

# POTENTIAL FOR A SMALL, TRACKED VEHICLE IN SMALL TREE MANAGEMENT ACTIVITIES

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## ABSTRACT

Small diameter timber offers unique challenges for resource managers. Soil disturbance, residual stand damage, and high equipment capital are often associated with using large logging equipment to extract this timber. In an ongoing project at the University of Idaho, an All Season Vehicle (ASV) RC 30 has been modified for use as a low impact skidding device. Several skidding methods are being evaluated including the use of log chains, tongs, skidding arch, and a modified tractor winch. Both uphill and downhill operations are being evaluated for site impacts, productivity, maneuverability, and machine reliability. Evaluations consisted of elemental time studies, quantitative and qualitative observations, and day-to-day operation of the ASV RC 30. The skid steer qualities of this machine have allowed it to operate with minimal disturbance to the residual stand. Our observations found that the ASV was underpowered for some skidding applications, but the machine was still an overall effective skidding device for most situations. Preliminary data shows that the ASV is an effective multiple use tool for small wood management.

## BACKGROUND

During the winter of 2001, an All Season Vehicle (ASV) model RC 30 was purchased for use as a low impact small diameter log skidder. This skidder project is in cooperation with the University of Idaho departments of Forest Products, Mechanical Engineering, and Electrical Engineering. Funding has been provided in part by the USDA Forest Service Southern Research Station and the USDA National Research Initiative Competitive Grants Program. Several studies are currently in progress with the ASV RC 30, however this presentation only addresses the initial modification and field-testing of the machine

## MACHINE SPECIFICATIONS

The ASV RC 30 is the smallest, tracked skid steer model produced by the ASV Company. This machine is designed primarily for landscaping and construction applications.

The stock RC 30 is powered by a Caterpillar 3013 1.5 liter, 3-cylinder diesel engine with a gross horsepower @ 2800 rpm of 31.5 hp (23.5 kw). The operating weight of the stock RC 30 is 3235 pounds with a ground pressure of 2.5 psi over a contact surface area of 1,183 inches<sup>2</sup>.

The machine's dimensions are:



## MODIFICATIONS

Since this study requires the ASV to operate in a forest environment, modifications had to be made for operator protection and improved protection for machine. The modifications for operator safety consisted of adding a front door and rear egress hatch manufactured out of 5/16-inch metal crusher screen with a one-inch box tubing framework. Added protection for the machine included the replacement of the fiberglass engine cover and the addition of a skidpan. These modifications increased the operating weight of the machine by approximately 300 pounds. A mounting platform for future electronics that extends over the ROPS/FOPS was also added to the ASV but has no functional bearing on the protection of the operator. None of the modifications would negate the ROPS/FOPS certification. A spark arrestor was added to the machine to comply with state and federal fire regulations.

## SKIDDING WITH THE ASV

Several tests were conducted to determine the reliability and productivity of the ASV RC 30 when skidding small diameter logs. These tests typically included logs having a large end diameter of 5 to 18 inches. Skidding distances varied according to the skidding method.

## Tongs and Chains

Initially, tongs were used to test the ability of the RC 30 to skid logs in both forward and reverse directions. The purpose of this test was to determine if forest conditions would cause the tracks to be thrown or a loss of traction would occur.

The ASV had some loss of traction when driving over slash due to ground resistance from the dragging log. Observations did show that driving over slash or other debris would not however cause the tracks to be thrown. The operator noted that constantly looking over his shoulder to back down the trail was difficult for long periods of time resulting in slower turn times.

Forward skidding had faster turn times; however, the tongs would release when going over rough terrain. This was remedied by using a choker chain instead of tongs.

An increase in soil disturbance was observed during forward skidding due to the lack of log suspension. Skidding distances using tongs and chains averaged around 200 feet.

### **Skidding with an Arch**

A Future Forestry Products Inc. two-wheeled skidding arch improved the skidding ability of the ASV. This was primarily due to greater log suspension resulting in less skidding resistance. With the addition of this arch, turn times and soil disturbance decreased, while piece size increased. Maneuverability over and around slash while loaded also improved. Limbs sticking out of heavy loads increased ground resistance resulting in slower turn times. Observations show that loads with the large end of the log suspended under the arch result in faster turn times. Power was a limiting factor when skidding with the ASV. Uphill skidding could be accomplished although turn times were greatly effected. Downhill skidding was preferred over uphill skidding. The average skidding distance while using the arch was around 2000 feet.

### **Modified Tractor Winch**

A PTO powered tractor winch was converted to hydraulic power provided by the RC 30's auxiliary pump. A quick disconnect three point mount was used to attach the winch to the ASV. This allows quick changes from the bucket to the winch in less then five minutes.

The winch is clutch driven and rated at 4500 pounds. The operator controls the winch by pulling on a rope connected to a control arm. As the operator pulls on the rope, more power is sent to the winch drum.

The winch has 132 feet of 3/8-inch cable. This winch was tested during January and February of 2002. In this test, 16- to 20-foot logs were winched to a trail for pickup by a forwarder. The snow depth during this test was 2 feet under the trees, and 1 to 3 feet deep on the trail. Environmental conditions limited the use of the winch when temperatures were around 32°F. At this temperature, heat from the logs skidding caused the logs to freeze to the snow. Later dynamic load tests on the winch revealed that the pulling power of the winch was only 2500 pounds. We are currently investigating the reasons for this low pulling power.

### **MACHINE LIMITATIONS**

Power is the limiting factor for this machine. Considerable increases in turn times result from this lack of power when traveling uphill. This is noticed both when traveling empty or loaded. Tight turns with the ASV when on loose soil were difficult since the large surface area of tracks needed to slide across the soil.

### **FUTURE MODIFICATIONS**

A radio remote control will be installed on the winch. This remote control will add to both the safety of the operator and increase production since the operator will not have to walk back to the machine every time the winch is operated. Changes to the hydraulic system could occur to increase the power to the winch. These changes may include the replacement of the existing 10 gallons/minute hydraulic pump for a larger one, and changes to pressure valves on the machine.

### **PRODUCTION STUDIES**

Elemental time studies are currently underway to determine the productivity of the ASV RC 30 using both the winch and the arch. These time studies are conducted in a dry ponderosa pine forest ecosystem. The management goal for the study site is to reduce the fire danger while restoring health and vigor to the remaining stand.

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