HARVESTING TECHNOLOGY WATCH

HTW-001
September 2008

Summary

TECHNOLOGY WATCH is a biannual report outlining research and technology developments that are occurring outside the FFR Harvesting Theme. The report has several sections of interest:

- New Logging Technology – This section showcases new logging equipment and technology being developed around the world.
- Technology Outside Forestry – Technology being utilised in other industries that could be applied in logging.
- Ex-FFR Files – A review of interesting research projects carried out in other FFR research themes.
- Global View – What's new in logging from around the world.

In this first issue, we review one of the latest innovations in Swedish forestry, the Besten, which is an unmanned harvester. Peter Carter (Chief Executive of Fibre-gen Ltd) gives us a preview of the new Hitman PH330 currently under development at Fibre-gen. Technology Outside Forestry looks at progress in exoskeleton development, and ex-FFR Files reviews some research carried out in the FFR Radiata Theme into a new way of counting logs. Global View takes a brief look at the logging research work carried out by FPInnovations – FERIC Division in Canada, and changes at Madill.

Keith Raymond, Future Forests Research Ltd

NEW LOGGING TECHNOLOGY

The BESTEN

One of the latest technological breakthroughs in Sweden is the Besten ("The Beast"), an innovative logging system comprising an unmanned harvester that works with two specially modified forwarders known as shuttles, each equipped with a remote control system for operation of the harvester.

In large-diameter clearfelling stands, with extraction distances up to 600m, the system is more cost-effective than the conventional two-machine harvester-forwarder system used in Sweden. The cost of logging with this system is around US$6.80-7.50 per m^3.

This is also lower than the current cost of many New Zealand ground-based logging systems.

The Besten at work (Photo supplied by SKOGFORSK)

The high productivity is due to the logs being loaded straight onto the shuttle by the harvester. The harvested logs never touch the ground, thus eliminating the need for the forwarder to load, saving time and fuel.

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The Harvester is controlled by the shuttle next in line for loading. When that shuttle has a full load, the next shuttle takes over remote control of the harvester. Because two forwarders are used in the Besten system, the Harvester never has to wait for a shuttle.

Given that the current system is only the second prototype, researchers at Skogforsk see that there is ample scope to increase productivity through improving the technology and methods utilised in the Besten. Their study suggested that fuel consumption could be reduced by 20–40% as compared with the conventional two-machine system. What's more, the Besten system also offers advantages in ergonomics and timber handling [1].

Skogforsk's research programme has targeted automation as a major area of research to help achieve their 2020 research goals. Although this system may not be ideally suited to New Zealand harvesting conditions, the concept of automating logging tasks and tele-operation as a way of increasing productivity should be investigated further.

References: [1] Bergkvist, I. (2006). Innovative unmanned harvester system. SkogForsk Results No.2.

Hitman for Processor Heads

By Peter Carter, Chief Executive Fibre-gen

HITMAN has become the standard for testing stiffness on logs destined for structural uses, and many harvesting and logmaking operations are now using HITMAN hand tools to maximise production of structural logs. This application of HITMAN technology has resulted in the extraction of greater value from the forest by enabling the sorting of higher stiffness logs from those better suited to non-structural uses, by detecting differences in stiffness otherwise impossible to pick by eye or other simple measures.

Harvesting operators need better tools to extract more value easily

HITMAN technology has also been applied to standing trees, enabling ranking of stands for suitability for structural log harvesting, and can also be used in the valuation of forests for tender as stumpage, or for sale. The measurement of standing trees in mid- or late-rotation inventory, or in pre-harvest assessment, provides a valuable tool to combine with standard density measures to predict accurately Machine Stress Grade or engineered wood product out-turn.

Despite the growing application of this technology to identifying and sorting structural logs, it will always be best to know whether a stem is of structural quality before logmaking, so logs can be cut to the right length to meet customer specifications. Once logs are cut, it is often too late to measure the quality, which may require them either to be sent to a different customer – involving re-handling and loss of volume from re-cutting to a shorter length – or worse, they get sent to the wrong customer, incurring extra transport cost, and where they fail to meet expectations.

This is where the HITMAN processor head application comes in. Development is now well advanced with the first on-head tool incorporated into a Waratah 626 Bigwood processor. The Fibre-gen project with support from John Deere Waratah, Technology NZ and FWPA has demonstrated the feasibility of the

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concept, and now needs support from prospective users to confirm key performance criteria and field testing sites. The final stages of development are now being planned to cover full integration with the processor head controls and optimisation systems, to be followed by field testing and operational evaluation.

Integrating HITMAN into processor heads offers a smart solution for maximizing structural log production

The concept will see HITMAN assessment prior to log making as the processor head progressively works along the felled stem, delivering structural wood into structural length logs, and non-structural wood into alternative log grades. Thus structural quality is extracted while limiting wastage of time, wood, and transport, so logs are delivered to specification with quality to meet customer needs…Is this close to the harvester's 'Holy Grail'?

TECHNOLOGY OUTSIDE FORESTRY

Advances in Exoskeleton Technology

Imagine a breaker out or tree faller being able to lift repeatedly 100 kg loads continuously all day without breaking a sweat, or to lift over 500 kg with minimal strain. If you think this is pure science fiction then check out this video on YouTube:

http://www.youtube.com/watch?v=sJ4J69EEpu4

Look, one hand: Because a wearer of the XOS feels almost no strain, he could hold these 16-pound bowling balls for hours on end Photo by John B. Carnett. Source: http://www.popsci.com/scitech/article/2008-04/building-real-iron-man?page=1

In the past seven years, a handful of engineers have taken the military's 40-year-old fantasy of mechanically enhanced soldiers that can carry heavy loads and begun to make it real. There are a number of different organisations developing exoskeletons. It seems that the most advanced technologically is Sarcos XOS which is the one previewed in the YouTube video. It seems from a Popular Science article written about the Sarcos XOS, that they have solved some of the problems associated with interfacing the mechanical exoskeleton with the human. There are clearly still problems with supplying power to the unit, as it still is powered through an umbilical cord. This is big money research – the current programme to continue to develop this exoskeleton is US$10 million for the next 2 years! To read the full article and view some pictures, check out the Popular Science article:

http://www.popsci.com/scitech/article/2008-04/building-real-iron-man.

Exoskeletons are not going to be available to solve today's, or even tomorrow's, logging problems, but the work does get you thinking what could be possible in the future.

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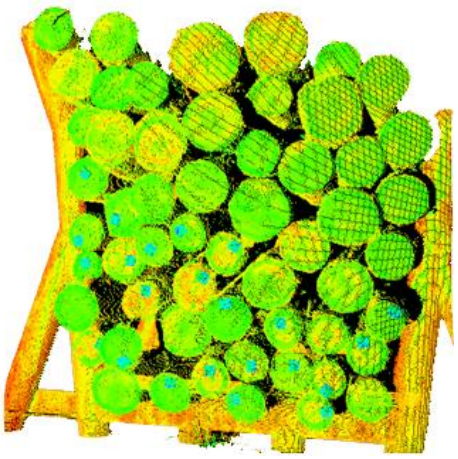
EX-FFR FILES

Using LiDAR to Count Logs

A project, currently in the Radiata Management Theme, is looking at automated ways of counting logs in piles. The project has been motivated by the log exporting and marshalling companies wanting a lower cost and more accurate way of counting logs before they are loaded onto a vessel. However if the technology being developed in this project proves successful, there are a number of other applications to which it could be applied in the logging industry.

In the past, automated image processing techniques have been trialled to count logs in digital photos. To date most of these systems have failed due to issues around lighting and accuracy of the counts. This project is taking a different approach by using a laser scanning unit to capture an image of the ends of the logs.

LiDAR (**Li**ght **D**etection **a**nd **R**anging) is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target.



An example of image capture using laser scanning

The image captured consists of millions of points for which x,y,z co-ordinates are known. The points are a record of the place and distance from the scanner that the laser hits in the scanning area. Researchers are currently developing an algorithm that uses this point data to count the logs within the pile. The algorithm works by looking for flat, round surfaces of the log ends.

Initial testing looks promising. Although the current development is targeted at counting logs at the port and central processing yards, there is potential that this sort of technology could be used to determine skid site log inventories.
For further information on this project please contact Andrew Dunningham (Andrew.Dunningham@scionresearch.com).

GLOBAL VIEW – What's new in logging?

FPInnovations – FERIC Division

This first issue of Technology Watch reviews the Canadian harvesting research organisation FPInnovations – FERIC Division. FERIC is the Forest Engineering Research Institute of Canada. Created in 1975, FERIC is a private, non-profit forestry research and development organisation and a division of FPInnovations.

FPInnovations is a merger, effective from 1 April 2007, of Canada's three forest sector research institutes – FERIC, Forintek, the wood processing research institute, and Paprican, the Pulp and Paper Research Institute of Canada.

FERIC has over 100 forestry and engineering professionals, technicians and support staff housed primarily in two offices (Vancouver, BC and Pointe-Claire, Quebec). The goal of FERIC is to "improve Canadian forest operations within a framework of sustainable development." A review of the research carried out in the past six months by FERIC shows that it has been active in harvesting and transportation research as well as research in silvicultural, bioenergy and wildland fire operations. This information has been sourced from the FERIC website (www.feric.ca).

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As in New Zealand, increasing fuel costs have caused an increased focus on fuel sources and fuel consumption. In the last 6 months, FERIC has started a study looking at fuel consumption of logging equipment. As part of that study they have developed a simple fuel meter, which can be fitted to any electrically powered field pump, which can allow for unmanned data collection [2].

Several studies are also looking at the use in logging of biodiesel (non-petroleum-based diesel fuel made from vegetable oils or animal fats). One study investigated the impact of a Biodiesel/Diesel blend on engine performance. Using a CAT 3406E in an engine testing facility, the study showed a 2% increase (based on volume) in fuel consumption between 100% diesel and 100% biodiesel. Only minor changes in engine performance were observed [3].

FERIC has also been extremely active in the areas of transportation and roading, based on the number of reports produced over the last 3-4 years, plus the projects they are carrying out in the 2007-2008 year. They have numerous projects in the areas of truck configurations and specifications, efficiency of transportation operations, safety and energy efficiency. The projects on roading cover topics in construction maintenance, water crossing and managing the road-truck interface.

FERIC shows a keen interest in increasing productivity. A review of the research reports published in the last three to four years shows that most of that work has been focused on ground-based mechanical harvesting and cut-to-length systems. FERIC has only one major project targeted specifically at cable logging. This is an evaluation of cable yarding systems and operations in interior British Columbia [4].

If you are interested in FERIC's work please visit the FERIC website at www.feric.ca. The best way to get an in-depth summary of the current work being carried out by FERIC is to read their research plan, posted on their website.

References:

[2] FERIC (2008) Harvesting Bulletin June 2008 FPInnovations FERIC (www.feric.ca).

[3] FERIC (2008) Harvesting Bulletin March 2008 FPInnovations FERIC (www.feric.ca).

[4] FERIC (2007) Research Project 2007 FPInnovations FERIC (www.feric.ca).

Modern Machinery buys Madill

The company that started in 1911 in downtown Nanaimo on Vancouver Island as Sam Madill and Sons Blacksmiths filed for bankruptcy in April. Until declaring bankruptcy, Madill Equipment of Nanaimo, B.C. was an innovator in building machinery to help the forest industry. When Madill closed its gates for the last time in April, about 190 people lost their jobs.

This left many loggers in the Pacific Northwest and around the world wondering who would support their Madill machines, which include yarders, feller bunchers, harvesters, log loaders, delimbers and saw heads. In June, they learned it will be Modern Machinery, a U.S-based machinery dealer with branches in Montana, Idaho, Oregon and Washington.

Modern has purchased the assets of the former Madill Equipment Company from the liquidator, and recently the sale was approved by a bankruptcy court in Canada. Modern bought all rights to the Madill product name, and will be the worldwide distributor of parts and service for Madill machines.

Modern also plans to set up parts and service distributors in Canada, Australia, New Zealand and Chile, countries where Madill has a significant presence. As part of the purchase, Modern has all the drawings and engineering to allow them to eventually work with manufacturers to make their own high quality parts. Modern's Madill parts operation will continue to be based in Nanaimo.

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