Rio Tinto
Mine of the Future™

Internet of Things World Forum
Chicago
John McGagh – Head of Innovation

October 2014
About this presentation

I will address three points during our time together:

1. Our world
2. Connectivity
3. Our internet of “big” things

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Who are we? A journey from 1873 to 2014

From

To

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Mining is physical, it is connected to “places”

Mining is a physical activity, the ore bodies cannot be moved. This drives a locally focused self-sustaining management culture that has been very successful over time.

Large mines trigger significant parallel development through towns, schools, hospitals, roads etc. This further drives the concept of self-sufficiency.
Technology enablers reduce geographic boundaries

- Power & cost of computer chips
- Cost & capacity of data storage
- Interconnectivity & cloud systems
- Proliferation of sensors

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Stepping out – our location experiences

2009 – regional

Western Australia, the world’s first and largest integrated Iron Ore operations centre

2014 - global

Integrated global multi commodity Processing Excellence Centre

Collaboration
Skills leverage
Productivity
Value add
Exploit Big Data
Distance irrelevant
Human systems
Advanced models
Intelligent analytics
Network partners

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Snapshot – remote operations and autonomy
We own and operate the world’s largest autonomous haulage fleet operating in full production mode on three mine sites

Our autonomous fleets have covered ~3,900,000km hauling material in our operations (x 5 trips to moon and back)

We have moved >200,000,000 tonnes using autonomous technology (~3,500 Sydney Harbour Bridges or 540 Empire State Buildings)

We have over 1,000 Rio Tinto person years of experience operating autonomous haulage embedded in our business

*Correct as of August 6 2014
Two worlds - fixed and mobile infrastructure

Mining – Mobile

Concentration – Fixed

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Fixed infrastructure, connected sensors

- Fixed infrastructure
- Significant capital investment
- Low levels of uncertainty

- Well instrumented
- Processes reacting to changes in mineral feed driven by geology

- Significant theoretical process models developed by academia over decades

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Mobile infrastructure, machines are sensors

Mobile infrastructure
Individual operating units
High levels of uncertainty

Machines individually instrumented
Equipment used on board the machine

Operating within a constantly changing geographic/geologic landscape

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The information required to make the “correct” decision has a significant time driven value component.
Mines look simple - how hard can this be?

- Grab the (sensor) data
- Turn into information
- Improve shorter-term decisions
Thinking model - the 737 index

737 weighs 79 tonnes t/o

Machines commonly used in the mining industry

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Grasping the scale
Machines are our mobile sensor platform(s)

Rio Tinto has ~900 HME trucks
Useful data produced by trucks
~4.9 Tb/day (fleet)*
Significant value to leverage

* Note: 70% utilized fleet, x5 overhead wrap on raw sensor data
An integrated strategy – data is the glue

• Rio Tinto Mine Automation System (MAS)
  – A seven year programme, partnership with University of Sydney
  – Embed many learnings and technologies from the defence sector

• One version of the “truth” in mining
  – Autonomy is one component in the mine
  – One part of our Sense/Think/Act strategy

Stitching it all together
Vehicles are components in the wider complex mine landscape. Rio Tinto believes we have to integrate many mining systems to capture most value
Mine Automation System (MAS)

- CAT - Aquila™
- Vulcan™
- Dispatch – (i.e. Modular®)
- Plants – control & historian
- Sensors
- Anything, anything, anything

Visualization

SENSE THINK ACT

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Mine Automation System (MAS)
Summary

I addressed three points during our time together:

1. Our world is physically connected to an ore body
2. Connectivity provides new opportunities to improve
3. Our internet of “big” things
   Fixed v/s Mobile - MAS

I hope the presentation was interesting and challenging.

The world is wired and the internet of “big” things is upon us.

This is the end of the beginning.
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