The "Berichte aus dem Fachbereich Geowissenschaften" are produced at irregular intervals by the Department of Geosciences, Bremen University.
They serve for the publication of experimental works, Ph.D.-theses and scientific contributions made by members of the department.

Reports can be ordered from:

Gisela Boelen

Sonderforschungsbereich 261

Universität Bremen

Postfach 330 440

D 28334 BREMEN

Phone: (49) 421 218-4124

Fax: (49) 421 218-3116

e-mail: boelen@uni-bremen.de

Citation:
Meinecke, G. et. al.
Report of RV POSEIDON cruise POS 271, Las Palmas – Las Palmas, 19.03.- 29.03. 2001
Berichte, Fachbereich Geowissenschaften, Universität Bremen, No. 196, 19 pages, Bremen, 2002.

ISSN 0931-0800

Contents

POSEIDON cruise Report POS 271

(19.03. - 29.03.2001 / Las Palmas - Las Palmas)

1. Introduction

The aims of this POSEIDON cruise from the 19th of March till the 29th of March 2001 were to perform the first tests within the DOLAN project - the continuation of the DOMEST project - on site, to run the monthly station work for the ESTOC site and to maintain the ESTOC mooring CI13. The CI13-mooring is part of the permanent time series station ESTOC (ESTOC “European Station for Time Series in the Ocean - Canary Islands) and contains in-situ pumps for sampling the water column for trace metals and three sediment traps. Sampling periods ranges from one to two weeks. The particulate material collected will be analysed to determine total fluxes of organic, anorganic components and for species composition of the planktonic organisms (pteropods, foraminifera, radiolaria, coccolithophorids, and diatoms). The objective of these studies is to identify signals of seasonal variations in those components, which play an important role in the sediment formation process. The results of these investigations will form a basis for the reconstruction of paleocurrent systems and paleoproduction of the sediments.

The aim of the project DOLAN is the operational setup of a moored sensor network in the deep sea. The advanced sensors will provide high-resolution data on particle fluxes and element concentrations in the open ocean and can be accessed from land via satellite and acoustic transmission. Communication under water will be performed through a bidirectional acoustic high-speed telemetry. Above water, a satellite network will establish the data transport between the moored system and a land based ground station in Italy. The system will be deployed at 3600 m water depth over a maximum duration of one year. With DOLAN a remotely controlled measurement of element and particle transport in the deep sea will be possible. Importantly, remote control includes access on a variety of data without recovering the sensors from the deep ocean. These possibilities allow an advanced sampling and probing of parameters depending on various environmental parameters, such as satellite derived ocean colour or particle input during dust storms. Such an “interactive” measurement of relevant parameters will enhance the understanding of transport processes from the surface to the deep ocean and allows a more detailed reconstruction of paleoclimatic changes.

Within DOLAN three subsystems will be established and used:

1. Deep-sea mooring with several measurement devices:
   Moored Sensor Unit (MSU) with Subsurface Platform (SSP) and Multi Sensor Device (MSD)
2. Parallel mooring with surface buoy:
   Surface Buoy Unit (SBU)
3. Deep Ocean Bottom Station:
   Deep Ocean Bottom Station (DOBS) with autonomous profiling Deep Ocean Profiler (DOP)

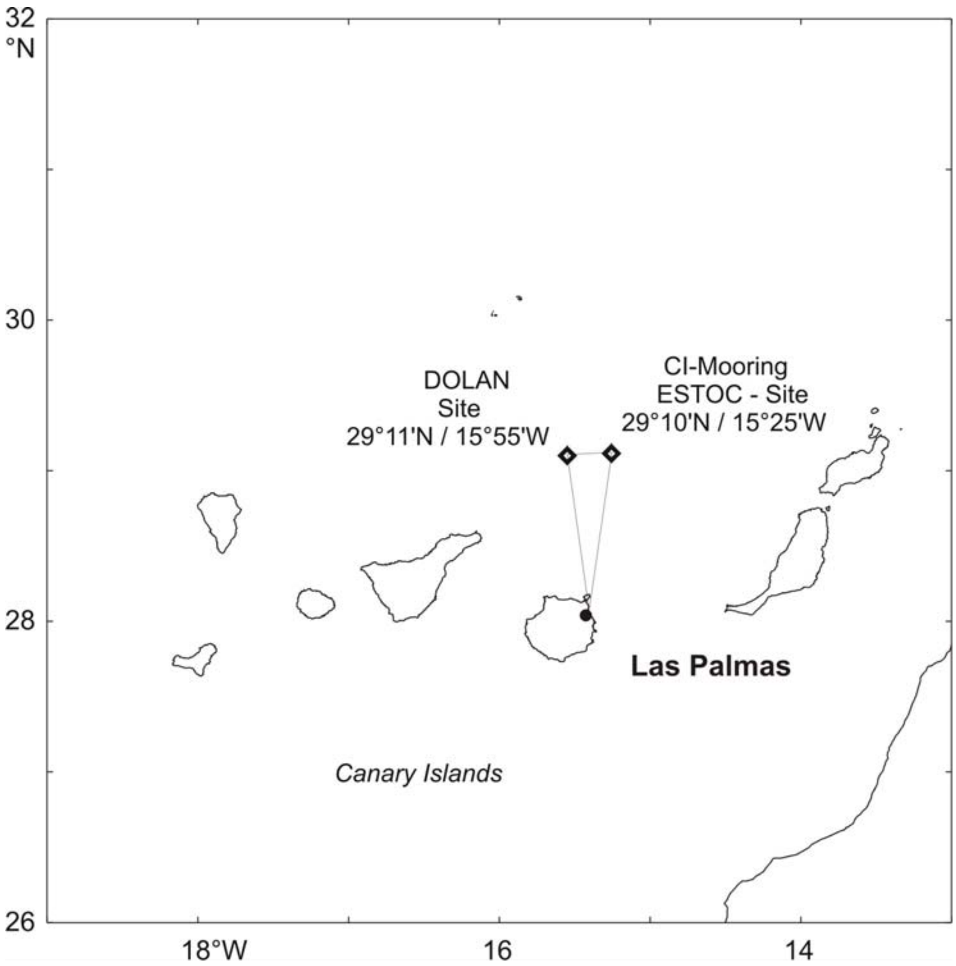

Fig. 1 Planned cruise track and location of DOLAN test site and ESTOC site and mooring CI13/CI14.

2. Participants

1.	Meinecke, Gerrit, Dr.	Dipl.-Geol.	Chief Scientist	GeoB-Bremen
2.	Bergenthal, Markus	Dipl.-Phys.	DOLAN	GeoB-Bremen
3.	Cianca, Andres	Dipl.-Geol.	ESTOC	ICCM
4.	Drünert, Frank	Dipl.-Ing.	DOLAN	OHB, Bremen
5.	Held, Matthias	Student	DOLAN	GeoB-Bremen
6.	Nowald, Nicolas	Dipl.-Geol.	DOLAN	GeoB-Bremen
7.	Ratmeyer, Volker, Dr.	Dipl.-Ing.	DOLAN	GeoB-Bremen
8.	Templer, Alexandre	Student	ESTOC	ICCM

GeoB	Fachbereich 5 - Geowissenschaften Universität Bremen Klagenfurter Str. D-28359 Bremen Germany
OHB	OHB-Teledata AG Universitätsallee 27-29 D-28359 Bremen Germany
ICCM	Instituto Canario de Ciencias Marinas Telde / Gran Canaria Gran Canaria Spanien

3. Research Programs

The research activities during the POS 271 cruise are related to the scientific programs DOMEST/DOLAN and ESTOC/CANIGO.

The scientific work at the DOLAN site, 60 miles north off the Canary Island Gran Canaria will focus on the first tests within the BMBF funded project DOLAN, which is the continuation of the DOMEST project. The main objective will be to test again the data-transmission into the deep ocean, as well as the connection to a satellite communication network. New devices will be tested for their functioning on board, in the deep ocean and connected to the acoustic communication line. Within the framework of the deep-sea device testing programme DOMEST the following work is planned:

1. Test of UW communication from the ship to devices and also on ships wire down to 2500 m water depth.
2. Communication with the Multi Sensor Device MSD. Test of the total communication, including the satellite link.
3. Test of Deep Ocean Profiler (DOP).

Parallel to the DOLAN activities, scientific work related to the CANIGO project will be done at the ESTOC site. Particle flux will be investigated by servicing the sediment trap mooring CI13. In addition to sediment traps, the ESTOC-mooring contains in-situ pumps for sampling the water column for trace metals, also. These pumps will be maintained during this cruise.

4. Narrative of this cruise

The RV POSEIDON left Las Palmas on the 19th of March in transit to the ESTOC site, 60 nm north off Las Palmas. During the transit to the ESTOC site, 6 XBT stations were carried out from aboard the RV POSEIDON. In the beginning of the 20th of March we recovered the CI 13 mooring and moved to the DOLAN site - 20 miles farther to the west, afterwards. The next 2 days we started to run several Rosette/CTD profiles in order to enhance the sample grid around the ESTOC station. In addition we deployed a drifting NOAA buoy. On the 22nd of March we re-deployed the CI 14 mooring at the ESTOC site. The RV POSEIDON moved back to the DOLAN site and we started to run the first acoustic communication tests with the MSD device. Within the next 6 days we have run several tests with the DOLAN Multi Sensor Device (MSD) interchanged with Rosette/CTD stations. During all these activities we have had good weather conditions. In the evening of the 28th of March we left the DOLAN site with heading to Las Palmas. In the morning of the 29th we arrived at Las Palmas harbour and this sucessful cruise was finished.

5. Report and Preliminary Results

5.1 Particle flux measurements with moored particle traps

(M. Bergenthal, V. Ratmeyer)

Particle flux measurements at the ESTOC (European Station for Time-series in the Ocean, Canary Islands) carried out since fall of 1991 show seasonal and short-term variability due to varying productivity and hydrographic conditions. This long-term particle flux record also indicates that a large portion of deep particle flux originates laterally. In CANIGO, additional sediment traps have been placed for some mooring intervals north of La Palma (mooring LP), between the eastern Canary islands (mooring CI) and the Moroccan shelf (moorings EBC). Including the ESTOC position, these three main trap locations cover the productivity gradient from the shelf region to the oligotrophic gyre.

On March the 20th the ESTOC sediment trap mooring CI13 was recovered. It carried three traps, two RCM 8 Aanderaa current meter and two particle pumps (Marine Chemistry department, Univ. of Bremen. After servicing of the mooring equipment, the CI mooring was re-deployed as CI14 (Fig. 2) at the same location. The CI14 mooring is equipped with three sediment traps, two Aanderaa current meter but no particle pumps.

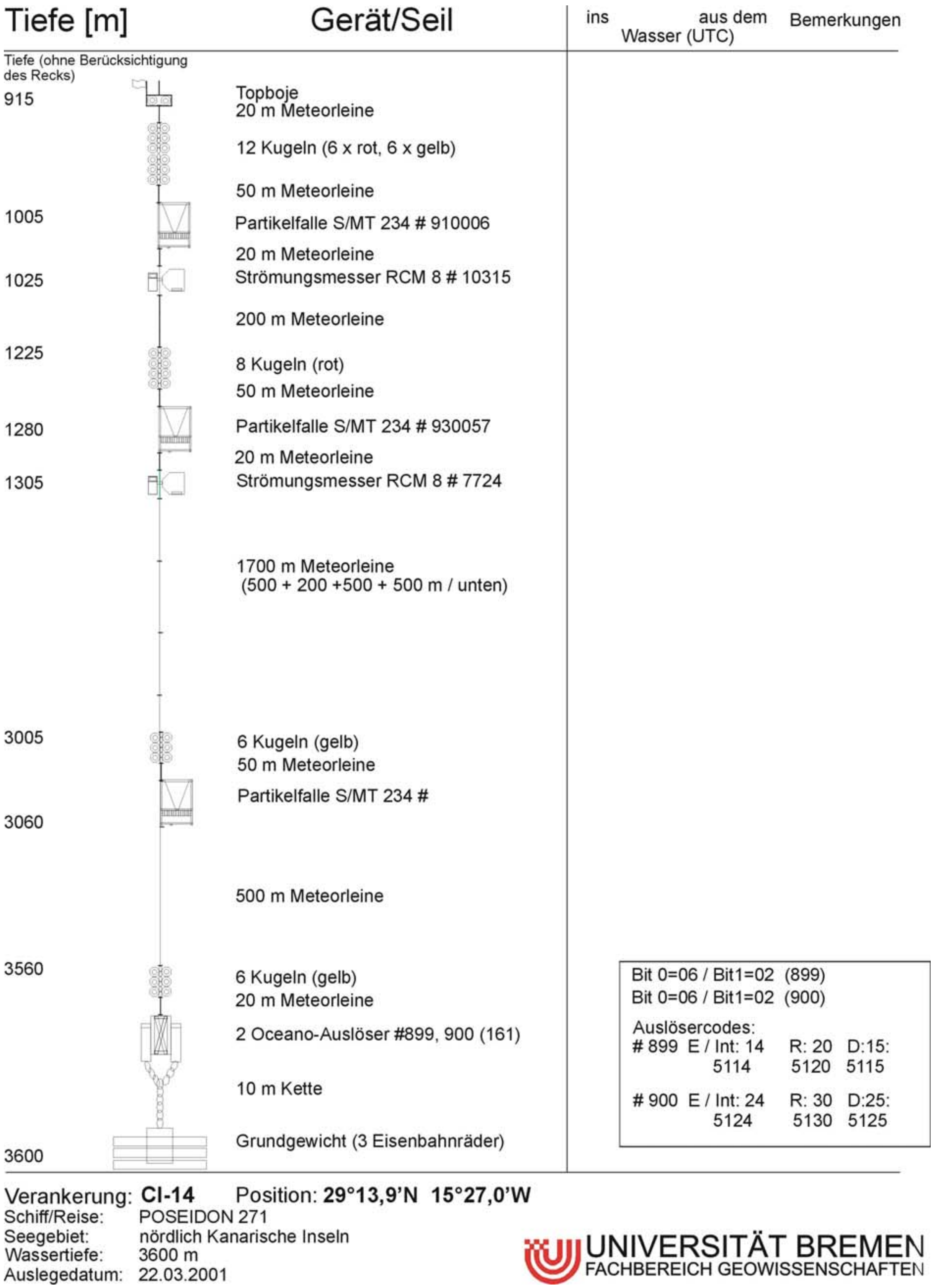

Fig. 2: Sediment trap mooring CI 14 deployed at ESTOC.

5.2 DOLAN

(G. Meinecke, M. Bergenthal, F. Druenert, V. Ratmeyer)

The DOLAN project is dedicated to Data transmission in the Ocean, based on a bi-directional link from the deep Ocean onto the land based station in Italy and vice versa. Above water the data transmission will be established by the OrbComm satellite system and in the water column the communication is performed by acoustic underwater modems.
The complete system consisting of three main moorings (Fig. 3), the surface buoy unit (SBU), the moored sensor unit (MSU) and the deep ocean bottom station (DOBS).

Main Objectives for the Cruise

The main objective for this cruise was to implement and to test the MSD sensor suit (Fig. 4) proposed in the Domest project. In complete, the UW-Winch (SSP) the Sediment trap, the Camera system and the FSI-CTD/Currentmeter (MSD) have to be attached to the control PC (BC2) and to two separate acoustic modems as 2 independent acoustic clients at the moored sensor unit (MSU). From each client you can obtain scientific data on request via OrbComm satellite link / SATEL (Pocket radio link for short distances) and acoustic underwater communication. The FSI CTD and the Sediment trap has been tested once before. Due to the larger packet length of the ADCP data output (1.000 byte), with has to be transmitted acoustically, it was necessary to implement new software inside the controller (BC2). With this new software, it is possible to transmit a JPEG-picture from the camera system acoustically, on an incremental base (each increment 1.000 byte). One of the main goals during this cruise was to run transmission tests from the camera device. All other devices have been tested successfully on other cruises.

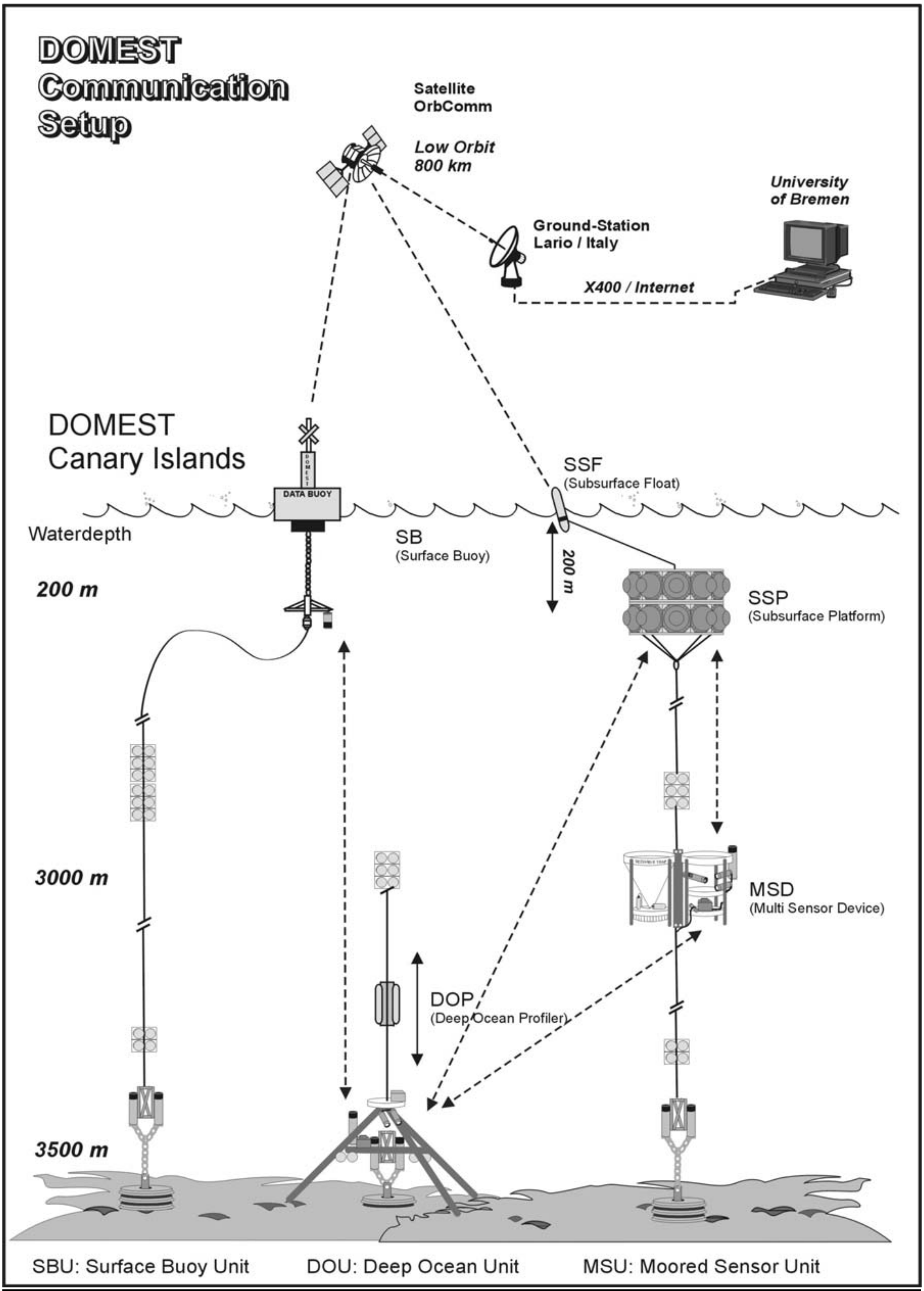

Fig 3: Communication setup and general design of DOLAN moorings and equipment.

Test equipment

One of the biggest problems with under water acoustic communication is to know what kind of communication took place inside the water column. If a communication fails during a test and if you don't have control about all kind of sounds in the water column, you can't decide why the communication fails - due to a real hardware problem or because the under water client haven't heard the signal. For this reason, for all acoustic tests the ORCA Deck Unit is used in conjunction with an FFT-Spectrogram Software package. This software is running on a separate PC, with itself is connected via an DAT-Recorder to the Line-socket of the Deck Unit. While the Deck Unit is transmitting a signal as an acoustic data stream into the Ocean, this signal is displayed in real time in the FFT-software on the monitor PC in the Lab. The same will happens with each sound and noise in the water column. If a signal is coming back from an acoustic client - moored deep in the ocean - received by the transducer and passes through the Deck Unit, this signal will be displayed in the FFT-software on the monitor PC. With growing experiences, it is easy to analyse the transmitted signals - optically displayed as spectrograms on the monitor PC and acoustically monitored at the Deck Unit, in order to separate different under water clients or to analyse possible failure sources. Both, the DAT-Recorder and also the FFT-software have the ability to save all the communication, either as WAV-files on Harddisk or as digital soundfile on the DAT Tape. This equipment has been used with great success from the beginning of the DOMEST project.

Integration and Test of the Multi Sensor Device (MSD)

The Multi Sensor Device (MSD) is the most complex device in the DOLAN project. The MSD consist of 3 scientific sensors, all with its own microcontroller inside. The FSI-CTD is a combination of CTD, acoustic currentmeter and backscatter sensor. The camera system is a combination of a digital video-camcorder - controlled by an BASIC tiger - and an image analysis PC, based on an miniaturised industrial used 200 Mhz Pentium PC with Windows and Optimas software. Finally, the sedimenttrap is also controlled by a small PHYTEC microcontroller, too. These sensor suits are connected via their serial RS 232 interface to the BC2 controller. The software running on the BC2, has to convert the different protocols from each sensor into one common protocol. This is necessary to understand each sensor and to pass the data through the 4th serial interface to the acoustic modem, where the data were converted to an acoustic data stream. With its own host serial port, the BC2 has to control 5 serial com-ports. Despite all specific problems of sounds - prolongating through the water column - to establish a communication from one acoustic client to another one, the acoustic request passes through the target modem to the connected BC2. Here, the information will be routed to the specific sensor. Inside the sensor, different processes have to start: wake up, boot, gather data, build up communication, send data, acknowledge.... - all these processes need to have different time to process. To take all these into account, different “time out” times and different “priorities” for processes have to stated and one build up on the other one. If one process need a longer time than stated in the “time out”, no data transmission could happen and the modem won’t proceed with the communication. Specially in the developmental stage of the DOMEST project, there are a lot of potential failure sources and all these processes need to have a fine tuning on each field test. On this cruise it was the third time for testing the complete integrated MSD, with new software, with 5 serial ports and the new 1.000 byte driver implemented.

After fixing minor problems - especially with the camera decive, we were capable to request data from all sensors installed at the MSD. Acoustically we requested for CTD data and the FSI CTD offers typically Conductivity, Temperature and Density - in addition current speed and direction (from 3D ACM sensor) and particle information (from Backscatter sensor). The sediment trap was capable to display status, RTC, sample list and the sample device can be programmed to run to specific samples. Due to an electronic failure of the camera, we only could request for status data of the digital camera system and need to finish the tests of the camera system.

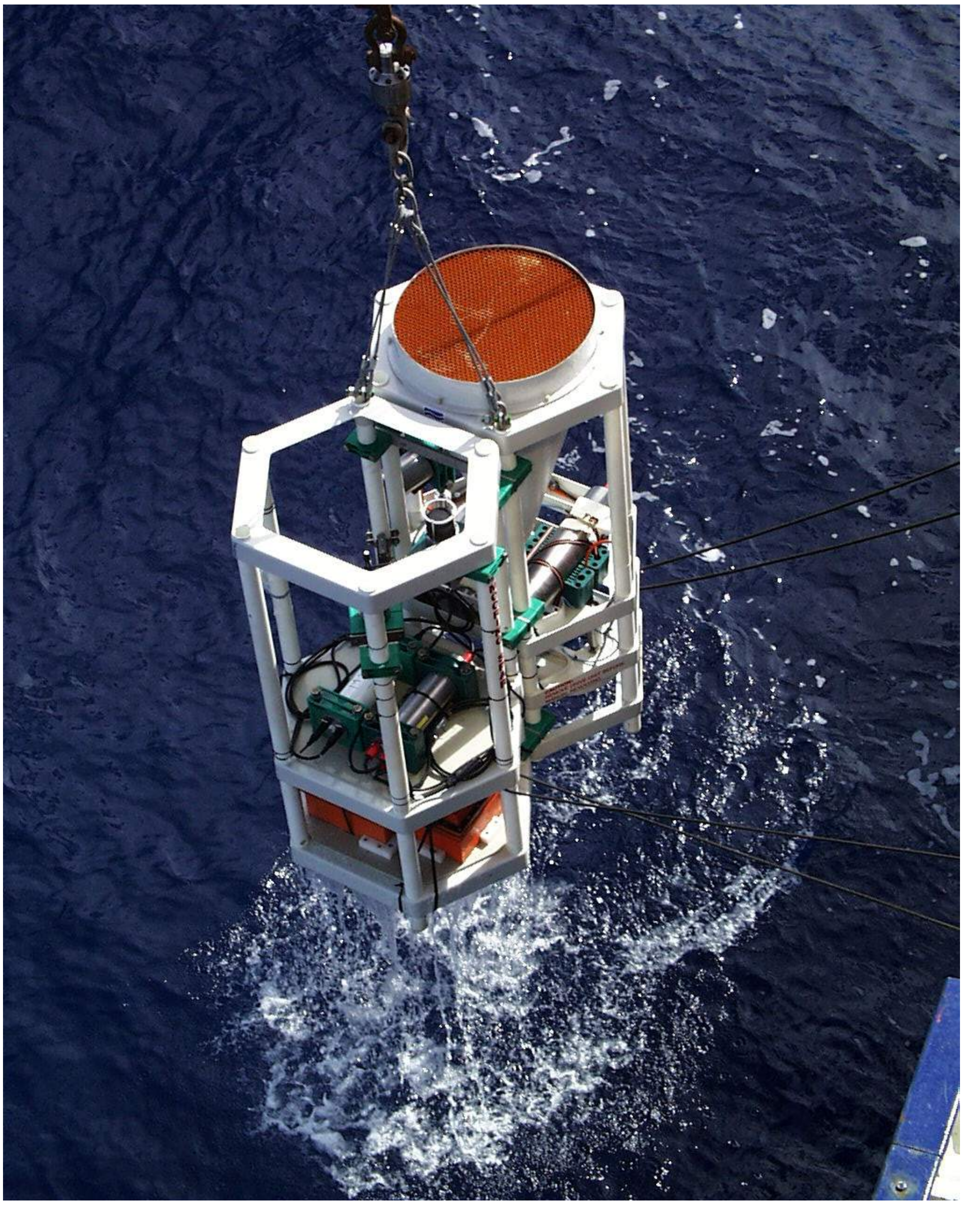

Fig 4: Multi Sensor Device MSD during tests at ships wire.

5.3 ESTOC Station work

(Andres Cianca, Alexandre Templer)

CTD Measurements

Measurements with a Conductivity-Temperature-Depth (CTD) recording FSI were carried out near the ESTOC and DOLAN positions and between Teneriffe and Gran Canaria. The FSI-CTD was operated together with a General Oceanics rosette carrying 10 x 5 l Niskin bottles.

The FSI-CTD has a laboratory calibration for the temperature and pressure sensors. A Beckman oxygen sensor recorded oxygen current and the temperature inside of the sensor. Salinity samples from the Niskin bottles were taken to check the correct closing of bottles, and samples from the deep ocean in low gradient zones were taken to calibrate in-situ conductivity and salinity of the CTD.

Salinity measurements with a Guildline AUTOSAL 8400 A were carried out after the cruise in a temperature-regulated laboratory at the ICCM. After processing, calibration and averaging to 2 dbar intervals, the accuracy of the FSI-CTD data are expected to be better than 1 ppt for pressure (e.g. 6 dbar for a pressure of 6000dbars), better 0.002 mK and better 0.003 in salinity.

XBT

Measurements were made using Shipican T7 (Deep Blue) probes, capable of measuring down to 760 m for ship speeds up to 20 knots. Following WALSH (1996) data in the upper 5 m are removed from the files because of the finite response time of the probe (0.63 s), generating unrealistic temperature values during the transition from air to water temperatures. A rate of fall of 6.5 m s^{-1} corresponds to a depth of 4.08 m. The deployments were made under way from Gran Canaria to ESTOC, with a nominal spacing between samples of 10 nautical miles (in total, 6 launches).

Chemical oceanography

During POS 271 water samples were taken from 5 l Niskin bottles of the CTD/rosette to analyse oxygen, nutrients, Gelbstoff and chlorophyll "a", both at ESTOC and DOLAN and on the way between Teneriffe and Gran Canaria. Samples were collected immediately after the bottles were on board from each depth. All samples were taken and parameters analysed according to the procedures established in the World Ocean Circulation Experiment (WOCE, 1994). In addition, Gelbstoff fluorescence spectra were measured with a Shimadzu Model RF-1501 Spectrofluorometer. Spectral calibration of the instrument was carried out as described in

DETERMAN et al. (1994). Fluorescence intensities were standardized to the integrated water Raman scatter band for the given excitation wavelength and denoted as Raman units DETERMAN et al. (1996). Chlorophyll a was determined on board by fluorometry, following the methodology described by WELSCHMEYER (1994) using a TURNER 10-AU fluorometer.

6. LITERATURE

DETERMANN, S., REUTER, R., WAGNER, P., WILLKOMM, R., 1994. Fluorescent mater in the eastern Atlantic Ocean: Part 1, method of measurement and near-surface distribution. Deep-Sea Res. 41, 659 – 675.

DETERMANN, S., REUTER, R., WILLKOMM, R., 1996. FLUORESCENT MATER IN THE EASTERN ATLANTIC OCEAN: PART 2, VERTICAL PROFILES AND RELATION OF WATER MASSES. DEEP-SEA RES. 43, 345 – 360.

WALSH, 1996: QUALITY CONTROL OF XBT DATA. AUSTRALIAN OCEANOGRAPHIC DATA CENTRE, SPECIAL PUBLICATIONS.

WELSCHMEYER, N.A., 1994. FLUORIMETRIC ANALYSIS OF CHLOROPHYLL A IN PRESENCE OF CHLOROPHYLL B AND PHAEOPIGMENTS. LIMNOL. OCEANOG. 39 (8), 1985 – 1992.

WOCE OPERATIONAL MANUAL, 1994. WHP OFFICE REPORT. WHP-O 91.1. WOCE REPORT NO. 68/91.

7. Station list PO 271

Date	*Stat.-No.*	*Device*	*Lat. (°)*	*Lon. (°)*	*WD (m)*	*Remarks*
19.03.	PO 179	XBT	28 19.80 N	015 21.80 W	3110	XBT
19.03	PO 180	XBT	28 29.70 N	015 22.90 W	3470	XBT
19.03.	PO 181	XBT	28 39.70 N	015 24.20 W	3575	XBT
19.03.	PO 182	XBT	28 49.80 N	015 25.30 W	3595	XBT
19.03	PO 183	XBT	28 59.70 N	015 26.40 W	3603	XBT
20.03	PO 184	XBT	29 09.80 N	015 27.20 W	3606	XBT
20.03.	PO 185	CI 13	29 12.70 N	015 27.40 W	3600	Recovery of CI 13 Mooring
20.03.	PO 186	CTD/WS	29 12.30 N	015 28.10 W	3606	CTD/WS
20.03.	PO 187	CTD/WS	29 12.80 N	015 27.50 W	3605	CTD
20.03.	PO 188	CTD/WS	29 12.90 N	015 28.00 W	3605	CTD
21.03.	PO 189	CTD/WS	29 12.70 N	015 27.20 W	3605	CTD
21.03.	PO 190	CTD/WS	29 12.70 N	015 26.90 W	3605	CTD
21.03.	PO 191	CTD/WS	29 12.50 N	015 26.70 W	3605	CTD
21.03.	PO 192	Buoy	29 12.30 N	015 26.80 W	3606	Deployment NOAA
21.03.	PO 193	MSD	28 49.00 N	015 41.90 W	3597	Domest
21.03.	PO 194	CTD/WS	28 49.00 N	015 42.00 W	3600	CTD
21.03.	PO 194-1	CTD/WS	28 48.60 N	015 41.90 W	3596	CTD
21.03.	PO 194-2	CTD/WS	28 49.00 N	015 42.10 W	3601	CTD
22.03.	PO 195	CI-14	29 13.90 N	015 27.00 W	3600	Mooring CI-14
22.03.	PO 196	MSD	28 28.90 N	015 55.00 W	3122	Domest
22.03.	PO 196-1	CTD/WS	28 29.00 N	015 55.00 W	3122	CTD
22.03	PO 196-2	CTD/WS	28 28.90 N	015 55.00 W	3110	CTD
23.03	PO 197-1	CTD/WS	28 09.00 N	016 06.90 W	2430	CTD
23.03.	PO 197-2	CTD/WS	28 09.00 N	016 06.70 W	2455	CTD
23.03.	PO 198	MSD	27 48.00 N	016 19.90 W	2944	Domest, Hydrophone
23.03.	PO 198-1	CTD/WS	27 48.30 N	016 20.20 W	2919	CTD
23.03.	PO 198-2	CTD/WS	27 48.20 N	016 20.30 W	2910	CTD
24.03.	PO 199-1	CTD/WS	27 29.80 N	016 32.80 W	3535	CTD

Date	*Stat.-No.*	*Device*	*Lat. (°)*	*Lon. (°)*	*WD (m)*	*Remarks*
24.03.	PO 199-2	CTD/WS	27 29.90 N	016 32.00 W	3535	CTD
24.03.	PO 200	ParCa	27 48.00 N	016 19.80 W	2978	ParCa-Camera
24.03.	PO 200-1	ParCa	27 48.00 N	016 19.80 W	2982	ParCa-Camera
24.03.	PO 200-2	ParCa	27 47.70 N	016 19.70 W	2990	ParCa-Camera
24.03.	PO 200-3	MSD	27 47.50 N	016 19.80 W	2978	Domest, Hydrophone
25.03.	PO 201-1	CTD/WS	28 20.00 N	016 00.10 W	2820	CTD
25.03.	PO 201-2	CTD/WS	28 19.80 N	016 00.10 W	2820	CTD
25.03.	PO 201-3	MSD	28 19.90 N	015 59.60 W	2833	Domest, Hydrophone
26.03.	PO 202	ParCa	28 52.80 N	015 46.10 W	3610	ParCa
26.03.	PO 203	CTD/WS	28 10.10 N	015 30.00 W	3611	CTD
26.03.	PO 203-1	CTD/WS	28 10.10 N	015 30.20 W	3610	CTD
26.03.	PO 203-2	CTD/WS	28 10.00 N	015 31.20 W	3610	CTD
26.03.	PO 203-3	CTD/WS	28 09.90 N	015 31.30 W	3609	CTD
27.03.	PO 204-1	MSD	29 12.00 N	015 27.10 W	3600	UW-Kamera
27.03.	PO 204-2	ParCa	29 12.00 N	015 26.80 W	3600	ParCa Kamera
27.03.	PO 205	ParCa	29 36.00 N	014 45.00 W	3484	ParCa-Kamera
27.03.	PO 205-2	ParCa	29 35.70 N	014 43.40 W	3480	ParCa-Kamera
28.03.	PO 206	ParCa	29 11.70 N	014 45.10 W	3525	ParCa-Kamera
28.03.	PO 207	ParCa	28 53.00 N	015 06.20 W	3580	ParCa-Kamera

Legend:

MSD	Multi Sensor Device (Sensor Suite, Sediment trap, CTD, 3D ACM)
CI	Canary Island mooring
CTD/WS	CTD and water sampler / Rosette
ParCa	Particle Camera
XBT	Expendable Bathy-Thermograph

8. Acknowledgement

The POSEIDON cruise POS 271 was very successful. All the time on board we have had an outstanding teamwork and a very friendly comradeship between crew and scientists. For this we very sincerely thank Captain Klassen and the entire crew of RV POSEIDON.