

nke

INSTRUMENTATION

Euro argo workshop 18 juin 2010 Paris

Euro argo 18 June 2010 Paris



Patrice Brault
nke

- Nke “offer” for Argo
- Using for «Coriolis at sea monitoring »
- Provor CTS₃ as base for more instrumented floats

PROVOR CTS3 → ARVOR

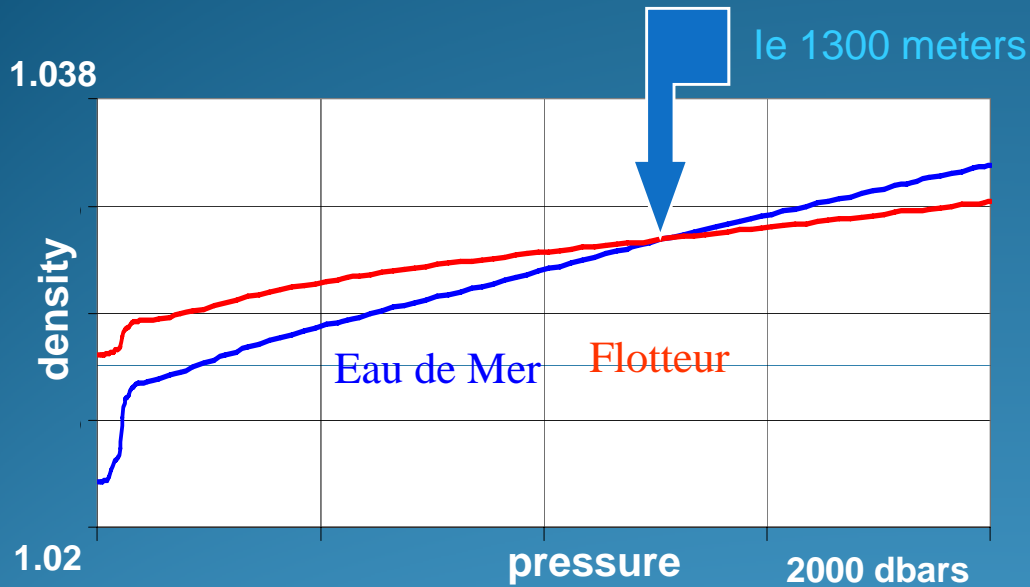
is Nke offer for ARGO in 2010



Provov CTS 3	Arvor	
SBE 41 CTD with pump	No change	
Identical high hydraulic pressure pump	Improved efficiency	
34 Kg	20 Kg	Deployable by one person
Φ 17 cm L 200 cm	Φ 11 cm L 180 cm	Including antenna

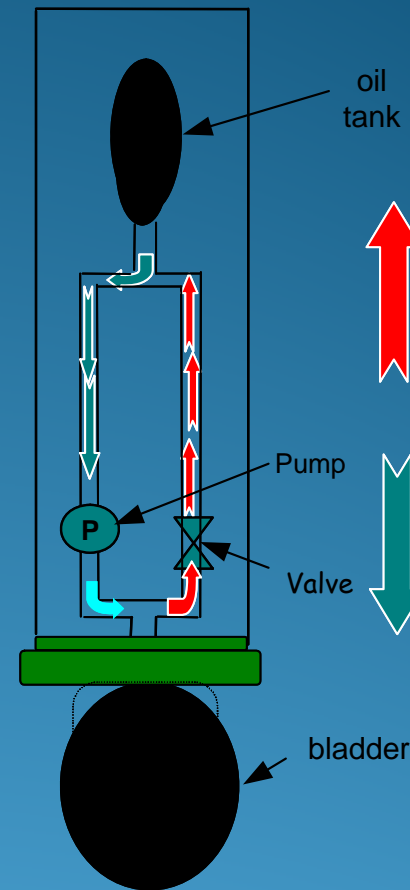
- Developed by Ifremer in industrial partnership with .. Nke
- Easier to deloy
- Cheaper

Buoyancy engine Provor/ Arvor



Stabilization crossing point **water** and **float** density

	Provor	Arvor
Oil capacity	3000 cc	850 cc
from 0 to 2000 dbars	250 cc	90 cc
Antenna emergence	500 cc	350 cc



→ No preballasting required whatever the area of deployment (1015 to 1045 surface density condition)

cycle details

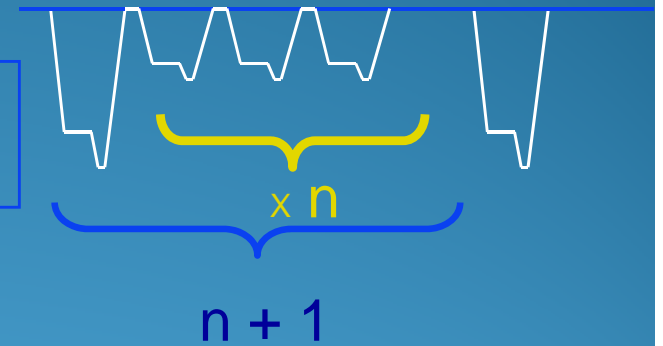
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Descent
5 cm/sec

Drift at parking depth
+/-30 meters) isobaric
9 days

To profil depth
Some hours

ascent
9.5 cm/sec

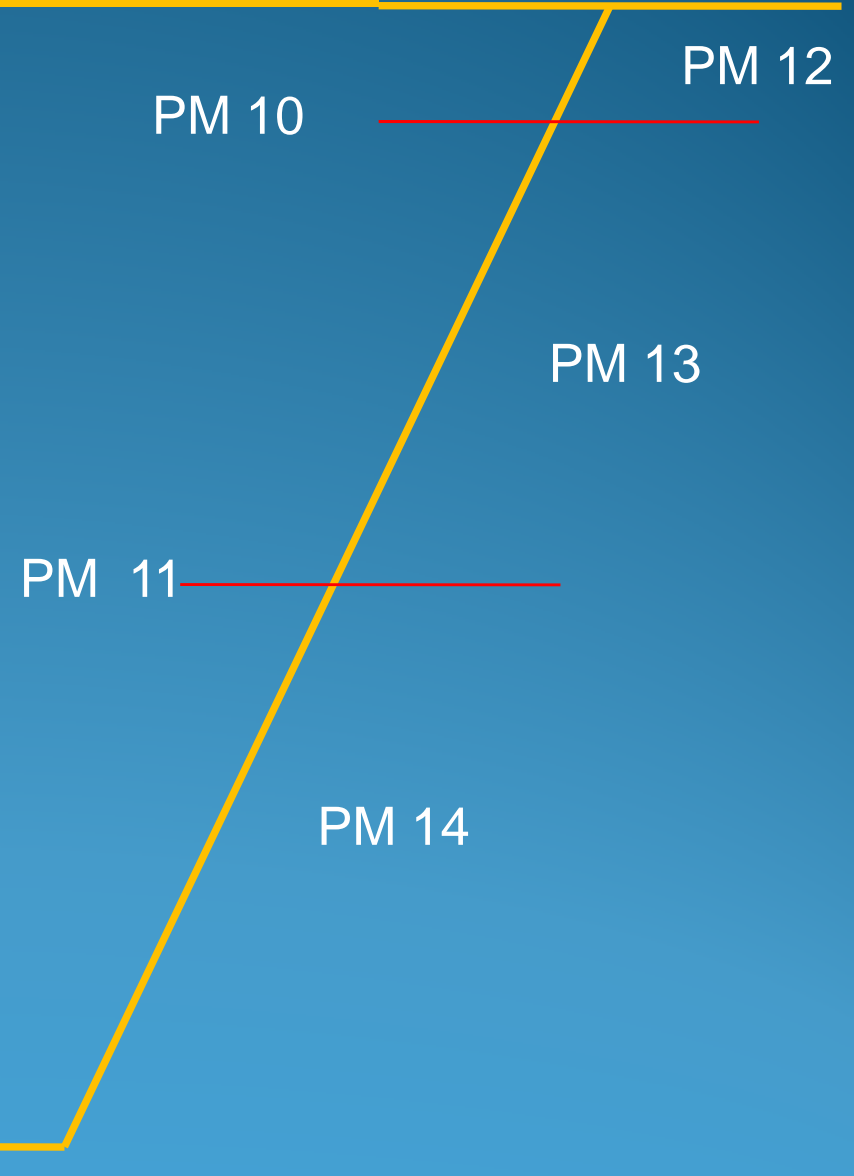


Cycle multiple different

INSTRUMENTATION

CTD pump will stop at P cut off : 5 dbars

PM8	Drift Depth	1500	dbar
PM9	Profile Depth	2000	dbar
PM10	Threshold surface/Intermediate Pressure	10	dbar
PM11	Threshold Intermediate /bottom Pressure	200	dbar
PM12	Thickness of the surface slices	1	dbar
PM13	Thickness of the intermedite slices	10	dbar
PM14	Thickness of the bottom slices	25	dbar



To monitor operation : technical message

- Using Argos 2 transmission
 - For 116 triplets (98 +18) 15 messages + 1 technical message
 - Selection of number of repetition
- 6 to 8 hours of transmission

Technical message

```
fffe2ff87abdef03810a10d4c07e0240966300e  
4c44a8c802a1c010766a0ececcea400246a00
```

not easy to decode !

Parameter		Parameter		Parameter	
descent start time	8	number of ascent CTD messages	5	minimum pressure in drift (bars)	8
number of valve actions at the surface	7	number of descent slices in shallow zone	7	maximum pressure in drift (bars)	8
float stabilisation time	8	number of descent slices in deep zone	8	grounding detected (grounding = 1, No grounding = 0)	1
float stabilisation pressure	8	number of ascent slices in shallow zone	7	number of hydraulic valve action in descent profile	4
number of valve actions in descent	4	number of ascent slices in deep zone	8	number of pump actions in descent profile	4
number of pump actions in descent	4	number of CTD measurements in drift	8	max pressure in descent or drift to Profile (bars)	8
end of descent time	8	Float's time (hh+mm+ss)	17	number of re-positioning in profile stand-by	3
number of repositions	4	pressure sensor offset	6	batteries voltage drop at Pmax, pump ON	5
time at end of ascent	8	internal pressure	3	profile descent start time	8
number of pump actions in ascent	5	max pressure in descent to parking depth	8	profile descent stop time	8
number of descent CTD messages	5	profile ascent start time	8	RTC state indicator (normal = 0, failure = 1)	1
number of drift CTD messages	5	number of entrance in drift target range (descent)	3	number of entrance in profile target range (descent)	3

248 bits

Coriolis : Argo float monitoring at sea

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The screenshot displays the Coriolis Operational Oceanography website interface. At the top, there is a navigation menu with links for HOME, THE CORIOLIS INFRASTRUCTURE, OBSERVING THE OCEAN, DATA SERVICES & PRODUCTS, SCIENCE, and ALL NEWS. Below the navigation is a banner with the text "MEASUREMENTS FOR OCEAN UNDERSTANDING" and "RESEARCH APPLICATIONS".

The main content area is divided into three columns:

- DATA & PRODUCTS:** Includes links for Product Catalogue, Data Selection, Quick-Look viewer, Temperature Map of the day, and Salinity Map of the day. A world map icon is visible.
- OBSERVING NETWORKS:** Includes a "GEOGRAPHIC SELECTION" section with links for Global Ocean, Global ocean underway data, Ireland Biscay Iberia seas, and Mediterranean Sea. It also features a "LATEST 30 DAYS" section with links for Profile Data, Underway data, Argo Data, GOSUD, OceanSITES Data, Drifter DBCP Data, and Everyone's Gliding Observatories Data. A "NETWORKS" section lists Argo, GOSUD, OceanSITES, SOOP, GTSP, and EGO.
- ALERTS:** Contains an "IMPORTANT NOTICE TO ARGO USERS: PRESSURE BIASES IN THE ARGO DATA SET" dated 06/04/2010.

Below the main content is a "TO SEE ON CORIOLIS" section with a "SCIENCE TOPIC" link. A "Legal notice & acknowledgements" link is also present.

The bottom section of the screenshot shows the "Argo Float monitoring At sea" page. It includes a sidebar with navigation options: "Global and regional views", "The latest 30 days of data", "Observing system networks" (with sub-links for Argo, Argo Network description, Atlantic Argo Deployment coordination, European Contribution to Argo, and French Contribution to Argo), "At sea monitoring", and "GOSUD". The main content area has the heading "Argo Float monitoring At sea" and a sub-heading "Argo Fleet". It contains the text "Coriolis has developed tools to monitor the behaviour at sea of a fleet of floats. Those statistics are updated on a monthly basis." and "Please click on a specific fleet to access the technical monitoring :". Below this is a dropdown menu for "Argo Fleet" with options: "Argo Fleet per year : Please select a year", "Provior CTS 2", "Provior CTS 3", "Provior CTS 3 DO", and "Arvor".

- Argo float**
- Provior CTS2
 - Provior CTS3
 - Provior XTS3 DO
 - Arvor
 - Apex



Data

Excel format Diagram for analysis

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Float monitoring - Mozilla Firefox

https://www.ifremer.fr/WC2techMonitoring/floatMonitoring?lang=en&category=cdfloatsTechnicalMonitoring&groupCode=436

At sea monitoring - Coriolis

Technical monitoring

Full report | VMO Correspondance | Print page

Active Floats | Dead Floats

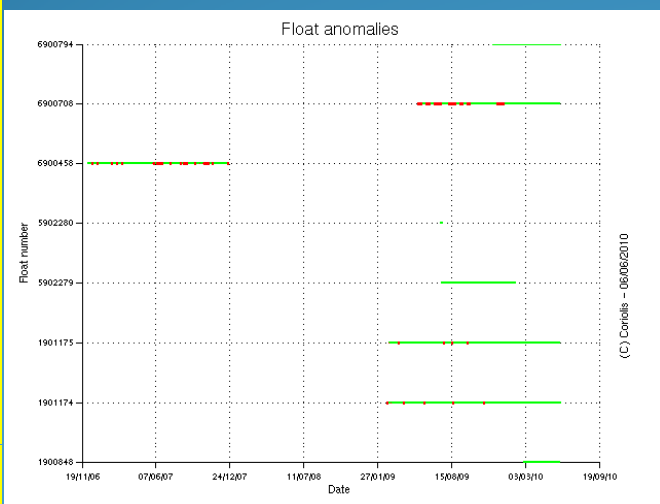
5 active floats at 06/06/2010
0 deployed floats, 0 new dead floats since last monthly bulletin at 21/05/2010

ARVOR (S)
+ 0
- 0

5 active floats at 06/06/2010
0 deployed floats, 0 new dead floats since last monthly bulletin at 21/05/2010

Floats	Program	Deployment data	Lastest cycle	T/S Profiles		Drift	Data Transmission			Battery Voltage	Kms			Excel File
				Quality	Length		Cycles with anomaly	Cycle	Missing Frames		Missing Measurements	Kms done	kms done / previous month	
6900794	CORLIOS	04/12/2009	04/06/2010 #182	OK	OK	OK	OK	-	126.9	11.4	-	Cycles		
6900708	CORLIOS	17/05/2009	03/06/2010 #39	OK	OK	OK	OK	9.8	76.1	4.0	3.3	Cycles		
1901175	TRACK	26/02/2009	03/06/2010 #227	OK	OK	OK	OK	8.8	452.7	15.9	16.3	Cycles		
1901174	TRACK	21/02/2009	04/06/2010 #234	OK	OK	OK	OK	9.1	467.0	16.1	16.3	Cycles		
1900848	CORLIOS	27/02/2010	04/06/2010 #23	21	Grounded	Grounded	OK	-	19.1	3.2	-	Cycles		

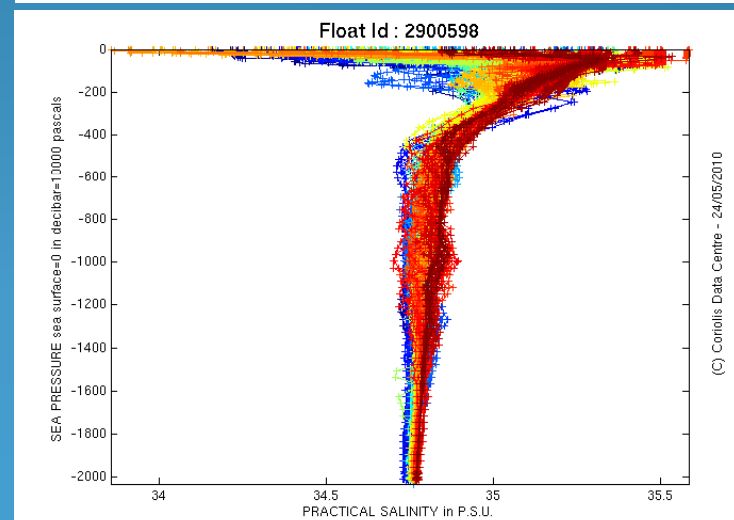
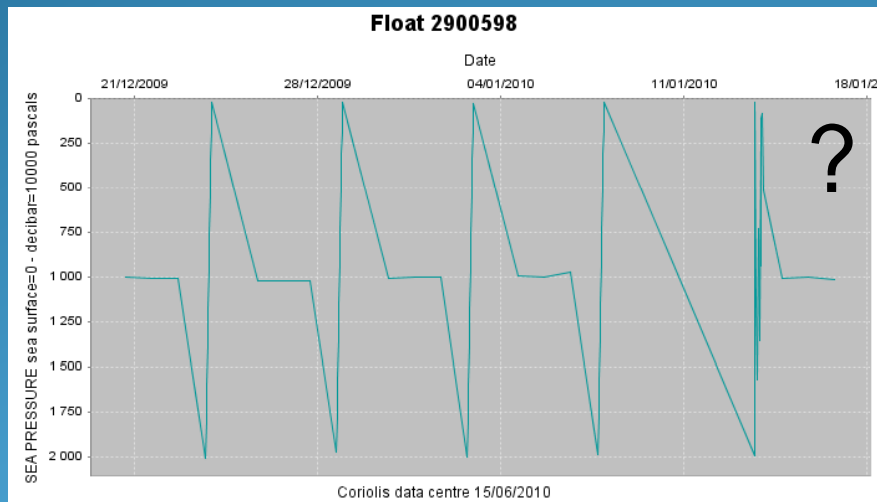
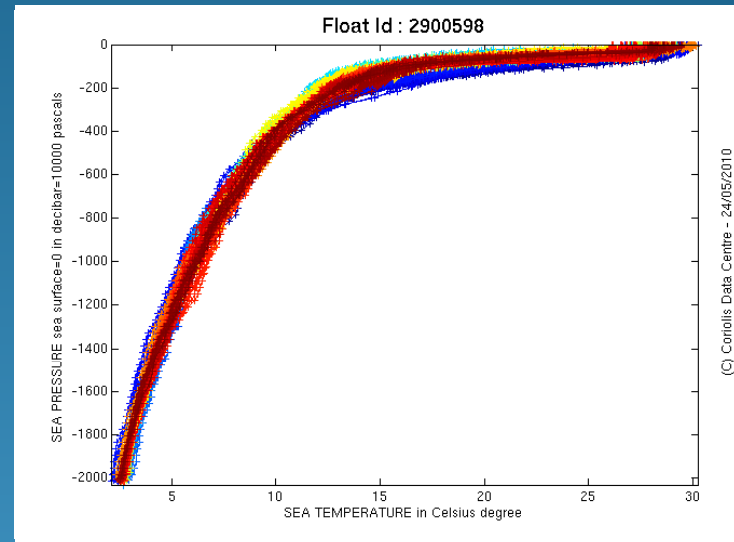
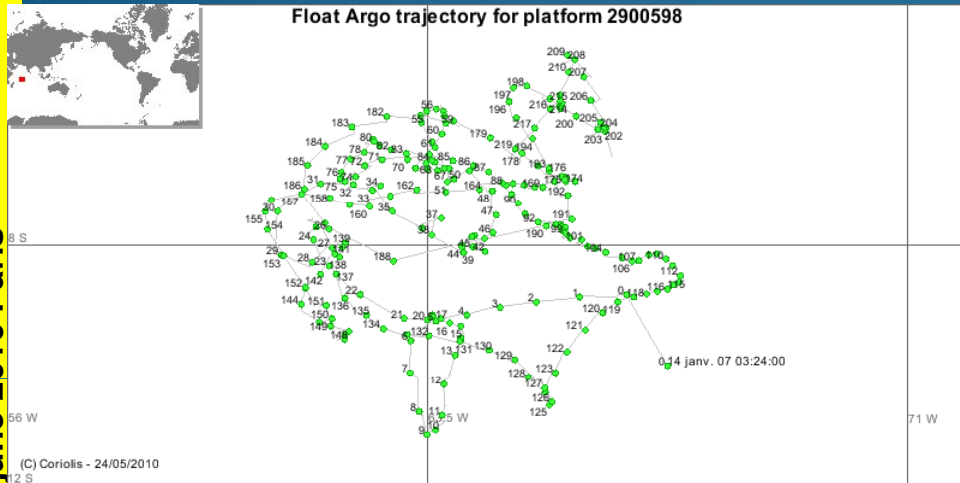
175	176	177	178	179	180	181	182
Surfac	DESFC	DESFC	DESFC	DESFC	DESFC	DESFC	DESFC
DESFC_1st_st	DESFC_1st_st	DESFC_Depth	DESFC_Depth	DESFC_Depth	DESFC_Depth	DESFC_Depth	DESFC_Depth
ab_time	ab_press	ab_valve	ab_pump	ab_h_correct	ab_me	ab_pump	ab_pump
time when first	stabilization appears during descent to	Descent float control - First stabilization pressure	Descent float control - Depth valve actions	Descent float control - Depth pump actions	Descent float drift control - Depth corrections	Ascent float control - End control	Ascent float control - Depth pump actions
45	13:42	470	6	0	0	04:30	8
21	19:24	90	7	0	0	04:36	8
16	17:30	450	5	0	0	04:36	8
17	17:19	470	5	0	0	04:25	8
15	17:01	680	5	0	0	04:37	8
15	17:13	580	5	0	0	04:37	8
15	17:01	420	7	0	0	04:37	8
15	17:14	370	6	0	0	04:44	8
16	17:32	610	5	0	0	04:44	7
14	17:08	290	5	0	1	04:38	8
18	17:50	680	5	0	0	04:44	7
13	17:33	450	6	0	0	04:39	7
15	17:15	660	5	0	0	04:33	8
16	17:27	610	5	0	0	04:39	7
14	16:57	380	7	0	0	04:39	8
17	17:10	420	7	0	0	04:34	8
16	17:46	300	7	0	0	04:40	8
16	17:34	550	5	0	0	04:46	8
15	17:52	740	5	0	0	04:46	8
15	17:41	570	6	0	0	03:47	21
15	15:35	270	7	0	0	04:29	12
15	16:41	290	7	0	0	04:05	12
16	15:47	250	8	0	0	03:41	12
16	15:36	260	7	0	0	02:54	11
15	15:00	430	7	6	0	02:06	11
15	14:36	470	5	0	0	02:42	12
16	13:18	70	8	0	0	02:36	11
15	13:07	60	7	0	0	02:19	11
16	12:31	20	8	0	0	02:13	10
16	14:19	550	6	0	0	01:07	31
35	13:49	460	5	0	0	02:19	12
0	12:56	1000	0	0	0	02:32	19
11	14:14	220	8	0	0	02:02	12



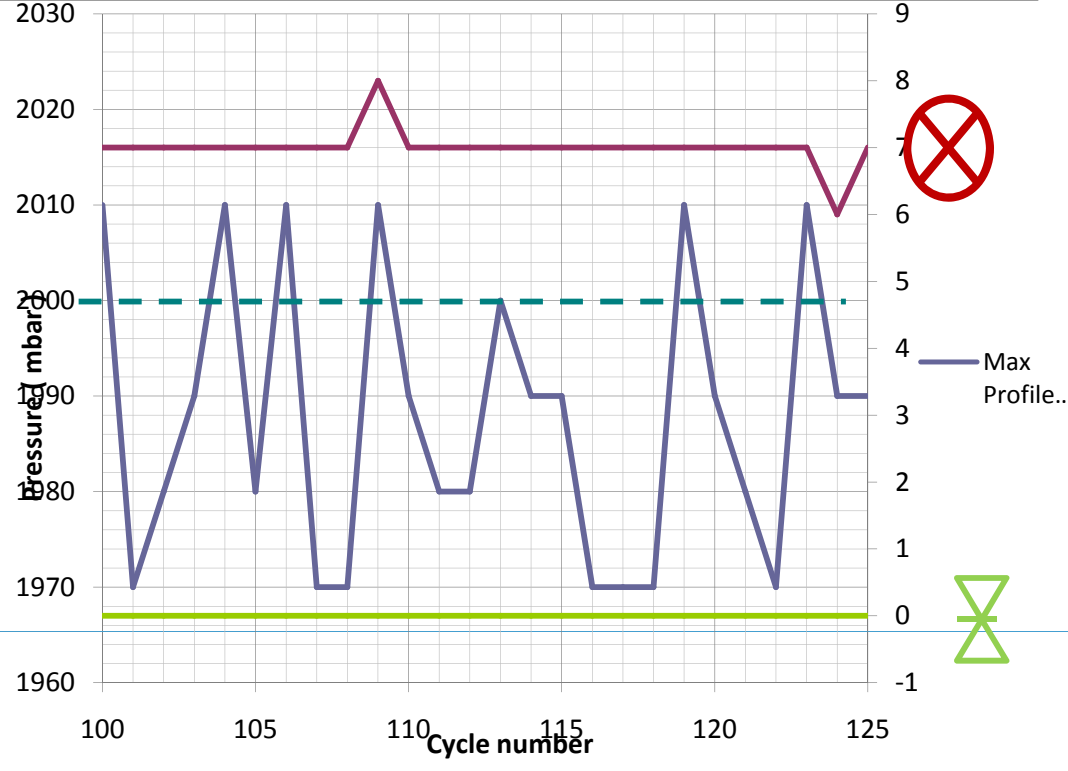
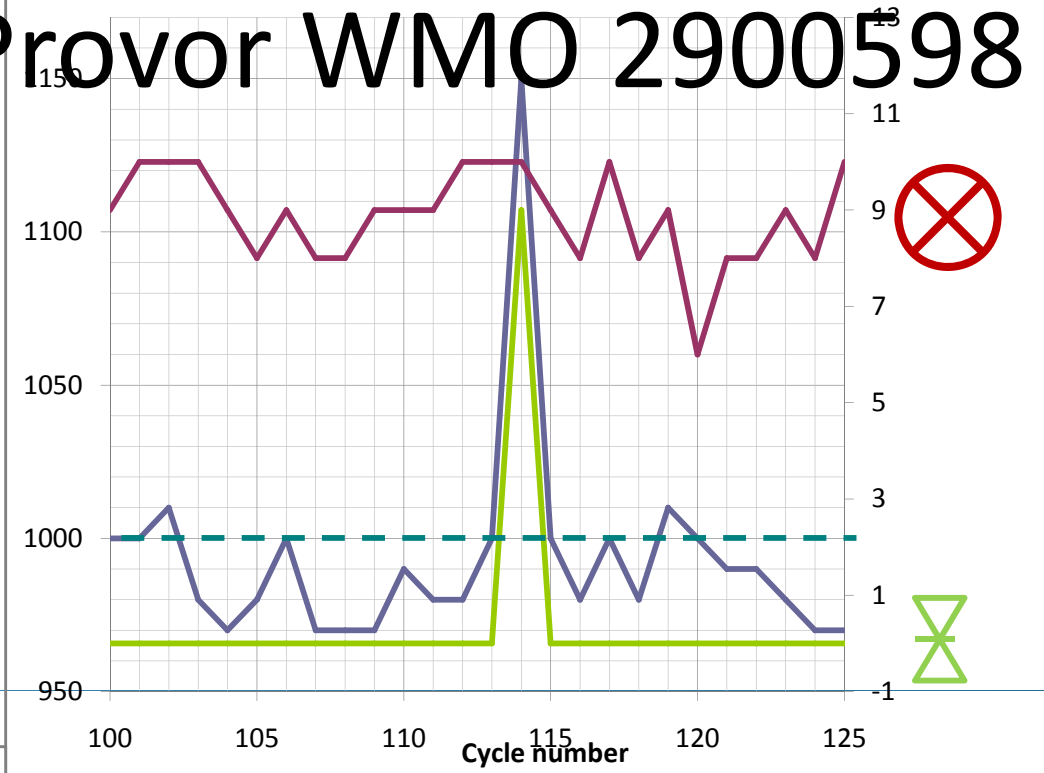
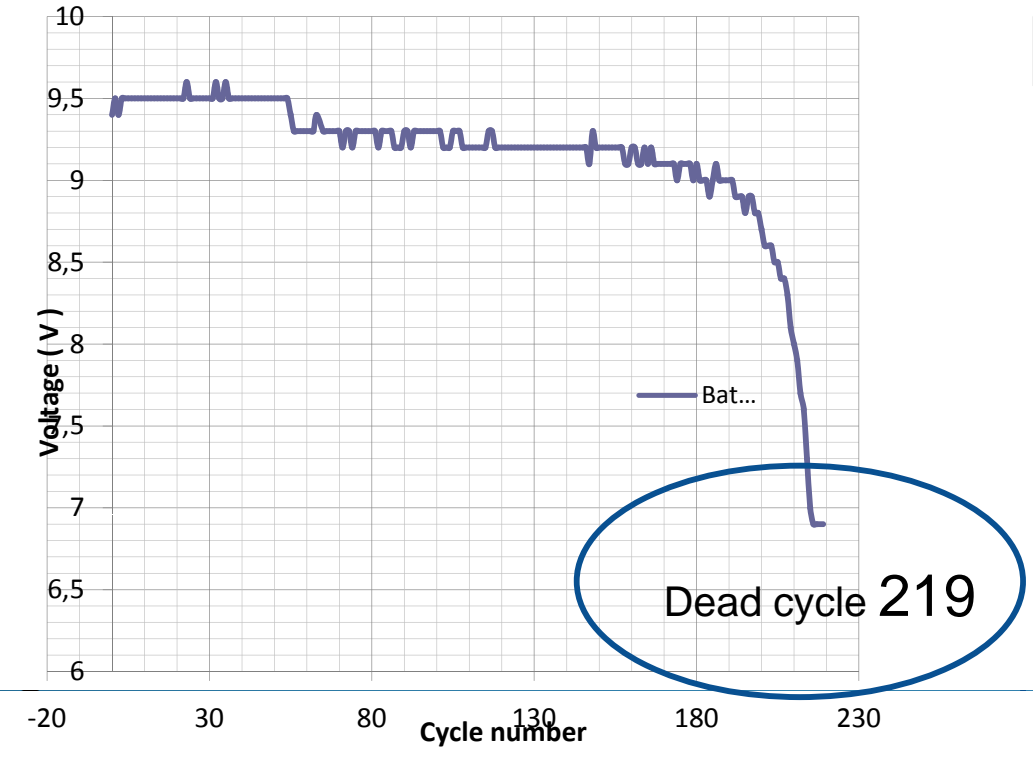
6900691	4	07:00:44	07:01:42	0<= 725	14:19	20:00
6900691	5	06:44:30	06:45:43	0<= 725	14:37	21:43
6900691	6	07:22:42	07:24:10	0<= 725	14:55	22:31
6900691	7	08:18:39	08:20:22	0<= 725	14:56	22:26
6900691	8	11:36:16	11:38:14	0<= 725	15:02	21:38
6900691	9	07:08:14	07:10:26	0<= 725	14:56	22:26
6900691	10	07:00:55	07:03:21	0<= 725	15:02	20:56
6900691	11	05:08:23	05:11:03	0<= 725	14:57	22:21
6900691	12	05:03:03	05:05:58	0<= 725	14:57	21:21
6900691	13	06:09:17	06:12:26	0<= 725	14:51	20:51
6900691	14	07:04:24	07:07:47	0<= 725	14:57	23:21
6900691	15	05:42:03	05:45:41	0<= 725	14:58	22:40
6900691	16	10:44:42	10:48:35	0<= 725	14:52	23:58
6900691	17	06:52:22	06:56:29	0<= 725	15:04	21:28
6900691	18	06:20:59	06:25:22	0<= 725	15:04	20:58
6900691	19	06:08:23	06:13:01	0<= 725	15:05	22:11
6900691	20	05:46:53	05:51:46	0<= 725	13:35	22:17
6900691	21	06:00:19	06:05:27	0<= 725	14:29	23:23
6900691	22	05:10:22	05:15:45	0<= 725	13:47	23:17
6900691	23	04:39:22	04:44:59	0<= 725	13:36	22:36
6900691	24	02:54:45	03:00:37	0<= 725	12:36	21:06
6900691	25	02:46:38	02:52:45	0<= 725	12:00	19:12
6900691	26	02:45:42	02:52:04	0<= 725	12:30	20:30
6900691	27	02:49:45	02:56:22	0<= 725	12:19	20:31
6900691	28	02:36:44	02:43:36	0<= 725	12:07	19:55
6900691	29	02:37:27	02:44:33	0<= 725	12:01	18:43
6900691	30	04:09:48	04:17:09	0<= 725	11:25	18:13
6900691	31	02:31:39	02:39:15	0<= 725	11:56	12:56
6900691	32	05:20:09	05:27:59	0<= 725	12:20	21:08

PROVOR CTS3 WMO #2900598



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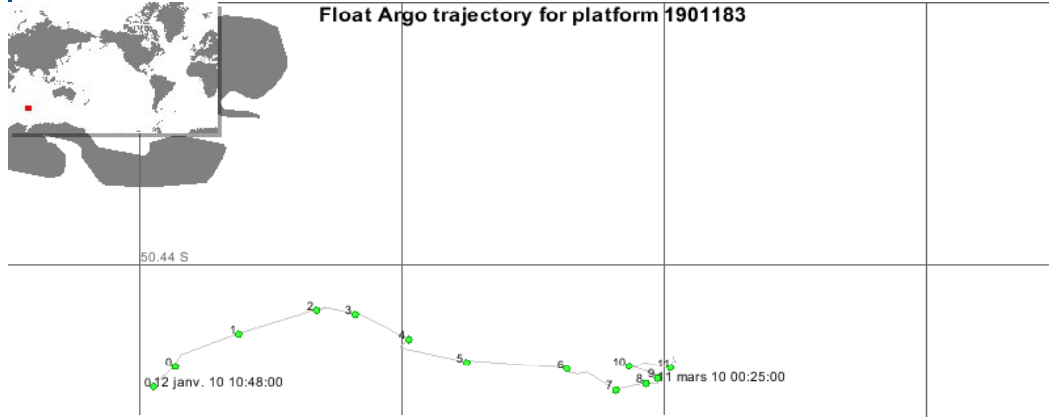
Provor WMO 2900598



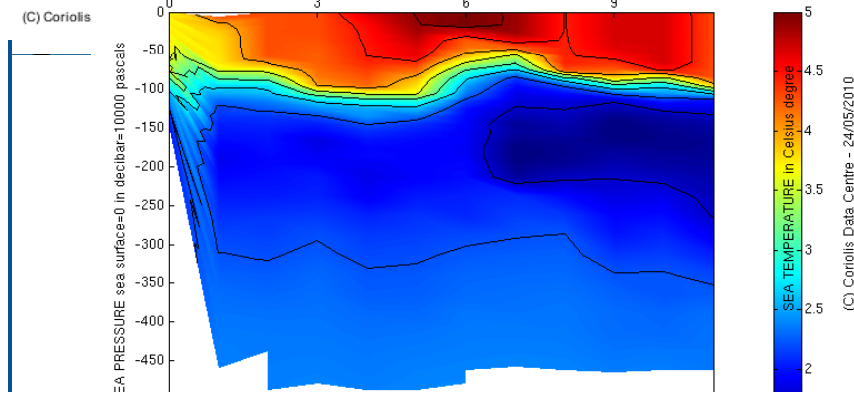
actions in order to correct depth position

-  Pump action
-  Valve actions

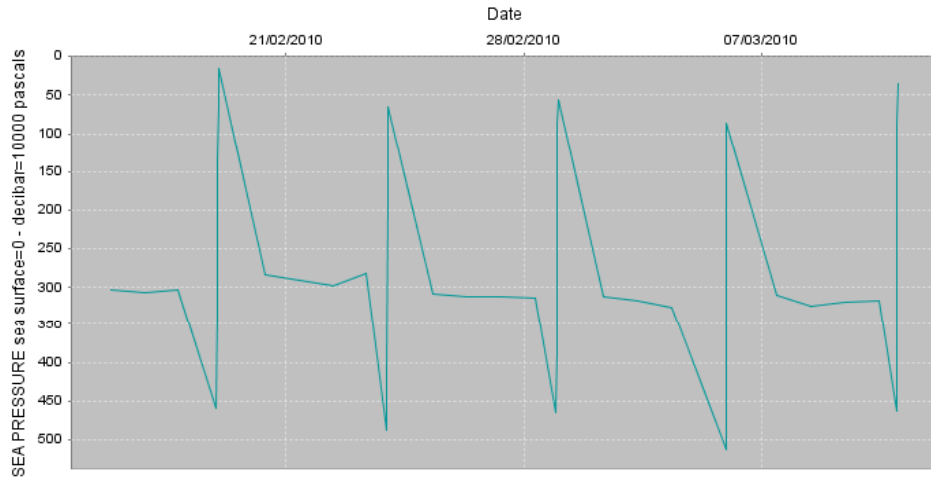
Dead of WMO 1900183 after 12 cycles ?



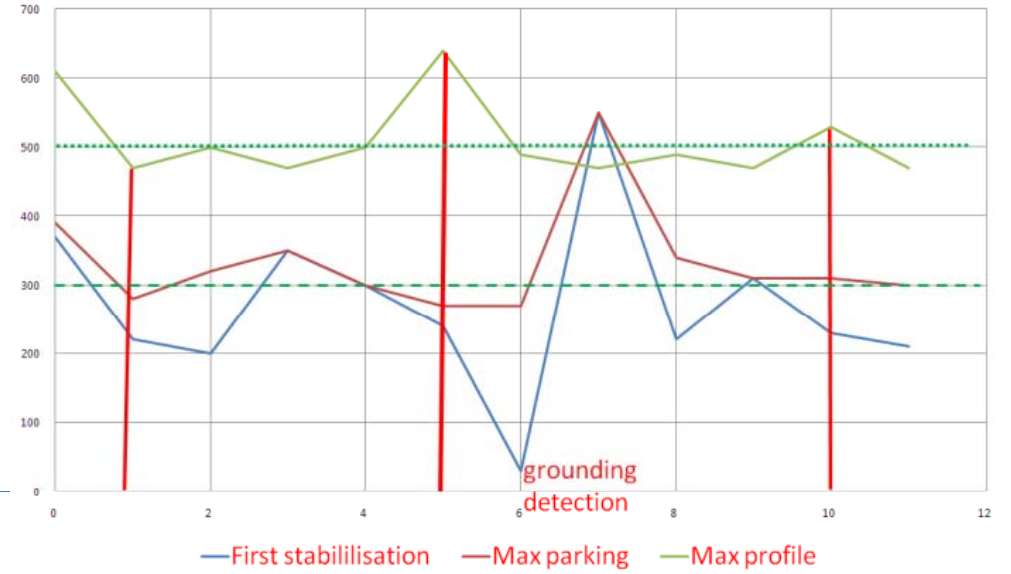
Float Id : 1901183
Cycle number



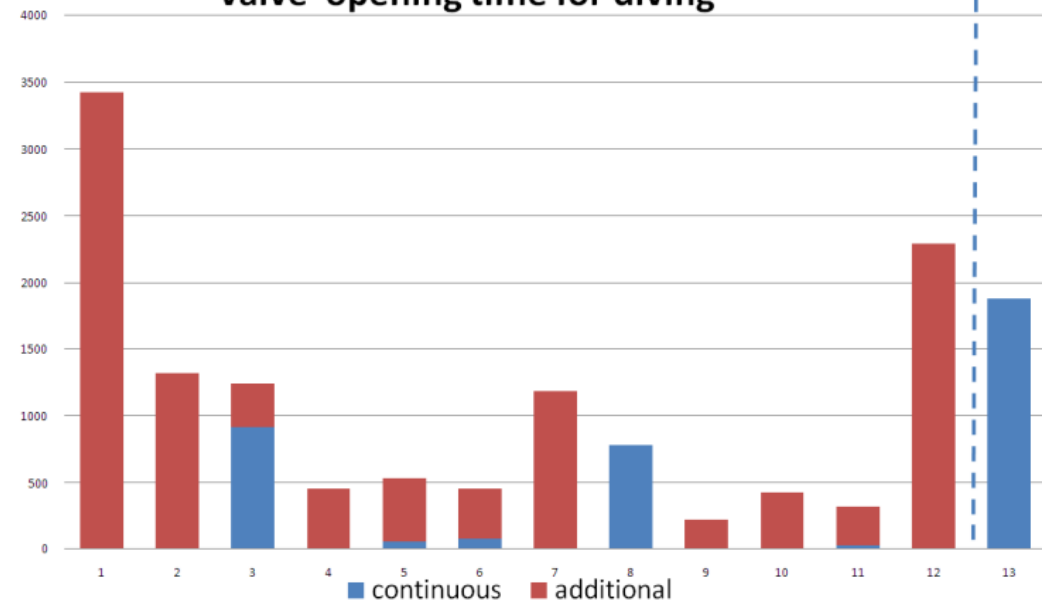
Float 1901183



depths pressure



Valve opening time for diving



Algorithm modification required



ARVOR		ARVOR I
20 Kg	weight	20 Kg
200 cm	height	190 cm
11,5 cm	aluminium hull	11,5 cm
240	trials at sea (still running 06/16/10)	196
2000m, 1 profile / 2 days		1 x 2000 m /9 x 500 m 1 profile per 1 day
> 250	electrical autonomy	> 250
no	two way capability	yes
lithium	battery	lithium

3 zones bottom , intermediate , surface

measure max 308 triplets
typical @2000 m (72 bottom, 19 intermediaire , 10 upper , 18 drift)

A2 (32 bytes)	transmission	Iridium SBD 192 bytes
15 messages (32 bytes)	data to be transmitted per typical profile	4 SBD (192bytes)
1 message (32 octets)	technical message to transmit	1 SBD (192 bytes) with mission parameters
5,12 KO		9,6 KO
6-8 hours (rep 25 times)	time on surface	< 30 minutes

soon A3

with Argos 3 satellites "rendez vous " typical surface duration 1 hour (TBC)
important increasing number of possible cycles

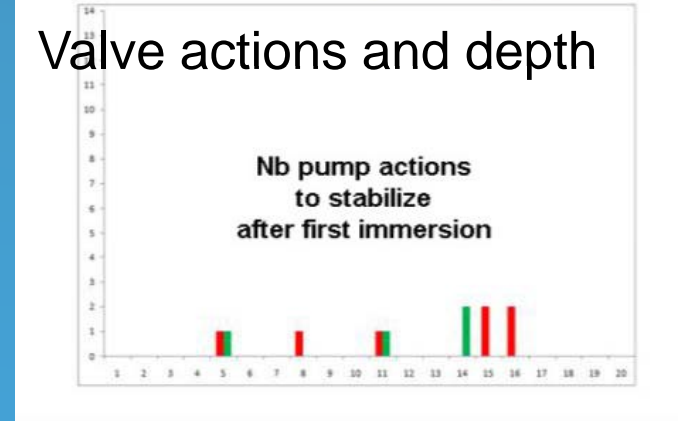
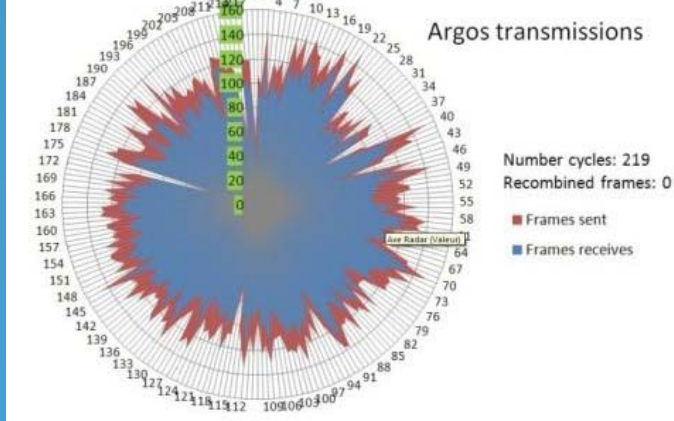
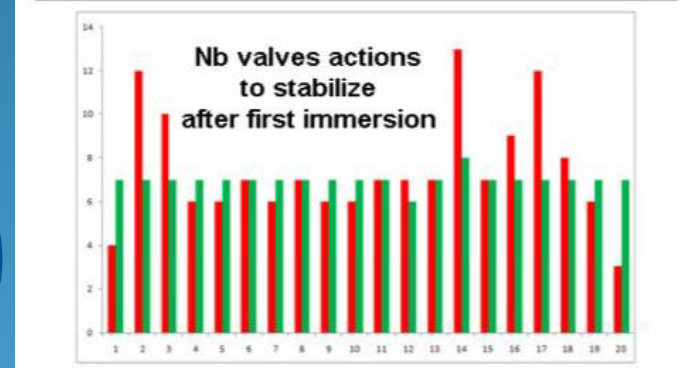
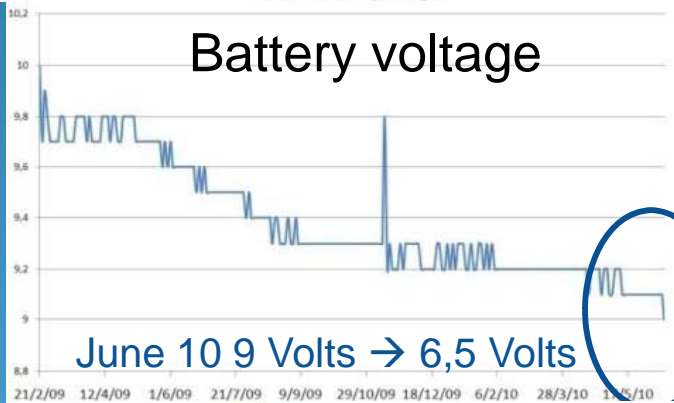
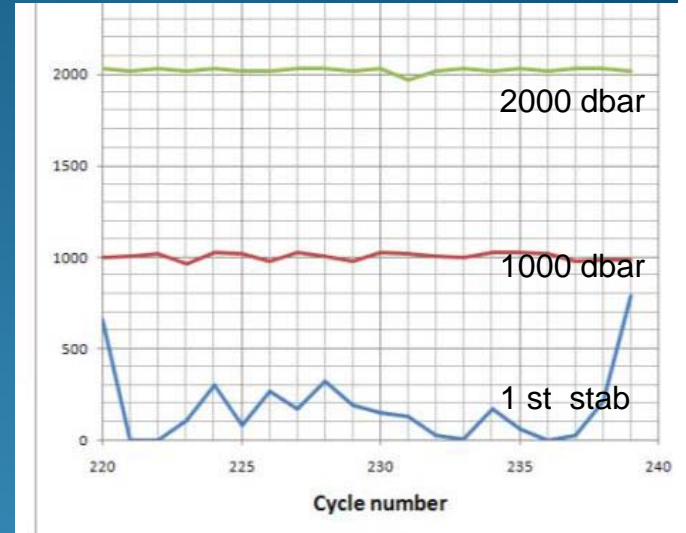
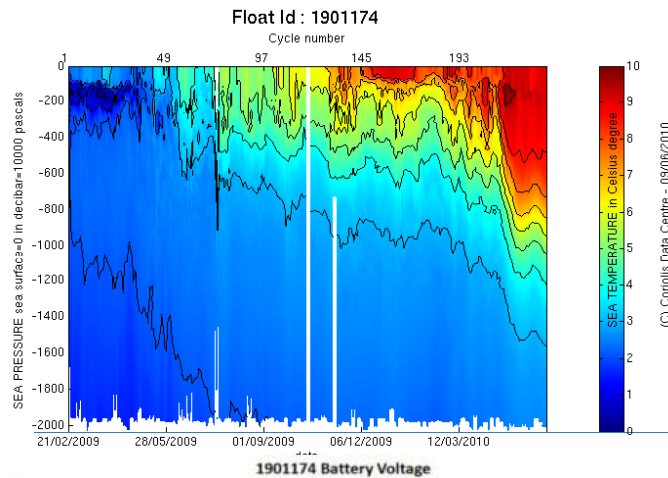
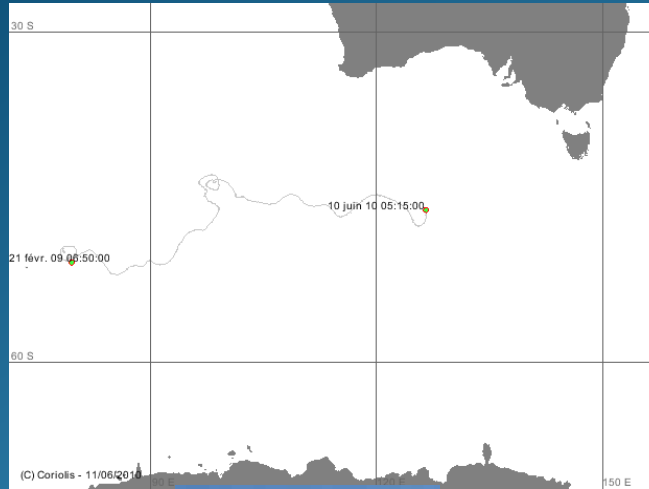


Arvor WMO 190174 :

WMO 190175 235 cycles

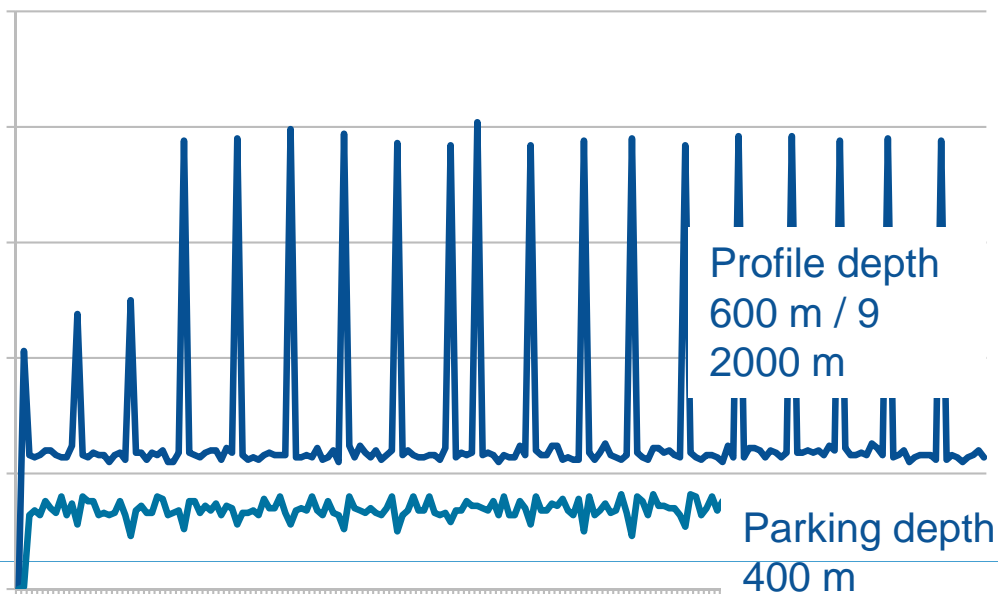
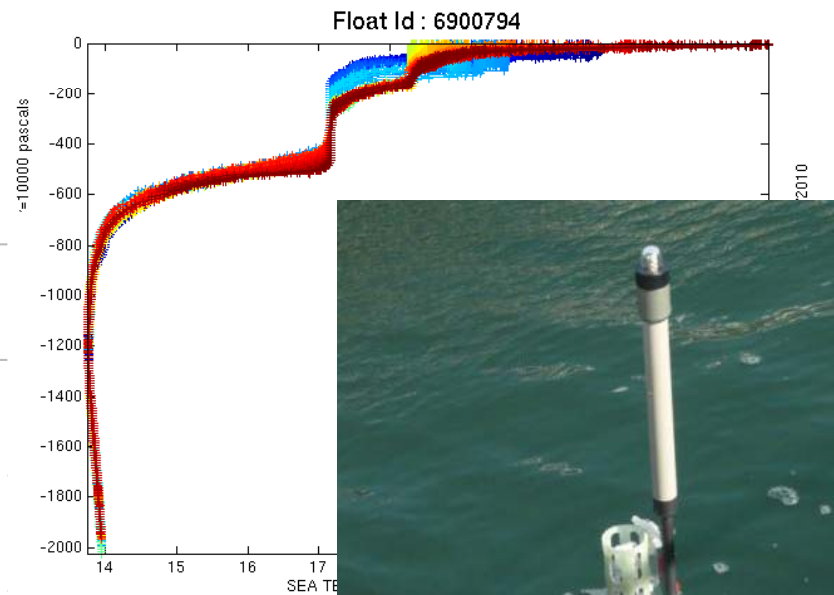
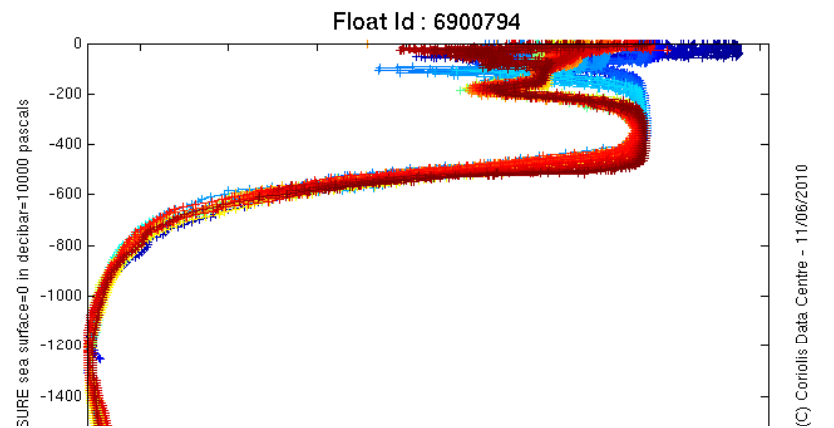
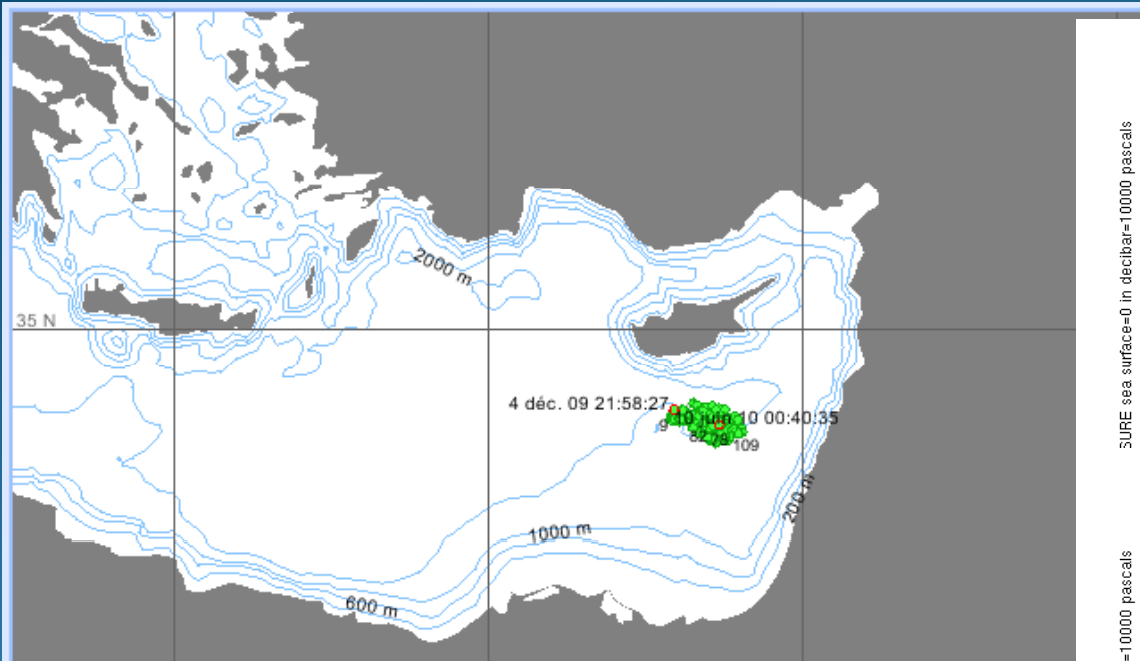
accelerated longevity trial
still in operation after 240 cycles

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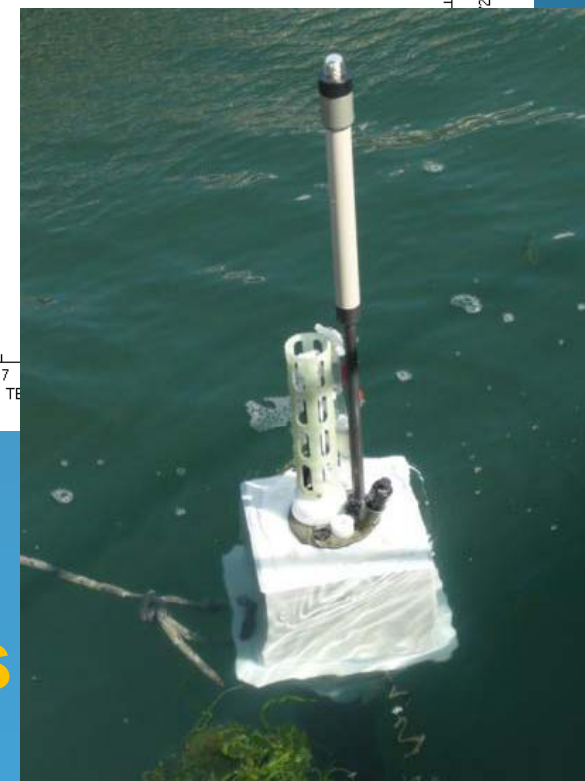


Arvor I wmo #6900794

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192
Cycles



Arvor Argos 3

- Software to optimize Argos 3 capabilities for floats developed by Ifremer ●
- Development by nke of new dual frequency whip and antenna at 401 and 465 MHz usable for Provor and Arvor Difficulties encountered but soon will be solve ●



nke PROVOR CTS3

INSTRUMENTATION

Possibility to carry more than one CTD

- Large hull : Internal diameter 150 mm
- Large buoyancy range (3 liters)

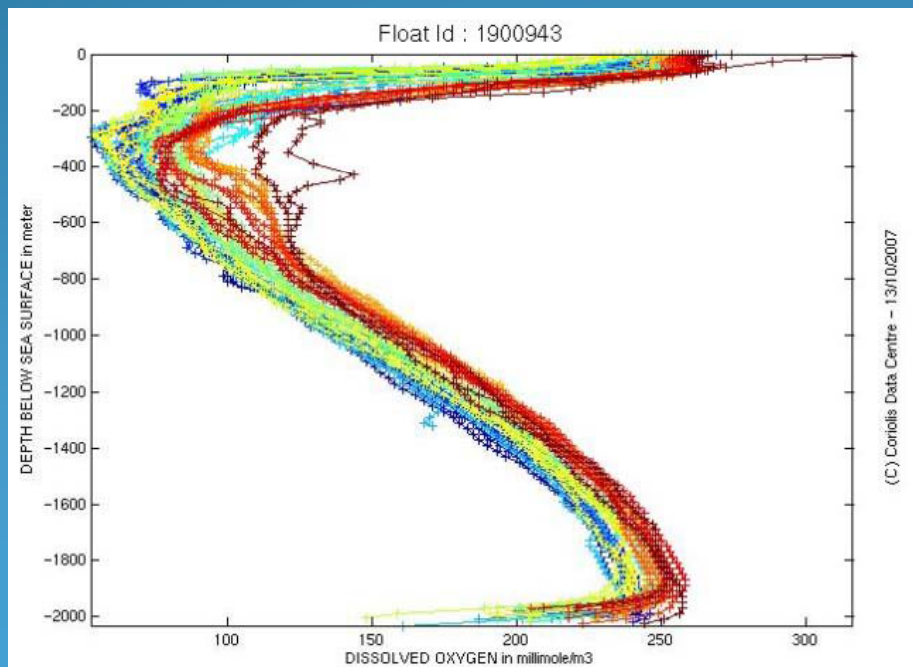
By :

- **Increasing length of tube**
- **Adding syntactic foam**
- **Additional carriage capability > 5 Kg**
- **External or internal sensor mounting**
- **Possibility to additional battery**



CTD and dissolved oxygen sensor (Aanderaa optode)

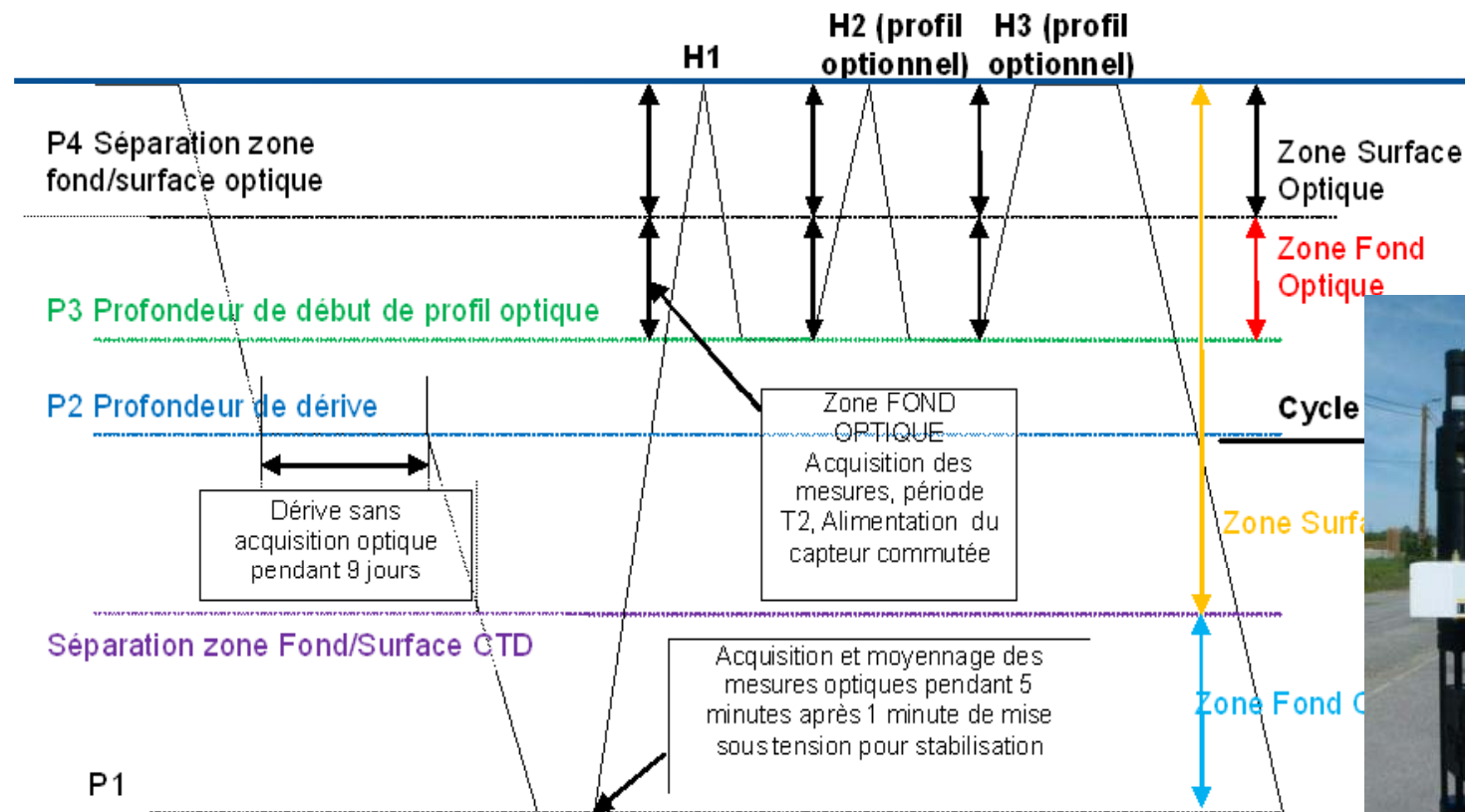
- 1 prototype deployed in February 2007, : contribution to Carbocean EU project (data on Coriolis web site, <http://www.coriolis.eu.org/WMO1900943>)
- Mounted on top of Provor
- 3830 to 4330
- Argos 2 transmission



Provbio BV2

CTD / OCR / C rover / ECO 3 Bi optique sensor

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Syntatic foam adaptation

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66 % battery capacity increasing



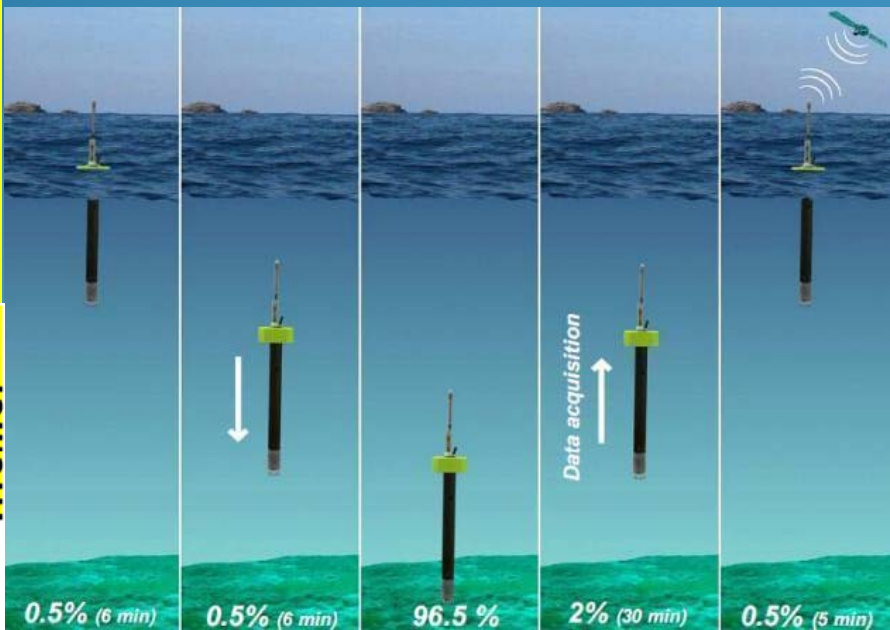
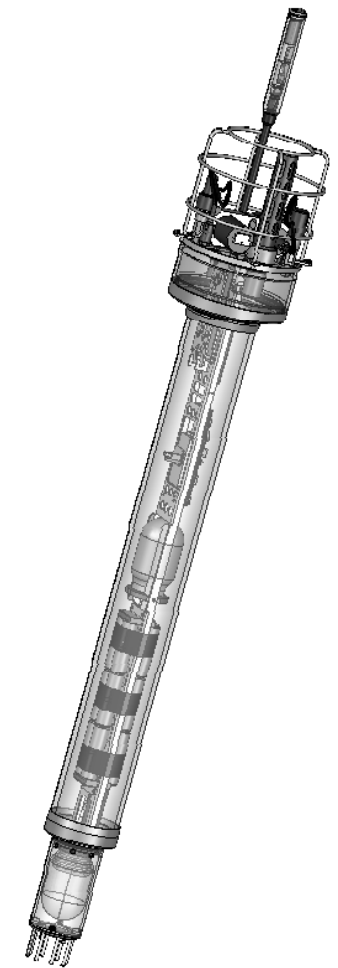
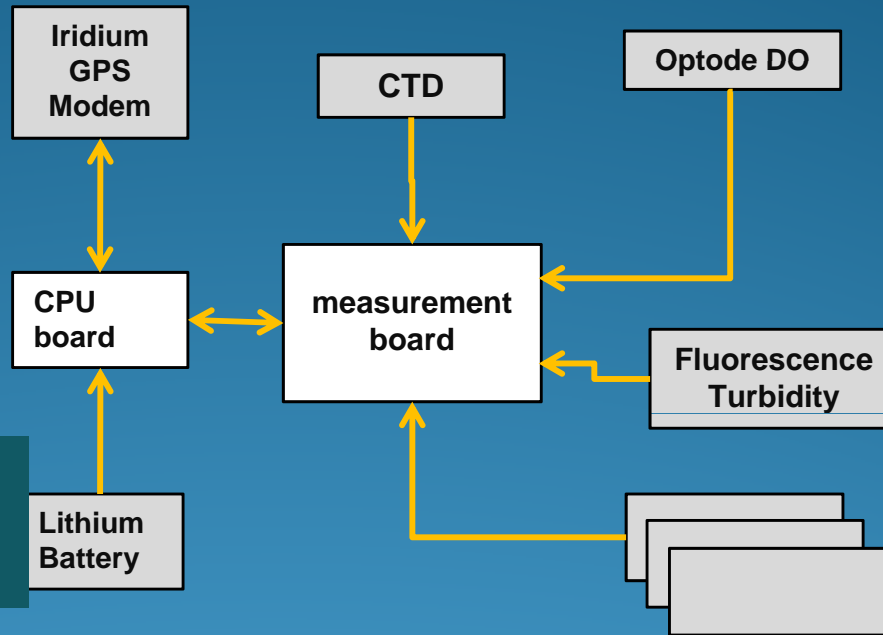
ARVOR CM

Development in partnership with Ifremer

Coastal Multi sensors

- CTD
- Optode DO
- Iridium GPS
- FLNTU
(fluorescence turbidity)

Arvor C CTD deployed with success on the shelf in Biscay bay
drift < 200meters /day



- Measurement board is in charge of sensors acquisition and control
- CPU board in charge of float motion control , messages building , Transmission control receive mission parameters

→ Will offer a more open solution for application with multi sensors

nke Provnuts for LOV

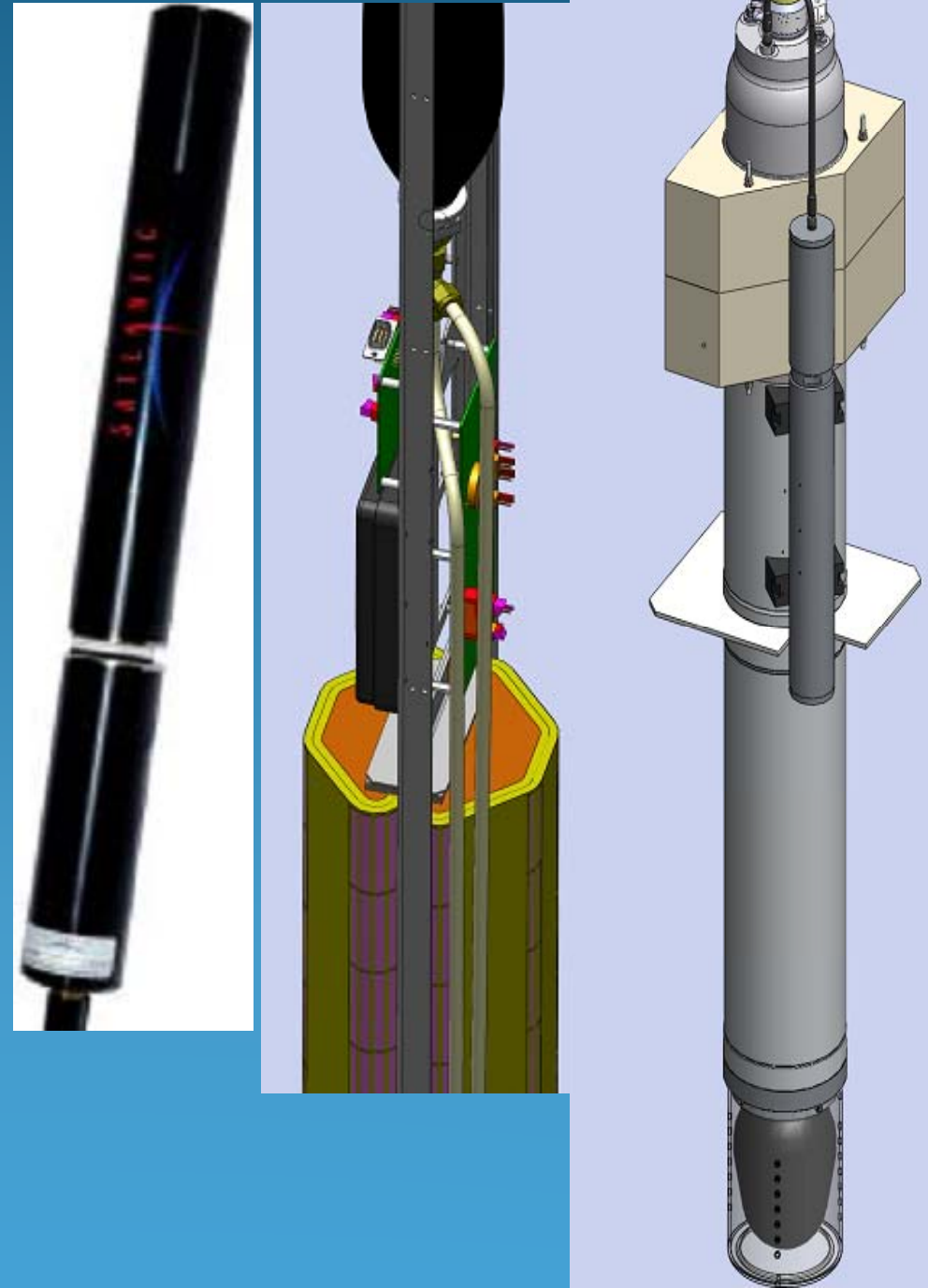
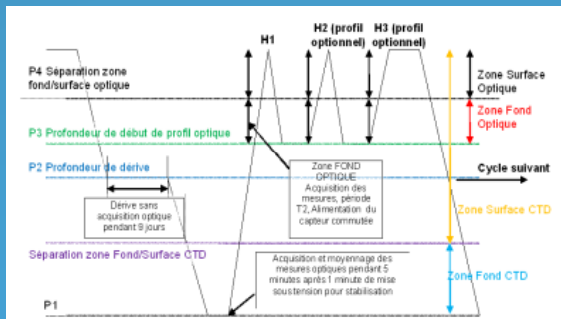
INSTRUMENTATION

- In development
- based on Provbio B2 functions
- Battery +66 %
- chassis , new foam floatability



SUNA (Submersible Ultraviolet Nitrate Analyzer)

1. UV source consumption
2. Output data per measure
 - real time NO₃- calculation 10 bytes
 - or
 - Full spectrum 511 bytes



to be transmitted for new LOV Project

		bytes
CTD	Conductivity	2
	Temperature	2
	pressure	2
	écart type	2
ECO 3	fluorometer 1	2
	fluorometer 2	2
	Back scaterring	2
	pressure	2
Irradiance 6 L +1 PAR	6L	2
	1PAR	2
	pressure	2
Suna nutriements sensor	10 processed data	20
	or full spectrum	511
	pressure	2
Technical data	<i>including "Mission parameters"</i>	140



Data to be transmitted per profile

	octets	SBD 2KO
CTD/ Eco 3/Ir 3+ PAR/ 10 Val suna	8976	4,6
CTD/ Eco 3/Ir 6+ PAR/ suna spectre	39636	19,818
CTD/ Eco 3/Ir 6+ PAR/ suna spectre comprimé	24306	12,153

Transmission via Rudics Iridium will be probably selected , regarding

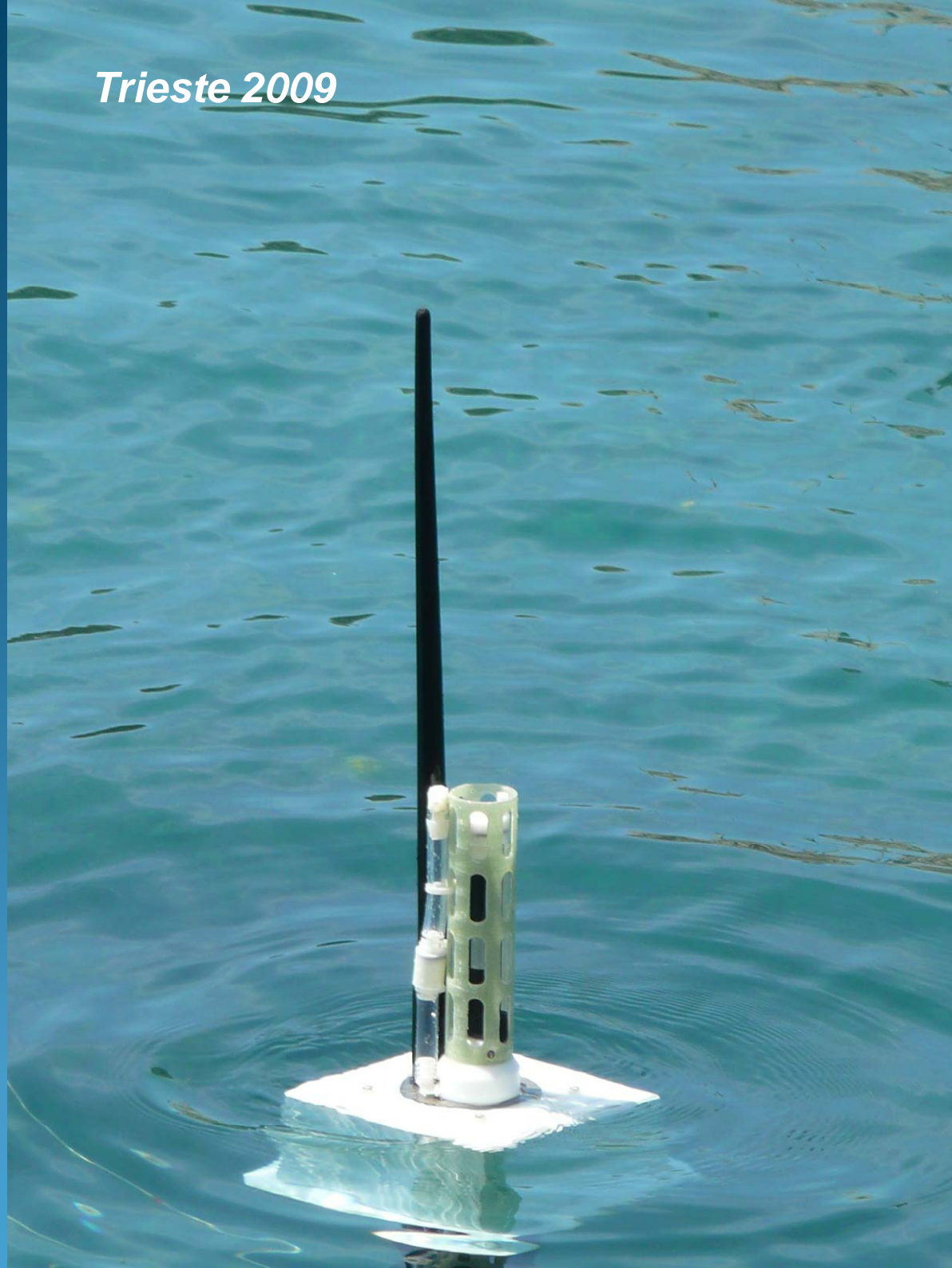
- **airtime fees**
- **Electrical consumption**

as conclusion

- **Thanks** to partners mostly , Ifremer and LOV
→ collaboration with scientific organization is strictly required for SME as us
- New Coriolis tools « **at sea monitoring** » facilitate technical data analysis and will enable a better understanding of missing cases .
→ Improvement and correction action will be possible in order to **increase operationality**
- New satellite transmission vector with higher volume transmission will also enable more technical data for a better understanding
- Floats with additional sensors , additional battery capacity , using higher rate capabilities are requested and Provor base is convenient for such applications

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- Merci

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