

# "Stretchy Technology" – where are the robots & technology solutions?

Richard Parker PhD, Scion Christchurch, 7-8 March 2017



### Background

"Why do we send firefighters into harm's way?"

Dr Richard Thornton CEO, Bushfire and Natural Hazards CRC

- Steep / difficult terrain
- Smoke & dust
- Fire
- Manual tasks
- Little mechanical assistance
- Physically demanding





### **Rural fire fighting in New Zealand**

- Rural volunteers
- Often in remote areas



### Hazardous forestry operations – tree felling

Automated



#### Mechanised

#### Motor-manual

Manual







# Military

# Mining



















### **Teleoperation**

- Remote operator
- Radio link
- Out of sight of machine



## **Technology solutions**

#### **Teleoperation**

- Roy Hill Remote Operations Centre – Perth
- 400 operators
- 15 mines, 31 pits, 4 ports, 1600km railway
- 1300 km from Pilbara mines





Source:

http://www.riotinto.com/annualreview2011/images/business\_review/l \_iron.jpg



#### Mining machines with no need for a cab





# **Operational comparison**

Fire	Mining
Mostly volunteers	Full time
Remote location	Well resourced mine
Complex terrain	Modified terrain
Large range suppression options	Standardised operations
Short duration (hours)	Long duration (years)
Limited \$ for equipment	Much more \$
Public good	For profit





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Source:http://sites.psu.edu/mariasharpe/tag/ci/

### **Dry fire fighting – manual**





### **Dry fire fighting – motor-manual**



#### Bosworth Trencher 1939



Merry Grader with tractor drive 1957

Source: https://www.fs.usda.gov/wps/portal/fsinternet/cs/photogallery



# Dry fire fighting - mechanised

#### MACHINE INTELLIGENCE



#### "Yanko Design"

INTERCHANGEABLE MODULES



Source: http://www.yankodesign.com/2009/08/21/firefighters-best-friend/



### Wet fire fighting - manual



#### Pump

- Simple
- Light
- Quiet

#### Hose

- Lighter
- Kink resistant
- Self moving

Nozzle

• Turn off water!



#### Wet fire fighting – very manual





#### Fire fighter heart rate



### Wet fire fighting – motor manual "Thermite"





### Wet fire fighting – mechanised Lockheed "Ox"









# Human Amplification

Exoskeleton
1960's General Electric Corp
Amplification of strength - 20:1
Work continuing









### **The Helicopter!**







### Helicopter





#### Transport, situational awareness + lunch



#### Scope for new bucket technology?





# **Electric fire fighting**

- Harvard University
- AC current, 600 W, 50 kV, 45 cm high flame
- Electrical field charges the carbon particles (or soot) generated by the fire
- "Creating an organised flow of charged particles inside the flame that pushes the flame away from the fuel source, putting it out."

Portable power pack Power pac

Source: Daily Mail, UK

# **Fire fighter training**

- Occurs away from fire activities
  - Car parks and football fields
  - Rural locations, but not remote
- Does not have the urgency
- Not 'real'
- No heat, noise, dirt or danger
- Therefore new recruits are often unprepared for what they will need to address
- Virtual reality training?





#### **Training for complex systems**







#### **Personal protective equipment**

- High capacity face masks
  - Remove CO around pump 300 ppm
  - Smouldering stumps and roots
- Particulates on clothing and in air





#### **UAVs – mature technology**

- IR heat detection
- Situational awareness
- Communications / data relay





### Maybe ... UAV water bombers!



#### **Flocks of them!**



#### **Situational awareness**



#### 3D electronic map – risk of "infotoxicity"

#### Conclusions

- Technology is being developed to:
  - Improve safety
  - Improve productivity
  - Reduce complexity for a part-time workforce





### Acknowledgements

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#### The End





#### www.scionresearch.com



Prosperity from trees Mai i te ngahere oranga

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