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
## STEP 1

**Beacon and assembly were cleaned**

- Fasteners, screws and beacon body were brushed softly

**ULB was removed**

- External corrosion points were present on the ULB body

## STEP 2

**Battery compartment was opened**

- Bottom cap unscrewed
<table>
<thead>
<tr>
<th>Battery compartment was cleaned</th>
<th>A doughy white deposit was present around the battery in the compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A sample was kept for analysis</td>
<td></td>
</tr>
</tbody>
</table>

- Seal, battery and guide were removed
- Battery removed
- Battery guide removal (note white deposit)
- First compartment examination

Neither noticeable internal damage nor corrosion inside the compartment observed.
<table>
<thead>
<tr>
<th>STEP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top compartment was opened</td>
</tr>
<tr>
<td>Shallow holes were made on the top cap in order to unscrew it with the special spanner</td>
</tr>
<tr>
<td>Top compartment was opened. Same white deposit as describe previously was present</td>
</tr>
<tr>
<td>Again a sample was kept for analysis</td>
</tr>
<tr>
<td>Cap seal was accidentally cut during the opening operation</td>
</tr>
<tr>
<td>A little part of the upper side broke during the operation (located in a severely corroded area)</td>
</tr>
<tr>
<td>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)</td>
</tr>
</tbody>
</table>
## STEP 4

**Visual examination of all the parts of the beacon (caps, body, compartments) was performed**

The visual examination didn’t reveal any severe damage to the body or any other parts of the beacon.

## STEP 5

The decision to continue the examination was taken because of:

- No water traces in the battery compartment
- No water traces in the top compartment
- No crack on the PCB
- No visual damage on visible electronic chips

## STEP 6

A new battery was replaced and the compartment closed. New guide and battery were inserted in the compartment. The seal was changed and the cap screwed on.

## STEP 7

The top compartment was closed. 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 where 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: 34 KHz
- Pulse duration: 10.7 ms
- Pulse rate: 1.3 s
- Pulse level: 0.02 Vpp

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
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 through 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.

Value measured:
- Golden unit / Hydrostat-contact OFF / 0mA
- Golden unit / Hydrostat-contact ON / 280mA
- ST24703 / Hydrostat-contact OFF / 360mA
- ST24703 / Hydrostat-contact ON / 360mA
In order to complete the test the battery was removed and a resistance check performed through the hydrostatic contact.

Resistance value was:
- Golden unit / 720 Kohms
- ST24703 / 40 Kohms

To summarize first acoustic and electrical measurements

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 compared to the reference. The impedance value measured through the hydrostatic contact seemed to be low.

At this stage these observations seemed to confirm an internal fault in the electronic hearth of the beacon.

Intermediate analysis

The DK120 ST24703 was not functional.

It was decided to keep the unit in an oven for several days in order to remove the moisture from the electronic part.

After 18 days at 45°C the following STEP 8 (bis) was performed.

STEP 8 (bis)
A second acoustic check in tank were performed

<table>
<thead>
<tr>
<th>Electrical measurements of the battery were made</th>
</tr>
</thead>
</table>
| Some relative average value where noted using a Golden unit DK120 (S/N: ST28565):
  | Frequency: | 37.3 KHz |
  | Pulse duration: | 9.7 ms |
  | Pulse rate: | 1.07s |
  | Pulse level: | 0.9 Vpp |

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

| Frequency: | 36.2 KHz |
| Pulse duration: | 9.7 ms |
| Pulse rate: | 1.1s |
| Pulse level: | 0.01 Vpp |

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.

Remember that prior to starting the test the two units had received new batteries (measured unconnected):

- Golden unit / 3.22V DC
- ST24703 / 3.28V 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 / 3.1V DC
- ST24703 / 2.7V DC

Measure of the current load using a direct power (3V DC sets) supplying the unit.

<table>
<thead>
<tr>
<th>Value measured:</th>
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</thead>
<tbody>
<tr>
<td>Golden unit / Hydrostat-contact OFF / 0mA</td>
</tr>
<tr>
<td>Golden unit / Hydrostat-contact ON / 280mA</td>
</tr>
<tr>
<td>ST24703 / Hydrostat-contact OFF / 0mA</td>
</tr>
<tr>
<td>ST24703 / Hydrostat-contact ON / 350mA</td>
</tr>
</tbody>
</table>

In order to complete the test the battery was removed and a resistance check performed through the hydrostatic contact.

<table>
<thead>
<tr>
<th>Resistance value was:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden unit / 950 Kohms</td>
</tr>
<tr>
<td>ST24703 / 950 Kohms</td>
</tr>
</tbody>
</table>
The X-Ray inspection didn’t reveal 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,