Destination (to) : Antares collaboration

Title : BSS "in water" test campaign

Reference : 3BSS_02_10A

Author : Ph. LAGIER

Abstract : Report on the "in water" BSS tests held at Ifremer pool La Seyne on October 2005.

Category :a (for information)

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CONTENT

1 - Purpose of the tests **4**

2 - References **4**

3 - People involved **4**

4 - Schedule **5**

5 - Safety **5**

6 - Presentation of the test **5**

- a) Introduction 5
- b) Schematic view of the test 5
- c) Main feature 6
- d) Technical datas 10

7 - Tests program **11**

- a) Remarks 11
- b) Tests performed 12
- c) Summary chart 13

8 - Conclusion **15**

LOGBOOK

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FOSELEV

1 - Purpose of the tests

The aim of this campaign is to understand why Line 0 BSS released failed. These tests come after the "BSS in air tests campaign" (see note 3-BSS-02-09-A). The goal is to reproduce, as far as possible, the conditions of the Line 0 BSS disconnection, by carrying out the tests in the Ifremer pool.

2 - References

- NCR-CPPM-2005-046 : Line 0 release problem,
- S. Cuneo document "BSS test campaign 2005 by S. Cuneo", sent by e-mail on 24/05/05,
- E-mail from JP Schuller (14/09/05),
- Technical notes Antares,
- 3-BSS-02-09-A "BSS in air test campaign",
- The three different versions (A, B, C) of the present document, sent by e-mail (15/06/05 - 05/07/05 - 03/08/05),
- The informations from Ifremer (safety rules and tests), Foselev (transport), Reboa (motor driven crane), Credam (beam for buoys), VBCProd (underwater film).

3 - People involved

Jean Pierre SCHULLER	Technical coordinator	CEA Saclay
Stefano CUNEO	Sub-Project coordinator	INFN Genova
Stefano CECCHINI	Quality manager	INFN Bologna
Paolo PIATELLI	Product responsible	INFN Catania
Mario MUSUMECCI	Product Engeneering	INFN Catania
Carmelo DAMATO	Technician	INFN Catania
Jean ROUX	Sea operations responsible	CPPM
Philippe Lagier	Responsible of the test	CPPM
Fabrice Gallo	Technician	CPPM
VBCProd Company	Under water film	La Seyne
Reboa/Foselev	Motor driven crane	La Seyne

4 - Schedule

13.05.05 : Failure of Line 0 release
03.08.05 : Sending of the present document ("C" version) to the concerned people.
week 31 to 39 : Organization of the test (availability and common intervention between Foselev, Ifremer, Reboa, VBCProd) ; management of the subcontracting (beam for buoys) ; purchasing of diverse material.
03.10.05 : Final decision for the dates of the tests.
week 40 to 42 : Preparation/assembly of material at Foselev.
17.10.05 : Writing of the "plan de prévention sécurité" (PPSPS) with Ifremer.
18.10.05 : Carrying of the BSS and buoys (19.10.05), from Foselev to Ifremer. End of assembly of the BSS.
21/22.10.05 : Tests BSS at Ifremer.
25.10.05 : Dismantling / storage of the material. Writing of the technical report.

5 - Safety

All the operations followed the Ifremer internal safety rules.

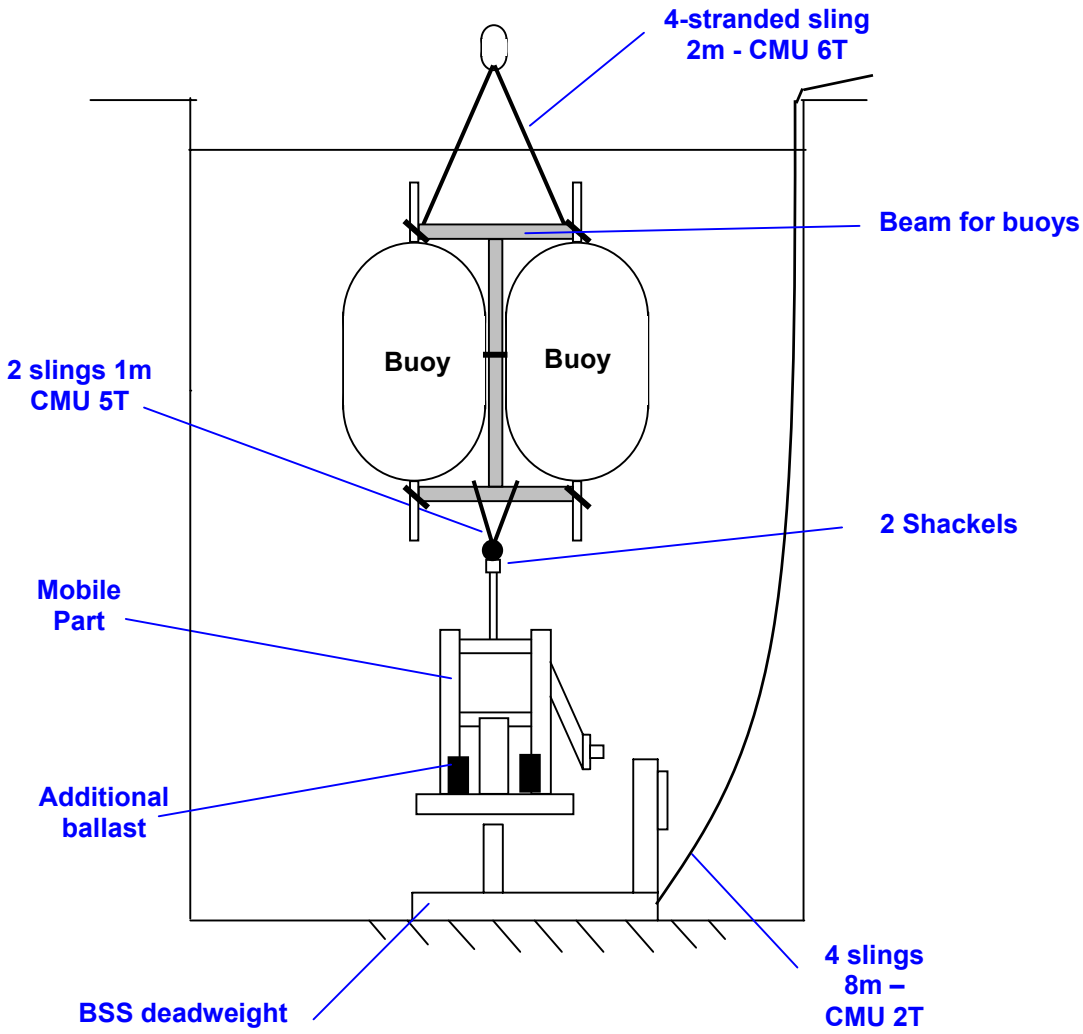
6 - Presentation of the test

a) Introduction :

The BSS (deadweight + Mobile Part) is laid on the bottom of the pool and the same vertical force of Line 0 (buoyancy of the complete line) is applied on it by using two buoys (see “technical data” below).
Several releases are performed in different conditions. Each test is filmed in order to see the behavior of the oscillating arm, the dampers, the acoustic releases and the Mobile Part during the release, which has never been done before.
Due to the important weight of the set BSS/Buoys, a motor driven crane is necessary.

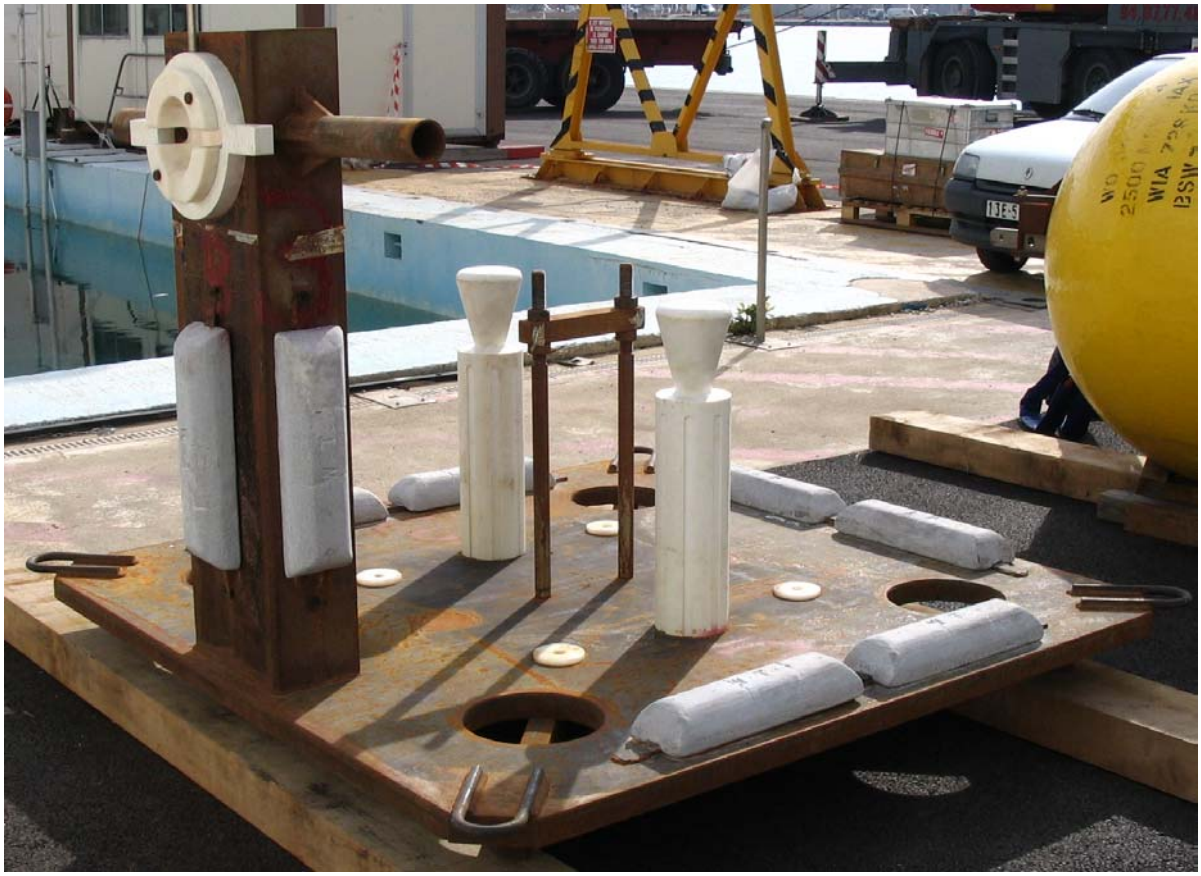
b) Schematic view of the test

(see page after)



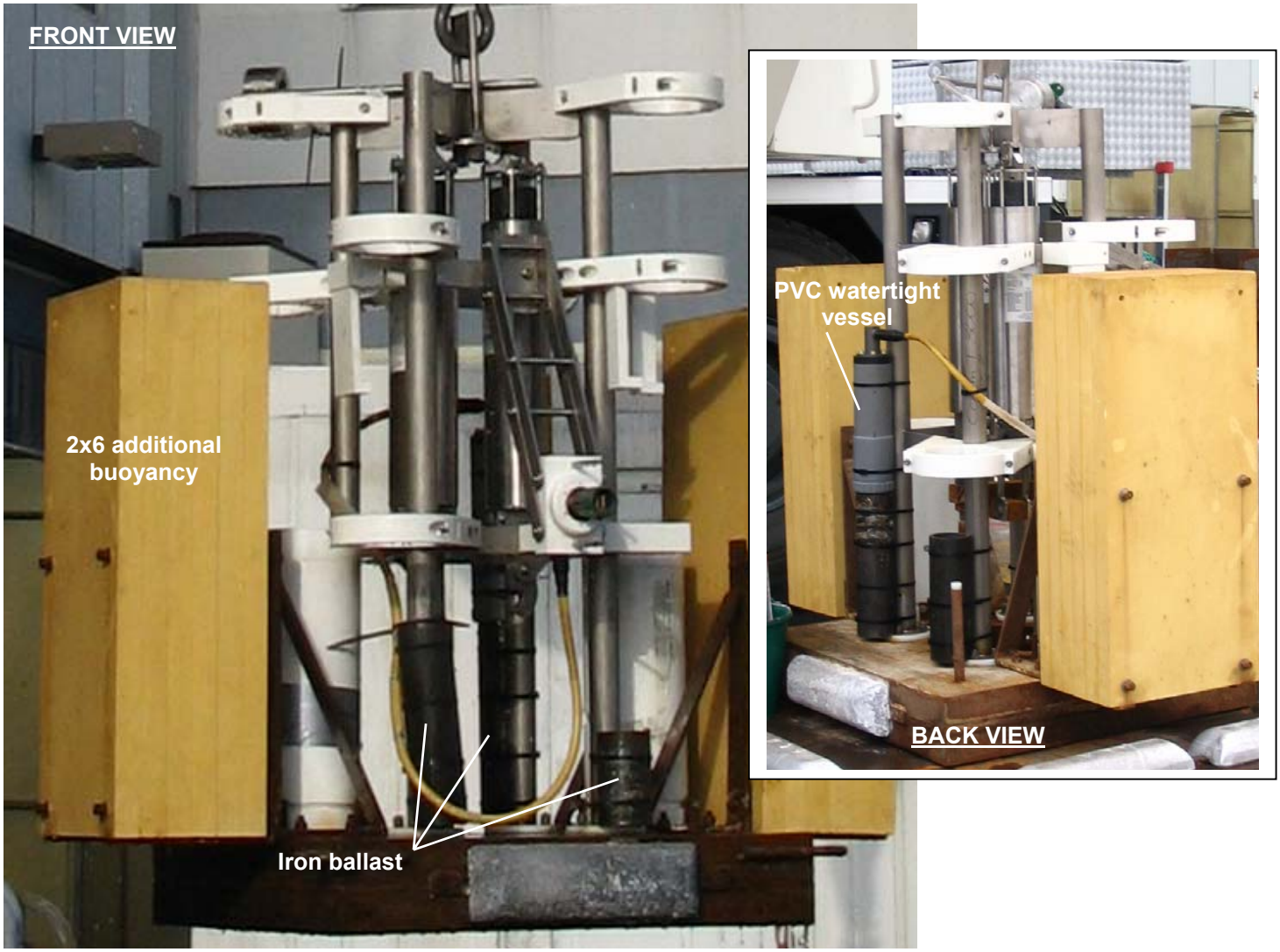
c) Main feature

BSS deadweight : the BSS deadweight is a last version ("number 3"). The ODI test connector is the number S/N 1016693-2.

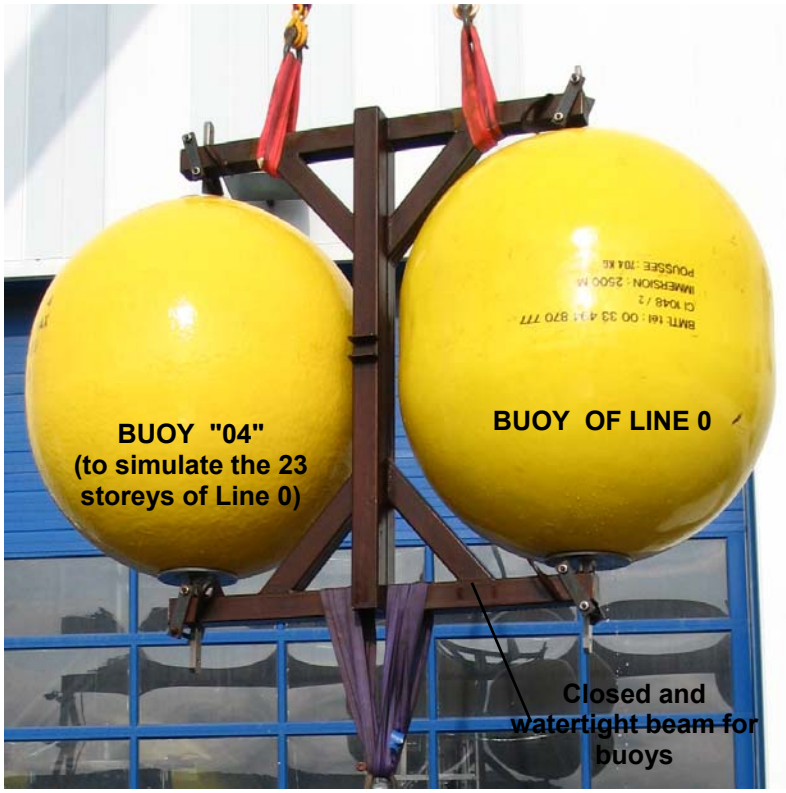


Mobile part : the Mobile Part of the BSS is the one of the Line 0. It is equipped with :

- one ODI jumper (S/N 1009533-10) with a dedicated PVC watertight vessel (for the fibers),
- the cardanic part,
- two damper cylinders of Line 0,
- two acoustic releases (ref. 265 and 266),
- its 2x6 additional buoyancy (plates 1000x435x50, 156 kg air/-105 kg water),
- the oscillating arm with a last version of PETP connector (2 centering axis),
- 4 iron ballast (total : 30 kg in air / 26 kg in water),
- last version of the acoustic release chain (square section).



Buoy : according to the technical note 4-DRL-01-05-B / L0, the buoyancy of the 23 storeys (without buoy) is 668 kg for Line 0. This value is roughly the same as the buoyancy of buoy "04". So, two buoys are used (buoy L0 + buoy “04”).



The exact assessment of the total mass has been reached with the weight of the beam for buoys (which is a closed and watertight beam), slings and additional ballast, during an ultimate weighing. This, to be in the same condition of the Line 0.

Remote control of acoustics release : the usual device is used :

d) Technical data :

Line 0 :

- weight Mobile Part : 1455 kg air / 882 kg water. (4-DRL-01-05-B / L0)
- weight complete BSS : 2935 kg air / 2122 kg water
- weight 23 storeys + buoys : **-1372 kg water (= traction L0 on BSS cardan)**
- speed recovery line : 0,88m/s (3-LIN-02-06-A), 1,05m/s (4-DRL-01-05-B / L0)
- height end guidance piston : 810 mm (from the ground)
- maxi inclination of BSS : 4° (sea current 0,14 m/s)

Buoys :

- weight "L0" : 875 kg air / -734 kg water (buoy "L0" naked)
- weight "04" : 728 kg air / -711 kg water (buoy "04" naked)
- diam x height : 1350 x 1530 mm (4-DRL-01-05-B / TD)
- weight of complete rigging : 40 kg air / 31 kg water (2 riggings + 4 plates)

Beam for buoys :

- weight naked beam : 110 kg air / 23 kg water
- dimensions : 1890 x 1590 x 250mm
- weight fastening system : 17 kg air / 14 kg water (8 plates + threaded rods)
- weight equipped beam : 1792 kg air / **-1365 kg water (=traction of the equipped beam)**

Rq : the "equipped beam" means the complete rigging, from the ring of the upper sling up to the BSS cardanic part (not included) : 1 "four-stranded sling" 2m/6T + 2 shackles + 2 slings 1m/5T + 1 beam for buoys + 2 buoys + 2 complete riggings buoys + 4 fastening systems + 2 slings 2m/1T + 2 shackles.

BSS "Ifremer" :

- weight Mobile Part : 1359 kg air / 882 kg water
  (4 iron tubes ballast 31kg air / 27kg water + BSS cardanic part included)
- weight BSS deadweight : 1472 kg air / 1280 kg water

Configuration of the Ifremer test :

- weight of complete unit : 4623 kg air / 797 kg water (without 4 slings 8m/2T)
- weight recoverable part : 3151 kg air / -487 kg water (complete rigging+MP)(*)
- height complete unit : 7,1m (dist. ground / ring of the "four-stranded sling")
- height recoverable part : 6,96m (dist. bottom MP / ring of the "4-stranded sling")
- complete unit submersion : 1m (1m prohibits any measurement of the time of rising)

(*) see third remark in 7.a.

Ifremer pool :

- capacity of the hoist : 1T
- overall dimension pool : 15m x 10m x 6m
- water depth : 5,5m

Film :
- under water video recording,
- 2 divers "opérateur de prises de vues",
- 1 camcorder 3CCD Sony + watertight tank + 1 spotlight HMI.

Motor driven crane :
- max load : 35 Tons,
- power : 8 Tons at 12 meters.

7 - Tests program

a) Remarks :

- Each test was carried out according to the same procedure :
  - assembly and preparation of the BSS in the desired configuration,
  - connection ODI jumper / test connector,
  - assembly of the buoys with BSS,
  - deployment,
  - release of the Mobile Part with acoustic releases. Using of the underwater camera,
  - recovery of the Mobile Part/Buoys,
  - recovery of the BSS anchor.

- Each assembly between the Mobile Part and the BSS anchor was under the responsability of Mario Musumecci, in order to check the tension in the acoustic releases, the location of the Mobile Part on the BSS anchor and the good location of the oscillating arm.

- Due to the relative low pressure, some air is present in the dampers. From the top of the lateral aperture of the cylinder to the top of the cover, the volume in air is 2x2,46 = 4,92 dm^3 (of whom 27,5% in the cover). At around 5m deapth, the final volume is around 3,7 dm^3. This increases slightly the buoyancy of the recoverable part. Let's take 4 kg more. This value is included in the data §6.d.

b) Tests performed :

b1. Usual release (see "Main features" § 6.c)

The BSS is laid on the bottom of the pool, in the usual configuration (no stress, no additional ballast...). During each test, the hook of the crane is hung on the ring of the "4-stranded sling" which is slackened. This, to avoid any upward effort on the buoys.

b2. Release with the BSS anchor inclined with 4° along one side of the deadweight

One acoustic release is higher than the other one, which is the worst case (see note 3-BSS-02-09-A)

b3. Release with the BSS anchor inclined with 4° along one side of the deadweight and 4 apertures of the dampers sealed.

b4. Release with the BSS anchor inclined with 4° along one side of the deadweight and 2 apertures of the dampers sealed.

b5. Release with the screws of the oscillating arm tightened "as strong as possible" (oscillating arm under stress) .

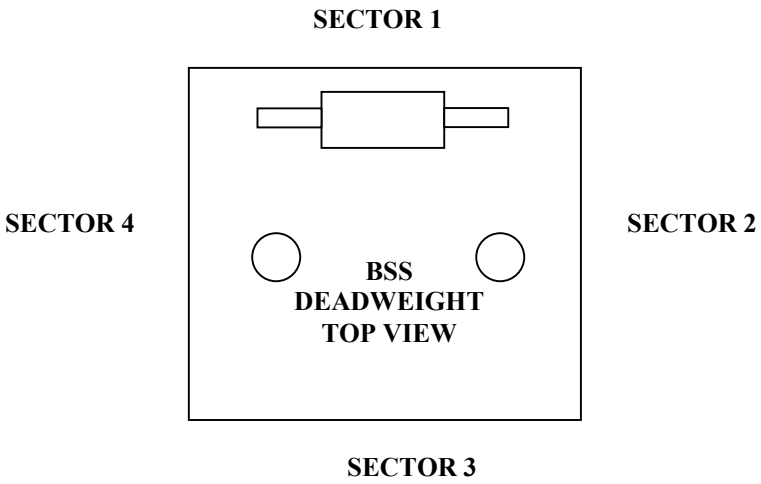
b6. Release with the BSS anchor inclined with 12° along one side of the deadweight and with the screws of the oscillating arm tightened.

b7. Release with the BSS anchor inclined with 12° along the side of the column deadweight.

b8. Release with the BSS anchor inclined with 4° along one side of the deadweight , with the screws of the oscillating arm tightened and with one aperture of the damper sealed.

b9. Release with a lower buoyancy of the recoverable part and with the screws of the oscillating arm tightened.

c) Summary chart (see page after)



Remarks *(1)* : screwed with the maximum torque.
(2) : film unavailable (problem of "top start").

Test number	Filmed part	Recoverable Part buoyancy (kg in water)	Tension in acoustic releases	Dampers sealing (4 apertures)	Oscillating arm	Slope of the deadweight	Releasing Mobile Part	Remark[2]
1	oscillating arm	-487	usual	4 free	free	no	ok	
2	dampers+connector and oscillating arm	-487	low tension	4 free	free	4°, sector 2	ok	- connector unlocked - camera out of order
3	dampers	-487	usual	4 sealed	free	4°, sector 2	ok - lower movemt ?	- starting of film delayed - adhesive tape sucked up
4	To be confirmed	-487	usual	2 free 2 sealed	free	4°, sector 2	ok - lower movemt ?	
5	To be confirmed	-487	usual	4 free	load moment 4,2 m.kg	no	ok	- measurement of the torque with oscillating arm looking downward (25° as the connection) *(1)*
6	general view	-487	usual	4 free	load moment 4,2 m.kg	12°, sector 2	ok - very slow movemt	
7	To be confirmed	-487	usual	4 free	free	12°, sector 1	ok - very slow movemt	- mobile part linked to the horizontal sling
8	general view *(2)*	-487	usual	3 free 1 sealed	load moment 4,2 m.kg	4°, sector 4	ok	- sea conditions - measurement of load moment after test : ok
9	To be confirmed	-340	usual	4 free	load moment 4,2 m.kg	no	ok	- without 2x6 buoyancy sheet - with 90 kg air lead

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8 - Conclusion

All the tests led the releasing of the Recoverable Part and it was not possible to find and reproduce the cause of the misdisconnection. It can be a sum of problems and maybe, the recovery of the L0 BSS deadweight will teach us more on the problem (marks on the PETP parts, ...).

LOGBOOK

JEUDI 20.10.05

9h00	Consignes aux plongeurs et grutier. Préparation du BSS (serrage des dampers, position du bras oscillant). Consignes de sécurité par Ph. L. Visite de M. Mazzara et Cormy (Ifremer).
9h40	Début d'assemblage de l'ensemble bouées / BSS.
10h50	BSS au fond.
11h00	Largage BSS PM en situation normale : ok, 1 prise du bras oscillant.
11h20	BSS hors de l'eau.
11h30	Assemblage BSS et visualisation du film.
11h45	Pause.
13h45	Reprise : BSS incliné (dampers pas vraiment en tension).
14h10	BSS au fond, 45° vers petite porte d'entrée. Inclinaison 4°.
14h15	Appel Reboa, problème de disponibilité de la grue pour le lendemain.
14h30	Nouvelle pose BSS (1 lien supprimé pour hauteur excessive). 2 prises de vue : dampers + connecteur en fond puis bras oscillant (petite caméra). Film appareil photo numérique.
14h46	Largage BSS PM avec connecteur non verrouillé et inclinaison BSS 4°.
14h50	BSS hors de l'eau : connecteur légèrement déconnecté. Caméra principale HS (prise d'eau).
15h20	Préparation BSS et choix prises de vues (dampers dans leur ensemble).
15h30	BSS immergé.
15h35	Largage BSS PM avec dampers bouchés (les 4 ouvertures), connecteur verrouillé et inclinaison BSS : mouvement apparemment plus lent. Démarrage prise de vue en retard, déconnection déjà effectuée.
15h40	Récupération du BSS : scotch dampers aspiré.
15h50	Reconditionnement BSS : 1 damper libre seulement.
16h00	Vu M. Mazzara pour intervention d'une autre grue le lendemain.
16h10	Fin assemblage BSS.
16h15	BSS au fond.
16h20	Largage BSS avec 1 damper bouché + inclinaison.
16h25	BSS à terre.
16h45	Nouvelle configuration du BSS : scotch + cales en bois ôtés. Serrage du bras oscillant ; mesure de l'effort vertical, au niveau des tiges de guidage titane du connecteur : 9kg.
17h00	Largage BSS, bras oscillant serré.

17h05 BSS à terre. Discussion sur pertinence du prochain test.
17h35 Préparation BSS : forte inclinaison lest + serrage bras oscillant.
17h50 BSS au fond.
17h55 Largage BSS avec bras oscillant serré et forte inclinaison. Mouvement de déconnection très lent.
18h00 BSS à terre.

VENDREDI 21.10.05

8h45 Consignes au nouveau grutier. Consignes de sécurité à l'ensemble. Choix du type de test : forte inclinaison du BSS.
9h00 Assemblage BSS.
9h30 BSS au fond.
9h35 Largage BSS avec forte inclinaison (sangles de maintien en tension pour éviter tout contact entre PM et Lest lors de la déconnection).
9h45 BSS à terre.
10h00 Discussion sur la nouvelle configuration du BSS.
10h15 Intervention de Jean Roux : se retrouver dans la même configuration que la L0 : inclinaison de 4° + 1 lumière du damper obturée + serrage du bras oscillant.
10h30 Mesure de l'effort vertical sur le bras oscillant : 9kg.
10h40 BSS reconditionné.
10h45 BSS au fond. Choix de la prise de vue.
10h50 Largage BSS avec inclinaison de 4° + 1 lumière du damper obturée + serrage du bras oscillant.
11h00 BSS à terre. Mesure couple résistant bras oscillant : idem.
11h10 Le film précédent est indisponible, problème du "top départ". Selon le plongeur, la séquence la plus intéressante est la précédente sur lequel on voit un mauvais travail de la PM.
11h15 Nouvel assemblage BSS (suppression plaque flotta et ajout 90 kg air de plomb).
11h35 Pesée dans l'eau de la PM seule, lestée : 1052 kg eau (avec les poches d'air des dampers, sans piston).
11h40 Assemblage Bouée/PM/Lest et peson. Masses de l'ensemble (avec élingues et connecteur) : 4570 kg air / 940 kg eau.
11h55 Largage BSS avec bras oscillant serré + plaques flotta et supports enlevés + plomb ajouté (90 kg air/82 kg eau).
12h00 BSS à terre. Fin manip, matériel lavé et rangé.