Petroleum Technology Transfer Council

EPA Gas Star

12th Annual Implementation Meeting

Houston, Texas

25 October 2005

Petroleum Technology Transfer Council

- Tech Transfer Program
- Field Examples
- Environmental Drivers

WWW.PTTC.ORG

Where does Technology Come From?

- Research Centers: Service,Major
- JIP's and Consortia
- National Laboratories
- Demonstration Projects
- Universities
- Other Industry Applications

How is Technology Transferred?

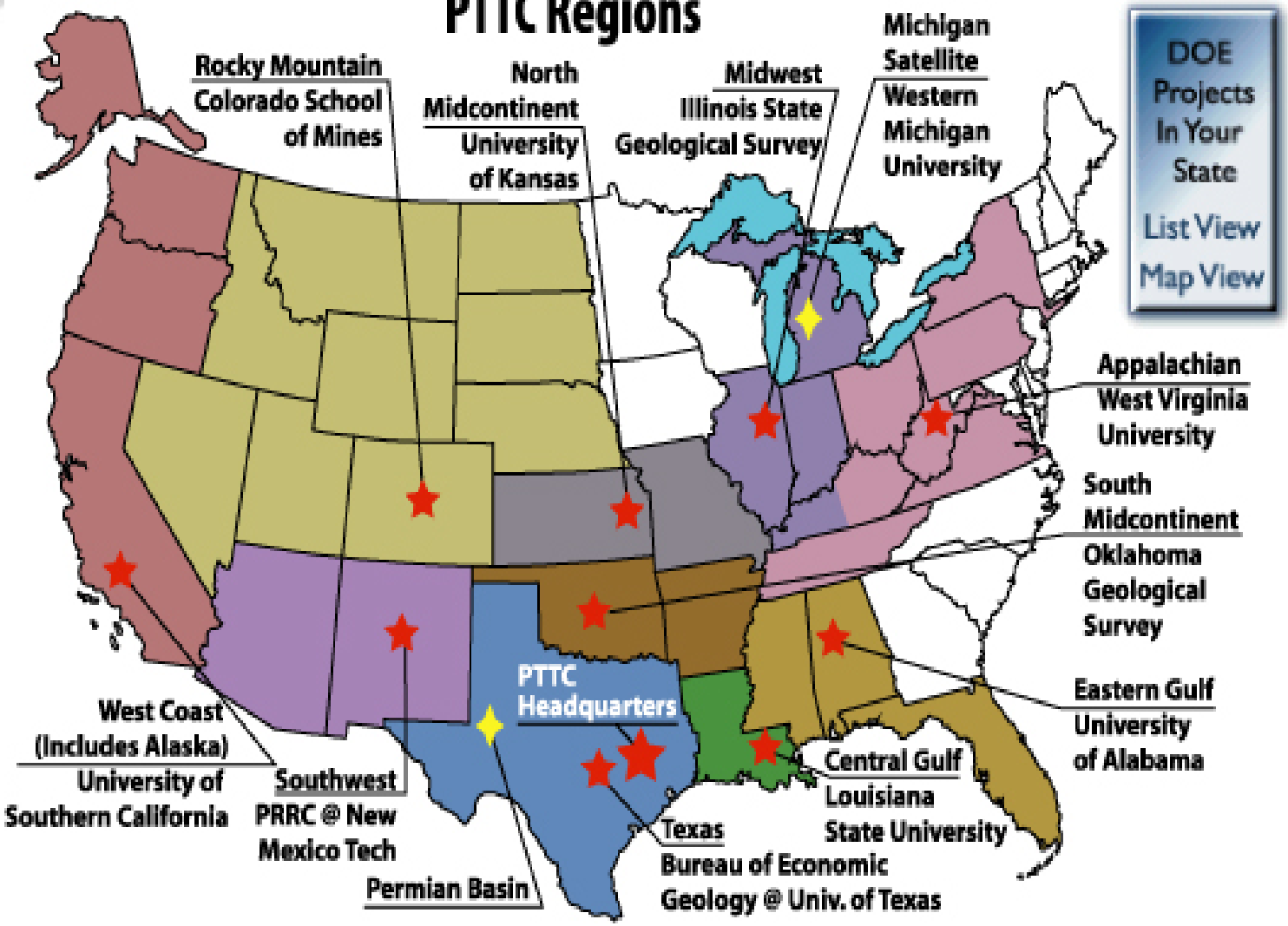
- Workshops
- Written Case Studies
- Newsletters, Technical Articles
- Web Network
- Regional Resource Centers

Who Makes Up the Organization?

- National Board of Directors
- Regional Lead Organizations (RLO)
- Producer Advisory Groups (PAG)
- National Headquarters Staff

PTTC
TECHNOLOGY | CONNECTIONS

PTTC Regions



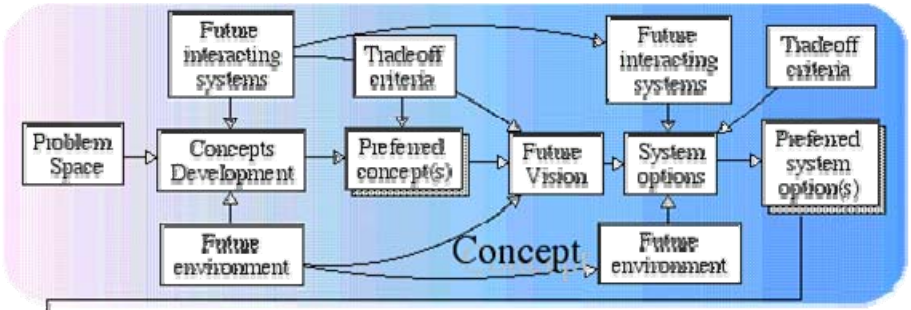
How is the Program Funded?

- Federal
- State
- Industry

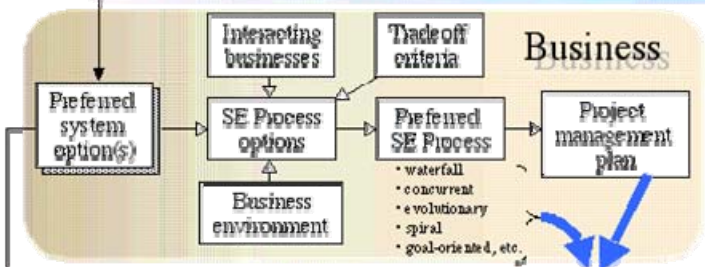
MICROHOLE TECHNOLOGIES

Systems Engineering: The MHT Program Approach

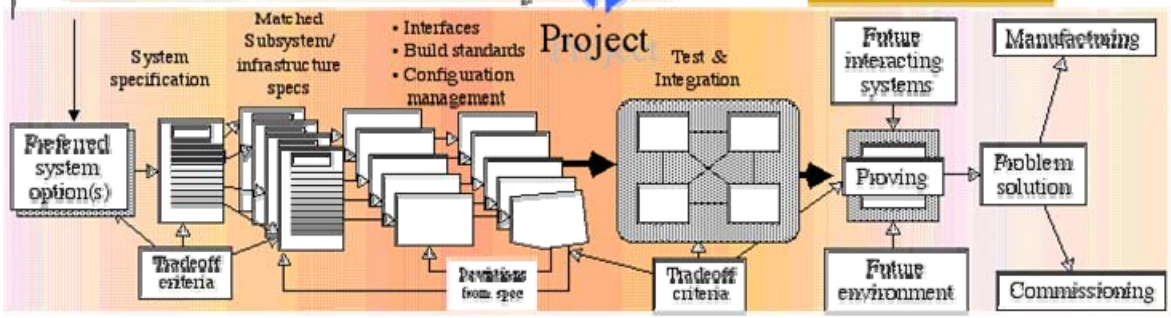
"~ the art and science of creating optimal system solutions to complex issues and problems" - Prof. Derek Hitchens



R&D – Organizing The Knowledge Pool



Business Unit – Risk-Averse Real World

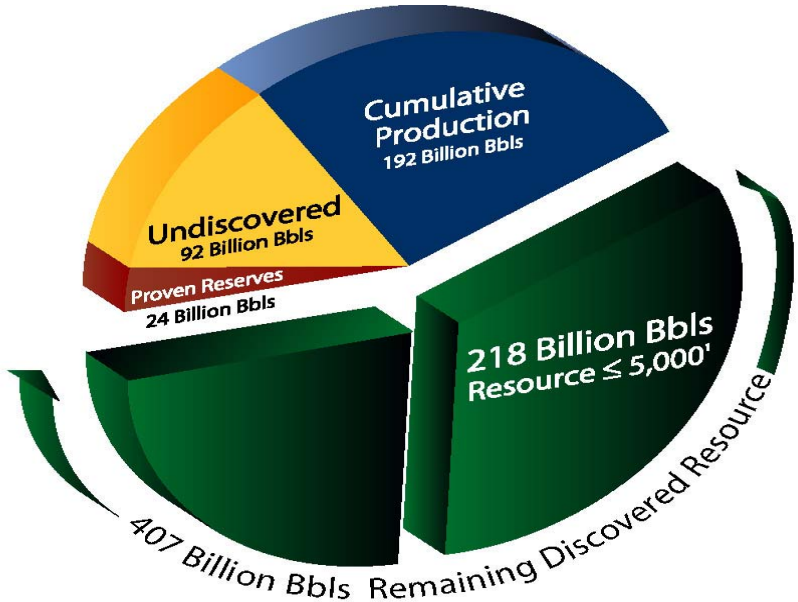


Tomorrow's "Game Changing" Venture

"Systems engineering requires a clear, singular mission and goal"

Diagram and quotes from Prof. Hitchens Website at http://www.hitchins.net

MHT Program “Singular Goal”: Greater Mature Domestic Oil Resource Recovery



- **407 Billion Barrels not economically recoverable with current technology**
- **218 Billion Barrels from shallow development alone**
  - **Conservative recovery estimate = 10 years of OPEC imports offset**

Source: EIA, 1997; USGS, 1995; IPAA, 1998; Intek, Inc., 1998

MHT Program Focus Areas

Technologies to Support Business Models for:

Development of Shallow (≤5000’), Lower Volume Oil and Gas Resources

Hole Size: Drill out of 4 ½ Tubulars

Longer term: Reduced Risk Exploration with Low Environmental Impact for Greater Access

MHT Awards
(See: www.microtech.thepttc.org)

Applicant	Technology
Stolar Research Corp.	Radar Guidance System
Gas Producton Specialties	Artificial Lift System
Baker Hughes Inteq	Smart Steering System (LWD)
Bandera Petroleum	Zero Discharge Mud System
Schlumberger	Hybrid Coiled Tubing Drlg. Rig
Western Well Tool	Microhole Drilling Tractor
Geoprober	Deepwater Demo
GTI	Onshore Demo
GTI	Zero Torque Drill Motor
Tempress	Waterjet Drilling System
CTES	CT Vibrator
Technology Int.	Turbodrill
Ultima Labs	MWD/LWD Comm. Sub
Baker Hughes Inteq	Comm. Sub
Confluent Filtration	Monobore
Confluent Filtration	Expanding Screen

Microhole vs Slimhole: A Technical Comparison

Microhole

Hole Size
- Exit 4-1/2” casing
  - 4-1/8” or 3-3/4”
  - 2-3/4” Sidetrack

Rig: Hybrid CT
- Instrumentation CT

Weaknesses
- CTD Rig cost
- Shallow (5-7,000’) use to date
- Limited small motor

Strengths
- Small Hole = LCost
- Lower Cost = LRist
- Smaller Footprint

Slimhole

Hole Size
- 90% of hole < 7”
  - Any ~6” Prod. Int. Typically

Rig: Rotary
- Special Rotary: SHADS

Weaknesses
- Kick tolerance
- Variable economics over conventional
- Industry Paradigms

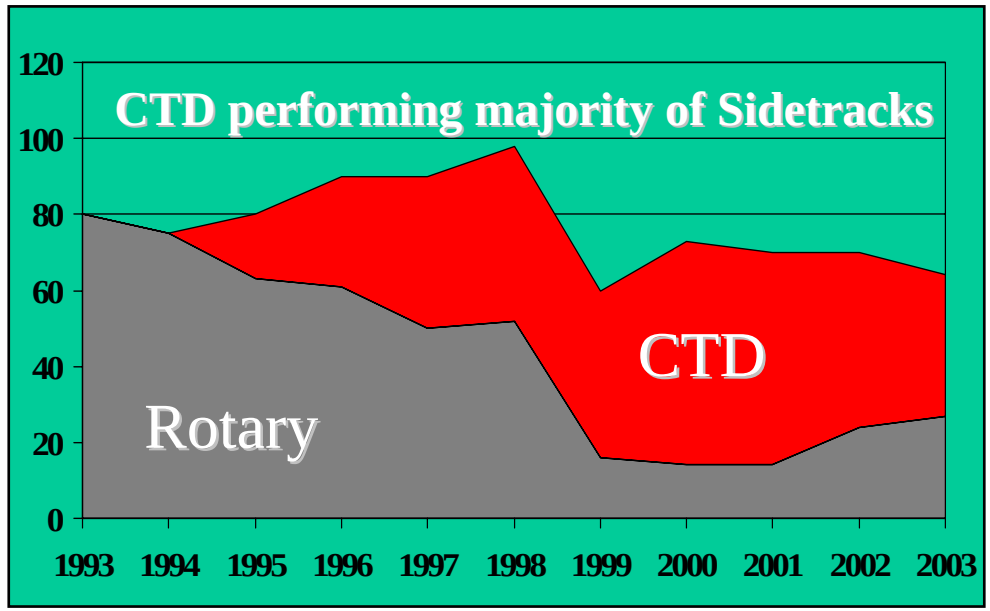
Strengths
- Small Hole = Lower Cost
- Lower Cost = Lower Risk
- Smaller Footprint

FIELD EXAMPLES

CTD In Alaska

Metrics:

- $1.5MM per well average
- ~2 weeks/well, 400'/day
- $3-4/Bbl currently
- 30% lower cost than equivalent rotary sidetrack



AK Milestones / Achievements:

- Technology initiated in 1992
- Over 500 wells drilled to date
  - ~270MM bbls Ad Rec
  - ~50% unrecoverable by Rotary
  - ~$2/Bbl historical cost

  400 sidetracks through/below 4 ½" tubing (3.75" bit)
  100 sidetracks through/below 3 ½" tubing (2.75" bit)
- Alaska record horizontal lengths: 3124' (3.75"), 2687'md (2.75")
- World record CTD depth at Niakuk field in 2004 (17515'md)
- 25k BOPD incremental/year
- Share technology worldwide (resurgence due to recent successes)

MOJ 8/9/05

The Basic CTD Sidetrack

Parent - 4 ½" production tubing, 7" liner

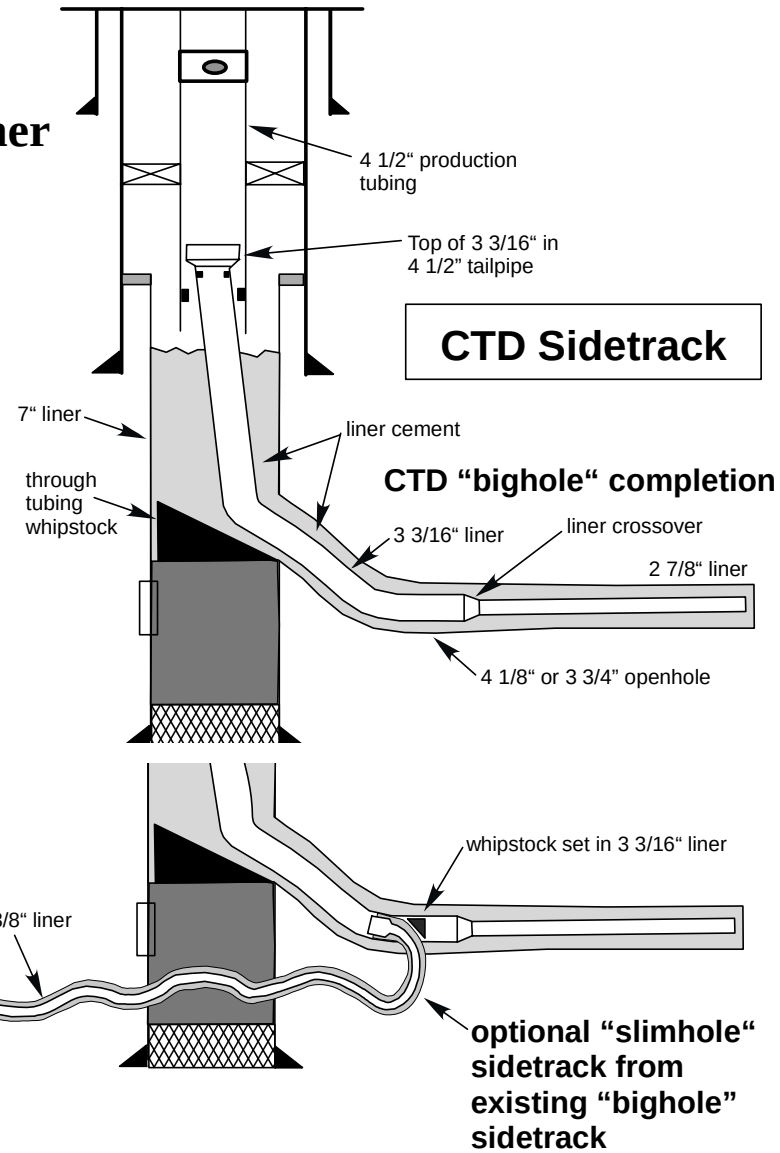
<u>Pre rig</u>

- Set 4 ½" x 7" whipstock
- Squeeze cement to abandon perfs

<u>CTD</u>

- Mill window
- Drill - 3 3/4" or 4 1/8" bicenter
  - 45° DLS common
  - Xanthan drilling fluid
- Run 3 3/16" x 2 7/8" liner & cmt
- Log CNL & Perforate

2 ¾" slimhole option increases candidates



MOJ 7/8/05

Key Factors for CTD Success

1) Cost savings potential and/or need UBD

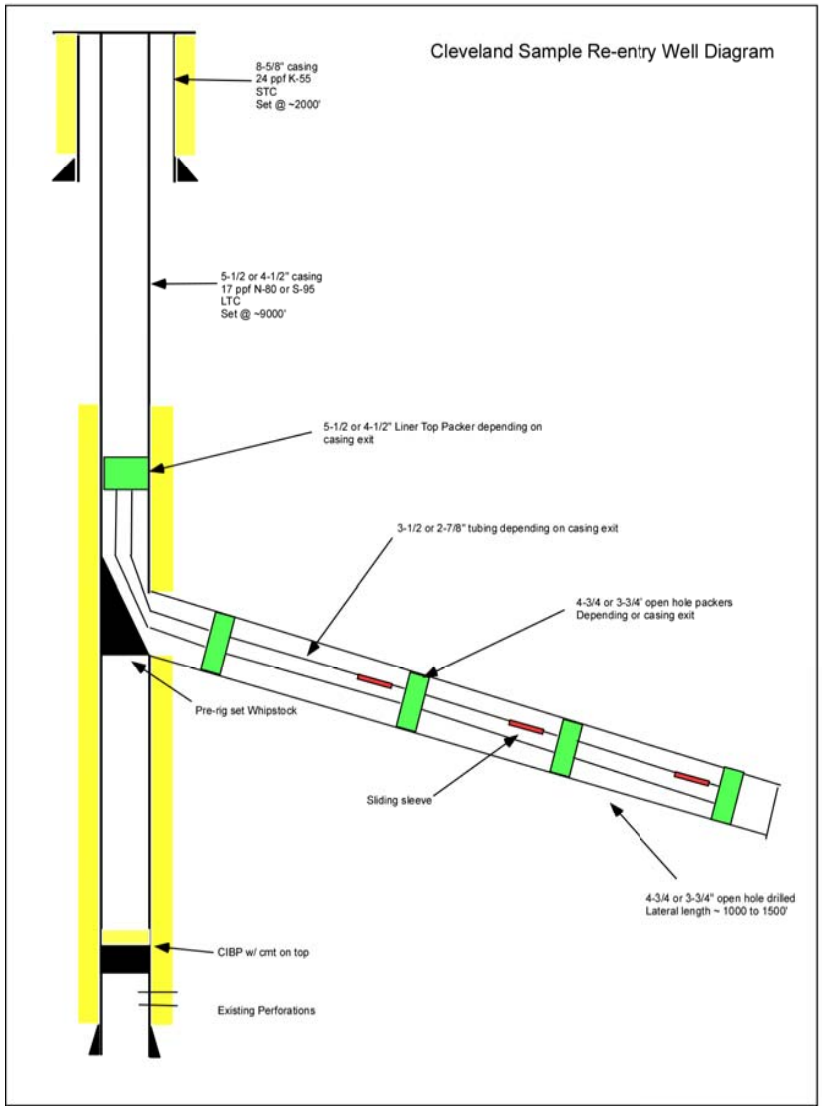
2) Relatively stable formation

3) Use proven tools

4) Multi-well campaign

5) Management commitment

Cleveland Re-Entry CTD Project



Scope of Project:

The Coil Tubing Drilling (CTD) Pilot strategic intent is to provide a low cost option for re-developing mature gas fields by utilizing existing wellbores for horizontal sidetracks. We will use wells slated to be P & A or marginal producers and drill 1500+' horizontals in the Cleveland formation.

The pilot program is 10 horizontal sidetracks at projected cost of $0.89 to $1.08m with an average of $.98m. Dry hole ~.$56m

The initial production expectations are 1.5+ mcf/d and reserves of 1.50+ bcf

Completions:

The wells will be hydraulically fractured using methods currently being employed with the ongoing horizontal well re-development program in the Cleveland that enables pin point fracs.

Goals:

Reduction of cost compared to grassroots wells by 40+%

With a successful program help expand CTD application throughout the NAG SPU (thousands of potential opportunities).

Target Start Date: August 2005 IN PROGRESS

Advanced Drilling Technology Inc. Rig

- 5000 Foot Depth Capacity
- 1 Inch thru 3 ½ Inch CT
- Zero Mud Discharge
- Over 140 Wells in Colorado and Kansas

Blast Energy Services Rig

- **Abrasive Jet Milling & Drilling**
- **8500 Feet Capacity with 1 Inch**
- **Long Reach Perforations**
- **Looking for Field Trials**

Environmental Drivers for Microhole Technologies

Rocky Mountain E&P Technology Currently Used

State-of-Art Rigs - - - 50+ Year Old Environmental Footprint

Extended Reach Drilling (ERD) - Drilling 15 to 20 mile lateral wells (current 7 mile technical limit

Lightweight drillpipe, floating drillpipe, and rotary-steerable tools that reduce hole friction and greatly increase drilling distances.

More efficient rigs

Lightweight, gasified and hollow sphere drilling fluids that improve hole cleaning and reduce lost circulation problems.

Expandable casing that will greatly reduce the casing size and casing weight.

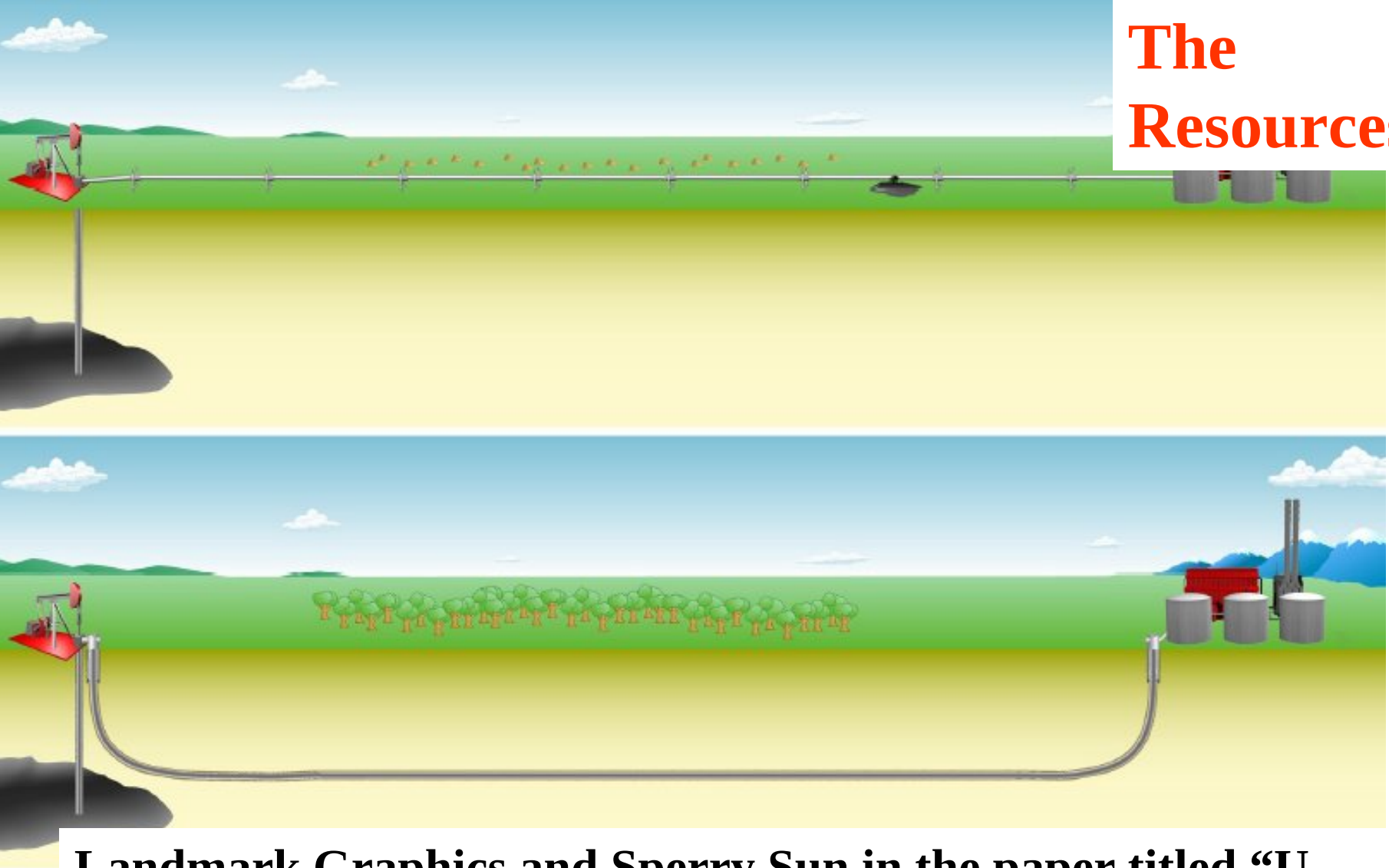
Systems that allow drilling with casing.

Retractable bits and motors that eliminate trips.

Dual-gradient drilling systems that reduce bottomhole pressures.

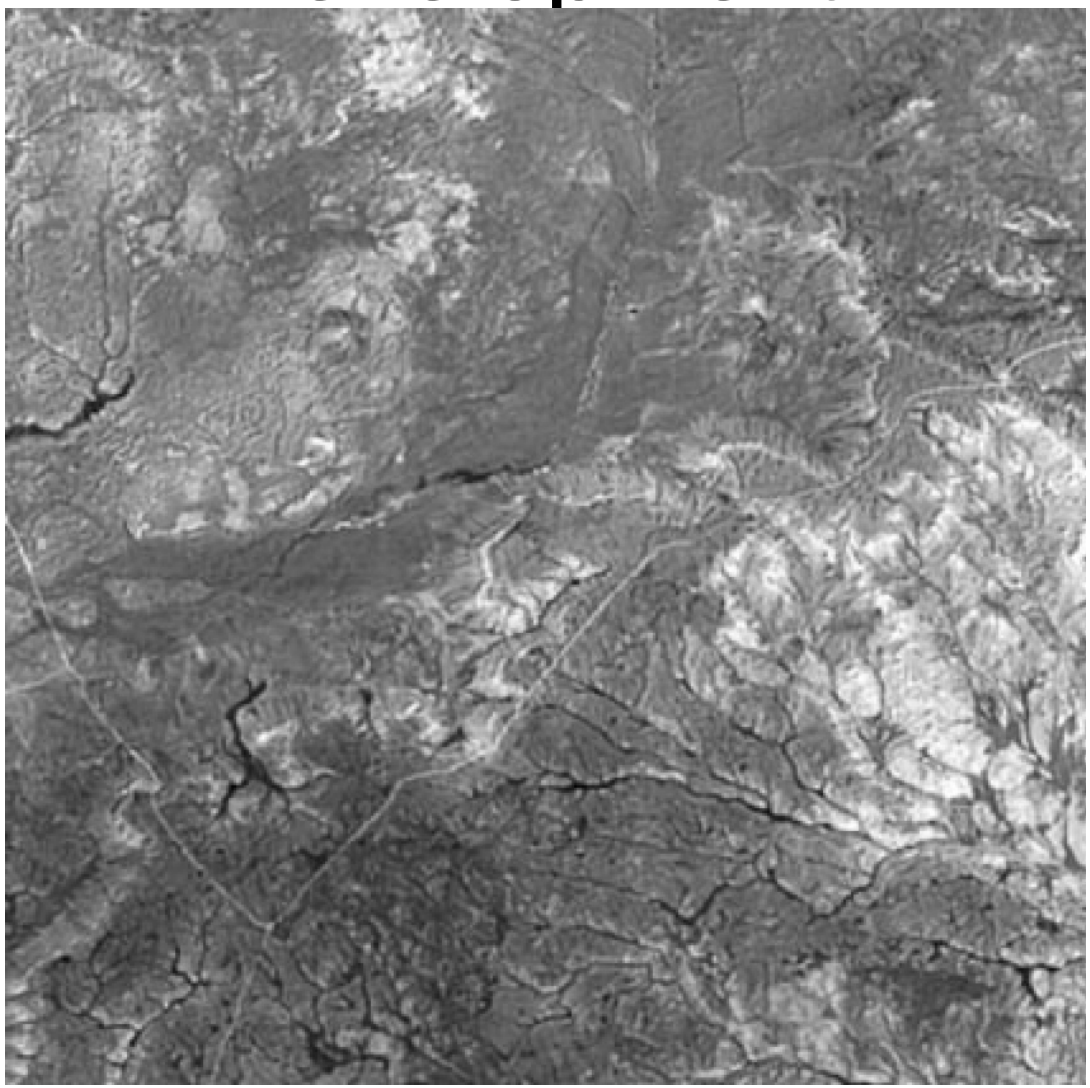
Long life bits that drill long distances and eliminate trips.

The Resources

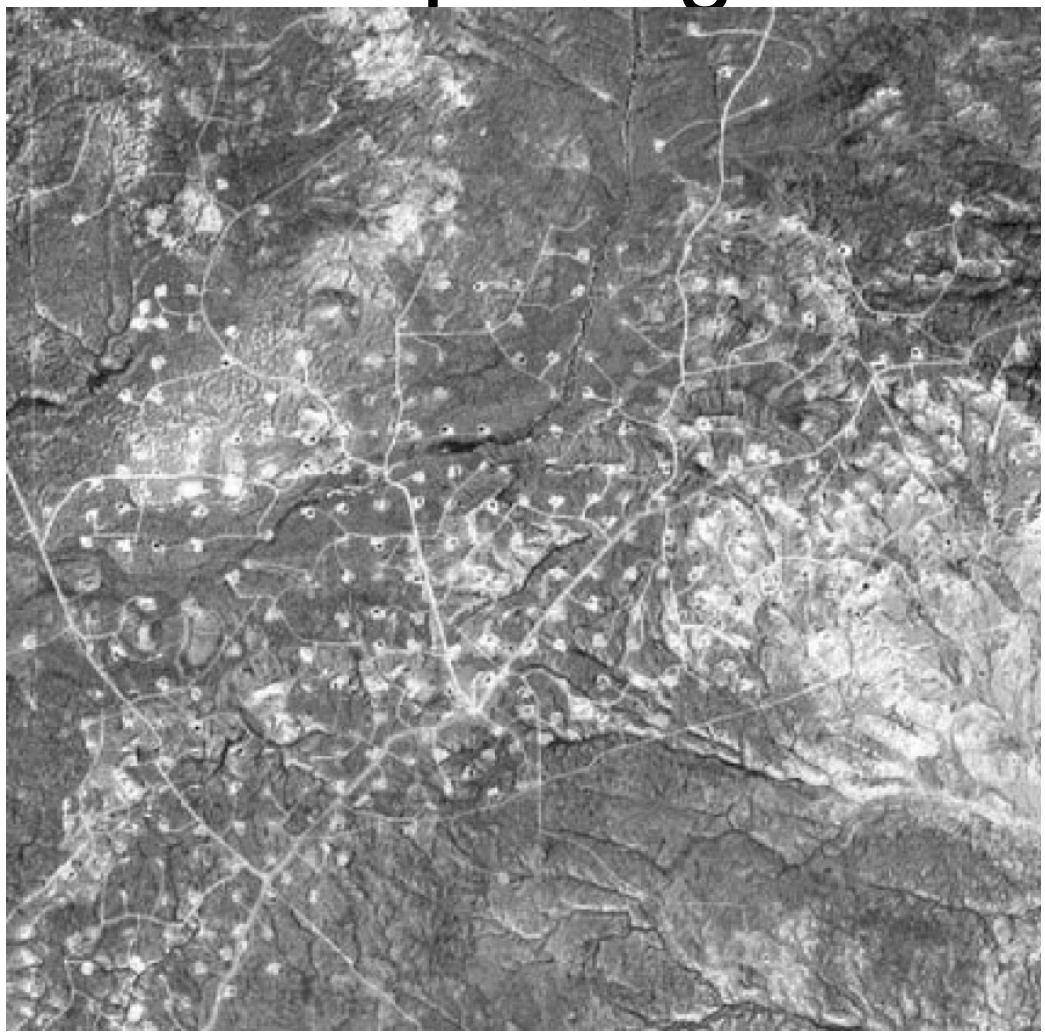


Landmark Graphics and Sperry Sun in the paper titled “U Tube Wells; Connecting horizontal wells End to End Case Study: Installation and Construction of the World’s First U Tube Well”

Jonah Field: 1986, Prior to Development



Jonah Field: 2002, 40 Acre Spacing



Currently More than 400 Wells

Application for 20 Acre Spacing > 850 New Wells

Objectives of Proposed Program

(1) To incorporate current and emerging technologies into a clean drilling system with no or very limited environmental impact

(2) To demonstrate a viable drilling system used for the exploration and exploitation of oil & natural gas primarily in the lower 48 states (DOE proposal),

(3) To create a team of industry academic and government partners with the knowledge to apply the best drilling systems for use in ecologically sensitive areas, with an understanding of the benefit to the environment.

A New A&M Program: Integrated Systems for Environmentally Safe Drilling Practices

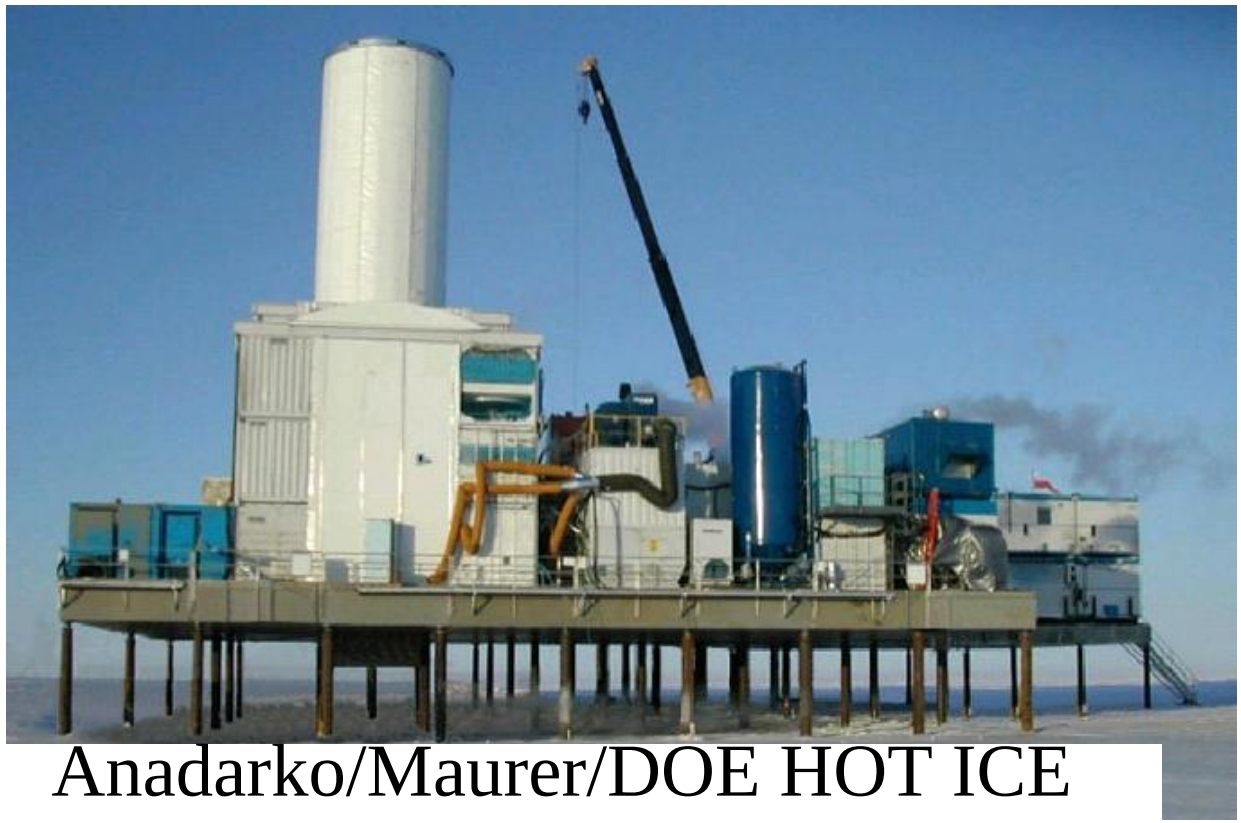
New technology can be adapted to oil and Gas E&P operations. Emissions to air and water and the impact on land forms could be reduced by more than 90% with

- *the implementation of new methods of transporting goods and materials through natural terrain.*
- *New drilling platforms & New drilling practices*
- *New multiphase fluid transport practices*
- *New remediation practices*

The Resources

Hybrid coiled-tubing drilling rig (courtesy of DOE and Tom Gipson – New Force Energy Services, Inc

Platform Drilling



Anadarko/Maurer/DOE HOT ICE well utilizing the Platform on the North Slope in 2003

Thank You

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