ODIM Brooke Ocean

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QPB: JIB

Date: June 4, 2010

To: University of Victoria
Purchasing Services
PO Box 1700
Victoria, BC V8W 2Y2
CANADA

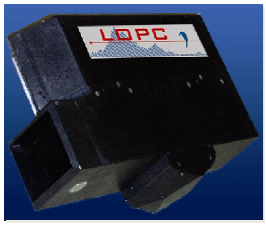
QUOTATION # Q10-203

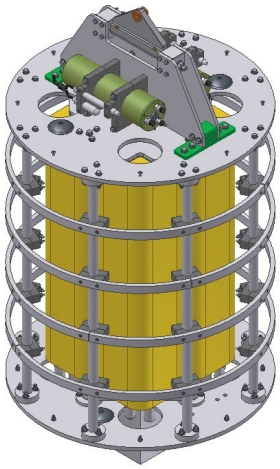
1 GENERAL

ODIM Brooke Ocean is pleased to provide the following price and technical proposal to the University of Victoria for provision of an automated/remote controlled electric profiling winch and telemetry system, in accordance with the CFI acquisition quote RFQ 5536a. This winch will permit the instrument package to profile from the surface to 210 m every 2 hours.

The proposed profiling winch will be based on ODIM Brooke Ocean's Moving Vessel Profiler (MVP) winch product line. We have more than 80 of these automated systems in operation world-wide. Several million dollars have been spent on development of the MVP control system, which will be adapted for use with the proposed profiling winch system. In addition to MVP, ODIM Brooke Ocean has designed and built numerous custom designed winching systems for unique marine applications.

We also have significant experience with data telemetry systems and fibre-optic cables and will leverage this expertise for this project.





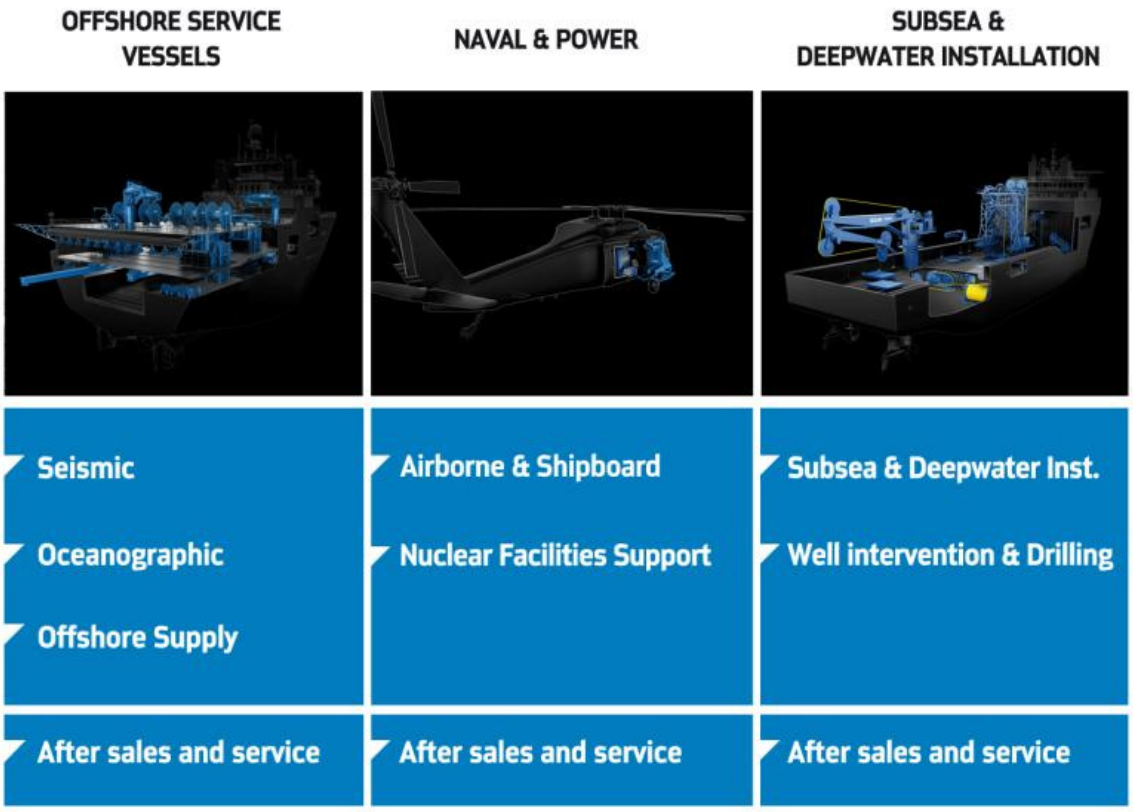
ODIM Brooke Ocean has developed telemetry systems for applications with cables as long as 5,000 m. These are used with products such as the Moving Vessel Profiler (MVP), Laser Optical Plankton Counter (LOPC), and other underwater systems

2 APPLICABLE DOCUMENTS

Request for CFI Acquisition Quote – RFQ 5536a CFI Paul Macoun Venus LEF Application Index 1.17 – Profiler Winch and Telemetry System Requirements

3 RELEVANT EXPERIENCE

ODIM Brooke Ocean manufactures advanced data collection systems including the Moving Vessel Profiler (MVP), SeaHorse wave-powered profiler, Free Fall Cone Penetrometer (FFCPT), Laser Optical Plankton Counter (LOPC) and supplies cable handling & launch/recovery systems for various payloads including unmanned vehicles, towbodies and oceanographic systems. ODIM is a subsidiary of ODIM ASA, a fast-expanding Norwegian technology company which develops and sells advanced automated handling solutions, primarily cable handling systems and winches for use on offshore, oceanographic, and naval vessels. The company occupies a leading position in selected market segments. We have recently been acquired by Rolls-Royce and as of January 1, 2011 we will be operating as Rolls-Royce Naval Undersea Systems.



ODIM Brooke Ocean is located in Dartmouth, NS, within walking distance of the Bedford Institute of Oceanography and DRDC Atlantic

4 DESCRIPTION OF MOVING VESSEL PROFILER (MVP)

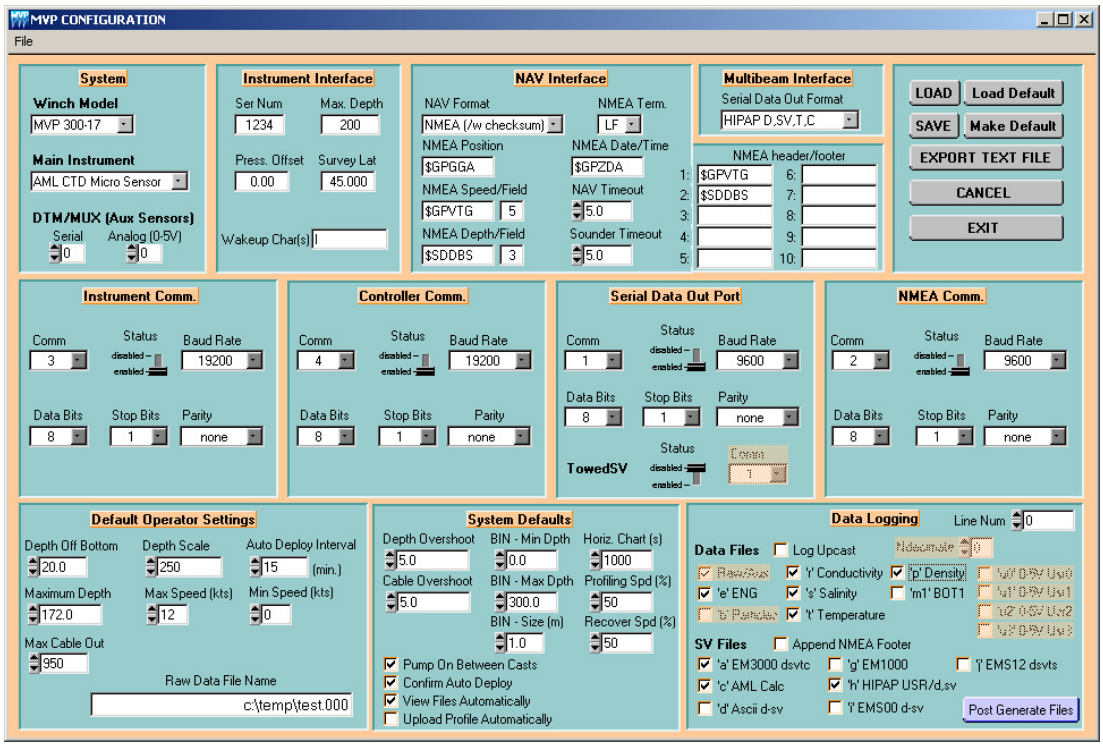
The MVP is a self-contained profiling system capable of sampling water column profiles from a vessel moving at up to 12 knots. The system provides vertical profiles of oceanographic data such as Sound Velocity and CTD for various operations including the calibration of multibeam sounder systems for hydrographic operations. The MVP is completely autonomous and can be controlled by computer without the requirement for personnel on deck. The MVP system consists of a single sensor free-fall fish ("fish"), an electric or hydraulic winch (depending on model), an overboarding sheave mounted on either a davit boom or A-frame, and a remotely located user interface controller. The MVP family of products ranges from the MVP30 (capable of profiling up to 30 m depth at 12 kts ship speed) up to the MVP800 (800 m depth at 12 kts).

MVP family of products

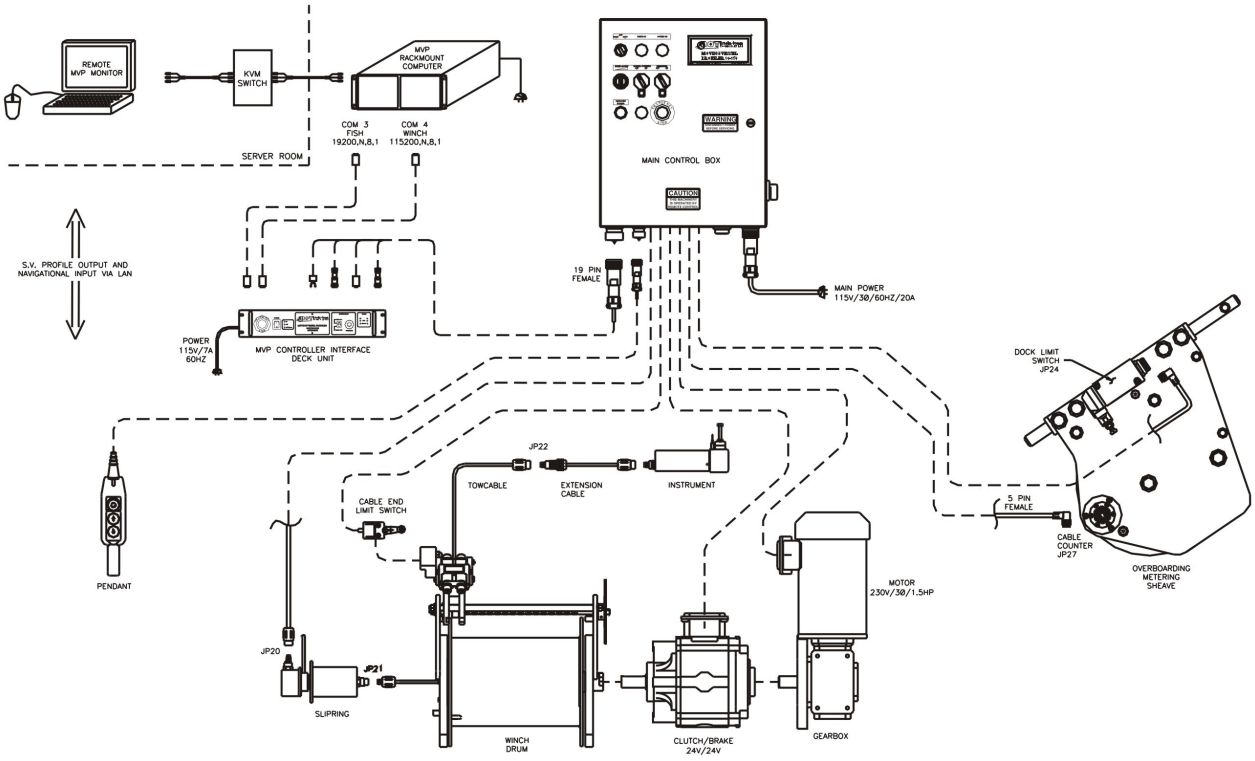
The MVP operates in the automatic mode described above or in manual mode operated with a hand held remote pendant at the winch. Manual mode is used as a convenient method to launch and recover the fish and is not intended for profiling.

As the free-fall fish travels through the water, data is collected by the onboard sensors, and transmitted through the electro-mechanical towcable and winch drum slip ring, to the system's computer controller, and then to other ship's systems as required (such as multibeam sonar or seismic surveying systems. The PC-based control system has numerous screens, allowing the operator to operate the system in automatic or manual mode, monitor the system performance and configure the system parameters.

MVP operator interface screen. This will be modified to act as the shore based operator interface for the buoy mounted profiler winch



MVP configuration screen



MVP30-350 (electric drive) block diagram. The profiler winch will not have a freewheel clutch and will incorporate a battery subsystem with charger to provide the additional power required for hoisting.

5 EQUIPMENT DESCRIPTION

The proposed profiler winch will be based on the MVP 30-350, with modifications as described below. The winch will be automated, with the ability to change operating parameters from the shore station. It will allow a customer supplied instrument package to be configured by an authorized user from a shore terminal as well as real-time transfer of data to the operations center.

It will consist of the following components:

- Electro-optical slip ring winch
- Electro-optical cable
- Instrumented overboarding sheave
- Automated control system with local and remote control
- Telemetry system & instrument interface module
- Weather proof security enclosure
- Rechargable battery pack to provide the additional power required during profiling
- Control computer and controller interface box
- Motion sensors to measure pitch, roll, heave and heading

5.1 Winch

The winch unit consists of a winch drum with a levelwinding system, a high efficiency electric gearmotor, fail safe brake, and an enclosure housing the power and control system, all mounted on a welded aluminum base. It will be nearly identical to the MVP30-350 winch with the following modifications:

- Focal ISO slipring replaced with Focal E/OSR slip ring
- Level wind and gearing modified for longer cable
- Eliminate freewheel clutch

The winch will be capable of handling the 100 kg instrument cage (submerged weight) with good control. The winch will incorporate a slip ring and a fairlead assembly mounted on a levelwinding system to ensure proper spooling. The electric motor will likely be a stainless steel washdown motor, but we may elect to use a cast iron motor with an additional marine protection package that includes treated windings and extra seals.

A high efficiency gearbox will be employed to maximize the efficiency of the drive train and minimize current draw. Because of the limited power available, the winch will not be capable of lifting the instrument package clear of the water.

The electro-optical cable (250 m length) is wound on an aluminum drum supported by ball bearings mounted to the drum supports. Electrical signals to and from the instrument package pass through the slip ring assembly. The winch drive train utilizes an electric motor controlled by an adjustable frequency drive. The drive for the levelwind system is also taken from the main shaft, through a chain drive.

A stainless steel NEMA-4X enclosure will house a variable frequency drive, DC power supply, start/stop Switch, Emergency stop switch, telemetry hardware, and control computer.

For security and additional protection from the environment, the winch unit will be housed in a weather proof enclosure with a keyed lock.

The winch can be controlled locally from the control box and remotely from a shore base.

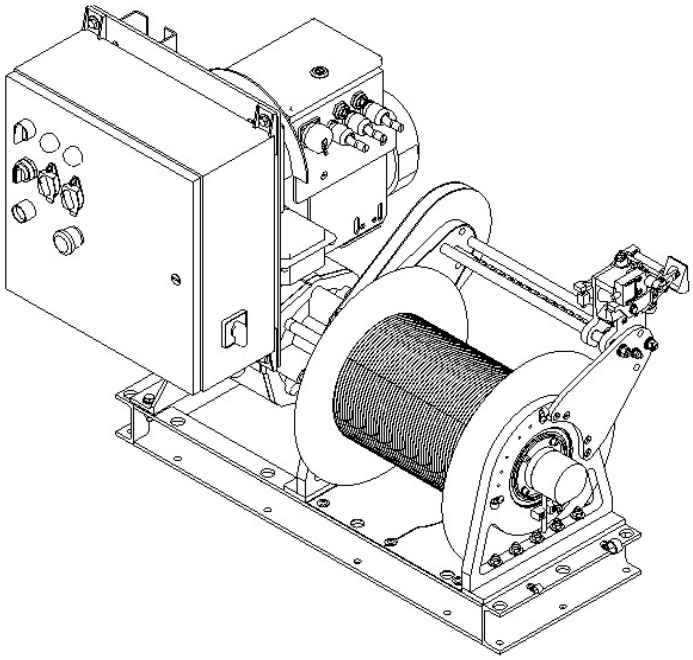
The winch will be designed to have a minimum factor of safety of 5:1 on the submerged weight of the instrument package (100 kg).

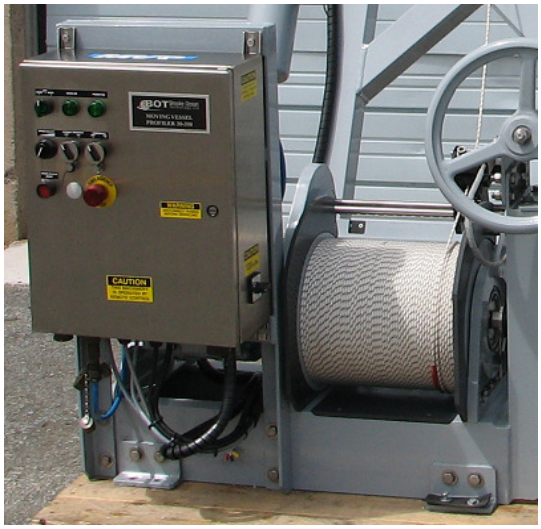
It will be capable of allowing the instrument package to profile to 210 m every 2 hours. A hydrodynamic analysis will be completed to confirm that 250 m of cable is sufficient to reach this depth at the defined current profile. The winch can be supplied with additional cable if required.

The winch will have the following features:

- Variable speed control
- Maximum line speed: 20 - 30 cm/s
- Maximum line pull – 150 kg
- Brake hold force: 300 kg (minimum)
- Capacity – 250 m of 7 - 8 mm dia. electro-optical cable
- Spring applied, fail safe brake
- High efficiency gear drive
- Diamond screw level wind for proper cable spooling

- Focal/Moog 180 slip ring with model 197 fibre optic rotary joint
- Marine rated 1 HP or 1.5 HP electric motor
- Stainless steel fasteners
- Water tight enclosure with variable frequency drive, control computer, DC power supply, motion sensor, emergency stop switch, and local joystick control
- Cable scope, speed, tension and angles displayed at control box
- Structural components powder coated to marine standards
- Approximate footprint: 80 cm x 90 cm x 90 cm high (not including enclosure)
- Approximate weight: 190 kg (not including enclosure)





MVP30-350 showing winch and control box. The A-frame is not part of the scope of supply.

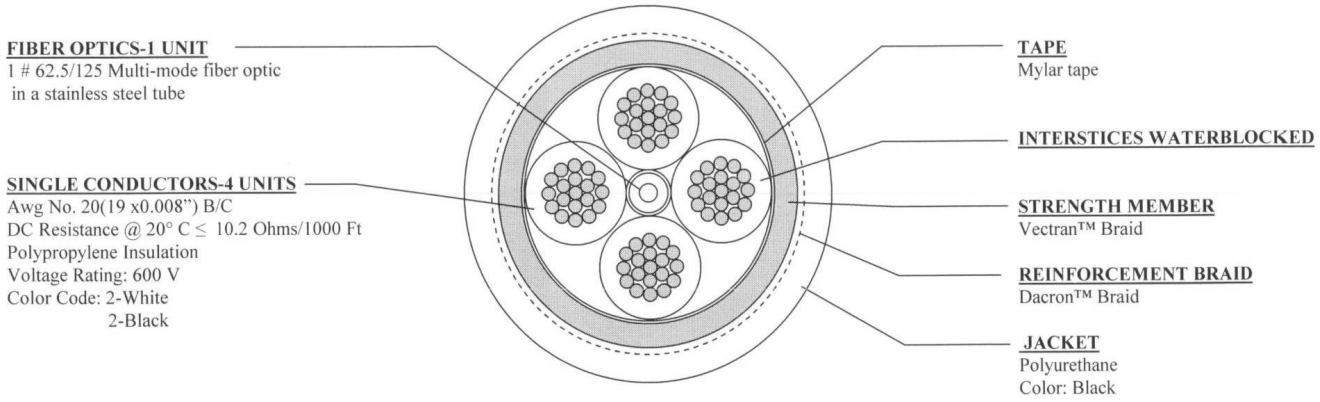
5.2 Electro-Mechanical Cable

The electro-optical cable has a polyester jacket with a Vectran strength member and internal electrical conductors. A stainless steel eye thimble mechanical termination attaches to the instrument package. Mechanically, the cable will be similar to that used for the MVP, with additional conductors.

The E-M cable will have the following conductors:

- Multi-mode fibre for communications
- 4 X 20 AWG power conductors for ~330 VDC

The cable will be 7 – 8 mm in diameter and have a minimum break strength of 1,361 kg.

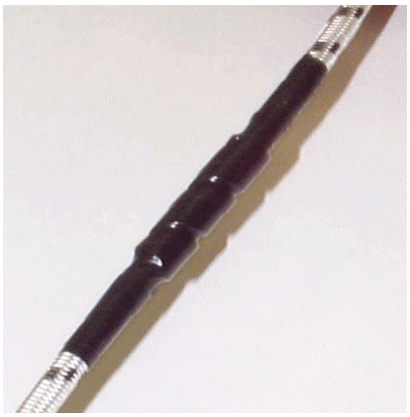


Cable will have a rugged outer jacket

The wet end of the cable will have a Subconn underwater connector(s) that interfaces to the instrument interface.

Both ends of the cable have a messenger; this is a bump on the cable that is a mechanical means of detecting cable position. This messenger is detected at the instrumented sheave and acts as a safeguard to automatically shut down the winch.

One messenger is used to shut down the winch if too much cable is paid out. The other is used to prevent the winch from attempting to hoist the instrument package out of the water. The control system will also use other means as a backup to prevent the winch from both the above. This will include monitoring depth, cable scope, and current draw.



Messenger will be installed at both ends of cable

5.3 Overboarding Sheave

The overboarding sheave is a standard design that ODIM Brooke Ocean has supplied to a number of users for overboarding and towing applications. It consists of a high strength, light weight Nylatron

sheave with follower arms to prevent the cable from escaping. The sheave is instrumented to measure cable scope, speed, tension and angles.

Additional features include:

- High strength swivel
- Sheave groove sized for cable
- Spherical roller bearings at sheave hub
- Sheave tread diameter: to be determined
- A hall-effect sensor and magnets built into the overboarding sheave provide cable scope and winch speed
- Load cell to determine cable tension
- Inclinometers to measure cable angle
- Limit switch to detect cable messenger will shut down winch
- Sheave will be designed to survive break strength of cable.
- Proof test certificate to be provided

Sheave data as well as height above bottom and depth are displayed locally on a backlit LCD panel mounted on the control box as well as the shore station operator interface/control screen.

Sheave features include:

- Reset function allows operator to reset cable out to 0
- Cable properties display selectable for metric or imperial units
- Preset function allows operator to preset cable out to any value

Instrumented Sheave

5.4 Power and Control System

5.4.1 Power

The winch, sheave, instrument interface and instrument package will be powered by ~330V from the subsea cable. Power from the subsea cable will be routed into a small junction box incorporating a DC-DC converter. Low voltage DC power will be routed to the main control box on the winch to power components in the box and instrument package (via the slip ring and E-O cable). If a decision is made to power the instrument interface with ~330VDC, a cable will be routed from the junction box to the slip ring.

To allow maintenance to be carried out, the junction box will incorporate a lockout system for isolating the winch system from the high voltage input.

The profiler winch system will be designed so that no more than 750 W is drawn from the subsea cable. In order to provide the additional power required to hoist the instrument package, a battery subsystem will be employed. This will consist of a bank of deep cycle rechargeable batteries with a charging system. This system will be marinized and housed inside a vented weatherproof enclosure.

5.4.2 Control System

The control system consists of four major components:

- Main control box (mounted on winch) with single board computer
- Controller Interface Box
- Controller Computer
- Control Software
- Instrument Interface
- MET & near surface instrument interface

The control system will permit the instrument package to profile at up to 30 cm/s from near the surface (1 m) to within 2 m of the bottom at depths to 210 m. It will also allow the instrument package to remain at a user selected depth to collect time-series data with minimal power draw.

5.4.2.1 Main Control Box

The Main Control Box is a stainless steel enclosure located on the side of the winch unit. It contains low voltage power supplies, an adjustable frequency drive, a line filter, Ethernet comms link, control circuit board, and a relay board necessary for control functions. A power cable is attached for the connection to the ship's power supply. Electrical connections with the mechanical enclosure are through watertight glands and connectors.

The main control box will also accept serial & Ethernet data from the customer supplied MET station and near surface instruments as well as Ethernet data from the instrument interface system.

The embedded controller on the TT8 circuit board is the main interface to the system drive components. It is used to monitor the control system status when operating in Hand or Auto modes. In Auto mode, the embedded controller controls all winch operations by executing commands output by the MVP Controller computer.

The main control box is equipped with the following switches, connections and indicators:

- Lighted power ON/OFF switch
- Manual override switch allows winch to be operated manually
- Spring centered local control joystick
- Limit bypass switch will override the sheave limit switch
- Bulkhead connector to allow system to be operated locally from the controller interface/controller computer

Main Control Box

5.4.2.2 Controller Interface Box & Computer

The Controller Interface Box is located at the shore station with controller computer. It acts as a junction between the profiler winch and subsea cable.

Controller computer and controller interface box

5.4.2.3 Control Software & User Interface

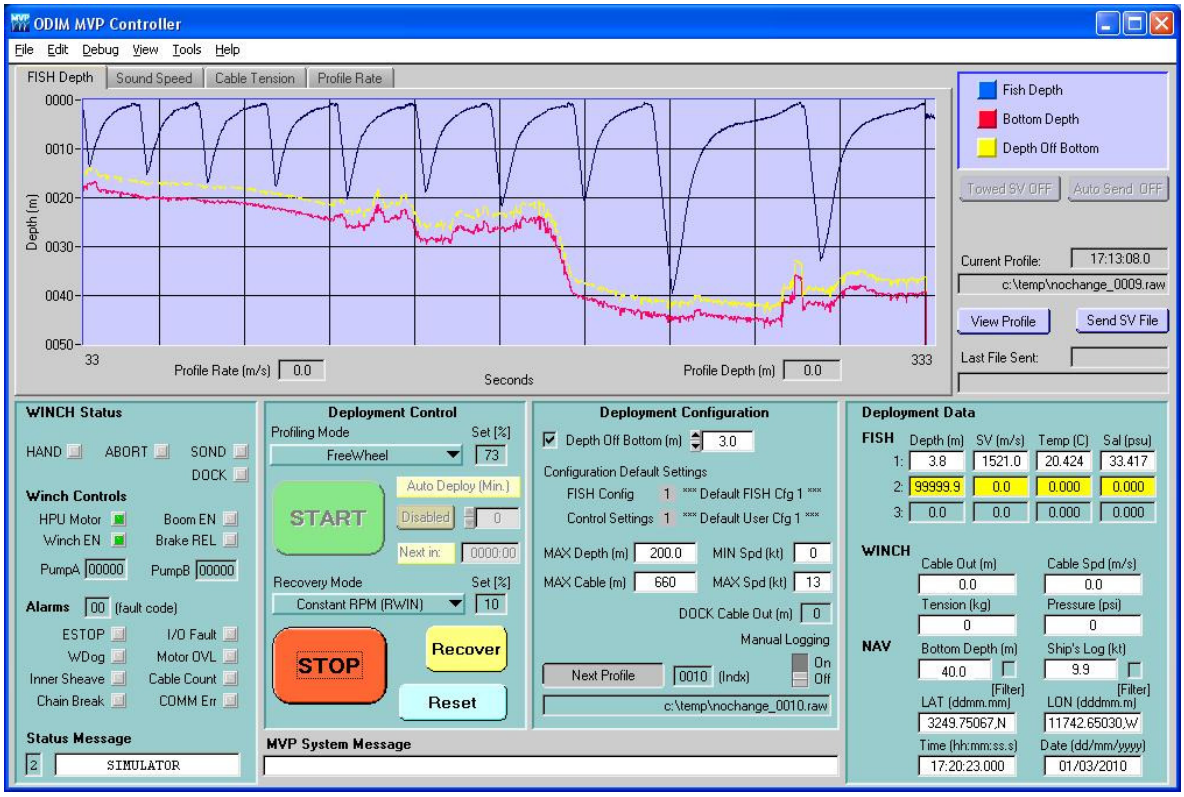
A distributed control system (based on the MVP control system) will be employed. High level commands such as “winch in”, “winch out” and “halt” are sent from the main user interface program running on a standard PC in the lab. At the remote winch location, the commands are converted to the required sequence of solenoid/relay operations by a 32-bit microcontroller running custom firmware. As part of fault processing, communications between the winch controller and the user interface program is constantly monitored. If communications is broken for an extended period of time, the winch is automatically placed in a “safe” state.

The user interface is LabView based and will require some modifications for this application. This will include a higher level of autonomy and fault monitoring to suit this application. Customer input into this part of the project is welcome.

The MVP control system has built-in fault monitoring; modifications will be required to allow the following parameters to be monitored:

- control voltages & motor voltage
- cable tension
- cable angles
- cable scope
- battery voltage and charging
- Instrument communications
- Instrument depth and altitude (pressure sensor and altimeter are customer supplied)
- Motion sensors (prevents operation in heavy weather. Exact conditions of shutdown TBD)

This system will be capable of detecting short circuits and ground faults, with the ability to isolate power to a specific interface if a fault is detected.



Operator interface that will be displayed on controller computer. The interface may require some modifications to meet customer requirements

5.4.2.4 Instrument Interface

The instrument interface is housed in a titanium, composite or plastic 1 atmosphere pressure housing rated for 250m. The interface will be capable of delivering up to 500 W while profiling and will include:

- DC-DC converter to provide 12/24 VDC power to the instruments
- Support for 8 analog channels, 8 serial instruments and 4 Ethernet instruments
- Ethernet comms link to the main controller at the surface
- Pressure sensor and altimeter
- Compass which measures tilt and orientation of the instrument housing
- Subconn connectors to E-O cable and instruments. One bulkhead connector per instrument type will be provided.

5.4.2.5 MET and Near Surface Instrument Interface

This hardware is mounted in the winch mounted control box and will include:

- DC-DC converter to provide 12/24 VDC power to the instruments
- Support for 4 analog channels, 4 serial instruments and 4 Ethernet instruments
- Ethernet comms link to the main controller
- Watertight connectors to E-O cable and instruments. One bulkhead connector per instrument type is required.
- Motion sensor to measure pitch, roll, heave and heading

5.4.2.6 Data Telemetry

Data will be acquired from the instruments in their native format. Each instrument (serial or Ethernet) will be given its own TCP/IP address to allow configuration for the control station. Analog instruments will interface to a 12 bit analog to digital converter. The sampling rate for each channel will be a maximum of 30 kHz.

Communication from the instrument interface to the surface will be implemented using an Ethernet extender operating up to 50 Mbps.

The winch controller, MET and Near-Surface Instrument Interface and the Sub-Sea Instrument Interface are expected to be individually addressed components over Ethernet.

5.6 Requested Certifications

The system will be either CSA approved or have acceptable electrical certification marks as outlined in the RFQ.

6 ACCEPTANCE TESTING

A series of acceptance tests will be completed to ensure the winch and telemetry system meets the customer's requirements. This includes Factory Acceptance Testing, Harbour Testing, and Sea

Acceptance Testing. For each of the above tests, a detailed test plan will be written that will be submitted to the customer for approval. The customer is welcome to participate in Factory and Harbour testing.

6.1 Factory Acceptance Testing (FAT)

The FAT will consist of a series of functional and load tests to verify system performance.

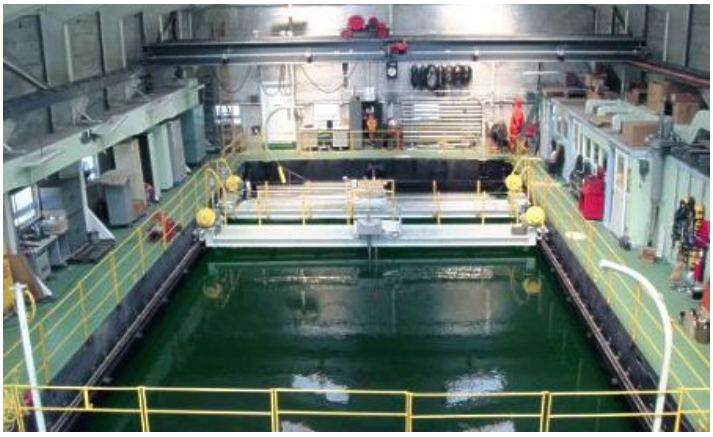
This will include:

- Wash down test of electric motor and electrical/electronics enclosures
- Verify all system functions are operating properly
- Verify system footprint and weight
- Raise and lower test weight equal to safe working load; ensure good control
- Verify maximum line pull and line speed
- Suspend 150 kg weight; ensure load does not creep over time
- Suspend 2 times safe working load of 100 kg from winch drum; complete a detailed inspection of all structural components to ensure there is no damage or deformation
- Subject overboarding sheave to 2 times safe working load and complete detailed inspection as described above
- Verify all sheave instrument functions are operating properly
- Verify operation of power and battery system
- Verify functionality of instrument interface
- Pressure test instrument interface housing

6.2 Harbour Testing

Harbour testing will be completed in a 2-3 day period with the package installed at the DRDC Atlantic acoustics barge in the Bedford Basin. This will allow the instrument package to be deployed down to 40 m depth. It is our preference to conduct these tests with the instrument package included. If this is not possible testing will be completed with the instrument interface and a dummy load of 100 kg.

A comprehensive series of tests will be completed to verify the functionality of the system with local and automated/remote control from a simulated shore station.



DRDC Acoustics Barge is located less than 5 km from ODIM Brooke Ocean's facility

6.3 Sea Acceptance Testing

Once Harbour tests have been completed, the system will be packed and shipped to UVIC for eventual installation on the buoy in Saanich Inlet. Sea Acceptance Tests will then commence. ODIM Brooke Ocean has budgeted for 2 representatives to be on site for 1 week to participate in this testing.

6.4 Follow On Technical Support

We have budgeted for 20 days of post delivery support.

7 TECHNICAL DOCUMENTATION

7.1 Operation & Maintenance Manual

An operation and maintenance manual will be delivered with the profiler winch system. The manual is in standard ODIM Brooke Ocean commercial format and contains system descriptions and specifications, installation and operating instructions, routine system maintenance, troubleshooting, assembly-level drawings with parts lists, electrical and hydraulic schematics, recommended spare parts lists, and vendor-supplied component specification sheets (if available).

Documentation will be provide in hard-copy format (3 copies) and electronic pdf format on CD-ROM.

8 QUALITY ASSURANCE

The profiler winch system will be produced according to the requirements of quality standard ISO9001:2008. ODIM Brooke Ocean is currently implementing this standard with certification planned for late June 2010.

9 PRICING & DELIVERY

Profiler winch and telemetry system	$ 475,659
Less: CFI discount	$ 95,132
Total	**$ 380,527**

Price includes:
Shipping to Victoria
Two ODIM Brooke Ocean engineers on site for 1 week to assist with sea acceptance trials
Twenty (20) days of follow on technical support

Terms:

a. All prices are in Canadian dollars and are FOB Dartmouth, Nova Scotia, Canada.
b. All applicable taxes, duties, insurance etc are responsibility of buyer
c. Offer valid for 60 days
d. Payment due within 30 days of invoice issue
e. This proposal is predicated upon mutually acceptable terms and conditions

Proposed Payment schedule:
Monthly progress payments.

Delivery:
We are proposing a 9 month delivery date.

Items Required

ITEM	QTY.	10 DESCRIPTION	List Price	Education Discount %	In – Kind Contrib. discount (%)	Discounted CFI Price 10.1
1	1 Only	Profiler Winch & Telemetry System	$475,659		20%	$380,527

References for Equipment Offered as In-Kind Contribution

The Canadian Foundation for Innovation (CFI) requires a third party valuation of In-kind contributions. Please provide install sites or client references for items offered as in-kind contributions. These references will be contacted for confirmation of value of the in-kind contribution.

Although based on our Moving Vessel Profiler (MVP), the proposed profiling winch is a unique design with a significant amount of non-recurring engineering. We do not have any install sites or client references for similar equipment. We can offer pricing information for our family of MVP's if required and as well as pricing information to support an audit.

SUPPLIERS MUST COMPLETE/CONFIRM THE FOLLOWING INFORMATION

F.O.B. University of Victoria:	
Shipping Charges:: INCLUDED__X_____EXTRA_____ COST_____	
Method of Shipping: Ground	
Name of Firm: ODIM Brooke Ocean	**Quote submitted by: Geoff Lebans**
Signature: 	
Vendor Quote Reference: Q10-203	**e-Mail Address: glebans@brooke-ocean.com**
Telephone Number: 902-481-2501	**Fax Number: 902-468-1388**
Terms: NET 30 DAYS	**Do not include GST/PST in the quote.**
Suppliers may offer alternatives that in their opinion equal or exceed the technical or performance standards of the quoted reference. UVic, at its sole discretion, determines "equal or exceed" specifications.	
Electrical Unit must be CSA approved or have Acceptable Electrical Certification Marks in British Columbia as Listed at http://www.safetyauthority.ca/files/Approved_Certification_Marks_for_Electrical_Products.pdf	