Next Generation Directional MWD Tool Requirements for Improving Safety and Accuracy

DEA-164

Discussion and Proposal for a JIP Market/Technology Feasibility Study

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Next Generation MWD
What is Required?

- Industry needs **Directional MWD tools** that can navigate accurately under anticipated conditions:
  - Distorted magnetic field
  - High angles
  - Interceptions
- Safety most important now – avoid interceptions, except when needed
- Determine **absolute and relative positions** quickly & accurately
- A consensus on **"new standard"** measurements will improve reliability and ability to respond, while reducing cost (both development and service)

Next Generation MWD
What is Required?

- SAGD - Twinning
- Intersection applications growing
- Proximity data near old ells with large ellipses (limited or no survey data)
- Next generation tools should be ***used routinely*** for better well placement and safety, gaining revenue to defray development costs
- Incorporating Ranging measurements & models in software for improved clearance analysis

Relief Well Drilling Technology

- Industry lacks tools to efficiently and precisely regain control
  - Global concern for the delays recently
  - 74 days to kill Montara
  - 85 to contain Macondo
- Could a directional MWD tool drill relief wells?

Relief Well Drilling Technology Brief History

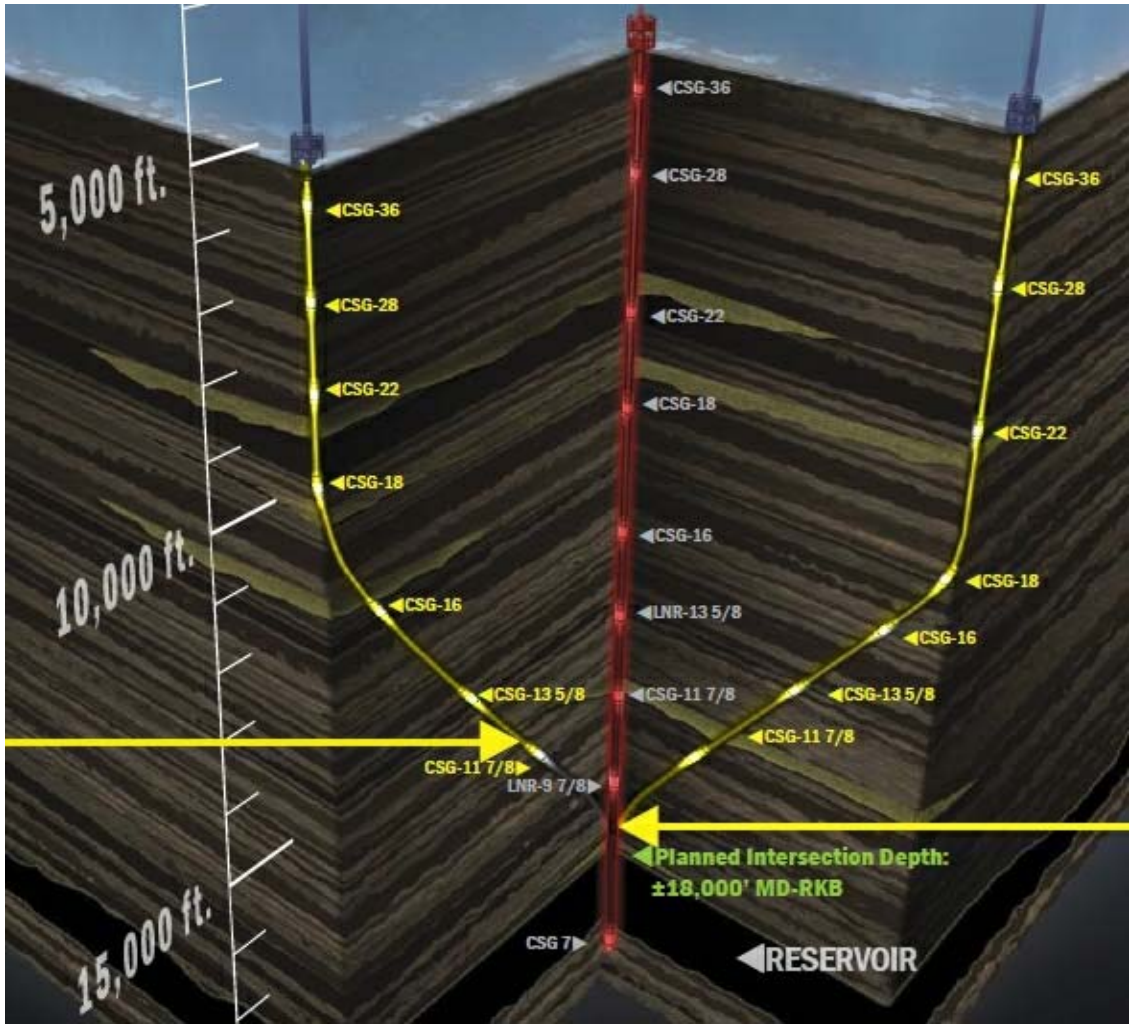
- First directional relief well in the U.S. was drilled in 1933 in Texas
  - Directionally drilled into same reservoir
- Special guidance tools followed
  - MAGRANGE (HO&M) 1975
- Process has not changed much in 30 years
  - Deploy mag ranging tool, analyze, drill ahead, repeat
  - Ixtoc 1 used MWD, Survey, Ranging tools in 1979
  - Same technology used in recent mishaps

- Source: *http://science.howstuffworks.com/environmental/green-science/relief-well1.htm*

Directional MWD Capability

- Basic Mag/Accel functionality same for 20 years
- Drive to reduce drilling costs
  - Focused on costs, not value added
  - Limited investment capital to improve/add sensors
- Developing tools for niche applications is financially challenging
- IP barriers to implementation

Next Generation MWD
Relief Well Application



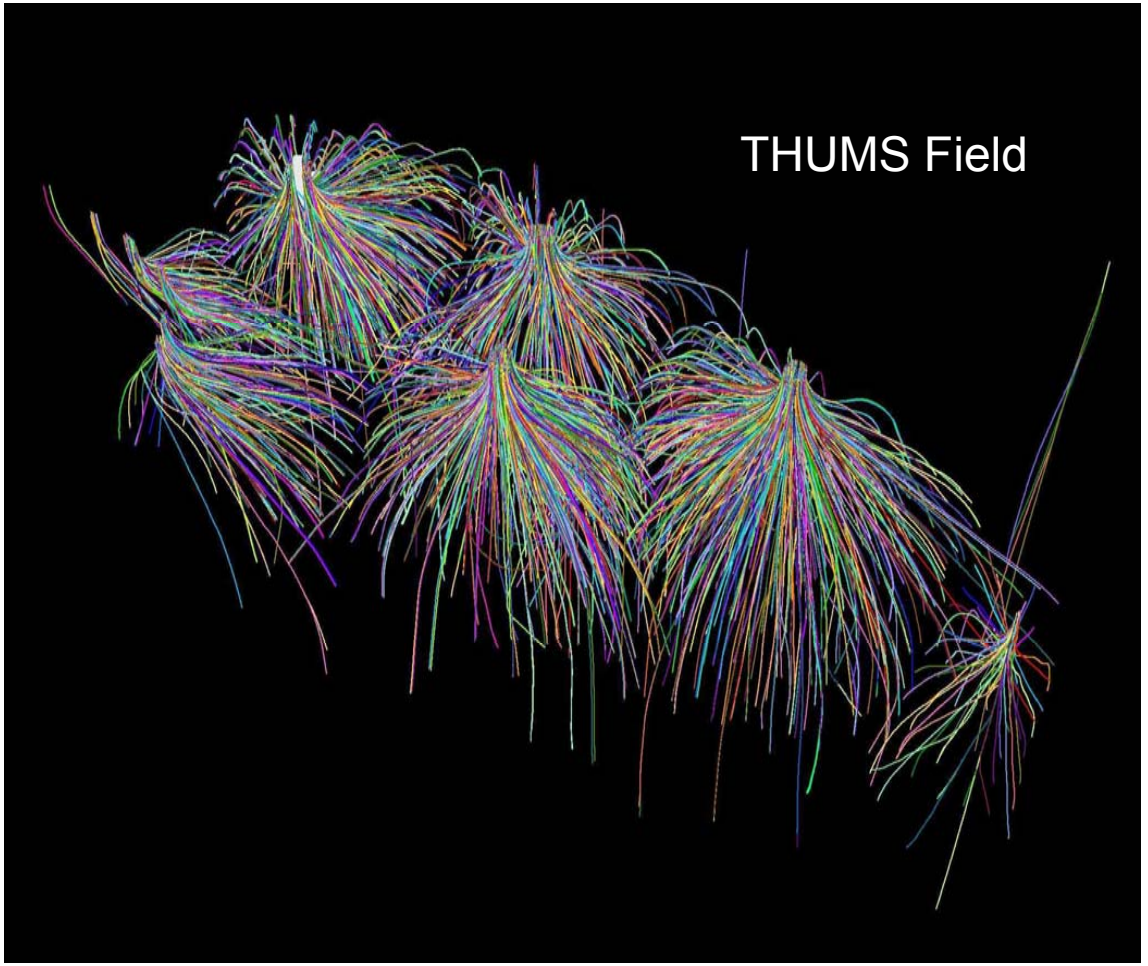
Industry Needs

- Reduced time to intersection
- Better proximity accuracy
  - Distance
  - Direction (vector)
- Incorporating Measurement models in software

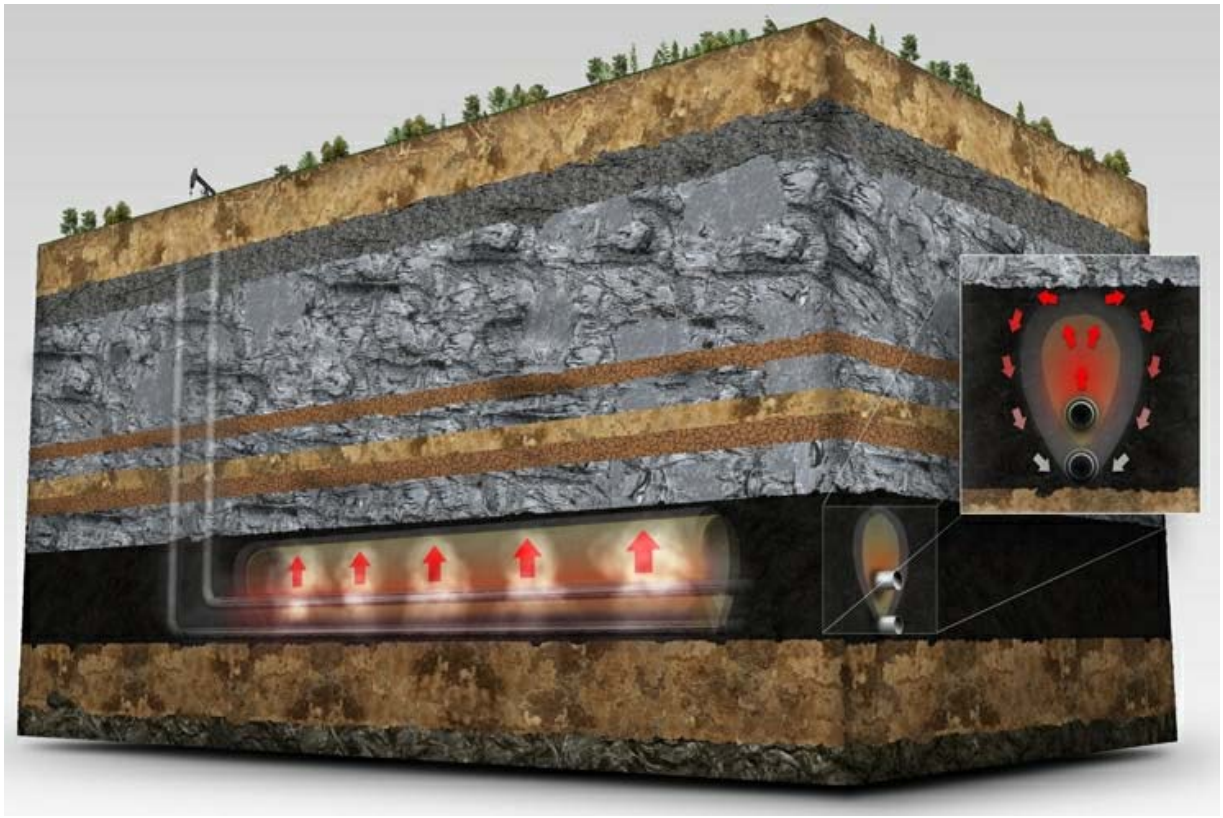
Next Generation MWD
Anti-Collision Application

Industry Needs

- Enhanced collision avoidance
- Reduced safety risk
- Fewer wells shut-in
- More accurate proximity detection



Next Generation MWD
SAGD Application (Twinning)



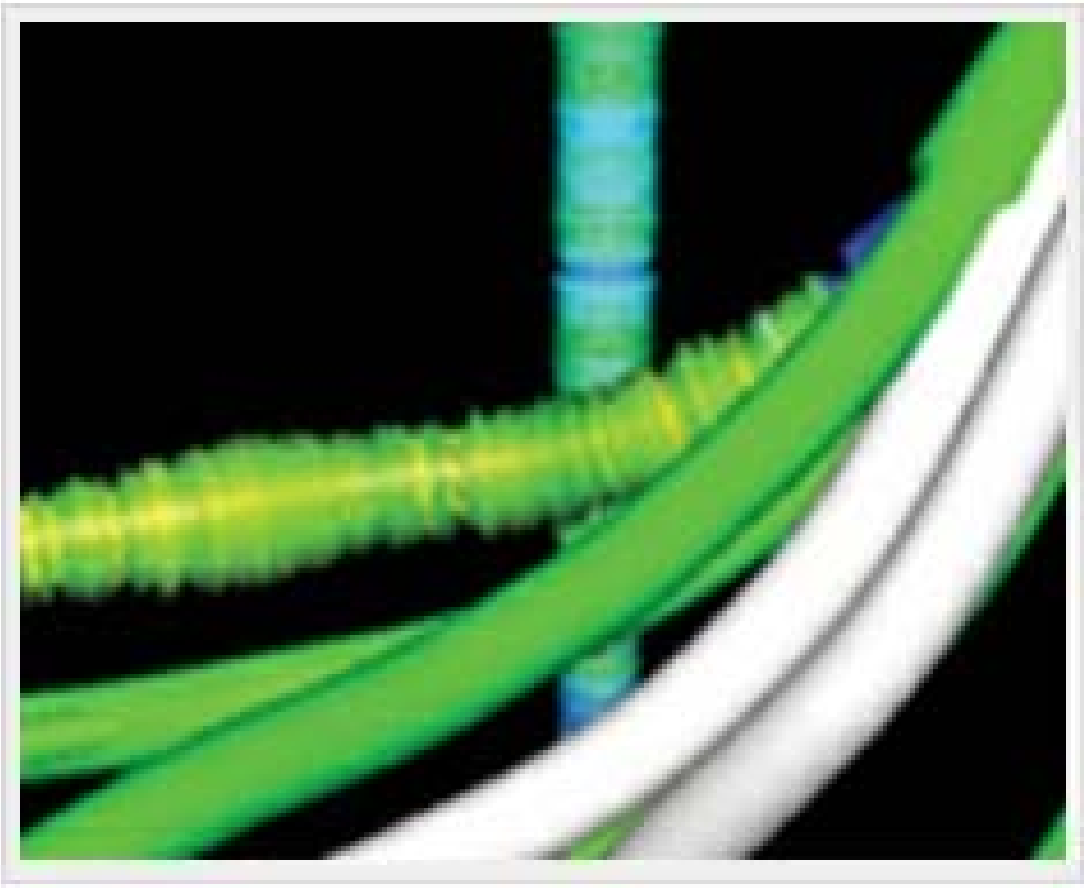
Industry needs

- Improved proximity accuracy
- Decreased positional uncertainty
- No wellbore intervention

Next Generation MWD
Proximity Application

Industry needs

- Improved distance and direction accuracy
- Especially near old wells with large ellipses of uncertainty



Survey Proposal

- Independent consultants to gather data
  - Survey operators to define requirements/specs
  - Assess price tolerance for next generation MWD service for multiple applications
  - Assess technical requirements and gaps
  - Assess IP barriers for key technologies
  - Can multiple service suppliers develop the solution?
- Recommend a path forward for industry
  - DEA Charter is “to advance new technology”

Deliverables

- Report with operator survey findings, needs assessment & recommendations
- Proposed next generation Directional MWD (functional specification)
- Cost/benefit analyses for significant scenarios
  - Health, Safety and Environmental (HS&E) liabilities
  - Well shut-in cost vs. better proximity determination
  - Development, operational, and R&M expectations

DEA - JIP Proposal

- Two phases, both start with interviews of drilling engineers and managers
  - 1st to develop preliminary findings
  - 2nd to confirm findings & conclusions
  - 35 to 40 interviews, most face-to-face
- Survey and assess available and needed technologies – visits to developers/suppliers
- Conclusions documented in written report
- Projected budget: $260,000 plus expenses
- Projected schedule: 7-8 months
- Participant cost ≈ $30,000 if 10 participants

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Mr. Richardson has been active in the design, development, and evaluation of electronic systems, instrumentation, and drill-string components to advance the state-of-the-art in drilling for oil and gas for more than 35 years. He is the ***founder and principal of TechRich Consulting***, which has provided technical and business consulting services to industrial clients since 2001. Previously, Mr. Richardson was on the professional staff of Arthur D. Little, Inc., where he was a Director of the Technology and Innovation Management and the Global Energy Practices. During his 22 years with the firm, his consulting work focused on the impact of new technologies in industrial markets, management of multidisciplinary product development projects, finding and assessing new technologies for acquisition or license, and technology (or R & D) planning. Before joining Arthur D. Little, Inc., Mr. Richardson was ***Chief Engineer for Eastman Whipstock***, Inc. His educational background includes a B.A. from Amherst College, graduate work in Ocean Engineering at the University of Rhode Island, and completion of the M.I.T. Program for Senior Executives at the Alfred P. Sloan School of Management.

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One of the ***founders of Tensor, Inc.***, and Exec. Vice-President, Austin, Texas, in 1975 through 1998, when company was acquired by AlliedSignal (later became Honeywell), and traded to GE Energy. Continued working as a chief engineer and resource for the development and improvement of products for oil and Gas industry. ***Co-inventor, developer and operating engineer of MAGRANGE***, the proximity detection system, first use in 1975. Performed services with this system for clients in the oil fields on 125 to 130 relief wells. Co-inventor, developer and operating engineer for MAGRANGE services for operators on 125 -130 relief wells. At Tensor, developed downhole navigation instruments including magnetic orientation modules for service companies for incorporation into their MWD and LWD systems, and steering tools, electronic multi-shots and retrievable MWD systems. Also developed special sensors for custom measurements. Education: BSEE, University of Texas, Austin, Texas.