

Live Gun Stuck Case Study



Prepared by:
Mohammed Al-Akhzami
Hanaey Ibrahim

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Agenda

- **Stuck History Brief**
- **Stuck Root Cause**
- **HWO Operation Summary**
- **Gun Case Study**

Stuck History Brief

WTU / Jan-2011

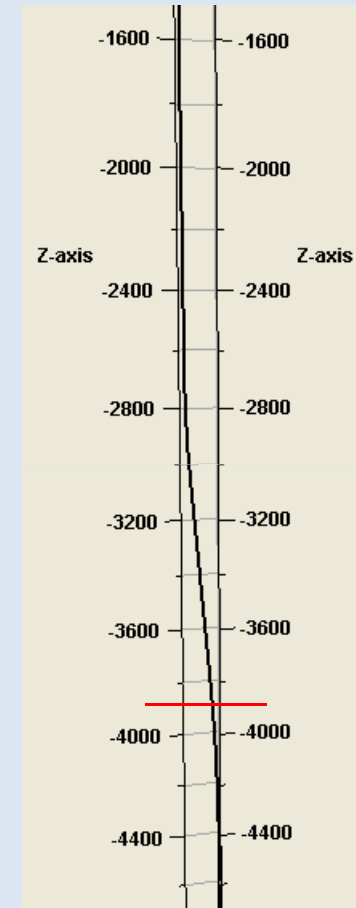
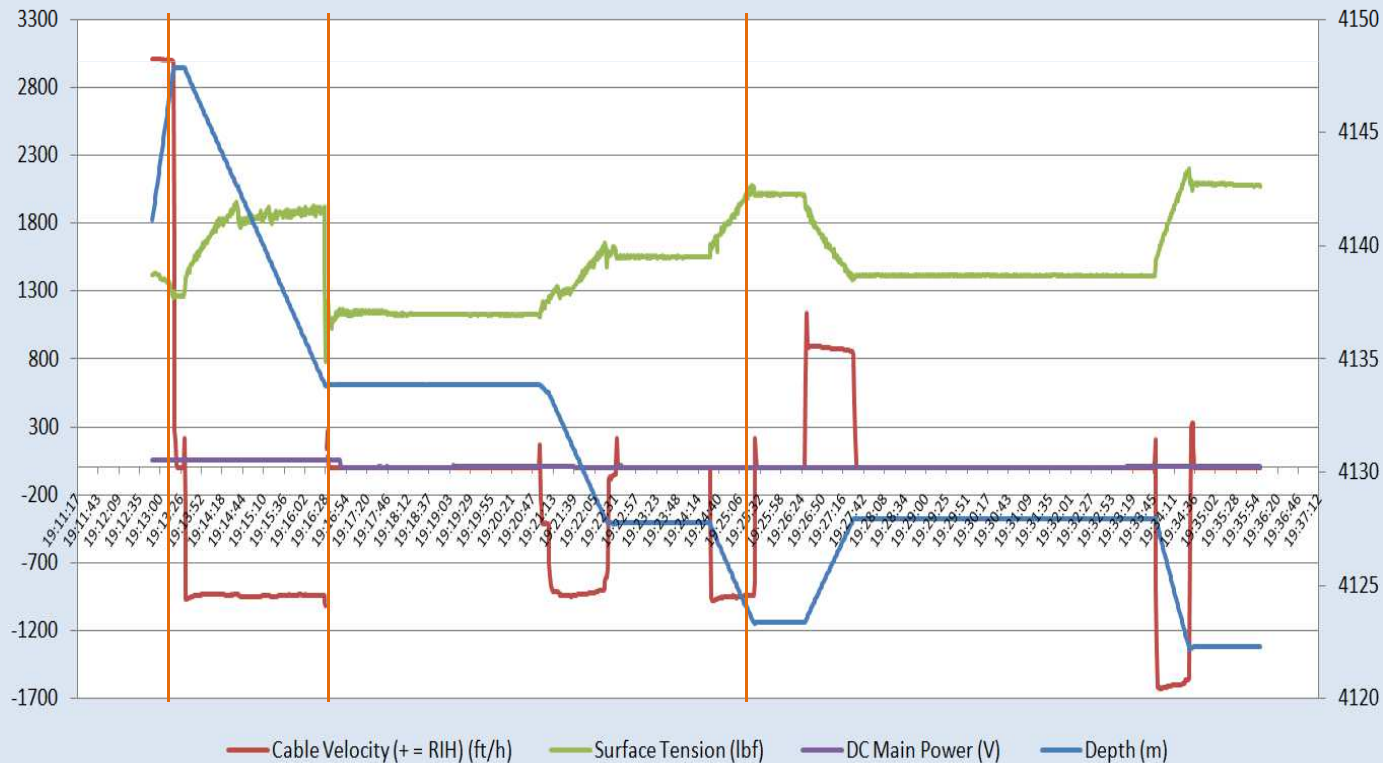
- Additional perforations were planned in W-1 to commingle the reservoirs: R1, R2 & R3.
 - R1 reservoir is opened and depleted.
 - Trigger run (0.5 m) and first gun (2.5 m) were completed successfully.
 - 2nd gun (9 m) was fired and got stuck while POH. Gun was released after flowing the well.
 - 3rd gun (9.5 m) got stuck while RIH and released after flowing the well.

Stuck Root Cause

- **3rd run (Repeated on 5-Jan-2011):** 9.5m length, 2.7/8" OD gun

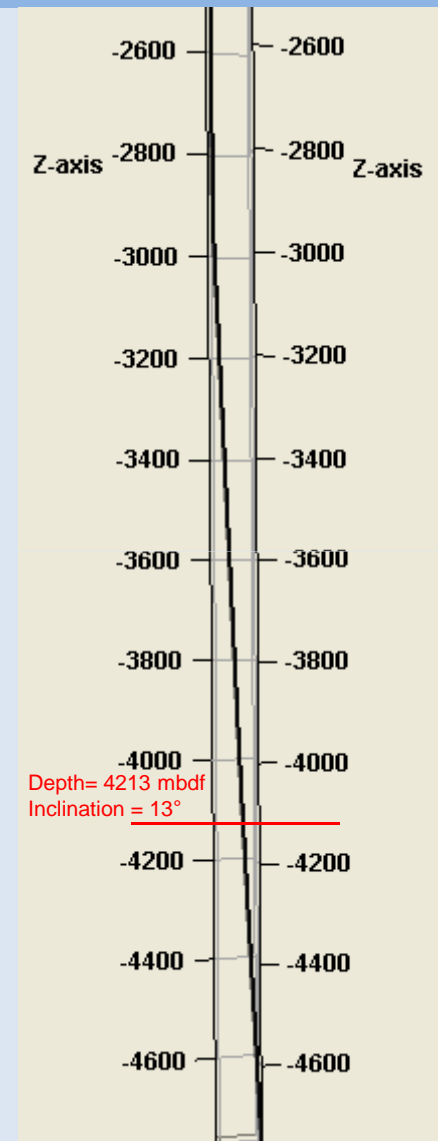
Description	Length (m)	OD (in)	Wire details
Head	0.48 m	1 3/8"	<ul style="list-style-type: none"> • Cable: <ul style="list-style-type: none"> ○ OD = 0.23" ○ Safe Working Load = 2945 lbf ○ Break Strength = 5890 lbf ○ Weight = 107 lbf/Kft.
1 3/8" – 1 11/16" Adapter	0.08 m	1 11/16"	
Electrical Release Sub	0.51 m	1 11/16"	
GR-CCL Tool	1.37 m	1 11/16"	
2 7/8" Head	0.43 m	2 7/8"	
2 7/8" Gun	9.5 m	2 7/8"	
Gun Bottom Noze	0.05 m	2 7/8"	

[Total length of gun assembly= 12.42m]



Stuck Root Cause

- W-2 gun stuck (8-Jun-2011): 9.5m length, 2.7/8" OD gun
 - During correlation for 3rd perforation, gun got stuck at 4213 mbdf.
 - e-line was pulled up to 2600 lbs tension for one hour but couldn't release it.
 - Flowed the well at maximum flow (0.1 MMm³/d at 10800 kPa THP) and tried to release tool string by applying maximum pull (2130 lbs). Not successful.
 - Gun got free after firing it. After firing, THP increased from 14,084 kPa to 14,298 kPa.
 - Decision was to terminate perforation job.



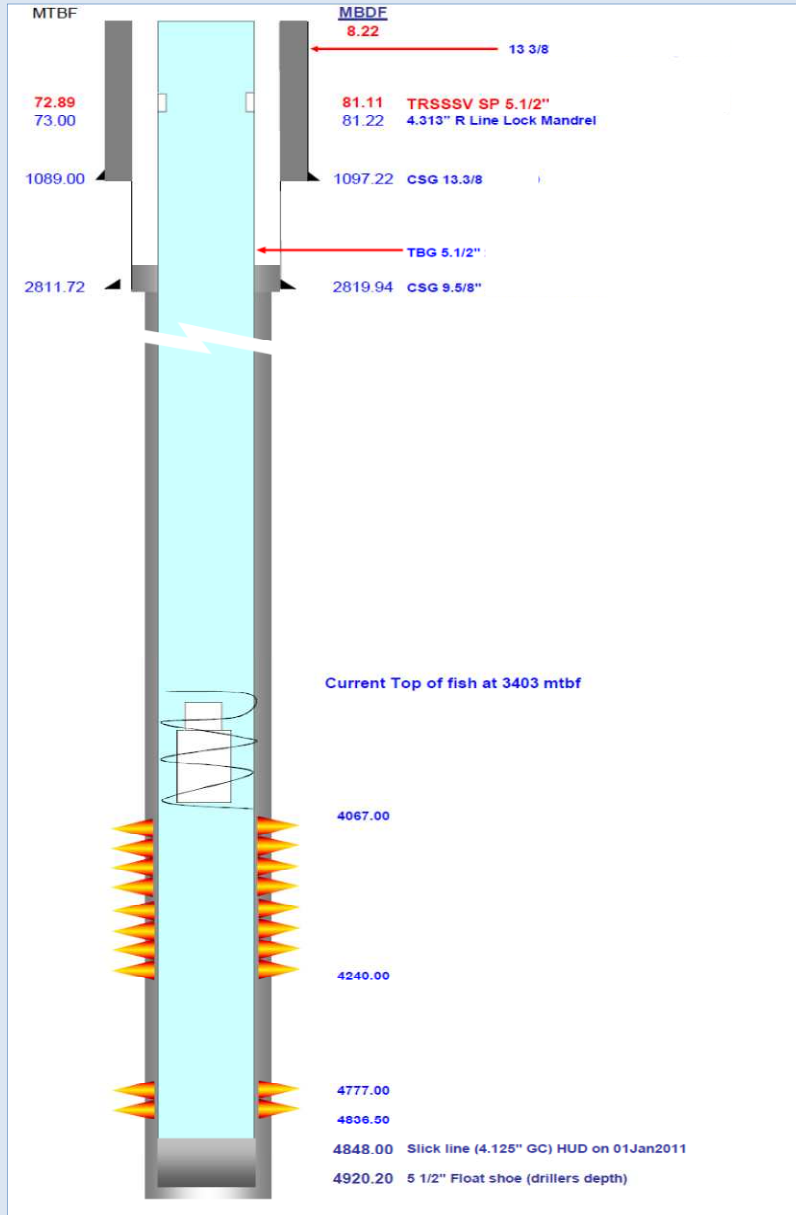
Stuck Root Cause

W-1	CITHP/ kPa	Open Interval/ m	Well ID/ inch	Gun length/ m	Gun OD/ inch
R1 (initially)	12,204	101.7	4.67	9.5	2.7/8
R3	16,656	12	4.67		
Difference	4,452				

W-2	CITHP/ kPa	Open Interval/ m	Well ID/ inch	Gun length/ m	Gun OD/ inch
R2 (initially)	16,055	48.6	3.74		
R1	18,009	7.2	3.74	9.5	2.7/8
Difference	1,954				

- Cable freeing (on 9-Jan-2011 @21:00):
 - Many trials have been carried out to release the gun but in-vain.
 - Decision was taken to fire the gun at stuck but was unsuccessful.
 - At 2,725 lbs pull; tension dropped to 970 lbs. Continued pulling up and cable was free .
 - On 10-Jan-2011 @ 19:00, Completed rigging down of e-line unit.

Stuck History Brief



20-Jan-2011: 3.8" LIB Run



12-Mar-2011: 3.8" LIB after driving fish 6m down from 3397mtbf

Actions for Intervention

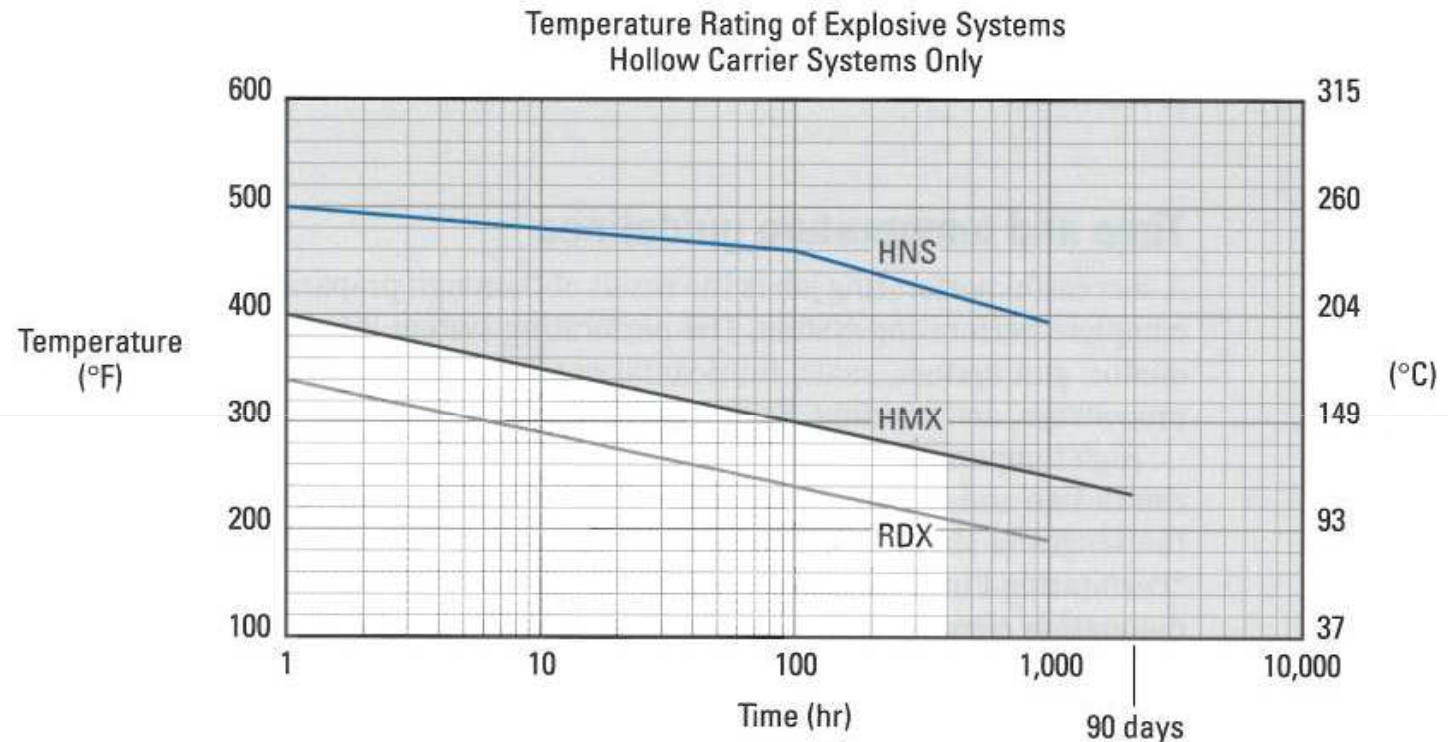
- R- Lock mandrel to be installed to avoid gun or cable jumping to well head.
- Open the well to flow to help lifting fish.
- Plan and waiting for work over resources.
- Review API RP-67 procedure for gun retrieve option.

Explosive Temperature Performance

Duration of gun in hole: 150 days (3600 hours)

BHP: 19,000 kPa

BHT: 122 °C



Contact your Schlumberger representative for high-temperature and long-duration operations falling in the shaded area above.

Figure 85. Time and temperature guidelines for selection of explosives in hollow carrier guns. Exceeding the temperature rating leads to reduced performance followed by burning (all explosives) and possible autodetonation (RDX and HMX explosives).

Source: Perforating Services Catalog; Schlumberger; 2008

Explosive Status

Low Order
Detonation

Auto
Detonation

De-gasing
/De-
composition

Live gun

HWO Operation Summary HWO/May-2011

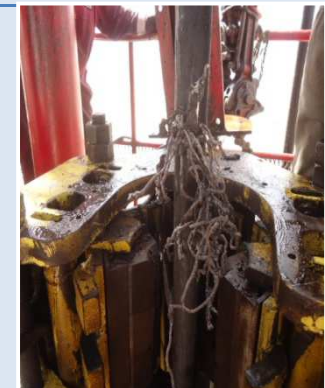
- 29-May-2011:
 - Fished Lock Mandrel and 20 m of wire by HWO.



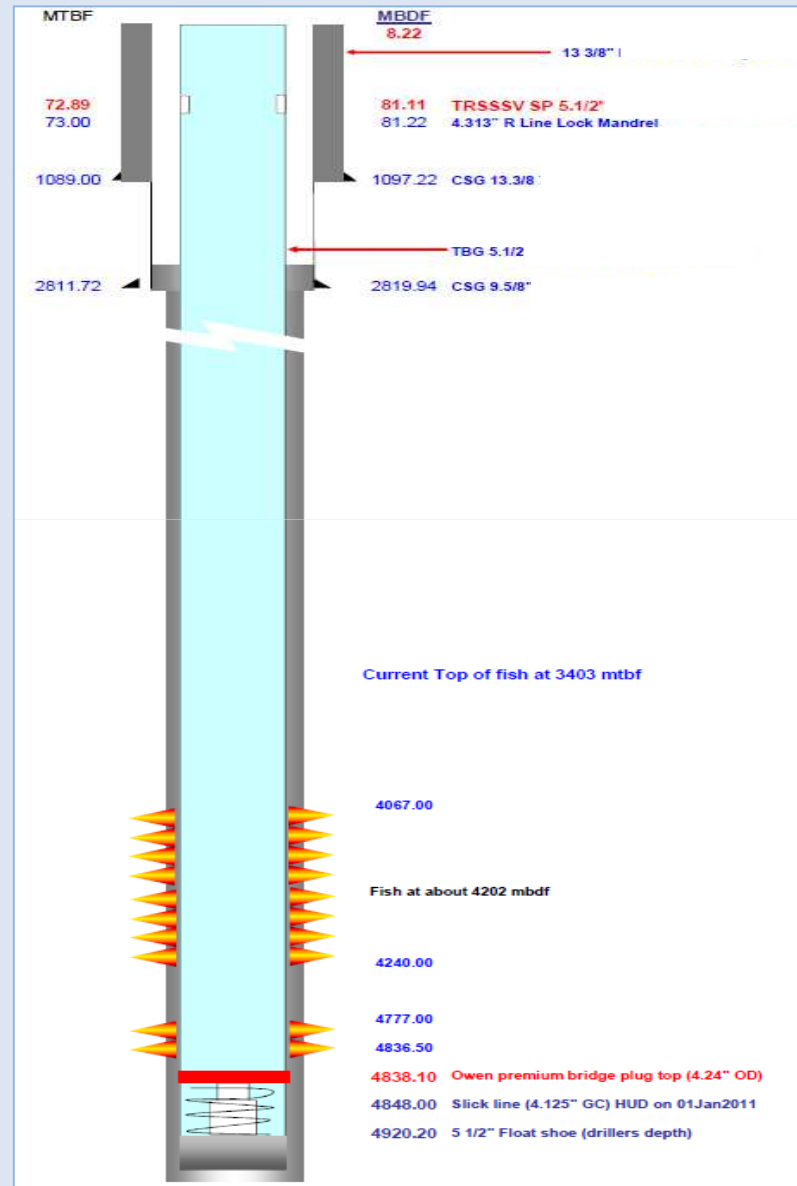
- 3-Jun-2011:
 - Fished the missing bottom part the Lock Mandrel and about 20m of wire (bird nest).



- 7-Jun-2011:
 - Fished only 2 m of wire after POH from HUD.

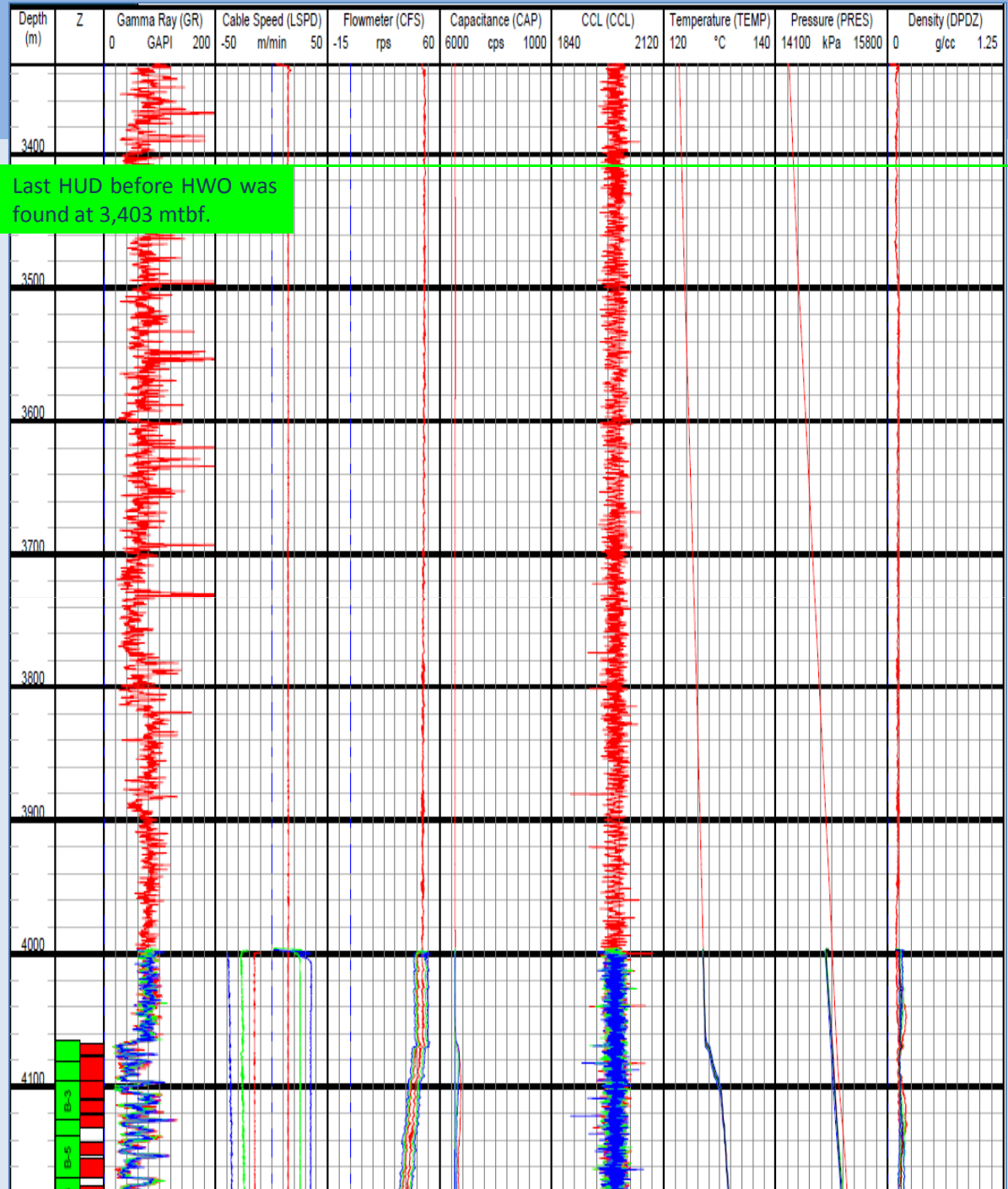


HWO Operation Summary HWO/May-2011



PLT Post

Workover



Conclusion and Recommendations

- History matching have been done with similar cases to know the root cause.
- Flowing the well for short period between runs does not minimize the differential stuck.
- Trials of rigid centralizers have been performed to avoid the differential stuck.
- Avoid risks is higher priority than cost/profit.
- Evaluate using flowing under balance technique.

Thank you

Questions?