Hyperdrill Summary Presentation

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IADC
GE-Baker Hughes
Houston Texas

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RENEWABLE ENERGY IS INTERMITTENT. It is also expensive.
TRAFFIC IS BAD.

TUNNELING IS SLOW, EXPENSIVE & DANGEROUS.
CONVENTIONAL DRILLING IS SLOW & EXPENSIVE.

BOTTLENECKS
1.) DRILLING
2.) COMPLETIONS
Focusing energy develops new oceans in TRANSPORTATION, ENERGY & NEW MATERIALS PRODUCTION
Packetized, Focused Energy. Intelligent Acoustics.

AEROSPACE & Mat Science
3+ km/s

Impact DRILLING
Conventional & Geothermal “Anywhere”
2 km/s (4500mph)

DIGITAL MINING
SAFE TUNNELING & PILING (1.5 km/s)
No Explosives
No rotation

HYPERCORE ™

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WE PUT HYPERVELOCITY TO WORK.

Simple Chemical Energy $\rightarrow$ Kinetic Energy $\rightarrow$ Work

Industrial. Scalable.

Hyper-projectile technologies.
Industry / Market Problems:
Low commodity prices. Hard rock.

Deep & expensive resources.

Market priority: Efficiency & Cost

Underground Mining

Energy Drilling

Infrastructure

Tunneling
Short Movie

See Video at: www.HyperSciences.com
Industry / Market Problems:
Low commodity prices. Hard rock.

Deep & expensive resources.

Market priority: Efficiency & Cost

Materials Production (Mining & MatSci)

Energy Drilling

Infrastructure

Tunneling
A New Engine. High Impact Platform Technology

Breaking thru Rock with the Power of HyperVelocity

HyperCore™

Piling  Mining  Energy Drilling  Tunneling

New Materials (Abrasives & Super Conductors)
“GAS-POWERED RAILGUNS”
TUNNELING, PILING, DRILLING DEEP GEOTHERMAL, MATERIAL SCIENCE
HOW: Focused Energy: Short, Extreme Pressure Impacts

Generate pressures that are order of magnitude greater than rock strength

10-100x rock strength = New way to break rock

World’s fastest commercial projectile technology: Mach 4.5+
Rock Breaking Efficiency: Hydro-Elastic Impact

Short-Impact Pressure 10 – 100 x material strength
The Physics of Hyper Impact

- **Energy:** \( E = \frac{1}{2} MV^2 \) (Joules)
  
  \(~1\text{MJ}: 700\text{ grams @ 1650m/s}\)

- **Power:** \( P = \frac{E}{dt} \) (Watt)
  
  \(~350\text{ MW (.003 sec)}\)

- **Impact Pressure** = \( \frac{1}{2} \rho V^2 \) (Pa) [psi]
  
  \(~4000\text{ MPa}\)
  
  \(~500\text{ Tonne-Force}\)

- **Break Rock:**
  
  Variable: Mass, Velocity
  
  5X-10X Faster, 30-80% lower cost
Pile Driving & Foundations

• 10 X Faster Pile Driving / Foundations
TUNNEL 5X FASTER.
30% LOWER COST.

DRILL 10X FASTER & DEEPER.
EXTREME LOW COST

PROVEN with SHELL.
HOW: Hydro-Impact Projectile
Near-Surface impact  Mach 6 (2 km/s)
HYPERDRILL™ ENABLES ENERGY ANYWHERE™

Our Patent-Pending Silicon TEG Plant is Moore’s Law for Geothermal.

- NEW ENERGY
- $2.5M / MW INSTALLED
- $.05 / KW-HOUR

PLANT SIMPLY SCALES

Our Geothermal and HyperDrill™ technologies were sponsored & funded in-part with Shell Game Changers™ Program
COMMERICALIZATION PATH:

Hyper-Drilling and Tunneling

2017
Tunneling & Piling-Conductor Casing

2018
HyperDrill™ Field Trials

2020
Energy Anywhere™ Geothermal
Market priority: Efficiency & Cost
• Low commodity prices. Hard rock.
• Deep & expensive resources.

HyperSciences Solution:
• Mature industrial-aerospace technology.
• \( V^2 \) Power of extreme velocity to break and pulverize rock
• Radically changes the economics of breaking & Pulverizing Rock.
HyperDrill™: Quantum Leap in Depth, Time & Cost.

Phase 2
Test Data

Hole Depth (ft.)

Rate of Penetration [ft/hr]

Patented & Patents Pending

3-10x ROP

Carthage Marble
Colton Sandstone
Mancos Shale

Conventional Drilling
TerraTek

AHD - Aug. HYPERDRILL™
3-5X with Rotation

PURE HYPERDRILL™
10X, No Rotation

Hyper-Performance Zone

Proven.
Augmented HyperDrill™: Guaranteed performance

Key Advantages:

• Lower Bit Count & Trips
• Save up to 50% Rig Days/Cost
• Complete compatibility
• Fast!

Key Use Cases:

• Chirt & Variable rock
• Deep
• Hard Rock
PURE HyperDrill™ = No rotation required! 10X+ ROP

Key Advantages:

*Hyper-projectile does all the work*

- Eliminate Bit Count & Trips
- MonoBore to TD if desired
- Save 80% Rig Days/Cost
- Rig compatibility
- Steerable

Key Use Cases:

- Granite/Basalt
- Chirt & Variable rock
- Deep
- Hard Rock
- Geothermal

Patented & Patents Pending
HyperDrill™ Technology Unlocks Deep Energy

- Shell Game Changer
  - 2.5 yr Funded

- Proven Technology
  - High Pressure Demo Tests
  - 100’s tunneling field tests

- Independent econ analysis:
  - $15.5 Billion dollar value in drilling
  - $100’s M + annual revenues

- Field trials now -> 12 months
  - Steerable. 3-10x ROP

Patented & Patents Pending
Aug. HyperDrill Technology Overview

**Driver Tech**

Diesel/air HyperCore is integrated in the BHA, Similar propellants as diesel engine

**Driven Tech**

Composite projectile is designed for high density to maximize dynamic pressure but will erode at impact.

**Performance**

Projectile impact creates crater, weakens rock, and creates fractures, improving ROP by 5-10x especially in hard rock and high pressure conditions
Minimum Viable Product Downhole Tool Design

Tool Features:

• 3-5x ROP Improvement

• Drop-in compatible with existing drilling technology

• Augmented HyperDrill – HyperCore gun integrated into rotating drill bit

• BHA features
  • Bent sub steering to 15 deg/100 ft
O&G Drill a Well on Paper Summary: $1- $4M per well net saved w/ Aug HyperDrill

- Europe: **$4.6MM (38%)** of Combined Sections Drilling Costs) per well net savings to operator
  - Expected 10-12 well program = $50MM savings
- Oman: **$1.35MM (47%)** of Combined Section Drilling Costs) per well net savings to operator
  - Expected 60-100 well program = $105MM savings
- Performed economic analysis for another Major IOC company – confirms our results.
**Shell Contract / Path**

- **Drill horizontal hole**
- Commission prototype at MineLab silver mine (N. Idaho)
- **Simulate drilling at depth**
  - Conduct test shots using stressed rock targets (simulated pressure environment) - SWRI
- **System integration**
  - Evaluate solutions for HSSE, blowout prevention, cuttings removal, cementing, casing, etc.

<table>
<thead>
<tr>
<th>PHASE 1</th>
<th>PHASE 2</th>
<th>PHASE 3</th>
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<tr>
<td>“Feas. Study: Drill Hole On Paper” report (DWOP)</td>
<td>Drill actual hole based on Phase 1 findings</td>
<td>Down-hole MVP tool design. OG&amp;Geo DWOP</td>
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- **Define MVP (Min. Viable Product)**
- Down-hole tool & Drill well on paper exercises to support Series A due diligence (September 2016)
  - Oil & Gas Engineered Geothermal – **New Energy Opportunities**
Proof Points

**Hypervelocity Testing**

Thousands of hypervelocity experiments completed by HSI team.

Bore sizes: 0.5”, 1.5”, 4”

Most experiments done in 1.5-2.7 km/s range

**Rock Impact Testing**

Hundreds of tests done in rock types of interest at downhole conditions (saturated samples under confining pressures > 3000 psi)

**Model Correlation**

Hydrocode models predict penetration characteristics and have been calibrated by Shell experiments. ROP proof.
There are three zones in the hole bottom post-shot:
1. Intact rock
2. High porosity (weakened) rock
3. Crater
Seeking **JIP Partners & Series A investment**

Non-equity Joint Industry Project Partners  
$250k minimum, applied as project specific

- HyperDrill Field Trials ($2.5-3 M, 3 phases)  
  - **Phase 1:** $450k phase w/ Matched $450k 4.5” Hole  
  - **Phase 2:** $1.25 M 8-12” Hole  
  - **Phase 3:** $500k 8-12” at 2000 ft section field trials

**Disruptive Innovation**  
Paradigm shift: Pulverize hard rock. New Materials

**Multiple Industries**  
Drilling, Civil Tunneling, Mining, Material Science, Aerospace

**$ Billion Markets**  
TAM estimated at over $5 billion/year
O&G Drill a Well on Paper Summary: $1- $4M per well net saved w/ HyperDrill

• Shell Project 1: > **$4 MM**
  • *(38% of Combined Sections Drilling Costs)* per well net savings to operator

• Shell Project 2: > **$1.5MM**
  • *(47% of Combined Section Drilling Costs)* per well net savings to operator

• Performed economic analysis for another Major IOC company – confirms our results.
HyperDrill™ Summary

• Technology basis mature and demonstrated

• MVP design complete & vetted by Shell and another Major
  • No Technical show stoppers
  • Risks identified and plan to test/mitigate identified
  • Series A ask focused on proof well demo

• DWOP Oil & Gas shows game Changing economics for operator
  • Europe: $4.6MM (38% of Combined Sections Drilling Costs) per well net savings to operator
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  • Expected 60-100 well program = $105MM savings

• Large opportunity Deep / Hard Rock
  • $15 bn (10 year)
Value: $15+ Billion
• 981m interval
• 6 bits
  • 4 PDC
  • 2 Impregs
• ROP = 3.2 m/hr
  • ~300 drilling hours
• ~18 days drilling + tripping
• UCS 35 – 65 ksi
• Temp 320 – 356°F
• MW = 14.1 – 14.4 ppg (OBM)
• Data provided by Shell via Email
  • K5 Bit Record
DWOP Oman 8-3/8” Hole Section
HyperDrill 3-5x improvement

Cost Savings Per Section of Conventional Drilling AFE

1x ROP = 3.2 m/hr
981 m section

3.5x ROP Factor
Savings = $992,000, 48%

HyperDrill™ 8-1500-S
1500m/s
3”, 27 gram darts
0.7” ID Barrel
Steering
Nominal Net Savings: $992,000
Minimum Net Savings: $625,000 (ROP Factor Variation)
Maximum Net Savings: $1,200,000 (ROP Factor Variation)
Summary: Slower conventional drilling and higher HD Performance = higher potential HyperDrill savings
DWOP Oman  HyperDrill™ improvement
8.375” Gross Savings - $1,400,000 - $2,140,000 /section

**Summary:** Slower conventional drilling = higher potential HyperDrill savings

Nominal Gross Savings: $1,615,000
Minimum Gross Savings: $1,430,000 (Rotary ROP Variation)
Maximum Gross Savings: $2,140,000 (Rotary ROP Variation)

No savings from increasing gun hours – already finish hole in < 133 hours
Net Savings Range for 8.375” Section

Nominal Savings = $992,000

Stacked worst case scenarios

Net Savings Range for 8.375” Section – Net Savings, Nearly Every Scenario
DWOP Oman  HyperDrill™ improvement
Days vs. Depth Europe – days saved

HD Days Saved
(12.25” + 8.375”)

HD Days Saved
(8.5” Section Only)
Commercialization Path – All Use HyperCore™ Engine inside

JIP’s Joint Industry Projects / SERIES A

HyperDrill JIPs and Hyper Tunneling
Both with same HyperCore™

2017-2018

2018-2020

2020-2023

HyperDrill™ Field trials

• Hard rock drilling
• Oil & Gas
• Geothermal
• Access enabler
• Mature product
• Reliability will be key

HyperCore™ Engine

• Mature Technology
• Integrated Solution
• Revenue
• Baseload Power

Energy Anywhere Geothermal

Patented & Patents Pending

• Large scale facility
• Fully integrated
• Cost savings
• NPV/IRR increase
• Faster access
HTBM™: Hyper Tunnel Boring and Mining
HyperDrill and HTBM: 38mm HyperCore™

HyperDrill™ & Scalable Geothermal Power
Geothermal Anywhere™. HyperDrill AI™ continuous microseismic Fast Drilling, Intelligent Completions & Silicon TEG plant

COTS Thermal electric generators (TEG)

Temperature difference directly into electric power.

No complex turbines required

Moore’s Law for Geothermal
Geothermal Anywhere™. HyperDrill AI™ continuous microseismic
Fast Drilling, Intelligent Completions & Silicon TEG plant
HyperDrill™ Technology Unlocks Deep Energy

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• Proven Technology
  High Pressure Demo Tests
  Fiber Optic Acoustic “Tomography”
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  Steerable

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- MVP design complete & vetted by Shell and another Major
  - No Technical show stoppers
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  - Series A ask focused on proof well demo
- DWOP Oil & Gas shows game changing economics for operator
- Large opportunity Deep / Hard Rock
- JOIN OUR JOINT INDUSTRY PROJECT
OUR TEAM:

Funded, Built several $16-$100M Oil, Gas, Mining & Tech Companies. With exits.

Mark Russell - CEO/Founder
Stanford University - MS Aero/Astro Engineering
Lead Engineer Blue Origin, Boeing, Intel, Kistler Aerospace, Russell Mining, St, Augustine Gold and Copper, Deepest DD coring

Dr. Carl Knowlton - Ram Accelerator
Inventor/Adviser
BS, MS, PhD Univ. of Washington
Professor, Univ. of Washington. Director of RAMAC/BTRA laboratory at UW.

Mike McSherry - Director
B.A., Economics/Int'l Business, William & Mary
CEO SWYPE, Entrepreneur in Residence m Providence Health. Arriva Mobile, Boost Mobile

Chuck Russell - Director, Avionics/Controls
Carroll College, Engineering. avionics/controls, Ram automation. Mining. RRPM Mining. Gen. Moly

Hossam Elbadawy - Houston Lead:
Advisor, Bus. Dev. /Tech
Northwestern University - Kellogg School mgt. MBA & Men BS Mech. Ain Shams Univ.
CEO Terrel, LimeRock Partners, VP Mfg Schlumberger.

Hani Elshahawi - Shell Game
Changer Sponsor
Formation Testing and Sampling Principal Technical expert. Shell, Schlumberger
DISRUPTIVE INNOVATION
MULTIPLE INDUSTRIES
BILLION $ MARKETS

TECHNOLOGY DEMONSTRATION PLAN:
• MICRO-PILING
• HYPER TUNNELING
• HYPERDRILL TRIALS
• CUSTOMER ACQUISITION / PARTNERSHIPS
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