sea surface at a speed of 10-12 knots in varying sea states. The system uses Overhauser sensors and measures ambient magnetic field regardless of survey direction or orientation with the field. For more information on the magnetometer refer to the manufacturers website at http://www.marinemagnetics.com/. Operational procedures are outlined in Appendix IV.

Problems were encountered with the operation of the magnetometer system. Although the system was checked before shipping, an 'Unable to communicate with the magnetometer' error was encountered when the system was installed on the vessel. After several attempts at troubleshooting the system, the manufacturer was contacted, some simple test were run under the direction of the service manager, and

we were informed that the software had to be upgraded from the existing 7.87 version to a new version (8.03) to use the new system interface that had recently been provided by the company. A new version of the software was provided and loaded on an ftp site. The software upgrade failed due to a missing portion of the program. Finally the complete software package was hand carried to the vessel, and installed on the computer. After several attempts, the baud rates and ports were confirmed and the system appeared to be operating.

A full day of data was collected on Thursday 10 July 2008. When the system was again started on 13 July 2008 an 'Unable to communicate with the magnetometer' error was again encountered, with the label on the error message stating that it was version 7.87. After several unsuccessful attempts to restart the system, all versions of the program are removed from the computer and attempts made to re-install the program to ensure that the most recent version of the SeaLink program is being used. More problems were then encountered. The setup program displayed an error message that the setup file was not in a 'C:\ProgramFiles\SeaLINK' directory. A directory was created and all files provided on the cdrom were copied to that directory. Further attempts to start the magnetometer result in the same message. Subsequent attempts failed because access was denied to a folder in C:/Documents/Mag1/Localsettings/Sealink/Temp while trying to install an 'isrt.dll' file. The entire folder in …/Temp was removed, and the procedure repeated, with the same error message occurring. It is not clear if the problem is with the permissions on the computer not allowing access to the file (although it is possible to remove the entire folder). The program does not appear to be very robust, and the problems with re- installing the program are rather confusing and frustrating. The program was then loaded into a different computer and the same error about the 'isrt.dll' file was encountered. The program did load, and it was possible to monitor the navigation string using the program. The same 'Unable to communicate with the magnetometer' error was encountered.

The entire magnetometer system was removed from the vessel and returned to BIO, where the same problems occurred. Problems were encountered with trying to remove and install the SeaLink program on the laptop, with an error message about access to the 'isrt.dll' driver. The program was installed on a different computer and would communicate with the towfish and operate well with no navigation input. When navigation data were provided, the system did not recognize the NMEA string from a Garmin GPS when it was routed through a Belkin serial-to-USB adapter. P. Pledge then substituted an Edgeport 8-port serial-to-USB adapter and serial ports from the magnetometer and the navigation system were connected through it to the laptop. The system then appeared to function properly. The SeaLink program was finally re-installed on the original laptop computer, the Edgeport adapter connected to the computer, and the magnetometer functioned properly. Much of the earlier problem may have been caused by the Belkin adapter, although when the port was monitored using the Hyperterm program, the GPS strings were all detected, and the program still would not function properly. Some questions remain unanswered.

**Brooke Ocean Technology Moving Vessel Profiler MVP200**

Measurements of the velocity of sound in the water column were made with a Brooke Ocean Technology Moving Vessel Profiler MVP200 equipped with an Applied Microsystems Limited Smart Probe SVP velocimeter with a temperature sensor. The system was used to provide data for correction of calculated water depths from the Kongsberg EM1002 multibeam bathymetry data. More information on the MVP is available at http://www.brookeocean.com and for the velocimeter at http://www.appliedmicrosystems.com.

At the start of the survey the towfish was upgraded to accept a new SVP velocimeter with a temperature sensor. This sensor is on loan from the Ocean Mapping Group at the University of New

Brunswick. Throughout the survey, MVP transects were run, with profiles collected every 2-3 minutes, to look at the variability in velocity, salinity and pressure. OMG/UNB will analyze statistics from these data to develop algorithms that will help determine the proper spacing between MVP casts based on the variability of the water column.

On a previous survey, problems were encountered with the ship's echo sounder. A feed was taken from the Knudsen 320 B sounder operating at 3.5 kHz and input to the MVP controller to provide water depth information. The depth information from the Knudsen sounder can have a larger number of false detection of the seafloor, than the ship's sounder, requiring that care be taken during MVP casts. Too shallow depths can result in the cast being terminated earlier than necessary, too deep depths can result in the towfish impacting the seafloor. The system was operated in the 'MAX Depth' mode, where a maximum towfish depth was entered before each cast the 'Depth Off Bottom' feature was disabled.

On several occasions, problems were encountered with the MVP system, requiring several attempts for the system to work under computer control. The engineer adjusted the sensor switch to be closer to the cable, resulting in more reliable operation. Problems were also encountered with the brake on the MVP, probably due to an accumulation of rust on the mechanism, causing it to bind on retrieval. The engineer applied a few gentle taps with a ball peen hammer, which appeared to fix the problem. This was repeated for about 20 casts before the brake would function without a little persuasion.

It was necessary to start the MVP program before the POS-MV monitor program. As stated earlier, problems were encountered with both the Regulus navigation system and the Brooke Ocean Technologies MVP when the POS-MV monitor was started before either of these programs. It appears that the POS-MV program latches on to the UDP port on the network and prevents the other programs from accessing it, if POS-MV is started first.

**Tides and Currents**

Bathymetry surveys in the Bay of Fundy must accommodate the largest recorded tides in the world. Prior to the survey, tides and currents for the survey area were calculated using the program Tides and Currents Pro by Nautical Software Inc. As shown in Appendix III, a tidal range of about 8 metres was predicted for Saint John, NB, during the period of the 2008 survey. Times are shown in Atlantic Daylight Time and tide heights are shown in centimetres.

For the duration of the survey, tide gauges were installed at Black's Harbour, NB and at several locations further up the bay to supplement the permanent gauge in Saint John, NB. Data were also downloaded from the gauge in Eastport, Maine, USA.

Tide height was applied in real time from the altitude signal available from the NovAtel OmniStar RTK GPS signal, and supplied to the POS-MV system.

## Access to Data and Samples

The multibeam bathymetry data collected during this survey are archived by the Geological Survey of Canada, Atlantic, and the Canadian Hydrographic Service in Dartmouth Nova Scotia. For access to the sub-bottom profiler and magnetic data, contact the senior scientist for the survey, Russell Parrott (902-426-7059) or Susan Merchant of the GSCA Curation group (902-426-3410). Data can be accessed by logging on to the Geological Survey of Canada Atlantic site at http://gsca.nrcan.gc.ca and the Canadian Geoscience Knowledge Network http://cgkn.net/.

## Acknowledgements

The captains and crews of the CCGS *Frederick G. Creed* provided valuable assistance with data collection. This project was funded by Natural Resources Canada through the Geoscience for Ocean Management program of the Earth Sciences Sector. XXX reviewed the manuscript.

## References

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Applied Microsystems velocimeter at http://www.appliedmicrosystems.com.

Brooke Ocean Engineering Moving Vessel Profiler http://www.brookeocean.com and for the

Canadian Geoscience Knowledge Network internet site at http://cgkn.net/

CARIS HIPS hydrographic data cleaning software, CARIS, 264 Rookwood Avenue Fredericton, New Brunswick, CANADA, E3B 2M2. http://www.caris.com

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Geological Survey of Canada Atlantic internet site at http://gsca.nrcan.gc.ca

GRASS GIS (Geographic Resources Analysis Support System) Geographical Information System (GIS) http://grass.itc.it/index.php

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SeaSpy Magnetometer http://www.marinemagnetics.com/ . Accessed on 28 April 2008.

# Appendices

**Appendix I - Survey Particulars**

| | |
|---|---|
| Name of Vessel: | CCGS *Frederick G. Creed* |
| Dates | 12 July – 30 August 2007 |
| Vessel captains: | Mario Bernard and Stephan Tessier |
| Area of Operation | Bay of Fundy |
| Senior Scientist: | Russell Parrott |

**List of Participants**

Geological Survey of Canada Atlantic

| | |
|---|---|
| Russell Parrott | Senior Scientist |
| Darell Beaver | Senior Surveyor, COB |
| Eric Patton | GIS, navigation, multibeam bathymetry |
| Scott Hayward | GIS, navigation, multibeam bathymetry |

Ocean Mapping Group, University of New Brunwick

Jonathon Beaudoin
Doug Cartwright
Christine Legere

Canadian Hydrographic Service

| | |
|---|---|
| Lynn Collier | Hydrographer |
| Peter Dobek | Hydrographer-in-training |

CCGS *Frederick G. Creed* Crews - 2 week rotation

22 to 25 June

| | |
|---|---|
| M. Bernard | Master, CCGS Fredrick G. Creed |
| C. Russell | Chief Engineer |
| S. Dubuc | Chief Officer |
| E. Sioch | Cook/Deckhand |

25 June to 9 July 2008

| | |
|---|---|
| S. Tessier | Master, CCGS Fredrick G. Creed |
| G. Côte | Chief Engineer |
| F. Dolbec | Chief Officer |
| M. Jean | Cook/Deckhand |

9 to 23 July

| | |
|---|---|
| M. Bernard | Master, CCGS Fredrick G. Creed |
| C. Russell | Chief Engineer |
| G. Gaudin | Chief Officer |
| E. Sioch | Cook/Deckhand |

**Appendix II - Activities**

All times are shown in UTC Universal Time Code = Atlantic Daylight Savings Time + 3 hr.

**21 June 2008 Saturday - Day 173**

20:00 CCGS *Frederick G. Creed* arrives Halifax.

**22 June 2008 Sunday - Day 174**

11:00 CCGS *Frederick G. Creed* arrives BIO. D. Beaver, S. Hayward and R. Parrott join the vessel. During the previous survey in the Gulf of St. Lawrence, the survey system electronics had been configured to use a shore-based RTK GPS system to provide tidal corrections. CHS Atlantic purchased NovAtel OmniStar receivers that allow height calculations via satellite transmission of RTK signals. The receivers have to be installed and the POS-MV reconfigured to use the signals. This is scheduled for 23 June.

The magnetometer components are checked to ensure that they are all in the storage cases and the deck lead was found to be missing.

One computer is loaded to run the Caris HIPS data cleaning program and operate in the lab. Another is loaded to a 3.0 terabyte network-based RAID is installed to store the multibeam bathymetry and sub-bottom profiler data.

The wireless network used on the previous survey was left enabled, however GSCA used hardwired connections for all devices including the HIPS and Regulus computers and the network-based RAID.

19:00 GSCA personnel depart the vessel. Vessel returns to Halifax for evening.

**23 June 2008 Monday - Day 175**

11:00 Creed returns to BIO.

12:00 S. Parsons from CHS-A arrives to set up the OmniStar system.

12:30 J. Beaudoin, OMG-UNB, delivers the MVP fish to Odim Brooke Ocean Technology (BOT) for updates to allow a new sensor to be used in the system.

A new satellite receiver has to be installed on the mast where the RTK receiver used on the previous survey had been mounted. The engineer lowers the mast, replaces the receiver and raises the mast back into position. The OmniStar system is turned on, but the laptop computer that had been used with the system for the previous week will not communicate with the console. M. Wright and D. Beaver perform tests that show the serial communication port had failed on the computer. A replacement computer is used to communicate with the system. Problems are encountered with the system and attributed to the proximity of the nearby suspension bridge which may be blocking signals.

15:30 The MVP towfish is returned to the vessel by BOT. J Beaudoin returns to BOT to get the connector cable that was supposed to accompany the towfish. J. Beaudoin and R. Parrott re-assemble the MVP towfish and attached it to the cable.

17:30 The MVP towfish is lowered into the water to confirm that the sensors are functioning and transmitting.

18:00 Depart BIO for tests in Bedford Basin. The OmniStar system functions briefly as the vessel moves away from the bridge, but loses the signal again as we get away from the shoreline. After a phone call to Fugro Jacques in St. John's NL, the system is re-initialized from the shore station and signals are received.

As the vessel gets underway, a problem is noticed with the ship's navigation system. Every time the VHF radio is used, navigation is lost by the vessel GPS, and error flags appear on the GPS screen.

Test lines are run to confirm operation of the MVP.

20:30 Return to BIO.

**24 June 2008 Tuesday - Day 176**

11:00 Continue with mobilization. Jonathon Beaudoin, OMN/UNB trouble shooting the MVP.
Personnel from Brooke Ocean Technology call to discuss the cause of problems encountered with the MVP system, where the UDP port changes during the day. It was determined that the MVP should be started before the POV-MV monitor to avoid conflicts.
D. Beaver, S. Hayward, R. Parrott continue with mobilization. S. Parsons checking the heights provided by POS-MV.
B. Wile will have the laptop computer from the launch repaired or find a different laptop with serial ports to log the OmniStar data. B. Wile will contact M. Eisan at BOT to arrange payment for upgrades to MVP fish.
Personnel from BIO Technical Services on board to determine cause of the cross talk with the vessels GPS navigation system when the VHF radio is used.

13:30 J. Beaudoin departs for Fredericton.

16:00 Depart BIO from patch test. Steve Parsons and Peter Dobek on board for trials. Parsons has determined that the strings output by the POS-MV system are relative to Mean Sea Level. The POS-MV output was adjusted to provide $INGGK strings which contain the heights relative to the ellipsoid. SIPS was adjusted to accept these strings and the offset values in SIPS changed to provide the depth of the transducer below the POS-MV IMU, relative to the ellipsoid.

17:15 Prepare for MVP cast. MVP controller interface had been turned off – no communication with fish until system powered up.

17:30 Complete MVP cast and start patch test lines. Run lines near DREA Acoustic Test Barge.

19:20 Complete patch test and return to BIO. Tracks saved in GlobalMapper as Day176Tracklog

**25 June 2008 Wednesday - Day 177**

11:00 S. Parsons and D. Beaver checking POS-MV, SIS and HIPS systems to determine where the offsets have been entered, and more importantly – which are actually active. It appears that some of the offsets entered in POS-MV do not actually do anything.
M. Wright and another technician troubleshoot problems with the ship's radio causing interference with the ship's GPS system. The VHF radio antenna was replaced, and new GPS receivers installed for tests. The original receivers were re-installed after trials showed no change with the new systems. A connector had come undone on the inside of one radio system – this is reconnected and reduces the feedback problems. Tests with a different radio still shows minor feedback. The system is now much better – but may need additional work in the future.

18:00 Creed departs BIO to confirm that offsets entered into the various components of the multibeam system are correct. Tests confirm proper offsets and the vessel returns to BIO.

**26 June 2008 Thursday - Day 178**

08:00 Creed departs BIO to start transit to Bay of Fundy. D. Beaver and S. Hayward on board to continue with equipment tests and establish procedures for upcoming surveys. A series of lines are run during the transit to Yarmouth, data are transferred into the processing system, and coverage maps are installed on the navigation system.

12:00 R. Parrott contacts the Port of Saint John and makes arrangements for the Creed to use the floating dock located on the west side of the harbour. Personnel at the Saint John Coast Guard base are contacted and will check to see if fenders are in place on the wharf face. The fenders make it much more convenient for the Creed to tie up, and reduce the amount of effort required throughout the night to ensure that lines are not snagged during tide changes.

21:00 R. Parrott arrives in Brier Island and starts mobilization of the magnetometer station. The equipment is placed on a shelf in the office at the Coast Guard base Westport. Personnel at the base will monitor the readout on an opportunity basis and report any problems to R. Parrott. The GPS receiver, used mainly for time synchronization, is placed over the main entrance. The sensor for the magnetometer is placed in deep grass behind the building, in a location not frequented by the public.
The existing multibeam bathymetry data coverage is discussed with Dean Robinson, the base commander (a former captain on the CCGS JL Hart). Captain Robinson is able to provide information on many of the features observed on the multibeam bathymetry and agrees to make notes on the draft copy of the 1:350,000 GSC Open File map left in his care. He will return the map at a later date and discuss the notes on the map.

22:05 Creed arrives in Yarmouth. Magnetometer connected. New survey files created in SIS. Next day's activities planned with the captain

23:30 R. Parrott departs Brier Island for Digby.

**27 June 2008 Friday - Day 179**

01:00 R. Parrott arrives in Digby.

09:00 Creed departs Yarmouth and travels WSW to start of SW/NE line in to the Bay of Fundy. Weather conditions are foggy with visibility of less than 1.5 km. The survey extends coverage on the survey line connecting the German Bank and Bay of Fundy survey and then along the southern extent of the Fundy data near Brier Island.

10:21 Power problem with RAID GIS and processing computers. It appears that the system is presently overloaded and it may be necessary to install another UPS.

14:01 MVP cast (file has too many records)

16:00 R. Parrott departs Digby for Saint John on the ferry.

16:27 MVP cast (File issues)

19:00 R. Parrott arrives Saint John and proceeds to floating dock in the container pier supervised by the Port of Saint John. Procedures are established for access to the dock, and discussions held with local fisherman about our requirements for use of the pier. The location of floating fenders at the Coast Guard base in Saint John is checked and none are available in the sheltered dock at the base. A call was made to the Creed and the captain decides to dock at the base.
Fisherman are currently removing their traps from the water. The season ends at midnight on 29 June 2008, and the traps will be removed over the weekend.

19:05 EOL, heading for deepwater cast.

19:36 150m MVP cast.

19:50 Creed en route Saint John

20:30 Fire and Emergency Drill.

21:30 Creed secured at the Coast Guard base in Saint John.

**28 June 2008 Saturday - Day 180**

09:00 Fuel truck scheduled to arrive.

10:00 R. Parrott arrives at the Creed. The fuel truck has not yet arrived.

11:00 The fuel truck has still not arrived. The captain postpones the fuel delivery until this evening and the Creed departs the Coast Guard base in Saint John. A large number of fishing boats are busy pulling traps from the waters around the entrance to Saint John. Quite a few traps still remain in the water. The magnetometer is not streamed to avoid the chance of tangling traps.

12:00 MVP cast near the start of line and start running lines between Saint John and Pt. Lepreau

11:45 Avoiding lobster pots. The number of traps decreases with increased distance from Saint John, with smaller clusters of traps found near the local harbours, such as Musquash and Dipper Harbour.

12:04 MVP cast.
13:26 MVP cast.
15:41 MVP cast.
20:18 MVP cast.
21:48 End of survey lines for day.
22:00 Run a short line over wreck previously seen in Anchorage C in the approaches to Saint John. Continue to Saint John
22:40 Creed secured at the Coast Guard base in Saint John. The OmniStar system has been left logging overnight to provide data that can be used to compare the OmniStar height data with the data from the tide gauge at the Saint John ferry terminal.
23:00 Attempt to set up magnetometer. An error message was received notifying that there was no communication with the magnetometer. The computer was rebooted and power cycled to the magnetometer, but the system still can not communicate with the magnetometer.
23:30 Fuel truck arrives with 10,000 litres of fuel for the Creed.

**29 June 2008 Sunday - Day 181**

09:00 C. Legere and D. Cartwright from the Ocean Mapping Group at the University of New Brunswick join the Creed to participate in the data collection.
09:15 R. Parrott returns to the vessel.
09:30 Depart the Coast Guard base in Saint John and transit to the survey area. A short section of line was run across the wreck in Anchorage C. Wind 15-25 knots from the SW. One metre waves with white caps. There are still a considerable number of lobster traps near the harbour entrance, but fewer than were present yesterday.
10:08 Start running lines towards Point Lepreau. D. Cartwright notices problems with the MVP system resulting in location data not being displayed. Problems had previously been encountered when the POS-MV monitor was started before the MVP. When both programs are stopped, and the MVP program started first, the problem persists. The configuration is then changed back to both UDP and serial links being active for navigation input (as had been done on the previous survey) and the navigation data is properly displayed.
10:15 MVP cast. Continue running lines.
Occasional lobster traps seen near harbour entrances along the line.
17:35 Knudsen 3.5 kHz sounder off for 5 minutes to check for crosstalk.
17:40 Knudsen 3.5 kHz sounder turned back on. Examination of the data revealed no signs of crosstalk between the systems.
18:15 Large deposit of uniform sediments over stratified sediments. A lobe of sediment is evident on the multibeam bathymetry data offshore from Chance Harbour to Dipper Harbour. The edge of the lobe was present near Point Lepreau.
19:12 Possible wreck on multibeam bathymetry and 3.5 kHz data in about 50 m water depth. Viewing of the data during cleaning showed a feature 50 m long, 20 m wide and 7 m high with a small moat surrounding it.
19:22 Eastern edge of sediment lobe seen on 3.5 kHz near Musquash.
19:24 Western edge of another sediment lobe seen off Lorneville.
20:00 Start a short line back towards the wreck.
20:30 Surveying over the wreck to confirm position and shape.
21:20 End of survey line. Run line into Saint John.
22:00 Dock briefly at Coast Guard base in Saint John to drop off R. Parrott, C. Legere and D. Cartwright.
22:15 Secure at the floating dock on the west side of Saint John Harbour. R. Parrott returns to the vehicle to vessel to pick up computers etc.

**30 June 2008 Monday - Day 182**

09:30 Depart the floating dock and pick up R. Parrott at the Coast Guard base in Saint John.
10:30 Start running lines from the Approaches to Saint John to Point Lepreau.
10:40 MVP cast. Several attempts are generally required to get the MVP to deploy under computer control.
14:00 Run a series of lines between Point Lepreau and Eastern Wolf Island.
21:30 Secure at Coast Guard base in Saint John.

**1 July 2008 Tuesday - Day 183**

09:30 Depart Coast Guard Base in Saint John with C. Legere from UNB on board.
10:30 Start running lines in the Approaches to Saint John to fill in gaps between this and previous surveys.
10:40 MVP cast.
14:00 End of infill lines near Saint John. Fill data gap while steaming to Musquash to complete coverage in that area.
14:30 Start on infill lines off Musquash
14:40 MVP cast. Problems are encountered with the MVP system, requiring several attempts for the system to work under computer control. The engineer adjusts the sensor switch to be closer to the cable, resulting in more reliable operation. The Knudsen sounder that is used to provide depth information to the MVP controller has noise spikes (shallower and deeper depths) which cause concern when using the MVP. The potential effect of a noise spike providing erroneous depths during the operation of the system is unknown.
16:15 Start line towards Point Lepreau. 25 – 35 m penetration on Knudsen 3.5 kHz. Two small pits, possibly pockmarks, seen on multibeam data south of Chance Harbour.
17:20 MVP cast. Some problems with false water depths from Knudsen stopping the cast part way through the free fall. Several attempts are required.
18:00 Surveying near The Wolves off Grand Manan.
18:35 MVP cast. Several attempts required again. The towfish stopped about 9 metres above the selected depth.
20:45 Run line through The Wolves to intersect lines from previous surveys.
21:00 Run line down edge of previous coverage. Power plug for OmniStar inadvertently kicked loose causing the system to lose power. The line will have to be re-run.
22:00 Secure at North Head, Grand Manan.
22:30 D. Beaver encounters problems gridding the last two sections of data. The data had been imported and cleaned with no problems, however the gridding failed.

**2 July 2008 Wednesday - Day 184**

09:30 Depart North Head with J. Beaudoin and C. Legere from UNB on board.
09:35 Commence sounding. Start to re-run the lines with poor navigation from the previous evening.
10:00 D. Beaver still encounters problems gridding the data collected this morning. A new field sheet is generated using UTM Zone 19 instead of Zone 20 and the data imported. It is not determined if changing the zone fixed the problem, or if the new field sheet has an effect. This will be investigated later.
11:00 Extend the line to allow J. Beaudoin to experiment with the outer beam correction parameters to as a possible method to correct an offset evident in the multibeam bathymetry data.
12:00 Run a line close to shore at The Wolves to provide the inner extent of the survey.
12:15 Talk to B. Wile about the problems with the magnetometer. He calls the manufacturer, Marine Magnetics and describes the problem. Wile then provides the contact number to me so that I can check parameters. After checking some of the values the technician informs me that the software version being used is not compatible with the new control box. Why would the

controller be supplied with outdated software? How did the system pass the check at the start of the season ?

12:30 Deploy the MVP and commence a long series of casts. Problems are encountered with the brake on the MVP, causing it to bind on retrieval. The engineer applies a few gentle taps with a ball peen hammer, which appears to fix the problem. This is repeated for about 20 casts before the brake functions without a little persuasion.

16:30 Still running MVP casts. About 100 have been collected on this series of lines so far. Making a turn near The Wolves.

19:30 Tied at North Head, R. Parrott, J. Beaudoin and C. Legere depart vessel.

20:00 S. Hayward goes to download the updated magnetometer software.

21:00 S. Hayward returns and attempts software installation. The file appears to be corrupt or incomplete.

**3 July 2008 Thursday - Day 185**

09:30 Problems are encountered with the electronic charting system on the ship's computer, resulting in a delayed start to the day.

10:10 Depart North Head en-route to survey between the Wolves and Point Lepreau. The weather was clear in North Head, and turns foggy as the vessel leaves the harbour. The sea state is less than 1 m, with light winds.

10:47 MVP cast to 140 m depth.

11:00 Troubles were encountered with bottom tracking on the EM1002 for 500 m while the water depth increased.

11:15 D. Beaver talks to B. Wile regarding the problems encountered with the new software release for the magnetometer. B. Wile will place an additional file on the GSCA ftp server from Marine Magnetics to be available for download tonight.

11:45 Run a track line at a variable distance around The Wolves.

13:16 MVP cast to 45m depth. The wind speed increases to 15-30 knots.

13:34 Steer offline due to a fishing vessel.

16:00 Steer offline due to a high flyer and buoy deployed by fishing vessel in our track.

16:10 MVP cast to 50 m depth.

21:50 Secure at North Head, Grand Manan.

**4 July 2008 Friday - Day 186**

09:00 An oil leak is detected in the engine cooling system. The vessel remains tied up North Head while the engineer and first mate work on the engine. GSCA personnel use the opportunity to catch up on processing the multibeam bathymetry data. The weather remains sunny and clear.

10:00 D. Beaver talks to Coast Guard contact at BIO to obtain contact information for wharf personnel at Saint Andrew's Biological station.

18:30 Depart North Head en-route to survey area. The weather remains clear and calm.

18:52 MVP cast.

19:56 MVP cast for a survey West of The Wolves.

21:15 Anomalies are noticed in the data collected on the first three lines. The lines have to be re-run.

23:25 Secure at wharf in North Head.

**5 July 2008 Saturday - Day 187**

09:55 Depart the wharf at North Head. Clear skies with light winds and a temperature of 17°C.

11:43 MVP cast.

13:00 Weather remains sunny and clear, 0 sea state.

15:41 MVP cast.

16:00 Surveying between The Wolves and Point Lepreau. The swath width is approximately 200m.

19:06 MVP cast.
21:00 Secure at the wharf in Grand Manan.

**6 July 2008 Sunday - Day 188**

09:30 Depart North Head for The Wolves. Sunny, with a little bit of fog and calm seas.
10:29 MVP cast.
11:05 MVP cast (towfish left in the water).
11:45 MVP cast (no good, towfish full of seaweed).
11:59 MVP cast (towfish cleaned deployed and retrieved, good cast, towfish back on board).
15:46 MVP cast.
18:15 Wind picking up from 10 kts half an hour ago to 30 kts from the South.
18:32 Heading into Saint Andrews.
20:02 Secure at Saint Andrews Biological Station. The engineer does bilge clean up.

**7 July 2008 Monday - Day 189**

09:40 Depart Saint Andrews Biological Station. Foggy with visibility under 200 m.
10:30 Running lines in Maces Bay between East Quoddy head and Pt. Lepreau.
11:16 MVP cast.
13:15 MVP cast.
The vessel slowed down several times during the day to allow the Grand Manan ferry to pass.
19:20 Arrive North Head, taking on fuel at 20:30

**8 July 2008 Tuesday - Day 190**

09:30 Depart North Head
09:45 Infilling data gaps off Swallow Tail, Grand Manan
10:00 Steer off line due to a tanker.
10:22 MVP cast.
11:58 MVP cast.
13:50 Slowing down for ferry to give him 1 mile clearance.
15:30 Engineer performing checks on engine cooling system. There still appears to be some residual oil in the cooling system. The engineer is shutting down one engine at a time.
15:45 Ship lost steering due to engine shut down. Vessel offline.
15:55 Steering recovered.
16:05 Ship loses steering again due to a possible conflict with the engine diagnostic being performed on the port engine.
19:19 MVP cast.
20:02 Cease survey operations for the day South of Colsen Cove, heading into Saint John
21:30 Secure at Coast Guard base Saint John. Foggy.

**9 July 2008 Wednesday - Day 191**

Crew change day
10:30 E. Patton and R. Parrott arrive at BIO, collect equipment and start drive to Saint John, NB to join the vessel.
15:30 E. Patton and R. Parrott arrive at Coast Guard base in Saint John and load gear on to vessel.
16:30 D. Beaver and S. Hayward load new software for the magnetometer. Problems are still encountered with the system. Both input channels on the computer are checked and found to function properly, however the navigation data does not seem to be recognized. A call is made to Marine Magnetics and after some discussion a $GPGGA rather than a $INGGA string is input into the magnetometer. This seems to cure the navigation problem. In an earlier call to the company we were assured that the $INGGA string would be sufficient for the system, and

as a result we had not experimented further with that issue. The system now appears to function on deck.

19:00 S. Hayward departs vessel for BIO.

20:00 The multibeam bathymetry data collected to date are exported as XYZ values from HIPS and imported into GRASS for gridding. A geotiff of all existing data is generated, and an offset of 18 m is discovered between the 2008 and previous data. The 2008 data is referenced to the ellipsoid, and previous data is referenced to MSL. Additional work will be required here.

**10 July 2008 Thursday - Day 192**

09:25 Depart Coast Guard base Saint John. Today is overcast and foggy with a light swell.

10:02 MVP Cast. Coming on line to survey route, heading NE parallel to NB coast. The magnetometer streamed and the system checked. The magnetometer appears to be functioning properly.

10:30 Problems are encountered with the Regulus navigation system. It appears that the POS-MV monitor was started before the Regulus system and latched on to the UDP port and prevents the Regulus program from accessing it. A similar problem Was encountred earlier with the MVP system. It looks like the POS-MV monitor program should be started last on computers where other programs require access to the navigation strings.
Surveying areas between Cape Spencer and Quaco Head. Areas of sand waves detected west of McCoy head.

11:00 Problems were encountered with ships navigation system due to changes made to output the $GPGGA string. The output rate is changed to 2 seconds and all seems well.

11:56 MVP Cast.

19:16 MVP Cast. The MVP is still temperamental requiring someone to monitor the system at all times. Errors have been encountered with the retrieval as well as the deployment. The deployment required constant adjustment of the ship's speed to get the velocity through the water to 12 knots. We were surveying with a rising tide and had to do about 15 knots to get the desired speed.

21:12 Recover the magnetometer.

21:08 Return to Saint John to take delivery of parts for the vessel.
Cease survey operations for the day near the Black Point offshore disposal site in the approaches to Saint John Harbour. Stopped logging Knudsen and Simrad.

21:45 Secure at the Saint John Coast Guard base.

22:00 The magnetometer data are downloaded and checked with a word processor to confirm content. The problems that had occurred with the output from the ship's navigation system caused the magnetometer to stop logging the navigation. The data are all present and time tagged. Navigation data still have to be integrated from the Regulus navigation files.

23:00 The engineer reports significant amounts of oil in the engine coolant. He was able to remove much of it with absorbent pads, however the cause of the problem is still unknown. On the previous crew change, the engineer had reported minor amounts of oil seepage – the problem appears to have gotten much worse. Plans are made to contact the representatives for the engine as soon as the office opens in the morning.

**11 July 2008 Friday - Day 193**

09:00 Secure at the dock in Saint John, NB, waiting for the engineer to make contact with Detroit Diesel in Quebec to discuss the problem with the engine.

11:30 Contact B. Wile and R. Murphy at GSCA to inform them of the situation and make tentative arrangements for a truck or van to come to Saint John for the survey gear. R. Parrott had checked with a local rental company and found that all passenger vans were reserved until early September !!

12:30 The service representative from Detroit Diesel will arrive at the vessel at 09:30AM (local time) on Saturday. Tests will probably take most of the day and repairs may be required. The chance of surveying in the vessel getting any survey time in the next two days appears fairly small. It is decided to leave the vessel fully mobilized and for Parrott, Beaver and Patton to return to BIO.

13:30 A rental car is obtained. R. Murphy is called to inform him of the change in plans and R. Parrott, D. Beaver and E. Patton depart the vessel to return to BIO.

**12 July 2008 Saturday - Day 194**

09:00 The vessel remains secure at the dock in Saint John, NB, waiting for service representative from Detroit Diesel.

12:30 The service representative from Detroit Diesel arrives at the vessel and starts tests.

15:00 R. Parrott contacts the vessel, learns that tests are still underway, and informs D. Beaver and E. Patton of the situation.

19:00 R. Parrott is informed by the captain of the vessel that the engine has been repaired and the survey can resume. E. Patton is informed that the vessel is functional and that the survey can resume. D. Beaver is out of cell phone range and cannot be contacted.

20:00 R. Parrott informs E. Patton that the survey will resume in the morning and plans are made to meet at BIO to pick up additional data and gear to be ready for a 22:00 departure. A message was left for D. Beaver informing him of the status of the vessel, current plans and requesting that he join the vessel in Saint John late Sunday if he does not get the message in time to meet at BIO at 22:00.

22:00 Depart BIO.

**13 July 2008 Sunday – Day 195**

02:45 R. Parrott and E. Patton arrive at the *CCGS Frederick G. Creed* and load gear on the vessel.

09:30 Depart Coast Guard Base Jetty en route to survey area east of Cape Spencer. R. Parrott and E. Patton on board. Today is partially overcast, with no fog, light winds and a low swell.

09:45 Start sounders and Knudsen near Partridge Island to get data to test the CHSQ HIPS system.

10:34 Deploy magnetometer.

10:37 MVP Cast. An attempt to start the magnetometer results in a version 7.97 error message stating that the system failed to communicate with the magnetometer. This is rather confusing since version 8.03 had been installed.

11:00 Further attempts to start the magnetometer result in the same message. In order to ensure that the most recent version of the SeaLink program are being used, all versions of the program are removed from the computer and attempts made to re-install the program. The first attempt failed because the setup program was not in c:/ProgramFiles/Sealink. Subsequent attempts failed because access was denied to a folder in C:/Documents/Mag1/Localsettings/Temp while trying to install an isrt.dll file. The entire folder in …/Temp was removed, and the procedure repeated, with the same error message occurring. It is not clear if the problem is with the permissions on the computer not allowing access to the file (although it is possible to remove the entire folder). The program does not appear to be very robust, and the problems with re-installing the program are rather confusing and frustrating.

11:37 MVP Cast.

15:00 The winds are increasing in speed with white caps present on the waves.

16:00 MVP cast. The magnetometer is recovered.

18:00 The winds are about 20 knots from the SW, resulting in larger waves. The data quality is still acceptable. The POS-MV shows the estimates of relative accuracy of positioning at 0.22 m for Latitude, 0.23 m for Longitude and 0.31 m for Altitude.

**14 July 2008 Monday – Day 196**

9:08 *Creed* departs Coast Guard base in Saint John en route to survey area east of Cape Spencer. Today is partially overcast, with no fog, light winds and a moderate swell.
9:12 Started logging Kongsberg EM1002 and Knudsen and POS-MV.
9:19 SIS CPU display is intermittently flashing yellow and red over the position and time information boxes. Time and position look accurate compared to Regulus and POS-MV.
9:41 MVP Cast.
9:51 Stop logging EM1002; SIS is logging raw files to yesterday's date folder. Reboot the computer and SIS as a precaution.
9:59 The reboot seems to have solved the problem. The display is now only flashing yellow on the position (related to SIS's inability to properly handle a GGK NMEA string), and the raw data files are now being logged to the correct day-date folder.
10:42 MVP Cast. R. Parrott performs a series of MVP casts to provide data to look at variability in the water column.
11:05 Turning back SW to cover a small data hole in coverage.
11:10 Resuming line running to the NE.
11:25 Recover MVP.
12:30 R. Parrott attempts to get the Marine Magnetics SeaLink magnetometer functioning again. The install program failed again due to an error reporting that the 'isrt.dll' file could not be accessed, due to file permissions, even though the file was present in the directory specified and was not a read only file. Attempts to remove the program failed because the same file could not be accessed. At present the program cannot be installed on or removed from the computer. The program was then installed on another computer. The same error occurred about access to the 'isrt.dll' file, however, the program did install. The system is configured to accept the magnetometer and navigation data, and the operation of both ports confirmed by checking for the presence of the navigation data. The SeaLink program is started and reports an 'Unable to communicate with magnetometer' error. The power supply to the magnetometer is disconnected and reconnected as recommended in the manual. This is repeated many times. The system still will not communicate with the towfish. The SeaLink magnetometer system has proven itself to be highly unreliable. It is not determined if this is a software or hardware problem. It would have been more productive to have slept!
14:21 Begin filling-in of curved survey lines and other holes.
16:07 Resume normal survey line running.
17:45 MVP Cast.
20:53 Stop logging EM1002 and Knudsen.
21:19 *Creed* secured at Coast Guard jetty in Saint John.

**15 July 2008 Tuesday – Day 197**

9:06 *Creed* departs Coast Guard base in Saint John en route to Grand Manan. Weather today is overcast, foggy, light swell. Lynn Collier from CHS-A joins the vessel.
9:19 Begin logging EM1002.
9:22 Begin logging Knudsen.
10:18 Begin line over new coverage near Musquash Harbour.
11:14 Finished coverage line near Musquash; stopping logging EM1002 and Knudsen to transit over existing coverage to re-survey a bad line in Maces Bay.
11:35 Start a fill-in line to fix bad data in Maces Bay.
12:26 Begin logging Knudsen in new survey area NE of Campobello Island.
12:28 Begin logging EM1002.
13:32 Slowing down to allow passage of a sailboat.
14:00 Begin new survey area immediately east of Campobello Island.

14:31 Turn to survey along US Border.
14:40 Now surveying NE-SW lines in between Campobello and Grand Manan Islands.
17:00 Back at BIO, R. Parrott, D. Manning and P. Pledge troubleshoot the magnetometer. Problems are encountered with trying to remove and install the SeaLink program on the laptop, with an error message about access to the 'isrt.dll' driver. The program was installed on a different computer and would communicate with the towfish and operate well with no navigation input to the computer.
21:15 Stop logging Knudsen and EM1002. Heading to North Head, Grand Manan.
21:45 *Creed* secured at wharf in North Head.

**16 July 2008 Wednesday – Day 198**
9:06 *Creed* departs wharf in North Head, Grand Manan en route to survey area northwest of Grand Manan. Weather today is sunny, calm, with light winds. L Collier aboard the vessel.
9:26 SOL at northern tip of Grand Manan. Logging Knudsen and EM1002.
9:47 MVP Cast.
12:55 MVP Cast.
13:00 Line heading was altered due to fishing vessel.
15:19 Copious amounts of lobster buoys in the water. *Creed* is bobbing and weaving, but valiantly staying on line.
15:46 MVP Cast. Most of the length of Grand Manan Channel is scattered with buoys, even on the Canadian side, making casting the MVP difficult.
17:00 Back at BIO, R. Parrott, D. Manning and P. Pledge continue troubleshoot the magnetometer. The system did not recognize the NMEA string from a Garmin GPS when it was routed through a Belkin serial-to-USB adapter. P. Pledge then substituted an Edgeport 8-port serial-to-USB adapter, serial ports from both the magnetometer and the navigation system were connected to it and input to the laptop. The system then appeared to function properly. The SeaLink program was finally re-installed on the original laptop computer, the Edgeport adapter connected to the computer, and the magnetometer functioned properly. Much of the earlier problem may have been caused by the Belkin adapter, although when the port was monitored using the Hyperterm program, the GPS strings were all detected, and the program still would not function properly. Note that when the program finally functioned, no USB mouse was connected – this may or may not be a factor.
20:51 Logging a line into Whale Cove to look for the 'Hole in the Wall'
21:28 *Creed* secured at wharf in North Head.

**17 July 2008 Thursday – Day 199**
9:00 *Creed* departs wharf in North Head Grand Manan en route to the survey area in Grand Manan Channel. Weather today is sunny, calm, with light winds. L Collier, CHS, aboard the vessel.
9:26 Started logging EM1002.
9:31 Started logging Knudsen.
9:49 MVP Cast.
11:08 The southwest end of Grand Manan Channel is strewn with buoys and lobster traps, making it very difficult to run parallel lines; MVP casts are out of the question over about 1/3 of the length of the survey line.
11:43 MVP cast.
13:16 MVP cast.
15:12 Fog banks rolling in. If the fog becomes dense, detection of lobster pots and buoys will become difficult, necessitating a shift closer to the coast.
15:31 Winds have come up a bit; 13 knots; waves beginning to crest.
16:08 *Creed* is dodging buoys; lines will be crooked and twisty.

20:27 EOL for last line of the day. Stopped logging Knudsen and EM1002. Headed for North Head.
21:12 *Creed* secured at wharf in North Head. L. Collier departs vessel to return to BIO.

**18 July 2008 Friday – Day 200**

8:56 Today's weather is foggy, with light winds. last evening.
9:22 *Creed* had another vessel tied alongside overnight, necessitating a late start today as the vessel was maneuvered out of the way.
9:26 *Creed* en route to continue survey operations in the Grand Manan Channel. Today's survey will be on the American side of the Channel.
9:47 Started logging Knudsen and EM1002.
10:04 Finished surveying a small line SW down Grand Manan Chanel to the 1-Papa traffic control point; now transiting across the Channel to the border, to begin surveying on the American side.
10:16 MVP cast.
10:44 Too many lobster buoys and zero visibility; turning around and surveying back to 1-Papa, then crossing over coverage to survey on the west Grand Manan coast.
11:27 MVP cast.
12:51 MVP cast.
15:46 MVP cast.
17:55 MVP cast.
20:45 Finished survey for the day; heading back to North Head.
21:17 *Creed* secured at wharf in North Head.
22:00 R. Parrott and Peter Dobek, CHS join the vessel and load the magnetometer on to the vessel. The magnetometer is installed, tested and found to be working.

**19 July 2008 Saturday – Day 201**

9:09 *Creed* departs wharf in North Head en route to survey area west of Grand Manan Island. R.Parrott and P. Dobek are aboard. Today's weather is foggy, with light winds, light swell. Thick fog is restricting today's survey to the Canadian side of Grand Manan Channel.
9:55 MVP cast.
10:04 Start logging Knudsen and EM1002, head SW, to resume coverage in Grand Manan Channel. Turned Knudsen power from 3 to 2, pulse length from 0.38 to 0.18 msec.
11:00 Magnetometer deployed and logging.
13:31 MVP cast.
14:00 High frequency noise in present on the magnetometer at frequent intervals. The spool containing the unused portion of the tow cable is moved to the lower deck, in an attempt to keep it away from the radio antennae, with no improvement in quality. On the line change the vessel is travelling with the tide, at 10-11 knots through-the-water, and the noise spikes disappear. The previous line had been run against the tide and the speed through the water had increased to over 13 knots.
18:25 Finish surveying in Grand Manan Channel. Heading toward North Head, steaming across the south side of the island. Logging EM1002 and Knudsen on the way.
21:10 Retrieve magnetometer.
21:20 Stop logging EM1002 and Knudsen.
21:27 *Creed* secured at wharf in North Head.

**20 July 2008 Sunday – Day 202**

9:06 *Creed* departs wharf in North Head en route to survey area east of Grand Manan. The thick fog and presence of lobster gear prevents survey operations on the American portion of Grand

Manan Channel. The weather forecast for the next 3 days predicts continuing fog with low winds. There will be very little probability of being able to survey on the US side of the border under the forecast conditions. It is decided to continue the survey south of Grand Manan and then return to survey operations near Saint John.

9:11 Started logging EM1002 and Knudsen.
9:31 Magnetometer deployed; MVP cast.
9:45 Magnetometer turned on.
9:46 Started logging MAG.
11:23 Start transect of MVP cast on a line running south from Grand Manan. MVP casts were taken every 2-3 minutes.
12:23 Heavy riptides; stopped MVP transect and recover towfish
15:25 EOL for the Grand Manan survey area. Retrieving magnetometer; stopped logging Knudsen and EM1002. Heading back to North Head to drop off R. Parrott, who will drive the NRCAN truck to Saint John.
15:35 R. Parrott disembarks the Creed in North Head. Creed departs North Head, cruising east on a transit line to Saint John.
15:44 Magnetometer and multibeam are activated again while heading to Saint John. A line of MVP casts is made while in transit to Saint John.
19:12 Stop MVP transect. Retrieved magnetometer and MVP towfish.
19:27 Stop logging EM1002 and Knudsen. End of survey for the day. Steaming to Saint John.
19:50 *Creed* secure at Coast Guard base in Saint John. R. Parrott re-joins the vessel.

**21 July 2008 Monday – Day 203**

9:10 *Creed* departs Coast Guard base en route to survey area to the southeast of Cape Spencer, N.B.
9:20 MVP deployed. The vessel will be running a series of profiles through the Saint John River plume on the way to the SOL.
9:28 Start logging Knudsen and EM1002.
9:45 Retrieve MVP as it was caught on seaweed. Redeploy after it has been cleaned off. Magnetometer deployed and operating. The magnetometer signal looks good with no noise spikes.
10:03 D. Beaver notices a crab angle on the data displayed in HIPS and suspects that the POS-MV may have an offset. The POS-MV and the SIS CPU are re-booted. When the data are checked later, the problem has disappeared.
10:13 Started logging SIS on new line southeast of Cape Spencer.
10:14 End of MVP transect. Recovering the MVP.
11:45 Start MVP transect on line towards Saint John.
13:00 End MVP transect and recover towfish.
13:15 A series of in-fill lines was run to straighten out the survey lines.
20:36 End of survey. Stop logging Knudsen and EM1002, and magnetometer. Retrieve magnetometer. Steaming to Saint John.
21:05 *Creed* secure at Coast Guard Base.

**22 July 2008 Tuesday – Day 204**

9:02 *Creed* departs Coast Guard base en route to survey area to the southeast of Cape Spencer, N.B.
9:15 Magnetometer deployed. Start an MVP transect out of Saint John. Start logging Knudsen and magnetometer.
9:30 Start logging EM1002.
9:46 SOL on new line building on existing coverage.

10:14 Magnetometer snagged on the MVP during a cast. The magnetometer is untangled and redeployed. The MVP is recovered.
11:15 MVP transect of 6 casts.
21:30 *Creed* secure at Coast Guard base in Saint John.
22:00 R. Parrott departs vessel for BIO.

**23 July 2008 Wednesday – Day 205**

Crew change day – no survey operations

**24 July 2008 Thursday – Day 206**

09:52 *Creed* departs Coast Guard base en route to survey area south of Saint John.
10:03 Magnetometer deployed. Today is windy, about 20 knots, overcast.
10:04 Started logging Knudsen and EM1002.
10:06 Started logging magnetometer.
10:27 MVP cast.
10:47 A tanker is at anchor in the middle of this line. The Creed makes a small course correction, leaving a small hole in the coverage, but thankfully not a big one in the vessel.
11:58 MVP cast.
15:58 MVP cast.
18:41 MVP cast.
18:42 Omnistar looses lock; the position indicator on PosMV turns red indicating an error. This may be related to the presence of thunderstorms in the area.
19:22 MVP cast.
21:10 End of survey operations for the day. Still logging all instuments on a transit line to Saint John.
21:35 Stop logging EM1002, Knudsen, and magnetometer. Retrieve magnetometer.
22:04 *Creed* secure at Coast Guard Base.

**25 July 2008 Friday – JD207**

09:00 Departure delayed this morning due to stainless steel filings found in the transmission overnight. The engineer believes we can be underway around 13:00.
12:15 *Creed* departs Coast Guard jetty in Saint John.
12:43 Magnetometer deployed, MVP deployed. Start logging EM1002, Knudsen. Survey line is a transit line en route to Yarmouth, N.S. while conducting a MVP transect, with a frequency of once per 5 minutes.
12:47 MVP cast.
13:04 MVP cast.
13:35 Retrieving magnetometer and MVP. The *Creed* is passing through Petit Passage, which has 7 knot currents.
14:00 Magnetometer redeployed, and logging started.
14:10 MVP cast.
15:12 MVP cast.
15:27 MVP cast.
15:29 Heading is compromised. Omnistar is not reading as High Precision.
16:08 MVP cast.
19:58 Stop logging EM1002, Knudsen and magnetometer. Retrieve magnetometer.
End of Survey.

## Appendix III - Predicted Tides for Saint John, NB

Hourly values in centimetres above chart datum – generated by the program Tides and Currents version 4.2 by Nautical Software Inc. Times are shown in Atlantic Daylight Time.

| Date | Time | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value | Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 June, 2008 | 0:00 | 221 | 332 | 470 | 607 | 706 | 735 | 690 | 590 | 458 | 315 | 193 | 136 |
| 25 June, 2008 | 12:00 | 162 | 257 | 393 | 540 | 665 | 731 | 720 | 643 | 526 | 390 | 259 | 173 |
| 26 June, 2008 | 0:00 | 164 | 231 | 350 | 490 | 622 | 710 | 726 | 670 | 564 | 430 | 291 | 180 |
| 26 June, 2008 | 12:00 | 138 | 178 | 283 | 424 | 571 | 689 | 744 | 720 | 633 | 509 | 369 | 239 |
| 27 June, 2008 | 0:00 | 159 | 158 | 233 | 356 | 499 | 629 | 711 | 719 | 657 | 548 | 414 | 277 |
| 27 June, 2008 | 12:00 | 173 | 140 | 189 | 301 | 446 | 594 | 709 | 757 | 725 | 631 | 500 | 355 |
| 28 June, 2008 | 0:00 | 222 | 143 | 146 | 225 | 353 | 498 | 630 | 711 | 718 | 655 | 544 | 408 |
| 28 June, 2008 | 12:00 | 271 | 169 | 139 | 192 | 309 | 459 | 610 | 726 | 772 | 736 | 636 | 499 |
| 29 June, 2008 | 0:00 | 346 | 207 | 125 | 127 | 209 | 341 | 493 | 630 | 715 | 724 | 660 | 548 |
| 29 June, 2008 | 12:00 | 409 | 269 | 164 | 133 | 189 | 310 | 465 | 621 | 742 | 789 | 751 | 646 |
| 30 June, 2008 | 0:00 | 502 | 340 | 192 | 104 | 105 | 190 | 327 | 486 | 631 | 724 | 736 | 671 |
| 30 June, 2008 | 12:00 | 556 | 414 | 267 | 156 | 123 | 180 | 305 | 467 | 631 | 757 | 807 | 767 |
| 1 July, 2008 | 0:00 | 658 | 507 | 335 | 176 | 82 | 83 | 171 | 315 | 483 | 638 | 736 | 750 |
| 1 July, 2008 | 12:00 | 684 | 566 | 418 | 263 | 145 | 110 | 170 | 301 | 469 | 641 | 773 | 823 |
| 2 July, 2008 | 0:00 | 780 | 666 | 508 | 327 | 160 | 61 | 65 | 159 | 310 | 486 | 648 | 751 |
| 2 July, 2008 | 12:00 | 763 | 693 | 572 | 417 | 254 | 131 | 98 | 163 | 300 | 474 | 652 | 787 |
| 3 July, 2008 | 0:00 | 835 | 787 | 669 | 504 | 315 | 142 | 45 | 55 | 156 | 314 | 497 | 664 |
| 3 July, 2008 | 12:00 | 764 | 771 | 697 | 571 | 410 | 240 | 117 | 90 | 162 | 304 | 482 | 664 |
| 4 July, 2008 | 0:00 | 797 | 839 | 784 | 662 | 493 | 298 | 126 | 37 | 57 | 166 | 329 | 515 |
| 4 July, 2008 | 12:00 | 681 | 775 | 773 | 693 | 563 | 396 | 224 | 107 | 89 | 169 | 315 | 495 |
| 5 July, 2008 | 0:00 | 676 | 801 | 832 | 771 | 645 | 473 | 278 | 114 | 39 | 72 | 187 | 353 |
| 5 July, 2008 | 12:00 | 539 | 698 | 779 | 767 | 682 | 547 | 377 | 208 | 103 | 97 | 184 | 331 |
| 6 July, 2008 | 0:00 | 511 | 684 | 797 | 815 | 748 | 620 | 447 | 258 | 109 | 52 | 97 | 217 |
| 6 July, 2008 | 12:00 | 384 | 565 | 712 | 778 | 754 | 663 | 525 | 356 | 196 | 106 | 113 | 205 |
| 7 July, 2008 | 0:00 | 352 | 526 | 687 | 783 | 789 | 717 | 588 | 420 | 242 | 113 | 74 | 130 |
| 7 July, 2008 | 12:00 | 253 | 418 | 589 | 720 | 769 | 735 | 641 | 501 | 336 | 190 | 116 | 134 |
| 8 July, 2008 | 0:00 | 228 | 372 | 538 | 683 | 762 | 757 | 682 | 556 | 394 | 234 | 125 | 103 |
| 8 July, 2008 | 12:00 | 166 | 291 | 450 | 608 | 721 | 755 | 714 | 617 | 478 | 321 | 191 | 132 |
| 9 July, 2008 | 0:00 | 157 | 251 | 390 | 543 | 672 | 736 | 724 | 648 | 526 | 376 | 233 | 144 |
| 9 July, 2008 | 12:00 | 135 | 203 | 326 | 476 | 620 | 716 | 739 | 693 | 594 | 459 | 312 | 196 |
| 10 July, 2008 | 0:00 | 149 | 178 | 271 | 402 | 543 | 656 | 710 | 693 | 619 | 503 | 365 | 240 |
| 10 July, 2008 | 12:00 | 166 | 166 | 236 | 355 | 496 | 626 | 709 | 724 | 674 | 575 | 444 | 307 |
| 11 July, 2008 | 0:00 | 203 | 164 | 196 | 285 | 409 | 538 | 641 | 687 | 669 | 597 | 488 | 361 |
| 11 July, 2008 | 12:00 | 249 | 186 | 192 | 262 | 376 | 509 | 628 | 702 | 711 | 659 | 560 | 433 |
| 12 July, 2008 | 0:00 | 304 | 208 | 173 | 207 | 294 | 412 | 534 | 629 | 671 | 653 | 583 | 478 |
| 12 July, 2008 | 12:00 | 360 | 257 | 201 | 211 | 281 | 393 | 519 | 632 | 699 | 703 | 648 | 548 |
| 13 July, 2008 | 0:00 | 422 | 297 | 207 | 176 | 212 | 300 | 417 | 535 | 627 | 665 | 644 | 574 |
| 13 July, 2008 | 12:00 | 470 | 355 | 257 | 207 | 222 | 295 | 407 | 533 | 641 | 703 | 700 | 639 |
| 14 July, 2008 | 0:00 | 535 | 407 | 283 | 197 | 173 | 215 | 308 | 427 | 546 | 634 | 668 | 641 |
| 14 July, 2008 | 12:00 | 565 | 458 | 343 | 248 | 205 | 228 | 309 | 426 | 553 | 658 | 712 | 701 |
| 15 July, 2008 | 0:00 | 630 | 516 | 383 | 259 | 179 | 166 | 220 | 322 | 448 | 568 | 651 | 675 |
| 15 July, 2008 | 12:00 | 637 | 552 | 438 | 320 | 230 | 197 | 233 | 327 | 452 | 582 | 683 | 726 |
| 16 July, 2008 | 0:00 | 699 | 614 | 489 | 348 | 226 | 157 | 160 | 231 | 347 | 481 | 600 | 674 |
| 16 July, 2008 | 12:00 | 682 | 628 | 530 | 407 | 286 | 204 | 188 | 244 | 353 | 489 | 621 | 712 |
| 17 July, 2008 | 0:00 | 737 | 691 | 588 | 449 | 303 | 187 | 136 | 162 | 254 | 385 | 525 | 640 |
| 17 July, 2008 | 12:00 | 696 | 683 | 610 | 497 | 364 | 245 | 178 | 187 | 265 | 391 | 536 | 664 |
| 18 July, 2008 | 0:00 | 740 | 741 | 671 | 550 | 398 | 250 | 148 | 123 | 177 | 290 | 435 | 577 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 July, 2008 | 12:00 | 679 | 712 | 674 | 581 | 452 | 312 | 202 | 159 | 196 | 298 | 439 | 588 |
| 19 July, 2008 | 0:00 | 707 | 758 | 731 | 638 | 499 | 339 | 197 | 118 | 124 | 207 | 340 | 494 |
| 19 July, 2008 | 12:00 | 631 | 712 | 716 | 652 | 540 | 398 | 258 | 165 | 152 | 219 | 342 | 494 |
| 20 July, 2008 | 0:00 | 641 | 740 | 762 | 706 | 592 | 440 | 277 | 150 | 102 | 142 | 251 | 400 |
| 20 July, 2008 | 12:00 | 557 | 681 | 734 | 707 | 619 | 490 | 340 | 208 | 140 | 160 | 253 | 393 |
| 21 July, 2008 | 0:00 | 550 | 687 | 760 | 749 | 667 | 536 | 376 | 220 | 117 | 104 | 176 | 306 |
| 21 July, 2008 | 12:00 | 465 | 617 | 720 | 741 | 686 | 577 | 436 | 284 | 167 | 129 | 179 | 295 |
| 22 July, 2008 | 0:00 | 445 | 600 | 719 | 763 | 723 | 620 | 478 | 317 | 174 | 101 | 122 | 221 |
| 22 July, 2008 | 12:00 | 366 | 527 | 668 | 745 | 736 | 656 | 532 | 383 | 237 | 140 | 131 | 207 |
| 23 July, 2008 | 0:00 | 337 | 492 | 639 | 736 | 752 | 688 | 572 | 424 | 268 | 146 | 103 | 152 |
| 23 July, 2008 | 12:00 | 269 | 422 | 580 | 705 | 756 | 722 | 624 | 490 | 339 | 202 | 127 | 141 |
| 24 July, 2008 | 0:00 | 234 | 372 | 526 | 662 | 738 | 732 | 653 | 529 | 382 | 236 | 134 | 116 |
| 24 July, 2008 | 12:00 | 185 | 313 | 468 | 620 | 728 | 758 | 705 | 597 | 458 | 308 | 181 | 123 |
| 25 July, 2008 | 0:00 | 153 | 255 | 396 | 546 | 670 | 730 | 710 | 624 | 499 | 356 | 221 | 136 |
| 25 July, 2008 | 12:00 | 134 | 213 | 346 | 500 | 643 | 738 | 754 | 692 | 579 | 439 | 291 | 172 |
| 26 July, 2008 | 0:00 | 123 | 161 | 265 | 405 | 550 | 666 | 718 | 693 | 606 | 484 | 347 | 221 |
| 26 July, 2008 | 12:00 | 145 | 150 | 232 | 364 | 514 | 652 | 741 | 752 | 688 | 574 | 434 | 287 |

**Appendix IV - SeaSpy Magnetometer**

This section has been modified from the Geological Survey of Canada Open File Report F.G. CREED EXPEDITION 2005-038 Multibeam and magnetometer survey of the St. Lawrence Estuary north of Rimouski (June 5th to 17th 2005), (Campbell et al., 2005) which provided a description of the operational procedure used for the SeaSpy Marine Magnetometer.

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This survey used the SeaSpy Magnetometer. The fish was towed at an average depth of 1 metre below the sea surface at a speed of 10-12 knots in varying sea states. The system uses Overhauser sensors and measures ambient magnetic field regardless of survey direction or orientation with the field.

**Procedures for Sea-Spy Magnetometer deployment during this survey**

1. Tow point on Fish - 60m of cable were measured on wharf (3 times vessel length) – A tow point was created using rope.

2. Tow point on Vessel- small shackle on port side rail (Figure 1).

3. Spool- 60 m *cable* wrapped loosely around port cleats (Figure 2), wooden spool on aft quarter/bridge-deck, deck lead to lab through conduit. Deck lead to adapter to small black input box. Black input box output splits to COM port input and power supply. (See manual for more details).

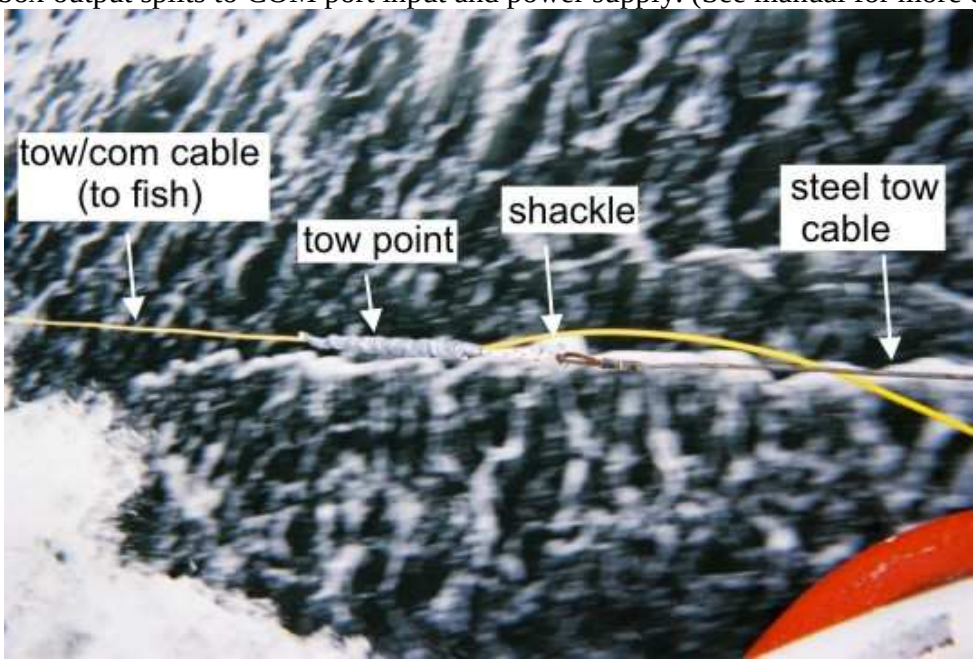


Figure 1- Magnetometer tow point in action.

4. Setup GPS input. Software accepts standard NMEA navigation input from a COM port. Software requires baud rate, parity, etc. to be set. In this case it was a baud rate of 9600 and no parity. Nav was updated at 10 Hz.

5. Determine layback. In this case approximately 3 x Vessel Length (60m) + Vessel DGPS/RTK offset (7.5m) + Towpoint (1m) = 68.5m

6. Deployment Procedures- The system requires 2 people to deploy the fish which weighs about 20 kg. Slowed to deployment speed of 2-4 knots. Before deploying, startup SeaLINK software. Check that GPS data is streaming in the GPS window. Press the "sync GPS" button to sync the computers clock to the GPS. In the command window, enter "p" to zero pressure the depth sensor on the tow fish. Set the cycle rate (usually 1 or 2 Hz). Press the "append GPS values button" to attach position information to the file. Enter the calculated layback. Fish lowered over top of railing on the side of vessel with person 1 holding tension on fish. Wraps were taken off cleats by person 2 as to not tangle cable or transfer tension to deck. Note two additional wraps were left on deck cleats as safety back up. Once fish is deployed, press the logging button on the acquisition computer to begin logging. Bring ship to survey speed (10-12 kts) (Figure 3).

7. Retrieval Procedures- Slow to recovery speed of 2 to 4 kts. Person 1 hand recovers fish while person 2 neatly wraps the tow cable on deck (not tight around cleats). When tow fish is along side, bring fish on board carefully, ensuring that the fish does not impact the hull. Removed composite nose piece and using potable water (starboard side of the Creed) thoroughly rinsed the brass connector and body of the fish, replaced nose piece and secured fish to railing. Note, corrosion takes place fairly quickly when the saltwater, fresh air and brass are all in contact, it is important to rinse the fittings after each retrieval, however it is not necessary to break the brass seal during this process, the o-rings provide the true seal.

Figure 2- Setup of magnetometer while on deck.

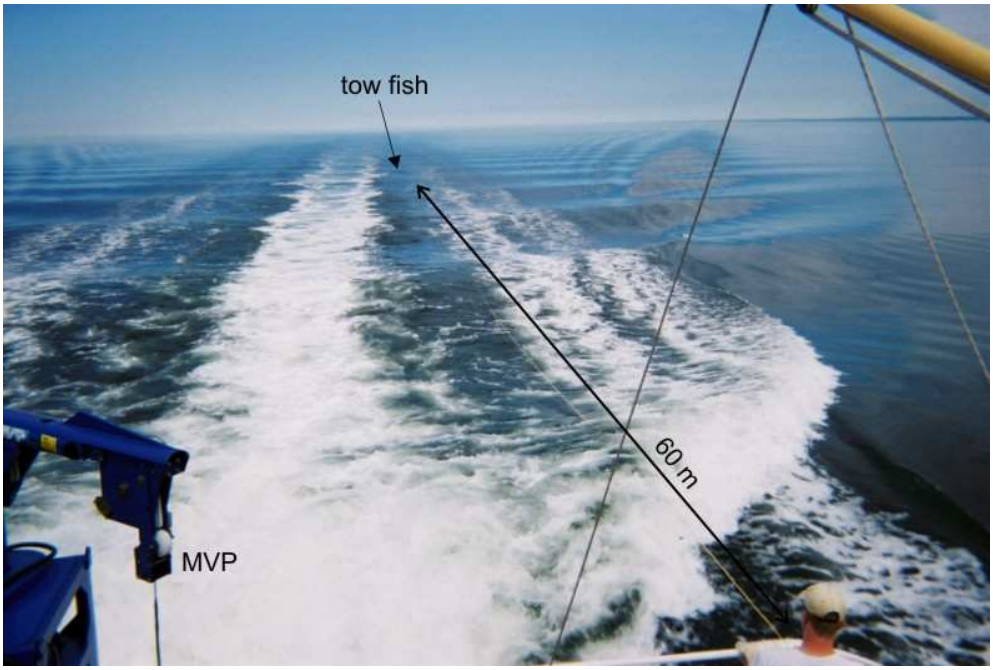


Figure 3- Setup of magnetometer while acquiring data.

SeaLink setup and magnetometer software configuration

System Requirements Windows 95 or higher with two available com ports.

- The Magnetometer requires both a Serial connection to the towfish and a real-time NMEA nav string from DGPS.
- A cycle rate of 1 to 2 hz is desirable on the magnetometer at 12 kts, 1 Hz gives reading ~ every 20 metres, 2 Hz every 10 m.
- Mag Baud 9600 string com1.
- GPS Baud 9600 10hz NMEA string com2.

Problems encountered

- No valid navigation string found, program restarted/rebooted until com port found.
- No valid magnetometer com link, Windows OS interpreted the magnetometer communications port as a plug-and-play mouse. The power was disconnected from magnetometer until windows completed reboot, power reconnected and program initiated.
- The pressure sensor provided erroneous calculations of depth throughout the cruise, sometimes showing fish above surface of the water. Fish could be observed under most conditions riding 60m aft and .5m or greater, below the surface.

**Magnetometer Base Station at the Coast Guard base in Westport, Brier Island:**

The magnetometer sensor was about 15 m from the building in a patch of tall grass, well out of the traffic area. Flagging tape was placed on the cable where it was visible next to the building. The CPU, GPS, and other electronics were setup inside the base in the office.

**Reference**

D. Calvin Campbell, Scott Hayward, Roger Côté and Louis Poliquin, 2005. F.G. CREED EXPEDITION 2005-038 Multibeam and magnetometer survey of the St. Lawrence Estuary north of Rimouski- June 5th to 17th 2005, *Geoscience in support of ocean management of the Estuary and Gulf of St. Lawrence*, Geological Survey of Canada Open File Report 4966, 2005; 22 pages

## Appendix V - *CCGS Frederick G. Creed* Acceptance Trials – Newspaper Article

The following newspaper article about the *CCGS Frederick G Creed* was found in a pile of old newspapers destined to be used to start fires in the woodstove at a cottage. The article was published in a newspaper on the south shore of Nova Scotia during the late 1980's.

# DFO evaluates new SWATH vessel

**by Geneva Faulkner and Pat McKenzie-Porter**

LIVERPOOL — The Department of Fisheries and Oceans (DFO) is evaluating the *Frederick George Creed*, a small waterplane area twin-hulled (SWATH) vessel for its hydrographic, oceanographic and fisheries program.

"We are assessing this particular type of vessel," said Joe Gough of the DFO, "because of its stability in all conditions. The vessel could be described as being on struts which are perched on two little underwater torpedos. Very little of the vessel actually touches the surface of the water."

The struts diminish wave-making drag which in turn makes it insensitive to rough weather conditions. It can operate in adverse weather at high speeds. The vessel reached Liverpool on December 1 from San Diego. One of the observers who had travelled with it from Boston described the trip as the smoothest sail he had experienced. There was no motion in heavy seas except the gentle movement associated with a large ferry. The stabilizers at the rear and front of the pontoons automatically adjust the motion of the boat to keep it steady.

The 75 ton aluminium *Creed* is 67 feet long and 33 feet wide. High performance Detroit Diesel engines generate 2,160 horsepower. A Canadian supplied Hydrographic Survey Multi-beam Transducer, Simrad, EM100, is mounted on one of the pontoons for accurate bottom mapping. The *Creed* is the smallest survey vessel in the world with this capacity. It can carry a crew of ten and remain at sea for a week. Normal transit speed is 20 knots though it can go as fast as 25 knots.

Interest in this vessel arises from its safety in all weather conditions. In calm weather, it operates efficiently which reduces fuel costs. The DFO is collaborating with the U.S. government to evaluate this SWATH (small waterplane area twin-hulled) vessel which the manufacturer claims provides "the ocean's kindest ride."

The vessel is named after Frederick G. Creed, the inventor of the modern SWATH concept. He was born in Mill Village in 1871, a fact which prompted the DFO to bring the vessel into Liverpool for two hours on December 1. Creed became interested in long distance communication and invented the prototype of the teleprinter. After several successful transmissions of entire newspapers, Creed formed a company in London to distribute his invention. The company later became part of International Telegraph and Telephone where Creed served as a director.

Creed patented his SWATH concept in 1942, which is now incorporated in the SWATH OCEAN 2000 Class survey/science vessel which is currently being assessed. It is operated by Canship Ltd. of St. John's, Newfoundland. The *Creed* was launched in San Diego, California last October. The extreme sea conditions off Nova Scotia and Newfoundland will be used to evaluate the vessel over the next four months.

**The *Frederick George Creed* sits at the Bowater-Mersey wharf outside Liverpool December 1 waiting to clear customs.**

Geneva Faulkner photo