Microhole Wireless Steering While Drilling System

- DOE Sollicitation: DE-PS26-04NT15480-2
- Microhole Drilling, MHT II
- Technology Development
- Microhole Coiled Tubing Bottom Hole Assemblies

John Macpherson
Baker Hughes INTEQ

Microhole Wireless Steering System

- Microhole Technology (MHT)
  - ***Conversion of remaining domestic resource to reserves (by 10%)***
  - ***Shallow infill drilling, less than 5,000 ft***
  - ***Small hole size, 3-1/2" borehole, low drilling cost***
  - ***Small environmental footprint***

- MHT II
  - ***The technology to be developed under this proposal is targeted at the specific problem of insufficient steering accuracy and borehole quality in the very slim borehole sizes, when the application of coiled tubing with an integral electric wire connection is uneconomic.***

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Microhole Wireless Steering System

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- Project Objectives
  - Develop a 2-3/8” downhole Bi-Directional Power & Communication Module (BCPM)
  - Develop a Surface Coil Tubing Communication Link (CTCL)
  - Manufacture 3 BCPM prototypes
  - Laboratory & Field Testing with a CoilTrak™ bottom hole assembly

- Project Duration
  - 18 months
  - Start Date: 1 April, 2005
  - End Date: 30 September, 2006

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Microhole Wireless Steering System

- INTEQ – Coiled Tubing Drilling Assembly Development
  - 1991
    - Development, field trials of first E-line CT drilling BHA systems – OrientXPress (OXP)
  - 1995
    - OXP drilled well at 265°F in Holland
  - 1999
    - Begin development of 2-3/8” Modular Coiled Tubing BHA.
  - 2001
    - Development of 3” Modular Coiled Tubing BHA.
    - Development of Ultra Slim (3-1/8”) Multiple Propagation resistivity tool (US-MPR) for CT drilling
    - Initial field test, first e-line operated 2-3/8” CoilTrak

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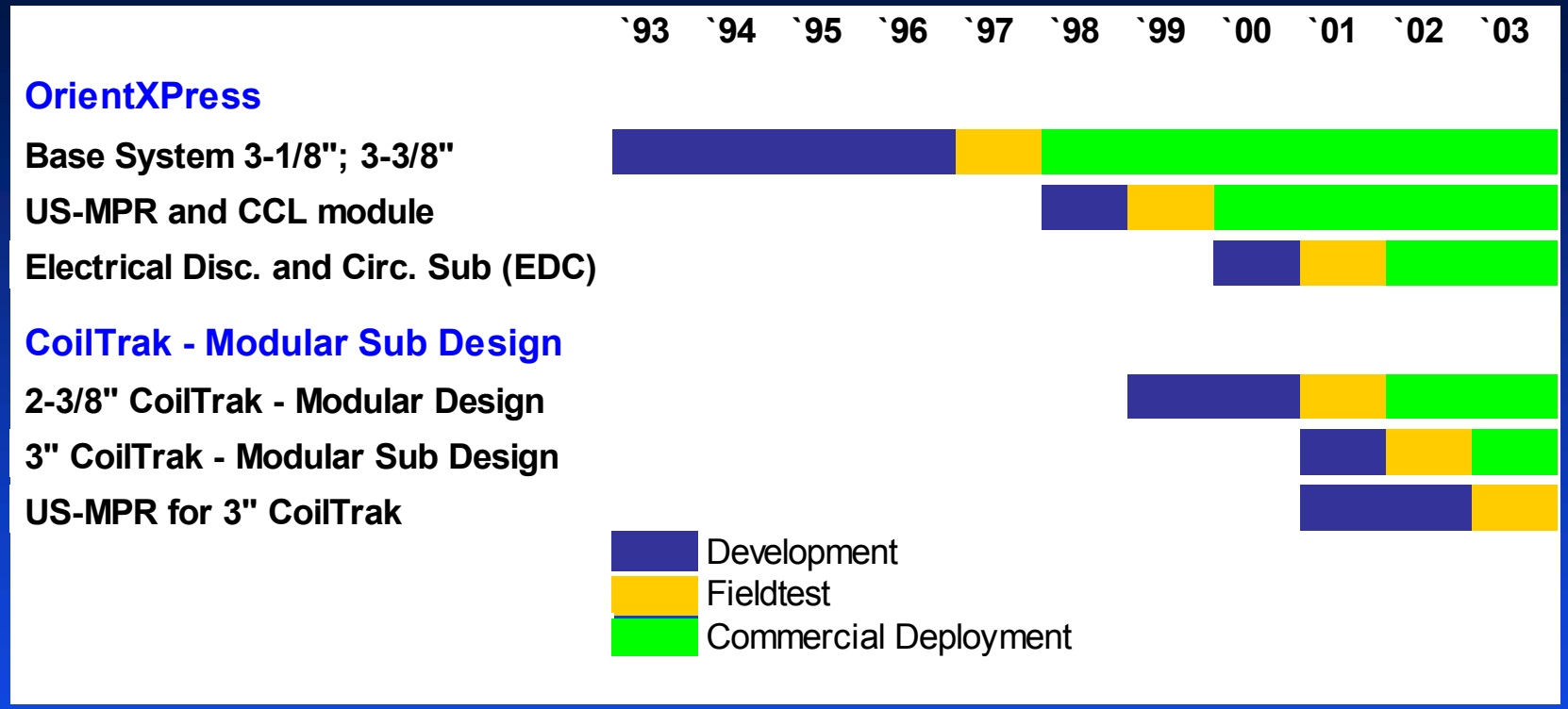
Microhole Wireless Steering System



- 2-3/8" Development Projects 2004 – 2006 (DOE MHT I)
  - Resistivity Device
  - Rib Steering Device

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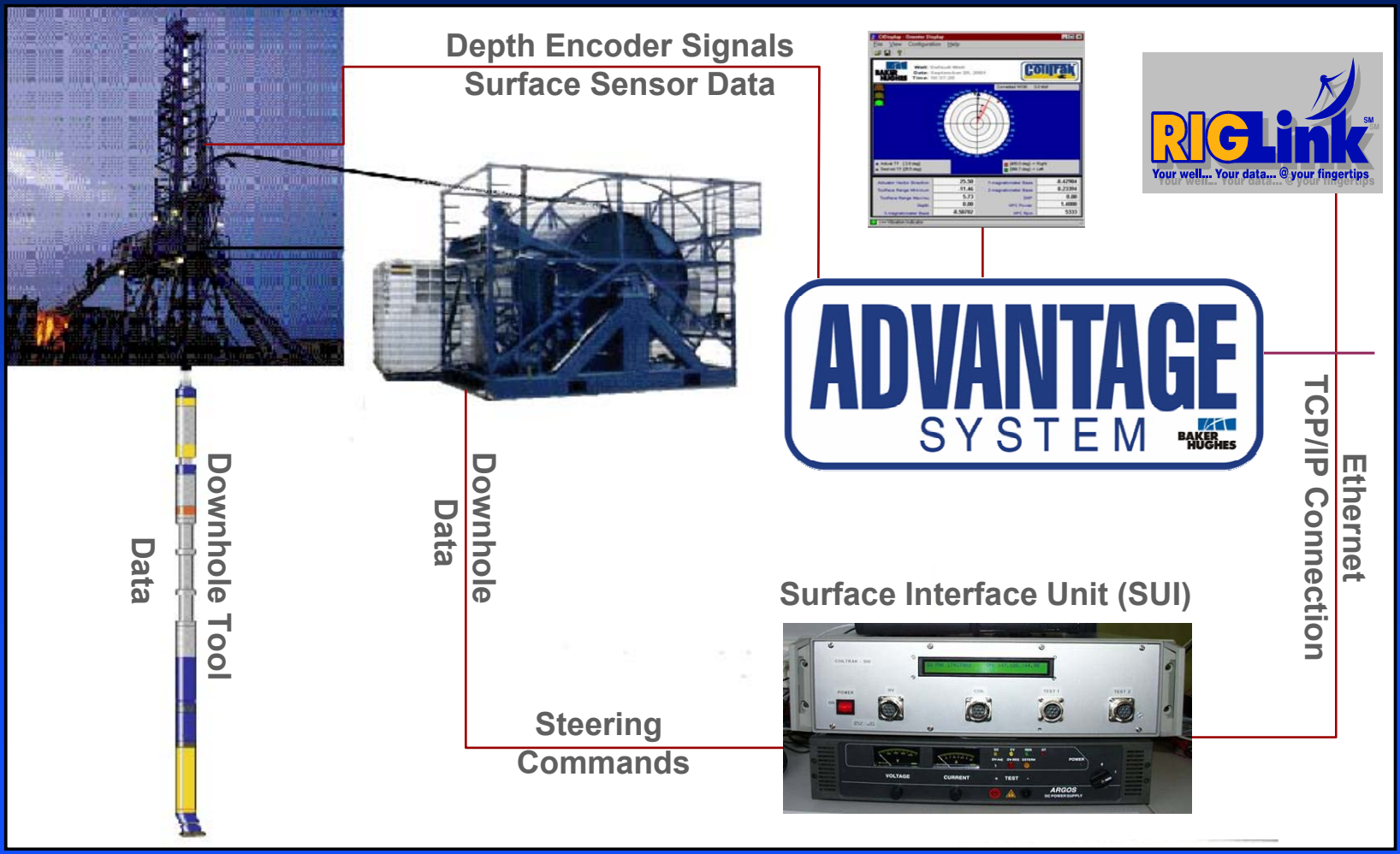
CoilTrak System (e-line)



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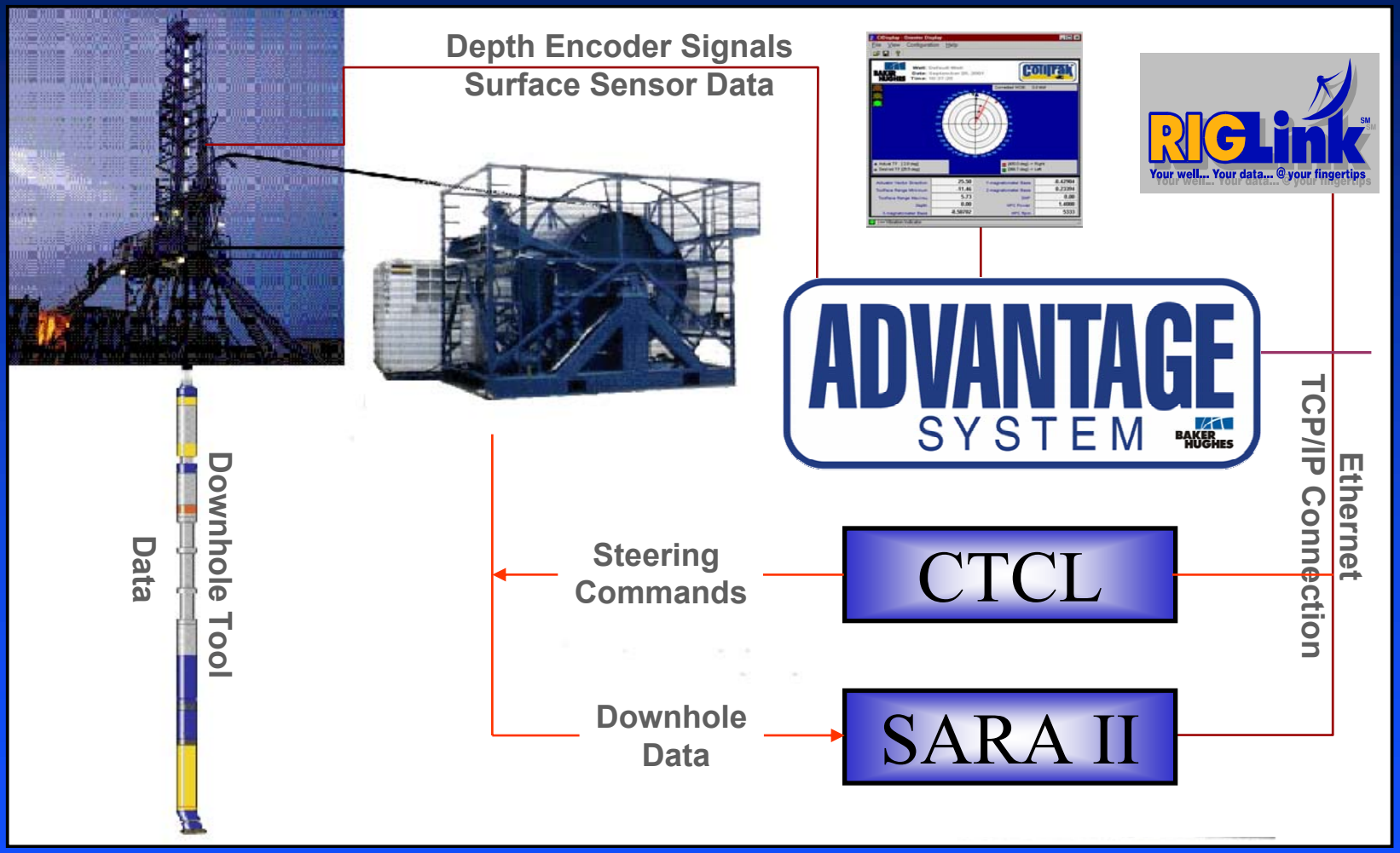
CoilTrak System (Mud Pulse)



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Microhole Smart Steering & LWD System

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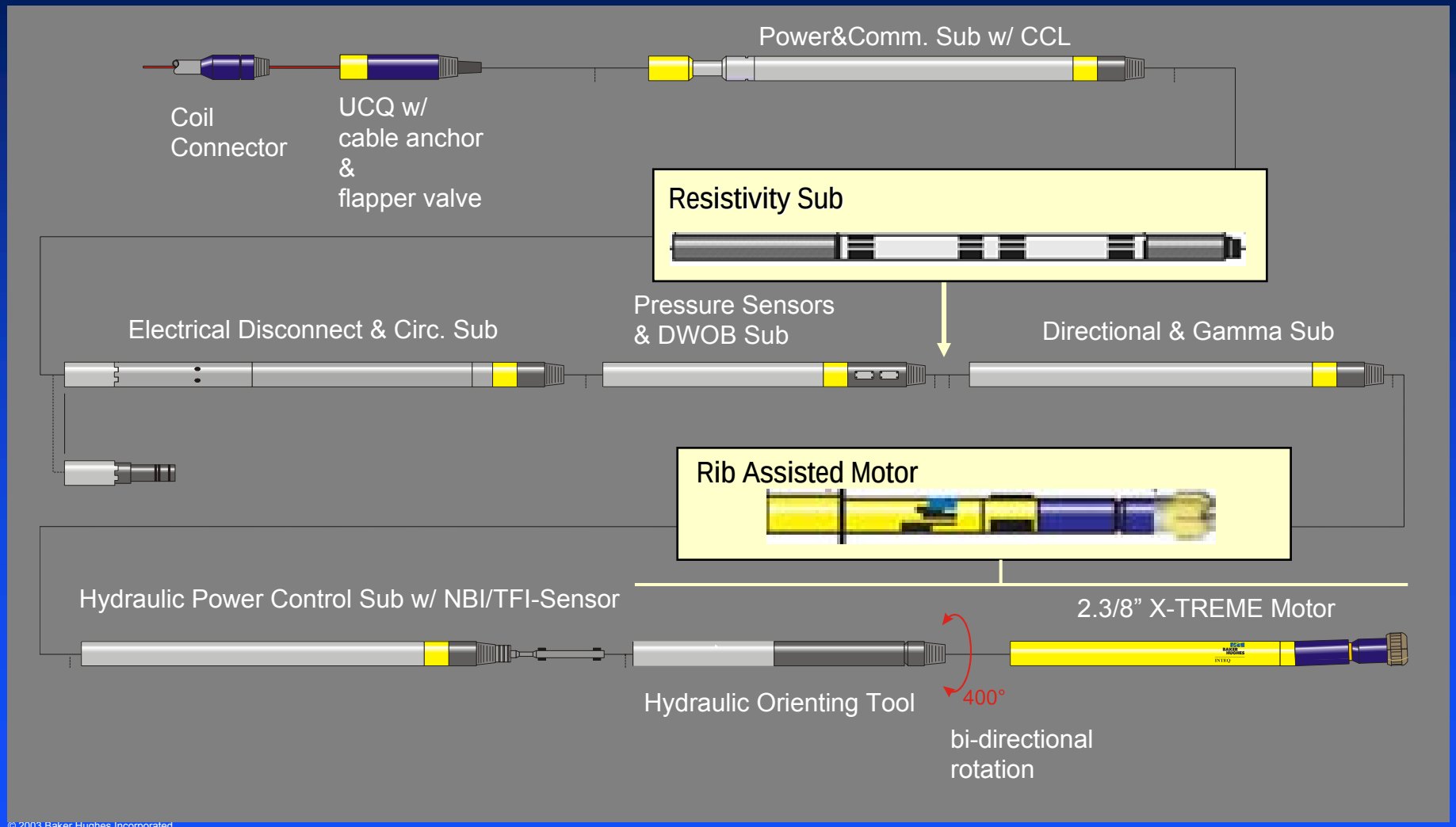
Project Components *2-3/8" CoilTrak*



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Microhole Smart Steering & LWD System

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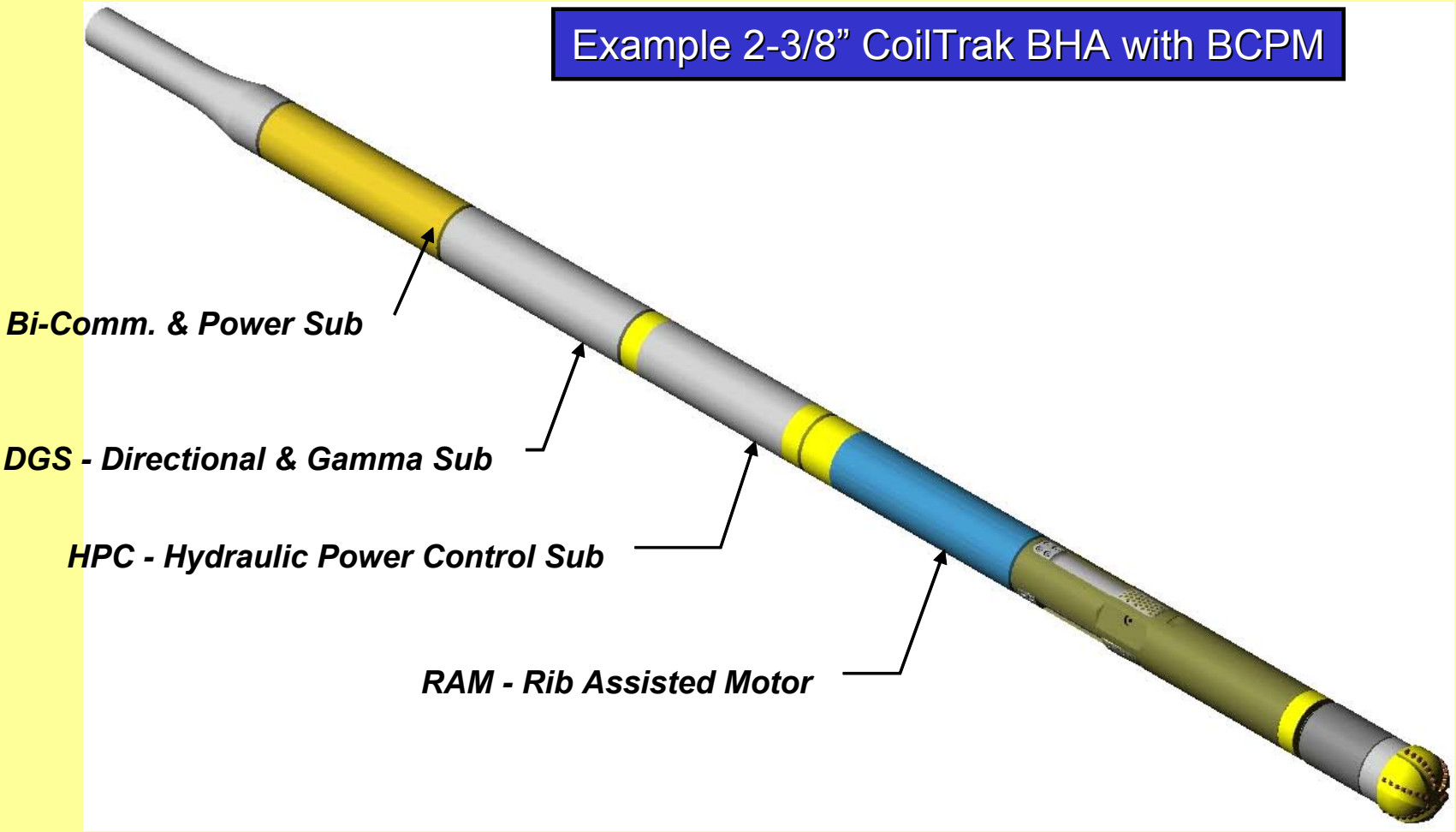

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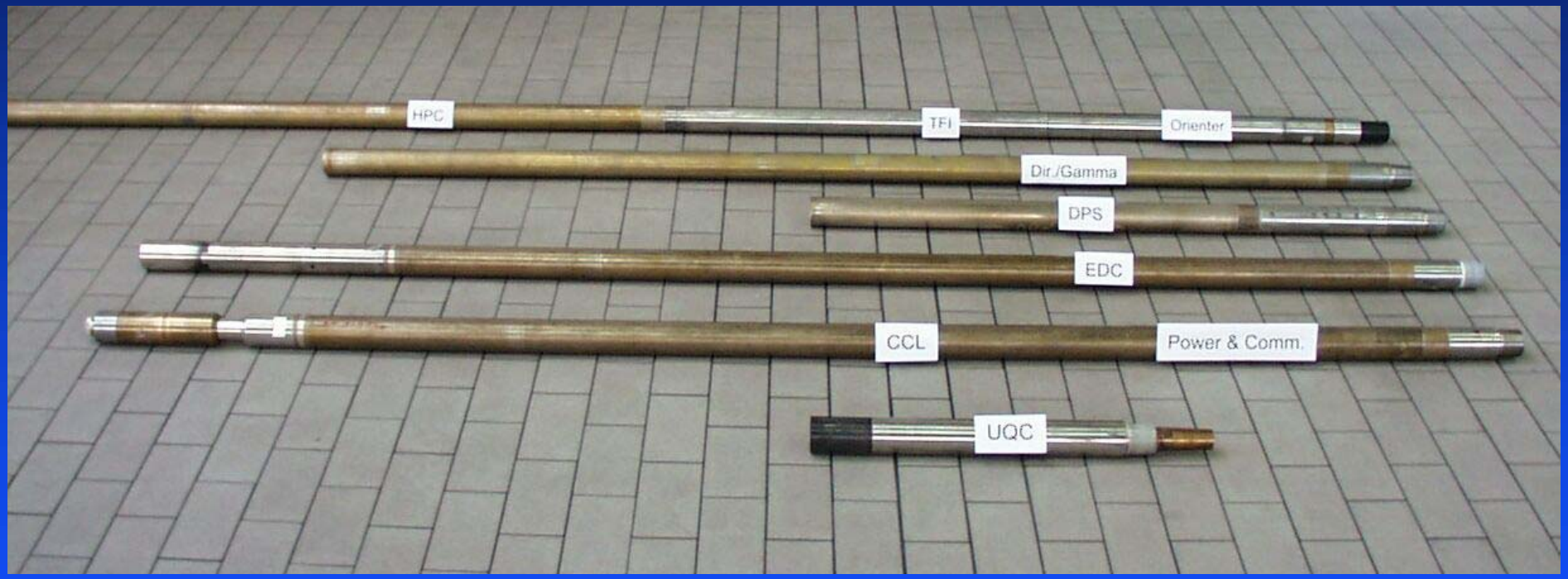
Current Tools

2-3/8” CoilTrak



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CoilTrak: Wireline vs. Mud pulse

	E-Line	Mud Pulse
Data Transmission	- Fast data acquisition - Additional sensors	- Slow data acquisition - Limited potential to add sensors
Two way communication	- Closed Loop System on wire	- Closed Loop System requires downlink set-up
Directional control	- Fine Increment orientation - Precise wellbore placement - Smooth well path	- Interrupts drilling process - Limited control
Drilling fluid	- No limitations	- Limited under-balanced drilling capabilities
Operation	- Cementing limitations - Work string required	- More flexibility with coil use
Electric power	- Continuous power supply	- Limited to battery power or alternator
Wireline logging	- High inclination possible - While drilling	- Inclination limit (approx.. 75°) - Or requires special logging coil with Wireline

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BCPM Mud Pulse Telemetry

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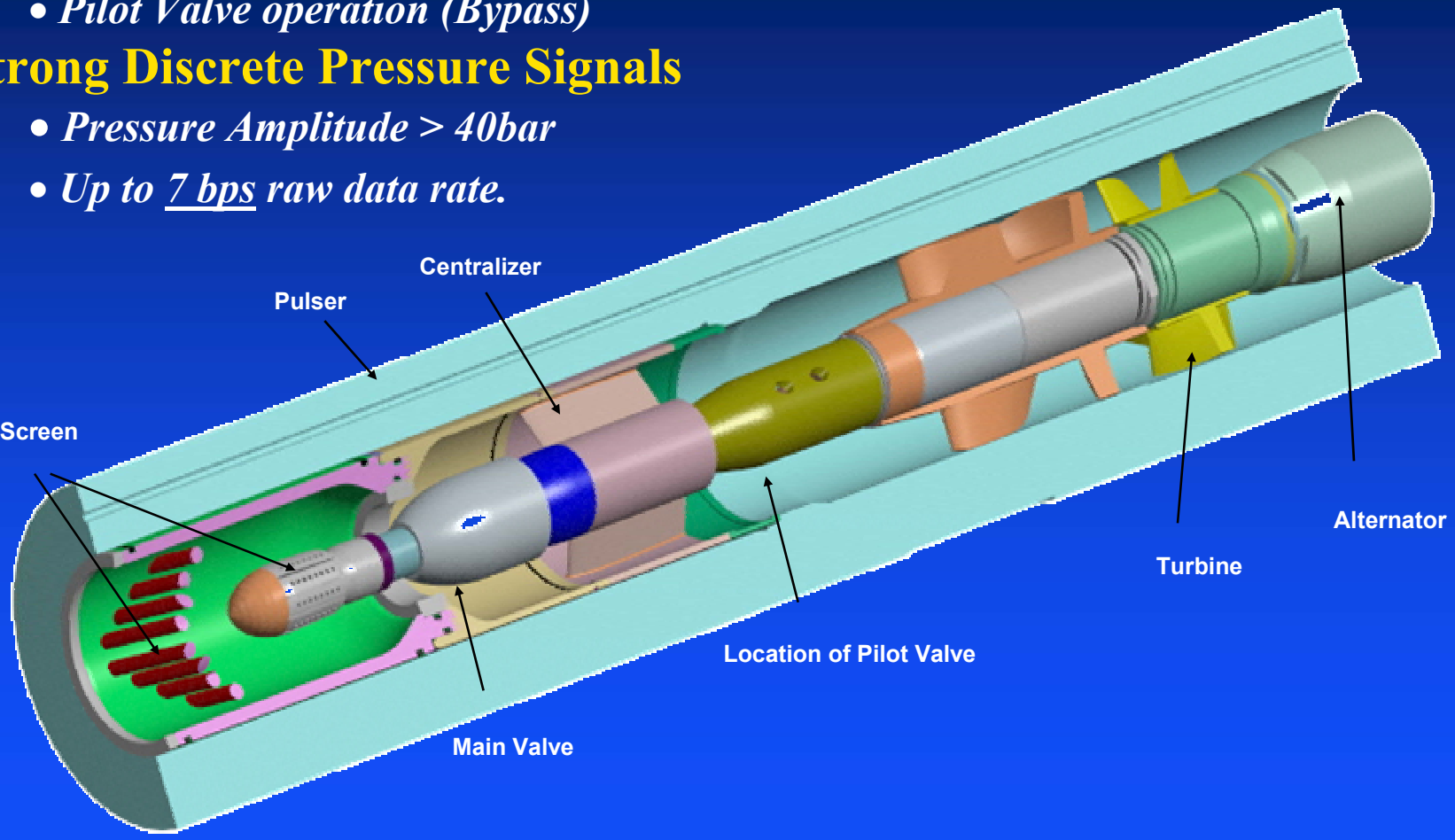
BCPM: Bi-directional Communication and Power Module

- **Low power consumption**
  - *Pilot Valve operation (Bypass)*
- **Strong Discrete Pressure Signals**
  - *Pressure Amplitude > 40bar*
  - *Up to 7 bps raw data rate.*



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MWD Telemetry System

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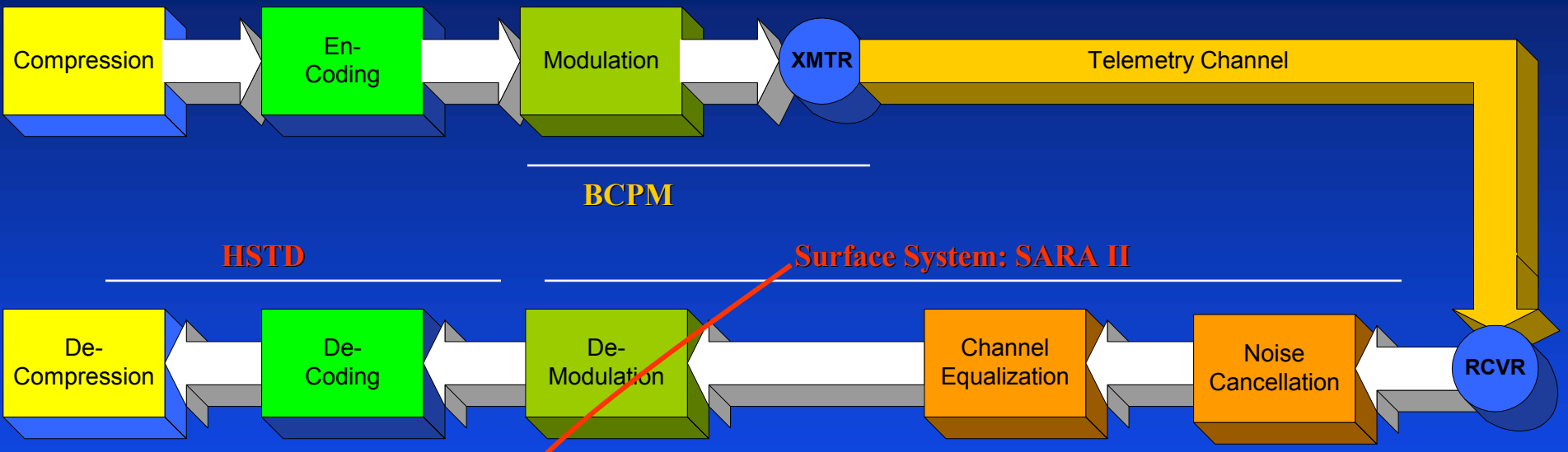
Basic Telemetry System Components



- 24 bit A/D, Low Noise, Multiple Channels
- Noise Cancellation
- Dual Pressure Processing.

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Operational Specifications

CoilTrak™ BAKER HUGHES

Tool OD	2-3/8”
Bore size	2-3/4” to 3-1/2”
Max. build up rate	50°/100 ft.
Max. operational temperature	150°C [300°F]
Max. survival temperature	175°C [350°F]
Max. hydrostatic pressure	1000 bar [14500 psi]
Max. differential pressure	300 bar [4300 psi]
Max. flow rate	250 l/min [65 gpm]

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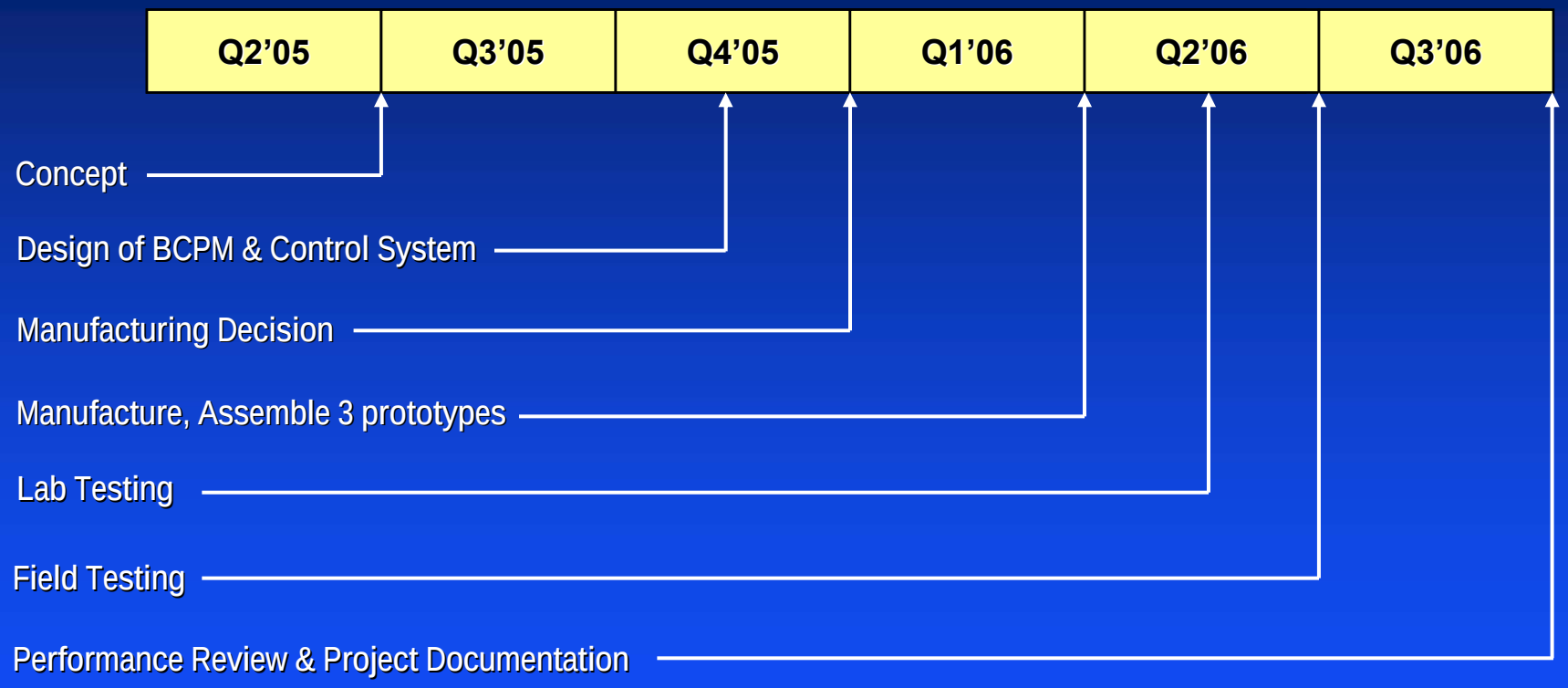
Project Deadlines



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