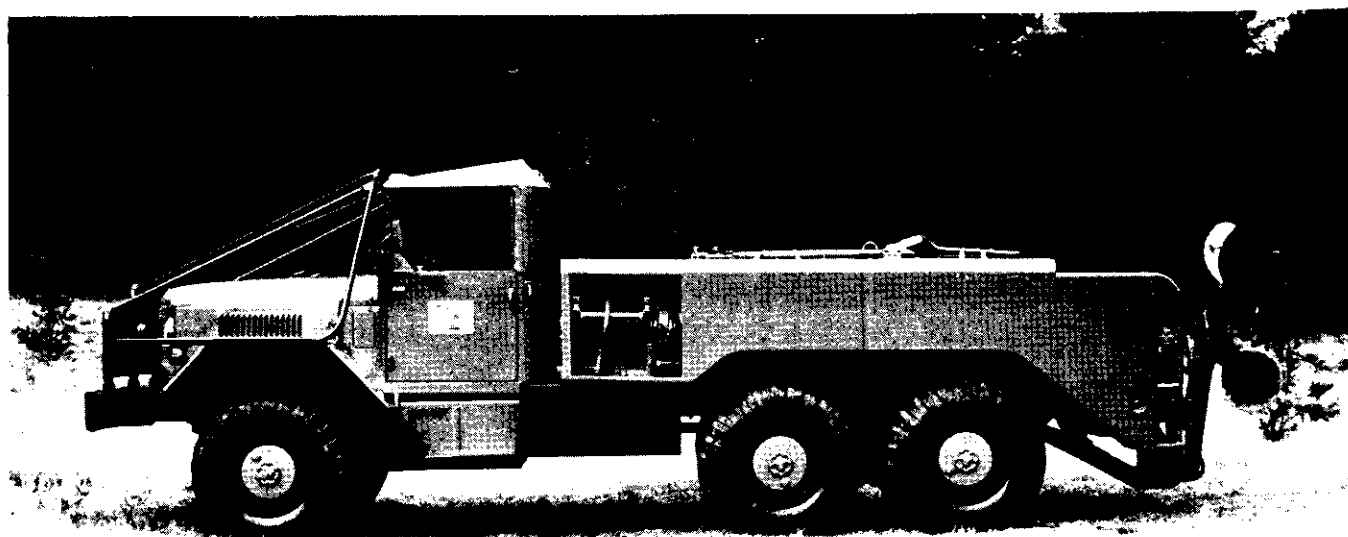


# Roscommon Equipment Center

## FINAL REPORT - PROJECT 19



## EVALUATION OF MICHIGAN TRUCK FIRE PLOW AND FLOATING HITCH

### NORTHEAST FOREST FIRE SUPERVISORS

JUNE 1979

## REC #19 - EVALUATION OF MICHIGAN TRUCK FIRE PLOW AND FLOATING HITCH

The intent of this project was to allow certain interested states to appraise the value of plowing equipment on all-wheeled drive vehicles, especially those in the 4x4 and 6x6 classes. The plowing equipment evaluated was the Michigan truck fire plow and floating hitch. The REC Committee selected participating states on the basis of need, interest and variation of terrain and soil. To date, the Michigan truck fire plow and floating hitch has been used by the Forest Service and has been evaluated by fire control organizations in Minnesota, New Hampshire, and Pennsylvania. Michigan has used truck fire plows for 20 years with good results. The truck fire plow and floating hitch are now standard equipment on most of Michigan's 6x6 fire control units and all larger sized 4x4's.

The Michigan truck fire plow is basically a scaled down version of the mouldboard-type tractor mounted fire plow developed for REC evaluation. A mouldboard plow was selected because, contrary to popular opinion, mouldboard plows require less drawbar capacity of the prime mover than either the mouldboard - disc-type or pure disc plow. Disc plows require large amounts of power to rip or tear through surface roots and grass, while mouldboard plows, especially those with turf knives, cut or slice through these materials. Tests have established that disc-type plows may require 50 percent more pull to construct fireline equivalent to that produced by mouldboard plows.

One of the most important features of the Michigan truck fire plow is the hitch system. The floating hitch is a controlled linkage that allows up to 17 inches of vertical movement in the float position.

The floating hitch (Figure 1) offers many advantages over the fixed hitch used previously. The floating hitch increases the operational capability of both operator and equipment in several ways.

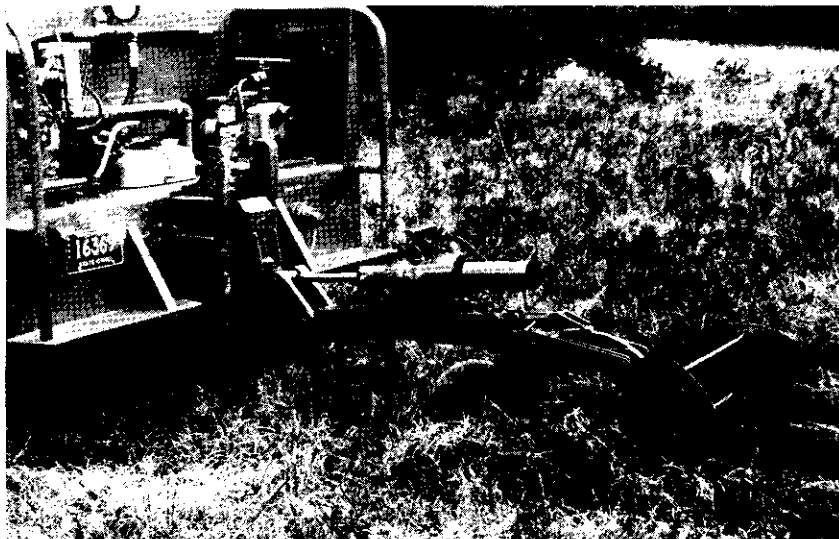


Figure 1. Closeup of Michigan plow with floating hitch building fireline.

1. Depth control of the plow is greatly enhanced. Precise depth control is particularly advantageous in the spring when the ground may be frozen a few inches below the surface. It is possible to adjust the plow depth so only the thawed portion of the ground is plowed. This conserves time and is easier on vehicles. There are many other plowing situations where accurate depth control is desirable.
2. When the hitch is in the float position the plow automatically compensates for uneven terrain and for the pitching action of the prime mover. This feature allows the operator to maintain a constant depth and a steady production rate with relatively few "skips" in the plow line.
3. When difficult plowing conditions (frozen ground, tough root systems, etc.) are encountered the hitch can be locked into a fixed position to force the plow into the ground and to keep it from rising until the obstacle has passed.
4. In all instances the hitch can be raised high enough to lift it and the plow over obstacles such as stumps, large rocks, etc. which may pass under the vehicle.
5. Hydraulically manipulating the hitch allows for easier hook-up or removal of the plow when such action is desired.

Truck plows produce a line 48 inches wide (Figure 2); tractor plow line width varies from 60-80 inches. Line production rates for truck fire plows average 1 to 3 mph, although the quality of line can deteriorate at higher speeds due to excessive throw of the furrow. The truck plow's average production rate (1-3 mph) compares favorably with the crawler-tractor unit's average production rate of 3/4 to 1-1/2 mph.

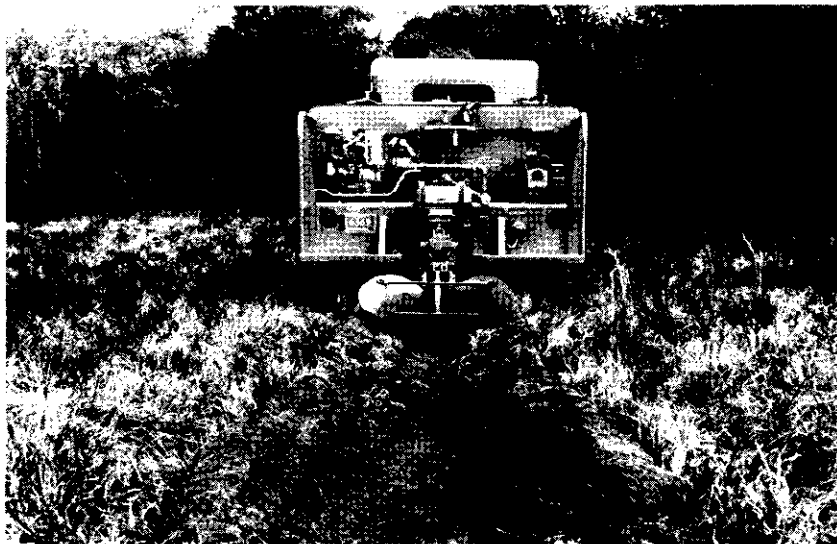


Figure 2. View showing plow line produced by Michigan truck plow with floating hitch.

A critical factor in successful truck plow operation is the power/traction balance of the prime mover. Ideally, the prime mover should have enough traction to use all of the available power without spinning the wheels. The power/traction balance is also related to the prime mover's ability to pull a plow uphill or through adverse conditions. The negotiability of the terrain is the controlling factor in truck plow use. Obviously, if the vehicle cannot traverse an area, it will not be able to plow in the area. Density of growth and certain fuel types may also limit the truck plow's ability to construct fireline.

Tests and field experience have demonstrated the fire plow to be a useful addition to initial attack trucks. It is estimated that a tanker's efficiency as an initial attack unit is increased 50 percent with the addition of a plow. Some advantages offered by plow equipped trucks are:

1. Time needed to transport a plow unit to the fire site is greatly reduced compared to a crawler-tractor plow unit.
2. No unloading time is required. The truck plow unit can begin fireline construction as soon as it arrives at the fire.
3. Trucks have the ability to carry a large water fire package to the fireline. The fire or control officer has the option of using the unit to construct plow line or lay down a water line.
4. Line production rates are equal to or greater than the production rates of crawler-tractor unit. (Note: This is not true in all terrain and fuel types.)
5. Once the water is gone, the unit may continue to function as an effective suppression tool.

The truck fire plow unit has some disadvantages. The primary problem associated with the truck plow is lack of rearward visibility. When the truck is equipped with a water tank it is impossible for the operator to see the plow when it is operating. Impaired rearward visibility is also related to other problems such as:

1. Plow breakage. The operator cannot see obstacles that may damage the plow, and as a result a higher percentage of truck plows than tractor plows are damaged.
2. "Skips" in the plow line. Often times an operator will travel 40-60 feet before he realizes that the plow is not functioning properly.

Other problems associated with truck fire plows are:

1. Most trucks are not equipped with dozer-type blades to clear the path through slash or downfall ahead of the plow. This sometimes makes it impossible for the truck plow to construct plow line in heavy slash areas.

2. Since most trucks are less maneuverable than crawler-tractors, the truck plow unit is more susceptible to becoming hung-up, or stuck, in some terrain and fuel types.
3. Truck plows do not produce as wide a line as truck plows; 48 inches compared to 60-80 inches.
4. In very soft ground conditions the plow may add undesirable weight to the truck,
5. Plows are an added expense due to the cost of the plow itself, and because of the special hydraulic installation required on the truck.

Comments from field users in the states selected to evaluate the truck plow and floating hitch have been generally favorable. A few users indicated they would like to have a plow instruction plate mounted in the vehicle cab to refresh the operator's memory. Others suggested attaching some type of limit switches on the plow with lights in the cab to enable the vehicle operator to tell the position of the plow. Some users experienced difficulties when attempting to plow in rocky areas.

As with crawler-tractor plows, one point that needs to be emphasized is the need for comprehensive training of operators in the use of the fire plow and floating hitch. In recent years, some fire equipment has become so sophisticated that it has exceeded the user's understanding of how the equipment works. Thorough training will bring operators up to the level of their equipment. Well-trained operators get more performance from their equipment and experience fewer breakdowns. The Michigan plow, a highly refined piece of equipment, has been tested and proven operational, but operators need training to get maximum benefits and performance from the unit.

Completed plans for the Michigan truck plow and floating hitch are not included in this report as the plow bottom design is undergoing a complete revision due to the unavailability of commercially manufactured parts. Another REC Project (No. 29) is investigating welded components for the plow to eliminate this problem. It may be possible to scale down the final plow design and adapt it for use on smaller 4x4 vehicles. Completed plans for the truck fire plow and floating hitch will be available from REC in the near future.

The following categories of REC reports are available:

- |                                     |  |
|-------------------------------------|--|
| <u>Final Project Reports</u>        | - Reports on original REC project work.  |
| <u>Interim Project Reports</u>      | - Issued for original REC projects when significant progress has been made on projects with a long project life.                                     |
| <u>Equipment Evaluation Reports</u> | - Reports on tests conducted by REC on commercially available products.  |
| <u>General Reference Reports</u>    | - Reports on equipment development and testing work done in other States within the Northeastern Area.   |
| <u>REC News Notes</u>               | - Any useful fire equipment development and testing information which is not covered in the preceding categories, usually of the "Equip-Tip" nature. |

For information on available publications contact:

Staff Specialist - Suppression  
Northeastern Area, S&PF  
370 Reed Rd.  
Broomall, PA 19008

Station Director  
Roscommon Equipment Center  
Box 68  
Roscommon, MI 48653