

## THE COLLINS WORK-ALL

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The Collins Work-All is a prototype multipurpose tractor that was originally designed and built in the mid-1980s by Mr. Maurice Collins, a New England inventor. Since then, major changes have been made to the unit. In November 1992, the tractor was tested as a skidder for a 1-month period by a New Brunswick silvicultural contractor, under the Technology Transfer program of the Canada-New Brunswick Cooperation Agreement to determine its suitability for small-scale forestry operations. FERIC staff were on-site for a 4-day period, during which tree-length material was skidded from a residual removal operation and a shelterwood cut. The *residual removal operation* involved the felling and extraction of trees that had been left standing during harvesting operations conducted some 10 years earlier. In this stand, scattered hardwoods and softwoods were intermixed with patchy advance softwood regeneration (1 to 3 m tall). The *shelterwood operation* was a first harvest in a spruce-fir stand that had a minor component of tolerant hardwoods. This first cut removed about 30% of the stand volume with the emphasis on eliminating hardwoods, balsam fir and poorly formed spruce. All operations were carried out on firm ground in level terrain (CPPA terrain classification 1.1.1).

### MACHINE DESCRIPTION

The Collins Work-All is a hydrostatic, four-wheel-drive tractor with an oscillating articulated frame. The prototype was powered by a 42-kW (56 hp) Ford four-cylinder gasoline engine. The unit is 4.47 m long, 1.52 m wide and has a ground clearance of 0.46 m, making it very maneuverable, and well suited to intermediate thinning operations (Figure 1). The gross weight of the tractor is 2870 kg.

Fold-away fuel and hydraulic tanks located behind each front wheel offer convenient access to the engine compartment. In addition, this location facilitates refueling and the addition of hydraulic fluid. The engine is located behind the cab, offering good visibility and maintaining a favor-



Figure 1. The Collins Work-All.

able weight distribution on the front wheels for skidding operations.

Articulation and oscillation between the front and rear frames result in good maneuvering characteristics and ensure constant four-wheel contact with the ground. All wheels are powered by independent hydraulic wheel motors, thus offering an infinite range of speeds up to a maximum of 19 km/h. This eliminates the need for shifting gears to maintain an appropriate travel speed for a given set of ground conditions.

Optional equipment includes front and rear ptos, a category I three-point hitch, a hydraulic skidding winch, butt plates and a front decking blade. The manufacturer will equip the unit with a diesel engine on request.

### STUDY RESULTS

During the 4-day period in which FERIC staff observed the Collins Work-All, a short-term, detailed time study was conducted. Table 1 summarizes this data.

**Table 1. Summary of time elements for the Collins Work-All, working in residual removal and shelterwood cutting operations**

| Time element                           | Residual removal | Shelterwood |
|--|------------------|-------------|
|  | Time (min)       |             |
| Travel in                              | 0.93             | 1.21        |
| Position                               | 0.84             | 0.78        |
| Choking                                | 3.94             | 4.11        |
| Cut/assist cutter                      | 1.25             | 1.34        |
| Travel out                             | 1.18             | 1.53        |
| Landing                                | 3.69             | 5.38        |
| Delay                                  | 1.51             | 3.07        |
| Total cycle time                       | 13.34            | 17.42       |
| Number of pieces                       | 4.2              | 4.9         |
| Number of cycles                       | 21               | 25          |
| Average volume (m <sup>3</sup> )/piece | 0.15             | 0.13        |
| Volume (m <sup>3</sup> )/cycle         | 0.67             | 0.67        |
| Productivity (m <sup>3</sup> /h)       | 3.0              | 2.3         |

The 30% increase in cycle time experienced in the shelterwood operation was attributed to three factors: First, the average skid distance increased from 80 m in the residual removal to 110 m in the shelterwood, thereby increasing travel time. Second, a smaller landing was used for the shelterwood operation. Hence, with limited space, a greater amount of time was spent separating the various products. Third, the machine operator spent more time directing the cutting in the shelterwood operation than in the residual removal operation (reflected in delay time). For the two sites, the volume per cycle was the same (0.67 m<sup>3</sup>). However, individual stem volume was smaller in the shelterwood operation.

## DISCUSSION

Although the Collins Work-All performed satisfactorily, some changes are recommended for safety and productivity. The tractor doors offer poor protection for the operator with respect to tree stems and branches entering the cab from below. This could be rectified by extending the present half door to cover the exposed area. The hydraulic winch was considered to be inefficient and alternative units should be considered. Its lack of a free-spooling feature in the reverse direction and its slow line speed in the haul-in direction seriously impeded the operator's work technique. To overcome this problem, the operator maneuvered the back end of the machine close to

the felled trees, thereby minimizing the winching distance. This technique limits the machine's application in thinnings etc. because of the possibility of damage to or removal of crop trees.

The tractor's wheel rims were also not equipped with valve-stem covers. Although not a problem during FERIC's visit, two tire failures occurred thereafter as a result of valve stems being ripped from the rim by logging slash.



*Figure 2. Rear view of Collins Work-All.*

Although the Collins Work-All requires modifications, the basic concept has potential for use in stand thinning/improvement activities. The tractor's narrow width, excellent maneuverability, and good payload capacity serve this machine in good stead. However, its performance on less favorable ground remains to be determined. For most potential buyers, the greatest liability lies in the estimated U.S. \$40 000 price tag, since the chief competition for this unit will be the multitude of small, used cable skidders that are selling for half this price.

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