

# **Roscommon Equipment Center**

## **- EQUIPMENT EVALUATION REPORT -**



**SKIDDERS IN FOREST FIRE CONTROL**

**NORTHEAST FOREST FIRE SUPERVISORS**

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Cover photo: John Deere Skidder with 500-gallon tank and Michigan hydraulic tractor plow.

## Skidders in Forest Fire Control

Traditionally, forest fires in the Lake States, as in many other parts of the country, have been fought with either dirt or water, or both. Devices to do this work have included a wide array of implements from shovels and pails to bulldozers, tractors with plows, and off-the-road tanker trucks in the jeep, 4x4, and 6x6 classes. The best features in these earlier fire suppression systems have been combined into a single fire fighting unit which hints rather convincingly at doing, with one machine, much of the work previously requiring several pieces of equipment. Tests in Michigan with modified forestry skidders have shown them to be a promising new tool in forest fire control.

### The Fire Fighting Skidder

The first fire fighting skidder was developed 11 years ago in Michigan around an original idea of a Canadian Electric Power Company which experimented with the articulated machine for power line right-of-way maintenance. The company had reasoned that the skidder, with its excellent cross-country mobility, could carry large amounts of herbicidal liquids into remote areas for spray treatment of nuisance vegetation.

Tests by the Canadian Electric Power Company proved their thinking to be correct and the off-the-road tanker soon caught the eye of fire control officials who saw in the machine a potential for fire fighting.

Subsequent events led to the shipping of the original skidder-tanker to Michigan where a heavy-duty hydraulically operated fireline plow was mated to the skidder utilizing an ingenious new hitching arrangement.

Trials and demonstrations in Michigan and throughout much of eastern and southern U. S. with the skidder-tanker-plow unit provided adequate evidence to justify further consideration of skidder-type machines for forest fire suppression purposes.

This decision led to modifications of the original design which included lowering the tank silhouette and overall C.G. of the machine. At the same time, a specially designed V-shaped blade was added to the skidder, as was a two-way radio, a powered winch, and incidental hand tools.

The weight of the fire fighting skidder, when fully loaded, is approximately ten tons, or about twice the weight of the machine as delivered new. The major part of this weight is in the 500 gallons of water carried by the skidder in a tank located behind the operator. But, in spite of its seemingly great weight, the skidder travels safely at road speeds up to 15 mph and will, with relative ease, negotiate terrain previously accessible only to crawler-type equipment. The cross-country mobility of the vehicle is its outstanding characteristic and the one which has created national interest in the machine for woods uses of all kinds, including forest fire control.

A total of four skidders were used in the Michigan evaluation tests. They were powered by engines in the 90-100 horsepower class and all were very similar in size, weight, appearance, power, tire size, etc. Transportation to and from fires was by "low-boy" type semi-trailers which can be hauled at speeds up to 50 mph.

Field experience has shown that early worries were mostly unfounded in regard to the delivery time needed to get skidders from their station to the fire site. Skidders are reaching fires in approximately the same elapsed time as has been normal for movement of heavy crawler equipment. In some instances, even faster times have been noted where skidders have been unloaded from their conveyance and allowed to move under their own power once they were near the fire scene.

This prompted one agency to totally eliminate the hauling unit, allowing the skidder to move on its own wheels and under its own power from the work station to fires. The radius of the operation for this experiment was somewhat arbitrarily established at 30 miles, a distance the skidder can easily reach in two hours. Results of the tests in self-delivery of skidders are inconclusive, but the practice is expected to have only limited application at its best.

### The Skidder Tanker

All skidder water tanks to this time have been constructed of steel, are rectangular in shape, and carry 300 to 500 gallons of water. They are interiorly coated with a heavy, mastic-like petroleum by-product. The coating material, which is reported to have certain self-healing characteristics, has been found to be a good low-cost preservative for rust protecting the interior of steel water tanks, but some new coatings may be even superior to this earlier product.

Pumps used with the skidder tanker have been both of the positive displacement and centrifugal types. The optimum output of these pumps has been empirically set at 20 to 35 gallons per minute at pressures ranging from 100 to 300 pounds per square inch. The controlling factors in establishing flow and pressures are the amount of water available and working time available to the fire fighter per load of water. In recent years, the volume of water discharged per minute on fires has been steadily rising due to higher volumes of water being carried to the fire by bigger and better equipment. Discharge pressures, on the other hand, have steadily dropped.

A fire fighter, using a skidder in fire suppression, has several options in discharging water from the skidder onto fires. A nozzle is available to him in the operator's compartment. For those times when he dismounts, or when he chooses to use a nozzleman to assist him in his work, a nozzle can be found at the rear of the unit. And, on certain special occasions, he has the choice of directing water left or right from fixed orifices mounted directly on the front of the skidder. (Figure 1)

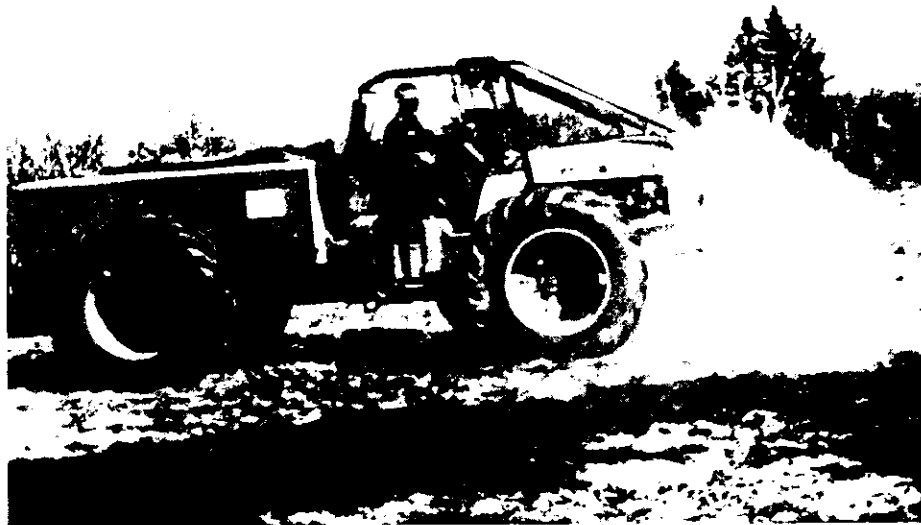


Figure 1. Skidder applying water at fire edge as directed by operator, through fixed-mounted nozzle, from cab.

## The Skidder Fireline Plow

The heavy-duty Michigan hydraulic plow attached to skidders is the same plow used in Michigan on crawler tractors, but the mounting is a new innovation and offers an interesting concept in hitch mechanisms. Known as the "float hitch", the new design preserves the inherent high undercarriage clearance of forestry skidders, but still allows the plow to perform freely and efficiently in all ground conditions, soft or hard, smooth or rough. (Figure 2) A hydraulic locking arrangement permits "fixing" the plow, when desirable, at any depth or position during plowing or transporting operations. The skidder hitch has been cited as the most unique "added" feature of the machine, and the basic elements of its design have been incorporated into plow hitches on trucks and tractors.

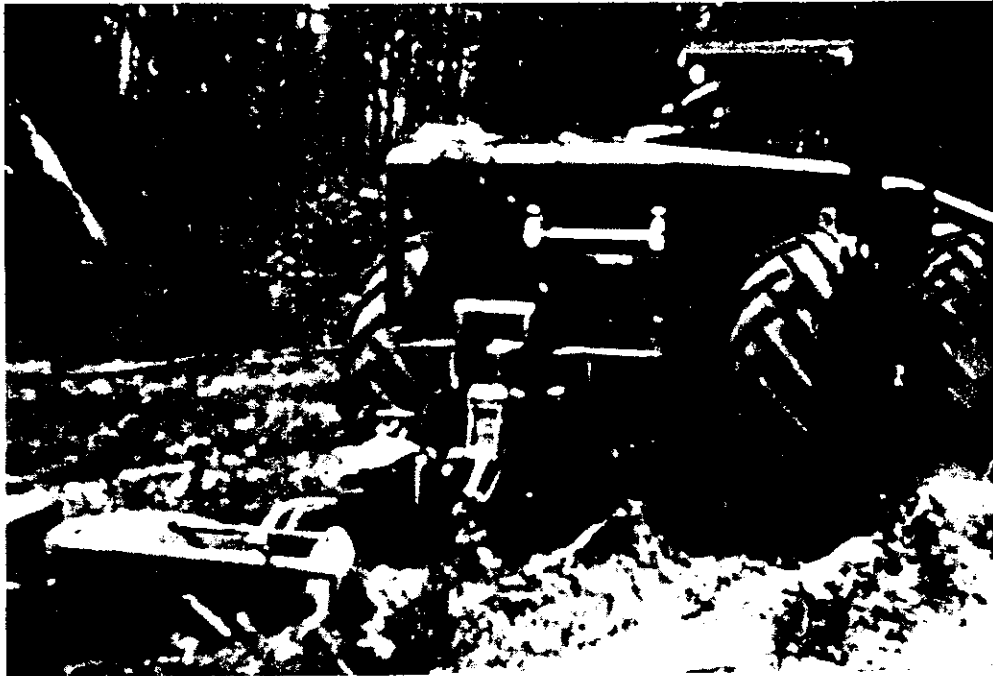


Figure 2. Skidder plowing fireline.

The skidder hitch is wholly hydraulically operated through two valves controlling a pair of double acting hydraulic cylinder. One valve has a "float" position, from which the hitch draws its name.

One of the two cylinders controls the raising and lowering of the plow and the "down" pressure (force) that can be placed upon the plow. The second cylinder controls the movement of the hitch assembly which can be moved up or down a distance of 18 inches at the actual hitching point. Both cylinders can, and are, operated independently, but each is dependent on the other for "best" operation.

The plow on the skidder is carried in an upright position, (Figure 3) fixed in this location with a positive (not hydraulic) locking device. When unlocked, the plow is lowered to the ground, and then forced into a normal plowing position as the draft vehicle moves forward. A spring assembly mounted on top of the plow compresses with hydraulic down pressure to allow a flexing action under certain ground conditions.

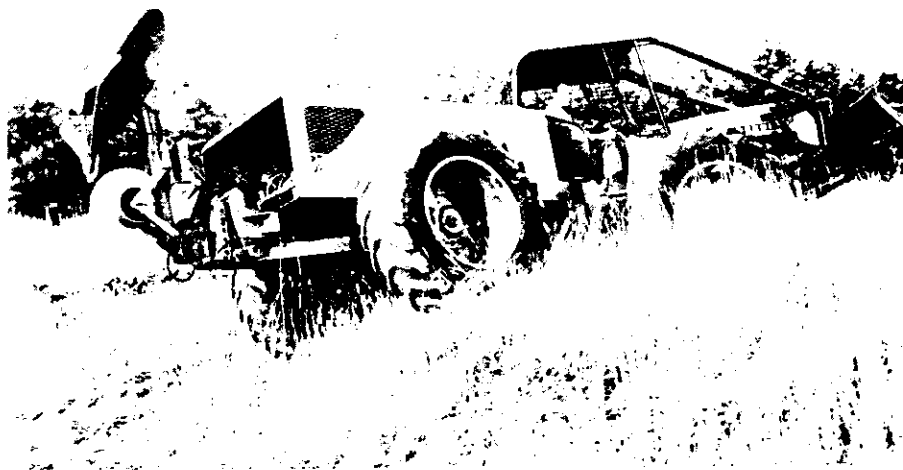


Figure 3.

The hitch is allowed to "float" except when encountering difficult plowing conditions (downed trees, strongly rooted shrubs, clay soils, etc.). At these times, the hitch is "locked" by moving the valve lever into the neutral position. Locking can be done at any point along the vertical 18-inch path of the hitch point.

Firelines produced with the double bottomed plow average 72-inches in width and 5 inches to 6 inches in depth. The exposure of this quantity of mineral soil handles most forest fire problems, especially when the natural dirt fire break is reinforced with water pumping equipment.

### Other Skidder Accessories

Perhaps no accessory is more important to a fire fighter than a reliable communications system. For his general safety, welfare, and convenience, two-way radios have been as much a part of the fire fighter's trade as have been his plows and pumpers. Michigan skidders in fire control have been equipped with modern radios, portable, easy to move, and readily adaptable from vehicle to vehicle. Too, they can be hand carried when desirable or necessary. Radios on fire fighting equipment have several times been credited with life-saving action resulting from their use.

Powered winches, front mounted and mechanically or hydraulically (fluid motor) driven, are now considered a necessity, too, for safe and effective operation of the skidders. Skidders, even with their exceptional mobility, have been known to get stuck or hung up. At such times, winches become an indispensable aid to the operator.

Front mounted blades for light dozer work, for brush and debris removal, and for machine and operator protection have been incorporated into the design of the skidder adapted for fire control duty. A V-type blade which moves ground trash to either side of the machine appears to be the most practical blade design at the present time, but more evaluation of blade types and performance is needed before a final design judgment can be made.

Simple hand tools (shovels, axes, etc.) and other light accessories (fuseses, portable fire shelters, etc.) are added to skidders to make them as complete a fire machine as is possible.

In sum, the skidder, made up as it is with all of its components, provides each operator with more "fire power" today than has been available to a single man any time in forest fire history. So great is this force that operators must be specially trained to reap the full benefits from the machine.

### Advantages of Skidders

The main advantages of forest fire fighting skidders are in their versatility. They have the ability to deliver large payloads of water to remote fire locations, and to plow firelines in forested areas at relatively high rates of speed. Research and tests indicate that no other machine used to date for forest fire control has had the same total capacity of the skidder in the two basic categories of a draft vehicle and a fire pumper.



In its present form, the skidder can, in the least amount of time, take more water into more forested areas than has been possible with any other vehicle ever used in fire control. Only the fire bomber can exceed the skidder's delivery time. Under certain conditions, too, the skidder can plow firelines at rates nearly double that of other conventional plowing equipment such as crawler tractors. The skidder is a comfortable machine to operate; its speed provides an uncommonly high "escape" safety factor for operators faced with fire "blow up" situations. At other times, because of its speed and agility, it allows fire officers to move rapidly between "hot" spots on fire. Visibility is excellent from the skidders because the operator rides high and can, for the most part, see unobstructed in all directions. There is some limited visibility to the rear caused by the water tank. Skidders have required less maintenance than many other machines used for similar purposes. This factor alone accounts for many conversions from track vehicles to rubber tired ones.

#### Disadvantages of Skidders

Some drawbacks to fire control skidders can be noted. They are high in initial cost; they require special operator training; there is the rear visibility problems while plowing; and, they are subject to specialized maintenance. But none of these drawbacks will likely be considered serious deterrents to the use of skidders if they continue to perform as dramatically and impressively as they have in their first few years of testing and use. The growing acceptance of skidders, adapted for fire control, is evidenced by the generally favorable feedback from operators who have recorded their experiences with skidders on running wild fires.

#### Conclusions

Forest fire control skidders appear to be earning a distinct suppression role in the nation's forest fire control operations. The combined qualities of high speed, great power, articulation, and excellent cross-country mobility have already made skidders "naturals" for woods use in logging operations, and these properties seem to offer the same efficient application in forest fire suppression. More evaluation under actual fire conditions will have to be made before these machines can be considered absolutely proven and totally safe for fire control. Re-designing of some components may eventually be necessary, especially if new uses (personnel carriers, supply vehicles, reconnaissance units, etc.) are to be considered in connection with skidders in forest fire control. The maximum potential of these machines in forest fire control is yet to be established and documented, but on the basis of factual data recorded to date, the machine appears to be making a strong bid for a permanent place in America's forest fire fighting arsenal.

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