SBE Water Samplers, Water Sampling with Internal Recording, Cabling, and Deployment

- Water Samplers
  - Care and feeding
- SeatermAF
  - User interface for internally recording instruments firing water samplers with an auto-fire device
- Setting up Auto-Fire
- Extracting CTD data corresponding to water sampler closures
- Cabling for deployment
- Deployment issues



# Water Sampling Equipment

#### • SBE 32 Carousel





Water Valve



# Carousel and ECO Maintenance



- Wash with fresh water after each use; Tiodized trigger surface is water lubricated
- Oil will gum triggers
- Replace worn lanyards





### Autonomous Water Sampling with Internally Recording Instruments

- Auto Fire Module (AFM) with SBE 32 Carousel
  - AFM receives pressure information from SBE 19, 19plus, 19plus V2, 25, or 50
- SBE 17plus Version 2 SEARAM with SBE 32 Carousel
  - SBE 17*plus* V2 receives pressure information from SBE 9*plus*
  - SBE 17*plus* V2 also provides battery power and internal data recording (16 Mbyte of memory) for SBE 9*plus*
- SBE 55 ECO Water Sampler
  - Receives pressure information from SBE 19, 19plus, 19plus V2, 25, or 50
  - Built-in capability similar to SBE 32 Carousel integrated with AFM
- All receive closure protocol from user via SeatermAF





# Setting Up Water Sampling Equipment: SeatermAF

SeaTermAF V	ersion 1.05 Communica	ations Utilitie	es Data Vie	w Help									_ 8 ×
Connect CTD Conr	Dect AFM	View Status Info Status	liew Header Info Headers	Closure Paran- efers AFM	Init Log	Capture	Upload	Program	AFM.	56 Diag	Stop	Discon	
SBE19	Ver?	COM	1 600,7,1	1,E	single	cast		) Ca	otuning				



# Setting Up CTD Communications

To access this dialog box, select the CTD and water sampling equipment in SeatermAF's Configure menu

mmunications	Closure Logic	Logic	Pressures/Times	Settings
EPROM Ver C Version Upload data Upload B C All as C All as C All se Header optic C Include C Don't inc	ision h less than 3.0 aud rate 19200 aud rate 19200 a single file parated by cast ons or header information default header form in clude default header	<ul> <li>Version 3.0 or greater</li> <li>By scan number range</li> <li>From a single cast</li> <li>By cast number range</li> <li>the upload file form in the upload file</li> </ul>	e e e	IMM Port



# Bottle Closure Logic

AFM with SBE19 Configuration Options			×					
CTD Communications SBE17plus Bottle AFM Closure Logic Closure	Bottle re Logic	Bottle Closure Pressures/Times	AFM Communication Settings					
Pressure sensor 79499 coefficients I:\data\SBE19\22659\2861.CON A0 = -2.686340e-001 A1 = -6.289699e+004 Close on downcast Real time baud rate Close on upcast Close on elapsed time, re Close on elapsed time, re Close on elapsed time, re	A2 = 0. cord CTD c	Browse 0000000e+000 data I CTD data						
Stationary logic         Time to hold in Pressure window (min):       10         Pressure window size(db):       10         Min change between bottles(db):       10         Enable pressure for first bottle (db):       500         Versure Change to Enable Upcast (db):       10         Stationary time on Bottom, (1 - 12 min):       5         Bottom Pressure Window, (1 - 25 db):       10								
Cancel Default Help		Save As	ОК					



# Bottle Closure Logic

• Downcast/Upcast Logic (downcast not applicable to SBE 17*plus* V2)





### Bottle Closure Logic

- Stationary logic (not applicable to SBE 17plus V2)

   Once CTD has reached *Enable pressure for* first bottle, bottle closes each time P remains within Pressure window size for Time to hold in Pressure window
- Elapsed time (not applicable to SBE 17*plus* V2)



## Auto-Fire Setup

- AFM
  - With SBE 19 or 25: SeatermAF converts user-input closure parameters in decibars to raw pressure numbers using .con file coefficients, CTD transmits raw pressure data to AFM
  - With SBE 19plus, 19plus V2, or 50: Instrument transmits data in decibars to AFM
- SBE 17*plus* V2
  - SBE 9*plus* transmits raw pressure data,
     SBE 17*plus* V2 converts raw pressure data to decibars, using .con file coefficients
- SBE 55 ECO Water Sampler
  - Operation similar to AFM



### Bottle Closure Pressures or Times

- AFM, SBE 17*plus*, and SBE 55 ECO close bottles on pressure
- AFM and SBE 55
   ECO can also close
   bottles on elapsed
   time in minutes
   from when armed

CTD Communications	SBE17plus Closure I	Bottle Logic L	tle Closure ogic	Bottle Closure Pressures/Times	AFM Communication Settings
	Number	of Bottles to Close	12 💌		
Closure Order	Bottle Position	Elapsed time since ARM (min)	Closure Order	Bottle Elapse Position since Af	d time RM (min)
1	1	10	12	0 0	<u>)                                    </u>
2	3	11	14.		
3	5	12	15	1010	)
4	į 7	13	16	1010	
5	9	14	17	1010	)
6	1 11	15	18	0 1 0	)
7	2	16	19	0 1 0	)
8	4	17	20		)
9	6	18	23		)
10	8	19	22		)
11	10	20	23		)
12	12	21	24-		)



### Data Recorded in Auto Fire Instrument

- AFM
  - 5 CTD scans are recorded in AFM at time of each bottle closure
- SBE 17*plus* V2
  - Since 17*plus* V2 is also memory module for SBE 9*plus*, all 9*plus* CTD data is recorded in 17*plus* V2
  - Bottle closure bit in status byte is set for 36 scans to indicate time of each bottle closure
- SBE 55 ECO Water Sampler
  - 5 CTD scans are recorded in ECO at time of each bottle closure



Telemetering and Water Sampling with Internally Recording Instrument: SBE 33

- Real-time interface SBE 32 Carousel:
  - receives power from SBE 33
  - converts it to power for SBE 19, 19plus, 19plus V2, or 25
  - telemeters data to deck
- Real-time interface SBE 55 ECO:
  - Operation with SBE 33 similar to that of SBE 32 Carousel with SBE 33



### Telemetering and Water Sampling with Internally Recording Instrument: SBE 33





# Deployment Issues: Cabling Telemetered Instruments





### What is a Slip Ring?







### Cabling the 9plus to the 11plus

- Use #20 twisted pair or coax to cable between SBE 11*plus* and winch
- Seacable is typically single or multi-conductor armored cable up to 10,000 meters, with less than 350 ohms resistance
- Grounding considerations
  - Use armor of sea cable for ground
  - Remember, salt water conducts, ship is metal (usually)
  - Ground chassis of your deck unit to hull of ship



# Cabling the 9plus to the 11plus





# How Do I Make the Wet End Connection?





## **Changing Batteries**











#### NiMH Batteries

Ni-Cad Batteries





# Plumbing for Success

- Sea-Bird conductivity cells and oxygen plenums rely on water passing through them, usually via a pump
- Pump is magnetically coupled impeller type, not self-priming
- Arrange tubing on instrument package to allow all air to escape from plumbing



### Plumbing for Success







vertical

### Plumbing for Success

Vinyl

tubing

Pump outlet Temperature DO sensor Pump (vertically sensor (vertically above Conductivity above DO outlet) T & C outlet) sensor



# Mating Habits of Underwater Connectors



Lubricate molded ridge on bulkhead connectors with 100% silicone grease

> Slide hand toward end cap to *burp* air

Note bulge due to entrapped air





# When Underwater Connectors Go Bad





# Make a Neat Underwater Package

- Cable tie or tape all loose cabling to frame of package
  - Loose cables flap as package rises or drops, resulting in fatigue
- Make sure no cables are in path of inlet to temperature sensors
- Instrument with aluminum housing: check zinc anodes occasionally; grounding problems can cause them to disappear



# What Do You Mean, Soak the Fish?

- This is not done in the galley!
- Soaking means putting the instrument package over the side and into water at a safe but shallow depth (like 10 meters)
- Soaking tip: use 2 display types
  - Fixed or scrolled text display to check all sensors and other parameters on deck and during soak
  - Multi-line plot for the cast



# How Long Should I Soak?





### Using Your CTD in Very Cold Places

- Glass conductivity cell is subject to breakage due to water freezing in cell
- Remove all water from conductivity cell
  - Repeated ice formation (film or droplets) on electrodes will degrade calibration at 0.001 - 0.020 PSU level
- Make a solution of 1% triton in sterile seawater
   Use 0.5 micron filtered seawater or boiled seawater
- Never use anti-freezes like glycol or alcohol
- SBE 43 Oxygen Sensor prevent freezing



## Correlating CTD Data with Water Samples

- Water sampler closure events are captured in data
  - GO 1015 systems mark the 9*plus* data stream with a status bit
  - SBE 32 Carousel and SBE 55 ECO systems use a list of scan numbers created by Seasave, .*bl* file
- This information is used by *Data Conversion* module to extract CTD data at time of water sampler closure into a *.ros* file
- Extracted data may be summarized into a table by *Bottle Summary* module



# Extracting CTD Data with Data Conversion

- You may create a .*cnv* and/or a *.ros* file
- The source of the data is your *.hex* or *.dat* file
- The indicator of what data to extract is a status bit in the data or a file of type .bl, .afm, or .bsr
- Data written to the *.ros* file is specified in the output variable selection dialog

🔤 Data Conversion	
File Options Help	
File Setup Data Setup Miscellaneous Header	iew ]
Process scans to end of file	
Scans to process	
Output format ASCII output	
Convert data from Upcast and downcast 💌	
Create file types Create bottle (.ROS) file only	•
Source of scan range data Scans marked with I	ottle confirm bit 💌
Scan range offset [s] .2	
Scan range duration [s] 4	
📕 Merge separate header file	
Select Output Variables	
Source for start time in output .cnv header	
Instrument's time stamp	System UTC
C NMEA time C	Upload time
Prompt for start time and/or note	
Start Process	Exit Cancel



### Specifying How Much Data Per Bottle Closure

- Data extraction is referenced to the time of closure
- Scan range offset is how many seconds before the bottle closure to begin extracting data
- Scan range duration is how many seconds total to extract data



### Summarizing and Tabulating Data

- *Bottle Summary* module creates a table of averages and standard deviations from data in *.ros* file
  - *.ros* file must contain pressure, temperature, and conductivity or salinity
  - Additional parameters may be derived from averaged variables
  - Data is output to a .*btl* file
  - If a .bl file is present, bottle numbers are inserted in .btl file



# **Bottle Summary**

Select

Tem Sali Den Volt Volt Sca

• Variables created by Data Conversion may be selected for inclusion in the .btl file

RR	Bottle Summary					
F	ile Options Help					
1	File Setup Data Setup Header View					
	C Output min/max values for averaged variables					
	Select Averaged Variables					
	Select Derived Variables					
	Oxygen Apply Tau correction					
lect Averaged	d Variables		×			
.,	ania kula kulanna Kaniki	. A				
V Procestro Digiga	anable Name [unit]		Select All			
Temperature []T	S-90 dea C1		<u>C</u> lear All			
Salinity (PSU)	0.00,000,00					
Density [sigma-t	heta. Ko/m^31	X				
Voltage 2		X				
Voltage 4		×				
Scan Count						
		ОК	Cancel			
-	Start Process		Exit Can	cel		



### Bottle Summary, Deriving Parameters

• Parameters derived from the averages may be added to the .btl list

Select Derived

	🕮 Bottle Summary	i		
	File Options Help			
d may tl list	File Setup Data Setur Dutput min/max Select Averaged V Select Derived V Oxygen Apply Tau corr	up Header View View Values for averaged variables		
ariables				×
Variable Name [unit]	▲ Add Change Delete Insert Delete All	Density     Nitrogen Saturation     Oxygen Saturation     Oxygen Saturation     Sound Velocity     Specific Volume Anomaly [10^	-8 * m^3/Kg]	Shrink All Expand All Shrink Expand
			ОК	Cancel
	Start Process		Exit	Cancel



### Activity: Create .ros and .btl Files

• Use SBE Data Processing to convert data from an SBE 9*plus* and create bottle files; see notes for instructions