

Innovating Our Way to Closure: Emerging and Digital Technologies for Efficient Reclamation of Legacy Oil and Gas Sites

Presenters

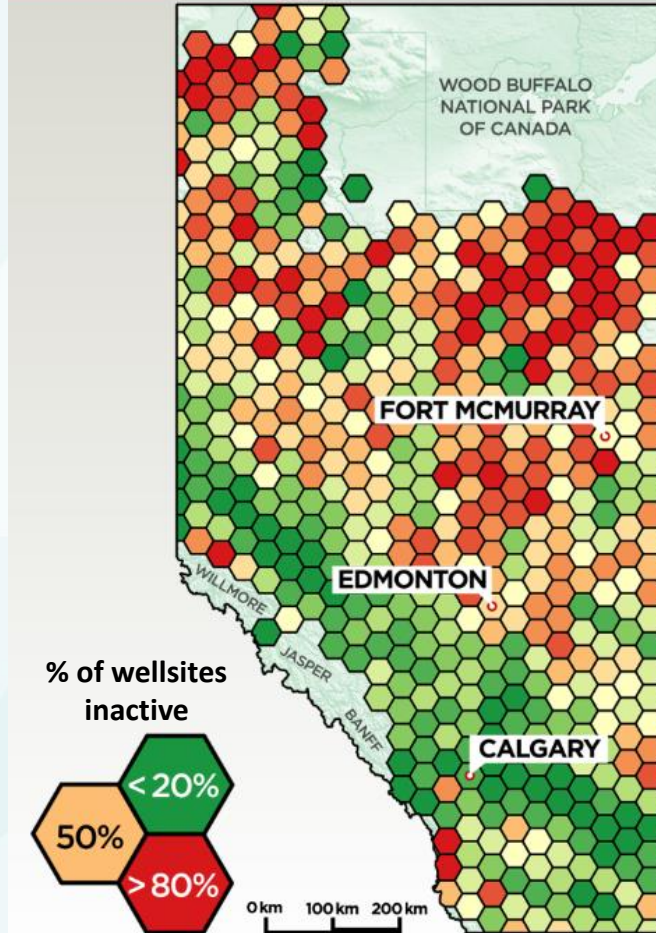
InnoTech Alberta - Simone Levy

Menome Technologies Inc. – Mike Morley

Key Issues

- ~165,000 wellsites pending reclamation
- Licensee liability rating challenges, increasing orphans
- Aging infrastructure
- 1.8M ha O&G footprint
 - Habitat fragmentation
 - Development constraints
- 925,000 tonnes of soil to landfill/year
- \$58.65B liability estimate per AER

Percent of oil and gas wells that are inactive



Points to Ponder

- What does our industry look like in 2030 and beyond?
 - Landscape
 - Oil and gas sector/WCSB
 - Health of service providers
- Where is Canada compared with the rest of the world in terms of technology adoption?
- Environmental and engineering sectors are moving rapidly to rely on digital and emerging technologies – e.g., NRCan, ‘Digital Oil and Gas’ initiatives

Identifying and validating potential opportunities

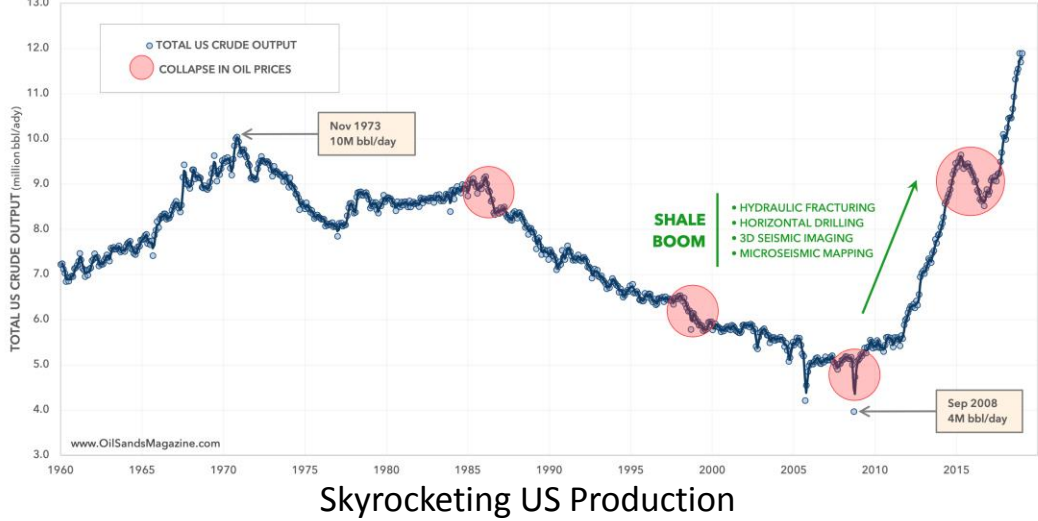
Technology or Process Improvement	Execution Impact	Industry Impact
Sensors and Remote Sensing	<ul style="list-style-type: none"> • Improve delineation and monitoring capabilities • Reduce site visits 	<ul style="list-style-type: none"> • Cost savings • Process streamlining • More sites addressed per \$
Digital Platforms	<ul style="list-style-type: none"> • More effective decision making • Support service providers • Reduce data silos • Focus on technical vs. repetitive tasks • Identify re-use opportunities to maximize existing investment – sites and equipment 	<ul style="list-style-type: none"> • Greater utilization of service providers -> lower rates • Enhanced collaboration • Creating opportunities through re-purposing
Leveraging AI/ML in Process	<ul style="list-style-type: none"> • Optimizing process/efficiency • Refine equipment capabilities • Manage big data 	<ul style="list-style-type: none"> • Process streamlining • Increased effectiveness
Optimizing soil and water treatment technologies	<ul style="list-style-type: none"> • Streamline selection and virtually establish success • Reduce volumes of soil disposed and associated GHG emissions • Shorten timelines and improve certainty of reaching closure 	<ul style="list-style-type: none"> • Increased sustainability • Cost reduction • Improved social license

CRIN Land Theme – Proposed Vision and Goals

Vision: *To leverage a network of forward-thinking individuals to accelerate land reclamation through technology and process innovation.*

Goals:

- Connect innovators and industry to find synergy and grow Alberta businesses.
- Collectively identify high priority challenges and address through strategic innovation, research and demonstration.
- Encourage ‘out of the box’ thinking to drive innovation, stretch \$, return land to productive use, or find alternative uses for disturbance.
- Make innovation and resulting tools more accessible to Alberta businesses.



Social License

Three Challenges



Environmental Concerns and Government Policies

Job Losses

Flight of Capital and Investment

Orphan/Inactive Wells

Q&A: \$80 oil would be a bonanza for many, but would it be bad for Calgary?

Lower energy prices are best way to encourage diversified economy, says former chamber president



Tony Seskus · CBC News · Posted: Dec 30, 2017 9:00 AM ET | Last Updated: December 30, 2017



<http://www.cbc.ca/news/business/legge-oil-diversification-1.4465820>

THE OPPORTUNITY

“People are doing great work in technology:

I'll be honest, the way to stay on this track, is to not let oil prices get back to \$80-\$100 a barrel.

As soon as that happens, **everybody's eye goes off the prize and we're back to the same old, same old.**”

WHY INNOVATE?

Technology Amplifies our Abilities

Ability to do more with less

New ways to solve problems

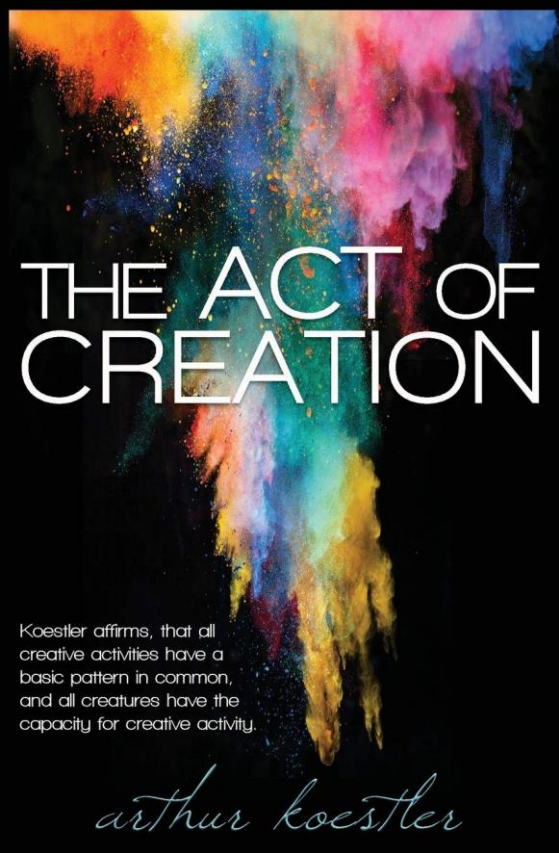
New capabilities that create new
opportunities



What we're doing is
building tools to amplify
a human ability.

**Apple is building a
'bicycle for the mind'.**

~ Steve Jobs



Incremental

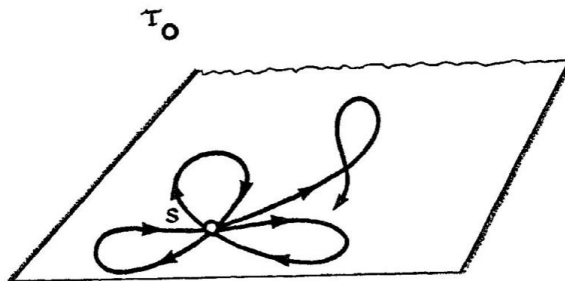
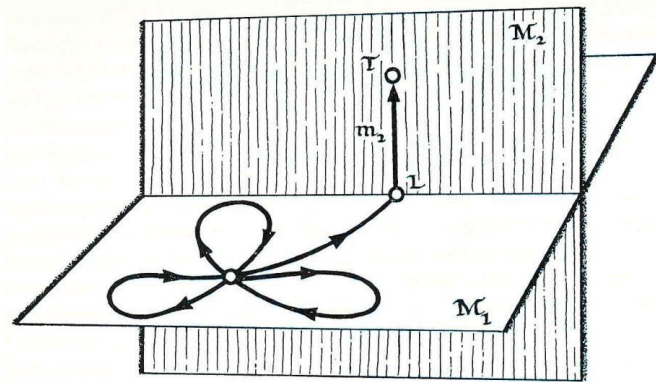


FIGURE 7

When life presents us with a problem, we start by exploring solutions based on solutions to similar problems in the past. This works as long as the conditions for the solution are still valid.

This does not work when the environment is changing rapidly as the rules of the game have changed.

Disruptive



Innovation takes place by combining ideas from known experience, with those outside the normal plane of experience.

Discovery takes place when the blinders of habit are removed.

1987

Road bike with
big tires

Trails:
Fire road
XC/Hiking

1986 Rockhopper
Hard Tail
CrMO frame
29-30 lbs
Bottom mount
U Brake



StumpJumper

Full double butted chromoly frameset • SunTour XC-9000 Index Control shifting system with combination brake/shift lever • Powerful new Deore-XT U-Brake • Competition geometry with 70° head angle, 73° seat angle and super short 17 inch chainstays • Competition pedals with durable nylon toe clips and straps • New Specialized Hardpack™ tires with lightweight GX-26 modular cross section rims • Custom built look with black anodized stem, bars and gray anodized Biopace chainrings and rims.

Feedback Loop

Challenge -> Innovation -> Opportunity

Challenges generate pain

Incremental Innovation addresses immediate pain

Disruptive innovation occurs when New capabilities open new unforeseen opportunities

Having an innovation mindset is the key key to surviving unforeseen challenges



2019

Improvements to suspension (lock outs, variable air chambers), frame geometry and carbon fiber wheels

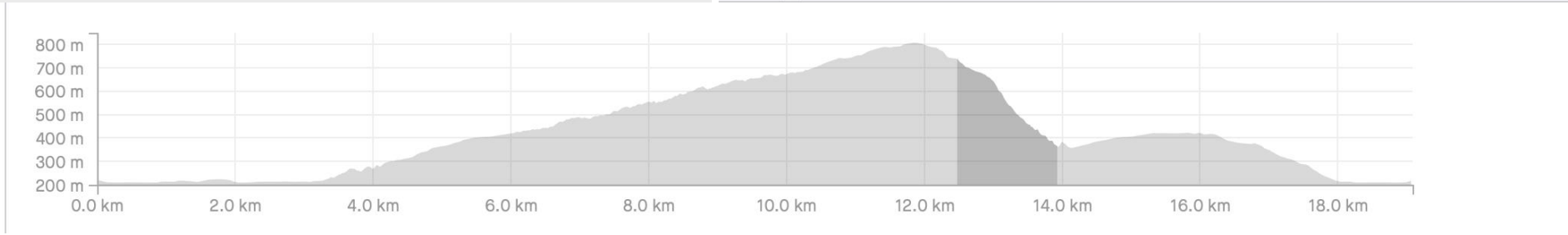
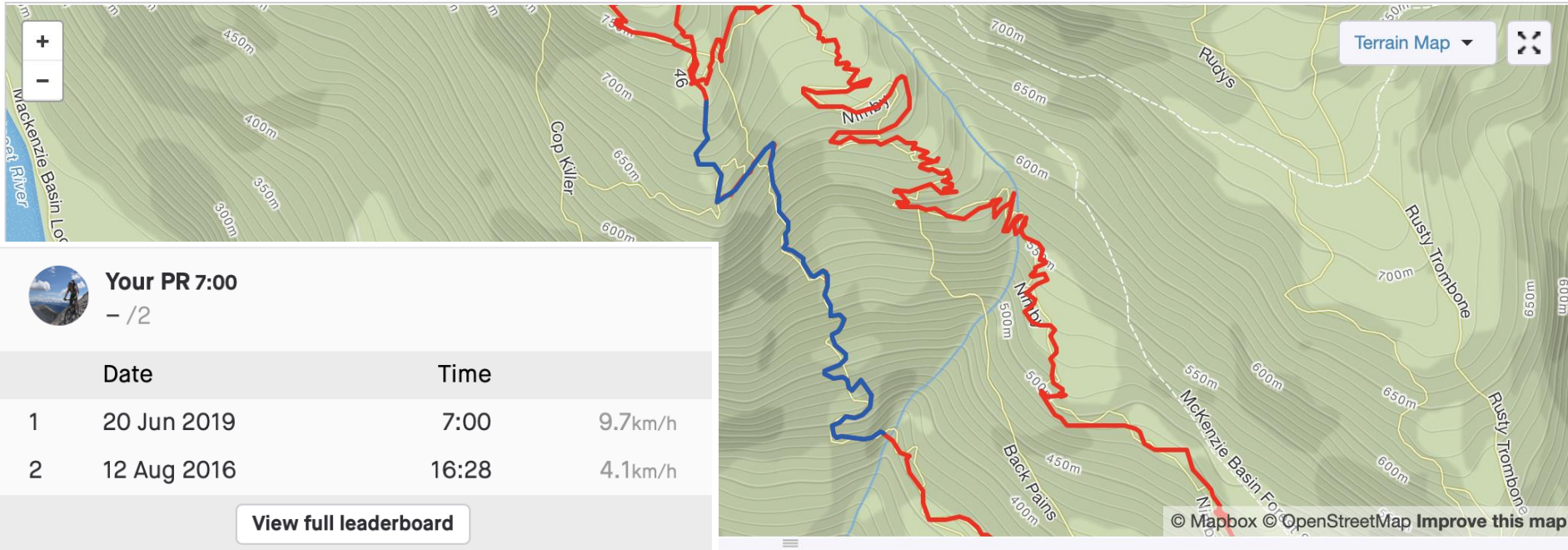
Trails:
we don't need trails!

2019 Santa Cruz Nomad
All carbon including rims

6" Front Fork
6" Rear
Carbon Fiber

29 lbs





52 – Fastest times on all downhill this year....Augmented Abilities through technology.

Whistler

In 2001 you could fire a cannon through the village

Lifts + Tail Building +
Mountain Bikes

=

An entire new industry
created by innovation...

Whistler now has more
visitors in the summer than
in the winter.



Whistler receives approximately 3 million overnight and non-overnight **visitors** each year (approximately 45 per cent in winter and 55 per cent in **summer**).

“There’s been the introduction of a new generation of data science.

We’ve seen a long list of technologies—for instance, robots, machine learning, artificial intelligence, new sensors—that are assisting the transition to greater digitization in the oil and gas business. The result has been a step change with increased computing power, connectivity and logistics.

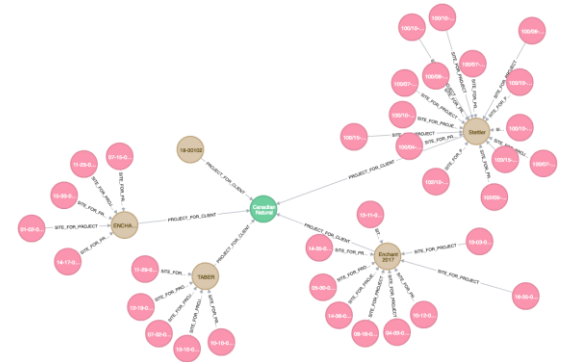
These applications are driving greater efficiencies that reduce costs and environmental impacts.”



Energy economist Peter Tertzakian. P

Innovation Trends in Canadian Oil and Gas: Peter Tertzakian

Economist, energy consultant and author discusses disruptive innovations transforming oil and gas for the future



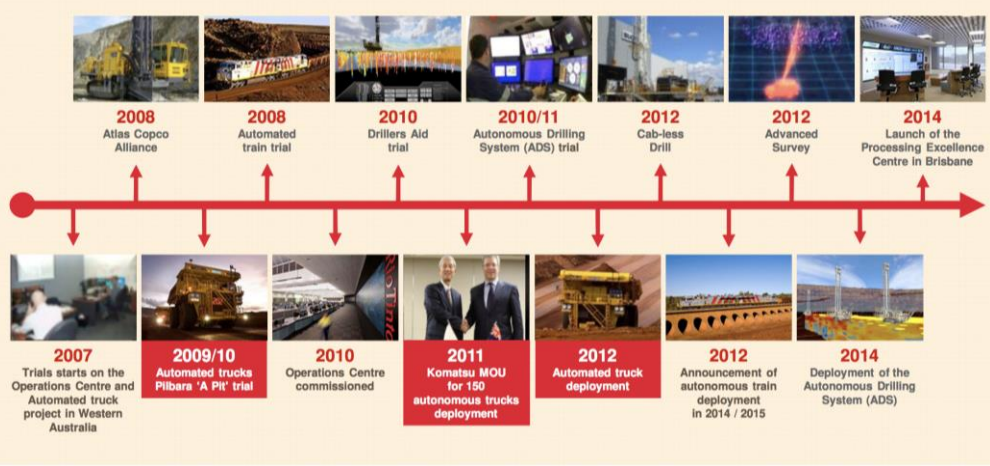
MINE OF THE FUTURE – IS ALREADY HERE - FULLY OPERATIONAL FULLY AUTONOMOUS DRILLING, TRUCKS, TRAINS -



When surviving competitively afloat the mining industry's ocean of high and low tides seemed impossible, Rio Tinto leveraged Big Data and Machine Learning to revolutionize the mining industry over the past decade, through its state-of-the-art autonomous operations.

“...we miners have little choice but to adopt the mindset of Silicon Valley... we will seek to take a new approach to capitalise on the megatrends... of the future...”

– Bold Baatar, Chief Executive – Energy & Minerals, Rio Tinto^[3]



RIOTINTO

Mine of the Future

73 Autonomous
hauling iron ore 24
hours a day by 2012

DATA**OPERATIONS**



http://www.riotinto.com/documents/140923_IMARC_Presentation_John_McGagh.pdf
<https://www.technologyreview.com/s/603170/mining-24-hours-a-day-with-robots/>

BENEFITS OF TECHNOLOGY

EFFICIENCY

"These autonomous trucks, have **reduced fuel use** by **13 percent** and hence **improved environmental performance by 13 percent.**"

REDUCED COSTS

Rio Tinto's automated blast hole drill system **enables a single operator** to use a single console at a remote location from the machinery and **operate multiple drills.**

INCREASED SAFETY

It's much **safer for the operators**, and its it is more precise using technology.

Rio Tinto preparing for the Mine of the Future with automation

With the company's long-haul autonomous rail system set to go live later this year, Rio Tinto's former CEO offered a glimpse into how it has been using data and automation to prepare for the Mine of the Future.



By [Asha Barbaschow](#) | February 26, 2018 -- 04:24 GMT (20:24 PST) | Topic: [Innovation](#)



"Who would have thought just 10 years ago that a mining company would use big data to analyse variation of plant and mine performance from a global perspective...."

Industry

“In the early 1970s, Inco **employed more than 20,000** people in its Sudbury mines. By 2006 that number had **shrunk to about 4,500**.

Today the number of workers in **Sudbury has fallen further, to about 4,000**.

Despite the vastly reduced work force, Vale's Sudbury mines **produce more nickel** today than they did in the 1970s.

Automation that has boosted productivity....

SUDBURY ONTARIO



Entrepreneurs

Sudbury's mining scene focuses **on local entrepreneurs**, many of them former employees of the two big miners.

Entrepreneurs launched more **than 300 mine-service-and-supply companies** in Sudbury which **employ 14,000 or so people**.

Partnership between
Industry,
Entrepreneurs and
Government

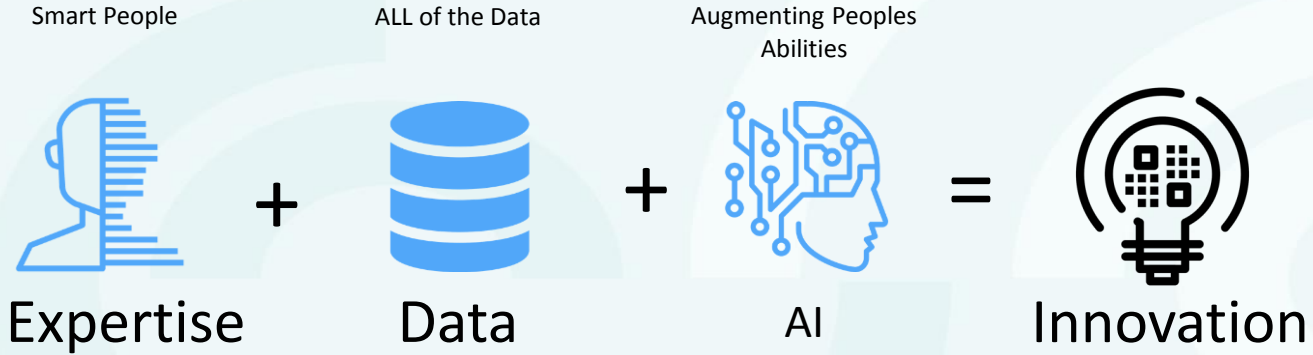
Government agencies and non-profit

The expertise is **supported by a non-profit organizations** and academic departments.

The Northern Centre for Advanced Technology (NORCAT) operates a working mine that allows fledgling inventors to try out new technology in an operating environment. “

ALBERTA OF THE FUTURE

- INNOVATION IS THE FOUNDATION FOR DIVERSITY, AGILITY, AND SUCCESS -



Augment People's Abilities

Let Machines Do The Boring, dangerous Work

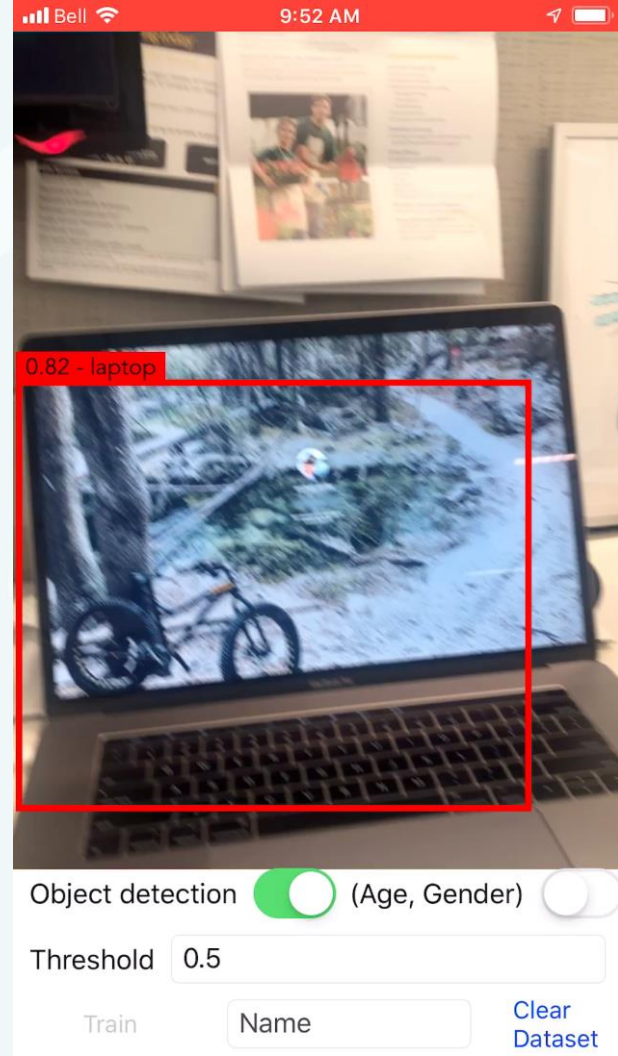
Recognizing objects from documents, pictures, videos, audio files

- Wildlife Detection
- Pipeline Integrity Analysis
- Automatically classify photos
- Soil Classification
- Failure Prediction
- Safety Detection

REDUCED COSTS

INCREASED SAFETY

EFFICIENCY



Jan. 12, 2017



Nov. 16, 2018



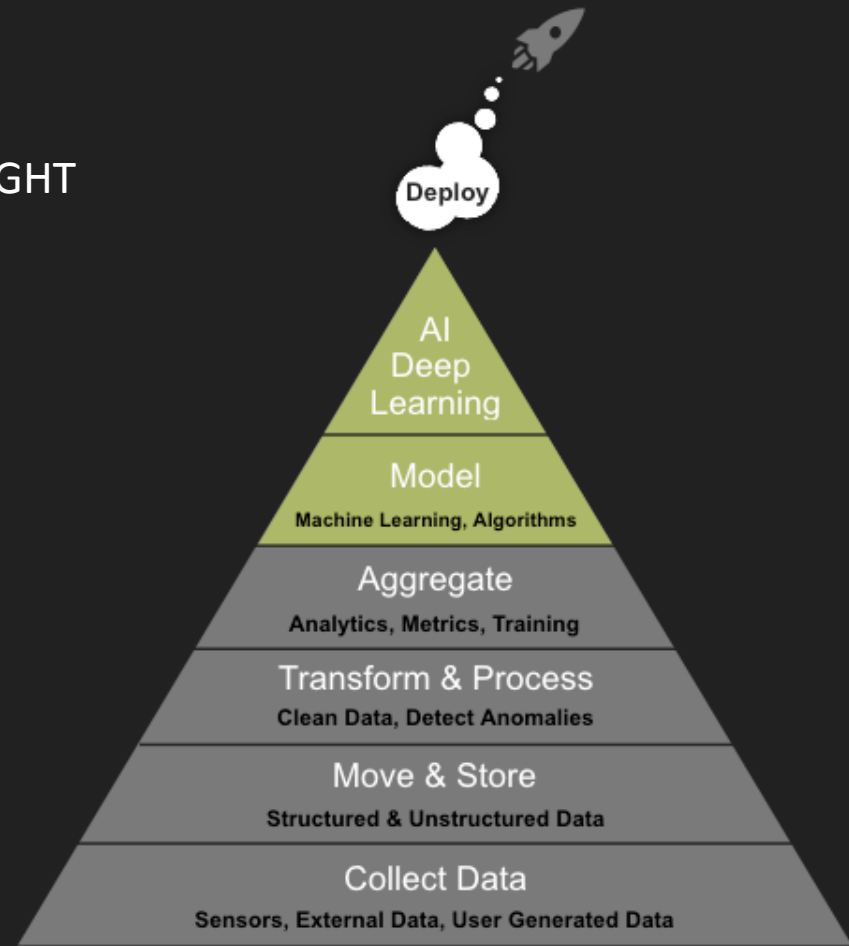
DATA DEMO

Data is the foundation of ALL INSIGHT

Data Insight

IMAGINE WHAT YOU COULD KNOW....

IF YOU HAD THE RIGHT DATA...



What is the Goal?

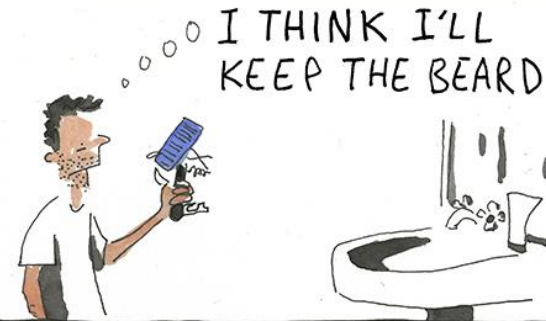
INCREMENTAL IS
NOT ENOUGH

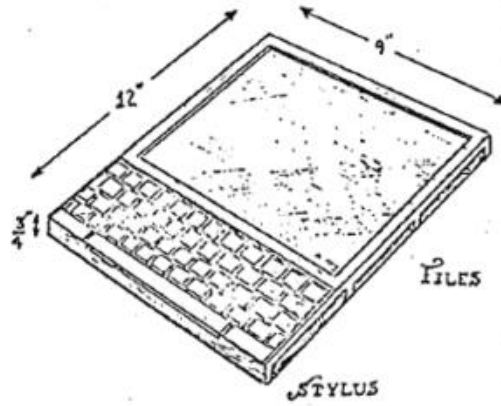
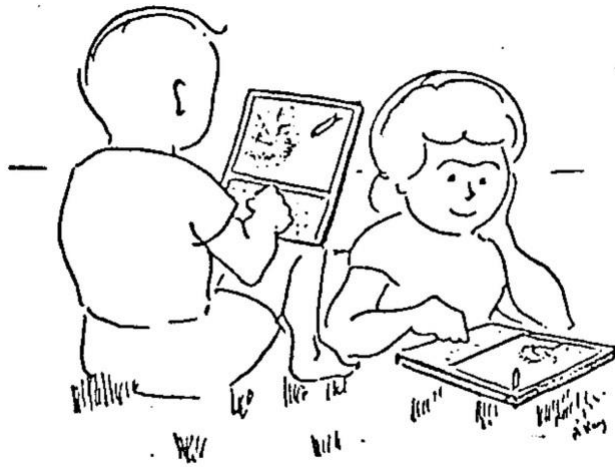
Think BIG

Think
Disruptive

THINK
BEYOND

2004-2014 Incremental
Innovation in
Environmental Work



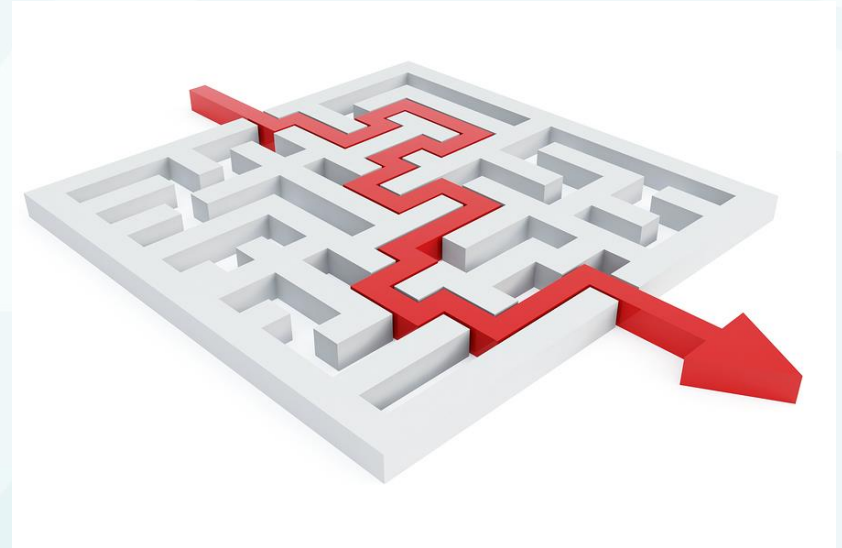


Alan Kay – Creator of the Mobile The best way to predict the future is to [invent](#) it.



Work to Date – InnoTech Alberta, CRIN and Partners

- Outreach program – scoping
 - Collaboration
 - Streamlining
 - Risk management
- 2018 Workshop
 - Managing soil
 - Leveraging data
 - Supporting collaboration
 - Environmental and oilfield service providers
- 2019 Workshop
 - Solution pathways
 - Roadmap and/or Efficiency Hub



Tools for Driving Change

Technology Roadmap to Improve Wellbore Integrity

SUMMARY REPORT



EFFICIENCY HUB **OGUK** LOGIN / SIGN UP

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Efficiency Task Force at a glance	OTHER INDUSTRY INITIATIVES	Cultural Change Champion	EFFICIENCY TASK FORCE	FORCE
OTHER INDUSTRY INITIATIVES	The Oil and Gas Innovation Centre (OGIC)	OTHER INDUSTRY INITIATIVES	EFFICIENCY TASK FORCE	Efficiency Champions Network
Oil & Gas Authority (OGA)-Asset Stewardship	EFFICIENCY TASK FORCE	East of England Energy Group (EEEGR)	EFFICIENCY TASK FORCE	Meet the Efficiency Task Force chair
TOOLS	ETF Steering Group	EFFICIENCY TASK FORCE	Inventory Management Tools	EFFICIENCY TASK FORCE CURRENT ACTIVITY
Simplification of Engineered Products Tools	OTHER INDUSTRY INITIATIVES	About the ETF	OTHER INDUSTRY INITIATIVES	Compression Systems
EFFICIENCY HUB	Scottish Enterprise - Knowledge Hub	OTHER INDUSTRY INITIATIVES	OTHER INDUSTRY INITIATIVES	OTHER INDUSTRY INITIATIVES
Case for Change	GET INVOLVED	The Oil & Gas Technology Centre (OGTC)	Oil & Gas Authority (OGA) - MER Strategy	ECITB Project Collaboration Toolkit
TOOLS	Host a Roadshow	GET INVOLVED	TOOLS	TOOLS
			Cultural Change Tools	Compression System Tools

Supporting Innovation...Your call to action

- Talk to peers – share learnings
- Explore the cutting edge in adjacent industries (and other parts of O&G sector)
- Collaborate with entrepreneurs and technology developers
- Access resources (i.e., CRIN) to join technology development working groups and events – November 2019 workshop
- Help de-risk and enhance adoption of technologies by supporting pilot work
- Share successes to grow and refine our industry, while building worker capacity

Follow CRIN and join online discussions

- [Follow CRIN on the Public LinkedIn Page](#) to get the latest updates on current CRIN events, news and activities and updates for network members
- **Join our Member-only group pages** for technology-focus areas with exclusive content and discussions, accessible only to CRIN members:
 - [Canadian Fuels Standard – Reducing the Carbon Intensity of the Barrel](#)
 - [Clean Resource Innovation Network \(CRIN\) Members](#)
 - [Digital Oil and Gas Technology](#)
 - [Low to Zero Carbon Hydrocarbon Production to End Use](#)
 - [Methane Monitoring, Quantification and Abatement](#)
 - [Novel Hydrocarbon Extraction](#)
 - [Novel Land and Wellsite Reclamation](#)
 - [Water Technology Development](#)

**Note: You must be logged into your LinkedIn account to view groups and must request to join these groups.*

