



AXYS TECHNOLOGIES INC.



***Developments in
Telemetry,
Data Display,
Buoy Configurations
and Sensors***

***Data Buoy Cooperation
Panel Meeting Oct 15, 2007***

Jeju, Korea

www.axystechnologies.com





AXYS TECHNOLOGIES INC.

**ABOUT AXYS: A Remote
Environmental Monitoring
Systems Company focused on:**

***Ocean,
Terrestrial,
Telemetry,
Consulting,
Support . . .***

Company Background

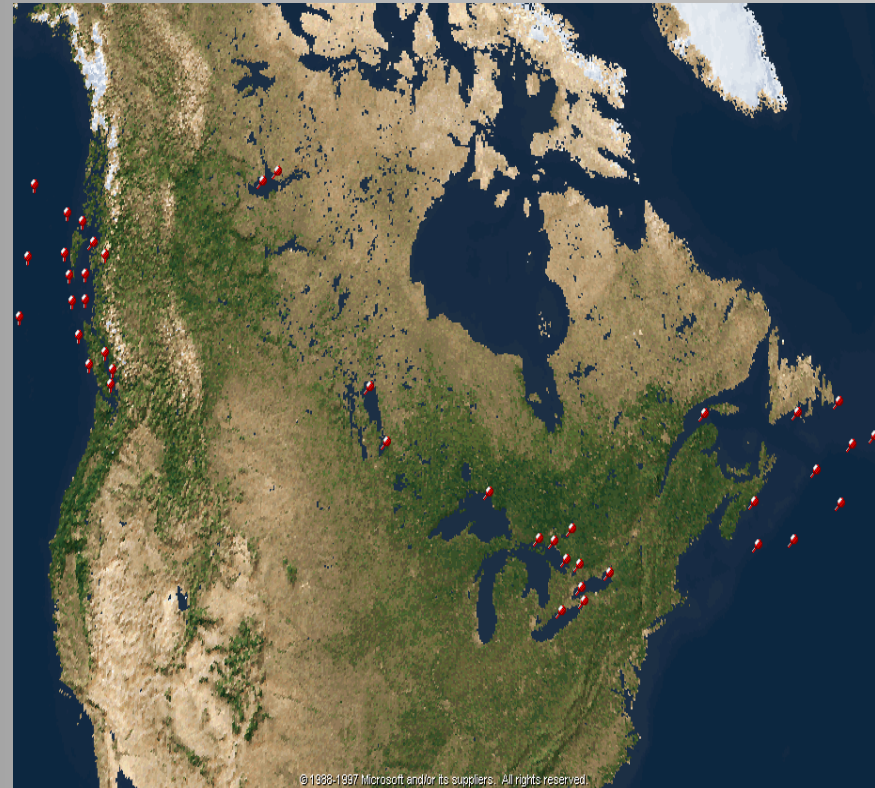
- **Founded in 1974, Victoria BC Canada**
- **Initial oceanographic consulting start**
- **Marine monitoring equipment**
- **Global – buoys in 20+ countries**
- **Leveraged into Land applications**
- **Strength – System Design and Service**
- **Marine Data Network Project**



WatchKeeper™

Buoy Networks

- **Data buoys since 1986.**
- **Buoy types:**
WatchKeeper, 3 Meter, NOMAD, WatchMate
- **Buoy uses:** Weather forecasting, Research, Oil & Gas, Security, Port monitoring, etc
- **Service contractor for Environment Canada's Marine Buoy Network.**





Status of GOES Transmitters

- *Most Buoys transmitting at 100 baud*
- *All at 10 Watts*
- *One Buoy transmitting at 300 baud.*
 - *Data Return typically 10% less than other stations*
- *New GPS Engine in transmitters meant a firmware update.*
 - *Time Sync Problems... "cause unknown"*
 - *Up to 15 minute delay in testing while waiting for complete almanac download...time is \$\$\$*



Status of GOES Transmitters

- *Re-evaluation of current model*
- *Trial of Sutron SatLink2*
- *Users queried very favourable*
- *40 Watt Amplifier available*



Argos PTT Repackaging



- *3m Buoys*
 - *Argos PTT and antenna co-located*
 - *Problems with PTTs locking up*



- *6m Buoys*
 - *Argos PTT and antenna separated by 6 metres*
 - *Systems are much more stable*



Iridium Pilot Project

- *Some Ships have very good rate of return in Arctic Waters*
- *CCGS Sir Wilfrid Laurier*





Iridium Pilot Project

- *Some Ships have poor rate of return in Arctic Waters*
- *CCGS Des Groseilliers*



Iridium Pilot Project

- ***Outfit AVOS with Iridium Transmitter on CCGS Amundsen***
- ***Messages coming via email hourly***
 - ***Cause of data gaps is being investigated***



AXYS TECHNOLOGIES INC.



Development of a Real-Time Water Quality Buoy for the Fraser River Estuary

***In partnership with
Environment Canada- Water
Quality Monitoring***



www.axystechnologies.com



Project Definition

- *Standardized meteorological measurements compliant with EC ODAS network;*
- *Water quality elements sampled to integrate into the EC National and Provincial Ambient Monitoring initiatives.*
- *Development of adaptive sampling criteria for the initiation of sample collection.*
- *Improve temporal sampling coverage and reduce manual sampling requirements. Additional benefit of reducing HAS sampling risks when operating on the river at night.*
- *Autonomous operation and remote command and control of system through broad band CDMA internet connection;*
- *Development of an expanded power and power management system;*
- *Deployment environment and station hazards;*
- *Emphasis on field serviceability.*



Data Parameters to be Collected

- ***Wind Speed and Direction***
- ***Air Temperature and Relative Humidity***
- ***Barometric Pressure***
- ***Conductivity, Temperature and Depth; Dissolved Oxygen; Turbidity; Nitrate; Redox (probe can be reconfigured);***
- ***Surface Currents***
- ***High Volume SPE Water Sampler for POP's***
- ***Whole Water Samples for water chemistry analysis***
- ***Time-lapse web cam images with imbedded data***
- ***Station house keeping: power monitoring, datalogger condition/reset info, water intrusion detection and alarm, telemetry and system error logs.***
- ***Station Position and watch circle monitor.***



Operational Considerations

- **Location** 

- Variable flow conditions; 300-12,000m³/sec
- Large woody debris
- Marine traffic

- **Maintenance**

- Low maintenance hull (foam/aluminum);
- 4 year Primary battery life; external access for auxiliary battery exchange;
- Easy WQ sensor cleaning/removal;
- Easy sample access;



Image © 2007 TerraMetrics
Image © 2007 DigitalGlobe
© 2007 Europa Technologies

© 2005 Google





Platform Design:

- *Modular, adaptable, rugged;*
- *Multi-mission capable;*
- *Advanced Water Sampling Enclosure.*



Moon Pool and Cable Conduits

- ***Subsurface Sensor Access***
 - ***Multi-parameter WQ probes;***
 - ***Current Meter;***
 - ***Depth transducer;***
 - ***Easy sensor maintenance with monthly inspections.***





Advanced Water Sampling Enclosure

- Infiltrax POP's Sampler, autonomous control interfaced to WM500, with manual control panel for field servicing;***
- Whole Water Sampler- Pump, Refrigerated sample chamber with custom sample manifold;***
- Auxiliary Power Supply;***
- WM500 relay control module.***



Station Power

- *Power demand= ~10 AHrs/day*
- *Batteries- 8 x 100 AHr*
- *Solar Power- 6 x 55 Watt panels*
- *Underwater current power generator- ~3 Amps with 3 knot current.*



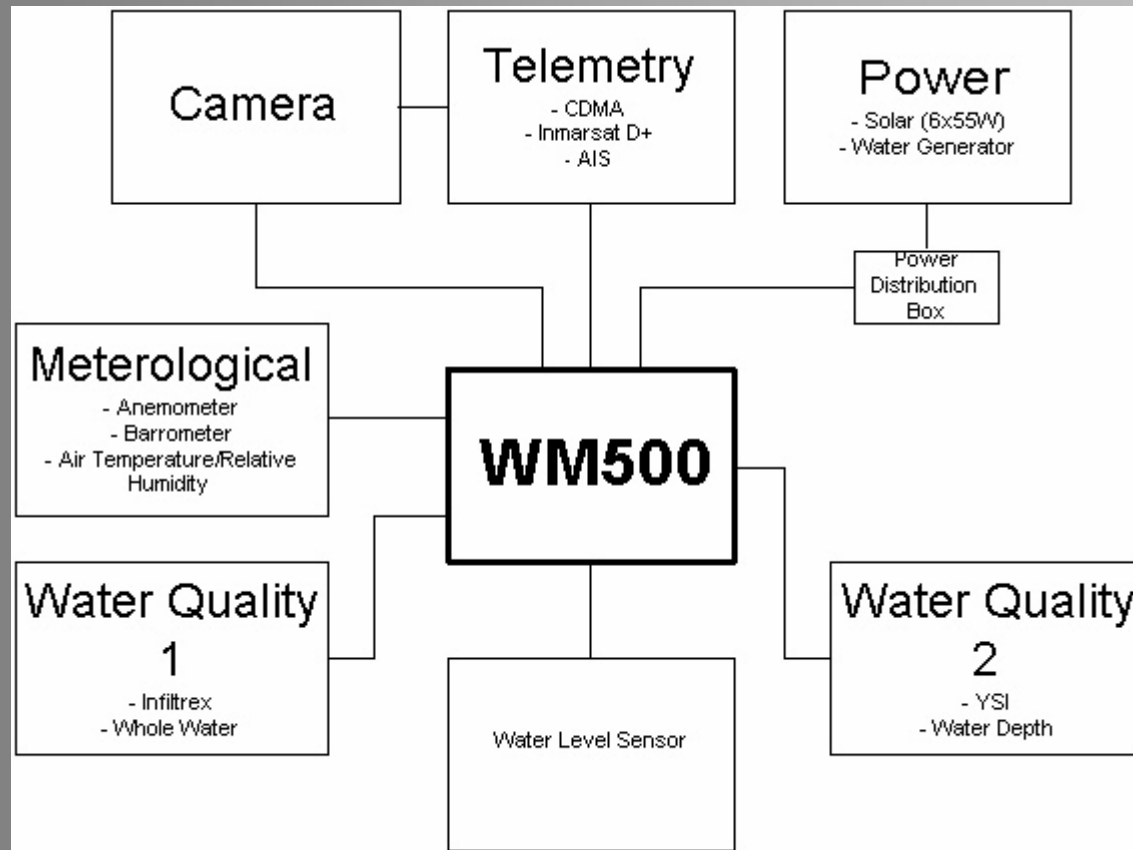


Mooring and Anchor

- ***All chain mooring with 3 t serrated steel anchor, 1.6:1 scope in 20m water;***
- ***Inspect annually, lifespan ~2-3 years for chain;***
- ***AIS transmitter broadcasting station position messages and watch-circle monitor to local marine traffic.***



Payload Schematic





WatchMan 500 Data Acquisition, Processing and Control Module

- 2 nodes with 1 GB compact flash datalogger;***
- Inputs: 16 Digital IO, 32 Analog, 8 Serial, 1 SDI12, 10 Switch Power, and 4 Time Counter.***
- Controls all system devices operation and communication;***
- Expandable.***



AXYS TECHNOLOGIES INC.

*Standard EC ODAS
meteorological sensors.*





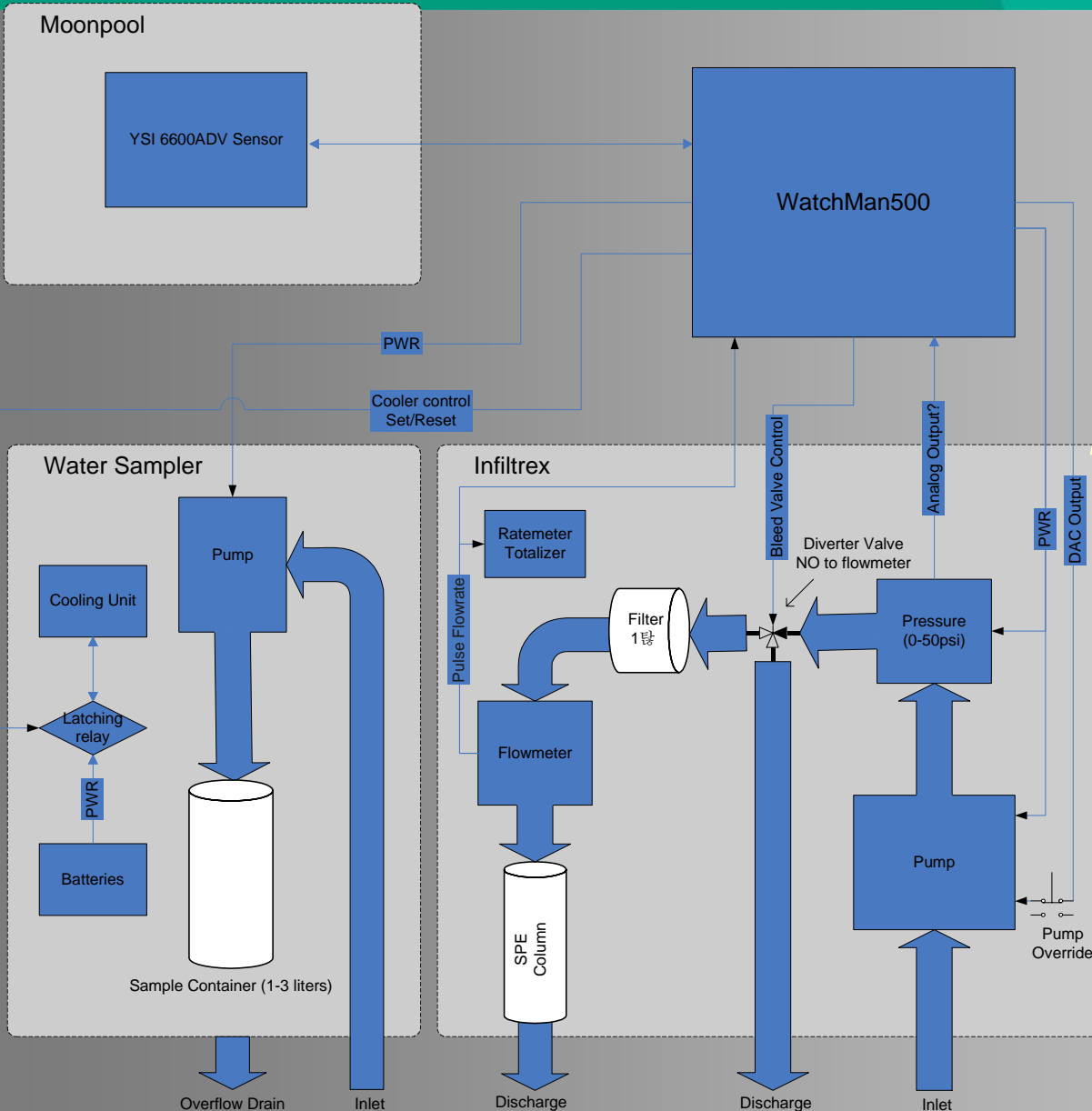
Sampling Regime

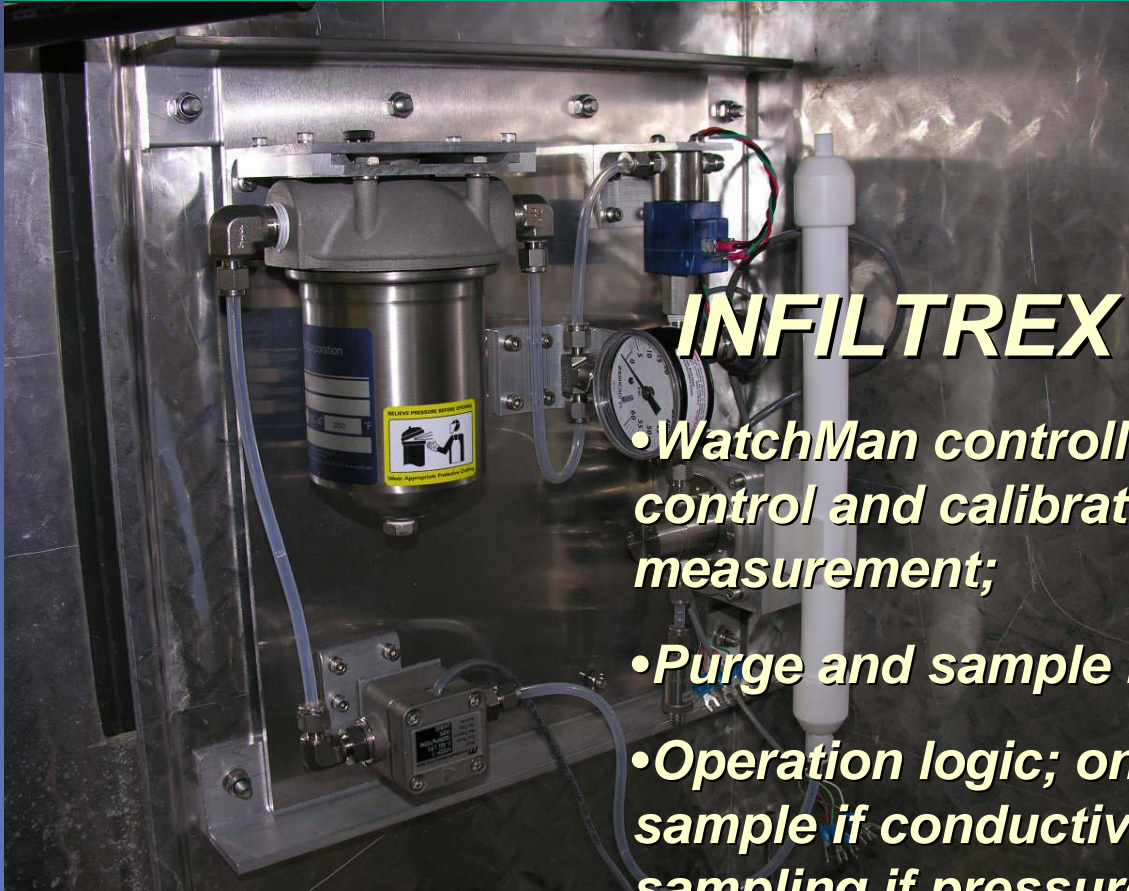
1	3	5	7	9	11	13	15
System Sampling (10 min)							
Air Link CDMA (11 min)							
Whole Water							
Sends message to camera every 10 min with one min offset							
Air Temperature, Wind Speed and Direction, GPS – 10 min sampling interval and duration							
AIS Transmits every 2 min with previous data interval's data							
1	3	5	7	9	11	13	15
Camera on for 10 min off set by 15s 1 picture taken every min between 8am and 8pm							
Water Quality							
Depth sensor (5 min)							
Infiltrex (5 min)							
<ul style="list-style-type: none"> event driven 							
Atmospheric Pressure and Compass - 10 min sampling interval and duration							





System Interface for the INFILTREX and Whole Water Sampler





INFILTREX POP Sampler:

- ***WatchMan controlled sampling, flow control and calibrated volume measurement;***
- ***Purge and sample isolated feed lines;***
- ***Operation logic; only want to take a sample if conductivity < threshold. Stop sampling if pressure > threshold. Stop sampling if flow rate < threshold.***
- ***Manual control, backup volume totalizer.***
- ***Modular filter and XAD columns for easy field service.***



Whole Water Sampling



- *Custom sampling device to meet stringent analytical requirements;*
- *Interfacing WatchMan 500 to control pump operation and activate a high capacity relay circuit to turn on the cooling chamber;*
- *Operation logic; only want to sample once per service period-date range and then only if conductivity < threshold.*
- *Auxiliary battery power.*



Telemetry

- *CDMA Cell Phone*
 - *using the TELUS EVDO network*
 - *all platform data, images and remote command and control.*
 - *Able to upload new datalogger firmware*
- *AIS*
 - *Messages 8 and 21*
- *Inmarsat D+ as Back-up*
 - *Basic met, position and status when activated.*



Weather Data Supplied by AXYS Technologies Inc.

Mon Oct 01 11:10:08 2007

Wind Speed: 0.6m/s Gust: 2.2m/s Direction: 153deg Air Temp: 12.3degC RH: 80.4% Pressure: 1017.83mb Conductivity: -7.000uS/m



CDMA WQ Buoy Web Cam Image

- ***Star Dot net cam;***
- ***No PTZ control, NMEA 4x enclosure not heated;***
- ***800x608 image;***
- ***Data overlay interface input from WM500.***



Station Data Management

- *Axys DMS*
 - *Two-way command and control of data, station management and remote diagnostics.*
 - *SQL database archival*
- *Web View*
 - *Internet access to all transmitted data, graphing and data export.*
- *EC WQ Web Page*
 - *www.waterquality.ec.gc.ca*
- *AIS Display*
 - *<http://members.shaw.ca/a-lester/vicapp.html>*
- *Direct Serial Connection*
 - *Access full system control and data.*

AXYS - WebView - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Mail Print

Address http://portal/AXYSWebView/WEBVIEW/webview.aspx Go Links

Google Go Bookmarks 654 blocked Check AutoLink AutoFill Send to Settings

AXYS TECHNOLOGIES INC. Site map

2007-10-01 13:53:29 (LOCAL)
2007-10-01 20:53:29 (UTC)
STATUS: Online

AXYS > WebView ECWQ | Hide | Logoff



WebView

Stations EC Water Quality buoy 1 Met 24

Stations	DataTimeStamp	MessageID	User System ID Name	Current Position Latitude	Current Position Longitude	Average wind speed	Average peak	Average	Average Air	Average	Average	Average
1 Met	2007-10-01 20:10:20	1	WM00158	4825.4091N	12323.1088W	2.7						
2 Water Quality	2007-10-01 19:10:20	1	WM00158	4825.4083N	12323.1117W	2						
3 Water Sample Status	2007-10-01 17:10:20	1	WM00158	4825.4051N	12323.1100W	1						
4 Status	2007-10-01 16:10:20	1	WM00158	4825.4639N	12323.5026W	2.8						
	2007-10-01 15:10:20	1	WM00158	4825.4086N	12323.1098W	3.4						
	2007-10-01 14:10:20	1	WM00158	4825.4090N	12323.1108W	2						
	2007-10-01 1	1	WM00158	4825.4068N	12323.1115W	1.7						

AXYS DMS (ATI050-NGUBBY\AXYS - AXYSDMS)

AXYS TECHNOLOGIES INC.

AXYS Data Management System (DMS)

2007-10-01 10:30:23 (LOCAL)
2007-10-01 17:30:23 (UTC)

File Tools Help

- Stations
 - Service Test
 - Services
- Communications
 - All
 - Serial - COM1 - (19200,8,None)
 - TCP Client - 199.212.20.105
 - TCP Server - 6168
 - 72.25.230.79:12345

Logging Synchronize Configure Tools

Name: Services **Description:** **Serial Number:** 8600000d4420e61d

Communication Details: Profile: TCP Server - 6168

Operational Mode: Diagnostics: [Dropdown]

Device Manager operational
 Sleep Mode enabled
 Messaging enabled

Save Request Send

Open Close Pause Clear Send File Options

Type: TCP Server **Description:** 6168 **Status:** Open

```
CONNECT $w5M5A,071001,171020,8600000d4420e61d,1,wM00158,4825.4051N,12323.1100W,1,0,2,6,213,12,2,77,4,8,8
$w5M5A,071001,171021,8600000d4420e61d,2,42,510,-7,000,0,000,0,000,7,270,1454,5,0,000,,5,4*1E
$w5M5A,071001,171022,8600000d4420e61d,3,Operational-AfterConfiguredSampleTime,,AwaitingService-CoolerOn,200710
$w5M5A,071001,171023,8600000d4420e61d,4,0,13,59,0,4,49,0,96,520*23
```

Send: [Text Box]

Done

Start | Inboxes - Microsoft ... | Intuitive ERP 7.2 ... | Intuitive ERP 7.2 ... | H:\ | Microsoft





Development Summary

- *Time lines are always more optimistic when developing a complex system designed by a number of stake holders and partner organizations. This is further compounded with the development of complicated sampling algorithms.*
- *Learn new things every time when interfacing to new sensors/devices...even though it might just be a serial device!! Not all devices work properly or as documented on the first go around.*
- *Full multi-parameter system burn-in and documentation critical in ensuring the success in the final system release.*
- *Multiple interfacing RS-232, SDI-12, LAN, Analog.*
- *3 x telemetry devices each with own sample formats and command and control protocols.*
- *We are now waiting for vessel support to get this station deployed.*



Questions?