



Programme Manager: Keith Raymond



HARVESTING PROGRAMME UPDATE

Issue Number: 31
Date: November 2017

Summary

This update features the completion of the Steepland Harvesting PGP programme and highlights all the commercial products arising from the seven years of research, development and commercialisation activities. The 2016/17 Annual Programme was completed on 31 August 2017 and a final programme report was presented to the PGP Investment Advisory Panel on 27 September, summarising the outcomes of the whole programme. We now look forward to the completion of the business case for the new Primary Growth Partnership in automated forestry value chains.

2016/17 PROGRAMME COMPLETION

The Steepland Harvesting PGP programme was completed on 31 August 2017 and the programme was reviewed at the Technical Steering Team Meeting held on 25th October, 2017 in Rotorua. Programme achievements are summarised below.

Programme Overview

- 7 year programme to 31 August 2017
- Total programme funding \$7.60 million
- Industry funding \$3.92m
- PGP funding \$3.68m
- Target benefits from original Business Plan and one-year extension: \$255m cumulative to June 2017
- Final programme report to PGP Investment Advisory Panel - 27 Sept 2017
- Final Programme Report to TST - 25 Oct 2017

Product Commercialisation

The work of the Commercialisation team providing support for the technology developers and commercial partners of each of the technology products arising from the programme was completed during the quarter.

Commercialisation Plans have been finalised for the following products:

- HarvestNav on-board navigation system (Margules Groome Ltd)

- Teleoperation control system and CutoverCam hauler vision system (Applied Teleoperation Ltd)
- Skyshifter tail hold carriage (Awdon Technologies Ltd)
- Doherty Quick Coupler (Doherty Engineered Attachments Ltd).

ClimbMAX Steep Slope Harvester

- First commercial winch-assist tracked feller buncher
- Commercially available through ClimbMAX Equipment Ltd
- 11 units sold (3 in NZ, 7 in Canada, 1 in U.S.)

ClimbMAX
INTERNATIONAL LTD WWW.CLIMBMAX.CO.NZ





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HarvestNav Machine Navigation

Commercialisation of the new version of the HarvestNav on-board navigation system as an “out of the box” system has been completed.

- The new HarvestNav was demonstrated at the three FGR Field Demonstrations at Greenoch Forest, Whanganui in April, Gammons Forest, Bay of Plenty in June and Moutere Forest, Nelson in August.
- A Commercialisation agreement has been signed with Margules Groome Ltd., covering commercial partnership, intellectual property (IP) strategy and product commercialisation.
- 18 of the original HarvestNav ‘apps’ have been implemented.
- 2 new “out of the box” units sold.
- Commercially available from Margules Groome Consulting Ltd.



Teleoperation Control System

Technical development of the Full Teleoperation System for the John Deere 909 feller buncher and the Volvo EC290 mobile tail hold excavator (called the Cab-Assist Backline) has been completed.

- A new start-up company, Applied Teleoperation Ltd, was launched to market all the remote control and teleoperation products (CutoverCam, Full Teleoperation, and Cab-Assist Backline). This company will build, install and service retrofitable teleoperation units for feller bunchers, mobile tail holds and other forestry machinery.
- The system was demonstrated at the Harvest Tech Field Demonstration in June and the field demo in Moutere Forest in August.
- A Commercialisation agreement was signed between FGR and Applied Teleoperation Ltd has been signed.





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CutoverCam Hauler Vision System

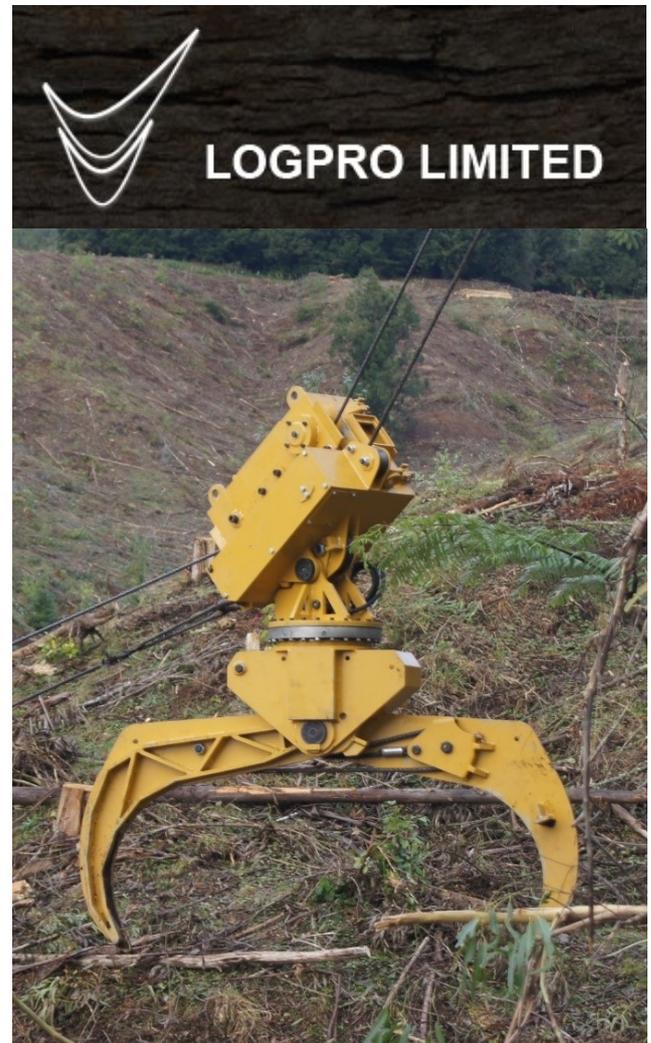
The new model CutoverCam has been redesigned to offer significant quality and price improvements over the earlier model. It is smaller, lighter, more robust and cheaper.

- The new model CutoverCam was launched to the market at HarvestTech2017 in Rotorua in June.
- Commercialisation of the new CutoverCam hauler vision system has been completed
- The pan/tilt version is available from ATL for \$9,750 (+GST) and the pan/tilt/zoom model is priced at \$12,750 (+ GST).



Alpine Grapple Carriage

- Modified and trialed in NZ
- Commercially available from Logpro Ltd
- 13 sold in New Zealand to date



Doherty Quick Coupler Attachment

Construction, assembly and workshop testing of the Doherty Quick Coupler has been completed by Doherty Engineered Attachments Ltd of Mount Maunganui. Forest Owner Marketing Services Ltd (FOMS) is the first adopter.



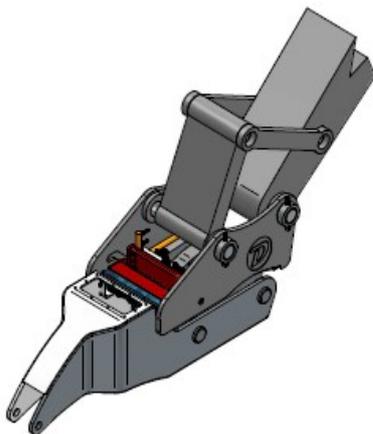
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The next stage of the project is to install the automatic quick coupler into the base machine of the first adopter. The system will then be demonstrated in the field.



PROTOTYPES IN THE PIPELINE

Three technology prototypes are in various stages of commercialisation: the Awdon Skyshifter, the Falcon tension monitoring 'app'; and the Robotic Tree-to-tree felling machine.

Skyshifter Tail Hold Carriage

Modifications to the Awdon Skyshifter twin winch tail hold carriage have been completed:

- The carriage was demonstrated in operation at the FGR/NZFFA Field Day in Whanganui in April, at the HarvestTECH field demo in June and at the Nelson demo in Moutere Forest in June.

- A Commercialisation Plan for the Skyshifter carriage has been completed
- Production trials have been completed.
- The Skyshifter is available for lease from Awdon Technologies Ltd

AWDON SKYSHIFTER



Falcon Tension Monitoring 'App'

- Prototype built by University of Canterbury School of Forestry
- Commercialised by DC Equipment Ltd



Robotic Tree-to-Tree Felling Machine

- Prototype built and tested
- Demonstrated in Christchurch Sept 2016
- Needs more investment to develop further



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PROGRAMME BENEFITS

- \$6.18/m³ lower cable harvesting costs (-17%)
- Commercialised 7 new products suited to NZ conditions
- De-risked investment by harvesting contractors
- Assisted local engineering companies with business development
- Continued to catalyse innovations in harvesting

TECHNOLOGY TRANSFER

During the course of the programme Forest Growers Research Ltd has organised or participated in:

- 19 conferences
- 11 workshops
- 13 field demonstrations to industry stakeholders

Over 170 technical reports, conference papers and refereed publications have been published.

Over the last 6 months FGR has organised three field demonstrations of the products arising from the Steepland Harvesting Programme and other new technology, including:

- Teleoperated John Deere 909 feller buncher
- Teleoperated mobile tail hold machine
- New model HarvestNav machine navigation system
- Alpine Grapple Carriage
- New model CutoverCam hauler vision system
- Skyshifter tail hold carriage
- UAV ('drone') technology
- Dyneema synthetic logging rope
- Tension monitoring systems

The field demonstrations were held at:

- Greenoch Forest, Wanganui, on Monday 10th April, as part of the NZ Farm Forestry Association's annual conference
- Gammons Forest, Bay of Plenty on Monday, 19th June, in conjunction with the HarvestTECH 2017 Conference in Rotorua.
- Moutere Forest, Nelson, on Thursday 3rd August

The field demonstrations were hosted by Arbor Forestry Group, PF Olsen Ltd, and Tasman Pine Forests Ltd at the harvesting operations of Ray McDougall of McDougall Logging Ltd, Ian Harvey of FPNZ Ltd, and Simon Rayward of Wood Contracting Nelson Ltd. FGR acknowledges the support and in-kind contribution of these companies in organising these field demonstrations.

NEW PGP PROGRAMME

While the Steepland Harvesting programme has catalysed a wave of innovation in harvesting machinery design in steepland operations, harvesting costs are forecast to keep rising, especially as many of the small forests on steep terrain are approaching harvesting age.

Forest Growers Research has proposed a much larger new programme with a wider scope than the previous PGP programme, to completely redesign harvesting and log-manufacturing processes across the whole forestry value chain.



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The programme builds on the concepts of forestry mechanisation, remote control and teleoperation developed in the Steepland Harvesting programme and extends into the field of automation and robotics in forestry.

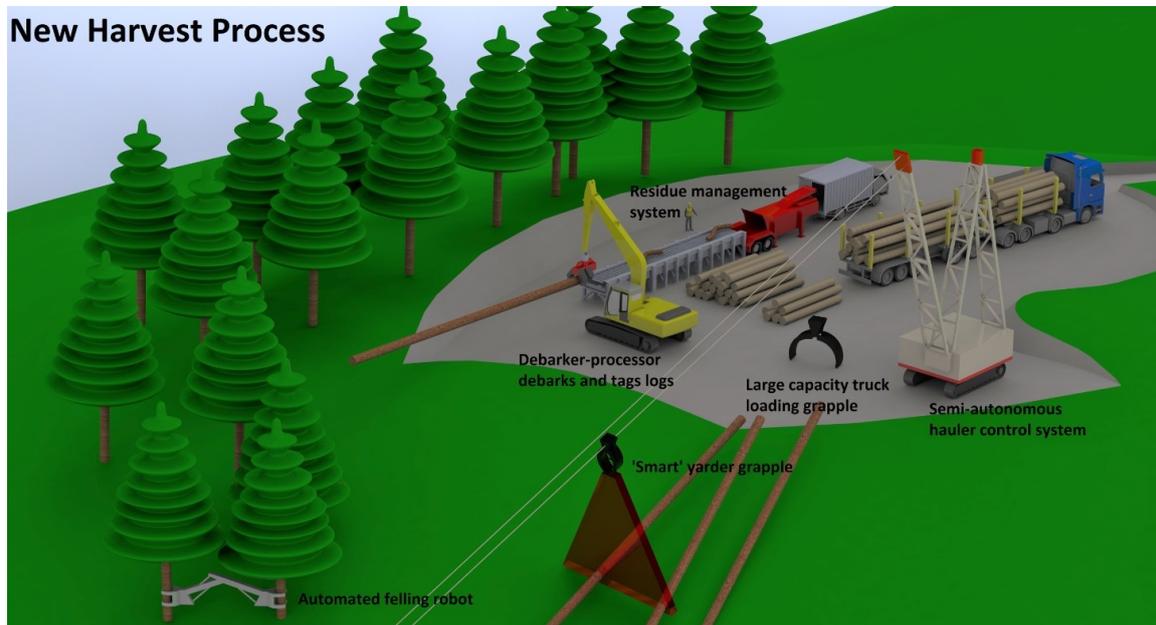
Our vision is "No boots on the ground, no hands on the log", to eliminate all manual handling and deliver a step change in forest operations. New highly automated harvesting and logistics systems are envisaged that will eliminate hazardous manual tasks, such as log branding, log measurement, quality control, stocktaking and truck load securing.

The proposal for a new Primary Growth Partnership (PGP) programme in automated

forestry value chains has been titled "Te Mahi Ngahere I te Ao Hurihuri – Forestry Work in the Modern Age" to reflect the focus on new automation and robotics technology.

By 2025 all harvesting operations will be fully mechanised, and at least 10% of operations will be automated to some degree.

Under this proposal log sorting and storage will be moved off the forest landings enabling smaller landings, through the use of teleoperation, automation, and robotics. A number of harvesting crews will supply several new centralised robotic sort yards.



New commercial products will be built for domestic and export sale:

- An automated log debarker-processor
- Log tagging and tag reading technology
- Semi-automated yarder grapple and control system
- An automated wood residue management system
- A robotic log sorter
- A large capacity semi-automated truck loading gantry and load securing system

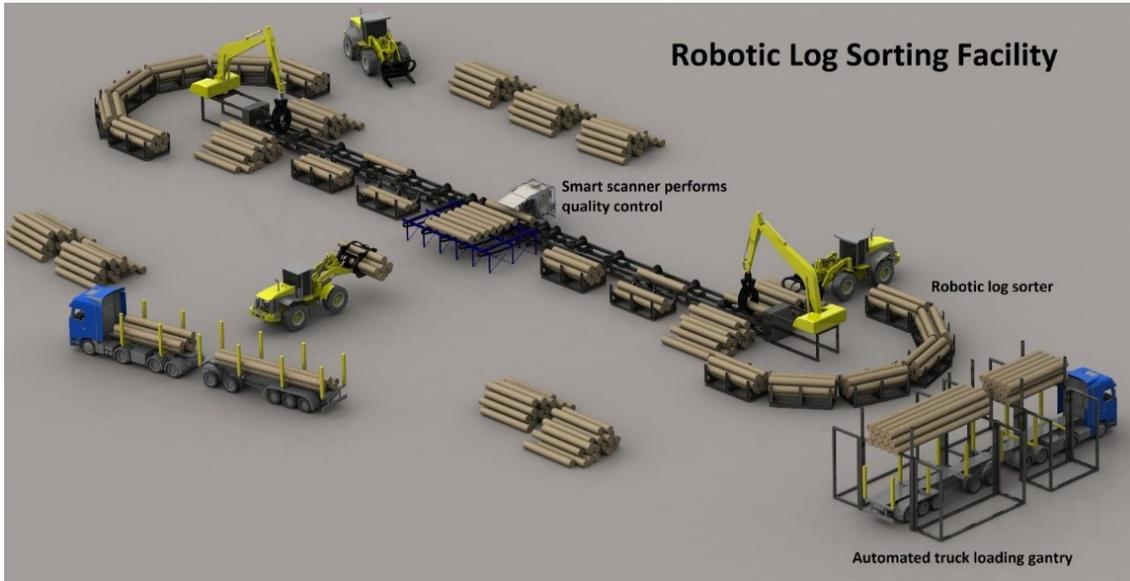


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The programme will result in significant benefits across the board, with key targets identified including:

- Operational cost savings across the forestry value chain of \$10 per cubic metre of wood delivered, which would make all forests more economical to harvest
- Alleviating the need for the estimated 800 additional workers in the industry through increased productivity (up 15%) and more automation
- environmental sustainability benefits through reduced landing size (sorting logs off-landing), less chemical fumigation (through increased debarking), increased HPMV use from log sort yards, and utilisation of forest residues that are currently unmerchantable.
- skill levels in the industry will increase, labour turnover will reduce and career opportunities in forestry will be enhanced.

The proposal was presented to the PGP Investment Advisory Panel in May and FGR was advised that the proposal has been approved to proceed to business case development stage of the funding process.

The business case is currently in preparation.

RESEARCH OUTPUTS TO AUGUST 2017:

The following research reports were completed during the last Quarter:

- Harvesting Technical Note HTN09-06: A Study of Breakout Forces in Cable Logging – Hunter Harrill & Rien Visser.
- Harvesting Technical Note HTN09-07: Tension Monitoring of Winch-Assist Systems: Update – Hunter Harrill & Rien Visser.
- Harvesting Technical Note HTN09-08: Benchmarking Harvesting Cost and Productivity: 2016 Update – Rien Visser.
- Harvesting Technical Note HTN09-09: Production Trials of the CutoverCam – Spencer Hill.
- Harvesting Technical Note HTN09-10: Production Trials of the HarvestNav Machine Navigation System – Hamish Marshall.
- Technical Report H031: Skyshifter Twin Winch Tail Hold Carriage: Field Trials – Spencer Hill & Don Scott.

These reports will soon be available on the FGR website: www.fgr.nz