

PGP Steepland Harvesting: a collaborative research and development programme

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Forest Growers Research Ltd

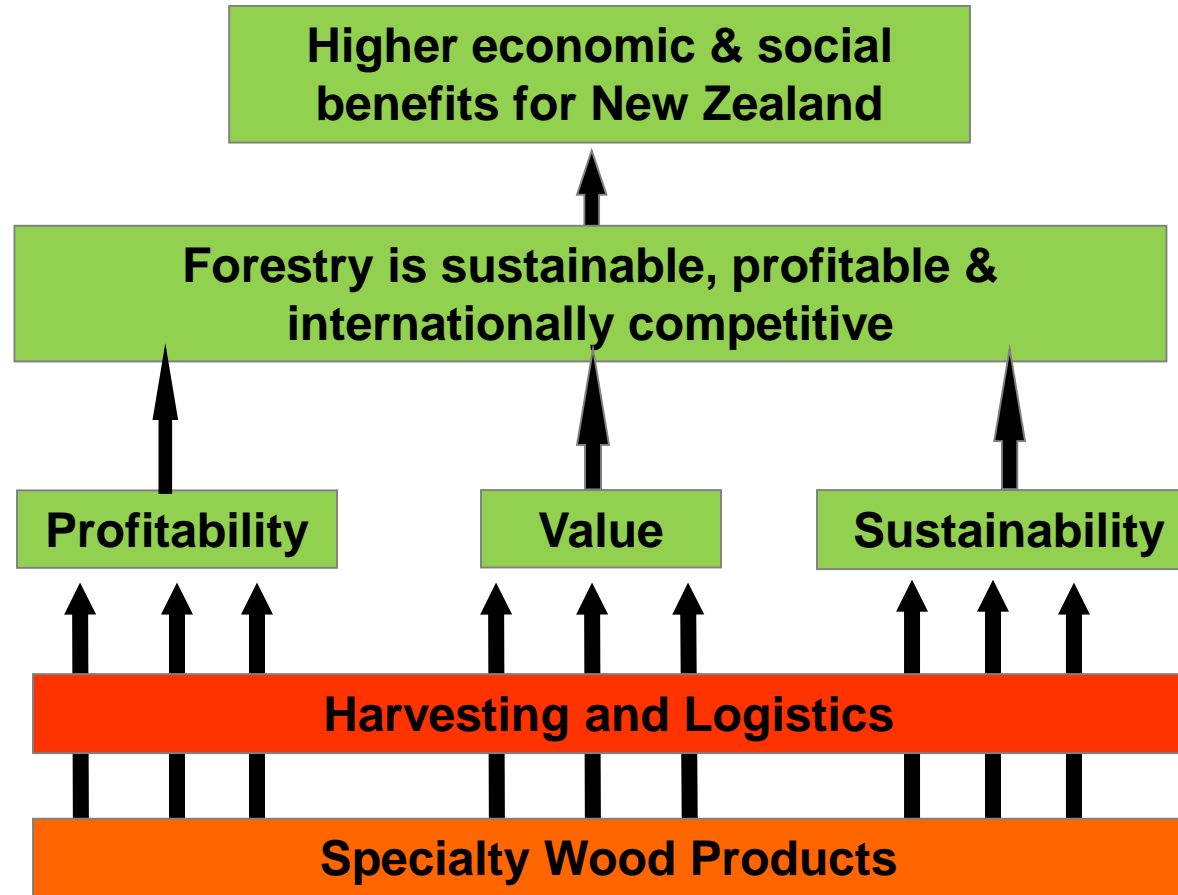
NZ Institute of Forestry Conference

10 July 2018

Ministry for Primary Industries
Manatū Ahu Matua



Forest Growers Research aspirations



Genesis of programme: 2008

- 1. Rising harvesting costs, especially in steep country**
- 2. Productivity is low compared to other forestry countries (Canada, Sweden)**
- 3. Safety is still an issue, especially felling and breaking out**
- 4. No research since closure of Logging Industry Research Organisation in 2000**
- 5. Strategic Summit held in July 2008 – what is the pathway?**

Programme goals

1. Improve productivity

- Increase mechanised felling and extraction
- create opportunities to attract workforce of the future

2. Reduce steepland harvesting costs by 25%

3. Improve safety

- Eliminate hazardous manual roles in tree felling and breaking out

4. Grow forestry machinery manufacturing sector

- New felling and extraction technology

Programme partners

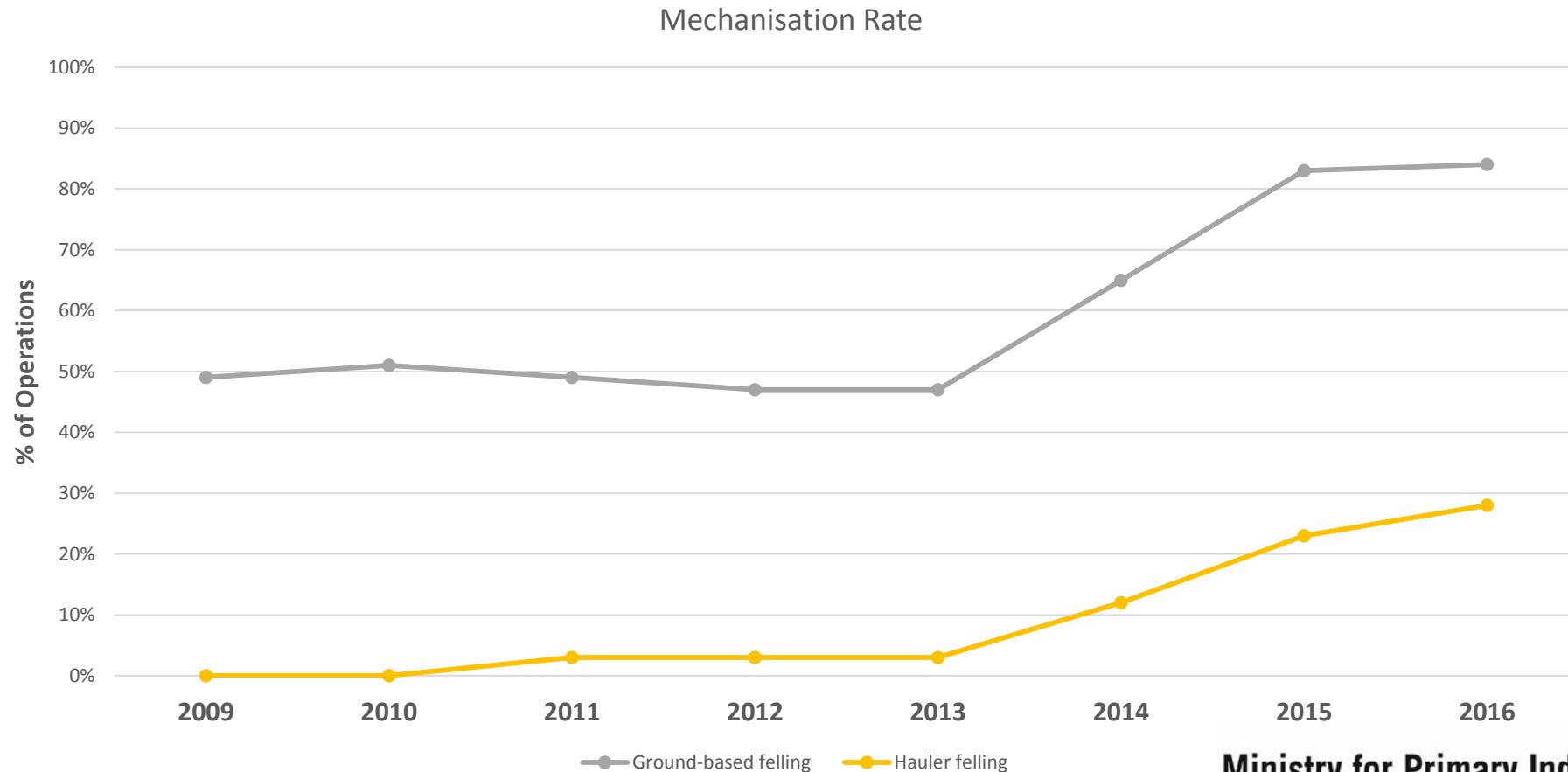
- **Forestry companies (13)**
- **Researchers and scientists – Scion and UC**
- **Government organisations (2)**
- **Forest machinery manufacturers (3)**
- **Harvesting contractors (2)**
- **Forestry consultants (7)**
- **Training and educational organisations (3)**
- **District and regional councils (2)**

GOVERNANCE PROCESSES

```
graph TD
    Agreements --> IFOC[Individual Forest Owners & Contractors]
    Agreements --> IM[Individual Manufacturers]
    Agreements --> FGLT1[FGLT]
    IFOC -- "In Kind, $" --> Consortium
    IM -- "In Kind, $" --> Consortium
    FGLT1 -- "$" --> Consortium
    Consortium((CONSORTIUM  
FGLT  
Manufacturing Partners  
Forest Owners & Contractors)) -- "Project Managers" --> TSG[Technical Steering Group]
    CA[Commercial Advisors] --> TSG
    TSG -- "Accountability" --> Projects[PROJECTS]
    TSG -- "$ Support" --> FGR[FGR Ltd.]
    FGR -- "Governance" --> Consortium
    FGR -- "Support" --> PM[PROGRAMME MANAGEMENT]
    FGR -- "Reporting" --> PSG[PSG]
    FGR -- "Accountability" --> PM
    PSG -- "Reporting" --> FGR
    PSG -- "Accountability" --> PM
    MPI[MPI] -- "Governance" --> PSG
    MPI -- "PGP Contract" --> FGR
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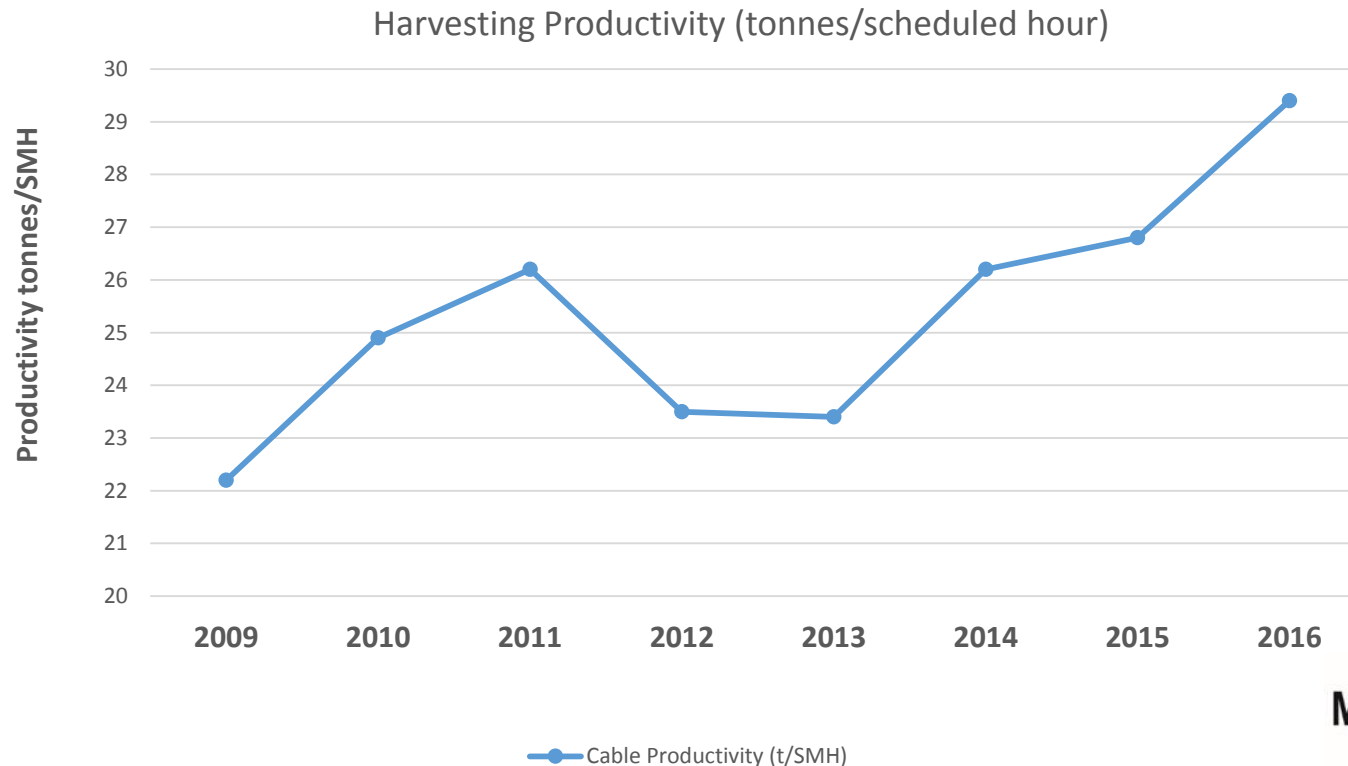
Sector-wide benefits: mechanisation

- **Mechanised felling in over 80% ground-based and almost 30% hauler**



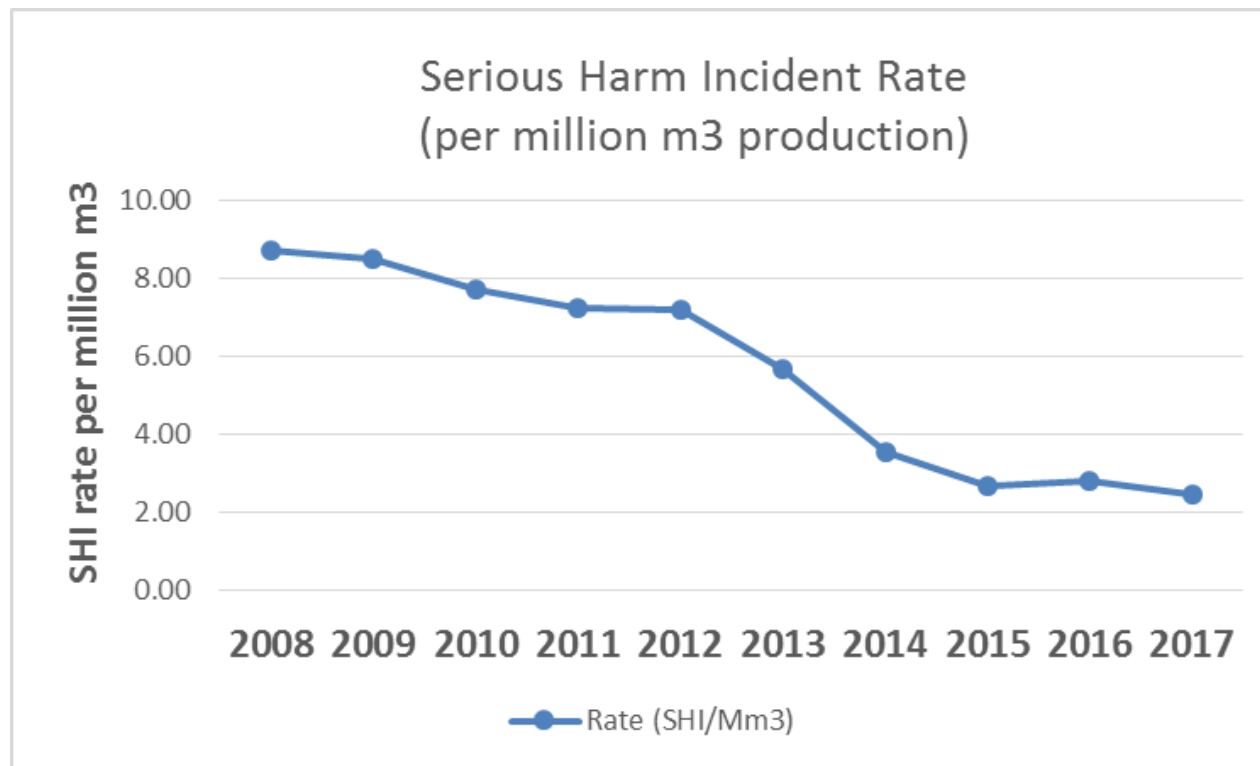
Sector-wide benefits: productivity

- **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**



Forest engineering developments

1. Winch-assisted felling
2. Teleoperated felling
3. Grapple carriages
4. In-cab vision systems
5. Skyline shifting
6. Processing and loading



Winch assisted felling

- **ClimbMAX Steep Slope Harvester**
 - Single winch integrated into feller buncher track frame
 - Commercially available (ClimbMAX Equipment Ltd)

ClimbMAX
INTERNATIONAL LTD WWW.CLIMBMAX.CO.NZ



FFE
FALCON FORESTRY
EQUIPMENT

- **Falcon Hydraulic Winch Assist**
 - Single winch excavator-based system with remote camera and multiple operating alarms
 - Commercially available (DC Equipment Ltd)



Winch assisted felling

- **Tractionline winch assist**
 - Dual winch excavator system
 - Commercially available (EMS Ltd)



- **Remote Operated Bulldozer (ROB)**
 - Dual winch system with operating alarms
 - Commercially available (Rosewarne & May Ltd)



Winch assisted felling

- **Waka Engineering winch assist**
 - Single winch excavator based system
 - Commercially available (Nathan Hill, Waka Welding Ltd, Waikouaiti)
- **Performance Mechanical winch assist**
 - Dual winch system on bulldozer or excavator base
 - Commercially available (Performance Mechanical & Engineering Ltd, Taupo)



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)



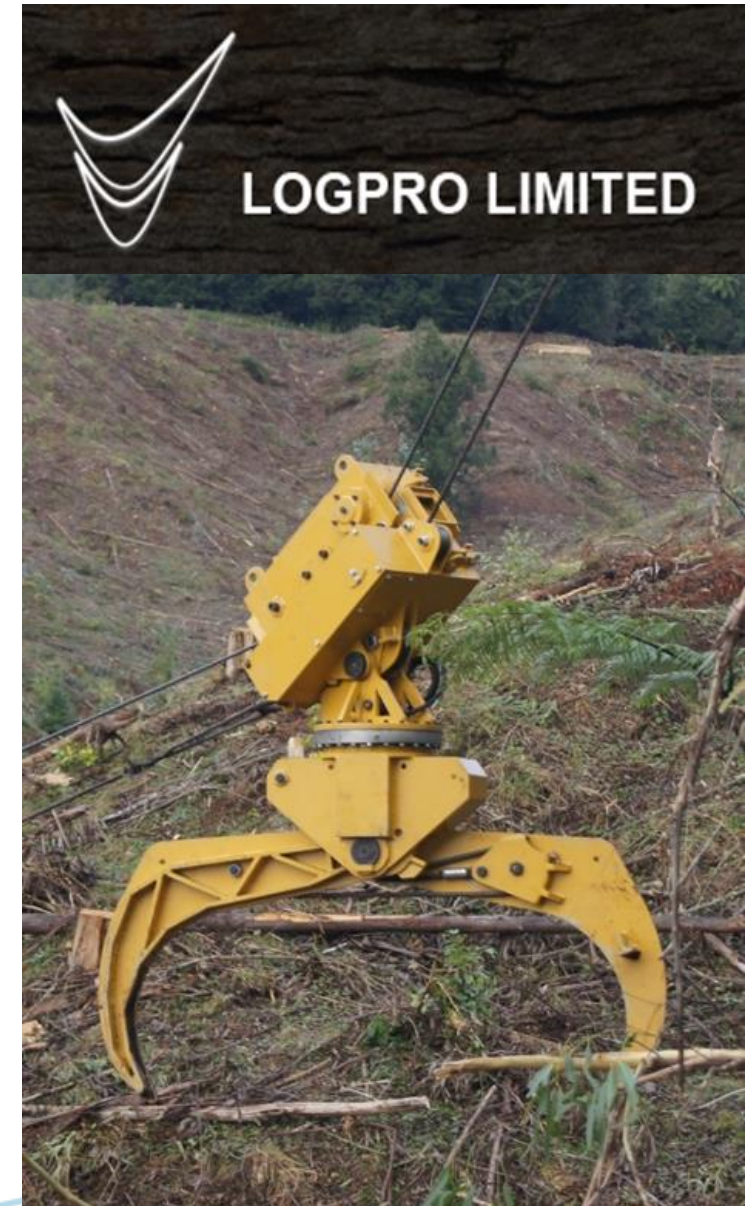
Teleoperated felling

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



Grapple carriages

- **Alpine Grapple Carriage**
 - Designed and built by Alpine Logging Equipment South Africa
 - Non-motorised (hydraulic accumulator)
 - Remote control grapple open / mainline close
 - 360 degree powered grapple rotation
 - Modified and trialed in NZ
 - Commercially available (Logpro Ltd)



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)



- **Hawkeye Grapple Carriage**

- Designed and built in NZ
- Kohler 350 5.5kW Diesel engine
- Commercially available (EMS Ltd)



In-cab vision systems

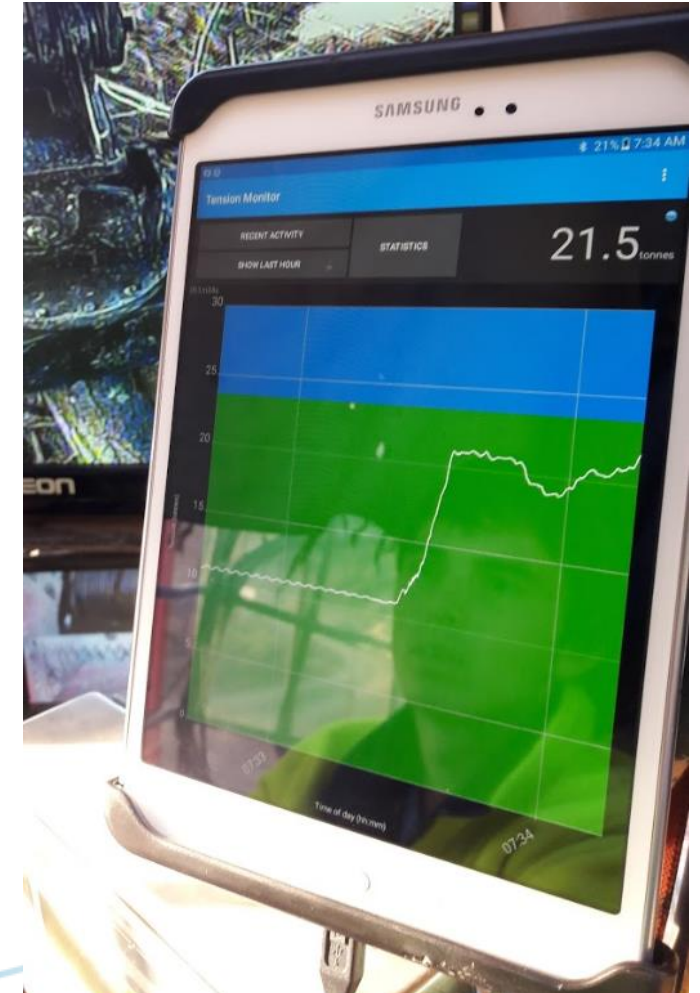
- **HarvestNav on-board navigation**
 - Harvest plan with GPS navigation
 - Forward view of terrain with machine slope warnings
 - Commercially available (Margules Groome Ltd)
- **CutoverCam hauler vision system**
 - Light weight one piece construction [3.5kg]
 - Pan – Tilt – Zoom and HD display
 - Commercially available (Applied Teleoperation Ltd)



In-cab vision systems



- **Falcon tension monitoring 'app'**
 - Prototype developed by University of Canterbury
 - Suitable with any tension monitor
 - Prototype units installed and being trialled
 - Commercially available later in 2018 (DC Equipment Ltd)



Skyline shifting

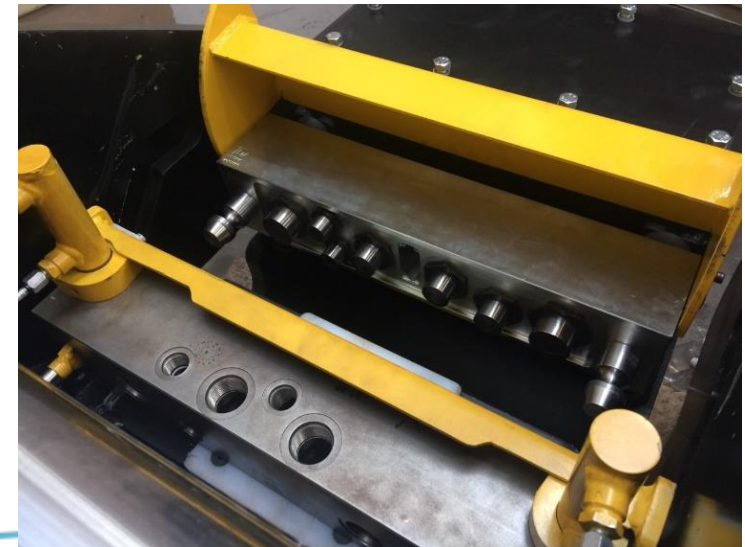
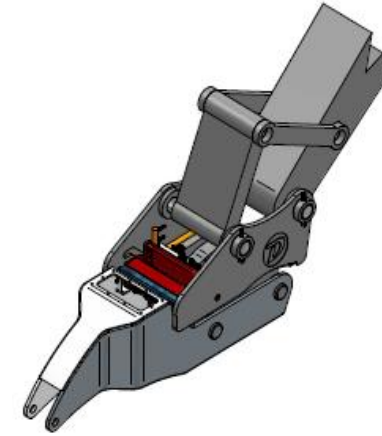
- **Skyshifter Tail Hold Carriage**
 - Lateral movement of skyline
 - Prototype built, tested and demonstrated in field
 - Available for production trial or lease (Awdon Technologies Ltd)
- **Cab Assist Backline (CAB)**
 - Low latency cameras and video link with warning system
 - High-definition LCD display
 - Commercially available (Applied Teleoperation Ltd)

AWDON SKYSHIFTER



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 in 2017
 - Workshop pressure testing to 600 lpm and 350 bar
 - Installation to first adopter machine and field trials later in 2018
 - Marketed by Doherty Engineered Attachments Ltd and serviced by Total Hydraulic Solutions Ltd



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**

Learnings from the Programme

- Engaging stakeholders early in the programme
- Effective programme governance and management
- Communication of project progress and promotion of outputs
- More input from contractors
- ‘Fast-fail’ approach – discontinue unsuccessful projects
- Delivery is slower than expected
- Project management requirements higher than expected
- More resources needed in commercialisation

Summary

- **19 new products developed in last 5 years – 13 commercialised and 6 prototypes**
- **Suited to NZ forestry conditions**
- **Collaboration between forestry companies, contractors, manufacturers and Government 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**