Forest Engineering Developments in New Zealand

6th International Forest Engineering Conference
17 April 2018
Harvesting issues & development drivers

1. Labour shortages are limiting industry growth
2. Safety is still an issue
3. Environmental ‘licence to operate’ is under threat
4. Rising harvesting costs and marginal profitability of some forests
5. Need to continue to mechanise forestry operations
Current harvesting operations: A partially mechanised process
Forest Engineering Developments

1. Winch-assisted felling
2. Teleoperated felling
3. Felling carriage
4. Grapple carriages
5. In-cab vision systems
6. Skyline shifting
7. Processing and loading
8. Robotics
Winch Assisted Felling

- **ClimbMAX Steep Slope Harvester**
  - Single winch integrated into feller buncher track frame
  - Commercially available (ClimbMAX Equipment Ltd)
  - 11 units sold (3 in NZ, 7 in Canada, 1 in U.S.)

- **Falcon Hydraulic Winch Assist**
  - Single winch excavator-based system with remote camera and multiple operating alarms
  - Commercially available (DC Equipment Ltd)
  - 63 units sold (including exports)
Winch Assisted Felling

- Tractionline winch assist
  - Dual winch excavator system
  - Commercially available (EMS Ltd)
  - 71 units sold (35 in NZ)

- Remote Operated Bulldozer (ROB)
  - Dual winch system with operating alarms
  - Commercially available (Rosewarne and May Ltd)
  - 32 units sold to date (10 in NZ)
Winch Assisted Felling

- **Waka Engineering winch assist**
  - Single winch excavator based system
  - Commercially available (Nathan Hill, Waka Welding Ltd, Waikouaiti)
  - 6 units sold (all in NZ)

- **Performance Mechanical winch assist**
  - Dual winch system on bulldozer or excavator base
  - Commercially available (Performance Mechanical & Engineering Ltd, Taupo)
  - 2 units sold to date (both in NZ)
Teleoperated Felling

- Full teleoperation of John Deere 909 feller buncher
  - First teleoperation console built and tested
  - Full machine functionality
  - HD low latency cameras and LCD displays
  - Full size joysticks
  - Trailer side control system
  - Video interrupt warning system
  - Commercially available (Applied Teleoperation Ltd)
Remote controlled felling carriage

• Falcon Felling Carriage Prototype
  • Prototype developed by DC Equipment Ltd
  • Features two felling saws: a smaller front saw and a larger rear saw
  • Hydraulic operated arm to raise/lower felling head
  • Currently being trialed
  • Released at HarvestTECH 2017 in Rotorua – June 2017
  • Planned for commercial production and sale later in 2018
Grapple Carriages

- **Falcon Claw Grapple Carriage**
  - Designed and built in NZ (now 3 models: 1250 / 1580 / 2150)
  - Kohler KD425-2 & KD625-2 air-cooled Diesel engine
  - Commercially available (DC Equipment Ltd)
  - 40 units sold (34 in NZ)

- **Alpine Grapple carriage**
  - Designed and built by Alpine Logging Equipment (SA)
  - Non-motorised (hydraulic accumulator)
  - Modified and trialed in NZ
  - Commercially available (Logpro Ltd) - 13 sold to date in NZ
Grapple Carriages

- Hawkeye grapple carriage
  - Designed and built in NZ
  - Kohler 350 5.5kW Diesel engine
  - Remote control grapple open/close from cab
  - 360 degree powered grapple rotation
  - Integrated digital camera and LED lighting
  - Commercially available (EMS Ltd)
  - 20 units sold (including exports)
In-Cab Vision Systems

- **HarvestNav on-board navigation**
  - Harvest plan with GPS navigation and machine slope warnings
  - Commercially available (Margules Groome Ltd)
  - 18 implemented as free download ‘app’ plus 2 new version sold

- **CutoverCam hauler vision system**
  - Joystick control of pan, tilt and (optional) zoom
  - Light weight one piece construction [3.5kg]
  - Low latency video link with HD display
  - Commercially available (Applied Teleoperation Ltd)
In-Cab Vision Systems

• Falcon Grapple Camera
  • Can be fitted to any swing yarder grapple system
  • Clear vision day or night with range up to 900 metres
  • Commercially available (DC Equipment Ltd)
  • 78 installed and operating in swing yarders in NZ

• Falcon tension monitoring ‘app’
  • Prototype developed by University of Canterbury
  • Two prototype units installed and being trialled
  • Commercially available later in 2018 (DC Equipment Ltd)
Skyline shifting

• **Skyshifter Tail Hold Carriage**
  
  • Lateral movement of skyline
  
  • Prototype built, tested and demonstrated in field
  
  • Available for production trial or lease (Awdon Technologies Ltd)

• **Cab Assist Backline (CAB)**
  
  • Low latency cameras and video link with warning system
  
  • High-definition LCD display
  
  • Commercially available (Applied Teleoperation Ltd)
Processing and loading

• Doherty automatic quick coupler
  • Rapid changeover from processor to log grapple
  • Single base machine to process logs and load trucks
  • First prototype designed and built
  • Ready for pressure testing in workshop
  • Installation to first adopter machine and field trials later in 2018
  • Marketed by Doherty Engineered Attachments Ltd and serviced by Total Hydraulic Solutions Ltd
Robotics

• Robotic Tree-to-tree machine (prototype)
  • Concept design by Scion
  • Prototype built by University of Canterbury Mechatronics programme
  • Field tested and demonstrated in Christchurch - Sept 2016
  • Needs more investment to develop further

• Robotic Log Sorting Facility (design)
  • Scan, sort and bulk load logs to HPMV trucks
  • Part of a new forestry automation programme
  • To be designed and built by Skookum Technology Ltd
Results of engineering developments to date

• 19 new products developed in last 5 years – 13 commercialised and 6 prototypes

• Suited to NZ forestry conditions

• Collaboration between forestry companies, contractors, Government and manufacturers has de-risked investment

• Growth of NZ forestry machinery manufacturers and technology developers

• Continues to catalyse innovations in harvesting

• Speeded up delivery of productivity and safety benefits
Sector-wide benefits: Mechanisation

- Mechanised processing in over 90% ground-based and hauler
- Mechanised felling in over 80% ground-based and almost 30% hauler
Sector-wide benefits: Productivity

- **33%** increase in ground-based productivity since 2013
  
  (36.8 tonnes/hour in 2017 vs. 27.7 tonnes/hour in 2013 – FGR Benchmarking)

- **25%** increase in cable harvesting productivity since 2013
  
  (29.4 tonnes/hour in 2017 vs. 23.4 tonnes/hour in 2013 – FGR Benchmarking)
Sector-wide benefits: Safety

- 60% reduction in serious harm injuries from 2012 to 2017
  (75 SHI incidents in 2017 vs. 194 SHI incidents in 2012 – WorkSafe NZ)

- Over 200 workers removed from manual felling and breaking out
Sector-wide Commercial Outcomes

- Over 180 new winch-assist felling units sold
  - Including over 90 machine exports to North and South America
- Over 70 new grapple carriages sold
  - Alpine, Falcon and Hawkeye grapple carriages
- Over 100 new camera systems sold
- 20 HarvestNav navigation systems in use
- Over $110 million sales of new harvesting machinery and equipment since 2012
Future Vision: An automated forestry value chain

“No boots on the ground, no hands on the log”