www.nke-instrumentation.com

Latests developments on profiling floats

nke instrumentation

Athens

October 2019

nke instrumentation

- Located in Hennebont, Brittany, France
- Specialized in oceanographic instrumentation since 1993
- 35 employees
- Float activity since beginning 90's in Martec, Kannad companies, and now in nke since 2009
- A long and constant partnership with IFREMER and now with LOV and Sorbonne University
- More than 2000 floats produced

- With courtesy from LOV, IFREMER and PML for "at sea" photos

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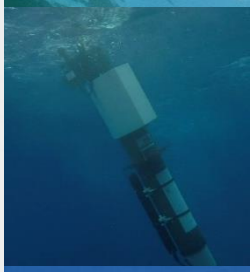
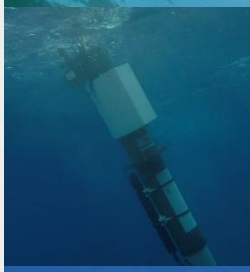


nke facilities



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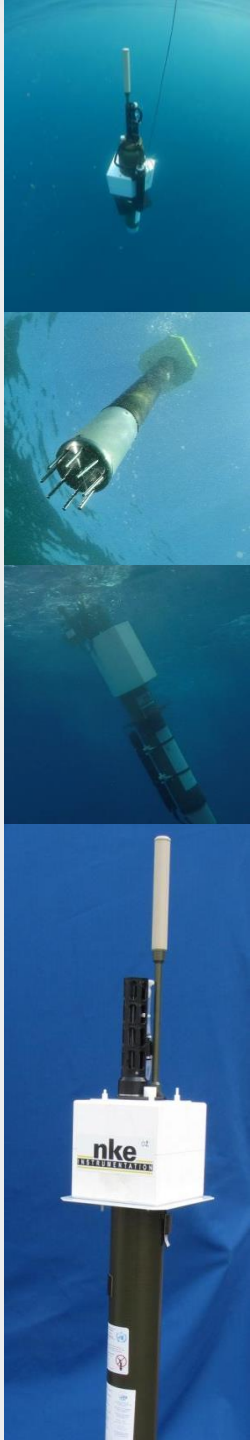
nke instrumentation

- Designer, manufacturer and seller **of instruments and systems for water measurements and environmental monitoring**
- **Open Ocean, deep sea, coastal areas, rivers, lakes**
- Involved in **national and international research projects**



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nke facilities : production area

Manufacture Area
approx : 150 m2 dedicated to instrumentation, extension possible depending on projects and activity

Storage Area
approx : 550 m3

Up to 350 floats per year capability

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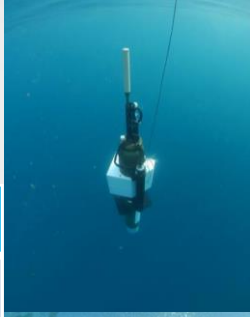
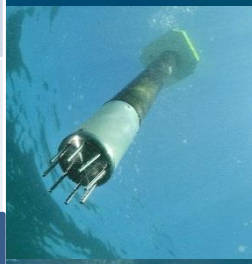
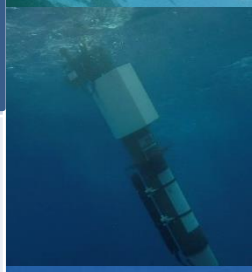
Range of Floats

Type	Nke model	Comments
ARGO TS, 2000 m, Argos	**Arvor-L, Arvor** **Provor CTS3**	Argos 2 200 CTD points max per profile
ARGO TS, 2000 m, Iridium	**Arvor-I** **Provor-I**	Iridium SBD Up to 2000 CTD pts in a profile Ice detection function
ARGO TS, 2000 m, Iridium	**Arvor-I -RBR** NEW	Iridium SBD Up to 2000 CTD pts in a profile Ice detection function
ARGO TS, DO, 2000 m Argos & Iridium	**Provor-DO** **Arvor-DO** **Provor-DO I** **Arvor-DO-I**	CTD & DO, Argos2 CTD & DO, Iridium SBD, 2000 pts, Ice detection
ARGO TS, DO 4000 m	**Deep ARVOR**	CTD & DO, Iridium SBD, 4000 pts, Ice detection
BGC, TS, 2000 m	**Provor CTS 4** **Provor CTS5** NEW	BGC sensors : D O, Radiometer, fluorometers, transmissometer, nutrients , NOSS, **pH** Iridium rudics, 0.2 dBar resolution, Ie detection UVP6-LP on progress (CTS5 only)
TS, DO, 400 m TS, Tu, Fl , DO, 400 m	**Arvor C** **Arvor-Cm**	Coastal applications (CTD & DO), Iridium SBD metric resolution
Polar	**PROVOR SPI**	Polar application, TS, DO, NO_3, pH
Acoustic spectrum, 1000 m	**Provor AC, AC2**	Hydrophone, data processing, Iridium transmission

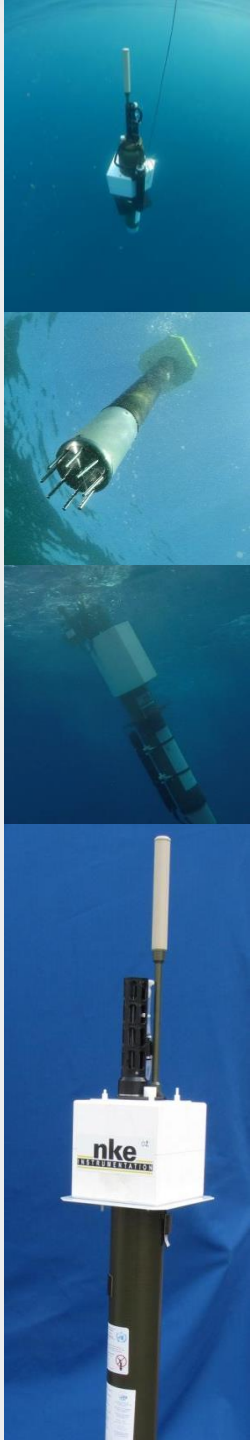





Improvements and new design

Firmware improvements on all nke floats

RBR CTD on ARVOR-I float

New design for PROVOR CTS5 (« PROVOR_V »)



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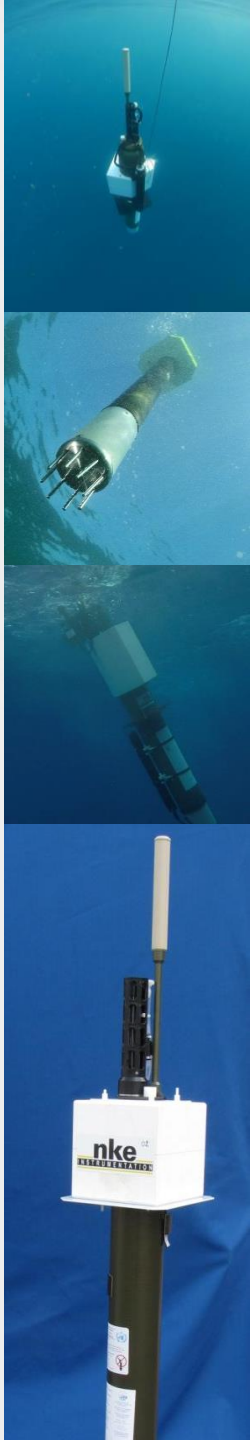
Firmware improvements on all nke floats

For both reliability and new functions

- Buzzer for deployment authorization (now Deep in addition to Core)
- New sampling zone in ascent after grounding (Deep)
- Buoyancy reduction optimization (less time at surface)
- Grounding Algorithm optimization
- High resolution measurement on bottom (Deep)
- Various improvements
  - Automatic mission start if armed mode is ON (Useful for non expert users and bad deployment sequence)
  - Different padding for empty packet in a message (not decoded as empty tech packet)
  - Self-test after armed mode command to check that float is ready for future deployment (focus during last preparation actions)
  - Synchronization of alternated profile and in-air measurement (if not required at each profile)



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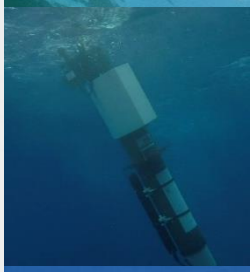
RBR CTD on ARVOR-I float



AST recommendation : Pilot Project & 100 floats with RBR CTD deployed per year

E-ARISE Project *

Two main goals for project

- Sustain of global Argo network
- Extension to Deep Ocean and BGC application

In partnership with IFREMER and RBR, RBR CTD will be integrated on ARVOR-I float to offer at the end of 2nd quarter 2020 an industrial float to community

Work has now started and delivery of 2 prototypes is scheduled for beginnig if 2020

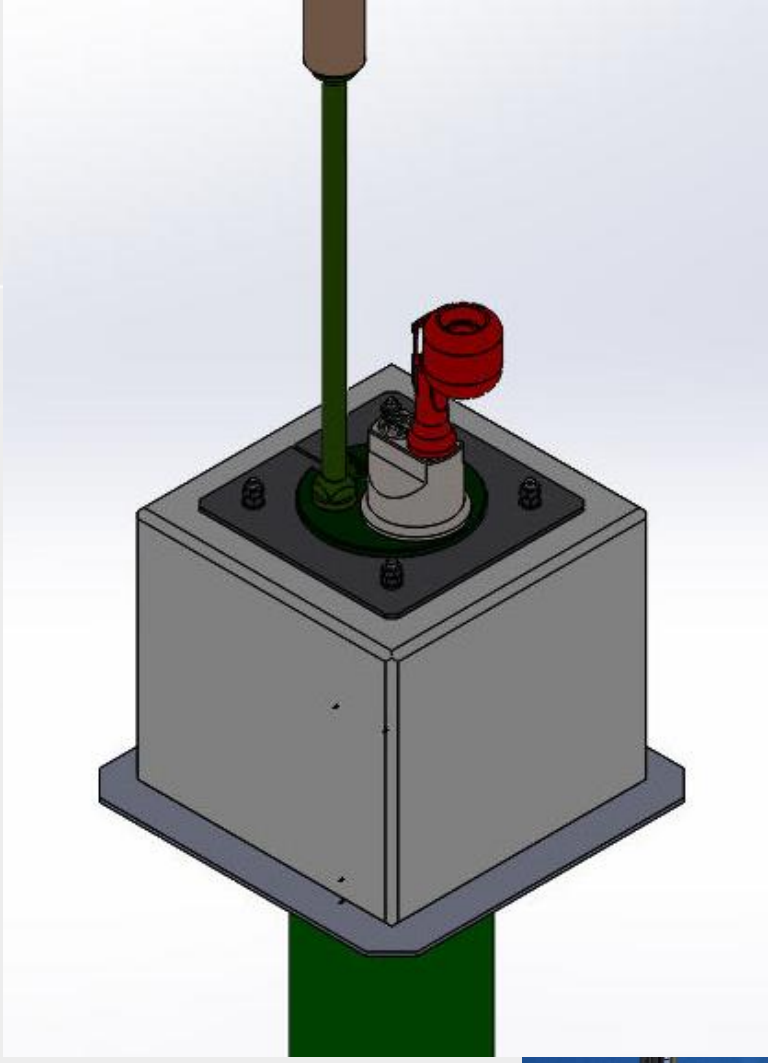
* This project has received fundings from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 824131

Horizon 2020
European Union Funding
for Research & Innovation

RBR CTD on ARVOR-I float

Same features than standard ARVOR-I

Main features of RBR CTD



Specifications

Physical

Power:	80µW sleep, 45mW sampling
Storage:	~120M readings
Communication:	UART, RS-232, USB-CDC
Energy/sample:	<18mJ
Energy/profile:	~400J (2000dbar sampling)
Sampling speeds:	Up to 8Hz
Materials:	OSP and titanium
Input voltage:	4.5V-30V

Conductivity

Range:	0 – 85mS/cm
Initial accuracy:	±0.003mS/cm
Resolution:	0.001mS/cm
Typical stability:	0.010mS/cm per year

Temperature

Range:	-5°C to 35°C
Initial accuracy:	±002°C
Resolution:	0.00005°C
Typical stability:	0.002°C per year
Time constant:	~700ms

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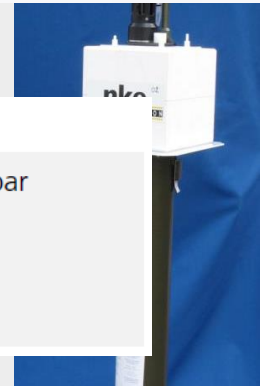
Depth

Range:	2000 / 4000 / 6000dbar
Initial accuracy:	±0.05% FS
Resolution:	0.001% FS
Typical stability:	0.1% FS per year
Time constant:	<0.01s



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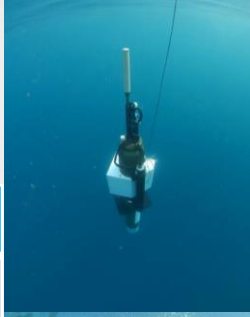
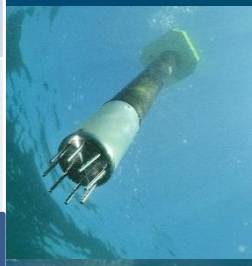
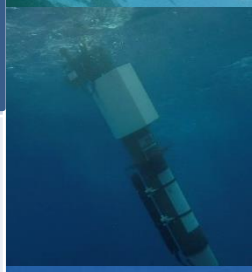
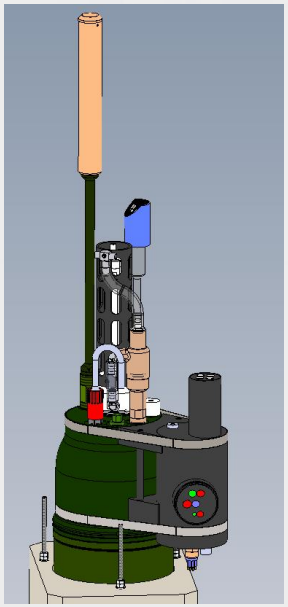





Nke BGC floats : PROVOR CTS4 and CTS5

PROVOR CTS4 (« PROVOR_III » in Jcommops database)

Mature float able to embed all 6 variables recommended by BGC-ARGO :

- CHL-A
- Backscatter (suspended particles)
- DO with in air measurement
- Nitrate
- pH
- PAR



5 floats with all these variables are now operating at sea (IMR, SIO)
6 more in recent future deployed by LOV

More than 200 units deployed with various sensor equipments

Main features

- High sampling possibilities (5 independant zones per sensor in water column, high resolution, specific treatment per zone and per sensor, with specific power mode
- Self ballasted float
- Ability to embed large battery pack for long life expectancy and contribution to core ARGO program in parallel of BGC goals

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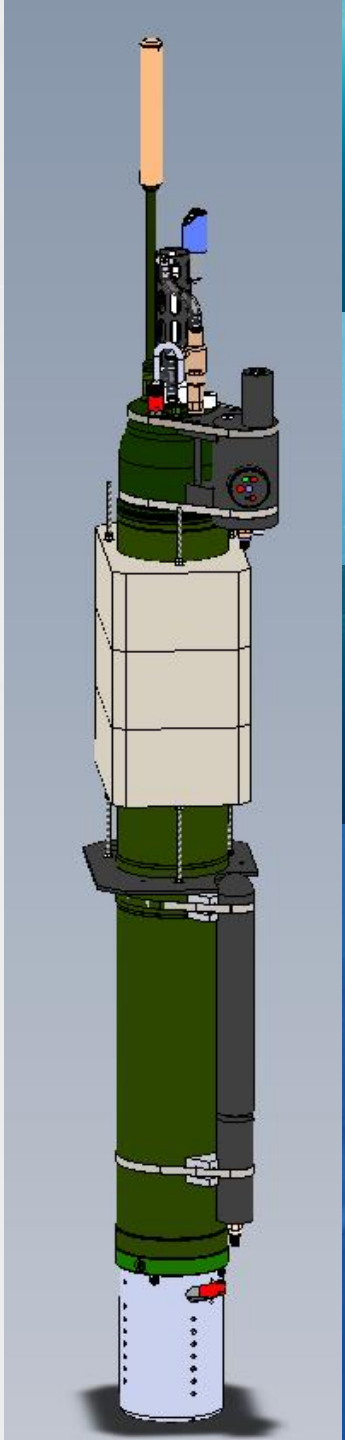


PROVOR CTS5 actual design

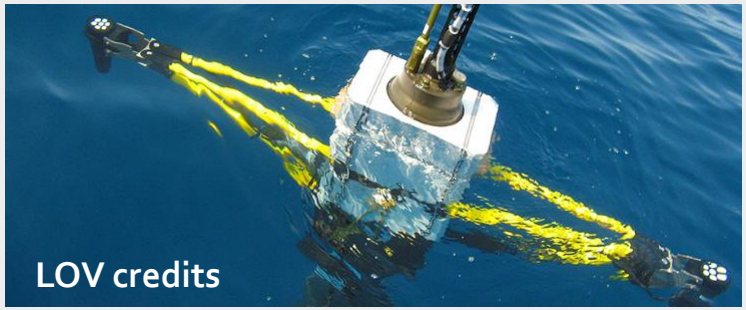
2012 -> 2019 : PROVOR CTS5 (« PROVOR_IV » in Jcommops Database)

Based on a couple of board : APMT designed by nke for float (displacement, Transmission, CTD, …) and 2nd board « PAYLOAD » developped on LOV request for scientific application, with driver coded by LOV Team. Developped during Naos project with LOV and Takuvik teams

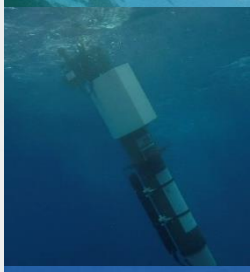
Initial main goals were :

- Flexibility and ability to quickly test prototype equiped with new sensors or new mission scheme, without need to request development to nke
- Offers also possibility to get influence of measurement on float's mission Scheme

Several application at sea since 2014 : PRO-ICE, PROVAL (Validation of Ocean Colour Sattelite)



PROVOR CTS5 actual design



2012 -> 2019 : PROVOR CTS5 (« PROVOR_IV »)

➢ This float has shown promising possibilities, but by design, is more difficult to offer to a larger sientific community.

➢ Reason is that nke do not have hand on Firmware for sensors acquisition. In a context of high reliability requirements for ARGO and BGC-ARGO application, this float's type is difficult to propose as answer in user's tender

Going from this situation, main question was

« how could nke combine both possibilities

- New performance with flexibility and ability for user to developped its own driver for sensor evaluation

- and at same time offer a float that gives new performance (mission scheme, file system, improved rudics transmission rate, …) and all improvment introduced ? »

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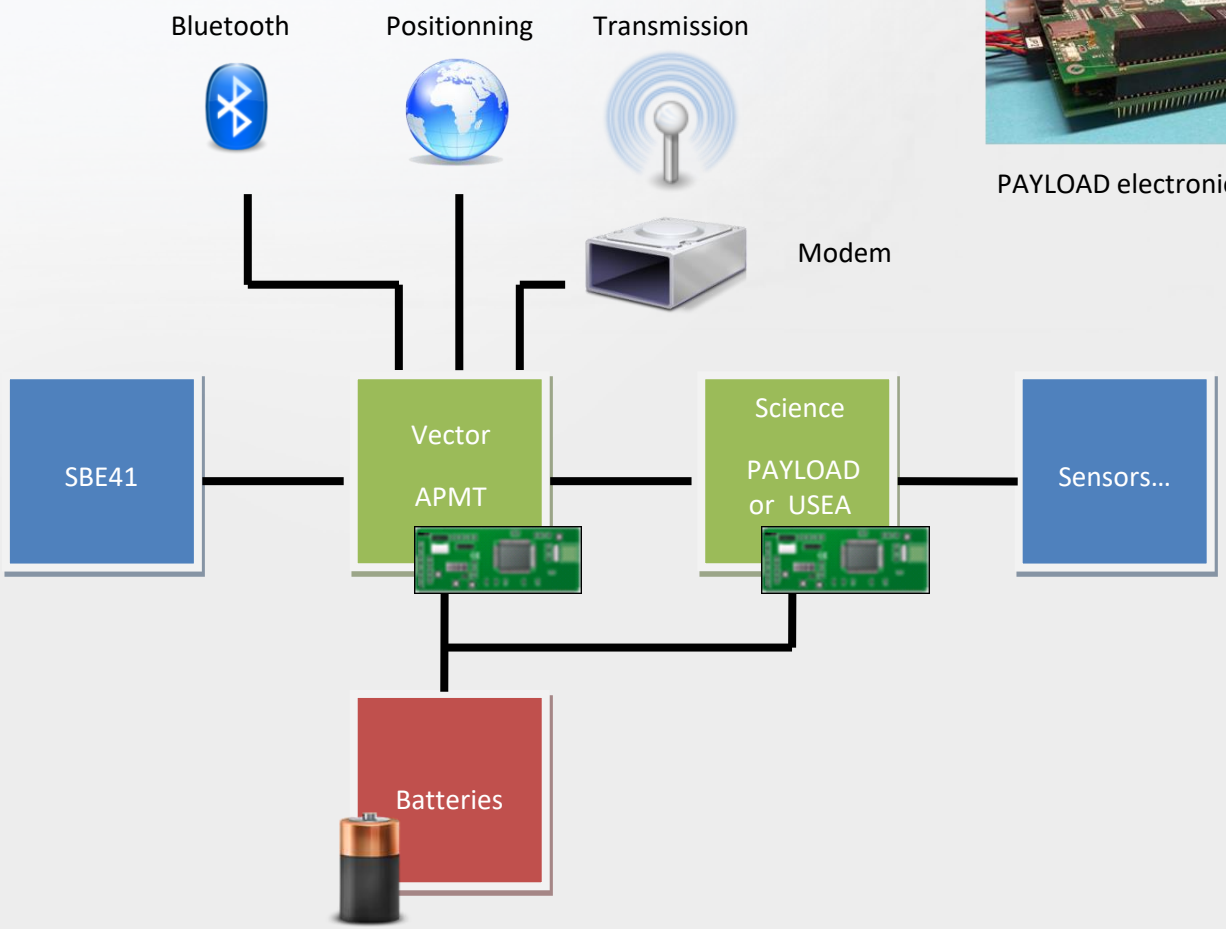
PROVOR CTS5 : Electronic architecture

PAYLOAD electronic board



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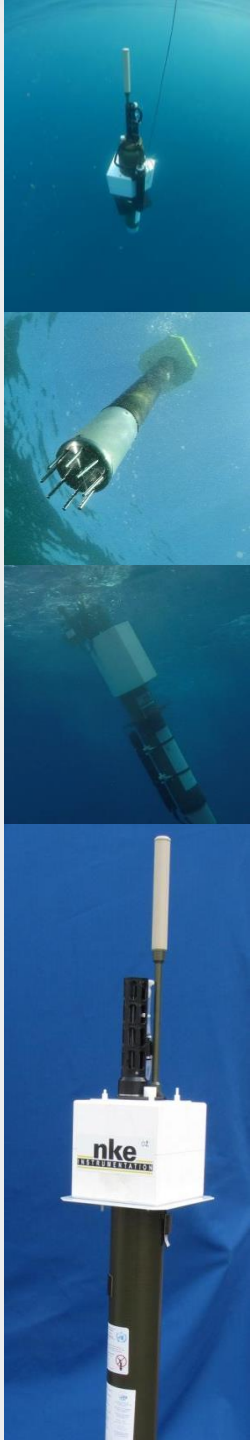
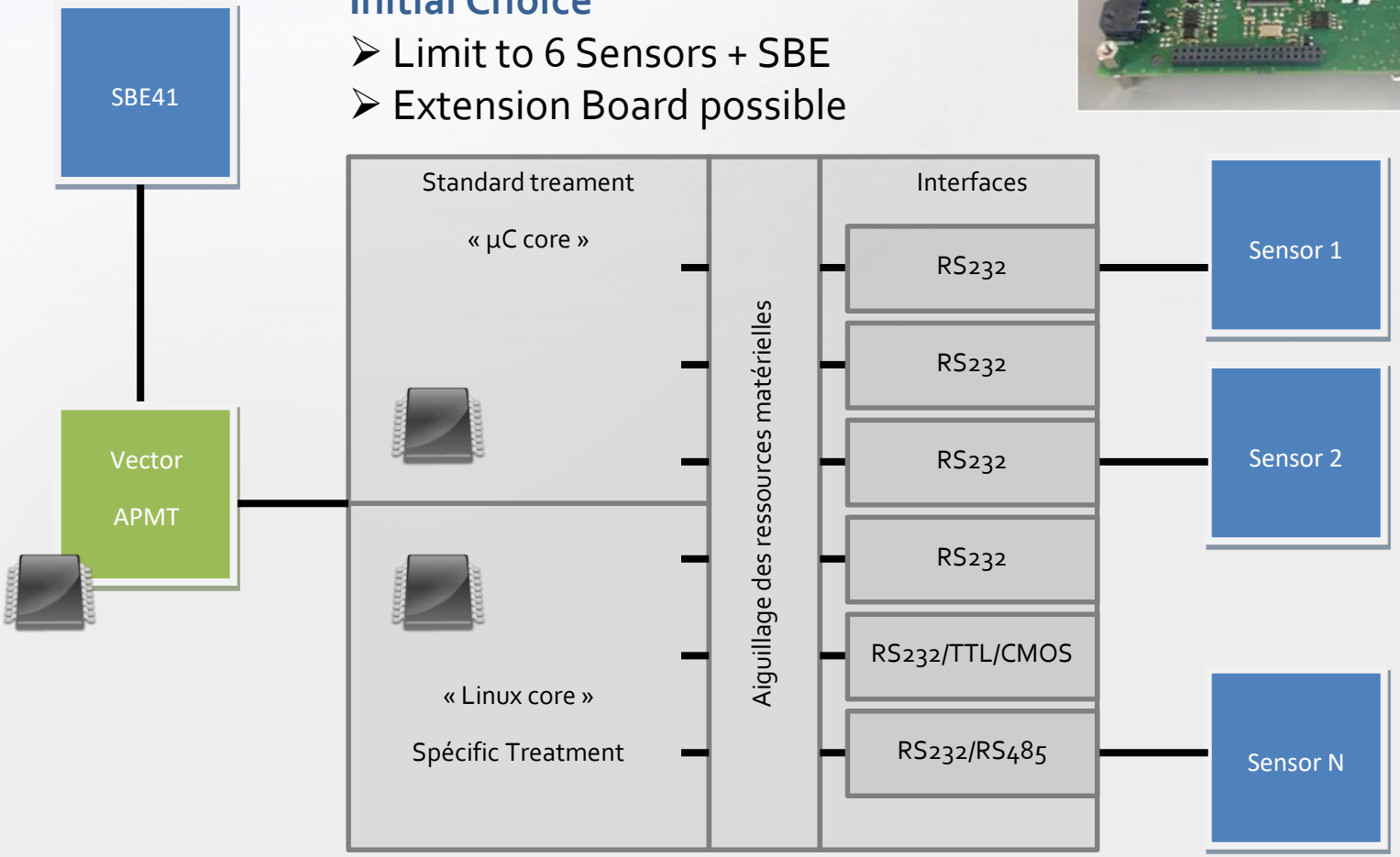
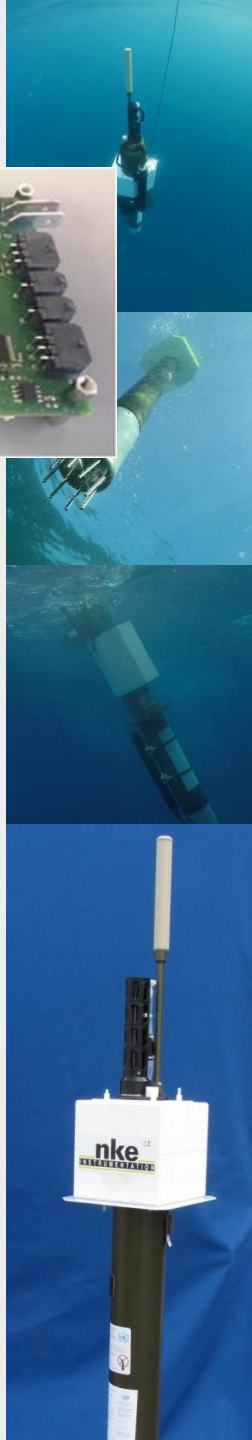


USEA new electronic our answer to both wishes

Initial Choice

- Limit to 6 Sensors + SBE
- Extension Board possible





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USEA internal architecture

Initial Choice : 2 cores !

- µC Core includes all standard BGC sensor drivers coded by nke for reliability requirements (coming from historical result on CTS4) and also UVP6-LP driver (on progress)

- Linux Core will enable to any user to code its own driver for evaluation and test application of new sensor or new mission scheme

Float can becoming now a standard offer float with 6 variables recommended by BGC-ARGO (+UVP6-LP)
And
Also with additional possibilities (any oceanographic sensor, …)

Both goals are now possible

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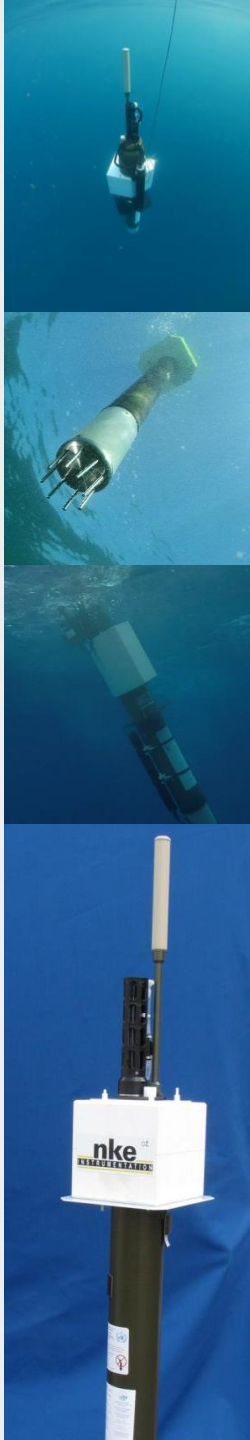

PROVOR CTS5 new features

Flexibility for mission scheme

- Mission described by an « Equation »
- Iridium Telecommand modification
- Modification pre-programmed by script

Transmission and storage

- Additional External Memory (micro-SD)
- Improved RUDICS Rate (typ. > 14 KB/min)

Large Sensor power supply possibilities

- Ex : DO Power supply with +5V to enable Continuous power (no self-heating phenomenon at this voltage)

File System instead of line command

- Configuration file
- Treated Data File
- Technical Data File
- Metadata File
- Traces File

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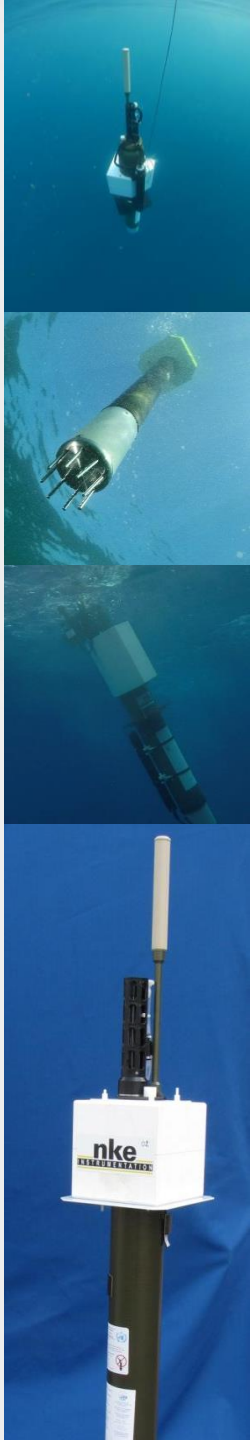
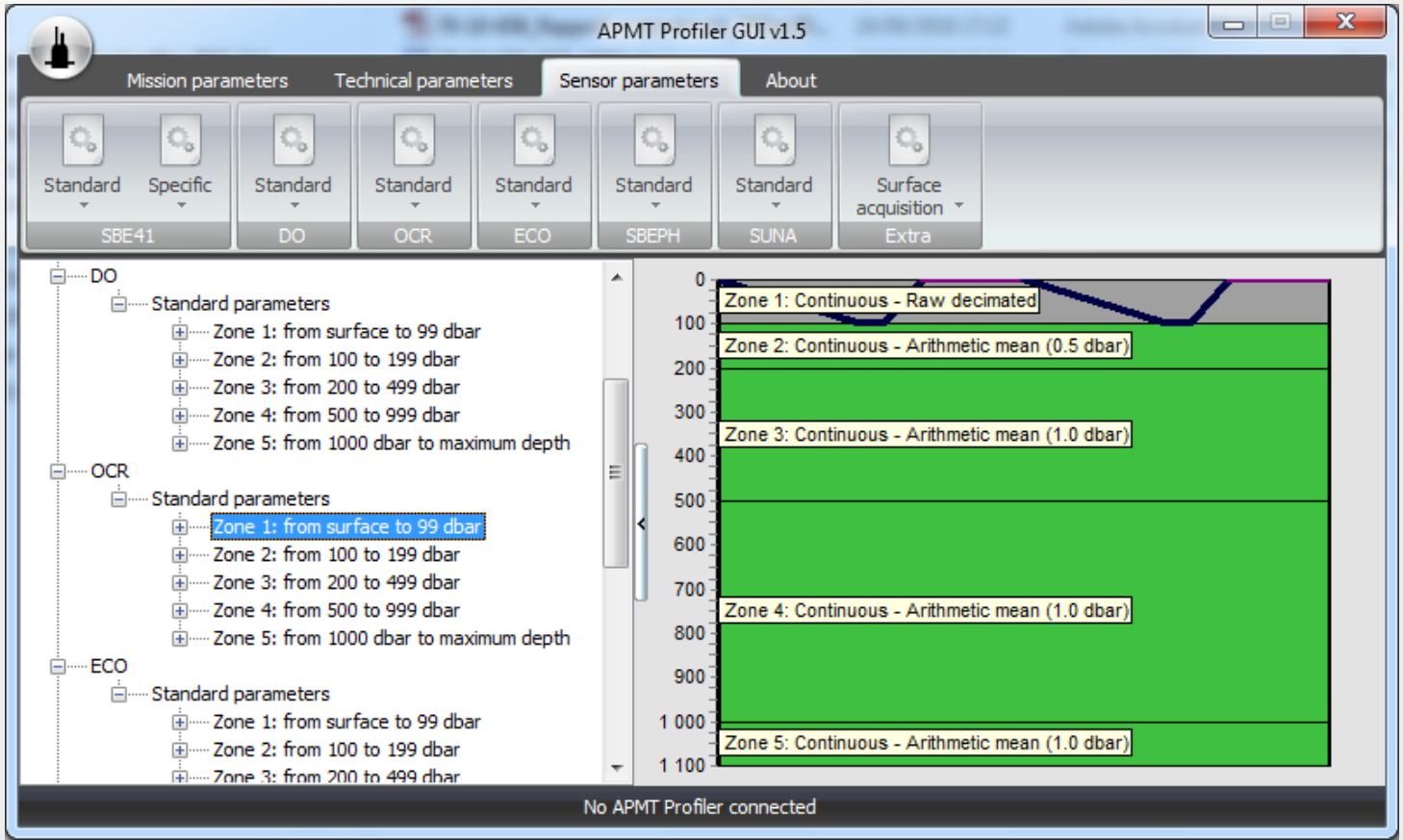
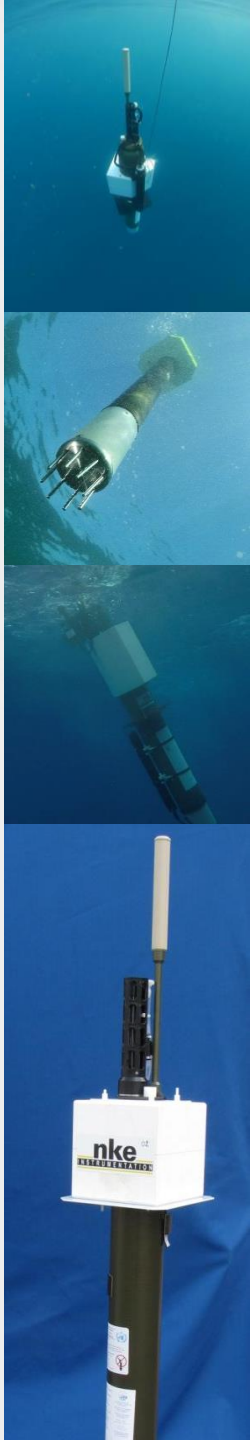


PROVOR CTS5 new features

User interface

- TCP/IP link by Bluetooth (FTP, TELNET)
- Graphical User Interface for configuration
- Decoding Library (*.dll et Linux)





PROVOR CTS5 new features

Navigation

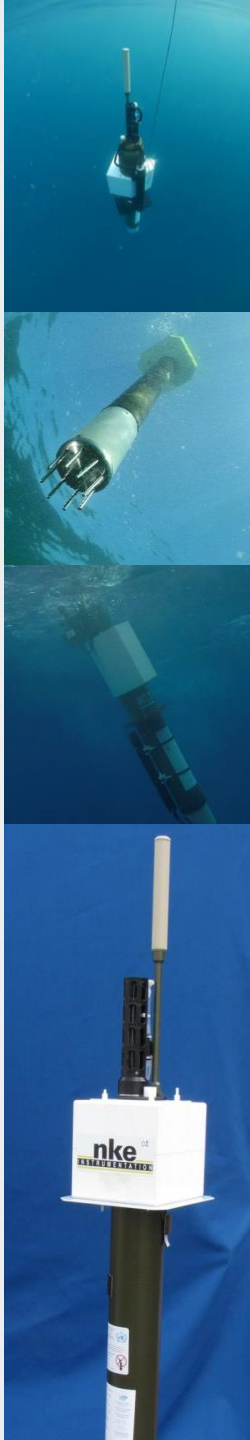
- « Near surface » and « In Air » Phases to comply with Dissolved oxygen measurement recommendation

CTD Data acquisition

- 1 Hz for SBE41 (instead of 0,5 Hz), better spatial resolution : 10 cm

Data Treatement

- Average with 0,5 dBar Slice thickness
- Raw Data with decimation at 0,1/0,2/0,5 and 1,0 dBar
- Timestamp for all Data transmitted



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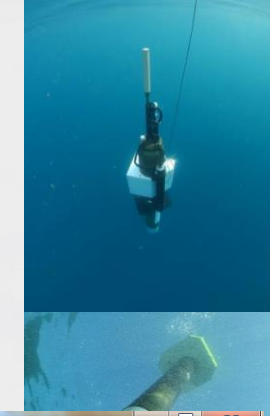
PROVOR CTS5 new features



Example of Metadata file

C:\Users\jsagot.MICREL\Desktop\3e82_017_00_metadata.xml - Notepad++

Fichier Édition Recherche Affichage Encodage Langage Paramétrage Macro Exécution Compléments Documents ?

3e82_017_00_metadata.xml

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        <MEASURE_BOARD Model="USEA" Firmware="1.00.019"/>
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            <SENSOR SN="03014" Model="DO4330"/>
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            <SVU_FOIL_COEFF c0="2.749372e-03" c1="1.217100e-04" c2="2.062590e-06" c3="1.655341e+02" c4="-1.938229e-01" c5="-3.551454e+01" c6="3.269046e+00"/>
        </SENSOR_DO>
        <SENSOR_OCR>
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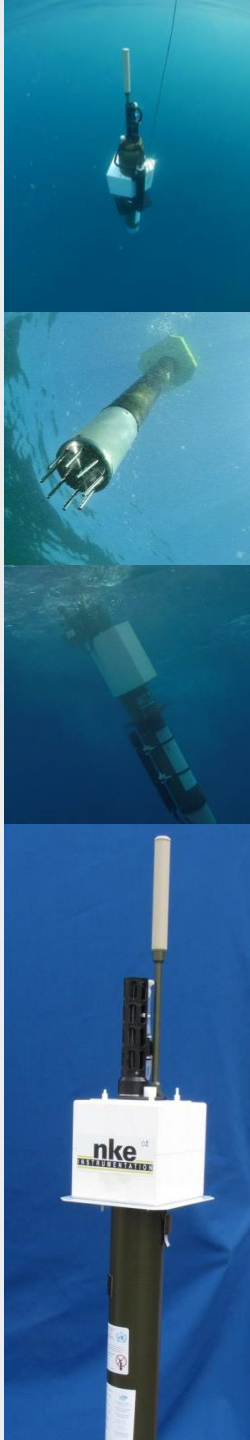
eXtensible Markup Language file | length : 2048 lines : 38 | Ln : 4 Col : 15 Sel : 0 | 0 | Dos\Windows | UTF-8 | INS

PROVOR CTS5 sensor driver implemented

Integrated on «µC Core»

- Detection and Automatic Sensor identification
- Standard Sensor Drivers
  - DO-4330 et DO-3835
  - OCR-504 et OCR-507 (7/14 canaux)
  - ECO (1/2/3 canaux)
  - c-ROVER
  - SUNA (spectre 45/90)
  - SBE-pH
  - UVP6-LP
  - …
  - ECO-V2 Soon



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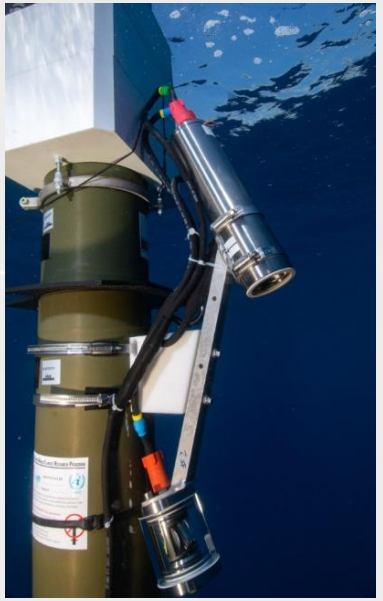
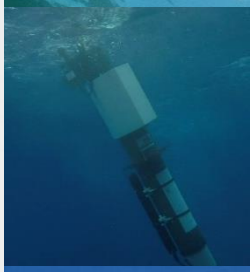
UVP6-LP on PROVOR CTS5



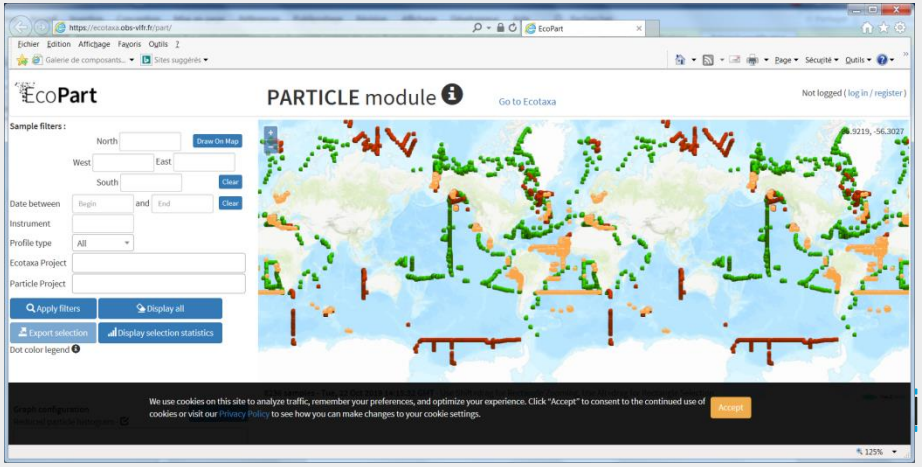


Underwater vision Profiler (UVP6-LP) (CNRS Patent) developped by LOV and manufactured by Hydroptic

UVP6-LP ***is designed to study large (>100 µm) particles and zooplankton simultaneously and to quantify them in a known volume of water. The UVP system makes use of computerised optical technology with custom lighting to acquire digital images of zooplankton IN SITU down to depths of 6000m.***

UVP6-LP specific features:
miniaturized and low price version of the UVP5
designed for low speed, limited space and low power vectors like profiling floats, gliders, floats, moorings, AUVs…
3,2 Kg in air / 1,5 kg in water
6000 m rated

Compatible with ECOTAXA http://ecotaxa.obs-vlfr.fr/part/



Thank you for your attention!

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