

The BOUSSOLE project technical reports; report #7-14, issue 1.

BOUSSOLE buoy deployment & maintenance log.

September 04, 2010 - March 31, 2011

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BOUSSOLE project

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Foreword

This report is part of the technical report series that is being established by the **BOUSSOLE** project.

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European Space Agency



Centre National d'Etudes Spatiales, France



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1. SCOPE OF DOCUMENT

The BOUSSOLE buoy deployment and maintenance log is a record of all events that occur from the deployment to the recovery of one of the two upper sections of the buoy.

The aim is to keep track of all maintenance operations, such as instruments cleaning or rotations, instruments malfunctions, incidents with the buoy structure, if any, biofouling development and so on.

This information is crucial to a subsequent correct interpretation of the data.

Keeping track of these events also allows their analysis in view of the permanent improvement of protocols.

The present report concerns "buoy deployment XI", from September 04th of 2010 to April 1st of 2011.

2. DESCRIPTION OF OPERATIONS

2.1 UPPER SECTION PREPARATION (2010-08)

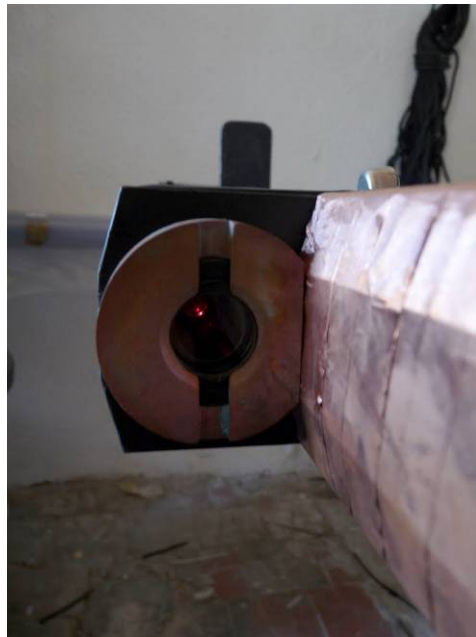
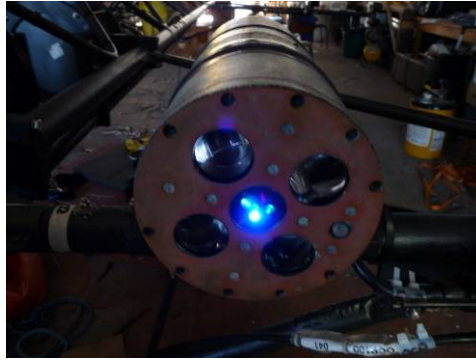
The buoy System (buoy XI called system #1) was delivered from Satlantic on August 02th, and installation on the structure began on August 17th. Then the deployment took place on September 04th 2010.

The Buoy was equipped with sensors used for the deployment of the buoy IX recovered on April 22nd with exception of the OCP 4m. The system was prepared in the CCI local in Villefranche-Sur-Mer and since the end of August was ready for the deployment. Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising. Aluminium plates (3 mm thickness) have again been fixed on the back side of the solar panels to reinforce them. The Bio-shutters were installed but not connected. The system was tested for some days running both with solar panel or ground alimentation. The following anomalies were observed:

- High air values for the Xmiss 4m.
- After a first cycle of measurement no connection was got with the DACNET. The DACNET was then opened to recover the microdrive for data download and it resulted to be corrupted (data were nonetheless retrieved).
- The internal pile was found to be discharged and was changed.

Dark IOPs measurements were also made for dark corrections.





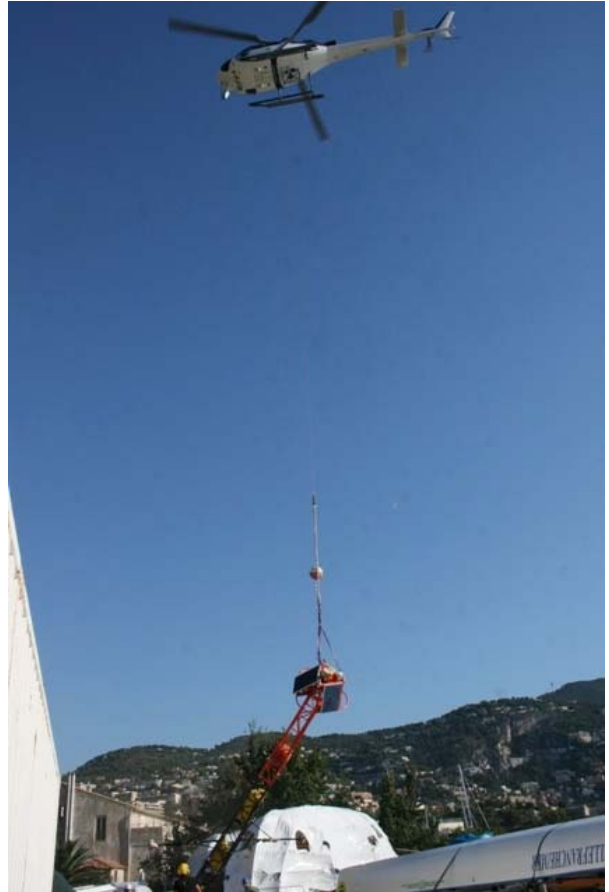


2.2 MOORING DEPLOYMENT

2.2.1 Saturday 04th September 2010

The upper structure to be deployed was brought to the Rochambeau field at local 06:30am with the help of 5 people from the LOV. The 4 arms were assembled and connected to the buoy. Then we communicated to the CASTOR we were ready to deploy. The CASTOR was at the BOUSSOLE side since the day before to exchange the entire mooring. The OK call for starting the helicopter operations arrived with the help of the *Semaphore* of Cap Ferrat since no GSM resources were at the Boussole site at that moment. The helicopter left Carros at about 09:10am. As usual the go/return trip lasted about one hour. At about 13h the ARGOS messages arrived regularly. The xmiss data at 4m were negative and no data came from the Strain sensor. The last maybe has not been connected.





At this date, buoy is equipped with

- DACNet #011
- CLC #004
- Junction Box #004
- Rads set: OCI #035_Eu4m, #040_Ed4m, #109_Eu9m, #047_Ed9m #095_Es, OCR #035_Lu4m and #038_Lu9m), MVDS #053, OCP #036(4m) and OCP 041(9m)
- Hyper spectral units HOCR #241_Lu4m, #242_Lu9m, #279_Es, STOR-X #032 and Bio-shutters #085_Lu4m and #086_Lu9m.
- HS4 #H4070403
- Strain-100 #001
- Transmissometers C-Star #1057-PR (4m) and #1058-PR(9m)
- ECOFLNTUS #726 (4m) and #727 (9m)
- ARGOS beacon #18797 (prog id#26021)
- CTD #37SI 46113-5325
- Strain gauge OML CSCB40K
- PAR #097

The lower part of the buoy is still equipped with the emergency ARGOS beacon #5433 (prog. id. #12237) whose batteries have been changed in July and August 2010.

2.2.2 Sunday 23th September 2010

This day divers from MARE NOSTRUM private company of Nice went to the Boussole site for cleaning the sensors and performing dark measurements. Pictures showed that one solar panel was curved and detached from its structure at the bottom.

2.2.3 Tuesday 19th October 2010

This day is part of the Boussole#103 cruise. Due to a strike on board, we were only allowed to download data. This was done through a CISCO connection at the first attempt.

2.2.4 Friday 22nd October 2010

This day the ARGOS started to send constant values.

2.2.5 Thursday 28th October 2010

This day the private boat LOLLIPOP from Darkpelican Company was rent in Villefranche to go to the BOUSSOLE site with three divers. First a normal connection with the buoy was attempted unsuccessfully. Then

three AK reboot were attempted and no connection was got. So divers dismantled the DACNET and the Microdrive was exchanged with a new one. The DACNET were then tested: the fuses the pile and the configuration were all ok. The clock was also synchronized before its re-installation on the buoy. Then a CISCO connection with the buoy was obtained and data showed the correct functioning of the system.

Divers also verified that all the cables of the strain Gauge were connected. No other intervention (eg: cleaning and dark measurements) was possible since divers almost expired their oxygen bottles due to the difficulty to re-introduce the DACNET into the buoy structure.

The solar panel that was curved has lost a part of the photovoltaic cells but it was still powering at 12V. The solar panel is the one with the MVD on its back.

2.2.6 Monday-Friday 15-19th November 2010

These days are part of the BOUSSOLE#104 cruise. The first day divers went at sea for cleaning the instruments and perform dark measurements. The Strain-100 was also dismantled and verified in the lab it was operational. Data were also downloaded through CISCO on the third cruise day.

2.2.7 Monday-Friday 28th November 2010

After a long decline of the battery voltage the threshold for the stand by state is reached and from now on the buoy will work intermittently following the weather conditions (cloud coverage).

2.2.8 Monday-Friday 10-13th December 2010

These days are part of the BOUSSOLE#105 cruise. The ARGOS was not functioning since few days before the cruise. Cleaning the connector fixed the problem. Very likely the interruption of the ARGOS occurred after a diving of the buoy head. The first day an attempt of CISCO connection was unsuccessful. The second cruise day divers cleaned the underwater sensors and reinstalled the Strain-100. No dark measurement was made. Cisco connector was also cleaned since no connection was got. Data were downloaded through direct connection (AK switch).

2.2.9 Tuesday-Friday 18-19th January 2011

These days are part of the BOUSSOLE#106 cruise. A cruise for cleaning the optical sensors between the cruises #105 and #106 was planned but cancelled due to bad weather. Divers found a lot of biofouling on the buoy and had to work hard for cleaning. Then the system was switched off and the Battery was dismantled and brought on the *Tethys II*. Here the battery level was verified to be at 11.1 V and the battery was put on charge. Then the broken solar panel (who was however sending about 3 V to the J/Box) was substituted with a new one. The J/Box output, before and after the exchange of

the solar panel, was at the nominal level (about 20 V). This means that the external recharge of the battery seems to be necessary when its voltage drops too much. Surface sensors and CISCO+ARGOS connectors were also cleaned. The second day the Battery was re-installed on the buoy (Voltage was at 13.2 V) and the system switched on. Soon after a CISCO connection was got and data downloaded. The schedule was also modified to diminish the connection attempt of the CISCO during night to limit power consumption. The following days the buoy worked regularly.

2.2.10 Saturday-Tuesday 12-15th February 2011

These days are part of the BOUSSOLE#106 cruise. The night before the start of the cruise the ARGOS dispatch stopped. The first day three attempt of CISCO connection were unsuccessful. The sea state didn't allow climbing on the buoy. The second day the sea state was good enough but the buoy was not visible at surface, the currents measured with the ADCP on board the *Tethys II* indicated currents between 0.5-0.8 m/s in the top 250 m. The third day the buoy was still underwater at Boussole arrival but its head came up at surface while divers prepared to go at sea. A buoy was fixed on the head to easily find out the point in case of a successive diving of the buoy. Divers cleaned the optical sensors and removed the hydrophone. Dark measurements were also made but ignoring if buoy was working or not (divers didn't noticed it was working but they couldn't say certainly). No other operation was possible due to strong current still present on the site. The last day the buoy was at surface but the zodiac could not go at sea again.

2.2.11 Friday 25th February 2011

This day the private boat Lollipop from Darkpelican was rent for going to the BOUSSOLE site with two private divers for verifying the buoy functioning and installing the LISST. When on site, divers went at sea for closing the AK connector and a direct connection on the top of the buoy was got and data downloaded. Divers then cleaned the optical sensors and put the black caps on the IOPs sensors before installing the LISST. The LISST was installed along one arm of the upper part of the lower structure, 1 or 2 m deeper then foreseen since the welding did not allow the flange to fix correctly. In the meantime the connectors and sensors on the buoy head were also cleaned, the ARGOS dispatch restarted correctly. A verification of the data showed that data from sensors linked to the STOR-X + the two fluorometers were missing since the last download (19 January). For this reason the old schedule was reloaded on the DACNet, though it appeared to work correctly on the downloaded data. From ARGOS messages the two fluorometers seem to work correctly.

2.2.12 Tuesday 1st March 2011

After a fast lowering of the battery voltage the buoy starts to show again some power failure shutdowns and MVD + Transmissometer at 9 m send constant values.

2.2.13 Sunday 6th March 2011

This day is part of the BOUSSOLE#108 cruise. When on site two attempts of CISCO connections were attempted unsuccessfully. In the meantime divers went at sea to dismount the LISST, cleaning the optical sensors and put dark caps on IOPs instruments. Then a direct connection on the top of the buoy was got using AK connector. Data were downloaded incompletely before the connection was lost probably due to some corrupted data files on the disk. Sensors on the buoy head were also cleaned and J/BOX voltage verified to be correct.

2.2.14 Sunday 7th March 2011

This day the ARGOS message dispatch stopped after a diving of the buoy due to bad weather.

2.2.15 Friday-Tuesday 25th-29th March 2011

These days are part of the BOUSSOLE#109 cruise. The first day the connector and sensor on the buoy head were cleaned and the ARGOS dispatch restarted. A CISCO connections was got at the third attempt, but connection was soon lost and few data were downloaded. The second day divers installed the LISST-100X and cleaned the instruments. Dark measurements of HS4 and transmissometers were made at 08:45, 09:00 and 09:15.

2.2.16 Thursday-Friday 31st March-1st April 2011

The buoy was turned off on 31st March in late afternoon. The day after the buoy upper structure was dismounted for the rotation with the system #2. The helicopter delivered the buoy at about 09h30. The structure was in good conditions, and bio-fouling was less than expected. The buoy was then first cleaned with Karcher on the Rochembau site and then transported into the CCI local. A test was then run on battery with radiometers HS and C-Stars darkened. Strange data were collected with the tilt sensor and few channels on the OCP_9m had low dark (the current signal was visible). All the rest worked fine. The buoy was dismounted in the following days. Instruments were shipped for calibration on April 21th, and arrived at different companies on 26-27 April. The aluminium structure was sent to the CNB on May 3th.

3. QUANTITATIVE SUMMARY

The deployment lasted 209 days, among which 33 days were without data acquisition (or with non exploitable data). The major part of data lack was due to low power from battery, the rest was due to microdrive corruption.

4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes.

5. ANY PROBLEMS ENCOUNTERED ?

- 1- Two major periods of low sun caused battery voltage to drop down. The first of the two occurred with a break of one solar panel. During those periods, acquired data are often full of errors that require manual editing of the data, and often are not exploitable because of absence of synchronicity with instruments without TIMESTAMP (eg: HS4 and CTD).
- 2- The Microdrive was corrupted once.
- 3- The ARGOS dispatch stopped several times.
- 4- The CISCO connection didn't work sometimes.
- 5- Corrupted data on the disk caused the loss of FTP connection with the DACNET software.

6. LESSONS LEARNED

- 1- It's better to install MVDS and J/Box detached from solar panels and to fix each solar panel cable separate from the others as much as possible to facilitate its exchange.
- 2- When loss of connection are encountered, stopping the file transfer and connect to the DACNET with a "classic" FTP software help downloading data: downloading is still difficult but connection doesn't get lost.

7. ACKNOWLEDGEMENTS

The BOUSSOLE project has been set up thanks to the work of numerous people, and thanks to the support and funding of several Agencies and Institutions. The latter are listed in the foreword of this report. Specifically, the following contracts are acknowledged : the French Space Agency CNES provided funds through the TAOB and TOSCA scientific committees, ESA through ESTEC contract N°14393/00/NL/DC, including CCNs #1, #2 and #3, ESRIN through contract N° 17286/03/I-OL, and NASA through a "Letter of Agreement". Funding has been also obtained from the French CSOA committee and the "Observatoire Océanologique de Villefranche".

The crews and Captains of the following ships are also warmly thanked for their help at sea: the Castor-02 vessel from the Fosevel Marine company (buoy/mooring operations), the INSU R/V Téthys-II and Georges Petit (regular monthly cruises), the GG-IX from the Samar company and the Nika-III (on-demand short operations on site). Pilots and crew members of the Valair and Commerçair helicopter companies are also thanked for their willingness in accomplishing for us unusual survey missions above the BOUSSOLE site. Emmanuel Bosc, Maria Vlachou, Guillaume Lecomte, who have occasionally provided some help in collecting data, are also thanked for their help.

The French institute IFREMER and the Norwegian Marintek company are also thanked for their help and fairness in the engineering

studies that were ordered to them after the major failure of the buoy in spring of 2002.

The data that are collected for several years near the BOUSSOLE site by the French weather forecast Agency, "Meteo France", and which are provided in real time on the internet, have been of great help in the day-to-day management of the monthly cruises.

Two companies have largely contributed to the BOUSSOLE project, namely the ACRI-in/Genimar company, Sophia Antipolis, France (buoy conception) and Satlantic Inc., Halifax, NS Canada (buoy centralized acquisition system and radiometers); their help is specifically acknowledged here.

8. APPENDIX

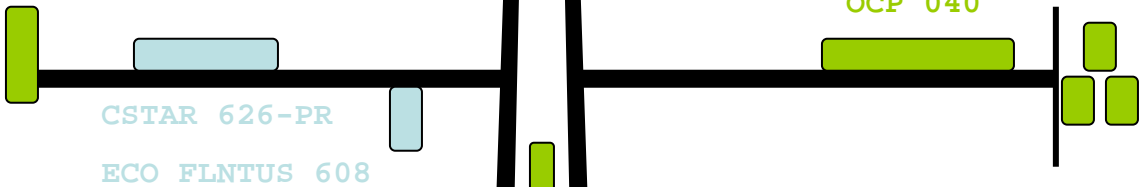
The following page contains the schema of the buoy and the list of the calibration files.

- SATLANTIC
- HOBILABS
- WETLABS
- SEABIRD
- GARROS

MVD (OCI) 030
 ARGOS 003
 Es (HOI) 327
 Junction Box SJB 002
 MVDS 0062
 PAR 0061
 Feux: ?
 Solar Panels:

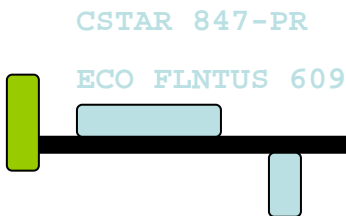
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Ed (OCI) 050
 Eu (OCI) 048
 Lu (OCR) 036



Lu (HOCR) 277

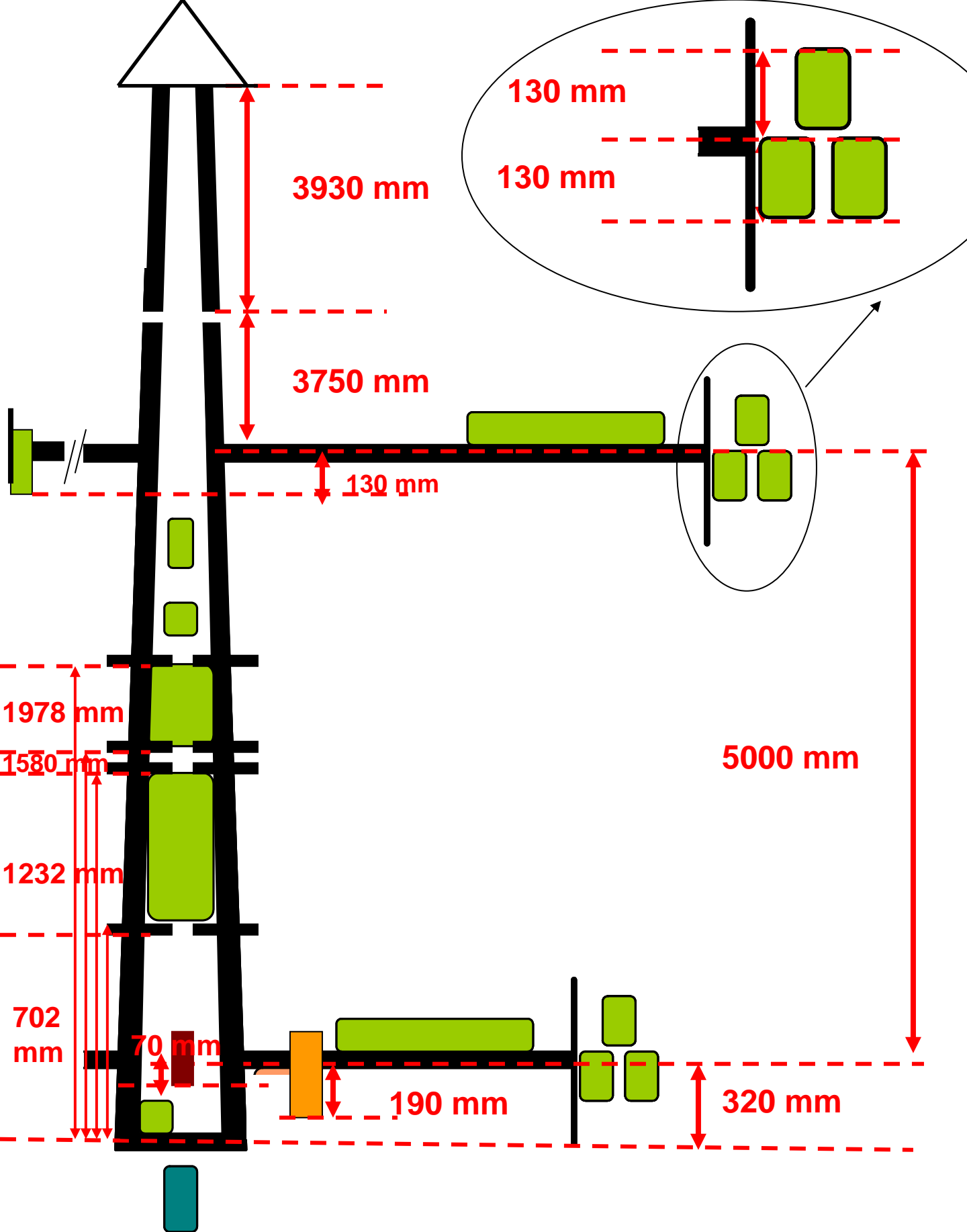
STOR-X 068
 CLC 004
 DACNet (mSM) 002
 Battery 002
 Strain-100 002

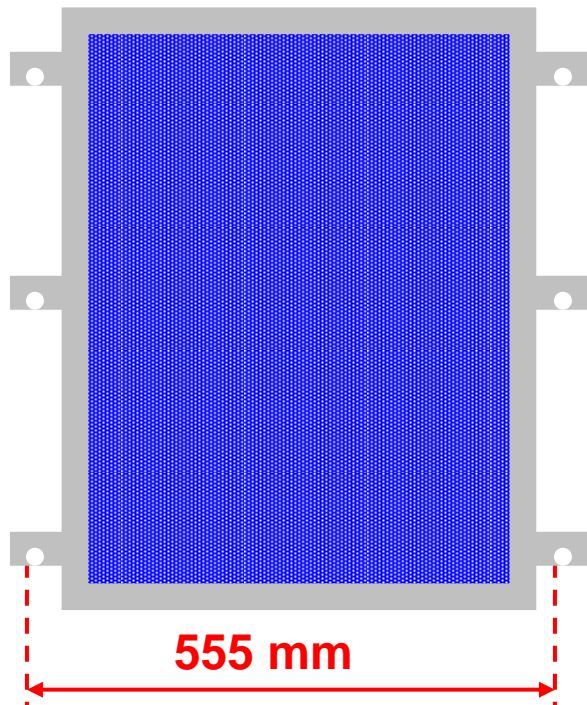
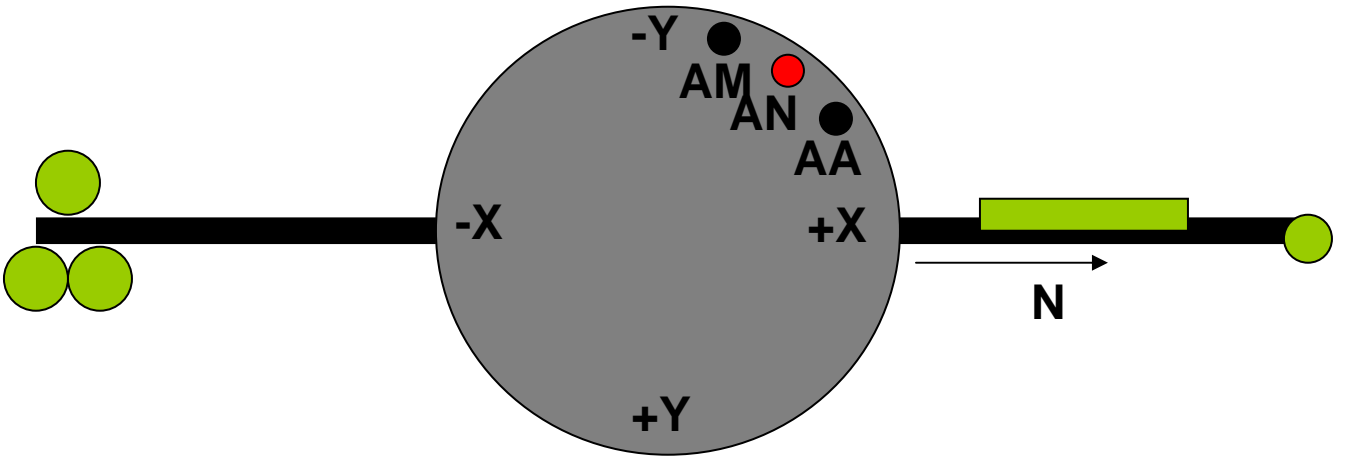


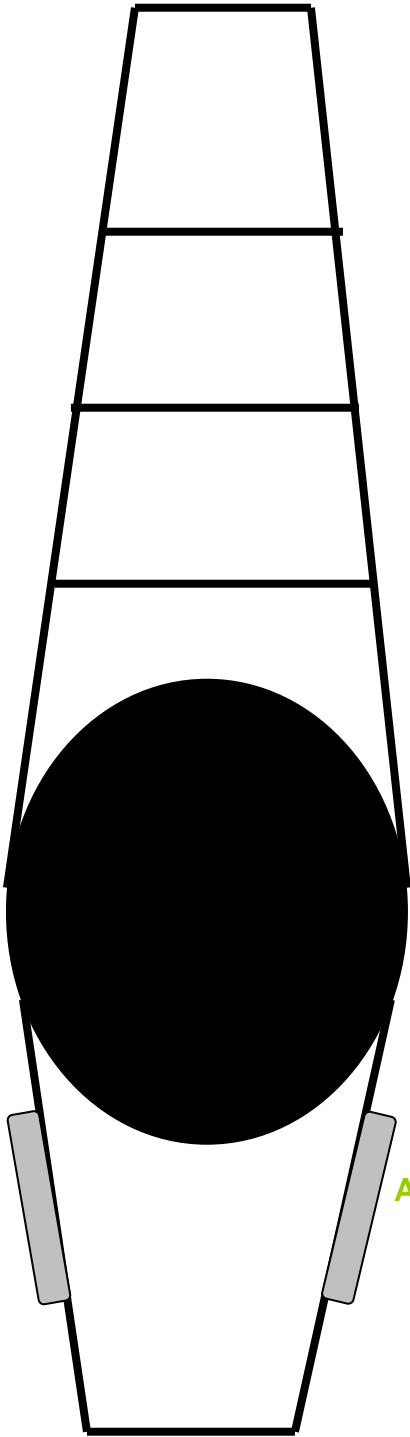
CTD 37SI30260-2404
 Ed (OCI) 164
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 Lu (OCR) 037

HS4 H4080705
 GAROS OML CSSPE00356









ARGOS 5433

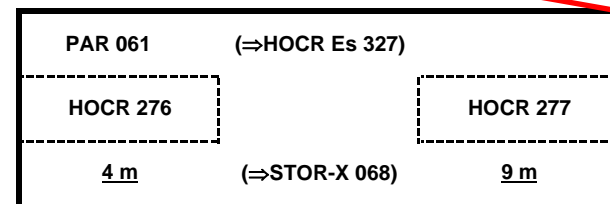
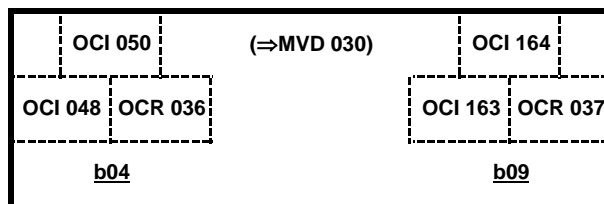
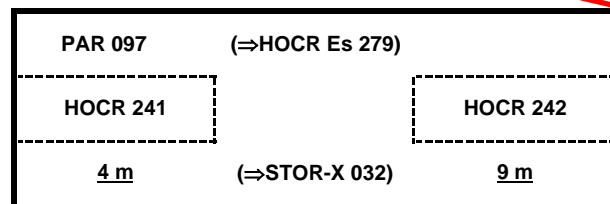
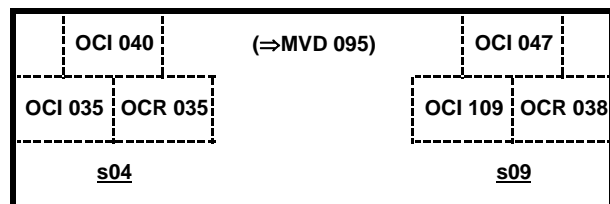
ARGOS 74605

2010

2010																		
JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER							
12-Jan	13-Feb	06-Mar	23-Mar	06-Apr	25-Apr	0-May	21-May	12-Jun	28-Jun	12-Jul	28-Jul	06-Aug	20-Aug	01-Sep	23-Sep	15-Nov	11-Dec	
(only rads cleaning)																		
4 m																		
ocp040e.cal		ocp036j_bis.cal		21 May		ocp040_replaced_036.cal		ocp036l.cal										
CST-1057PR 726_2009-10-27		HPL241d & PLD241d.cal		tx-meter : CST-626PR fl-meter : 608_2010-04-09		HPL276b.cal & PLD276b.cal		CST-1057PR 726_2010-08-25		HPL241e & PLD241e.cal								
9 m																		
ocp041e.cal		ocp037j_bis.cal		ocp041h.cal														
CST-1058PR 727_2009-10-27		HPL242d & PLD242d.cal		tx-meter : CST-847PR fl-meter : 609_2010-04-09		HPL277b.cal & PLD277b.cal		CST-1058PR 727_2010-08-25		HPL242f & PLD242f.cal								
MVD																		
mvd053i.cal		mvd062i.cal		mvd053j.cal														
HED279d.cal & Hse279d.cal		HED327c.cal & Hse327c.cal		HED279e.cal & Hse279e.cal														
H4070403 2009-8-8.cal		H4080705 2009-11-22.cal		H4070403 2010-5-15.cal														
SATSTX0032b.cal		Strain100_002b.cal		Strain100_001b.cal														
		SATSTX0068b.cal		SATSTX0032c.cal														

buoy X deployment (2010-04-22, vf2)

buoy XI deployment (2010-09-04, vf1)



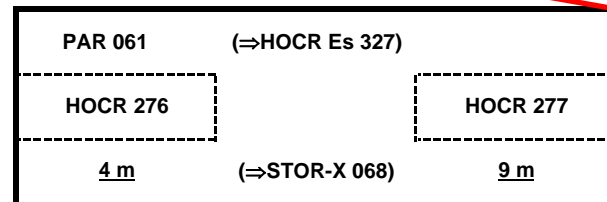
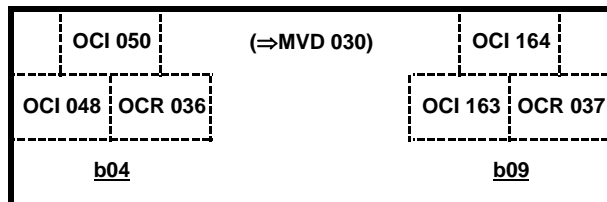
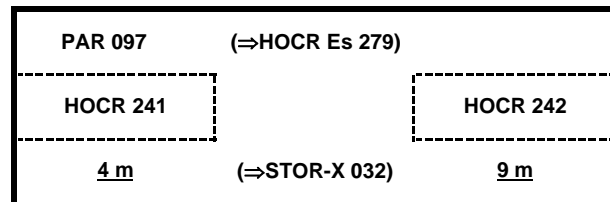
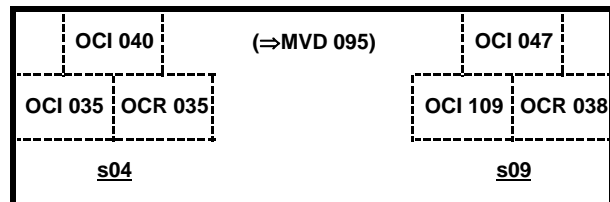
same configuration of buoy IX

2011

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
	18-Jan	14-Feb 25-Feb	6-Mar 27-Mar	18-Apr 28-Apr	18-May	16-Jun 29-Jun	11-Jul 27-Jul					
		(only rads cleaning)										
4 m	CST-1057PR 726_2010-08-25	ocp036l.cal HPL241e & PLD241e.cal				ocp040j.cal tx-meter : CST-626PR fl-meter : 608_2010-04-09					ocp036l.cal CST-1057PR 726_2010-08-25	HPL241e & PLD241e.cal
9 m	CST-1058PR 727_2010-08-25	ocp041h.cal HPL242f & PLD242f.cal				ocp037l.cal tx-meter : CST-847PR fl-meter : 609_2010-04-09					ocp041h.cal CST-1058PR 727_2010-08-25	HPL242f & PLD242f.cal
MVD		mvd053j.cal HED279e.cal & Hse279e.cal				mvd062j.cal HED327h.cal & Hse327h.cal					mvd053j.cal HED279e.cal & Hse279e.cal	
	H4070403 2010-5-15.cal Strain100_001b.cal SATSTX0032c.cal					H4080705 2010-10.cal Strain100_002b.cal SATSTX0068c.cal					H4070403 2010-5-15.cal Strain100_001b.cal SATSTX0032c.cal	

buoy X deployment (2010-04-22, vf2)

buoy XI deployment (2010-09-04, vf1)



same configuration of buoy IX

