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COFE MEETING, JANUARY 14, 2016: WINCH ASSIST DEVELOPMENTS IN THE U.S. PACIFIC NORTHWEST

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Introduction

Traction-assist (also called winch-assist, or tethered-assist) technology for steep-slope harvesting and forest operations has increasingly been implemented worldwide over the past four to five years. Industry involvement and the need for relevant information in western Canada have dramatically expanded in the last year alone. FPInnovations attended the Western Region Council on Forest Engineering (WR.COFE) seminar in January 2016, where one of the technical sessions focused on steep-slope tethered-assist technology. More than 300 attendees received updates an academic (Oregon State University), a manufacturer (Summit Attachment & Machinery), a contractor (Technical Forest Solutions), a regulator (Oregon Occupational Safety and Health Administration), and a cable logging specialist (Brian Tuor).

Steep-Slope Winch Assist in the U.S.

Similar to western Canada, the Pacific Northwest of the United States has seen a tremendous increase in the implementation of winch-assist technology for steep-slope operations.

Oregon State University

Forestry associate professor Kevin Boston presented the university team's proposed work on the "development of innovative logging techniques for a safer working environment." With the average logging workforce being over 51 years of age and having the highest fatal occupational injury rate (91.3 per 100 000), of which timber felling and choker setting rank at the top, the team has proposed to:

1. Demonstrate new mechanized logging systems with industry co-operators;
2. Assess the practical and physiological response of workers during operation;
3. Develop design guidelines and criteria for new logging systems; and
4. Deliver outreach and educational components to the logging industry.

While the focus in the first year will be to evaluate tethered-, or winch-assist, logging equipment, the ultimate goal is to "implement a clear and concise suite of design guidelines and educational opportunities for new logging systems for practicing loggers and policy makers." The intent is to compare a conventional manual timber felling and choker system with three new logging systems:

1. Feller buncher with conventional choker yarding;
2. Feller buncher with mechanized grapple yarding; and
3. Winch-assist mechanical felling and forwarding.

Summit Attachment & Machinery LLC

Company co-director Bruce Skurdahl presented the development of the company's steep-slope winch-assist machines in a session entitled "Evolution of a Revolution." Along with long-time logger Eric Krume, they developed their first Summit combination winch-assist and hydraulic yarder (Figure 1) (see FPInnovations Info Note No. 4, May 2015).

Figure 1. First Summit combination winch-assist system. (Image courtesy of Bruce Skurdahl.)

Their next machine was based on a Hitachi log-loader (Figure 2). The winch was mounted at the counterweight area, with some modifications and reinforcements, and through a fairlead over the top of the stick. They bury the heel rack in the ground for stability and operate the assisted machine on the slope below. The owner of this machine has ordered a second one for his logging operations. All modifications are done through load calculations and engineered drawings to ensure strength, integrity, and operational safety.

Figure 2. Second Summit winch-assist system. (Image courtesy of Bruce Skurdahl.)

The company's third machine was based on a well-used Madill 2250 feller buncher (Figure 3). They put the winch system in a box and bolted it on to where the cutting head is attached; the pin on the folding gantry is there just to ensure quick cable spooling.While many used machines may no longer be suitable for their primary job, they can have a second life as a base winch-assist machine.

Figure 3. Third Summit winch-assist system. (Image courtesy of Bruce Skurdahl.)

Their latest completed machine is based on a used Kobelco 350 excavator (Figure 4). All their machines have an electronic load cell in the sheave pin on the top of the stub boom, and it is

coupled with an electronic control system. As the operator moves up or down a hill, the electronic control system instructs the winch to wind in and wind out with a specific line pull based on what that load cell is measuring.

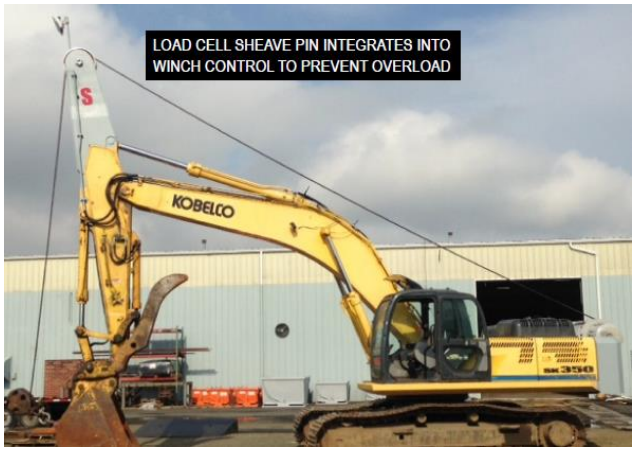

Figure 4. Fourth Summit winch-assist system. (Image courtesy of Bruce Skurdahl.)

The Lantec winch holds 560 m (1850 ft) of 24-mm (1-inch) swaged cable and has an automatic brake and big gears for long service life. The felling machine operator has live video streaming on a tablet screen in the cab, showing the winch operation and load cell readout. It can also display the harvest map, showing the harvest boundary, contours, planned skyline location, and live machine location.

Bruce also presented some numbers from Krume Logging, as well as from other contractors using their machines, indicating 33% increase in production using winch-assist mechanized cutting compared to manual felling. Even though mechanized felling is three times more expensive than manual ($200 versus $65/truckload), the daily return for the crew is higher due to increased productivity of the whole system (11 loads and $8 250 revenue per day versus 7 loads and $5 250). He concluded that implementing winch-assist mechanized tree harvesting addresses safety, production, and quality simultaneously by largely replacing manual felling and stacking trees in bunches for extraction, minimizing breakage during felling and yarding, increasing daily productivity, and potentially protecting resources because fewer roads and culverts are required and there is less maintenance. He also emphasized that due to the high capital cost of this technology, it is imperative that timberland owners are committed to working long-term with contractors and to having clear regulations ensuring operator safety while still allowing innovation and evolution.

Technical Forest Solutions LLC

Frank Chandler, a second-generation logger from Washington State and distributor (sales and support) of EMS TractionLine winch-assist in North America (Figure 5), presented some updates on this equipment as well as the impact its use has had in his harvesting operations.

Figure 5. The EMS TractionLine winch system. (Image courtesy of Frank Chandler.)

The technical specifications and photos of the machine will not be included here, since a more comprehensive technical report is being prepared based on a productivity study of the TractionLine near Kelso, Washington (Figure 6). Frank presented in detail some of the features of the TractionLine system, such as:

- Twin-line cable assist
- Two individual machines (easily transferred and used with another steep-slope machine)
- Load-rated components
- Dual real-time displays
- Safe and quick shifting and disconnecting process
- Swivelling lower block
- Accurate rope spooling
- Dual shackle attachment
- Break-away (movement) switch
- Machine sustainability (repurposed)

Figure 6. View of the FPInnovations study site of the EMS TractionLine.

Frank shared that, from a contractor's point of view, the primary reason for adopting this technology in his operations was safety. It has allowed him to safely keep up with steep-slope felling production requirements while providing a safe working environment for his crews. According to his operator, the machine is extremely smooth and comfortable to operate on slopes, although the contractor is still learning where to use it and how to work it. The system has given him the flexibility of using it for felling and bunching only when felling productivity lags behind cable extraction productivity; he also uses it for felling and shovelling on slopes of up to 100% and up to 250 m in length, effectively replacing skyline yarding. He then concluded that "this is a very small step towards a big change in our industry."

Cable logging specialist

Brian Tuor, a renowned cable logging specialist, gave an update on cable tension monitoring. He spoke from a cable logging perspective, but the majority of the points are relevant to winch-assist technology. There are several ways cable can be worn out or destroyed:

- Fatigue (tight–loose cycles, bending, vibration)
- Abrasion (ground, on/off drum, recoil)
- Burning (on ground/rocks/logs/cable)
- Abuse (kinks, grapples, neglect)
- Tension (overloading/over-tensioning)

How does a cable react to tension? Brian presented the fact that every time the elastic limit is exceeded, a cable weakens and breaks at lower than its original breaking strength (Figure 7). Tension-monitoring systems are imperative for these winch-assist applications to protect operators and the investment.

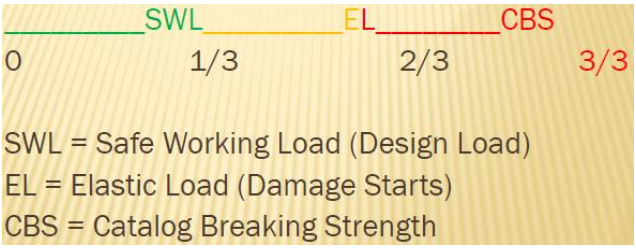

Figure 7. Theoretical design loads of cables.

Oregon Occupational Safety and Health Administration

Dr. John Garland, a well-known consulting forest engineer and Forest Activities Code committee member, updated attendees on the rules and regulations regarding winch-assist technology. The committee "periodically reviews the rules in their entirety and proposes new

rules if they are called for by changes in technology or changes in the way we are operating." The current regulation on machines operating on slopes over 50% requires a variance to operate on such slopes. The variance has special record-keeping requirements under the Safety Code. "We are still sorting that out and no final decisions have been made. There is a recognition that the rules will have to change to accommodate steep-slope tethered logging."

For additional information about the COFE meeting, please contact the author.