Spray04 recovery guide

TT

This document describes the steps to follow for the Spray recovery. Procedure sheets are given in annex.

Take the time to read the entire document, important advices are given. I strongly recommend to consult this document during the glider operations.

Personnel :

- one operator to do the procedure steps
- one supervisor to check and verify the procedure steps
- in option but appreciated : one person for taking photos and/or videos

1. Preparation

Difficult weather (fog, rain, …) and sea conditions (waves, …) must be avoided to try to recover the glider with some chances of success. To proceed to the recovery, a rendezvous between the ship and the glider must be taken. As the glider is moving relatively slowly (25 km / 13.5kn per day), the meeting point location and date should be anticipated well in advance. In that way, information regarding the cruise schedule has to be sent to the team on shore (PLH, PT and TT). For the same reasons, short messages containing the glider positions and other values will be sent on board. For that purpose, the emails addresses on board have to be sent as soon as known.

The glider is rather flexible for its recovery in the sense that the surfacing periodicity can be modified by changing the maximum depth for the profiles. For example, dives to 1000m correspond to surfacing with a period of ~5h10-5h30, while 100m dives occur with ~20-30mn periods. It is then possible to define relatively precisely the time of arrival on surface.

The recovery devices (lasso, net, Argos receiver, phone numbers, procedure sheets, …) must get ready before to fix the recovery location and time window. The team on shore must also be contacted enough in advance. A good synchronisation with the team on shore is required to receive the last known glider GPS positions, to send the commands for the depth changes and/or to end the glider mission. The best solution is to be in touch via satellite phone calls. The Argos receiver must be turned on to detect when the glider arrives in surface and to help the glider search.

An estimate of the surface position can be obtained from the glider trajectory together with the surface drift. The ship must stay away from that position while the glider is not definitively on surface i.e. while the mission has not been stopped from shore. A 1 Nm radius appears to be a rather safety range. The Argos receiver indicates when the glider is at surface and if she stays, the glider Argos beacon repetition rate is around 90s. When the glider is at surface and her GPS position is known after a phone call to shore, the ship can approach the position with a visual watch for an orange device on surface (eventually look for the birds, they usually fly around).

While the glider is at surface, she continues to have an activity to get GPS fixes and send them on shore via Iridium with a period of ~15-20mn. To do so, she sets alternatively her wings vertically (Photo 1).

Photo 1 – *Left* : Glider on surface. *Right* : Glider approach while taking a GPS fix or transmitting an Iridium message (one wing is vertical)

2. Recovery

During the recovery operations, we essentially try to avoid to break any part of the instrument. The most fragile because well exposed are the wings which contain GPS and Iridium antennas, the tail fin comprising the Argos beacon antenna, and the CTD located at the top of the glider. An optical sensor is installed on the bottom of the tail. The sensor is flush mounted with the tail bulkhead and is in that sense less exposed but one must still pay attention to it.

The easiest and safest way to proceed to the recovery is from a rubber boat as far as the weather and sea conditions allow it. In that case, it is possible to approach the glider smoothly and to grab her by hand or straps to bring her on board. At least two persons are required to lift the instrument weighting 52 kg in air. Extreme care should be taken to wings, fin, sensors and to avoid shocks against the boat hull during that step. To lift the glider on board, the handling position with a minimum risk is to have the wings vertical and the CTD on the sea side. The glider will be secured on a cradle to protect against vibration, scratch on painting, moves, …. To put the glider on the ship, in case of waves, it is best to lift it separatly from the rubber boat since shocks are likely to happen. Shocks can destroy the motor gears and consequently it can be very difficult to open the instrument.

Photo 2 – *Left* : lift the glider on board. *Right* : The glider secured on the cradle.

If sea state conditions do not allow to use a rubber boat, then we have to use the recovery net. The ship driving is then of first importance. It should be avoided that the glider comes against and/or goes under the hull. The net is rather slow to move, it has some inertia which in other respects insure its stability to the flow. Ropes attached to the frame help to manoeuvre the net.

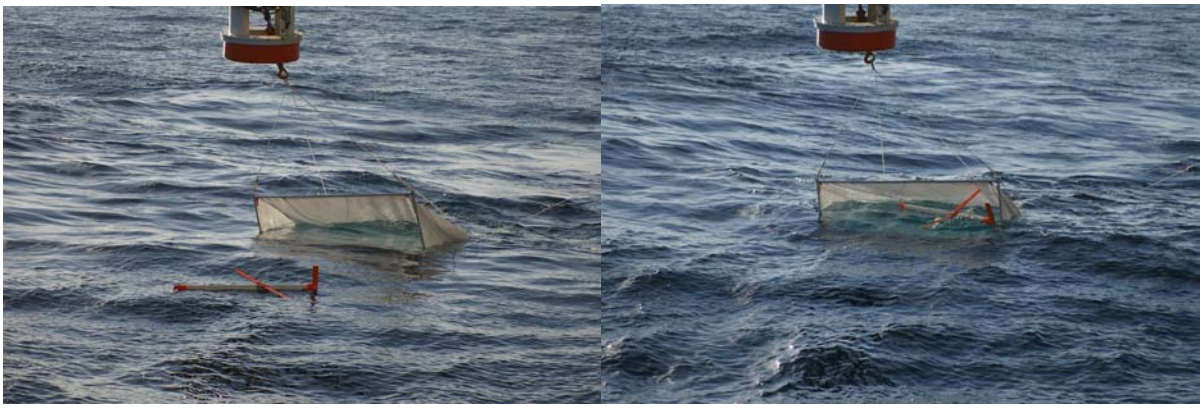

Photo 3 – Net test for a fake glider recovery…with a rather calm sea.

3. Connecting to the Spray

A single plug (Impulse 4 pins like) allow to connect to the Spray. The laptop-Spray cable is composed of 2 pieces for a possible direct connection on the electronic board too.

- Connect the plug on the Spray
- Connect the DB9 plug of the serial link to the laptop. An USB-serial adapter can be required for laptops without serial port.
- Connect the 2 parts : ➔ connectors are rather fragile and can slip easily ←
- Run HyperTerminal (or any other communication software) with 9600 8-N-1 settings
- ➔ open a capture file to log the Spray dialog ←

- Spray can be in activity (running GPS or Iridium) and information pass on the link like as in the case of Iridium activity

```
i=6, +SBDI:2,474,2,0,0,0
mtque=0
Tdog = 7333
nsent 0 nsat 0
Bad isu 1  bad gps 1
ngps = 62, p=213 t=0 isu=3
min, max =  1400  2600
now=   1441 dc=  534
Final roll value =   1986
min, max =  1300  2650
now=   1734 dc=   -4
Final pitch value =   1726
p= -1.44
p= -1.44
p= -1.43
p= -1.43
```

- Then wait for the following message

```
will wake up every 10 s  90 times
Hit w to exit sleep
>
```

- Spray is then in a low power mode, it awakes every 10s and sends the '>' character.
- Type regularly W, → Spray accepts only UPPER CASE CHARACTERS ←
- When Spray recognizes a W, it sends a welcome message followed by the prompt 'BAS >'. If extra W characters are read, Spray is then in a submenu, you have to type Q to be back to the main menu characterised by the prompt 'BAS>'

```
>>> W
 Tdog = 7333
 pumped 445 s total
 final pump current =  0.4 amps
      MAIN MENU Spray   4   Dive # 478  Op_mode = 2 in Mission mode
IRIDIUM SBD is implemented
SBE CTD Version
NO 16-bit A/D
                  ESC Abort prog :  U.pdate menu
C.ompass       :  D.ebug modules :  E.eprom menu
F.lash CF1     :  G.PS test      :  H.yd pump test
L.ow-power mode:  M.otor test    :  N.av test
I.ridium test  :  R.ead results  :  S.how params
T.est start    :  W.atchdog/Burn :  X.mit on RF
Y. 12-bit a/d  :  Z. CTD test    :  0. set Dive#=0
   BAS>
```

- Before disconnecting from Spray, put the glider in low power mode with the L command.

4. Spray menus

The dialog with Spray is menu driven. The main menu is given below. At any time, the U command re-displays the menu. To go to a function or a sub-menu, type the first letter. For example by typing C, we access to the compass menu with the C_1> prompt indicating the first level of the compass functions. To come back to the main menu, just type Q. The menus

are displayed only at the first entrance, typing a U redisplays the current level menu. In the following the bold characters are the ones typed by the operator.

```
   BAS> U
      MAIN MENU Spray   4   Dive #   0  Op_mode = 0 in Mission mode
IRIDIUM SBD is implemented
SBE CTD Version
NO 16-bit A/D
                  ESC Abort prog :  U.pdate menu
C.ompass       :  D.ebug modules :  E.eprom menu
F.lash CF1     :  G.PS test      :  H.yd pump test
L.ow-power mode:  M.otor test    :  N.av test
I.ridium test  :  R.ead results  :  S.how params
T.est start    :  W.atchdog/Burn :  X.mit on RF
Y. 12-bit a/d  :  Z. CTD test    :  0. set Dive#=0
   BAS> C
             Test of Compass : Oct 29 2005
               Compass Menu
Q.uit TCM2 test :   U.pdate menu   :   W.ake up TCM2
O.ff TCM2       :   S.end string   :   G.et TCM2 reading
A.vg roll
C_1> Q
BAS>
```

5. Details of the procedures

The recovery operations must be documented in order to gain in experience regarding the operation modes, required times, encountered problems … Procedures sheets are given in annex, details are given in the following for each procedure.

5.1. Procedure « Recovery notes »

From the remarks of the previous paragraphs, fill the first lines of the sheet. Photos and/or videos to illustrate the comments are very welcome.

When the glider is on board and before rinsing it, a visual inspection gives a description of its general state. Every detail regarding its external state should be noted in the ‘Visual inspection’ section of the sheet and illustrated by photos. The left cover of the top tail fairing (looking forward) is dismounted to check the interior of the tail, and in particular verify that the oil reservoirs are full.

Once it is done, the Spray can be rinsed and put in secure place to proceed to the next steps of the sheet.

The « Stop the mission » section requires to be connected to the glider. Report to the paragraphs 3 and 4 for the operation mode and the Spray menus principles. Follow the procedure instructions.

5.1.1. Stopping the Spray mission

Here is an example of the dialog established with the Spray to stop the mission. From the main menu with the BAS> prompt, type the 0 (zero) command then the U command while looking at the first line of the returned message. Dive # should come to 0 and Op.mode be 0 too.

```
      MAIN MENU Spray   4   Dive # 478  Op_mode = 2 in Mission mode
IRIDIUM SBD is implemented
SBE CTD Version
NO 16-bit A/D
                  ESC Abort prog :  U.pdate menu
C.ompass       :  D.ebug modules :  E.eprom menu
F.lash CF1     :  G.PS test      :  H.yd pump test
L.ow-power mode:  M.otor test    :  N.av test
I.ridium test  :  R.ead results  :  S.how params
T.est start    :  W.atchdog/Burn :  X.mit on RF
Y. 12-bit a/d  :  Z. CTD test    :  0. set Dive#=0
   BAS> 0
   BAS> U

      MAIN MENU Spray   4   Dive # 0  Op_mode = 0 in Mission mode
IRIDIUM SBD is implemented
SBE CTD Version
NO 16-bit A/D
                  ESC Abort prog :  U.pdate menu
C.ompass       :  D.ebug modules :  E.eprom menu
F.lash CF1     :  G.PS test      :  H.yd pump test
L.ow-power mode:  M.otor test    :  N.av test
I.ridium test  :  R.ead results  :  S.how params
T.est start    :  W.atchdog/Burn :  X.mit on RF
Y. 12-bit a/d  :  Z. CTD test    :  0. set Dive#=0
   BAS>
```

5.1.2. Check the internal parameters.

A check of the internal parameters is done with the Y command from the main menu.

```
        BAS> Y
              12-bit a/d Oct 29 2005
                12-bit a/d Menu
Q.uit ad12 tst    :   U.pdate menu   :   M.easure all
P.itch value      :   R.oll value    :   O.il press
B.attery value    :   V.acuum value  :   A.ltimeter
F. optical        :   E.eprom change vac, bat
Y_1>
```

Type B for the batteries voltage, P for the pitch position and R for the roll position. Write down the values on the sheet. Type Q to return to the main prompt.

5.1.3. Check the CTD.

A check of the CTD is made with the Z command from the main prompt.

```
        BAS> Z
             Test of SBE : Apr 20 2005
           SBE Menu
```

```
Q.uit SBE test  :  U.pdate menu    :  D.ebug SBE
C.TD sample     :  P.ressure sample:  S.tatus of SBE
Z.ero Pressure  :  1. SBE pump on  :  2. SBE pump off
Z_1> C
  0.30  20.6198   0.0000
   257    25619     1000
Z_1> Q
SBE pump is off & SBE is in low power
   BAS>
```

Write down the values on the sheet. Type Q to return to the main prompt.

5.1.4. Reset to zero the roll motor position

From the main prompt, type M

```
         BAS> M
           pitch/roll motor test Oct 29 2005
                  Pitch/Roll Motor Menu
Q.uit motors tst  :   U.pdate menu   :   M.easure pots
P.ort roll        :   S.tbd roll     :   X.mit pitch
A.ft pitch        :   F.wd pitch     :   0. pitch
G.PS (stbd)wing up:   I.su (port) up :   Z.ero roll
M_1> Z
```

The Z command sets the roll batteries pack in a position which gives a flat attitude on surface (wings horizontal) and allow to take out the electronics. Type Q to return to the main menu.

5.1.5. Empty the external ballasts.

From the main prompt, type H then O

```
         BAS> H
         Test of Hydraulic Pump : Oct 29 2005
              Hydraulic Pump Menu
Q.uit pump    :   U.pdate menu : T.oggle using vac sw
C.lose valve  :   O.pen valve  :   H.yd pump on
                  Z.ero accumulator
H_1> O
Opening valve
H_1> Q
```

Check after 5-10 mn that oil is migrating inside by touching the bladders to feel if they empty. If it is not the case, type a C.lose valve followed by a O.pen valve and a Q.uit. Then check again the ballasts after 5-10 mn.

Type L to put the glider in the low power mode. The following message is displayed

```
entering lowpower...please wait
Burn wire is OFF
Watchdog is initialized and burn wire is off
will wake up every 10 s
Hit w to exit sleep
```

The cable can now be disconnected and the glider plug closed by the dummy plug.

5.2. Procedure « Steps for opening »

This is the Spray opening to prepare it for the shipping. The steps are detailed in the corresponding sheet and we have just to follow it step by step. Care will be taken to have the two parts at the same level while separating the Spray tube (step 8 of the "Opening" section) to avoid that the aft bridge scratches the bore seal area of the hydraulic section.

To separate the 2 parts, take the tail only 5 cm away to avoid to break cables and/or connectors. Disconnection of the cables is described from bottom to top. A mark for each connector is written on the aft bridge.

For the « Hydraulic section inspection », the tail will be let horizontal on its PVC blocks and one can report to section 5.4. Taking out the electronics is described in the « Removing the chassis » section. First of all, one checks that the roll batteries are turned to the bottom by looking inside with a flashlight. Otherwise one needs to connect to the glider and send the commands of the line 0 of the procedure sheet. The communication connector is the last one on the electronic board on the left while looking forward (Photo 4).

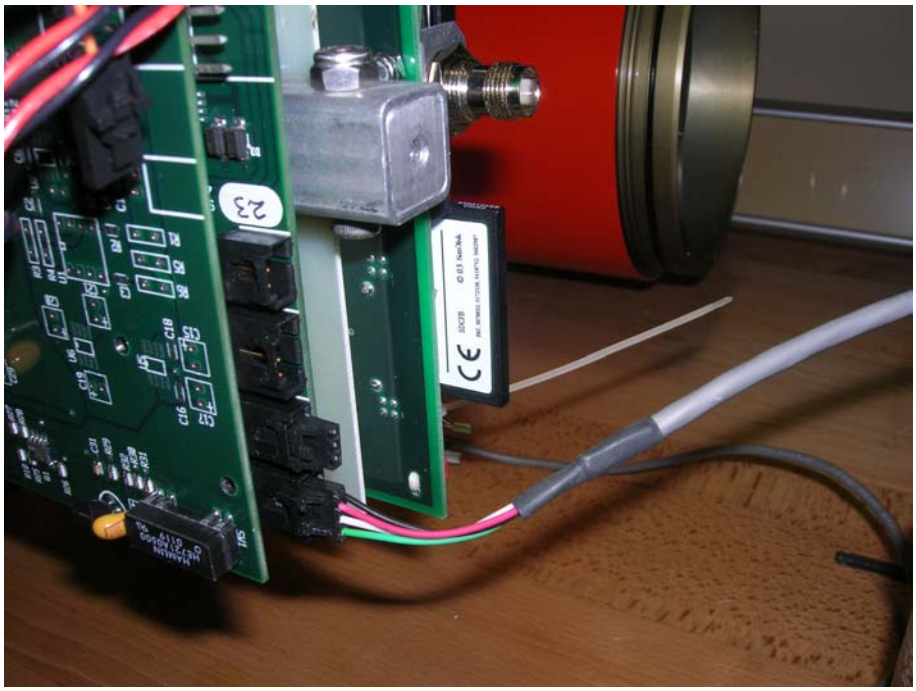

Photo 4 – Communication connector on the glider electronics.

It could be a bit difficult to insert the teflon sheet, try to roll it and check that the forward is flat. The chassis output must go slowly, there is not need to force. The chassis with the batteries is quite heavy and be not surprised by the weigh when it comes out from the container. Put it in a safe place on cradles to wait for its own preparation.

Wings have to be dismounted and replaced by dummy blocks. The O-rings wings must be put on the dummy blocks to be able to do a slight vacuum later. The wings bore seal parts must be protected, tape around those parts is OK.

The memory board can be removed and copied on a disk. A PCMCIA adapter is required to do so.

5.3. Procedure « Shipping preparation after recovery »

These operations insure a minimum risk shipping of the glider and mainly for the mechanical parts like motors gears by restricting the batteries to move. After removing the motor gear, the roll batteries packs are fixed with a locking bolt (hole in the forward bulkhead). The gear is placed in a baggie and taped to the motor; do not lose the very small gear screw.

For the pitch batteries pack, the gear is removed, reversed and put back in place. In that way the gear is not engaged anymore. To check that the motors tuning has not been destroyed during shipping, we take some measurements to keep trace of some values as described in the « Measure motors counts » section. The pitch block is first set forward next to the mid-support. With the aft bridge as a spacer between the forward bulkhead and the top mid-support bar, do 3 measurements of the pitch motor potentiometer and write it down (Photo 5 left). Do the same with the aft bulkhead and the communication electronic board (Photo 5 right). Note the 3 values. As the M command sends back the locked roll motor position, write it down too.

The pitch pack being free to move on the rack, it must be secured and protected to avoid displacements. Foam blocks set forward and aft and tape it against the mid-support will do the job plus eventually a tie-rap engaged in the pinion.

Disconnect all the batteries and measure the voltages for each block.

Put the chassis back in the container with the teflon and close the container with the PVC tape. Put a ~10 inHg vacuum to keep the cover in place. The electronic section can go in the shipping box.

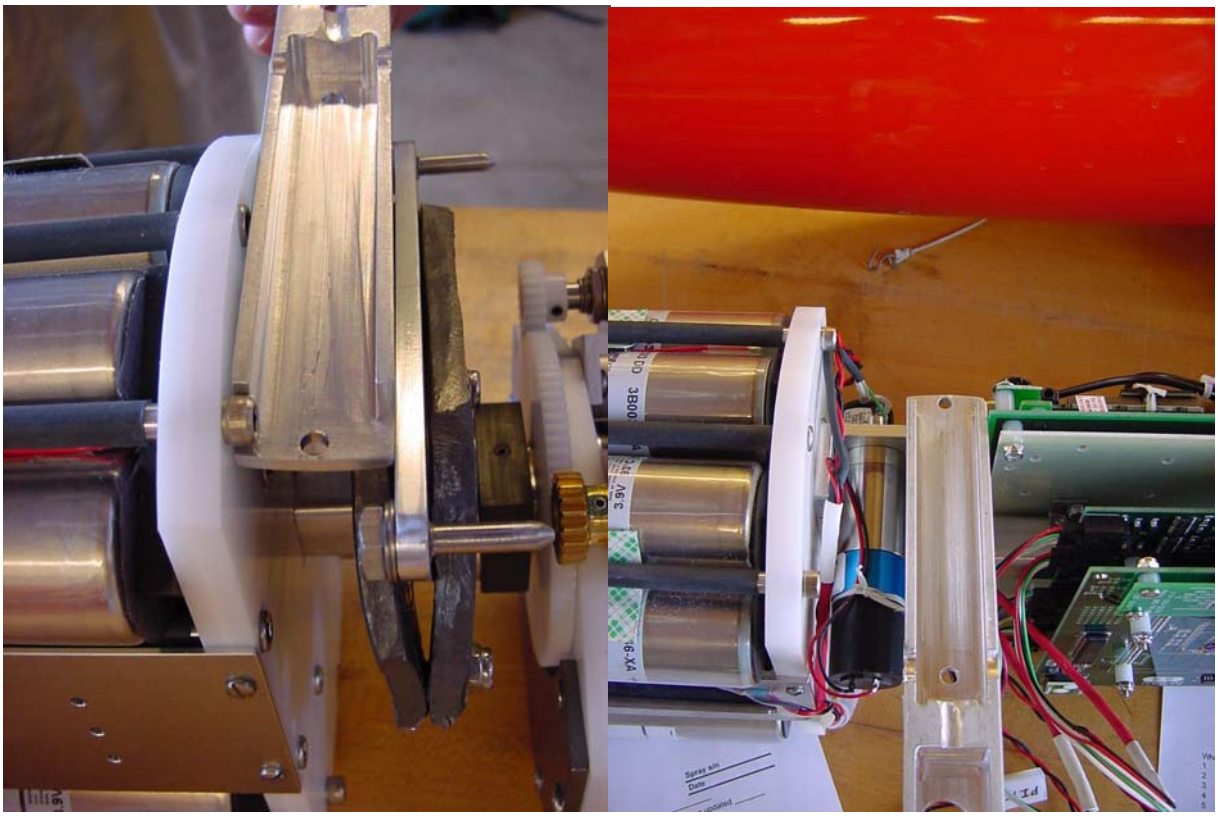

Photo 5 – Use of the aft bridge as a spacer to measure the pitch motor positions. *Left:* spacer between the mid-support bar and the forward bulkhead. *Right:* spacer between the motor support and the communication board.

5.4. Specific instructions for the hydraulic section

At the end of the mission, we have to check for air in the hydraulic circuit and for oil leaks. Air bubbles can be both in the oil bags and in the air trap, an oil leakage will be marked with traces on the container wall.

It is worth to take out the oil bags. Unscrew the screw at the top of the internal ring and take out the bags and the fixing bar at the same time (Photo 6 and Photo 7). Take care of the bags as there is only a few space to get them out of the container. Don't put them close to a spiky or cutting object. Take photos of the bubbles inside the bags if any. To see if there is air inside the air trap (Photo 8), roll the container either on the right or left to have the transparent part of the tube as the highest point, air will naturally comes here. Try to take pictures of the bubble too.

If there is oil traces on the container wall, then it is good to try to detect the path followed by the oil to find its origin. Take pictures too.

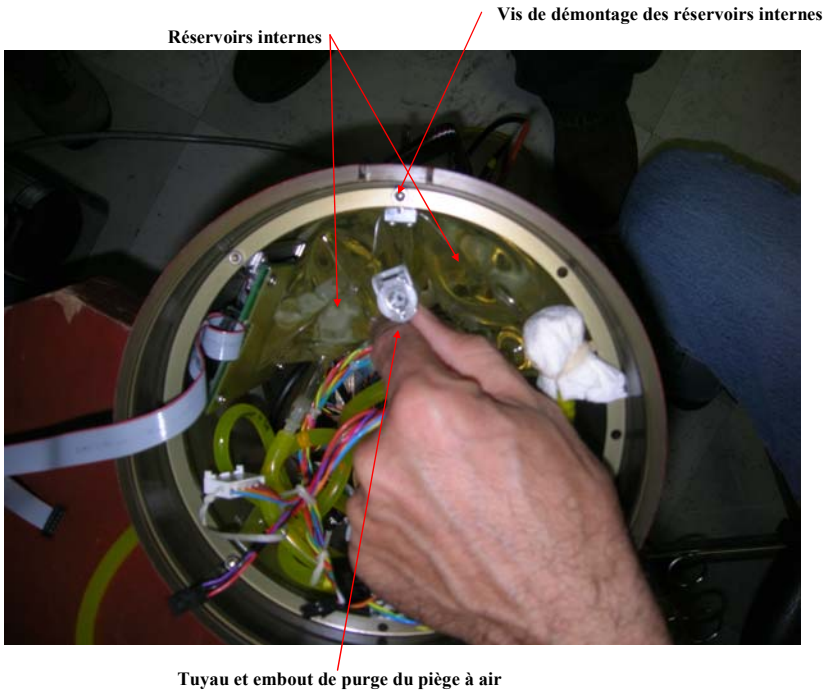

Photo 6 – The screw to unmount the oil bags and the pipe and pipe end for air removal are shown.

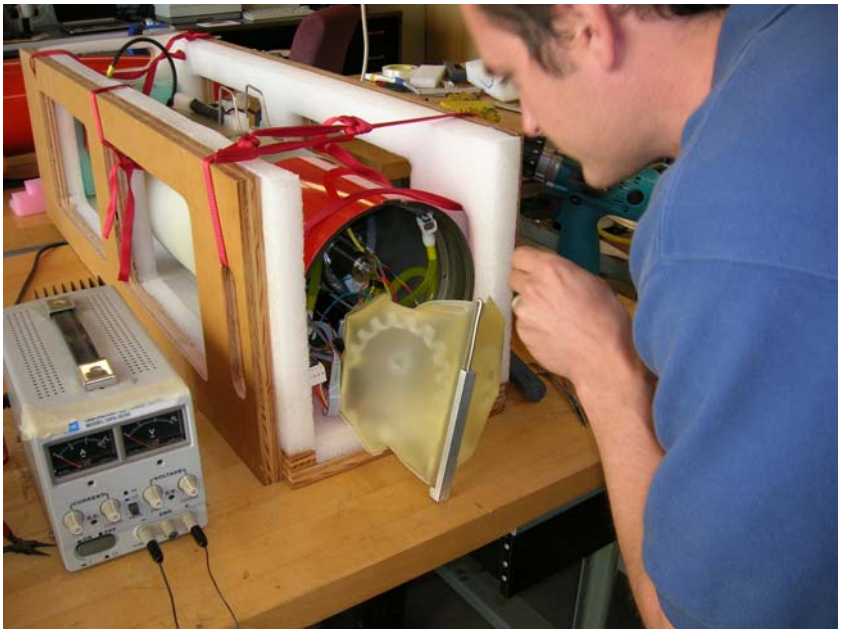

Photo 7 –Internal oil bags outside the hydraulic section.

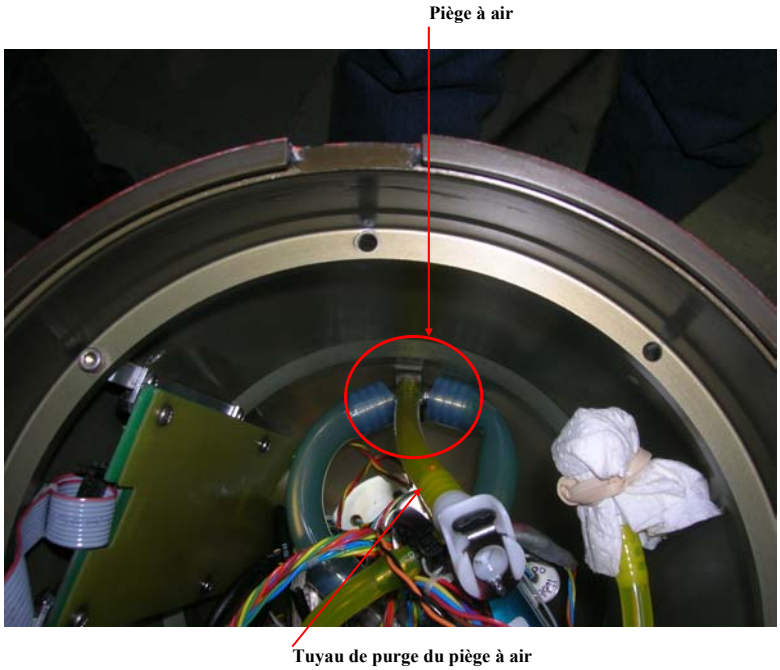

Photo 8 – Oil bags being outside, one can clearly see the air trap together with the tube to purge it.

Once the interior has been checked, put back the oil bags checking that the aft end of the bar is going above the air trap. Do not force either to get out or in the oil bags. Screw the bar in place. Put the cables and connectors inside.

If air samples are taken, go to section 6.

Put the closing plate, check that the O-ring is in place and put a 25-30 inHg vacuum or as much the pump can evacuate. Check that the vacuum is stable. Put the hydraulic section in the shipping box.

6. Air samples in the hydraulic circuit

Air samples are supposed to be taken during the cruise to try to find the air origin (either from the container or from the water). The easiest way is to take a sample from the air trap.

A purge tube is directly connected to the air trap and is the simplest access to the air bubble. The tube is the one located between the two oil bags (Photo 6 et Photo 8). A connector is available in a scotch 33 box inside the black Facom box of the glider case. A syringe used to extract air bubbles is available too (Photo 9). Ask to the people doing the sampling how many cc has been trapped and write down that number.

There is no need to take out the oil bags to takes the samples otherwise follow instructions of section 5.4.

Purge du piège à air avec la seringue

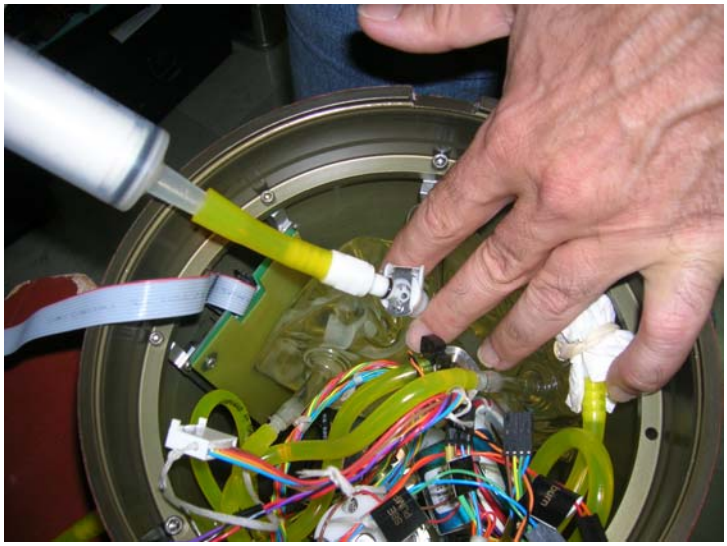

Photo 9 – For information, tools used to purge the air trap.

7. Comments

Operations described here can be long and awkward, you must know that you have time to begin them in order to be under no pressure. Take time to fill the procedure sheets and write anything you could judge necessary including remarks regarding the procedure itself, it will help to improve the future operations. In case of doubt, it is better to take advice before going forward. All the operations on the glider need to be done by 2 persons, one is doing while the second is checking the corresponding procedure and the present document. It is important to keep the team on shore regularly informed of what is going on with the glider operations, it will be easiest for them to respond faster to any questions.

July 06 ver. 1.6
JS/TT

RECOVERY NOTES **Spray s/n**

Operators_____ **Date**

Infos on weather, sea state, wind_____

Recovery method (Rubber boat, net, lasso, ….)_____

1rst Argos réception time_____Direction_____Signal Strength_____Periodicity_____

Next Argos réception time_____Direction_____Signal Strength_____

Next Argos réception time_____Direction_____Signal Strength_____

Next Argos réception time_____Direction_____Signal Strength_____

Next Argos réception time_____Direction_____Signal Strength_____

Next Argos réception time_____Direction_____Signal Strength_____

Next Argos réception time_____Direction_____Signal Strength_____

Seen on surface time_____Ship Lat_____Ship Lon_____

Grabbed at time_____Ship Lat_____Ship Lon_____

Recovered at time _____Lat _____Lon _____

On board at time_____

Visual Inspection on deck

Remove the top fairing : visually inspect the external bladders. Are they full ? _____

inspect the exterior for corrosion and biological growth, scratches,... Take photos where appropriate.

Boss plug
Nose section
Nose-Cylinder Interface
Cylinder-to-wings
Port wing
Starboard wing
Cylinder-Tail Interface
Tail to polypro fairing
Conductivity cell
Tail Bulkhead
External Bladders
Pressure Sensor diaphram
Optical Sensor
Drop Weight
Wet Volume
Cowlings
Tail fin

Rinse everything thoroughly including drop weight plug and bring the glider on the bench

Stop the mission and read parameters

Dry the comm plug and plug in with a PC

Open a log file _____ **W**.akeup_____ **Q**.uit_____

From the Main menu (BAS>) **0.** (zero) to Reset the Dive Number and OpMode to 0 _____

Y. for 12-bit a/d___ **B**.attery _____ **V**.acuum _____ **P**.itch _____ **R**.oll _____ **Q**.uit

Z. CTD test_____ **C**. for P,T, C Press _____ Temp _____ Cond _____ **Q**.uit

M.otor_____ **Z.**ero roll_____ **Q**.uit_____

H.yd pump test **O**.pen valve _____ **Q**.uit **L**.owpower ____ close log file _____

Follow the disassembly instructions on the 'OPENING' check-out sheet

STEPS FOR OPENING **Spray s/n_____**

Operators_____ **Date_____**

If roll pack is not at its zero position, dry the comm plug and plug in with a PC

0 At the main prompt BAS>**M**.otor_____ **Z.**ero roll_____ **Q**.uit_____ **L**.owpower_____

Opening:

1 Disconnect the external communication cable from the PC.
2 Remove the tail fin (Two #8 set-screws: 9/64" Allen Driver).
3 Set the Spray on PVC blocks: two on main housing, two on tail (see photos).
4 Remove the hot-glue at the top Ortman slot (oring cleaning tool will work).
5 Remove the teflon rod (use oring cleaning tool to lift up + needle-nose to grab)
6 Remove the nose boss plug (3/16" Allen driver).
7 When the vacuum is gone, use the PVC wedge tool to open. Try to not scratch the painting
8 Keep the tail level to the main housing as it is slid back SLOWLY.
9 WARNING : Take the tail only ~5cm away
10 Dry bore seal area with kim wipes.
11 Disconnect all cables between the tail and main housing.
On the TT8 Driver board (inside board on the port side), from the bottom to the top,
Disconnect COMM ____ ALT ____OPT_____OIL_____HYD____BURN____
On the TT8 Analog board (outside board on the port side), from the bottom to the top
Disconnect SBE (4pin Cgrid) ____SBE PUMP (3-pin Cgrid) _____
Disonnect the RF Cable to ARGOS_____
12 Set the tail aside on the PVC blocks. Later, estimate and note the amount of air.

Hydraulic section inspection

Inspect the interior_____ Inspect bore seal area_____
Air in : the internal saddle bag ? _____ the air trap ?_____
Remove saddle bag, any signs of oil leakage? _____
Inspect the bore seal on the main housing _____

Removing the chassis:

Inspect the electronic bay area and cabling
1 Look inside with a flashlight to make sure that the roll pack is rolled flat.
To either side (<20 degrees) is OK. If needed, plug in the comms cable and
send commands to try to get it to roll flat (See at the beginning of the sheet)
2 Disconnect the comms battery (stbd lower side, connector is labelled).
3 Disconnect the pitch and roll batteries (port upper side, connectors are labelled).
4 Remove the aft bridge (3/52" and 9/64" Allen driver) and the alignment pin.
5 Disconnect the Iridium antenna cable and move underneath the chassis to the port side
(lift up on the central square tube to get it past the bottom of the electronics).
6 Loop the Iridium antenna cable over the port wing to keep it out of the way.
7 Move the comms battery cable over to the port side as well.
8 Unscrew the nose bolt (3/52" Allen driver).
9 Lift up on the central square tube and slide in the teflon sheet. If it stops ~6-10" short, it is probably ok
10 Bolt the aft bridge back on, turned 90 degrees (off-center hole on stbd side).
11 Slide the chassis out ~6 inches **SLOWLY**. If it only comes out ~1/4", **DO NOT FORCE !!!**
loosen the nose bolt some more and try again.
If still stuck, try to push the teflon sheet further in.
12 Disconnect the GPS cable from the preamp and loop over the stbd wing.
13 Pull the chassis the rest of the way out and set aside. **IT'S HEAVY**
Grab between the pitch pack and mid-support plate for a balanced hold.
14 Remove the wings and their O-rings and install them on the dummy wing blocks.
and then the wing blocks on the container
15 Protect the wings connection side with tape and put the wings protection
16 Inspect pitch and roll for wear _____
17 General inspection of chassis _____
18 General inspection of the pressure case interior _____

Remove the flash card

Using a PCMCIA adapter plug in a PC
Create a new directory_____
Download the flashcard to the directory
Put in a secure place in an anti-static bag

Then follow the 'SHIPPING REC.' sheet

Shipping Preparation after recovery **Spray s/n**_____

Operators_____ **Date**_____

Roll batteries preparation

____**Remove** the roll gear (0.050" Allen driver) , put in a baggie, and tape to the motor, with the set-screw.

____**Insert** and lock the roll locking bolt.

Pitch batteries preparation

____**Remove** the pitch gear, and re-install hub-first, so the motor is not engaged.

Measure motors counts

____Apply power : plug in either roll or pitch batteries to the TT8 board set

____Plug in with the comm cable on the TT8 Driver board (inside board on the port side)

____**Open a logfile**_____

____Get the BAS> prompt with W chars to awake the glider

____Go to **M**.otor test

____Slide the pitch pack all the way**forward**, with the measurement spacer between the mid-support and fwd bulkhead.

____**M**.easure pitch counts; do 3 times to get idea of reproducibility: _____ _____ _____

____Slide the pitch pack all the way**aft** with the spacer between the aft edge of the geartrain mount and the comm board.

____**M**.easure pitch counts; do 3 times to get idea of reproducibility: _____ _____ _____

____Record the Roll Pot counts (with the roll pack locked) _____ **Q.**uit_____

____Download the EEPROM parameters to the log file :**E**.eprom_____ **D**.isplay_____ **Q**.uit_____ **L**.owpower_____

____Disconnect the comm cable ____Disconnect the power to the TT8.

Secure pitch batteries

____**Secure** the pitch pack with ~4" foam forward, and 2" aft, with aft stop piece bolted in place. Tape on mid-support

____Unscrew the alignment pin (if not done), place in baggie and tape to the chassis or main housing.

Disconnect Batteries

____**Disconnect** the roll batteries and measure the voltages: Port roll pack_____ Stbd roll pack_____

____**Disconnect** the fwd batteries and measure the voltages: Port fwd pack_____ Stbd fwd pack_____

____**Disconnect** the 3 port pitch batteries and measure V: Bat 1: _____ Bat 2: _____ Bat 3: _____

____**Disconnect** the 2 stbd pitch batteries and measure V: Bat 1: _____ Bat 2: _____ (should be ~7-8V)

Slide in the chassis

____Do a final cable inspection to make sure nothing will get pinched when it is inserted into the main housing.

____Place the teflon sheet into bottom of the main housing so that it is fully inserted (not sticking out past the end).

____Slide in the chassis ____Tighten the nose bolt. ____Screw on the aft bridge.

____Install the PVC cover plate, aligning the 3 counter-bored holes with the bridge bolts.

____Screw on a vacuum fitting and draw a 10" Hg vacuum. ____ Install the nose boss plug.

The electronic section is ready to go in the shipping box