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RUSSIA INTERNATIONAL PERFORATING SIMPOSIUM

Maximize Efficiency of Coiled Tubing-Conveyed Perforation with Advanced Gun Deployment System and Real-Time Correlation in High-H2S/High-Pressure Wells

Schlumberger

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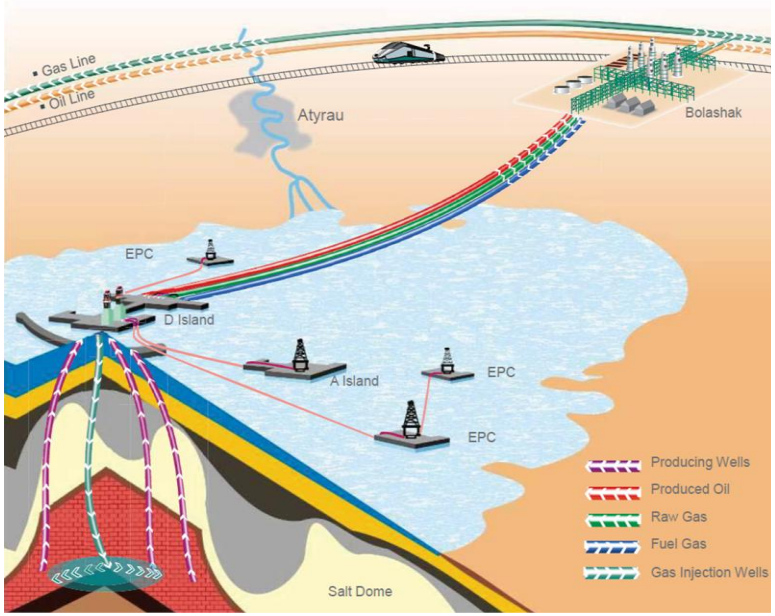
OUTLINE

- Introduction
- Project challenges
- Appraisal
- Technology implementation
- Developed project approach
- Case study
- Conclusion

INTRODUCTION

- Oilfield located in Kazakhstan, Caspian basin
- Estimated Recoverable reserves 13 Bbls oil
- Worlds biggest oil discovery since 1968
- Project scope:

  - CT conveyed well perforation
  - Gun Deployment system
  - Commissioning – 14+3 wells
  - Handle possible H2S on surface

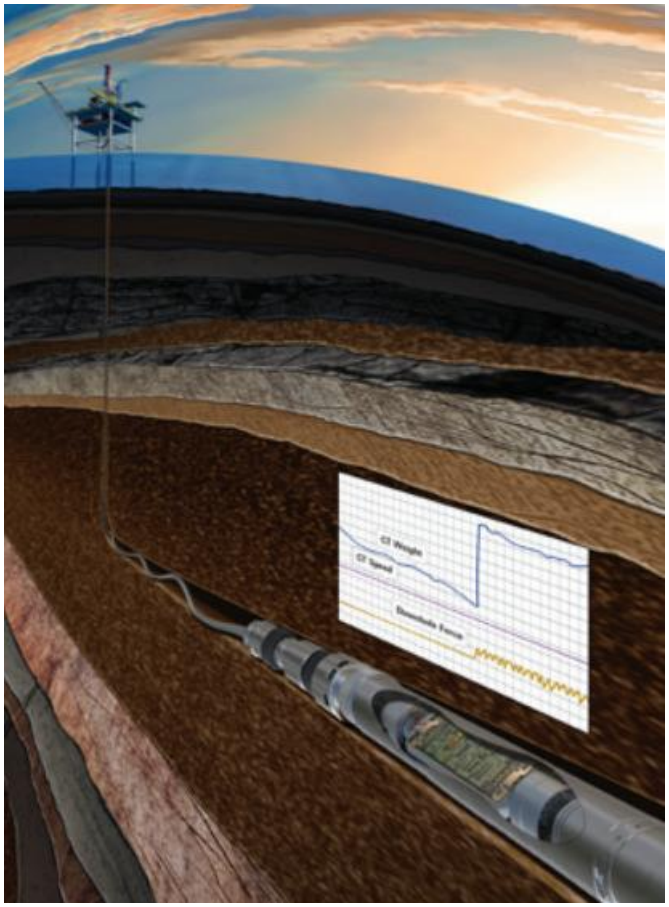


PROJECT CHALLENGES

- Reservoir Conditions
  - Hostile reservoir conditions: HP and Ultra High H2S 15-20%
  - NO fluid influx, H2S release or Well Flow allowed
  - BHP – above 10000 psi, WHP – 7500 psi
- Environment
  - Ambient Temperature vary −40 °C to +50 °C
  - Ultra shallow water, ice blocked in winter season,
  - 150 km remote from onshore, sensitive eco-system
- Unique Technology Requirements
  - 15K 5.125” H2S rated Surface equipment
  - Customized H2S rated perforation system
  - Emergency redundant downhole disconnection system

APPRAISAL

- Comprehensive risk analysis
  - High H2S concentration
  - Well Integrity, double barrier requirement
  - Chrome completion
  - Well depth and tortuosity
  - Well fluid influx and no-flow policy
- Technology challenges
  - Gun conveyance method analysis
  - Tool string selection and survivability after detonation
  - Precise real time depth control
  - Potential H2S handling at surface
  - Corrosion prevention and mitigation plan
  - Fishing contingencies
  - PCE configuration for perforation

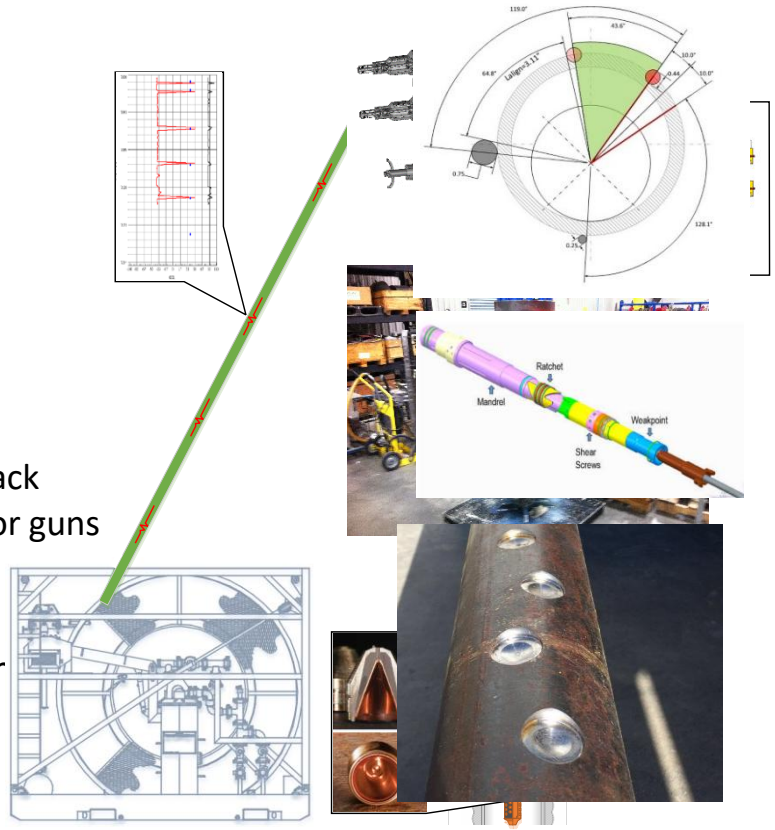


TECHNOLOGY IMPLEMENTATION

- Electric line enabled CT system
  - Electric line injected in CT
  - GR/CCL real time readings
  - Tension/Compression readings optional
  - Electrical disconnect device
  - Electrical detonator initiation

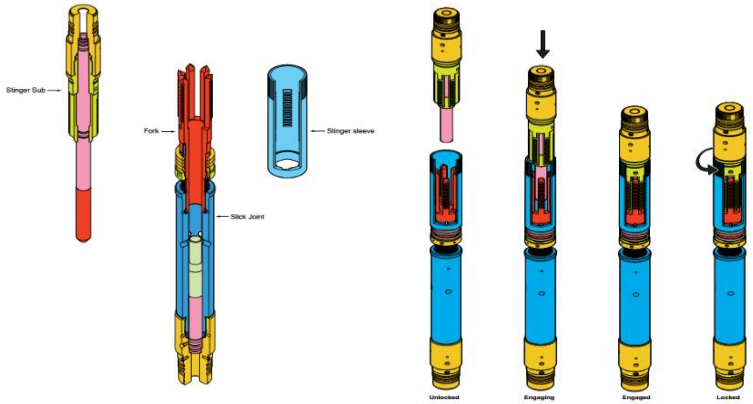
- Gun deployment system
  - New design H2S rated 5-1/8” 15000 psi deployment stack
  - H2S rated set of aligning connectors, swivels, adaptors for guns

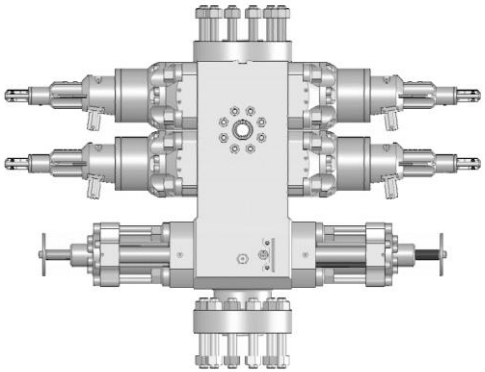
- Perforation Tool string
  - Redundant disconnect system: electrical and mech
  - Shock resistant H2S-rated CT logging head
  - H2S-rated Shock absorbers
  - Rounded scallop HP guns, orienting featured

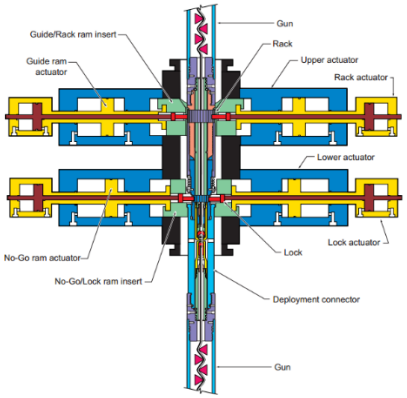


TECHNOLOGY IMPLEMENTATION - CONTINUE

- Advanced gun deployment system
  - Remotely connects / disconnect perforation connectors
  - Hold gun string weight
  - Able to work under pressure
  - 3 components connector: lock sleeve / slick joint / stinger
  - Sealed ballistic transfer
  - Set of aux components: retrieval / deployment ballistic / flow through

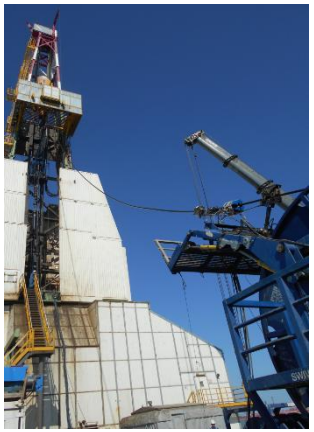


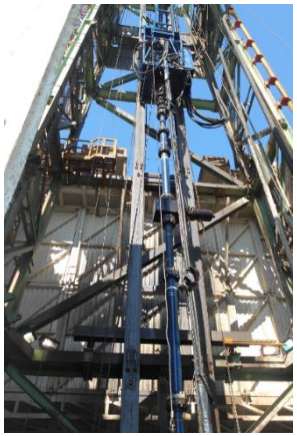


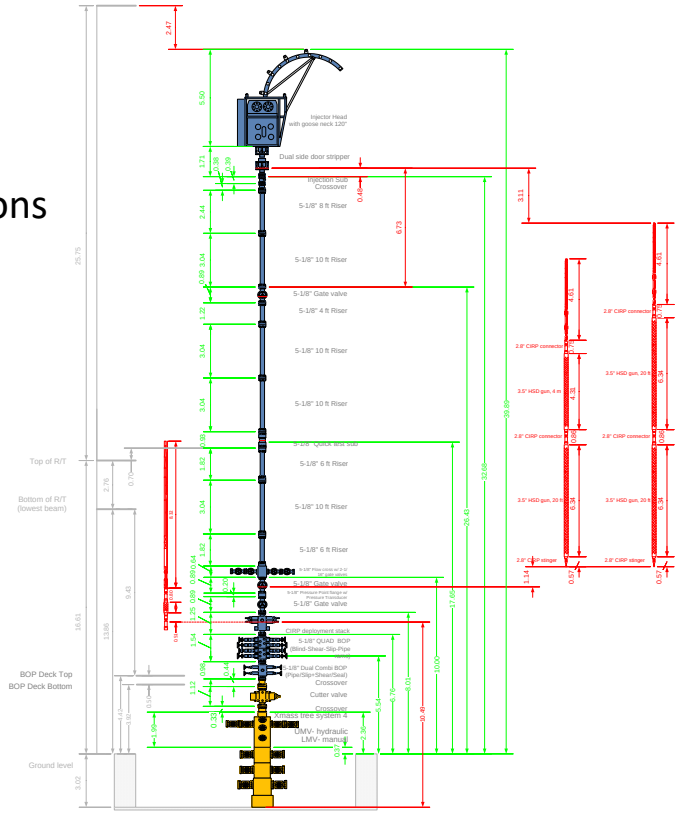


DEVELOPED PROJECT APPROACH

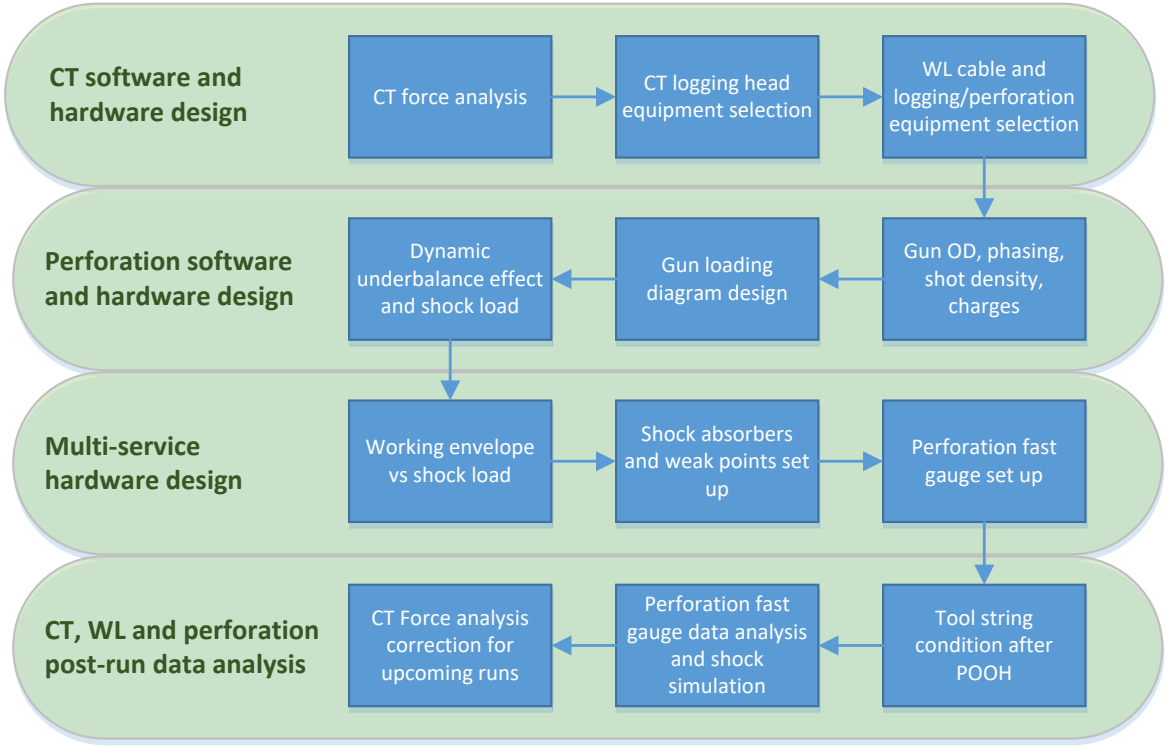
- PCE configuration design
  - Tailored for conveyance guns in double and trebles
  - Designed for 3 different rig and 2 rigless interventions
  - Fully compatible for all fishing scenarios
  - All contingency safety precautions included
  - New approach to “in scale” PCE space out design

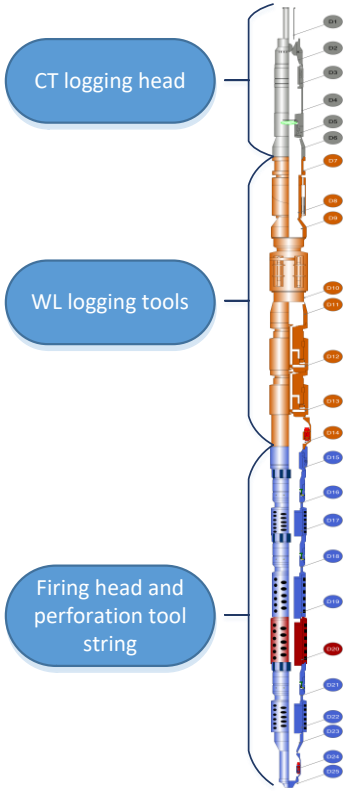






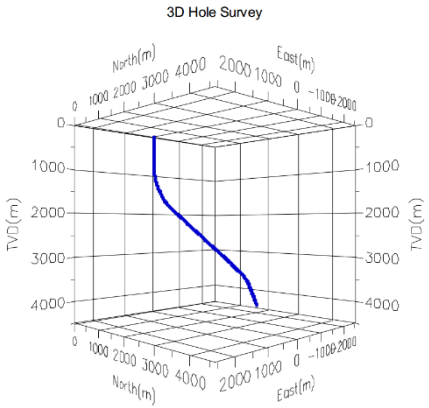
TECHNICAL APPROACH - CONTINUE

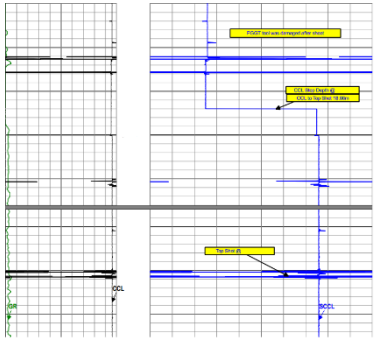




CASE STUDY

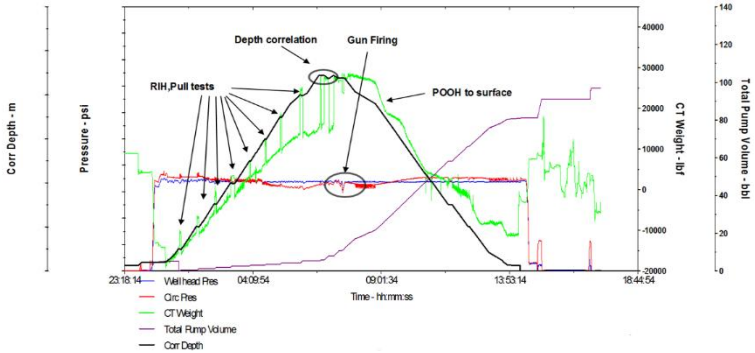
- Well generic description
  - Oil producer
  - Carbonate formation
  - Chrome completion
  - Long deviated section
  - BHP above 11000 psi
- Perforation objectives
  - Dead well deployment of gun (17-20) string with CT
  - Convey to perforation interval (squeeze mode)
  - GR/CCL correlation
  - Overbalance perforation with DUB effect
  - POOH with maintained pressure

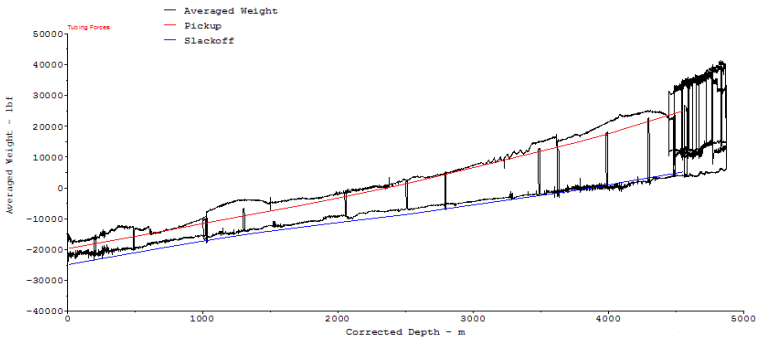




CASE STUDY - CONTINUE

- Acquisition job data analysis
  - Weight stability
  - Applied pressure during RIH/POOH
  - Speed limitations vs completion jewelry
  - Tool string gained weight after perforation
  - Cumulative metal fatigue and abrasion of CT
- CT post-run force analysis
  - Compared predicted and actual weigh readings
  - Adjustment of friction coefficients
  - Friction reducers / well fluid / CT pressure values
  - Upcoming runs simulations adjustment

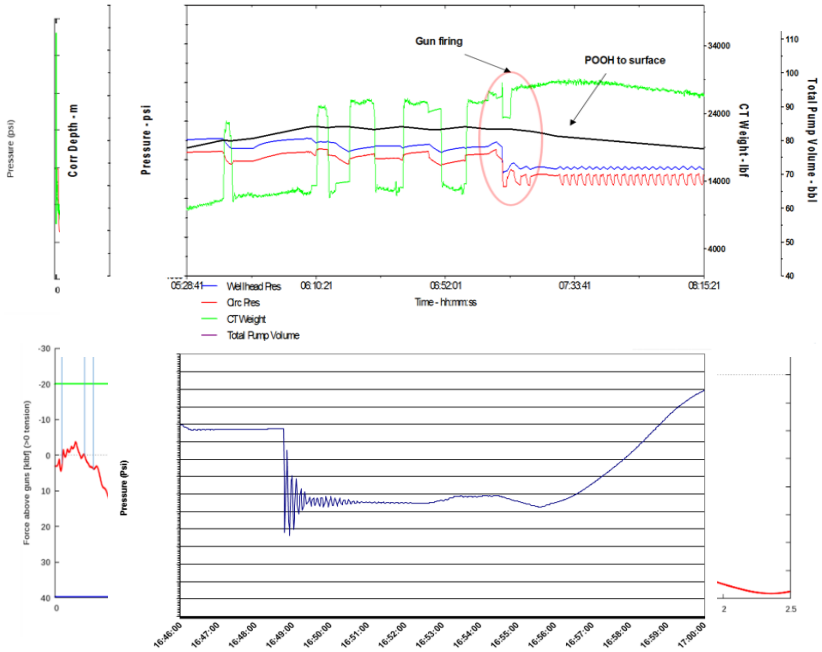




CASE STUDY - CONTINUE

- Shock Analysis Correlation
  - Recover recorded pressure data
  - Compare Pressure during DUB
  - Adjust pressure and shock load simulation
  - Adjustment of upcoming runs

- Detonation Indication Verification
  - Pressure monitoring at surface and downhole
  - CT weight indicator readings
  - WL signal after detonator initiation
  - Physical impact and CT movement at surface



CONCLUSION

- Seamless integration of e-line-enabled CT perforation method with the advanced gun deployment system
- Perforation in controlled way with well integrity and influx management under anticipated operational parameters
- Reliability of electrical and mechanical disconnect combination in one tool string
- Service quality through developed design and execution systematic approach
- Proven solution for high H2S / high pressure environment

Thank you!

Questions?

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