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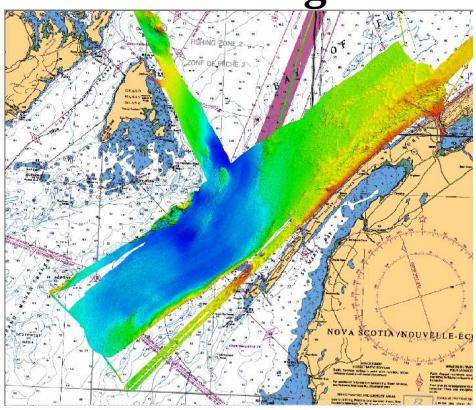
Cruise Report Creed IML 2006-030 - Bay of Fundy 12 June – 17 August 2006



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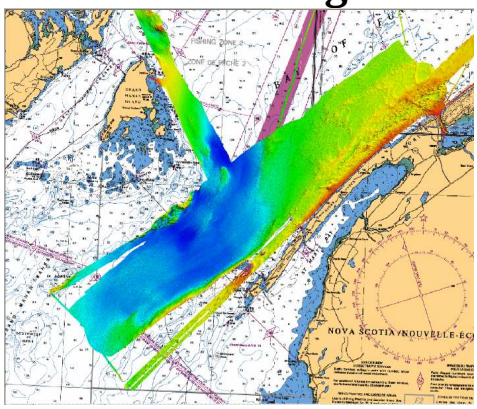

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Open files are products that have not gone through the GSC formal publication process.

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Background

The Geological Survey of Canada (GSC), a division of Natural Resources Canada (NRCan), has initiated a project to produce a series of maps showing the bathymetry, seafloor backscatter, and surficial geology throughout the Bay of Fundy. Survey *Creed IML2006030* was conducted from 12 June to 17 August, 2006, and collected multibeam bathymetry, multibeam backscatter, sub-bottom profiler and geomagnetic data in the approaches to the Bay of Fundy, from Digby, Nova Scotia, southwest towards the Gulf of Maine. This was the first of a series of cruises planned to the area.

The survey was conducted as a joint project between the Geological Survey of Canada and the Canadian Hydrographic Service of the Department of Fisheries and Oceans Canada.

The project will provide geoscience information to resolve user conflicts and balance competing demands for seafloor use with conservation. The primary outcome of this project will be that ocean-management decisions made by stakeholders will be based on sound scientific information provided by NRCan.

Survey *Creed IML2006030* was conducted using the CCGS *Frederick G. Creed* (Figure 1). The vessel was equipped with a Kongsberg Simrad EM1002 multibeam bathymetry system, Knudsen 3.5 kHz and 120 kHz sounders and a SeaSpy marine magnetometer. Data were collected in the approaches to the Bay of Fundy, as shown in Figure 2. The vessel operated out of Digby, NS, Saint John, NB and Grand Manan, NB.

Previous surveys in the Bay of Fundy (Fader et al., 1977; Amos et al., 1992; Parrott et al., 2000) 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 Simrad EM1002 multibeam bathymetry system.

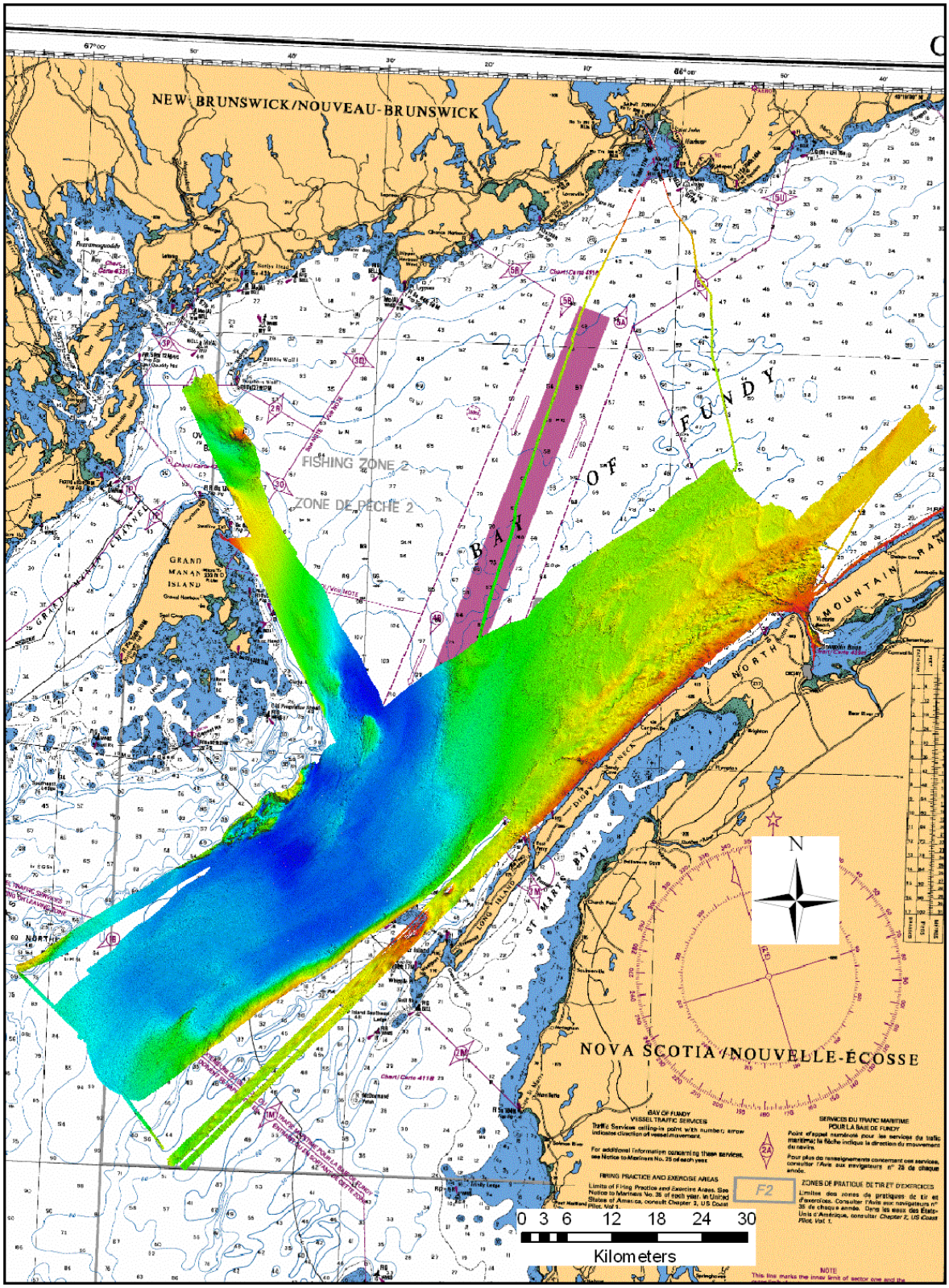

Figure 2. Multibeam bathymetry coverage in the Bay of Fundy collected during Creed IML2006030.

Data Acquisition and Processing

The following equipment was used during survey Creed IML 2006030:

- Simrad 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 Simrad 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. Typical line spacing was 380 m in 190 m water depth. 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). The latter meant that in water depths greater than 145 m, the swath width ceased to scale with water depth and was held steady at 500 m. The multibeam bathymetry coverage is shown in Figure 2.

During the survey, data were processed using version 6.0 of the CARIS HIPS data cleaning program (by Universal Systems Limited, Fredericton, NB) on a Windows XP workstation to remove spurious soundings and navigation data and to apply 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 artefacts. 5-metre and 10-metre grids were constructed using the "swath-angle" option for weighting soundings in the gridding process. The colour coding of depths was manually adjusted so detail could be seen in large areas of uniform depths.

Navigation and Attitude

An Applied Analytics Corporation POS-MV 320 attitude sensing system with integrated differential GPS navigation system was used to determine the position and attitude. The systems integrate data from an inertial measurement unit together with differential GPS using Coastguard RTCM Type 9 corrections. This survey was performed using DGPS corrections resulting in a typical accuracy of 0.5 metres (1 sigma). Typical heading accuracy was 0.015^o (1 sigma) with a baseline GPS antenna length of 2.6 m. Vessel attitude is measured using an inertial measurement unit to provide an accuracy of 0.02^o for pitch, roll and heading. More information on this system can be found at www.applanix.com.

In regions where no previous multibeam coverage existed, survey lines were run with the Regulus navigation package by ICAN Limited, Mount Pearl, NF. Otherwise, survey lines were run in the Geographic display module of SIS in the manner described in the previous section.

Knudsen 320M echo sounder

Sub-bottom profiler data were collected with a Knudsen 320M sounder. The system was used to operate a 3.5 kHz transducer array installed in the port sponson. Hardware to operate a 120 kHz transducer was installed on 1 August 2006. More information on the sounder is available 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 available at http://www.knudsenengineering.com/ASP/Support/Download.asp.

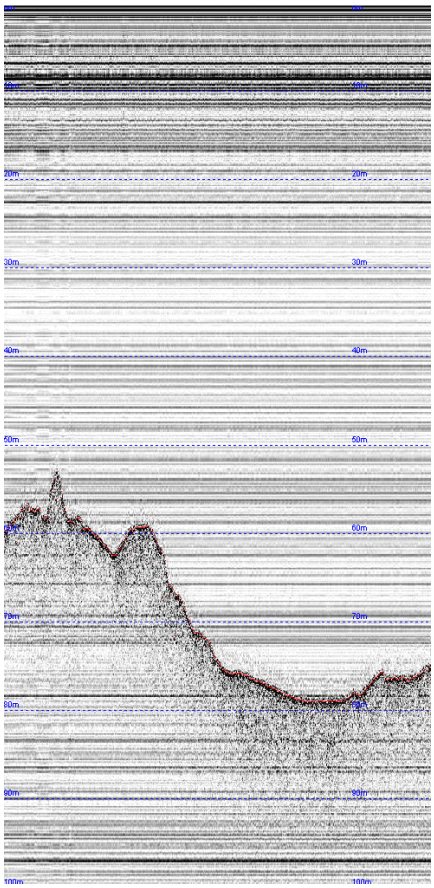

Figure 3. Example of 3.5 kHz data collected with the Knudsen 320B sounder with a power level of 2, 6 msec chirp, and gain of 35 before the ballast tank was flooded. Note the coherent noise on the record.

The Knudsen echo sounder synchronizes its system time with the controller PC every four minutes. In order for this operation to be valid, the PC's own time was synchronized to the NMEA ZDA string output from the POS-MV. This was done using TARDIS2000, freeware available from http://www.kaska.demon.co.uk/. This synchronization has two advantages: (1) post-processed sections can be easily aligned with other time-based datasets (e.g. unmerged multibeam lines) and (2) heave can be applied in post-processing using the heave stripped from the multibeam lines. This latter statement arose from initial difficulty getting the Knudsen to apply real-time heave; however, as of 7th July 2006, this matter was rectified and the Knudsen then applied real-time heave. The accurate time stamp was still important for reason (1) above but also as a backup in case the Knudsen stopped applying real-time heave.

The Knudsen 320B echosounder was configured in a manner similar to that recommended by John Hughes Clarke of the Ocean Mapping Group, Department of Geodesy and Geomatics Engineering, University of New Brunswick, after trials on the *CCGS Matthew*. A pulse length of 3 msec was used for the chirp signal, with the power level set at 1, gain at 30, a 3 ms chirp length and no TVG. These settings resulted in very poor quality records, with much noise and little penetration. The operating parameters were adjusted to determine the effects of changes in the settings on the records. A series of lines were run with the power level set at 1, gain at 50, a 3 ms chirp length and a TVG of "20logR" (20 times Logarithm Range) applied. Records were generally quite faint with little or no penetration. Bottom tracker results were generally poor. Settings were then changed to power level set at 2, gain at 35, a 6 msec chirp length and a TVG of 20logR applied. The firing rate decreased to 1 Hz. The records were much better quality, with penetration of 10-15 metres in some of the local depressions. Bottom tracking was much improved. The gain was then decreased on the Knudsen to 25; the records were not as dark as with gain of 35, with some reduction in noise levels. Attempts to remove 20logR spreading loss gain resulted in very weak signals – basically no returns were visible with a gain of 30. After further experimentation, the pulse length was set for a 3 ms chirp to increase the shot rate, the power level set at 2, gain at 35, and a TVG of 20logR applied. Record quality was improved over those acquired with power level 1.

Severe coherent noise was evident on the 3.5 kHz sub-bottom profiler records at all times. A sample of the data was e-mailed to Knudsen Engineering for analysis, and was found to have very low amplitude returns. Knudsen recommended checking the transducer to ensure that there was sufficient fluid present to cover the transducer and provide the proper coupling between the transducer and fluid. The transducer array is installed in the port ballast tank, in a specially constructed well, located between the ship's ribs. The engineer on the Creed contacted his colleagues in Quebec, who reported that while the vessel was in the shipyard it was noticed that a portion of the antifreeze used in the well had leaked out. No action to correct the problem appears to have been taken at that time.

The ballast tank is classified as an 'enclosed space' and requires that the appropriate safety standards be used to access the area. The panel can safely be removed for a visual inspection and photographs, but an air quality test must be performed before any personnel can enter the tank. Richard Boisvert, the engineer on the *CCGS Frederick G. Creed*, removed the inspection panel to enable a quick visual inspection and to allow photographs to be taken. A small amount of antifreeze was visible in the bottom of the ballast tank. Several photographs were taken of the inside of the tank and the transducer well.

Late in the day on 7 July, the ship's engineer commented to Bruce MacGowan (CHS) that the ballast tank contained a space below the transducer well, and that an air gap existed between the transducer array and the outside of the ship's hull when the tank was empty. The ballast tank was then partially flooded to ensure that water was present below the array. The amount of ringing present on the data was dramatically reduced, and penetration into the sediments improved. The amount of water in the tank was subsequently reduced to the minimum amount that would ensure that the array was covered to reduce possible effects on the ship's trim. The placement of the array will have to be improved at the earliest opportunity.

Brooke Ocean Technology Moving Vessel Profiler MVP100

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. The system was used to provide data for correction of calculated water depths from the Kongsberg Simrad 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.

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 10 metres was predicted for Digby, NS, during the period of the 2006 survey. Times are shown in Atlantic Daylight Time and tide heights are shown in centimeters.

For the duration of the survey, tide gauges were installed at the Lighthouse Cove lighthouse on Brier Island, in North Head on Grand Manan Island, and at the privately owned public wharf in Digby, NS to supplement the permanent gauge in Saint John, NB. Data were also downloaded from the gauge in Eastport, Maine, USA.

Access to Data and Samples

The sidescan sonar, sub-bottom profiler and grab samples collected during this survey are archived at the Geological Survey of Canada, Atlantic, in Dartmouth Nova Scotia. For access to the geophysical data and samples contact the senior scientist for the survey, Russell Parrott (902-426-7059) or Susan Merchant of the GSCA Curation group (902-426-3410). Graphical records for the sidescan sonar and subbottom profiler, digitally processed sidescan sonar mosaics, DVDs of the sidescan sonar and sub-bottom profiler data in SEG-Y format, and a CDROM with the seafloor images and grab sample photographs are available for viewing. 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 jointly funded by Natural Resources Canada through the Geoscience for Ocean Management program of the Earth Sciences Sector, and the Canadian Hydrographic Service of the Department of Fisheries and Oceans Canada. John Shaw reviewed the manuscript.

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

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Appendices

Appendix I - Survey Particulars

Name of Vessel:	*Frederick G. Creed*
Dates	12 June – 17 August 2006
Vessel captains:	Mario Bernard and Stephan Tessier
Area of Operation	Bay of Fundy
Senior Scientist:	Russell Parrott
Senior Hydrographer	Bruce MacGowan, Glenn Rodger

List of Participants

Geological Survey of Canada Atlantic

Russell Parrott	Senior Scientist
Garret Duffy	Postdoctoral Fellow - multibeam bathymetry
Eric Patton	GIS, navigation, multibeam bathymetry
Scot Hayward	GIS, navigation, multibeam bathymetry
Paul Girouard	GIS, navigation, multibeam bathymetry

Department of Fisheries and Oceans

Bruce MacGowan	Senior Hydrographer
Glenn Rodger	Hydrographer
Andrew Smith	Hydrographer
Kelly Sabadash	Student Hydrographer

Frederick G. Creed Crews - 2 week rotation

June 10 to June 14

S. Tessier	Master, CCGS Fredrick G. Creed
R. Boisvert	Chief Engineer
M. Poulin	Chief Officer
M. Jean	Cook/Deckhand

June 14 to June 28

M. Bernard	Master, CCGS Fredrick G. Creed
C. Russell	Chief Engineer
A. Scherrer	Chief Officer
E. Sioch	Cook/Deckhand

Appendix II - Activities

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

10 June 2006 Saturday - Day 161

11:00 Parrott, Duffy, MacGowan, Rodger join CCGS *Frederick G. Creed* at the Bedford Institute of Oceanography (BIO). Also on board are Mike Ruxton, Larry Norton, Morely Wright, and Gerry Dease from BIO. During the previous survey in the Gulf of St. Lawrence, the survey system electronics had been configured to use a RTK GPS system to provide tidal corrections for use. The RTK GPS system was not deployed for this survey and the on-board equipment has to be reconfigured to use. All keyboards are replaced with English versions. A new RAID drive is installed for additional data storage. Brooke Ocean Technology personnel Darrell, Paul and Murray diagnose the problems that had been encountered with the MVP.

12:00 Connor's diving team arrive. MacGowan briefs them on the damage that had been reported on the transducer cover.

13:00 Connor's diving tender arrives. A video inspection of the EM1002 transducer is performed, as well as anodes, props and canards. The damage to transducer appears to have been limited to the hard cover over the transducer. The captain proposes that the damage has been caused over the winter by ice forming behind the cover and expanding to break the cover.

21:00 Installation of computers virtually complete –however, Larry and Mike will return tomorrow to do final checks.

11 June 2006 Sunday - Day 162

11:00 Parrott, MacGowan, Rodger onboard the *Frederick G. Creed* .

11:30 Depart for Bedford Basin to do Moving Vessel Profiler (MVP) trials.

14:30 Secure BIO. Drop off Brooke technicians Darrell and Paul. The problems with the MVP have been caused by a valve on deck being corroded and rusted due to the exposure to the salt air. The engineer on the Creed recommends that the valve be moved from its present location on the MVP above deck to below deck, to keep it out of the weather. MacGowan decides to keep the ship here tomorrow to let the hydraulic technicians move the valve.

15:30 Run patch test in Bedford Basin.

19:00 Secure BIO.

12 June 2006 Monday - Day 163

11:00 Brooke Ocean and hydraulic people discuss requirements to move valve to location within the vessel. It takes until noon to confirm that all the parts are available and that they can do the job today. The work is scheduled to start shortly after lunch.

18:45 Hydraulic technicians finally arrive.

21:00 Depart to Bedford Basin for trials of MVP system. System appears to function properly.

22:00 Secure.

13 June 2006 Tuesday - Day 164

08:00 Creed departs BIO en route to Yarmouth. The captain calls MacGowan during the afternoon to confirm that they will be in Yarmouth tonight. The ship is fully functional and ready for survey.

14 June 2006 Wednesday - Day 165 – Crew change day.

13:30 Parrott, Duffy, MacGowan, Rodger depart BIO in van for drive to Yarmouth.

15:00 Check tide gauge installed by CHS on Digby wharf. The gauge is functioning properly, but we can not find the tide board attached to the wharf. Message left on CHS answering machine requesting information on location of board.
16:00 Arrive onboard the *CCGS Frederick G. Creed* in Yarmouth. Continue with installation of computers.

15 June 2006 Thursday - Day 166

11:00 Cook departs vessel to restock pantry.
13:30 Cook returns with provisions.
Heavy rain and wind. 40-50 km winds forecast for afternoon. Remain at dock, and start processing of data from patch test. Call made to CHS Quebec to obtain offsets for POS-MV system to apply lever arm corrections to multibeam data.

16 June 2006 Friday - Day 167

09:30 Depart Yarmouth for survey area. Parrott takes the truck to set up magnetometer reference station on Brier Island and meet vessel in Digby.
11:20 Sound Velocity Profile (SVP) cast.
12:12 Start of Line (SOL) #0001 to connect previous German Bank survey with new coverage of the Bay of Fundy– Sunny, warm, calm. Collect multibeam bathymetry and 3.5 kHz sub-bottom profiler data.
14:15 SVP dip.
14:25 SOL #0005.
19:00 Digby abeam. Extend line for another hour.
20:00 End of Line (EOL) #0016. SOL #0017. Parrott calls to say he will not be back until ~23:00. The 100' coaxial cable for the station magnetometer sensor has a short or break in it. A message was left on Bruce Wile's cell phone requesting that another be sent by bus. A 20-meter video cable is also requested to enable Regulus to be viewed the lab as well as on the bridge.
21:45 Secure at Digby.

17 June 2006 Saturday - Day 168

09:30 Depart Digby for survey area. Run line #0021 out to survey area. Sunny, warm & calm. Collect multibeam bathymetry and 3.5 kHz sub-bottom profiler data.
10:10 SVP cast. Start to run long lines from Digby southwest towards the Gulf of Maine.
10:15 POS-MV filter changed from 10 sec to 20 sec to reduce the effects of long term swell on the multibeam bathymetry data on previous line.
10:20 SOL #0022.
11:28 SOL #0025
12:20 SVP cast.
13:20 SOL #0027. The computer controlling the multibeam system (Seafloor Information System – SIS) will not accept the new velocity profile from the MVP computer. This same problem occurred on the previous survey. The short-term fix for the problem requires that the MVP computer be re-booted.
16:30 SVP cast. Reboot MVP computer.
16:51 SOL line 0034.
16:15 SVP cast.
16:24 SOL 0039.
19:00 SOL 0044 – Line into Digby.
19:45 EOL. Secure Digby.

18 June 2006 Sunday - Day 169

09:30 Depart Digby for survey area. Run line #0046 out to survey area. Sunny, warm & calm.
10:10 SVP cast. Start to run lines to infill between the long regional lines previously run. Collect multibeam bathymetry and 3.5 kHz sub-bottom profiler data.
13:26 SVP cast.
13:47 SOL #0055. Overcast with light winds
17:39 SVP cast.
17:59 SOL #0066
20:23 Return to Digby to take on fresh water. Note that no fresh water services are available on the wharf and arrangements were made to have water delivered by truck.
Large sandwaves on multibeam bathymetry data in approach to Digby.

19 June 2006 Monday - Day 170

09:30 Depart Digby for survey area. Run line #0080 out to survey area. Overcast with light winds.
10:10 SVP cast.
10:25 Run lines overlapping the long regional lines previously run.
11:00 Call from Bruce Wile in response to message left on 16 June. A 100 m coaxial cable and connectors are required for the magnetometer base station and a video splitter is required for use on the bridge. Request that the gear be shipped to Digby by bus later today.
13:10 SVP cast.
13:25 Continue to run lines overlapping the long regional lines previously run.
14:30 End line. Wind and wave height increasing. Start adjacent line on way back to Digby.
18:00 Call from Bruce Wile – cable for magnetometer and a video splitter have been placed on the Digby bus and will be held at the station for pickup. The package should arrive tonight and be available at 08:00 AST tomorrow.
19:10 End of long line. Continue survey near entrance to Digby harbour.

20 June 2006 Tuesday - Day 171

09:30 Depart Digby for survey area. Run line #0111 out to survey area. Overcast with light winds.
10:15 SVP cast.
10:25 Deploy magnetometer
10:30 Problems with ship's generator. Run lines northeast from Digby.
11:30 Parrott collects station magnetometer cable from the Digby bus station, assembles and tests entire unit. Some problems encountered when first connect to sensor with 100 metre long cable between the controller and the sensor. No problems when connected directly. The system worked on the third attempt! Something is not quite right here.
14:40 Parrott arrives at the Westport Coast Guard base and starts to install the system. The computer, controller, GPS and accessories were placed on a small shelf in the base office. The GPS antenna is placed on a support beam over the front door to the base. The magnetometer sensor is placed behind the base, in an area that was well away from traffic. Flagging tape was placed on the cable at irregular intervals to make it noticeable and hopefully prevent people from tripping over it.
17:00 Creed returns to Digby to wait for diesel mechanic. Continue with data processing.

21 June 2006 Wednesday - Day 172

09:30 Depart Digby for survey area. Run line #0138 out to survey area. Overcast with light winds. MacGowan remains on shore to check tide gauges and magnetometer base station.
10:15 SVP cast.
10:25 Deploy magnetometer at start of regional line.
10:30 Start regional line running #0132 southwest from Digby.

14:11 New file on Magnetometer and Knudsen. Start infill line.
Attempts to import multibeam bathymetry data into GRASS failed due to a missing library file. Arrangements are made to have the library emailed to the vessel. An image of the backscatter was exported from HIPS and imported to ArcMap and Global Mapper. Gridded backscatter data were imported as ascii xyz data into Global Mapper.
14:30 New file on Magnetometer and Knudsen. More infill.
16:30 Stop logging on magnetometer and Knudsen. SVP cast.
16:42 Start line back to Digby. Restart logging for magnetometer and Knudsen.
21:44 Recover magnetometer.
22:20 Sounders off.
22:45 Secure at Digby wharf.

22 June 2006 Thursday - Day 173

09:25 Depart Digby for survey area. Run line #0161 out to survey area. Sunny and clear.
09:30 Sounders on.
10:15 SVP Cast en route to line. Line shortened at Digby end to ensure that the line is completed in time to allow the vessel to be back at the dock for 21:30 to take on water.
10:30 Magnetometer deployed. Computer would not communicate with the magnetometer. Check all connections on deck.
11:30 Attempts to control the magnetometer with the SeaLink program were unsuccessful. Messages about Com1 not being available were displayed at the start of the program. The computer was re-booted several times – with no effect. After a call to Bruce Wile, the manual was read in more detail –RTFM (read the manual first). Attempts to use Hyperlink to read the serial strings from the magnetometer showed that the port was still in use. Finally the computer was rebooted with the serial feed from the magnetometer disconnected, which cleared the port. The serial cable was then reconnected and data was received indicating that the magnetometer was still functioning, but attempts to communicate using the commands from the manual were unsuccessful. Attempts to use another laptop to connect to the unit required use of a USB to serial connector, and resulted in interruption of all mouse functions on that computer.
12:20 After too many attempts to regain control of the magnetometer, it was decided to log the serial strings directly to a file, and to note the offset between GMT and the time recorded by the magnetometer. For the first file JD172/Hyper_log1.txt, GPS time was 12:21:15 while the magnetometer showed 00:10:15. It will be necessary to correct the times in the recorded data to correct for this offset.

The missing library was received by email and installed into GRASS. The attempt to import data was partially successful, but more missing drivers were discovered. These problems are teething pains associated with upgrading the processing system to the latest release.
13:16 Knudsen data over a shoal “Frenchman’s Elbow” show sediments below a depth of ~30 metres. Shallower than 30 m, no sediment was present, potential indications of a low stand of sea level.
13:23 Knudsen 3.5 kHz having problems tracking the seafloor in shallow water. Tends to jump to multiple.
15:15 End of Line. Start new line for return to Digby.
15:18 Increment files on Knudsen and magnetometer
15:30 Perform SVP cast while underway and on line surveying.
Export multibeam bathymetry data from HIPS as a geotiff file and import into ArcMap and Global Mapper. Attemps to import the gridded data into GRASS were unsuccessful due to missing drivers. Previously collected data from older surveys were exported from GRASS and imported into ArcMap and Global Mapper.

18:00 UPS system for multibeam computers starting to overload. MacGowan calls Jim Wilson to arrange for additional capacity to be delivered this evening from BIO.
20:30 End of long line. Turn off magnetometer logging.
20:55 Recover magnetometer.
21:30 Secure at wharf. Take on water.
23:00 Jason Greene arrives from BIO and installs an additional UPS to distribute the load. The individual UPS systems are now running at 40% and 60% load, while the single unit was overloaded.

23 June 2006 Friday - Day 174

09:25 Depart Digby for survey area. Run line #0187 out to survey area. Overcast with light winds. Foggy offshore.
09:30 Sounders on.
10:20 SVP cast at start of regional line.
10:30 Stream magnetometer and start logging.
13:20 Strong magnetic anomaly over Moores Ledge.
13:30 Another over Middle Shoal.
13:40 Bedrock outcrop on Knudsen. The shoal appears to be void of sediments in water depths less that about 40 metres. In depths greater that 40 metres, a thin blanket of coarse sediment is present. Possible low stand indicator with a different depth.
14:00 Install Knudsen PostSurvey software on laptop and browse through various records. Data generally has a coherent noise throughout the entire water column which can potentially mask reflectors.
Load sub-bottom profiler data into Chesapeake Technologies SonarWiz program. SEG-Y format data load quickly and display as a fence diagram along track. Unfortunately, the image of the data appears corrupt, and it is impossible to determine where the seafloor or any reflectors are.
15:30 End of line. MVP cast. New files on Knudsen and magnetometer. Start NE trending regional line back to Digby.
17:00 Generate predicted tides for Lighthouse Cove, Brier Island to apply to multibeam bathymetry data until tidal model developed.
17:45 Strong magnetic anomaly over Middle Shoal.
19:00 Discussions were held between Parrott, MacGowan and Duffy about a modified survey plan to improve the rate of survey coverage. The present plan uses long regional lines, with infill as required to cover the area. Coverage rates can be quite slow due to the shallow water encountered near Brier Island. Holes in the coverage in these shallow waters are quite difficult to infill when the ship is based in Digby. For the next couple of days shorter lines will be run from Digby to Brier Island, to intersect the edge of the deep water of Grand Manan Basin. At that time the lines will be extended to allow survey of portions of Grand Manan Basin while based in Digby. This will leave a wedge shaped zone of shallow water that will be surveyed either later in the season if the ship can be based in Westport, or left for next year for the *Matthew* and launches to survey. The description of the harbour at Westport, presented in the Sailing Directions for the Bay of Fundy, has raised concerns about the depth of water at the jetty. There may not be sufficient depth of water available for the *Creed* to stay at the dock.
20:50 End regional line. Infill holes en route to Digby.
21:30 Recover mag. End logging
21:45 Dock at Digby. Take on fuel.

24 June 2006 Saturday - Day 175

02:00 Go to bus station to pick up serial data splitter.

02:45 Bus still has not arrived.
09:30 Depart Digby for survey area. Run line #0187 out to survey area. Overcast with light winds. Foggy offshore.
09:35 Multibeam sounders on and recording.
09:50 Knudsen sounder on and recording.
10:20 SVP cast at start of regional line.
10:30 Stream magnetometer and start logging.
12:50 End of short regional line just beyond Sandy Cove. Change files on Knudsen and magnetometer. Start infill lines.
14:10 Start short regional line back towards Digby
The Knudsen system had been started up at 3 ms pulse width, gain = 50, power = 1, with 20logR gain applied. Logging was turned off and the system was changed to see if we can actually get some penetration with the system. The new settings are 6 ms pulse width, gain = 35, power = 2, with 20logR gain applied
- firing rate dropped to about half of previous
- still a considerable amount of coherent ringing in the water column
- there does appear to be some penetration on the records.
16:11 End of line towards Digby. Change file on magnetometer.
16:12 In my enthusiasm for improving the appearance of the records I forgot to turn logging on. Logging now on. Stratified sediments seen in some areas on Knudsen. Bottom tracking very good with very few cases of the system logging in on the second multiple.
17:35 Infilling hole, running erratic course. 10 m penetration on Knudsen in depressions.
17:47 Back on line
18:35 End of short regional line. Increment file numbers on magnetometer.
Decrease gain on Knudsen to 25. Attempts to remove 20logR gain resulted in no returns at all. Records not as dark as with gain of 35, some reduction in noise levels.
18:50 Areas of stratified reflectors. A zone of low backscatter was noticed on the multibeam bathymetry data at approximately the same time.
19:15 Very little seen on the magnetometer all day. The survey stopped short of the high anomalies seen over Middle Shoal yesterday.
20:17 SVP cast.
20:51 Knudsen gain to 30
20:55 Recover magnetometer.
21:20 Sounders off.
21:30 At dock in Digby – low tide – long climb up!!
23:00 Pick up serial data splitter and deliver to ship.

25 June 2006 Sunday - Day 176

09:30 Depart Digby for survey area. Run line #0247 out to survey area. Overcast with light winds. Foggy offshore.
09:35 Multibeam sounders on and recording.
09:40 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain.
10:05 SVP cast en route to regional line.
10:13 Stream magnetometer.
11:41 Knudsen transmitter had been turned off for some reason !
13:00 End short regional line. Change files on Knudsen. Start logging on magnetometer – oops – logging had not been enabled for magnetometer.
13:30 Near Sandy Cove. Some penetration on Knudsen into sediments adjacent to linear mounds - possible eskers.

14:00 Import geotiff of multibeam bathymetry coverage collected to yesterday evening.
16:00 Possible submerged river channel evident on multibeam bathymetry image. Fairly consistent water depth of 102 m. Stratified sediments on Knudsen at various places. Relationship to the channel are uncertain at present. The UNB/OMG tool for plotting sub-bottom profiler data and co-registered multibeam data would be quite useful.
Magnetics boringly uniform.
16:38 End of short regional line. Start infill lines. Increment files on magnetics and Knudsen.
18:00 10-15 metres penetration on Knudsen. Wedge shaped accumulation of sediments.
20:00 Magnetometer cable severely twisted. Magmetometer turned off. The towfish is removed and the cable streamed to see if the cable will straighten itself. About half of the twists cleared. The magnetometer will be deployed on the starboard side of the vessel on the next deployment to see if the cable will untwist more.
20:10 Entering area with many lobster trap buoys. Terminate line and return to Digby with sounders on.
20:30 Sounders off.
21:15 Secure at Digby
22:00 Haul the magnetometer cable up on to the wharf and take the twists out.
23:00 Duffy uses a serial splitter to feed the heave signal from the POS-MV to both the EM1002 and the Knudsen. Problems encountered – reset to original settings.

26 June 2006 Monday - Day 177

09:30 Depart Digby for survey area. Run line #0275 out to survey area. Overcast with light winds. Foggy offshore.
All computers in lab had been shut down when temperatures reached 30^{o}C. Boot up computers. Encounter the usual problem with the serial ports on the mag, and have to reboot computer to clear the port. 3-4 attempts required to get the program to recognize the serial string from the navigation system.
09:40 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain.
09:50 Multibeam sounders on and recording.
09:55 SVP cast en route to regional line.
10:13 Stream magnetometer. Logging on. Layback 60 m. The magnetometer was streamed just port of centre line on vessel to see if the cable will twist when deployed from this location.
13:00 Alter course to survey along the edge of Grand Manan Basin. Increment files on Knudsen and mag.
13:30 Slow down to deploy SVP. Very good records on Knudsen.
14:00 Increment sensitivity to 1 on Knudsen to keep tracking on surface rather than sub-bottom reflector. 5-10 m sediment present over a strong reasonably uniform reflector.
15:16 End of Line. Run reciprocal course with 400 m offset.
Extensive iceberg scouring evident on multibeam.
15:30 The magnetometer cable is again starting to twist – but in the opposite direction to that seen when deployed from the port rail. Move the cable back to the previous position to see if the cable will untwist itself.
17:30 At course change for Grand Manan Basin lines. Increment file numbers on magnetometer and Knudsen.
19:45 Contact Knudsen engineering about ringing on the 3.5 kHz records, and make arrangements to send sample records and information about settings from shallow and deep water areas.

20:15 End of regional lines. Start infill lines. Recover mag. Most of the twists have been removed from the cable. A plan has evolved – deploy from one location until noon, and from the other after.
21:15 Sounders off.
21:30 Secure at Digby.
22:00 Paul Girouard arrives at the vessel. Current status discussed and plans made for him to join the vessel for the 09:15 departure time.

27 June 2006 Tuesday - Day 178

09:30 Depart Digby for survey area with Paul Girouard on board. Run line #0305 out to survey area. Overcast with light winds. Foggy offshore.
Encounter the usual problem with the serial ports on the mag, and have to reboot computer to clear the port. 3-4 attempts required to get the program to recognize the serial string from the navigation system.
09:40 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain.
09:50 Multibeam sounders on and recording.
10:10 SVP cast en route to regional line.
10:20 Stream magnetometer. Logging on. Layback 60 m. The magnetometer is streamed just port of centre line on vessel to see if the cable will twist when deployed from this location.
11:10 Problems with port side engine. Modify survey plan for the day to remain in close proximity to Digby.
11:25 Magnetic anomaly
12:25 End of line near Digby. Continue with series of short lines between Digby and Centreville.
13:00 Start backup of Knudsen data. Transfer to laptop and burn to DVD.
16:00 Continue running nearshore lines while waiting on word on new injectors for the port engine. Some activity on the mag.
Duffy gridding the data in HIPS. The system is starting to get bogged down by the volume of the data. He is dividing the area into a number of field sheets that will be gridded individually.
16:10 Problems with the port engine get worse. Black smoke coming from stack. Start line back to Digby.
17:00 Recover magnetometer for transit through lobster pots to Digby.
18:00 Secure at Digby. Backup of Knudsen data to DVD continues. Engineer arranges for injectors to be sent from Rimouski.
19:00 B. MacGowan departs for Halifax.
23:00 G. Duffy leaves on Digby ferry bound for Fredericton.

28 June 2006 Wednesday - Day 179

Crew change day. Parrott, Girouard & Rogers to Brier Island to check station magnetometer & tide gauge. Could not check station magnetometer, wrong security code to unlock door.
Backup of multibeam, 3.5 kHz and magnetometer data.

29 June 2006 Thursday - Day 180

Parrott & Girouard return to Brier Is. to check station magnetometer, everything fine. Return to ship, injectors replaced but engineer discovers that a valve head has to be replaced.
Arrangements made to have one shipped from Rimouski for delivery next day. MacGowan and Rodger return to Halifax in mid-afternoon, Parrott & Girouard leave after supper with Girouard to return tomorrow with new valve head to expedite repairs.

30 June 2006 Friday - Day 181

Girouard returns to Digby with new valve head as well as engine oil. Valve head sent from Rimouski not shipped because of weather delays, picked one up from Detroit Diesel instead. Return to Halifax early evening and pick up valve head from airport. Call late in evening requesting that a couple of gaskets be picked up from Detroit Diesel (storesman called in and package left outside for pickup) and delivered to Windsor for pickup later by Detroit Diesel mechanic. Back home at 23:00.

01 July 2006 Saturday - Day 182

MacGowan, Rogers & Girouard leave BIO at 18:30, arriving at Digby ~21:00. Engine repairs completed, test run in Annapolis Basin after arrival. Everything working fine.

02 July 2006 Sunday - Day 183

09:30 Depart Digby for survey area. Run line #0323 out to survey area. Overcast with light winds. Light Fog offshore.
09:55 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain. (Discovered the next day that logging was not turned on, today's data lost.)
09:55 Multibeam sounders on and recording.
10:40 SVP cast en route to regional line.
11:05 Stream magnetometer. Logging on. Layback 60 m. The magnetometer was streamed from the regular position on the port side. No problem with initial magnetometer communications.
15:00 Broke off NE/SW line because of deteriorating weather. Now heading NE, much more comfortable with the wind and swell on the starboard quarter. Ran line up some of the extension.
19:45 Weather conditions worsening, turned around and headed for Digby.
20:05 Magnetometer recovered.
20:37 End of day's survey, Knudsen switched off.
21:00 Secure at Digby.

03 July 2006 Monday - Day 184

09:15 Depart Digby for survey area. Run line #0347 out to survey area, filling some data holes on the way. Sunny, winds app. 20kn. from the south.
09:23 Multibeam sounders on and recording.
09:35 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain.
10:25 SVP cast before start of regional line.
10:35 Stream magnetometer. Logging on. Layback 60 m. The magnetometer was streamed from the regular position on the port side. Again, no problem with initial magnetometer communications. Have been disconnecting coax from small splitter box overnight which may account for the immediate communications, time will tell.
16:00 B. MacGowan noticed that 3.5 logging depth of approximately 16m instead of expected160m. Change the transducer blanking from 15 to 25.
18:30 Magnetometer stopped and brought onboard for svp cast.
Glenn Rodger again noticed error in 3.5 bottom tracking, changed Tx blank from 25 to 30. Bottom tracking is an ongoing problem throughout day.
18:48 Magnetometer back in water and logging
23:35 EOL 381, end of today's survey, Knudsen off, heading to Digby.
00:05 Secure at Digby.

4 July 2006 Tuesday - Day 185

09:00 Depart Digby for survey area. Run line #0382 out to survey area. Sunny with light winds. Problem starting Knudsen computer, Data on com port fools computer into thinking it has a serial mouse rendering the mouse useless. Disabled serial mouse, cleared problem.
09:35 Multibeam sounders on and recording, SOL 382.
10:15 Snagged lobster gear across bow, worked free of it.
10:35 MVP cast and magnetometer streamed.
21:45 Slowed for ferry.
22:55 Magnetometer retrieved.
23:22 EOL 413, end of day's survey.
00:00 Secure at Digby.

5 July 2006 Wednesday - Day 186

09:00 Depart Digby for survey area. Run line #0414 out to survey area. Overcast with light winds. Heavy fog.
09:15 Knudsen sounder on and recording. Sounder on Power level 2, processing gain 0, Gain 30, pulse length 3 ms chirp. 20 logR spreading loss gain.
09:35 Multibeam sounders on and recording.
10:30 Port main engine shut down. Problem traced to loose clamp on coolant hose, all coolant drained from engine. Decision made to continue with survey on one engine while repairs carried out and to cool port engine with water until new coolant arrives from Halifax. Knudsen shut down when originally thought to be going back to Digby for repairs.
10:44 Knudsen sounder on and recording.
11:15 Stream magnetometer on port side. Logging on. Layback 60 m.
11:40 Repairs finished, back on two engines.
11:50 Magnetometer on board for MVP. Cycling and logging not turned off.
11:53 SVP cast following breakfast while on regional line.
12:03 Magnetometer re-deployed.
16:43 Magnetometer on board for MVP at SE end of regional line, cycling and logging turned off.
16:51 Manual cast performed while ship fully stopped in order to get probe as deep as possible.
17:05 Magnetometer re-deployed.
17:10 System would not accept new MVP, returning the following error: *(CCUH) not able to transfer S00 datagram to echo sounder on change of SV profile. Continue with existing profile for sounder type 1002, serial number 295?*
Unable to restart pinging because of reported BSP error in SIS. Had to reboot EM1002. Now pinging and logging but same error still returned when attempting to load new MVP. Answered yes to above error message so assuming it is using this morning's MVP but not sure. Checked both files for differences in header but both identical. Only difference is file size, this afternoon's being much larger.
17:29 Start of line 429.
22:39 EOL 440, heading to Digby.
23:40 Secure at Digby.

6 July 2006 Thursday - Day 187

09:25 Depart Digby for survey area to run line #0441 out to survey area. Weather quite variable - sunny with light winds, changing to drizzle, light fog patches. Attempted to boot SIS but unable to properly communicate with the transducer. Attempt to get things going by powering down, re-setting boards and turning the power back on in the main unit. The problem persists. Because of the early hour, it is impossible to get phone support. Decide to return to Digby until

the problem is resolved. Secure at Digby at 13:15. Performed troubleshooting while on the phone with Simrad and finally get the system to restart after deleting the old SIS database and re-entering all the parameters.

15:55 Depart Digby once more.
16:10 Knudsen sounder on and recording.
16:20 SOL 441
16:35 SVP cast. Errors showing up when attempting to load SVP. Other strange things going on, apparent on the display. Carrying on with line 442 while trying to figure out problem. Lines 442 & 443 may have to be discarded.
16:50 Magnetometer deployed and logging.
17:45 Line 443 aborted after snagging lobster gear, magnetometer retrieved. Captain decides to avoid this small area off Digby till after lobster season.
18:00 SVP cast. Same problem. Steam slowly while we again try to resolve problem. Glenn Rodger found a parameter that was not reset when we reloaded system. Problem solved!
18:15 Magnetometer re-deployed.
18:32 SOL 444. Running line extensions to NE.
21:35 Magnetometer retrieved.
22:07 EOL 455, end of day's survey.
22:16 Knudsen sounder off
22:30 Secure at Digby. R Parrott and G Duffy arrived along with coolant for the engine.

7 July 2006 Friday - Day 188

10:30 Depart Digby with R Parrott and G Duffy for survey area to run line #0441 out to survey area. Sunny with light winds.
10:35 SOL line #0455 out of Digby to main survey area.
11:22 Knudsen sounder on and logging, heave compensated.
11:42 SVP cast and magnetometer deployed at centre of boat but not logging.
11:51 SOL line #0457, regional line to SW.
12:00 Magnetometer now logging.
12:21 Magnetometer moved to port side as it appeared to be twisting.
13:45 Logging true heave on SIS.
13:52 Changed spike filter in SIS from "strong" to "weak" and beam spacing to "in-between".
16:37 Knudsen turned off to allow engineer to inspect transducer box. A small amount of coolant is present – but not enough to indicate a major leak from the box. Digital images of the transducer box and compartment are taken.
16:40 Magnetometer retrieved for MVP.
16:48 MVP cast. While logging off, Glenn Rodger enabled hull temperature/velocity sensor to feed into SIS.
16:55 Magnetometer streamed at centre of boat to try to untwist it.
19:31 Heave damping ratio changed from 0.707 to 0.5 on POS.
21:55 Magnetometer retrieved, seaweed attached to fins, appears to have untwisted a little.
22:00 Discussions between MacGowan and the engineer showed that the 3.5 kHz transducer box was mounted on a plate within the ballast tank, and that there was air below the array when the ballast tank was pumped dry. The tank was partially flooded to cover the transducer array. The amount of ringing present on the 3.5 kHz records was dramatically reduced.
22:40 Secure at Digby. R Parrott and G Duffy return to Halifax.

8 July 2006 Saturday - Day 189

09:00 Depart Digby for survey area. Running line #0480 out to survey area, hugging the west side of Digby Gut. Sunny with light winds.

09:10 Start of day's survey.
09:15 Knudsen started. About 0.5 m of water in forward port ballast tank so records very good compared to previous days.
10:30 MVP cast, magnetometer deployed at centre of ship. Some twisting apparent in the cable when deployed.
14:18 MVP cast. Magnetometer retrieved and re-deployed on port side of ship, cable seems even more twisted.
15:28 Returned to earlier MVP, velocities seem way out of range.
15:41 MVP cast while underway, magnetometer left deployed. Again major velocity differences, MVP velocities as follows: 1st 1493m/s, 2nd 1485m/s, 3rd 1500m/s.
16:22 EOL line #0497, SW end of regional line. Restarted SIS program, deleting process files, as screen updates and keyoard and mouse responses terribly slow.
16:38 SOL line #098, Running NE on south side of regional lines.
17:29 Used 1st MVP values.
17:38 Velocities still don't look right, used 2nd MVP values.
19:25 Crossing to outer regional line. Rebooted SIS computer as it was still terribly slow, seems to have done the trick.
21:00 Interupted line for ship traffic, resumed it at 2121.
21:45 End of regional line heading to Digby. Magnetometer retrieved, few twists.
22:50 Secure at Digby.

9 July 2006 Sunday - Day 190

09:35 Depart Digby for survey area. Running line, hugging the east side of Digby Gut. Girouard stayed ashore to check station magnetometer. Surveying line extensions to the NE.
09:39 SOL line #0512, Knudsen logging.
10:50 MVP cast. Magnetometer in water. B MacGowan and G Rogers unsure if logging on. Contacted P Girouard via cellphone. Logging OK.
12:05 P Girouard at station magnetometer, all systems OK on arrival. Inadvertently unplugged serial port when moving laptop to insert USB memory. Reconnected but no data coming in. rebooted system, magnetometer. Data coming in but no GPS. Finally realized that GPS data expected on COM 3 rather than COM 1 when using USB connection. Everything working on departure.
15:08 SIS display does not appear normal. SIS shut down and restarted.
13:14 SIS crashed, restarted.
16:25 Magnetometer onboard. MacGowan and Rogers unsure how to stop magnetometer before retrieving so disconnected the power to magnetometer.
19:54 EOL line #0536, end of day's survey.
20:20 Secure at Digby.

10 July 2006 Monday - Day 191

09:05 Depart Digby for survey area. Running line, hugging the east side of Digby Gut. Cloudy with wind SW 15-20.
09:12 SOL line #0537, Knudsen on. Had a great deal of trouble starting the magnetics program. Could not synchronize time as no satellite data coming in so eventually shut computer down and rebooted. The problem persists. Check all cables and Belkin serial to USB adapter, everything fine. Remove USB link to PC while program running and reinserted it. No navigation coming in. Established after several tries that the wrong port number was assigned but still had to reboot 2 or 3 times before finally receiving satellite data and trying to synchronize but, unfortunately, there was no connection to magnetometer. After re-checking all connections as well as disconnecting and reconnecting the magnetometer, and a couple more reboots, everything finally working at approximately 10:20.

10:30 MVP cast.
10:50 Magnetometer in water and logging. Data quality flagged as “acceptable” rather than the usual “excellent”. Will check all connections, etc., alondside this evening. The winds now 15-20 knots, as predicted. Running regional line NE to SW at 10.5 knots. For comfort in heavy swells.
15:38 MVP cast towards end of NE-SW regional line.
21:32 End of regional line, heading to Digby.
21:35 Magnetometer retrieved.
22:40 Secure at Digby, Knudsen off, very uneventful day except for magnetometer this morning

11 July 2006 Tuesday - Day 192

09:05 Depart Digby for survey area. Sunny, wind SW 10-15.
09:35 SOL line #0567. Knudsen on. Low on fuel and water, engineer had to dump some water from port forward ballast to better trim the ship but Knudsen data still looks good.
10:21 MVP cast. Magnetometer streamed, still showing “acceptable” data quality.
14:08 MVP cast.
15:28 MVP cast. Probe left in water, rapidly changing velocities may require another cast.
15:35 Heavy fog.
15:59 SVP cast. The area between CIP 3A and 4A has many sudden and drastic changes in velocity, up to 15 m/s from highest to lowest. The changes are not only in one direction but go up and down very suddenly and, at times, drastically. There were several changes between the various casts in SIS throughout the day.
18:00 Had to abort the line on the SE side of the regional lines because of the heavy fog and extensive activity in the area of the Northwest Ledge, probably whale tour boats.
18:45 Reduced speed to 8 knots, because of unknown boat crossing ahead of us in the fog. Resumed regular speed after 20 min.
20:10 Fog has lifted, good visibility
20:30 Back in fog.
21:22 EOL line #0599, heading to Digby. Magnetometer retrieved, very few twists apparent in cable. Fog has lifted for run into Digby, pleases captain because of numerous lobster buoys.
21:50 Secure at Digby. Had to have a boat moved to secure a berth. MacGowan heading to Halifax, back Thursday evening.

12 July 2006 Wednesday - Day 193

Crew change day. Data cleaning and backup.

13 July 2006 Thursday - Day 194

09:30 Depart Digby for survey area. Cloud, rain, wind NE 15-20 knots. Winds of 20-25 knots predicted, decide to stay close to Digby. Running part of regional line directly off Digby and carrying on to line extensions to NE.
10:02 Knudsen on and logging.
10:35 MVP cast.
10:45 Magnetometer streamed, still showing “acceptable” quality. Continue to attach it to the port side, no apparent additional twisting.
12:30 Wind NE 25-30.
12:43 MVP cast. Change of up to 6 or 7m/s in velocity.
13:10 End of extension line to NE, heading back toward SW, much more comfortable on ship.
14:25 heading from line extensions to regional lines on a NW course. Very uncomfortable on ship, extremely poor data.
14:40 Back on SW course, much more comfortable.

15:20 Tried coming about to reverse course, winds now NE 30 knots, 3 m swells. Too much for Creed, heading to Digby.
15:25 Magnetometer retrieved, got drenched.
16:20 Knudsen turned off, logging off at 16:53.
16:35 Secure at Digby. Still a fair amount of wind beating the Creed against the jetty. Have to stay here, not enough water in protected area. Moved around corner later when space became available. Rogers and Girouard spent remainder of day cleaning and backing up data.

14 July 2006 Friday - Day 195

09:30 Depart Digby for survey area. Heavy fog, wind SW 5-10 knots. Filled short data gap on way out to survey area, NW edge of regional lines. Knudsen on and logging. MacGowan back onboard.
10:20 SVP cast.
10:30 Magnetometer streamed and logging. Program started right away, doesn't seem to be any reason to explain whether or not it will be difficult to start. Quality showing as "acceptable".
13:24 MVP cast.
14:12 MVP cast.
15:36 MVP cast. Again frequent large variations in velocity, close to 15 m/s between CIP 3A and 1A. Location and variations appear to be dependant on direction and state of tides.
19:00 Fog finally lifts, wind SW 10-15 knots.
20:25 End of regional lines. Captain offers to start filling large hole in data that was avoided earlier, visibility is good and buoys can be seen. Appears to be fewer traps set, end of season is near.
21:00 Severe thunderstorms with us till Digby, plenty of wind, rain and lightning. Very impressive to see.
21:48 Magnetometer retrieved, cycling and logging not turned off till 10min later.
22:15 Knudsen turned off.
22:20 Secure at Digby

15 July 2006 Saturday - Day 196

09:30 Depart Digby for survey area. Sunny, misty, light wind. Continue to fill data gaps on way out to regional lines. Line #0647 first line of day.
09:33 Knudsen on and logging.
10:25 MVP cast.
10:35 Start of line #0648, NW edge of regional lines. Magnetometer streamed. Still towing from port side with little or no twisting.
12:30 Noticed that Regulus chart 4011 was different than that on bridge electronic chart system. Turns out that the Regulus chart was an older version from before traffic lane changes were introduced. Loaded a more recent version from ship's CD. Did not delete older version, created new directory c:\Program Files\Ican\Regulus\charts and changed the chart path in Regulus.
13:35 MVP cast. Entering zone of frequent velocity changes, set MVP to cast every 15 min. Did not work first as auto mode was left disabled. Performed approximately 10 casts in automatic mode, not always at 15 min. intervals, sometimes more. Will check refraction and see if data improved. Velocities so variable it is almost impossible to run the whole line on only 2 or 3 casts. As mentioned before, really depends on location and tides.
15:34 End of regional line on NW side. Transiting to SW side to run 1 more line by Northwest Ledge.
17:45 Some problems with MVP's. Data very noisy or non-existent. After several deployments, data seems to be OK.
18:45 Transiting to SW to run a line close to shore. Conditions ideal for this. No wind, clear and near high tide.

19:00 Last MVP of day. Probe finally taken out of water.
19:51 Ran line inside fairway buoy off Centreville.
21:00 Finished inshore line, filling a few data gaps outside Digby.
21:30 Magnetometer retrieved, logging off.
21:35 EOL line #0679, end of day's survey.
21:10 Secure at Digby. Knudsen not turned off till 22:15.

16 July 2006 Sunday - Day 197

09:30 Depart Digby for survey area. Light wind, heavy fog. Running line #0680 out to survey area.
10:00 Knudsen on and logging.
10:36 MVP cast, magnetometer streamed. Start of regional line, heading SW.
11:12 Reverted to MVP from yesterday morning as surface velocity decreased by over 5m/s since 10:36 cast.
12:16 MVP cast. Still heavy fog. Because of trouble with MVP yesterday afternoon, decided to not leave probe in water. Will do a cast when visual observation of data being collected suggests a need. I expect there will be 3 or 4.
13:12 MVP cast.
15:24 MVP cast.
16:05 End of NE-SW line, start of regional line #0695 heading NE.
21:30 Magnetometer recovered.
21:49 End of line #0706, last line of day.
22:10 Knudsen turned off.
22:25 Secure at Digby, very uneventful day. Fog finally cleared up as we entered the Digby Gap.

17 July 2006 Monday - Day 198

09:25 Depart Digby for survey area. Light wind, again heavy fog. Ran line in basin before going through gut. They are taking on fuel this evening so decided to head directly out to NW edge of regional lines, beginning a little SW from where we would normally start, to ensure an appropriate time for arrival.
09:30 Knudsen on and logging.
10:26 MVP cast, magnetometer streamed.
10:40 Start of line #0708, heading SW.
11:44 MVP cast. Surface velocity approximately 8m/s higher than yesterday's in this area.
11:50 Talked to captain about taking on fuel this evening and being on the heavy side tomorrow when the weather is expected to be a little on the nasty side. Captain agreed, will refuel tomorrow instead.
12:40 MVP cast.
12:55 MacGowan noticed that magnetometer not cycling or logging, never turned on. Now cycling and logging.
14:19 MVP cast. Had to delay MVP because of fishing net across path.
15:35 End of line #0719, turning to head NE. Lines completed to NW side of traffic lane, now in separation lane.
17:00 MVP cast.
20:43 End of regional lines. Will fill in gaps on way in to Digby.
21:00 Magnetometer retrieved, entering area with lobster buoys. Cycling and logging stopped.
21:38 End of day's survey, line #0734. Too many buoys to run lines.
21:45 Knudsen turned off.
22:15 Secure at Digby.

18 July 2006 Tuesday - Day 199

09:30 Depart Digby for survey area. Light wind, light mist. Ran line in basin before going through gut. Also filled data gap on way out to survey area.
09:35 Knudsen on and logging.
10:30 Start of regional line, heading SW. Expecting SW 25 later so plan on only going as far as inbound traffic lane before turning back.
10:35 Magnetometer streamed and logging.
11:02 MVP cast.
11:26 MVP cast. Velocities quite irregular. MVP surface velocity 4m/s lower than hull sensor.
11:59 MVP cast. Wind SW 20.
12:25 Reached inbound traffic lane, turning NE.
14:22 At NE limit of line, turning SW. Conditions still good enough to head back towards inbound traffic lane. The ship is light so it is still quite comfortable.
16:00 Back at SW end, at inbound traffic lane. Wind app. SW25, seas app. 2.5m. Probably last trip today down to this end. Heading back NE.
16:30 Seaweed attached to the Magnetometer, cable twisted to the extreme. Brought it on board. Detached magnetometer from cable and streamed the cable with only a cap on the end. Brought it in immediately as, although streamed straight back, extremely tight kinks remaining, afraid of breaking cable. Streamed it out again very slowly, trying to take the twists out as it was paying out. This worked fine, brought it back after a few minutes and the twisting had largely disappeared. Reattached the magnetometer and streamed it once more. A better fin design might eliminate this problem. The leading edge of the present fins are nearly at right angle to the magnetometer. Perhaps if the tops of the fins were rounded or a new pair of fins were built with a more swept back design it would keep anything from being caught up on them. Better still, how about a swivel connector.
17:00 Magnetometer back in water, looks ok, appears to be working fine.
18:10 At NE end of line, weather much better here. Will fill in big data gap that was avoided because of lobster gear.
18:15 Magnetometer retrieved before heading in to area with buoys.
18:28 MVP cast.
21:06 Running line #0764 into Digby.
21:38 Knudsen turned off
22:00 Secure at Digby, taking on fuel.

19 July 2006 Wednesday - Day 200

09:25 Depart Digby for survey area. Light wind, light mist. Ran line #0765 in basin before going through gut. Steamed at speed to start regional line. Also filled data gap on way out to survey area.
09:27 Knudsen on
09:35 A fishing vessel appears to be drifting in middle of channel, towards shallow water. The *Creed* turned around to move alongside the vessel and sounded the horn to rouse the crew. Someone finally appeared in the wheelhouse, somewhat sleepy looking. No problem with boat, they start the engine to move out of channel.
10:50 MVP cast, magnetometer streamed and logging.
11:30 Line terminated, magnetometer retrieved. MacGowan fell ill, returning to Digby.
12:45 Secure at Digby. Ambulance met Creed at dock and took MacGowan to hospital for tests. MacGowan released form hospital in afternoon, tests found nothing. Rogers drove McGowan back to Halifax, returned late in the evening with Kelly Sabadash as a data processor. Girouard went to Brier Island to check station magnetometer. Had to wait a couple of hours for lifeboat

to return to get into building. Had lifeboat sound 2 or 3 areas along dock in Westport so Creed captain can determine if there is enough water for the *Creed* to tie up.

20 July 2006 Thursday - Day 201

03:30 Rodger returns to vessel with Kelly Sabadash, who will take over the multibeam bathymetry data processing, and enable Rodger to function as HIC.
09:10 Parrott joins vessel.
09:20 Depart Digby for survey area with Rodger as HIC, Sabadash as data processor, Girouard and Parrott who joined the Creed for the next 3 or 4 days. Bright and sunny with light wind. Ran line #0768 on way to survey area to fill data gap.
10:35 MVP cast, magnetometer streamed and logging.
10:45 Start of line #0769, picking up where we left off yesterday.
12:25 MVP cast. MVP cast 6m/s higher than ship sensor. Repeat cast, same result. Determine that pump feeding water to ship's sensor not turned on. Everything looks fine after pump switched on.
12:40 MVP cast.
13:12 Knudsen processing gain reduced from 2 to 1
Magnetometer generally shows very low variability. Penetration through overlying sediments evident in some locations on the 3.5 kHz sounder.
14:46 SVP cast.
15:40 End of line #0779, SW end of regional line. Transiting to SE edge of Regional line, through Northwest Ledge. Captain to take the vessel into Tiverton to check out the possibility of tying up at the public wharf if need be. Soundings taken yesterday at Westport indicate that there would only be app. 0.65 m of water under Creed at low tide, too little margin of error.
16:55 Large anamoly on magnetics. 20 m penetration on 3.5 kHz sounder.
17:50 Strong reflector 5-10 m deep on Knudsen 3.5 kHz
18:00 Check magnetometer data from early in the cruise. No navigation data had been logged in the data stream. It will be necessary to integrate the data with navigation from the multibeam bathymetry system using the time strings present in the magnetometer data.
19:08 Recover magnetometer and close file. Run lines into Tiverton to check for sufficient water depth to tie up in case of strong winds.
22:15 Sound near jetty to determine if Creed can tie up inside the jetty, in case of predicted strong northeast winds.
22:30 Alongside at Digby.
Backup Knudsen 3.5 kHz JD 178, 184
Backup Knudsen 3.5 kHz JD 195, 196, 197

21 July 2006 Friday - Day 202

09:30 Depart Digby for survey area. Heavy rain shower in early morning. Overcast with very little wind, fog encountered in Digby Gut. Filled data gap in Digby Gut on way out to survey area.
09:40 Multibeam system and Knudsen on and logging. Magnetometer not deployed.
Stratified sediments on 3.5 kHz profiler.
10:00 SVP cast.
11:40 SVP cast.
13:30 Running lines near shore along Digby Neck to beyond Sandy Cove.
15:30 Winds forecast to increase to NE30-35. Decide to end surveying at end of line.
16:50 Secure at Digby. Winds increasing, white caps in Annapolis Basin. Heavy rain.
17:00 Backup Knudsen 3.5 kHz data JD 198-202. Import a section of HDCS data into GRASS for display and test of the program.

22 July 2006 Saturday - Day 203

09:30 Depart Digby for survey area. Overcast and fog with very little wind.
10:35 Magnetometer deployed. Very consistent signal.
10:40 SVP cast.
10:43 Multibeam system and Knudsen on and logging. Knudsen operating with 3 ms chirp. 20LogR, AGC, processing gain = 1, power level = 2. Penetration of ~10 m evident.
12:05 SVP cast.
14:09 SVP cast.
15:21 Knudsen maximum range had been set to 200 m. Water depth went beyond 200 m and tracking was lost. Reset range to 250 m.
16:00 Acoustic backscatter images were produced from Caris Hips and output as geotiffs. These were imported into ArcMap and overlaid on the bathymetry. The displayed range was modified under the "Layer Properties" to stretch values from 50-110 over the entire grey scale and thus add some contrast to the previously rather bland image. Areas identified as sand waves from the bathymetry show a lower backscatter than the surrounding seafloor. Closer scrutiny shows that many of the iceberg scours and pits have low backscatter associated with them, indicating that fine grained material is accumulating in these areas. The meandering channel about 4.5 km offshore from Digby Neck, and another long section closer to shore also have low backscatter associated.
17:00 End of southwest regional line into Grand Manan Basin, turn and run reciprocal offset line back towards Digby.
21:20 End of line. Recover magnetometer

23 July 2006 Sunday - Day 204

09:30 Depart Digby for survey area. Overcast and fog with 25 knot winds from the SW.
10:00 Too much wind at survey site for operations. Return to jetty in Digby. Continue with data cleaning and backups.

24 July 2006 Monday - Day 205

09:30 Depart Digby for survey area. Wind 10-15 knots, fog, heavy swell, overcast. Filled data gap on way out to survey area.
09:40 Knudsen on and logging.
10:38 MVP cast.
11:15 Magnetometer streamed and logging.
10:46 Start of regional line #0840, heading SW. Picking up line where we stopped on Saturday, app. 15 km from NE end. We are now too far from shore to complete one full regional line per day. Plan on doing shorter lines at NE end tomorrow, then picking up from end of these on subsequent days.
12:25 MVP cast.
14:11 MVP cast. Swell getting bigger as we approach outer end of line.
15:10 MVP cast.
15:48 At SW end of regional line, turning NE. More comfortable in this direction.
17:45 No fog for the past 2 or 3hrs, light winds, light swell, some blue sky starting to show.
21:00 End of regional line. Knudsen off, magnetometer retrieved, cycling and logging not turned off till 21:30. Running line #0867 on way in to Digby to fill a data gap.
22:15 Secure at Digby. Uneventful day, a little uncomfortable in the heavy swell.

25 July 2006 Tuesday - Day 206

09:30 Depart Digby for survey area. Wind SW10-15, sunny for a change. Problem with fuel transfer pump shortly after leaving dock. Stood by just inside Gut while bypass put in place, engineer will repair pump this morning.
09:45 Underway, filled data gap on way out to survey area.
10:05 Knudsen on and logging.
11:02 MVP cast, magnetometer streamed and logging. Start of regional line #0871, heading SW. Picked up line app. 20 km SW of NE end.
12:43 MVP cast.
14:37 MVP cast.
15:45 At SW end of regional line, turning NE to run line #0882. MVP cast.
19:00 Winds S20, still sunny.
20:25 End of line #0892, magnetometer retrieved, cycling and logging not turned off till 20:45. Heading to Digby to fuel at 22:00
20:45 Knudsen turned off.
21:45 Secure at Digby.

26 July 2006 Wednesday - Day 207

Crew change day. Cleaned and reviewed data in morning. Scott Hayward arrived early afternoon and all went to Brier Is. to check station magnetometer and tide gauge.

27 July 2006 Thursday - Day 208

09:30 Depart Digby for Survey area, winds light, calm seas
10:23 Knudsen logging underway
10:34 MVP cast
12:24 MVP cast
14:13 MVP cast
15:15 MVP cast
15:25 Magnetometer cycling and logging started
16:25 MVP cast
16:40 Turn NE
17:02 Magnetometer re-positioned to centre of vessel (mildly twisted)
19:40 Magnetometer retrieved to remove twists
20:00 Magnetometer back in water, cycling and logging. Wind SW15, sunny and clear.
21:33 Magnetometer retrieved, Line#0917 ended, heading back to Digby, Cease operations for the day.
21:38 Knudsen Logging stopped

28 July 2006 Friday - Day 209

09:30 Depart Digby, Overcast, winds 5-10 knts, sea state 1.5 - 2.5m
10:36 MVP cast
10:47 Magnetometer deployed, layback was re-measured and layback set to 68m (appears layback was being measured from stern not vessel reference point)
10:53 Underway and logging, heading SW - MB line#0918
11:06 Ship speed slowed from 12 to 10 knots due to sea state
11:50 Error on SIS: “!grid engine thread stopped or not running”. SIS restarted
12:50 Run survey line back to Digby to enable the engineer needs to change the starboard engine air intake (estimates 6 hrs labour). Also, the sludge tank needs to be pumped at high tide.
14:49 Knudsen logging stopped. Cease operations for the day.
15:57 Tied alongside wharf in Digby.

29 July 2006 Saturday – Day 210

09:00 Depart Digby, overcast, winds 0-5 knots, sea state 0-1 m.
10:11 Knudsen on and logging.
10:14 MVP cast.
10:16 Magnetometer deployed.
10:19 Underway and logging from a position (4 km NE of traffic call in point 6 mike) running SW line #0926, visibility very good > 1.5 km.
12:19 MVP cast
12:43 Data gap due to lost bottom tracking.
12:44 Data logging properly.
13:00 Deep swell and low winds with poor visibility.
14:17 MVP cast.
14:33 Wind Picking up, Captains discretion to end line early, turning northeast
14:39 Turning back NE significantly less vessel pitch in this direction
21:11 Line #0952 completed, survey day end
21:14 Magnetometer Retrieved, heading back to Digby
21:16 Knudsen logging stopped for the day, cease operations for the day.
22:00 Defragging SIS drive.

30 July 2006 Sunday –Day 211

09:11 Depart Digby, clear skies, winds 0-5knts, sea state 0-1 m.
10:23 MVP cast.
10:25 Magnetometer deployed, 3.5 Knudsen logging, clear, visibility > 15 km.
10:28 Multibeam line #0953 underway heading SW.
12:24 MVP cast.
14:03 MVP cast, winds from NW, (moderate swell developing between 3 Bravo and 2 Bravo traffic zone), increased vessel pitching.
15:15 MVP cast.
16:43 *44° 16.4522’ - 66° 47.4324’ DDM Basking Shark spotted off port bow
21:03 MB line #0979 finished, 3.5 Knudsen turned off, heading to Digby
21:07 Magnetometer on board, cease operations for the day.
22:28 Tied up in Digby.

31 July 2006 Monday - Day 212

09:06 Depart Digby for survey area, winds light, sea state 0-1 m, skies fairly clear.
10:00 Knudsen and magnetometer both indicate the GPS data are not available. The POS-MV system was rebooted, which cleared the problem.
10:13 MVP cast. Visibility greater than 15 km.
10:34 MB line #0980 underway with POS sync problems.
10:47 SIS reboot just completed line #0981 underway everything looks fine. Magnetometer deployed and logging, still troubleshooting Knudsen.
12:12 Knudsen logging, appears to have been a problem with the “serial connection splice cable” problem corrected
12:25 MVP cast
12:36 Knudsen logging re-started, problem from earlier???
12:49 Alter course for fishing vessel (near traffic corridor 3 Bravo).
14:20 Circle for infill.
14:25 Back on line 0990.
15:07 MVP cast, more fish/sharks in same area as yesterday.

16:01 Heading NE from (traffic area 1 Bravo) back toward Digby.
21:02 Multibeam line #108 finished, Magnetometer retrieved, Knudsen turned off, heading back to Digby. Cease operations for the day.
22:18 Tied at wharf in Digby.

01 August 2006 Tuesday - Day 213

09:32 Depart Digby for survey area, winds light, waves 0-1m, skies fairly clear, visibility > 15 km.
10:15 Captain informs me we must return early for fuel, 17:00 local.
10:39 MVP cast, Knudsen turned on and logging.
10:44 Magnetometer problems, will not synchronize with GPS time. This is a definite software issue, telling the user that the system cannot find a valid NMEA string when in fact it is present. The system was rebooted several times and the communications ports on the POS-MV and the Sealink magnetometer compared. The magnetometer was finally deployed at UTC/GPS time 11:44:26. Note that the magnetometer showed the time as 21:26. The data set will have to be synchronized to GPS time later.
10:49 Start multibeam line #1009, heading SW.
12:03 MVP cast.
12:30 Veer off line to avoid fishing buoys.
13:28 MVP cast. The magnetometer is still not functioning. It will be necessary to contact the manufacturer to determine the cause of the problem with the system.
14:41 Turn NE and head towards Digby to refuel the vessel, and to meet technician from Knudsen Engineering who will install another transducer board in the Knudsen 320B echosounder.
18:15 MB Line #1026 complete heading back to Digby. Magnetomer recovered.
18:21 Knudsen logging stopped.
16:40 Tied along wharf in Digby.
17:00 Darren Gibson from Knudsen Engineering joins the vessel to install a 120 kHz board in the Knudsen sounder and connect to the 120 kHz transducer.
22:00 Installation of 120 kHz sounder complete.

02 August 2006 Wednesday – Day 214

09:30 R. Parrott joins vessel. Tied along side wharf in Digby. Waiting for a new pump for the ship's generator.
13:11 Leaving wharf after the engineer made temporary repairs to the pump.
13:45 MVP cast.
14:11 MB Line #1026 underway heading NE baseline along shore to a point NE of Parkers Cove, magnetometer not deployed due to close proximity to shore.
14:16 MVP cast. Circulating pump for surface velocity measurements had been turned off on vessel. Restart pump - continuing line.
20:20 Tied along wharf in Digby. R. Parrott departs vessel.

03 August 2006 Thursday – Day 215

09:11 Leaving wharf in Digby, Overcast, Winds 10 knots, waves 1-2 m.
10:21 MVP cast.
10:23 Knudsen on and logging. The magnetometer would not work. Investigate problem/
10:30 MB line #1043 started, heading SW.
11:08 MVP cast.
12:16 MVP cast and magnetometer deployed, still no positioning being logged on the magnetometer 00:56:30 Magnetometer Time 12:20:36 GPS Time
13:29 MVP cast.

14:48 Turned 2nm after 2 Bravo, heading NE
18:52 Turning off survey block at 6 Mike and heading North to Saint John to meet John Hughes Clark et al. Still running sounders.
19:03 Magnetometer on board
21:24 MB Line#1069, Finished in Saint John Harbour, Knudsen stopped logging, cease operations for the day.
22:00 Awaiting John Hughes Clarke,
24:00 New velocimeter installed on MVP with help from G. Rodger and engineer.

04 August 2006 Friday – Day 216

09:51 Leaving Wharf Saint John, skies slightly overcast, light breeze, visibility > 8 km. John Hughes Clarke from the Ocean Mapping Group at the University of New Brunswick has joined the vessel for the day.
Note that the captain used a lead line to measure the water depth at the Coast Guard wharf in Saint John last night and discovered that there was only 0.3 m clearance at low tide. He explained that with a spring tide the vessel would have touched the bottom. The initial plan was to dock on the southwest side of the harbour at the "Navy Island Terminal 2B west side" but that there were no cleats to put his lines on. The cruise ship dock (Pugsley Terminal) would be a preferable location for docking the vessel. The CHS tide table for Saint John shows high tide at 6.9 m last night and low tide of 2.0 m this morning.
09:54 Begin logging line #1070, Saint John Harbour.
10:15 J. Hughes Clarke begins continuous cycling on MVP with new velocimeter that he installed to provide temperature readings in addition to the velocity and depth values provided by the previous sensor.
10:41 SVP sent up.
11:14 SVP sent up.
12:17 SVP sent up.
12:17 SVP sent up, visibility < 5 km.
14:13 New course 235° staying in Bay of Fundy Traffic Channel, passing (2 Bravo).
15:35 New MVP file conflicted with SIS, holes in coverage.
16:44 Turn NE in Bay of Fundy Traffic Channel heading back to Digby, redundant coverage, still logging, overcast w/ drizzle, visibility <1 km.
17:42 MB Line #1099. Finished operations for the day, heading back to Digby
18:25 Tied at Digby for the night, John Hughes Clarke departs, Kelly Sabadash (COGS/CHS student) leaves vessel.

05 August 2006 Saturday – Day 217

09:12 Depart Digby Wharf, overcast, sea state clam, wind 5 knots, visibility low, due to the foggy conditions < 250 m.
10:30 Magnetometer deployed and logging. Note that there is still no GPS time synchronization. 10:29:03 GPS UTC, 09:41:21 magnetometer time.
10:34 Knudsen dual frequency logging. MVP cast.
10:38 On MB line #1101 heading SW.
11:00 Visibility improving, sea state very good.
13:15 MVP cast.
15:36 MVP cast.
21:09 Magnetometer brought onboard, untwisted 21:09:29 GPS UTC, 20:21:49 Magnetometer Time. MB #line 1127 just completed.
22:41 Knudsen sounders stopped logging for day in North Head Harbour.

22:45 Secure in North Head, Grand Manan Island, NB. Run multibeam bathymetry line all the way to the wharf.

06 August 2006 Sunday – Day 218

09:30 Depart Wharf in North Head Harbour. Visibility greater than 15 km, clear skies, fair seas
09:37 Knudsen Transducers logging.
09:38 Multibeam line #1131 underway. Note that all the coverage files are missing from the SIS hard drive. Begin generating new track lines. A decision was made to collect data along lines parallel to old data.
10:56 MVP cast.
10:58 Magnetometer deployed and logging. Still no GPS synchronization. GPS UTC time 10:58:32, magnetometer time 00:02:13.
11:46 SIS crash "Microsoft error must shutdown".
12:32 MVP cast.
13:40 MVP cast.
17:38 Heading back to Grand Manan.
18:49 A large pod of Right whales was encountered. The magnetometer was recovered. GPS time 18:59:00 magnetometer 07:53:04.
19:04 Knudsen sounders off.
19:10 Secure at North Head, Grand Manan.

07 August 2006 Monday – Day 219

09:06 Depart Wharf in North Head Harbour, Visibility > 8 km, winds SSW 20-25 knots, heading south.
09:17 Knudsen on and logging 3.5 and 120 kHz data. MB line #1158 underway
10:23 MVP cast.
10:26 Magnetometer deployed GPS/UTC 10:26:03, 00:01:44 magnetometer time.
11:45 Mayday call received. Break line to respond to call.
11:50 There are 2 vessels closer to the vessel in distress. Turning back SW to resume survey.
13:50 2 m seas. Heave showing in data.
17:35 Magnetometer onboard and stopped logging 17:27:07 GPS/UTC time 07:02:46 Magnetometer time
17:38 2.5m seas. Heading back to Digby. (end MB line#1178). Winds 30 knots out of the south
20:30 G. Rodger departs for Halifax.
23:30 R. Parrott and E. Patton arrive at vessel.

08 August 2006 Tuesday – Day 220

10:40 Depart wharf in Digby, light winds, fog. < 1 m swell. Heading NW to resume inner bay coverage. R. Parrott and E. Patton on board.
10:49 Began logging Knudsen transducers.
12:15 SVP.
12:19 SOL 1179. Magnetometer deployed GPS/UTC 12:19:37, 01:17:37 Magnetometer time. Begin transit along NW line towards Grand Manan.
14:00 Running regional SW line towards Grand Manan. 1-2 metre swells. Light winds.
15:28 SVP.
16:00 Detour around a series of 5 targets on radar. Pass about 500 m from targets but unable to see them due to heavy fog.
16:30 End of line. Fog lifting, sea calm. Start SW line for transit back to Digby.
17:30 Run line through area where targets seen earlier. No sign of vessels or buoys in clear visibility.

18:21 SVP.19:40 High pitched whine coming from equipment enclosure in lab. Temperature 28.6 degrees in enclosure. Start air conditioner.
20:00 Calm seas, clear with good visibility. Continuing line NE towards Digby.
21:00 Power down Knudsen transceiver and computer, POS-MV and computer. Noise still present.
20:45 EOL. Stopped logging Simrad. Stopped logging magnetometer at 20:45:48. Retrieving magnetometer.
21:05 Call Gerrard Costello to ask him to arrange for replacement electronics. Shut off UPS while talking to him. Noise still present. The only electronics running in the rack is the RAID. Costello contacted G. Rodger, and passed his phone number to us. G. Rodger was unfamiliar with the detailed workings of the RAID. It was suggested that one of the CHS technical support group who was familiar with the unit be contacted, and if necessary travel to Digby tomorrow during the crew change.
22:00 Secure in Digby. R. Parrott departs for Halifax.

09 August 2006 Wednesday – Day 221

Crew change day. Continue with data processing.

10 August 2006 Thursday – Day 222

09:00 Departed Digby wharf en route to survey area at NW edge of current coverage.
E. Patton, A. Smith (CHS), and G. Rodger on board.
10:10 Deployed magnetometer and MVP.
10:19 SOL. Surveying NE to SW. Began loggin Knudsen, EM 1002. Skies overcast, visibility good. ~ 0.5 – 1.0 m swell. Winds 14 knots, northerly.
13:17 SVP.
13:42 EOL. Heading back to Digby, running SW-NE line on the way back. Sunny with light winds.
13:44 SOL.
15:00 Using first SVP of the day, 20060810_101121_salinity.03200.asvp.
15:09 Stopped logging Simrad. Problems with SIS CPU in wheelhouse. Circling back on line.
Hard drive on SIS CPU was full. Deleted temporary files fixed the problem.
15:38 Started logging Simrad again. Line 1212.
15:42 Display problems with SIS computer. Stopped logging on line 1212.
15:51 Rebooted SIS computer, started logging again on line 1213.
16:02 Stopped logging Simrad. Unknown problems with SIS computer prevents real-time swath coverage from updating on helm display. Data appears to be recording properly despite this. Resuming line running on line 1214.
17:38 EOL. Retrieving magnetometer.
17:48 Magnetometer on board. Steaming to Digby.
19:15 Creed secured at Digby wharf.

11 August 2006 Friday – Day 223

09:00 Creed departs Digby wharf. Sunny day, light winds. ~ 0.5 m swell.
10:05 Magnetometer deployed, MVP cast.
10:09 Logging magnetometer.
10:23 SOL. Running a NE-SW line on the northwestern edge of current coverage. Began logging multibeam bathymetry and Knudsen.
13:28 Visibility excellent, > 35 km.
13:55 MVP cast. Had to repeat the MVP cast 4 times because seaweed was caught in the MVP echosounder, giving empty files.
14:20 Successful cast. MVP retrieved.

14:50 SVP changing rapidly through this portion of the line. Increased from 1490.5 to 1501.0 in about 5-10 minutes.
15:39 Began turn to the NNW to run a line on the east side of existing coverage east of Grand Manan Island.
18:00 End of NNW line into Owen Basin; running a SSE line adjacent to previous line back to North Head, Grand Manan.
22:05 EOL. Stopped logging magnetometer. Retrieved magnetometer. Heading to North Head, Grand Manan. Continuing to log multibeam bathymetry all the way into the wharf on line number 1246.
22:21 Stopped logging Simrad. Entering North Head to secure at jetty.

12 August, 2006 Saturday – Day 224

09:23 Creed departs wharf at North Head, Grand Manan. Logging Simrad on a transit line out to the main survey area east of North Head, Grand Manan. Weather is clear, sunny, light winds, no swell.
09:27 Began logging Knudsen.
09:36 SVP cast.
09:38 Magnetometer deployed. Began logging magnetometer at magnetometer time 23:39:10.
09:49 SOL. Continuing survey line that was broke off at the end of JD223, steaming to the SE.
10:45 SVP cast. Winds have increased to 10 knots.
12:49 Breaking off of NW line to circle and fill a hole in coverage from an adjacent line surveyed JD223.
12:53 Filled the hole, now circling to resume our course NW.
13:06 Passed through the wake of Grand Manan ferry; bubbles in water column caused sounder to intermittently lose bottom; will cover this area on the return line.
13:37 SOL multibeam line 1259; circling to fill hole in adjacent line.
13:40 Filled hole; circling back on original NW line.
13:45 SOL 1261; a regular NW-SE line.
14:15 Circled back on previous line to filled bad data gap caused by ferry at 13:06.
14:35 Along-track banding pattern noted on multibeam bathymetry backscatter.
15:45 Noted increase in currents and eddies in area east of Clarks Ground; passing through distinct bodies of water; SVP changing constantly.
17:21 Clouding over; rain beginning.
18:22 Wind has increased to 15 knots.
19:01 Wind and rain have subsided.
19:29 Line 1280: Cutting this line short, about halfway, and turning to port and running the next line to the northwest. This is a logistical move to allow the Captain enough time to receive water in North Head.
21:34 EOL. Stopped logging magnetometer. Retrieving magnetometer.
21:44 Magnetometer on board. Running line 1286 as a transit line back into North Head, Grand Manan.
21:57 Stopped logging Simrad. Stopped logging Knudsen.
22:01 Creed secured at North Head wharf.

13 August 2006 Sunday – Day 225

09:24 Creed departs wharf in North Head, Grand Manan, en route to survey area east of Grand Manan. This morning is clear, calm, NW winds 10 knots.
09:28 Multibeam bathymetry logging en route to the survey area.
09:36 Magnetometer deployed. Magnetometer logging 00:30:31 magnetometer time.

09:37 Knudsen logging.
09:51 MVP cast.
09:58 SOL in main survey area. Running a NW-SE line, bearing 150.
11:48 MVP cast.
14:00 Wind has died down completely; flat clam.
16:46 Circling off this line to fill a data hole.
17:11 Stopped logging magnetometer because it got tangled in seaweed, making the cable spiral.
17:28 Tangle straightened out, magnetometer re-deployed. Logging started.
20:34 Running line 1315 in such a way to straighten the survey grid.
21:18 End of survey operations for the day. Stopped logging magnetometer; retrieving.
21:23 Magnetometer on board. Continuing to log Simrad and Knudsen into Long Island Bay.
21:32 Stopped logging Simrad and Knudsen.

14 August 2006 Monday – Day 226

09:30 Departed North Head wharf en route to survey area. Logging Simrad, Knudsen on the way out on a transit line.
09:39 Magnetometer deployed, logging on mag: Magnetometer time 00:20:00.
09:56 SOL in main survey area. Surveying a NW-SE line. Weather is sunny, clear, light winds.
10:17 MVP cast.
11:53 MVP cast.
13:30 Beginning with line 1330, filling in an extreme curve in the survey lines caused by a shoal south of the Wolves.
15:29 Sounder stopped sounding for a few seconds. Circling to fill hole in data coverage.
18:30 Winds have picked up noticeably. ~ 15 knots now. Sea very choppy with many whitecaps.
18:35 Striping noted on the Knudsen and multibeam backscatter.
21:40 Filling data gap in an area created from transit lines in and out of North Head.
21:52. Finished survey operations for the day. Returning to North Head, Grand Manan. Stopped logging magnetometer.
21:56 Retrieved magnetometer. Continuing to log Simrad and Knudsen on the way in to North Head.
22:04 Stopped logging Knudsen.
22:15 Creed secured at wharf.

15 August 2006 Tuesday – Day 227

Winds too high for surveying (20-35 knots). Spent the whole day processing alongside.

16 August 2006 Wednesday – Day 228

09:30 Creed departs wharf en route to West Head. Weather sunny, clear, large slow swell from yesterday's wind.
09:35 Began logging multibeam, Knudsen. Surveying on a transit line to West Head, Cape Sable Island.
09:48 Magnetometer deployed.
09:51 Began logging magnetometer. (magnetometer time 00:30:00).
09:58 MVP.
17:20 EOL. Stopped logging multibeam, Knudsen and agnetometer. Retrieving magnetometer.
17:24 Magnetometer on board. Creed is steaming directly to West Head.
21:00 Creed secured at wharf in West Head, Cape Sable Island.

16 August 2006 Thursday – Day 228

Transit to Halifax

17 August 2006 Friday – Day 228
Patch test in Bedford Basin. Demobilize CHS and GSCA gear.
End of 2006 Bay of Fundy Survey.

Appendix III - Predicted Tides for Digby

Hourly values in centimeters 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												
14-Jun-06	12:00a	663	787	821	759	636	480	309	159	87	120	228	373
14-Jun-06	12:00p	537	686	766	749	660	533	385	239	146	148	237	373
15-Jun-06	12:00a	531	691	802	817	741	610	449	278	138	85	135	252
15-Jun-06	12:00p	403	568	711	775	744	646	513	362	219	137	153	251
16-Jun-06	12:00a	391	551	707	807	808	723	587	425	255	126	88	149
16-Jun-06	12:00p	273	428	594	729	782	742	637	500	346	205	132	157
17-Jun-06	12:00a	258	400	561	713	803	796	707	570	407	241	121	94
17-Jun-06	12:00p	162	290	447	613	742	788	742	635	494	337	198	129
18-Jun-06	12:00a	157	258	400	561	710	794	783	694	557	397	236	123
18-Jun-06	12:00p	102	174	303	461	626	752	794	746	636	492	333	194
19-Jun-06	12:00a	126	152	252	393	553	699	781	771	684	551	394	237
19-Jun-06	12:00p	128	111	184	312	470	635	759	799	750	639	494	332
20-Jun-06	12:00a	190	120	145	242	381	540	686	769	762	678	550	396
20-Jun-06	12:00p	242	135	120	192	319	477	641	765	805	755	643	495
21-Jun-06	12:00a	330	185	112	135	230	368	528	676	761	755	675	550
21-Jun-06	12:00p	400	247	141	127	199	326	484	648	772	810	757	643
22-Jun-06	12:00a	493	323	175	102	125	221	359	521	671	757	751	672
22-Jun-06	12:00p	550	400	247	144	133	208	335	494	659	781	813	755
23-Jun-06	12:00a	637	483	310	161	92	120	219	360	525	675	757	747
23-Jun-06	12:00p	666	543	392	241	143	140	220	350	511	675	790	812
24-Jun-06	12:00a	745	622	464	289	144	85	123	228	373	539	686	758
24-Jun-06	12:00p	738	652	527	376	228	141	151	239	373	534	694	797

25-Jun-06	12:00a	805	727	597	436	263	128	85	137	250	399	564	701
25-Jun-06	12:00p	757	724	630	502	351	211	141	167	265	403	565	716
26-Jun-06	12:00a	801	789	699	564	401	233	116	95	163	284	435	596
26-Jun-06	12:00p	716	751	701	600	468	320	194	146	191	298	440	599
27-Jun-06	12:00a	735	798	765	662	522	360	204	111	115	199	327	479
27-Jun-06	12:00p	629	728	739	673	563	429	287	180	158	221	337	481
28-Jun-06	12:00a	632	749	786	732	619	476	318	180	115	145	243	376
28-Jun-06	12:00p	526	661	733	720	640	523	389	257	174	177	257	379
29-Jun-06	12:00a	522	662	755	765	694	573	428	279	165	130	182	291
29-Jun-06	12:00p	428	571	686	732	697	605	483	350	234	177	202	294
30-Jun-06	12:00a	420	560	684	751	736	651	525	383	248	159	152	222
30-Jun-06	12:00p	339	477	611	704	725	672	570	445	318	219	186	231
01-Jul-06	12:00a	330	458	591	696	738	703	608	480	344	226	164	181
01-Jul-06	12:00p	264	386	522	643	713	713	646	538	412	293	213	201
02-Jul-06	12:00a	258	362	488	611	697	718	669	569	443	315	216	177
02-Jul-06	12:00p	212	304	427	558	664	715	698	622	510	387	277	213
03-Jul-06	12:00a	216	282	387	509	621	691	696	638	537	415	298	216
03-Jul-06	12:00p	195	242	339	461	584	678	713	683	602	489	368	267
04-Jul-06	12:00a	215	229	299	403	521	624	681	676	614	515	399	291
04-Jul-06	12:00p	221	214	268	366	486	603	686	710	672	587	473	353
05-Jul-06	12:00a	257	214	235	307	412	527	624	674	662	599	502	389
05-Jul-06	12:00p	288	227	227	287	385	504	618	695	710	666	576	460
06-Jul-06	12:00a	339	245	207	233	309	415	532	628	673	658	592	494
06-Jul-06	12:00p	382	282	226	234	298	400	521	635	708	717	665	569
07-Jul-06	12:00a	446	321	226	193	225	307	420	541	639	681	660	590
07-Jul-06	12:00p	487	372	270	218	233	305	413	541	658	728	729	666

08-Jul-06	12:00a	560	428	295	199	172	215	307	430	560	660	697	666
08-Jul-06	12:00p	586	476	353	248	201	226	311	430	567	689	755	743
09-Jul-06	12:00a	666	546	402	261	166	149	207	314	449	588	688	716
09-Jul-06	12:00p	672	578	456	324	217	178	220	320	454	601	727	784
10-Jul-06	12:00a	756	661	526	369	221	130	128	205	329	478	625	722
10-Jul-06	12:00p	735	673	564	429	288	181	155	217	334	482	640	766
11-Jul-06	12:00a	811	762	649	499	330	178	96	115	213	352	514	666
11-Jul-06	12:00p	754	749	668	544	398	248	146	137	219	353	514	680
12-Jul-06	12:00a	802	829	760	631	468	289	137	71	112	228	381	553
12-Jul-06	12:00p	707	783	757	658	522	364	209	116	127	227	373	544
13-Jul-06	12:00a	715	828	837	750	608	435	250	103	56	119	249	413
13-Jul-06	12:00p	593	743	803	759	647	500	332	176	95	125	238	393
14-Jul-06	12:00a	571	742	842	832	732	582	402	216	81	55	134	274
14-Jul-06	12:00p	447	630	772	815	756	634	480	305	152	86	130	250
15-Jul-06	12:00a	410	591	757	842	817	709	555	373	192	73	65	156
15-Jul-06	12:00p	302	478	660	790	818	748	622	462	286	140	86	139
16-Jul-06	12:00a	262	422	602	758	829	794	684	531	352	181	79	85
16-Jul-06	12:00p	182	329	505	681	797	813	738	609	448	274	138	95
17-Jul-06	12:00a	151	271	429	603	747	806	767	660	512	341	183	96
17-Jul-06	12:00p	111	209	353	524	690	795	802	726	599	440	272	145
18-Jul-06	12:00a	107	162	277	428	594	727	779	741	640	501	341	196
18-Jul-06	12:00p	119	139	233	371	535	690	785	789	715	592	438	276
19-Jul-06	12:00a	155	119	170	278	422	578	703	753	720	628	498	349
19-Jul-06	12:00p	214	144	162	250	381	537	683	773	777	707	588	439
20-Jul-06	12:00a	283	165	128	173	275	412	562	683	734	707	622	501
20-Jul-06	12:00p	360	231	163	178	260	385	535	676	764	770	703	587

21-Jul-06	12:00a	441	287	170	131	172	269	403	550	671	724	701	621
21-Jul-06	12:00p	506	368	241	173	186	265	387	534	674	761	768	700
22-Jul-06	12:00a	585	439	285	167	128	170	267	401	549	670	724	700
22-Jul-06	12:00p	620	504	367	239	172	188	269	393	541	681	766	767
23-Jul-06	12:00a	695	577	428	271	155	122	171	274	411	561	681	729
23-Jul-06	12:00p	697	612	493	352	226	165	190	279	408	559	698	775
24-Jul-06	12:00a	764	682	558	404	247	139	120	182	293	436	587	700
24-Jul-06	12:00p	733	688	594	469	325	204	158	199	299	434	588	721
25-Jul-06	12:00a	782	752	658	525	367	215	124	127	205	327	476	623
25-Jul-06	12:00p	720	731	668	563	431	288	181	158	219	331	473	625
26-Jul-06	12:00a	743	780	729	620	480	321	182	118	148	243	376	527
26-Jul-06	12:00p	663	735	719	638	522	384	247	164	170	251	374	521
27-Jul-06	12:00a	665	759	766	692	571	424	270	154	124	182	294	435
27-Jul-06	12:00p	583	700	740	697	599	472	332	211	158	193	292	425
28-Jul-06	12:00a	571	700	763	738	644	513	364	224	139	145	228	353
28-Jul-06	12:00p	499	638	727	734	666	553	419	284	185	165	227	339
29-Jul-06	12:00a	477	618	723	752	700	591	453	309	190	141	179	281
29-Jul-06	12:00p	416	560	682	740	716	629	505	368	245	174	185	266
30-Jul-06	12:00a	388	526	654	730	729	655	537	399	265	173	158	222
30-Jul-06	12:00p	336	475	612	711	738	690	589	460	326	219	176	212
31-Jul-06	12:00a	306	431	564	674	723	697	611	489	356	239	175	188
31-Jul-06	12:00p	268	388	524	649	724	725	660	551	422	296	209	189
01-Aug-06	12:00a	241	341	465	589	680	705	663	571	453	329	231	191
01-Aug-06	12:00p	223	312	431	560	669	722	705	631	520	395	279	209
02-Aug-06	12:00a	207	267	367	486	599	673	683	633	542	430	318	236
02-Aug-06	12:00p	213	256	346	461	581	676	714	686	608	500	379	273

03-Aug-06	12:00a	214	221	284	382	495	599	662	664	613	526	421	317
03-Aug-06	12:00p	246	233	280	368	478	592	678	707	675	597	489	371
04-Aug-06	12:00a	269	216	226	289	385	495	597	656	656	605	521	419
04-Aug-06	12:00p	319	252	241	289	377	486	599	683	710	676	596	486
05-Aug-06	12:00a	365	261	207	218	282	381	495	599	660	661	610	523
05-Aug-06	12:00p	417	314	244	234	284	376	492	610	698	726	689	602
06-Aug-06	12:00a	484	354	243	184	197	269	376	501	614	680	679	621
06-Aug-06	12:00p	525	410	297	221	211	270	373	501	631	727	755	709
07-Aug-06	12:00a	609	477	333	210	149	170	255	378	517	643	713	705
07-Aug-06	12:00p	633	522	392	266	183	179	253	373	518	663	767	790
08-Aug-06	12:00a	729	610	461	301	166	108	144	249	390	547	685	754
08-Aug-06	12:00p	732	640	511	364	223	137	147	240	380	543	703	811
09-Aug-06	12:00a	821	740	602	435	258	117	69	127	253	413	588	733
09-Aug-06	12:00p	794	752	640	494	328	175	93	122	236	393	573	745
10-Aug-06	12:00a	848	841	738	584	401	212	72	43	125	269	446	634
10-Aug-06	12:00p	780	825	761	632	470	289	129	60	110	241	412	605
11-Aug-06	12:00a	781	872	843	724	558	364	169	41	36	138	296	485
11-Aug-06	12:00p	680	818	842	759	617	443	252	95	44	113	255	433
12-Aug-06	12:00a	632	803	876	828	698	527	328	137	29	48	164	330
12-Aug-06	12:00p	525	719	840	842	746	597	416	222	77	46	127	273
13-Aug-06	12:00a	454	652	809	861	799	667	495	299	122	38	76	199
13-Aug-06	12:00p	366	561	744	844	829	726	574	392	204	77	62	150
14-Aug-06	12:00a	293	471	660	798	831	763	634	468	282	126	64	114
14-Aug-06	12:00p	237	401	587	753	833	805	701	553	375	201	91	89
15-Aug-06	12:00a	175	312	481	655	773	793	726	604	449	280	145	101
15-Aug-06	12:00p	155	272	427	600	746	809	777	677	536	369	210	116

SeaSpy Marine Magnetometer:

This was the first GSCA survey with the SeaSpy Magnetometer. The fish was towed at an average depth of 1 m below the sea surface at a speed of 10-12 kts in varying sea states. The system uses Overhauser sensors and measures ambient magnetic field regardless of survey direction or orientation with the field. The system requires 2 people to deploy the fish (~20 kg), but is rather low maintenance once it is deployed. A known steel hull wreck was crossed twice by the magnetometer (once just of nadir and once near nadir) and significant variance was observed in water depth of approx. 100m (figure 8). All preliminary field observations show data quality as excellent.

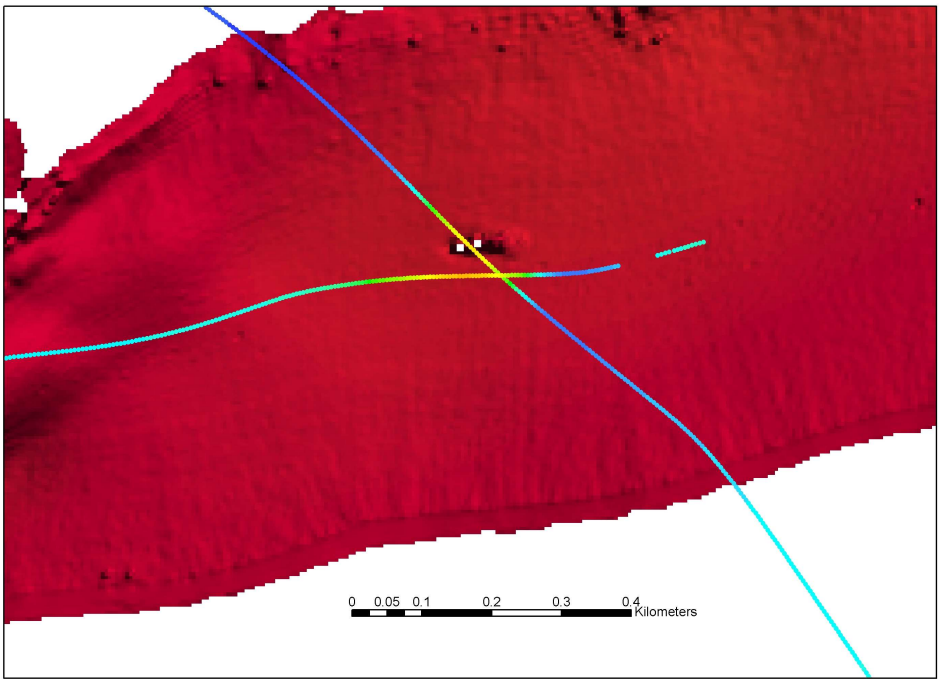

Figure 1- Magnetometer response to two crossings of a known wreck.

Procedures for Sea-Spy Magnetometer deployment during this survey

1. Tow point on Fish- 60m of cable measured on wharf (3 times vessel length)- Using Samson braid rope, created tow point (braided, clamped and taped).

2. Tow point on Vessel- Nicopress fitting on ½" wire cable affixed to aft-port cleat. Tow points connected by small shackle (figure 9).

3. Spool- 60 m *cable* wrapped loosely around port cleats (figure 10), 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).

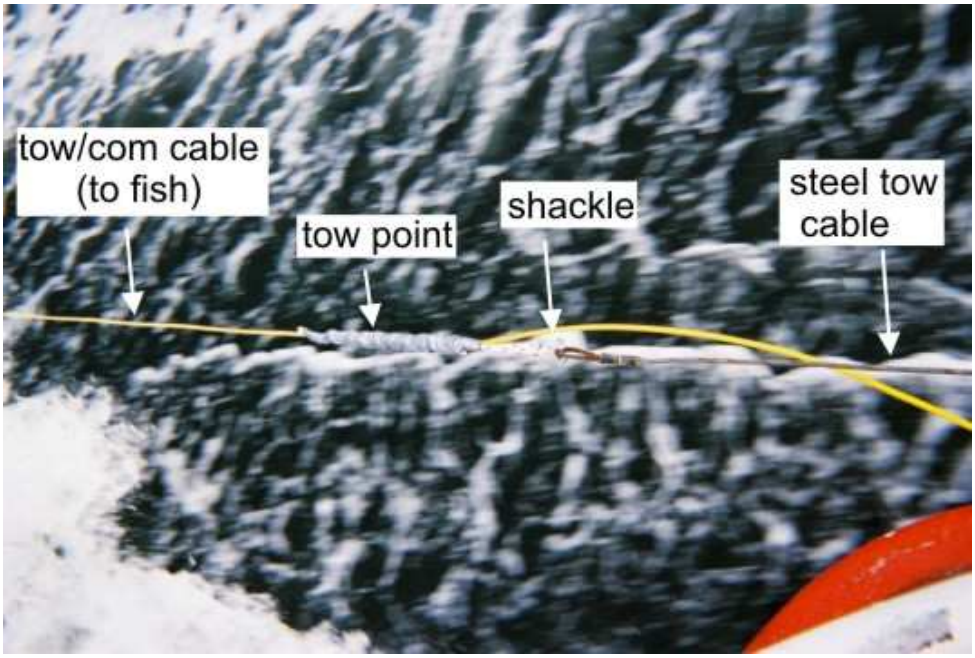

Figure 2- Magnetometer tow point in action.

4. Setup GPS input. Software accepts standard NMEA nav 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

5. Deployment Procedures- Slowed to deployment speed of 2-4 kts. 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. Tow point on last wrap handled by person 1 while person 2 pulls wire cable over railing and shackles the rope tow point to wire cable. Tension was then slowly released by person 1. 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 11).

6. Retrieval Procedures- Slowed 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) rinsed thoroughly 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 3- Setup of magnetometer while on deck.

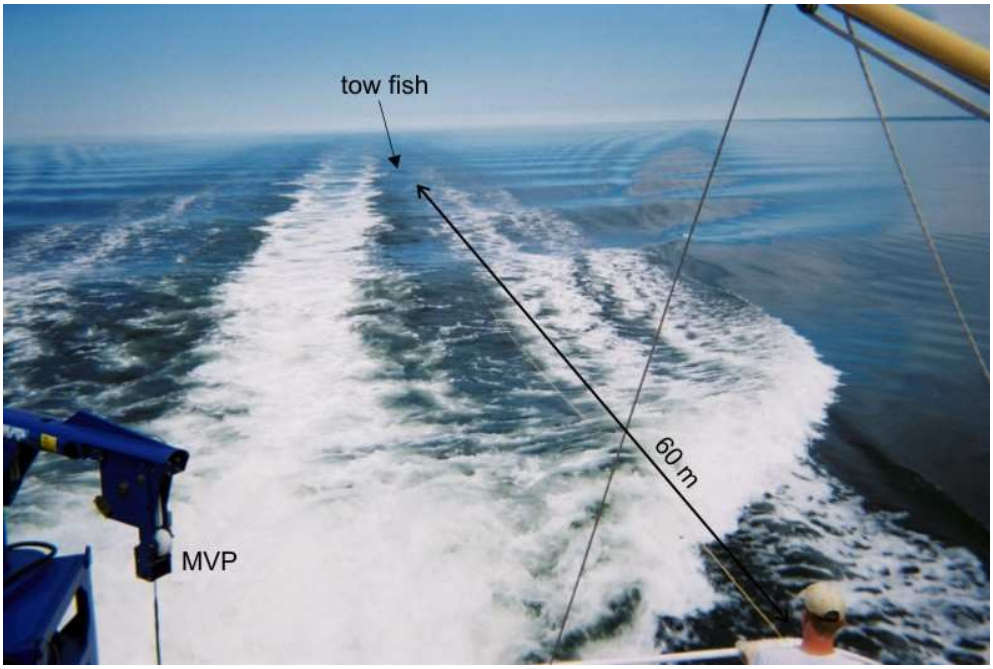

Figure 4- Setup of magnetometer while acquiring data.

SeaLink setup and magnetometer software configuration

- Requirements – System 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 mag com port as a plug and play mouse. Power 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.

- No ability to configure the "x" of "z" offset of the Magnetometer is provided with the sealink software, due to the MVP mounting aft centre, it was necessary to deploy magnetometer approximately 3m to the Port of the RP, giving an overall error of positioning +- 6m instead of the usual DGPS corrected positioning of +- 3m. Primary corrections received from Coast Guard DGPS station in Riviere du Loup (300 Khz) and RTK reference station Ile du Bic

- June 12th - JD 164 data does not correlate with previously collected mag observations.

Magnetometer Base Station at IML:

Base Station at IML was set up Friday June 3rd,

The magnetometer sensor was secured to a softwood palett approx 15 m from CPU, oriented East West on grassy knoll (figure 12). Interference was first encountered during setup due to physical positioning of magnetometer near concrete bunker housing the CPU. Once the sensor was positioned away from the building, signal strength improved significantly. The CPU, GPS, and other electronics were setup inside the bunker (figure 13) and power supply was provided from an adapter in a light socket (not ideal). Data quality was fair to good during the first 4 days, and good to excellent for the remainder of the survey. A few storms caused power outages during the survey so some data was lost due to power failure.

Figure 5- Station mag setup outside.

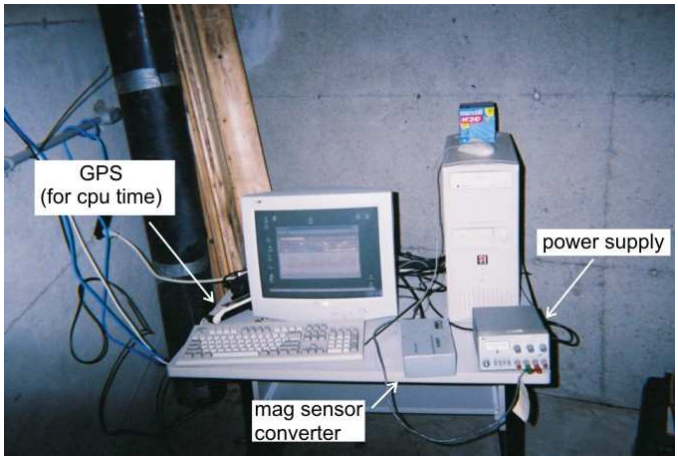

Figure 6- Station mag setup inside bunker.