



December 2007

## Introduction

The Underway CTD (UCTD) is an underway system for acquiring conductivity and temperature profiles at ship speeds up to and exceeding 13 knots. It is manufactured, packaged, and sold by Oceanscience Group, in Oceanside, California. It was acquired by the Upper Ocean Processes Group, and subsequently tested aboard the NOAA ship *Ronald H. Brown*, on the Stratus 2007 cruise in October 2007.

## Components

- Sea-Bird CTD Probe 10-400
- Tail Spool
- Tail Spool Re-winder
- Winch with Level Wind
- 1400 Meters of 300 lbs Spectra Line
- Davit and Block
- Mounting Pedestal
- Power Supply
- UCTD software
- Bluetooth Software



Figure 1. Probe/ Tail Spool, Re-winder & Winch

Line is spooled automatically off the probe's tail while it drops through the water, and line is manually paid out from the winch spool. The simultaneous payout of line from the probe's tail and winch effectively makes the line velocity zero through water, allowing freefall.

The CTD probe samples conductivity, temperature, and depth at a sampling rate of 16 Hz while descending vertically through the water column at ~4 meters per second. Data are stored internally in flash memory and downloaded wirelessly via Bluetooth to a host computer or PDA after recovery.

The latitude and longitude of individual casts are obtained by matching an internal time stamp in the data file header to an externally collected GPS file. Synchronization of instrument and GPS time is important. MATLAB scripts were used for processing.



Figure 2. UCTD Assembled

## Operation

The system is operated from the after-portion of the stern deck. A length of line equal to the desired cast depth is wound onto the CTD's tail spool. While the ship steams away from the drop site, the probe plunges vertically with a nearly constant drop rate independent of the ship's speed.

Depth	Speed	Turn-Around
200 Meter Tow-Yo	10 knots	10 Minutes
200 Meters	12 knots	30 minutes
800 Meters	4 knots	40 Minutes
1200 Meters	1 Knot	35 minutes

Figure 3. Typical Profiling Cycles

## CTD Sensor Specifications

The range of the temperature sensor is 5° to 43° C; conductivities can be measured from 0 to 9 S/m; and the pressure range is 0 to 2000 m. The pressure housing is rated for a depth of 2000 meters, although the operating depth is normally less than 1000 meters. Typical accuracies of the processed data are 0.005-0.02°C for temperature, 0.002-0.005 S/m for conductivity, 1 dbar for pressure, and 0.02 -0.05 psu for salinity.

	Conductivity [S/m]	Temperature [°C]	Depth [dbar]	Salinity [psu]
Resolution	0.0005	0.002	0.5	0.005
Raw Data Accuracy	0.03	0.01 to 0.02	4	0.3
Processed Data Accuracy	0.002 to 0.005	0.004	1	0.02 to 0.05
Range	0 to 9	-5 to 43	0 to 2000	0 to 42

Figure 4. Sensor Specifications

## Data

During the Stratus 2007 cruise off Ecuador, Peru, and Chile, over 300 casts were conducted. Selected data, seen in figure 5, were collected while underway between the SHOA DART buoy and the STRATUS IMET buoy.

The probe was deployed every half hour and obtained a temperature and conductivity profile down to approximately 200 meters; see figure 6 for a typical cast profile. Ship speed was 12.5 to 13 knots, allowing profiles to be obtained roughly every 6 to 7 nautical miles.

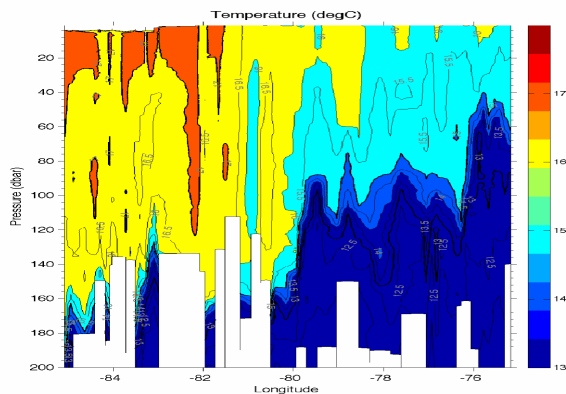


Figure 5. Temperature versus depth along 20°S between the SHOA DART and WHOI ORS buoys.

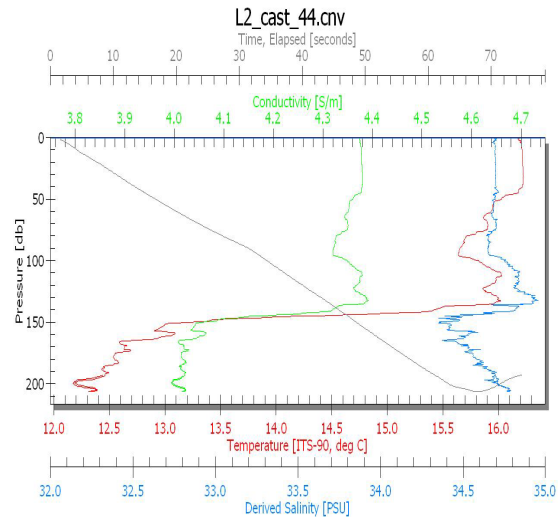


Figure 6. Individual cast from SHOA DART and WHOI ORS buoys.

## Conclusion

With proper training and attentive use, the UCTD is an effective tool for acquiring conductivity and temperature profiles at ship transit speeds, optimizing valuable ship time.

Also, the system consists of easily shipped and assembled components. The software and data processing were found to be unproblematic.

Notably, the intense sampling scheme afforded by the UCTD provided a near real-time evaluation of conductivity and temperature profiles over great distances.

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