

## EXAMINATION REPORT

**Purpose:** Dukane DK120 / BEA ULB examination

**Date:** 16/06/2011 and 04/07/2011






**Place:** BEA laboratory

**Scope:** Accident investigation / AF447 event

**ULB Type:** P/N: DK120 S/N: ST24703



AF447 CVR Recorder - beacon assembly

<p><b>STEP 1</b></p> <p><b>Beacon and assembly were cleaned</b></p> <p><b>ULB was removed</b></p>	   	<p>Fasteners, screws and beacon body were brushed softly</p> <p>External corrosion points were present on the ULB body</p>
<p><b>STEP 2</b></p> <p><b>Battery compartment was opened</b></p>		<p>bottom cap unscrewed</p>

**Seal, battery and guide  
were removed**



A doughy white deposit was present around the battery in the compartment

A sample was kept for analysis



Battery removed



First compartment examination



Battery guide removal  
(note white deposit)

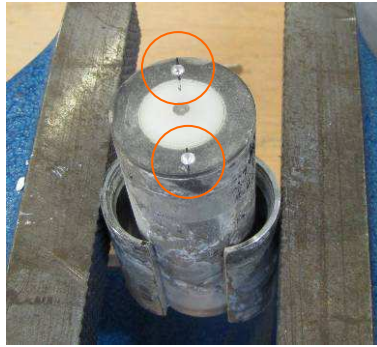
**Battery compartment  
was cleaned**



Neither noticeable internal damage nor corrosion inside the compartment observed

**STEP 3**

**Top compartment was opened**



**Top compartment was cleaned**



Shallow holes were made on the top cap in order to unscrew it with the special spanner

Top compartment was opened. Same white deposit as describe previously was present




Again a sample was kept for analysis

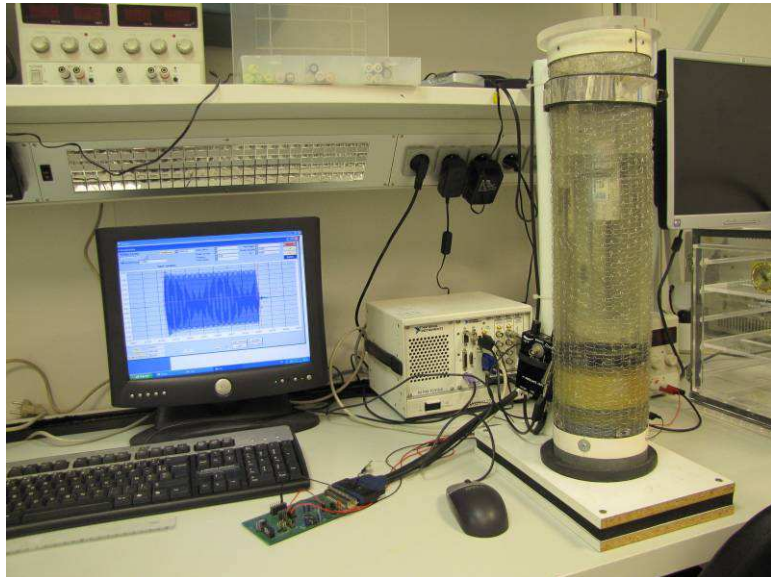
Cap seal was accidentally cut during the opening operation

A little part of the upper side broke during the operation (located in a severely corroded area)

The visual examination of the top compartment revealed no corrosion inside, and no damage on the visible side of the electronic circuitry (board and components)



<b>STEP 4</b>  <b>Visual examination of all the parts of the beacon (caps, body, compartments) was performed</b>	The visual examination didn't revealed any severe damage to the body or any other parts of the beacon	
<b>STEP 5</b>  <b>The decision to continue the examination was taken</b>	Because of: <ul style="list-style-type: none"><li>• No water traces in the battery compartment</li><li>• No water traces in the top compartment</li><li>• No crack on the PCB</li><li>• No visual damage on visible electronic chips</li></ul>	
<b>STEP 6</b>  <b>A new battery was replaced and the compartment closed</b>		New guide and battery were inserted in the compartment  The seal was changed and the cap screwed on
<b>STEP 7</b>  <b>The top compartment was closed</b>	 	The top cap seal was rebuilt using silicon rubber (in order to fill the hole made by the broken part on the upper side)  A new top cap was screwed on

**STEP 8****Acoustic checks  
in tank were performed**

Some relative average value were noted using a Golden unit DK120 (S/N: ST28565):

Frequency:	37.2 KHz
Pulse duration:	10.3 ms
Pulse rate:	1.08 s
Pulse level:	0.6 Vpp

A measurement was made under the same conditions with the ULB of the event:

Frequency:	<b>34 KHz</b>
Pulse duration:	<b>10.7 ms</b>
Pulse rate:	<b>1.3 s</b>
Pulse level:	<b>0.02 Vpp</b>

**Electrical measurement  
of the supply was made**

Because of a lot of discrepancy between the two acoustic measurements, it was first decided to check the power supply of both the Golden unit and the CVR beacons.

Remember that prior to starting the test the two unit had received new batteries (measured out of load):

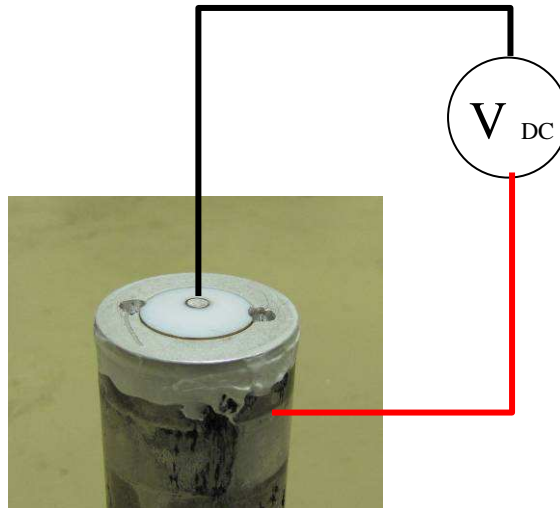
- Golden unit / 3.2V DC
- ST24703 / 3.19V DC

Once placed in their beacon, and immediately after the 5 minutes test in tank a new voltage measurement was made (measured unconnected):

- Golden unit / 3.2V DC
- ST24703 / **2.7V DC**

## Electrical measurement

Suspecting a faulty power supply a direct measurement of the batteries voltage was made through the hydrostatic contact on the upper side of both the Golden unit and the ST24703 beacons

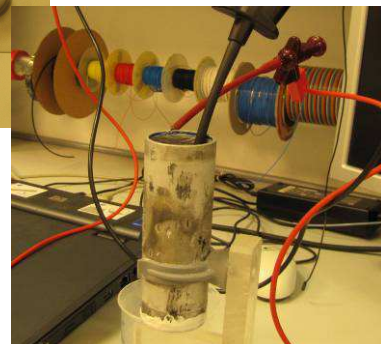
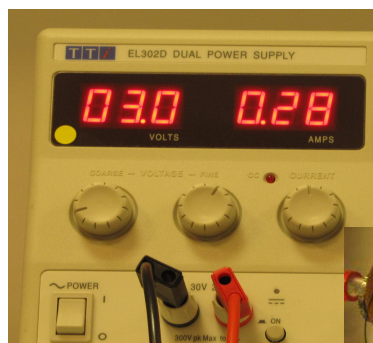


Voltage value measured trough the contact was :

- Golden unit / 3.2V DC
- ST24703 / **1.8V DC**

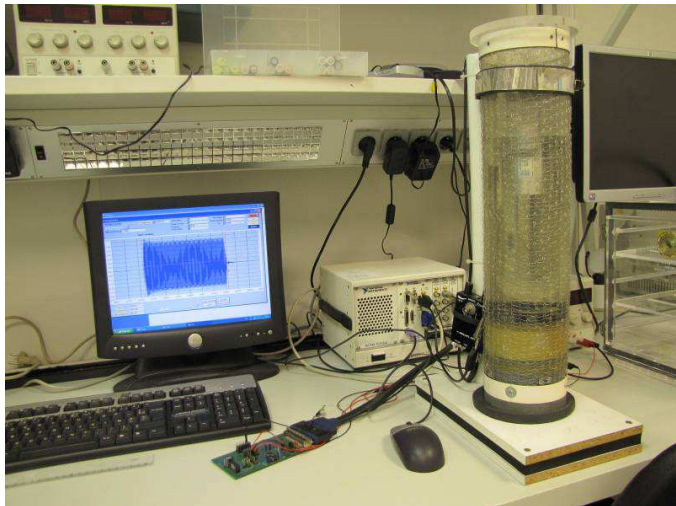
It was finally decided to check the current load using a power supply (3V DC sets) supplying the unit.

## A direct power was attempted



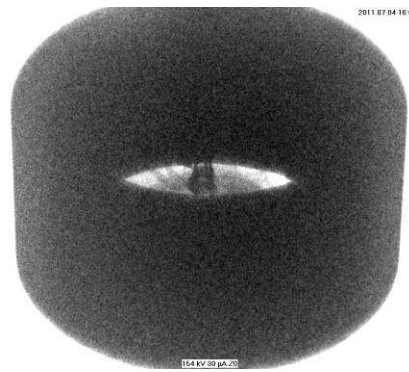
Value measured:

- Golden unit / Hydrostat-contact OFF / 0mA
- Golden unit / Hydrostat-contact ON / 280mA
- ST24703 / Hydrostat-contact **OFF** / **360mA**
- ST24703 / Hydrostat-contact ON / **360mA**

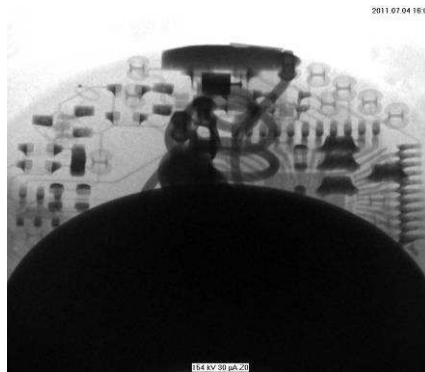
	<p>In order to complete the test the battery was removed and a resistance check performed through the hydrostatic contact.</p> <p>Resistance value was:</p> <ul style="list-style-type: none"><li>➤ Golden unit / 720 Kohms</li><li>➤ ST24703 / <b>40 Kohms</b></li></ul>
<b>To summarize first acoustic and electrical measurements</b>	<p>The pulse level was very low and the other parameters of the acoustic signal were far from the reference. The load current values measured on the ST24703 beacon were similar with or without the hydrostatic contact activated. The current value was quite high compare to the reference. The impedance value measured through the hydrostatic contact seemed to be low.</p> <p>At this stage these observations seemed to confirm an internal fault in the electronic hearth of the beacon.</p>
<b>Intermediate analysis</b>	<p>The DK120 ST24703 was not functional.</p> <p>It was decided to keep the unit in an oven for several days in order to remove the moisture from the electronic part.</p> <p>After 18 days at 45°C the following STEP 8 (bis) was performed.</p>
<b>STEP 8 (bis)</b>	



<p><b>A second acoustic check in tank were performed</b></p>	<p>Some relative average value where noted using a Golden unit DK120 (S/N: ST28565):</p> <table> <tr> <td>Frequency:</td><td>37.3 KHz</td></tr> <tr> <td>Pulse duration:</td><td>9.7 ms</td></tr> <tr> <td>Pulse rate:</td><td>1.07s</td></tr> <tr> <td>Pulse level:</td><td>0.9 Vpp</td></tr> </table> <p>A measurement was made under the same conditions with the event ULB:</p> <table> <tr> <td>Frequency:</td><td><b>36.2 KHz</b></td></tr> <tr> <td>Pulse duration:</td><td>9.7 ms</td></tr> <tr> <td>Pulse rate:</td><td>1.1s</td></tr> <tr> <td>Pulse level:</td><td><b>0.01 Vpp</b></td></tr> </table> <hr/> <p>Because of some discrepancies between the two acoustic measurements, it was then decided to check again the power supply of both the Golden unit and the CVR beacons.</p> <p>Remember that prior to starting the test the two units had received new batteries (measured unconnected):</p> <ul style="list-style-type: none"> <li>➤ Golden unit / 3.22V DC</li> <li>➤ ST24703 / 3.28V DC</li> </ul> <p>Once placed in their beacon, and immediately after the 5 minutes test in tank a new voltage measurement was made (measured unconnected):</p> <ul style="list-style-type: none"> <li>➤ Golden unit / 3.1V DC</li> <li>➤ ST24703 / <b>2.7V DC</b></li> </ul> <hr/>	Frequency:	37.3 KHz	Pulse duration:	9.7 ms	Pulse rate:	1.07s	Pulse level:	0.9 Vpp	Frequency:	<b>36.2 KHz</b>	Pulse duration:	9.7 ms	Pulse rate:	1.1s	Pulse level:	<b>0.01 Vpp</b>
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<p><b>Electrical measurements of the battery were made</b></p>	<p>Measure of the current load using a direct power (3V DC sets) supplying the unit.</p> <p>Value measured:</p> <ul style="list-style-type: none"> <li>➤ Golden unit / Hydrostat-contact OFF / 0mA</li> <li>➤ Golden unit / Hydrostat-contact ON / 280mA</li> <li>➤ ST24703 / Hydrostat-contact OFF / 0mA</li> <li>➤ ST24703 / Hydrostat-contact ON / <b>350mA</b></li> </ul> <hr/>																
<p><b>Electrical measurement with direct power</b></p>	<p>In order to complete the test the battery was removed and a resistance check performed through the hydrostatic contact.</p> <p>Resistance value was:</p> <ul style="list-style-type: none"> <li>➤ Golden unit / 950 Kohms</li> <li>➤ ST24703 / 950 Kohms</li> </ul>																

**X-Ray examination to  
assess piezo-cell  
damage**

Piezo-ring view



Electronic board view

The X-Ray inspection didn't revealed any noticeable damage to the piezoelectric ring.

**CONCLUSION**

Even if the impedance fault initially detected through the hydrostatic contact disappeared after the oven session, the acoustic fault (very low value of the pulse level) was still there.

The DK120 ST24703 was thus considered as not functional,