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APPLICATION OF GASGUN® IN OPTIMIZING WELL INJECTIVITY, A CASE STUDY IN A SOUTH OMAN FIELD

Abdullah Al Qassabi*

ABSTRACT

The GasGun is a stimulation treatment for oil and gas wells that utilizes a low-order, solid-propellant explosive to generate high-pressure gas which creates fractures in reservoirs. The tool, which is normally run on Wireline, contains a solid propellant that rapidly generates high pressure gas when it burns. Multiple fractures radiating 10 to 50 feet from the wellbore are created by the progressively-burning propellants.

The advantages of the GasGun over hydraulic fracturing are that there is minimal vertical growth of fractures, multiple fractures are created, the entire zone is stimulated, there is no need to inject fluids, less equipment is needed, and the cost is much lower. Pressures created are between 10-20 thousand psi over 10's of milliseconds.

The GasGun can't always replace hydraulic fracturing. Large hydraulic fracture treatments can create a fracture hundreds, if not thousands of feet in length. But many small pay zones in marginal wells cannot justify the expense of these treatments. The GasGun can be a very economical alternative and requires much less equipment. There are many applications where the GasGun can be used in place of hydraulic fracturing or in conjunction with hydraulic fracturing to achieve the desired outcome.

This new technology was used in sandstone reservoirs in five wells in South Oman. In the four Injector wells, the injection rate was 100% higher than prior to the GasGun application. While for the producer well, the production rate was 50% higher via longer running hours.

* **Medco LLC, Oman**

INTRODUCTION

The poster covers the way this technology works and presents the case study of five wells (mostly injectors) stimulated with the GasGun in 2013 MEDCO in its concession in the south of Oman.

Reservoir pressure in field "A" had fallen from 2000 psi to 700 -800 psi which represents a 65 % drop of its original pressure.
The way forward decided by Medco was to implement Water flooding to raise reservoir pressure and sustain field production.

Water injection started in early 2013 with two water source wells and four injectors in a 5-spot irregular pattern.

The main objective of the project was to improve the pressure profile of FU #1 by injecting water from FU #3 as illustrated in **Figure 1** and **Figure 2**

METHOD

The challenge was to stimulate the injector wells to increase injectivity for the best economic return. The modest size of the field did not justify the high expenditure associated with hydraulic fracture-stimulation.

Additional challenges that led to the use of Gasguns included:

- First injection within 10 months
- Long perforation intervals
- To manage the project expenditures
- To do better than common perforations

Medco chose to use GasGun for its proven results, easy deployment and effective cost.
GasGun is a gas-generating progressively-burning propellant. The high pressure gas (20,000 psi) will create multiple radial fractures all around the wellbore. The created fractures (up to tens of feet in length) will connect the wellbore to the virgin

formation past the damaged zone, to increase flow rates.

A comparison of GasGuns and hydraulic fracturing are shown in **Figure 3** and **Figure 4.**
Advantages of GasGuns over hydraulic fracturing are

- minimal vertical growth of fractures
- multiple fractures are created, the entire zone is stimulated, there is no need to inject fluids
- Less equipment is needed, and the cost is much lower.

RESULT

The GasGun has been achieving very good results in North America in the past 10 years. The ability of the technology to produce fractures in different directions makes it a very viable technique to communicate with the undamaged rock in the reservoir and increase productivity/injectivity.

In Oman, GasGuns were used to treat five wells; four Injector wells and one producer well, all in sandstone formations.

The GasGuns were conveyed by wireline to the zone of interest. After a correlation pass, the GasGun is positioned across the perforation interval and initiated. The Gasgun will release gas with a progressively building pressure of up of 20,000 psi as shown in **Figure 5**. The process takes up to 100 milliseconds. The wellbore fluid column (minimum 100 meters of fluid required above the gun) directs GasGun energy into the formation with only 1 % of energy lost up hole. It also prevent the GasGun tool from moving up hole.

Table 1 and **Figure 6** illustrate the injection wells enjoyed a 100% increase in injectivity, and the producer well enjoyed a 50% increase in productivity through longer running hours.

CONCLUSION

GasGun treatment can replace hydraulic fracturing in marginal wells with many small pay zones. They are much cheaper and require much less equipment.

TABLE 1

RESULT OF GASGUN TREATMENT

Well	Observation (before)	After
A	Running hrs - 14	Running hrs - 24
B	Inj. Rate : 40 m3/d	Inj. Rate : 100 m3/d
C	Inj. Rate : 144 m3/d	Inj. Rate : 216 m3/d
D	Inj. Rate : 100 m3/d	Inj. Rate : 200 m3/d
E	Inj. Rate : 600 m3/d	Inj. rate : > 1000 m3/d

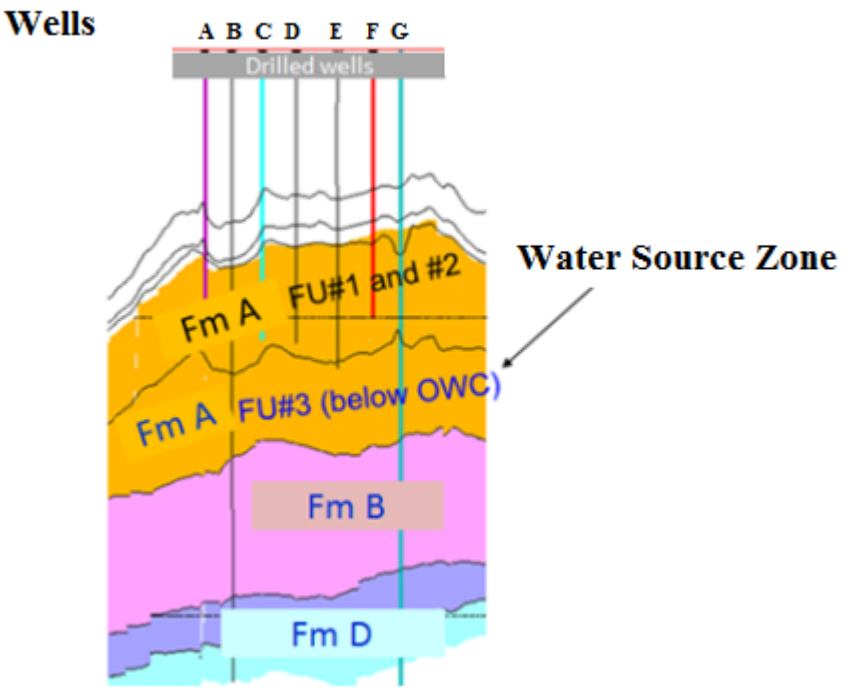

Figure 1 - Formation layers in A field

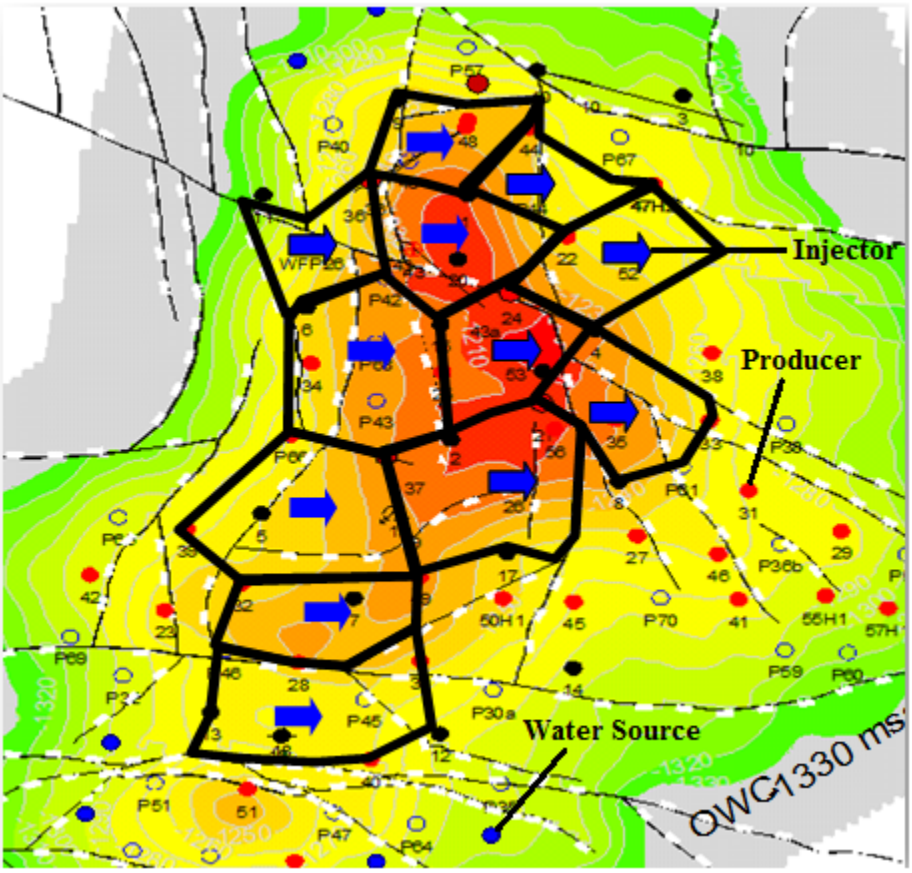

Figure 2 - Basic Waterflood activities

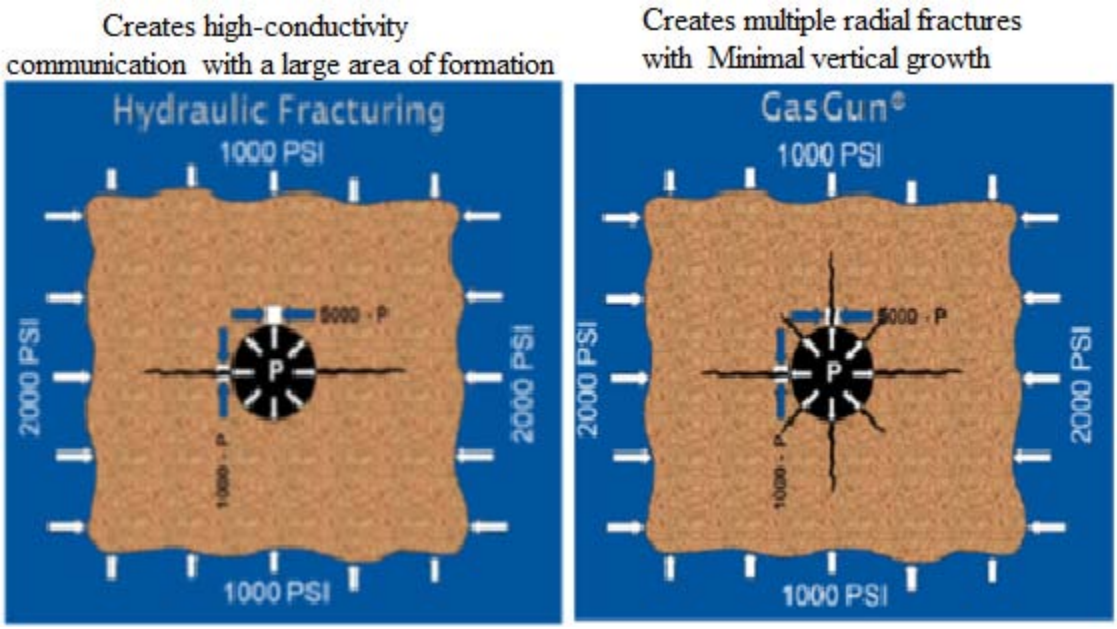

Figure 3 - Comparison of Fractures created by Hydraulic Fracs and GasGuns.

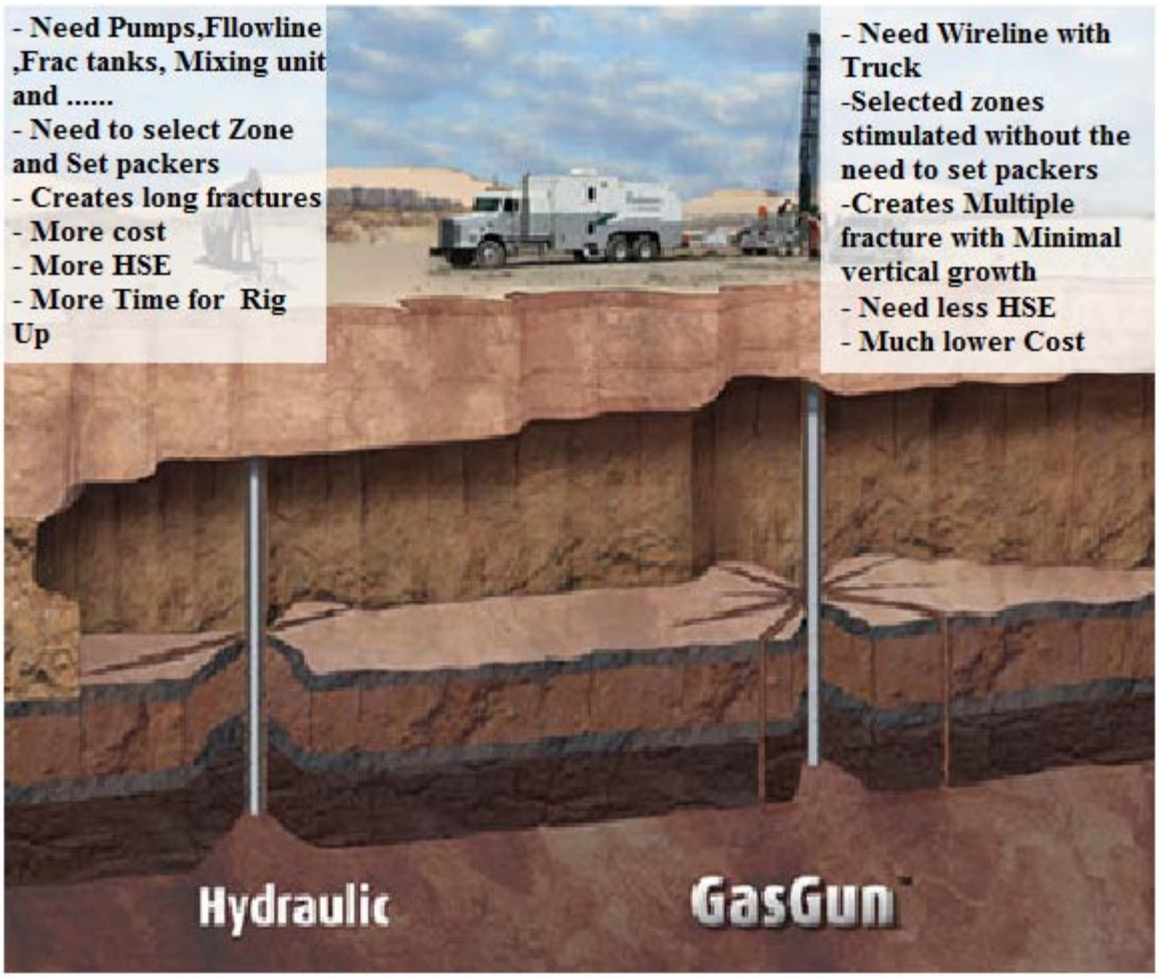

Figure 4 - Downhole Comparison view of Fractures created by Hydraulic Frac and Gas Gun

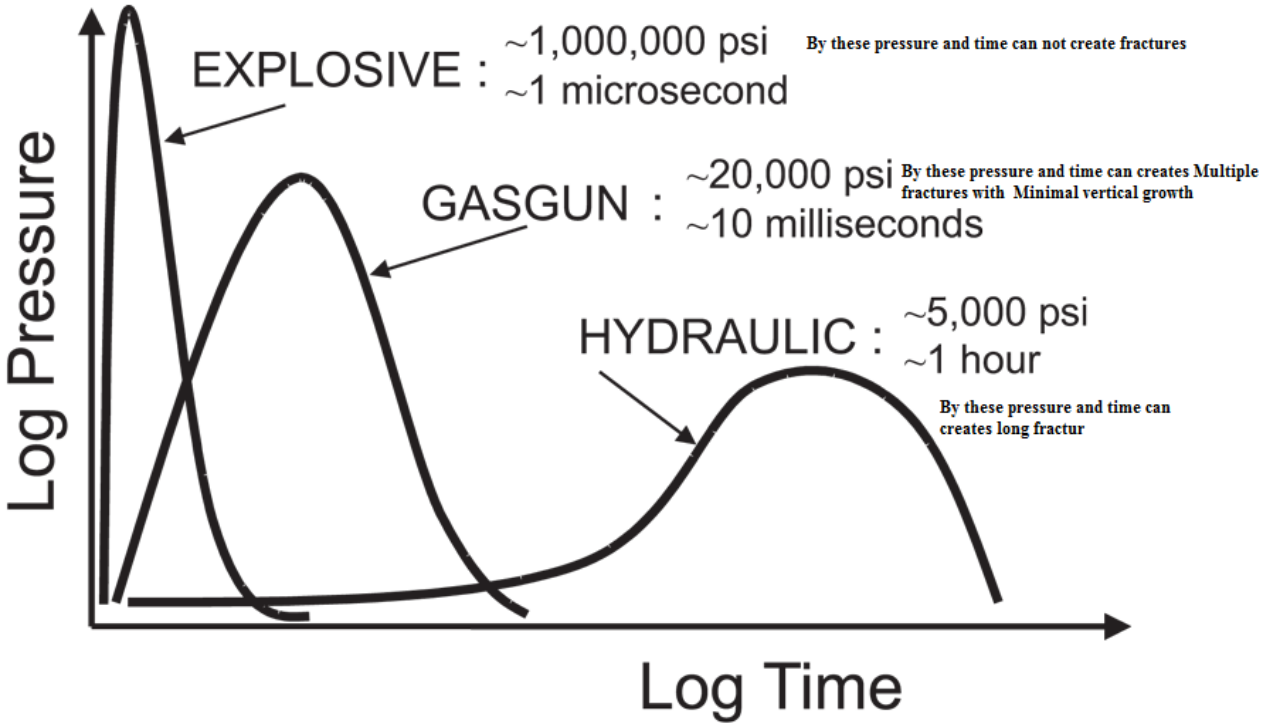

Figure 5 - The Released Energy-Timing of Explosives, GasGun and Hydraulic Frac.

Figure 6 - pump running hours after GasGun treatment