REPORT

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The Morgan SX 70 series Hydrostatic Skidders

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Figure 1 - SX704 Dual-arch grapple, SX704 Swing-boom grapple, SX706 double bogie Swing boom

Introduction

Hydraulic drive trains have been used in a range of logging equipment such as excavators and Bell loggers for a number of years. A recent development in hydrostatic drive is the Morgan Syncrotrack by International Silvatech Industries Inc. The system has been designed and fitted to the Morgan SX-70 range of skidders which include the SX-704 grapple skidder, the SX-704 swing boom and the SX-706 swing boom (rear bogie).

The Morgan SX70 range of skidders incorporate new design features that can assist in the successful harvesting of traditional skidder country and marginal sites that are currently logged by combination crews (skidder/tractor) or other tracked machines. Increased productivity and reduced site degradation can be expected.

This report comments on the advantages and likely applications of these new skidder features.

The Syncrotrack Drive System

For power to be transmitted to the wheels on a conventional drive train requires a torque converter, transmission, drive shafts, differentials and planetary drives. In the Syncrotrack system, power is transmitted from hydraulic pumps directly to hydraulically driven wheel motors. The end result is a significant reduction in moving parts in the drive train, which will reduce operating costs and spare parts inventories.

The Syncrotrack incorporates two systems; an hydraulic drive system and an integrated steering system. The hydraulic drive system comprises of a pressurised hydraulic fluid source, at least one pair of right and left hand isolating valves, right and left hand flow restricters and a flow combiner. The two systems work in parallel to power the four wheels. The hydraulic system has a logic block (unique to Silvicom). The logic block allows for controlled limited differential flow of fluid to each pair of wheels under 100% duty conditions. It reduces wheel slip which improves tractive effort of the machine, reduces site degradation, increases tire life and reduces fuel consumption. Although this system is integrated in the SX70 range of Morgan skidders, it is also available as a retro-fit option for conventional skidders.

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The Syncrotrack system allows the machine to become multi purpose. For example, one week the machine could be used for skidding. The next week, it could be used for slashing or site preparation (Figure 2).

Figure 2 - SX704 skidder with attached slasher

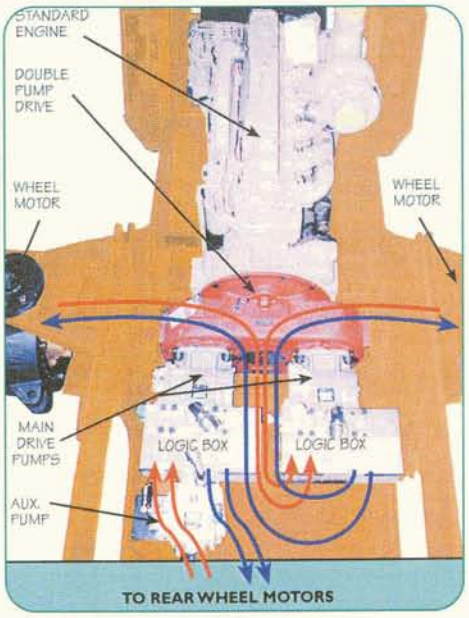


Figure 3 - Hydraulic system, top view

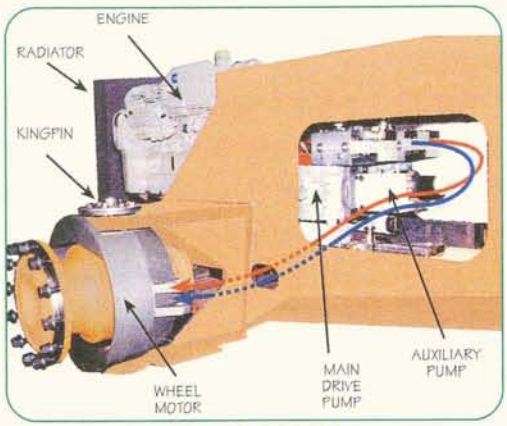


Figure 4 - Hydraulic system, side view

The Steering System

Both the SX704 and SX706 machines have 90° of articulated steering. The SX704, as an option, has 60° of articulated steering and 30° of Ackerman type steering at the front and rear wheels, providing a total of 120° (60° in both left and right directions-Figure 5). The addition of the front and rear steering, significantly enhances the machine's manoeuvrability without affecting the machine's stability due to the reduced articulation steering angle. The front and rear steering joints can be operated independently or in unison with each other. The combination of the two steering systems offer these advantages:

- Reduces the turning radius of the machine to 2.9 metres, a real advantage on small landings and skids. (Turning radius of a Caterpillar 525 is 4.3 metres)
- Facilitates crab steering (forward travel with all wheels following separate tracks-Figure 6). It allows the machine to work on marginal soils longer, less rutting out of skid tracks and reduced soil compaction.
- A micro-processor adjusts the wheel speed of each wheel to match the steering radius of the desired turn resulting in reduced ground damage.
- The problem of pulling large loads with an articulated machine can be compensated for with the wheel steer. It prevents the machine from sledging away from the desired direction of travel.

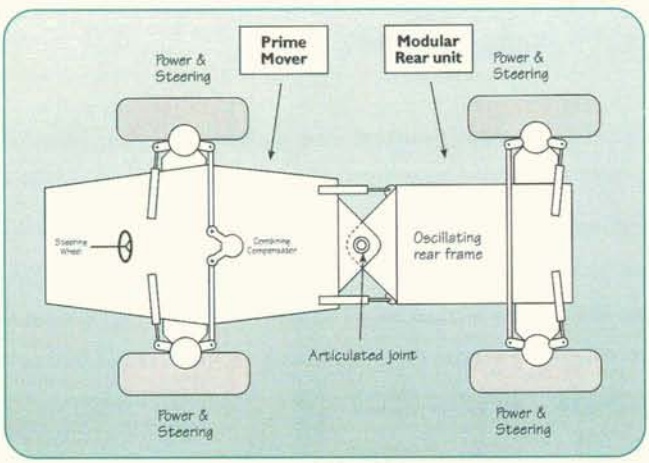


Figure 4 - Steering system

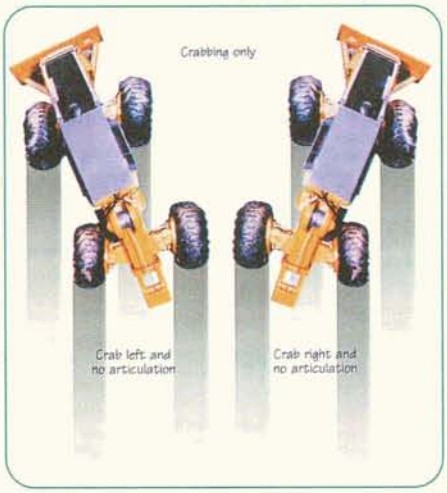


Figure 5 - Crabbing

The Operator's Cab

One of the major ergonomic features of the cab is the operator's seat which is able to swivel 270° and is lockable at 15° increments. The operator can rotate the seat at any time by using the heel of his/her foot to release the rotation lock and vice versa to re-lock the seat at desired position. This design is a plus for skidder operators. It does away with the strain and twisting on the neck and back muscles that operating a grapple and reversing does with conventional seating.

Other advantages include:

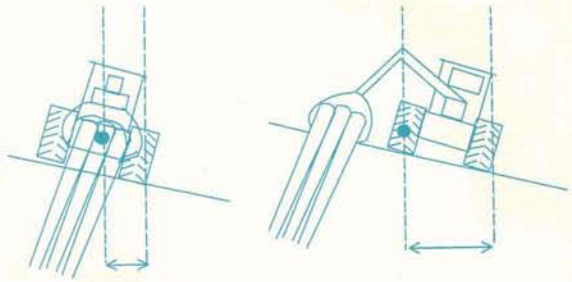
- Operating from a side-on position offers a wider field of view of machine functions.
- All of the major functions are operated from two joysticks fitted on the operator seat with the left joystick providing drive and steering functions, while the right joystick operates the machine's attachments.

Swing-Boom grapple

If you are pulling away from a pre-bunched pile of stems, it is hard to beat a standard dual arch grapple machine. The swing boom, with its reach and 140° boom rotation, offers certain advantages

over a standard grapple, particularly in unbunched wood.

- The 4.5 metre swinging boom means you have extended reach capabilities allowing the operator to make up a drag from one position.
- Effective operation of the swing boom allows the operator to build height to a stock pile efficiently by:
  1. swinging the drag to the side of the machine and utilising the grapple functions, thereby reducing the need to blade or back the drag into the stock pile like a conventional machine.
  2. by operating the machine from a side-on position means it is not necessary to make any turns after landing the drag. The operator can simply bring in a drag forwards, place it and drive back to the bush backwards.
- The possibility exists to use this machine for loading. The distance from the tip of the grapple jaws to the ground when fully extended is 4.1 metres which is enough height to clear
- The operator can use the swing boom to attain a weight distribution advantage when skidding on cross slopes. By swinging the drag to the upper-side of the slope, creates a shift in mass distribution providing more stability on slopes (refer to Figures 7a and 7b).



[Left] Figure 7a - Centre of mass with load directly behind

[Right] Figure 7b - Centre of mass with load out to side

The maximum recommended slope (Silvatech, March 1999) that the SX 70 can work on with the swing boom is:

uphill 30-40°

downhill-50°

sideslope-20°

Conclusion

There are currently ten SX 70 Morgan skidders in operations in Asia, USA and Canada. For any new machine to break into the market-place, it needs to prove itself by being productive and reliable. Time is often what is required for this process to take place.

The purchase price for a Morgan SX 70 skidder with a swing boom and four wheel steer is approximately NZ $480, 000. A conventional machine similar in size and power rating (like the Timberjack 560) is priced at around NZ.$380, 000. Although somewhat more expensive than a conventional skidder, the Morgan SX 70 skidder does have definite advantages that could see it successfully utilised in harvesting operations in New Zealand.

General Specifications Morgan SX 70 Series Skidders

SX-704 Dual Arch	Engine	Power train	Brakes	Steering	Blade	Tire size	Grapple	Cab
$390000 Articulated steer $426000 Four wheel steer	Detroit-Perkins 7.6 ltr-156 KW Cummins 6CT 8.3 ltr-160 KW	Syncrotrack hydrostatic drive 4 pump system driving 4 wheel motors • Direct drive splitter gear box with direct mounted hydrostatic pumps • Direct coupled variable hydraulic wheel motors with integral parking brake	Hydraulic dynamic braking-wet disc, spring applied, parking and service brakes	Optional All wheel drive in addition to articulated	8'-6" decking blade	Firestone Forestry 30.5-32 12PR	Dual function arch and grapple with 120" Tree tow bunching head 270° grapple rotation	Rops/Fops certified Dual doors 6 way adjustable seat including 270° rotation lockable at 15° increments. Full instrumentation and system fault lights Full left and right joy stick control

SX-704 Swing Boom	Engine	Power train	Brakes	Steering	Blade	Tire size	Grapple	Cab
$436000 Articulated steer $479000 Four wheel steer	Detroit-Perkins 7.6 ltr-156 KW Cummins 6CT 8.3 ltr-160 KW	Syncrotrack hydrostatic drive 4 pump system driving 4 wheel motors • Direct drive splitter gear box with direct mounted hydrostatic pumps • Direct coupled variable hydraulic wheel motors with integral parking brake	Hydraulic dynamic braking-wet disc, spring applied, parking and service brakes	Optional All wheel drive in addition to articulated	8'-6" decking blade	Firestone Forestry 30.5-32 12PR	Tree tow 15' reach swing boom and grapple with 106" bunching head 140° boom rotation 270° grapple rotation	Rops/Fops certified Dual doors 6 way adjustable seat including 270° rotation lockable at 15° increments. Full instrumentation and system fault lights Full left and right joy stick control

SX-706 Swing Boom	Engine	Power train	Brakes	Steering	Blade	Tire size	Grapple	Cab
$504000 Rear bogie	Detroit-Perkins 7.6 ltr-156-203 KW Cummins 6CT 8.3 ltr-160-192 KW	Syncrotrack hydrostatic drive 4 pump system driving 4 wheel motors • Direct drive splitter gear box with direct mounted hydrostatic pumps • Direct coupled variable hydraulic wheel motors with integral parking brake	Hydraulic dynamic braking-wet disc, spring applied, parking and service brakes	Articulation steering ± 45°, 90° total	8'-6" decking blade	Firestone Forestry 30.5-32 12PR (FWD) Nokian ELS 700/500-26.5 (REAR) Flexible steel tracks 33" width	Tree tow 15' reach swing boom and grapple with 120" bunching head 140° boom rotation 270° grapple rotation	Rops/Fops certified Dual doors 6 way adjustable seat including 270° rotation lockable at 15° increments. Full instrumentation and system fault lights Full left and right joy stick control