PROPELLANT-ASSISTED STIMULATION SUCCESS IN INDIA (using StimGun™)
A CASE STUDY
PROPELLANT-ASSISTED TREATMENT

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-A CASE STUDY IN INDIA

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FIELD DESCRIPTION & OBJECTIVES

A FIELD IN NORTH-EAST INDIA

- An Exploratory well in North-East Indian field was drilled to explore the formation.
- Based on the integrated study of geological and geophysical data, four objects were approved for initial production testing.
- All objects were in the same formation.
- This sandstone formation has 12 % porosity, 60% water saturation and 1-5 mD permeability, with high stress magnitude (~0.75 psi/ft).
- The objective of the testing was to identify fluid type, flow rate and pressure data to build a rich reservoir model.
WELL HISTORY

OBJECT I- CONVENTIONAL PERFORATION

- INTERVAL- 1997.5m – 2000m
  1st compressor application-100 KSC – No surface activity- CHP/THP=0 psi
  2nd compressor application-140 KSC – No surface activity- CHP/THP=0 psi
  3rd compressor application-165 KSC – mild gas flow- FTHP=0, SCHP= 80 psi
  4th compressor application-132 KSC – No surface activity- CHP/THP=0 psi

- INTERVAL- 2000m – 2002.5m
  1st compressor application-100 KSC – No surface activity- CHP/THP=0 psi
  2nd compressor application-150 KSC – No surface activity- CHP/THP=0 psi
  3rd compressor application-159 KSC – No surface activity- CHP/THP=0 psi
  4th compressor application-24 KSC - No surface activity- CHP/THP=0 psi
PETROPHYSICAL ANALYSIS

Object I - Conventional Perforation

INTERVAL: 1997.5 m – 2002.5m

Object II – Stim Gun Perforation

INTERVAL: 1954 m – 1957m

Object III – Stim Gun Perforation

INTERVAL: 1866 m – 1871 m

PROPELLANT-ASSISTED STIMULATION
Overbalanced perforations with wireline were required, so as to test many objects in the same well without lowering the completion string.

Low permeability did not provide good perforation clean-up.

With conventional perforation, the expected flow could not be achieved due to the possible presence of skin factor.

The challenge was to overcome the near wellbore damage in order to connect the wellbore with uninvaded formation.

Propellant-assisted technology was recommended to penetrate near wellbore damage, reducing skin and mildly stimulating the well.
DYNAMIC EVENT SIMULATION

- Scientific platform capable of simulating short-time (0.5-tens of seconds) dynamic events, widely used over the last 20+ years.

- Applications include:
  - Dynamics of perforating events
  - Propellants
  - Underbalance mechanisms
  - Tunnel Clean-up
  - Shock modeling
  - Risk Mitigation
NEXT-GEN DYNAMIC EVENT SIMULATION

Integration of new physics and numerical algorithms
- New wellbore flow model developed and implemented
- Shock-capturing Riemann-based hydrodynamic solvers incorporated
- Improved fluid thermodynamic closure

A new graphical user interface with a modern look and feel
- Updated input forms and software controls
- Simplified user input
- Automated report generation
The model assumed an initial positive skin of 3.8 and 5 mD permeability.

Model results estimate post treatment skin of -3, 100% perforation break down, bi-wing fractures ~4.24 m in length, fracture conductivity index of ~4mD/ft

No warnings or flags were observed.
PRODUCTION PERFORMANCE

OBJECT II

- 1st compressor application-100 KSC- The well became active.

- 8mm bean- Gas along with muddy water flowed with flare height up to 15ft
  4mm bean- The well flowed only gas at first followed by gas with light oil/condensate
  5mm bean- Gas with light oil/condensate was observed to flow continuously
  THP= 370psi, SCHP=600psi, Flare height= 15-18ft

- PLT Results-
  3mm bean: 7146m3/day.
  4mm bean: 9536m3/day.
  5mm bean: 14093m3/day.
DYNAMIC EVENT SIMULATION

OBJECT III

- The model assumed an initial positive skin of 4.2 and 2 mD permeability.
- Model results estimate post treatment skin of -3.1, 100% perforation break down, bi-wing fractures ~4.65 m in length, fracture conductivity index of ~4mD/ft
- No warnings or flags were observed.
PRODUCTION PERFORMANCE

OBJECT III

- 1st compressor application-100 KSC- The well became active.
- Flowing gas continuously through 3mm bean @ 2084 m3/day along with water intermittently@ 1.2 m3/day.
- Well is kept closed for build-up study for PLT job.
- Operational Forecast: PLT job
OBSERVATIONS AND CONCLUSIONS

- With conventional perforation in object I, no flow could be established. Gas indication was observed.

- With propellant-assisted application in object II & III, Detailed reservoir studies were carried out and the following parameters were measured.
  - Initial reservoir pressure in shut-in condition.
  - Bean study through 3, 4 and 5mm beans under flowing conditions.
  - Fluid properties like API gravity, Density, Water cut etc.
  - Final build-up study in shut-in condition.

- Hence the objective of testing the formation was achieved with the application of propellant-assisted technology, as near wellbore damage was treated by reducing skin and mildly stimulating the well.
QUESTIONS?
THANK YOU!

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