

APPS 2018
ASIA PACIFIC PERFORATING SYMPOSIUM

PERFORATE OR STIMULATE?

 **PERFORATORS.ORG**
INTERNATIONAL PERFORATING FORUM

APPS-03-18

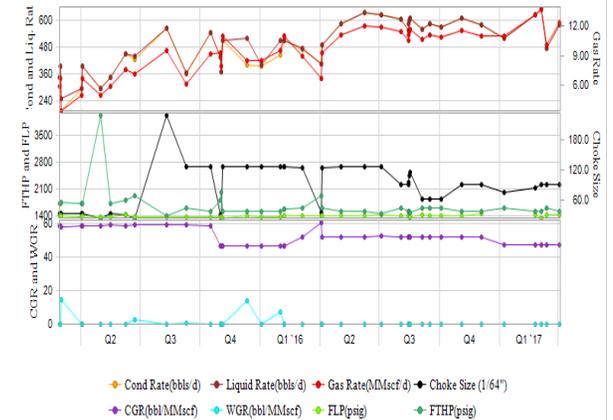
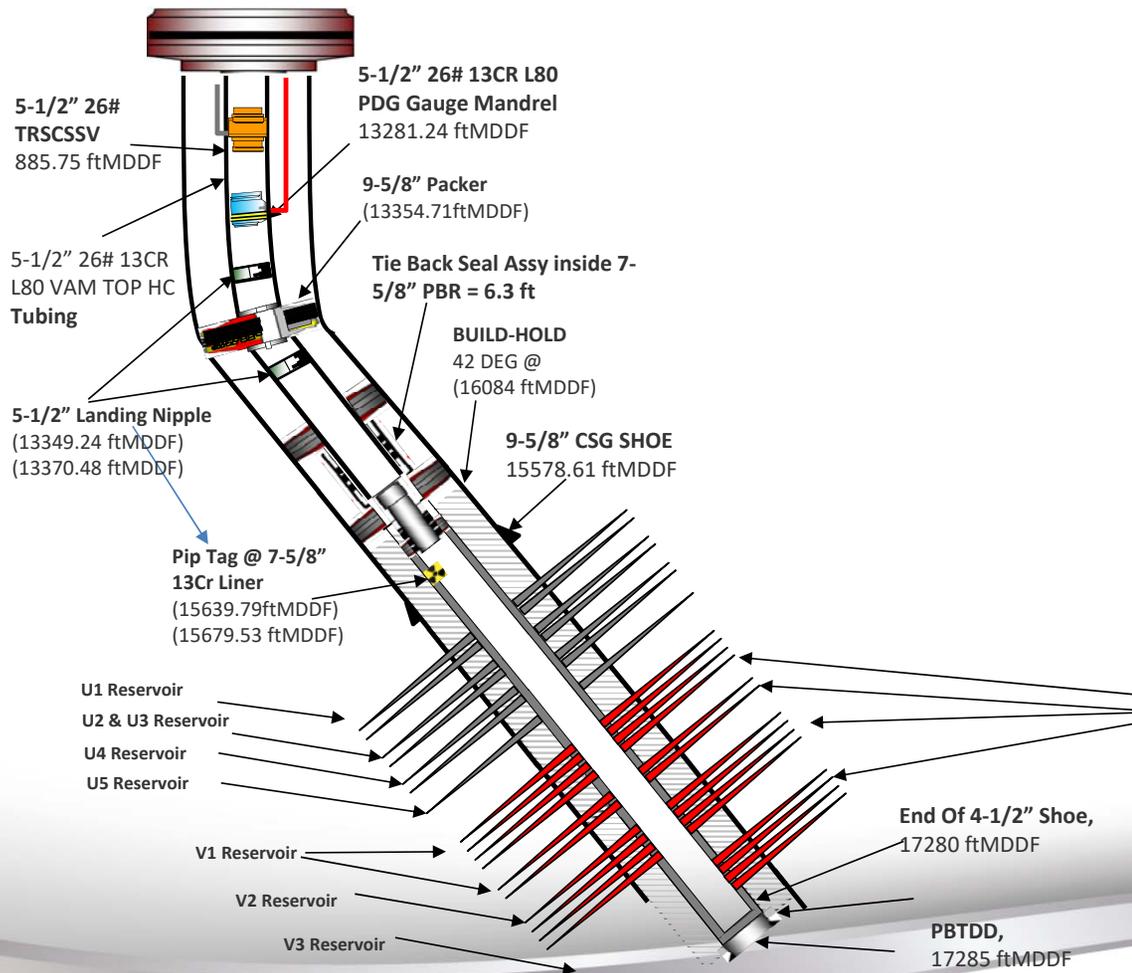
AUTHORS: IZURA ARIPI, ETIQAH SITI NOORASHIKEEN, RAYNER GILBERT, AK ISMAIL PG M SALLEH,
MOKTHAR KARIM, ROHAIZAT GHAZALI, TOTO SETIAWAN, SITI AISYAH A GHANI

Open

PRESENTATION OUTLINE

- Problem Statement
- Propellant Gun Definition
- Propellant Gun - Execution Focus Area
- Propellant Gun Experience
- Lessons Learnt and Recommendation

PROBLEM STATEMENT



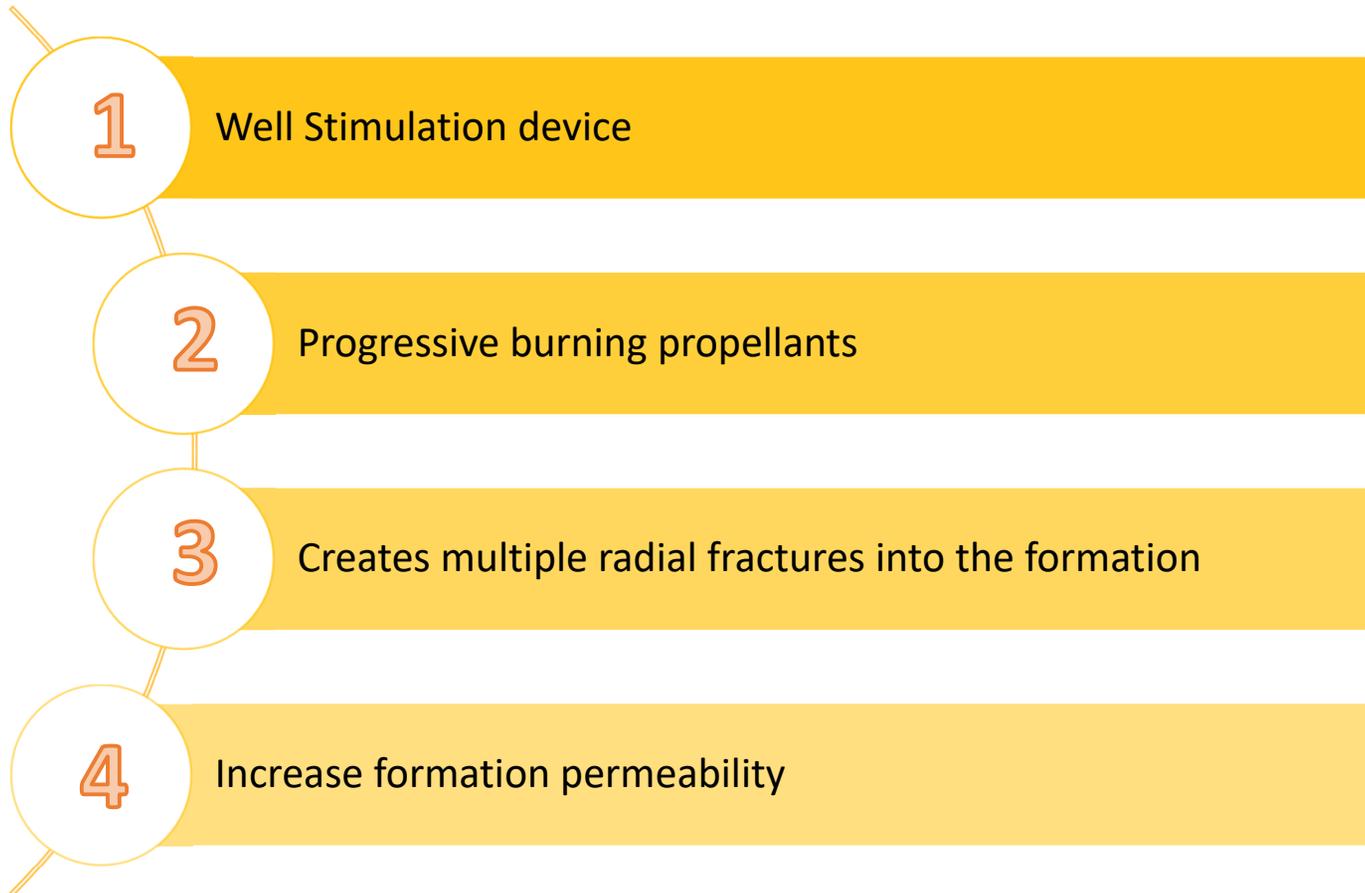
Problem statement :

- Well has been producing at low rate (10-12 MMscf/D) since the beginning due to high skin (~74 based on PBU);
- Producing intervals V1, V2, V3;

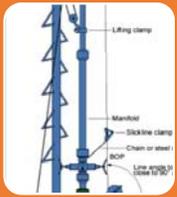
Zone	Interval (ft-MDDF)	Total Length (ft)
V1 U	16707 – 16809	102
V1 L	16864 – 16896	32
V2	16917 – 17033	116
V3	17077 – 17183	106
TOTAL		356

PERFORATE OR STIMULATE

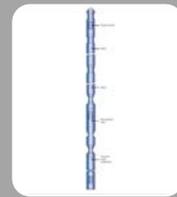
WHAT IS PROPELLANT GUN?



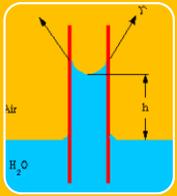
PROPELLANT GUN – EXECUTION FOCUS AREA



Conveyance Method



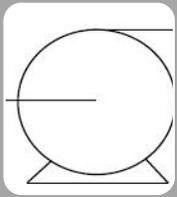
Toolstring



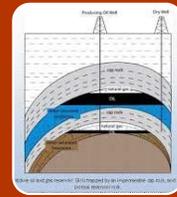
Fluid Column Height



Fluid Type



Pumping Equipment



Well Condition

PROPELLANT GUN EXPERIENCE

PG#1

Conveyance method used:

- Slickline unit - 0.125" wire

Pumping equipment and fluid used for PG#1:

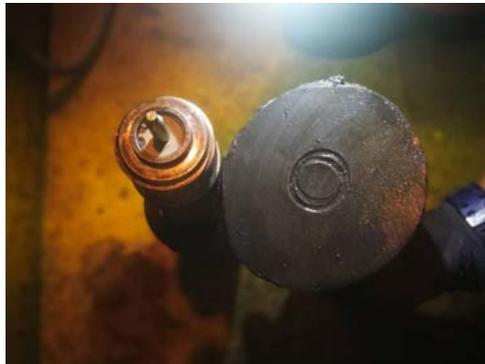
- Graco pump and diesel to meet requirement of 300 ft fluid column above top perforation.

Results after RIH PG#1:

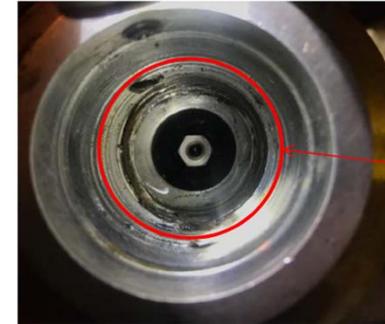
- Firing head thread parted leaving firing head & gun assembly in hole (Fish!)
- Trigger battery bent
- Slickline cable kink
- High losses - all fluid pumped were lost to formation post PG#1

Post PG#1:

- RIH LIB to tag fish



LIB impression



Parted firing head

Parted thread



Trigger battery bent



Kink slickline cable

PROPELLANT GUN EXPERIENCE

Improvement post PG#1

Conveyance method

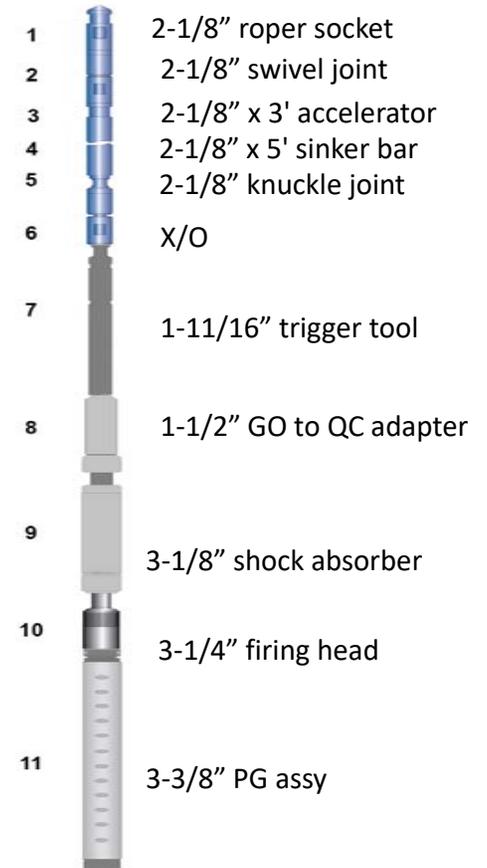
- Slickline unit - 0.14" wire

Toolstring

- Add perforating shock absorber and apply threadlocker compound at firing head thread.
- Take onboard extra batteries and trigger tools

Pumping equipment & fluid requirement

- Mobilized triplex pump, batch mixer and vertical tank
- Revised requirement of 4000ft (80 bbl) of fluid column above top perforation
- Utilized 8.43 ppg brine to replace diesel
- Pumping strategy: To fill up tubing to maximum prior PG#2 and top up fluid post each run



PROPELLANT GUN EXPERIENCE

PG#2 & PG#3

Results post PG#2:

- Successfully fire gun and tools recovered in one piece on surface
- Observed fluid level reduced to 2000ft above top perf only
- Observed wire in good condition
- Battery issue reported - investigation & troubleshooting onboard

Pre- PG#3:

- Top up 80 bbl fluid (4000ft) catch up with losses
- Proceed operation with spare battery and mobilize more from onshore

Results post PG#3:

- Successfully fire gun and tools recovered in one piece on surface
- Observed fluid level reduced to 2000ft above top perf only
- Observed wire in good condition
- Trigger tool issue reported - banana pin carrier parted



Broken battery



Parted banana pin at carrier

PROPELLANT GUN EXPERIENCE

PG#4

Results post PG#4:

- Encountered held up (tension increased to 3200lbs while normal weight is 1700lbs) while pick up tool from flag reference point to target depth
- Attempted several times with same results
- Due to time constraint, decision was made to fire at PG#2 depth
- Observed firing head thread parted, gun was held by grub screw only
- Trigger tool issue reported - investigation & troubleshooting onboard

Unsuccessful attempt to fix 2 trigger tools with broken electronic board and parted carrier & 2 broken PT switch has lead to decision to suspend the operation



Firing head thread parted



Firing head thread left inside shock absorber



Carrier parted from the EFH



Parted wire at EFH

Parted banana pin at carrier

PROPELLANT GUN EXPERIENCE

Fishing

- The first LIB shows held up depth 3 ft above previous top of fish
- Sand and mud recovered using sand bailer
- Further attempts recovered **230 pcs of port plug**, debris and parted O-ring before impression of firing head is observed
- Attempts to recover fish gun were conducted using a few pulling tool and heavy duty jar, although good latching was achieved the fish was stiff and no movement was observed. It was decided to suspend the operation after exhausted with all available options onboard.



LIB impression



Debris from well



Port plugs recovery



LESSONS LEARNT AND RECOMMENDATION

- Simulation & study on energy and impact emitted from propellant gun to the toolstring need to be conducted.
- It was never or not proven that 3-3/8" propellant gun can be deployed by using slickline without impacting the electronic tools i.e. trigger and battery. It is recommended to use E-line in the future.
- It is not recommended to use reusable carrier with port plugs as the propellant gun will not shear-off the port plugs but it will fall and be left in hole.
- To consider pumping while gun in hole, simulation of pumping effect to wire and toolstring to be conducted using dummy gun while it is stationed at perf interval
- As happened during perforation gun #4, after RIH to flag depth and POOH to perf interval, an overpull was experienced by 1500 lbs causing slickline unit being pulled at surface. This has caused onsite team to decide to immediately changed perf interval to previous depth. It is suspected that this is due to crossflow between zones. As caution, it is advised to avoid run in hole passing thru perforated zone or wait for pressure to equalize.
- To bring high rate pump to ensure capability to catch up with fluid losses to reservoir & to consider option of setting bridge plug above perf zone to reduce fluid loss. This can save chemical consumption to top up fluid level.

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**QUESTIONS?
THANK YOU!**

