FUTURE FORESTS RESEARCH

HARVESTING PROGRAMME UPDATE

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Programme Manager: Keith Raymond

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Summary

This update reviews progress in the Primary Growth Partnership programme "Innovative Harvesting Solutions" up to Quarter 4, 2013/14. Significant progress during the quarter has seen the extension of the HarvestNav software application to the industry as a free download, installation of the teleoperation control system into a John Deere 909 feller buncher, and completion of the design of the new Innovative Yarding System. The 2014/15 Research Plan has been approved and is now underway.

RESEARCH PROGRESS: 2013/14

FFR's Harvesting Programme has completed the fourth quarter of the 2013/14 year. Outputs from Year 4 of the six-year PGP Harvesting Programme were presented at the Technical Steering Team Meeting on 23rd July, 2014.

Steep Slope Feller Buncher

The report on the productivity and environmental studies of the ClimbMAX Steep Slope Harvester in Maungitaniwha Forest in Hawkes Bay has been completed and the commercialisation plan for the ClimbMAX has been updated by Trinder Engineering. This completes the development programme for the ClimbMAX Steep Slope Harvester.

The HarvestNav application was released to the forest industry in April 2014 This on-board navigation software loaded on a Windows 8 computer tablet can be mounted in any logging machine (Figure 1) to provide machine operators with information on harvest area terrain, such as slope, boundaries and water courses.

Version 1.5 is now available as a free download from the Interpine Forestry website or click here to download: http://www.interpine.co.nz. The recent focus has been on extending this software to the industry and planned enhancements include: ability to handle external GPS sensors to monitor all machines and crew positions on-screen; and integration of external tilt sensors for self-levelling machines.

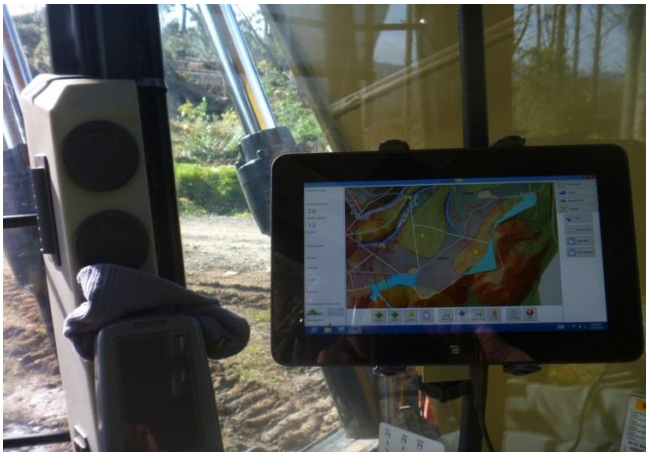

Figure 1: HarvestNav on-board navigation system

Teleoperated Felling Machine

Significant progress has been made in Task A of the teleoperation project with the development of a remote control unit (Figure 2).

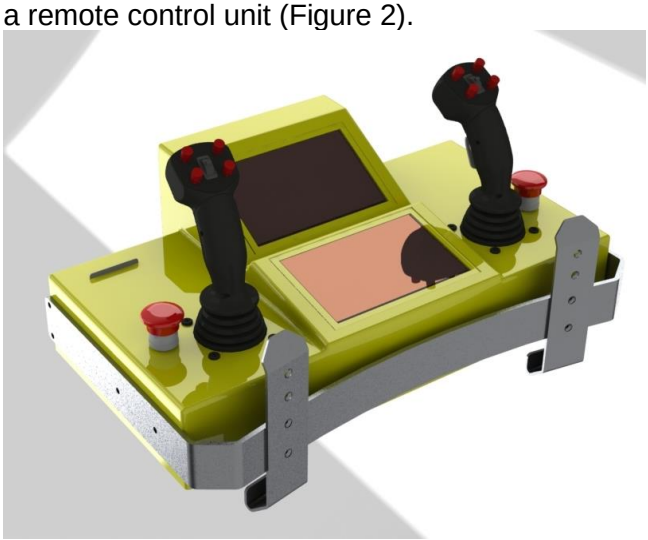

Figure 2: Prototype Remote Control Unit

Future Forests Research Ltd, PO Box 1127, Rotorua. Ph: 07 921 1883 Email: info@ffr.co.nz Web: www.ffr.co.nz

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This FFR project aims to design, build and commission a teleoperation system for harvesting machines operating on steep slopes.

There are three parts to the project: teleoperation of a purpose-built feller buncher (Task A by Scion); retrofitting teleoperation to a converted excavator loader (Task A by University of Canterbury Mechatronics); and development of a lightweight semi-autonomous felling machine (Task B by Scion and UC Mechatronics).

Stage I of the teleoperation of the purpose-built feller buncher is remote control of the machine functions of a John Deere 909 feller buncher owned by Ross Wood of Wood Contracting Nelson Limited.

This remote control unit was built over the last six months by Scion researchers and engineers from Advanced Design & Modelling Limited. The remote control system has been installed into the John Deere 909 feller buncher and basic machine control functions for tree felling were achieved during the installation.

In initial tests in early July, the harvesting contractor was able to start felling trees from a distance (Figure 3).

Figure 3: Contractor operating the John Deere by remote control

In Task B of the teleoperation project, the development of the prototype "stick insect" robotic felling machine was completed during the 2013/14 year.

The robot concept was conceived by Scion researcher Dr Richard Parker and the prototype was designed by University of Canterbury Mechanical Engineering students Sean Bayley, Thomas Gilbert, Scott Paulin, and George Wareing, supervised by Dr Stefanie Gutschmidt (Figure 4).

In March 2013, the design won the Ray Meyer Medal for Excellence in Student Design awarded by IPENZ, the Institution of Professional Engineers for the best student engineering project from all universities and polytechnics across New Zealand.

Figure 4: Dr Stefanie Gutschmidt (Academic Supervisor, Mechanical Engineering) and Dr Richard Parker (Scion) with the prototype "Stick Insect".

In early trials the biped prototype robot was capable of traversing between simulated trees in a laboratory environment at University of Canterbury. In the forest it will navigate from tree-to-tree during steep slope felling operations.

Current work is focussed on developing joystick control for the machine and addressing the scale-up issues prior to development of a larger "working model".

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Advanced Hauler Vision System

The development project for the CutoverCam hauler vision system has been completed.

The CutoverCam system can be set up anywhere on the cutover to provide a clear view of the breaking out site and the location of workers prior to inhaul (Figure 5).

Figure 5: CutoverCam in action

CutoverCam is now commercially available from Cutover Systems Limited in Rotorua. To contact click here: http://cutoversystems.com.

A project exploring the application of a grapple camera system in an "after dark" logging system was undertaken this Quarter.

Improved Grapple Control

Further work in this project is in three areas:

1. The Cable Rigging Efficiency project aims to measure the efficiency of different rigging configurations. Hunter Harrill of the University of Canterbury, School of Forestry has undertaken field trials of 8 different operations, measuring skyline tensions and productivity.
2. Further development work has continued on the alpha prototype Scorpion Grapple. The dual-arm grapple, carriage and control system has been built. Scion will provide documentation of the initial development of this grapple carriage, and when the alpha prototype is completed a series of field trials will be undertaken in 2014/15.
3. In the Felling Wedge project a new improved felling wedge is under development. This project is aimed at improving directional felling of manually-felled trees for grapple extraction. The alpha prototype of this felling wedge, developed by loggers in Northland, has been tested during initial field trials. Further development will continue in the 2014/15 year.

Innovative Yarding System

Concept design work for the Innovative Yarding System has been completed. The new design for the Innovative Yarding System comprises three innovative yarding carriages (a mobile tail hold carriage, a lateral yarding carriage and a new grapple carriage) and a hydraulically-powered yarder and control system. This system will provide a low cost alternative to existing cable yarders.

A simulation model of the system was demonstrated to the "expert panel" guiding direction in this project during May. A technical and economic feasibility analysis showed that the alternative extraction system has the potential to provide a 23% improvement in productivity over current tower hauler systems.

The next stage of the project is the construction of 1/8 scale working models of the carriages.

New Hauler Technology and International Monitoring

Analysis of the 2013 data for the Benchmarking of Harvesting Cost and Productivity project has been completed. Input of over 200 harvest areas

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in 2013 has brought the total number of entries in the database up to 742 harvest areas. A report on the 2013 Benchmarking results has been completed and will be published soon.

In the Precision Forestry project the integration of GPS information with grapple harvester data to provide productivity maps is underway. If you are using the production data from a grapple harvester and want more information on this project please contact Alejandro Olivera Farias at the University of Canterbury School of Forestry:
alejandro.oliverafarias@pg.canterbury.ac.nz

2014/15 RESEARCH PLAN

The 2014/15 Research Plan for the "Innovative Harvesting Solutions" programme has been approved by the FFR Board and MPI. The Research Plan, which has three intermediate outcomes and five objectives, is now underway:

1. Mechanisation on Steep Terrain:

- Objective 1.1 Steep Slope Feller Buncher: Further development of the HarvestNav on-board navigation system.

- Objective 1.2 Teleoperated Felling Machine: Installation of the teleoperation control system to a harvesting machine (Task A) and development of the robotic felling machine to prototype stage (Task B).

2. Increased Productivity of Cable Extraction:

- Objective 2.2 Improved Grapple Control System: Completion of the Cable Rigging Efficiency project, and development of the Scorpion Grapple and Improved Felling Wedge.

- Objective 2.3 Innovative Yarding System: Construction of the prototype innovative carriages and low cost yarder to alpha prototype stage and co-investment to take to commercialisation stage.

3. Development of Operational Efficiencies:

- Objective 3.2 New Hauler Technology and International Monitoring: Continuation of the Harvesting Technology Watch programme and on-going development of the Benchmarking Harvesting Cost and Productivity database.

The total budget for 2014/15 is $1,155,646, made up of industry cash funding of $477,823 plus $100,000 in-kind contribution, matched by PGP funding of $577,823 from the Ministry for Primary Industries.

If you would like a copy of the 2014/15 Annual Plan please contact Keith Raymond at: keith.raymond@ffr.co.nz or phone Keith on 027 4385233.

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