MILITARY POTENTIAL TEST OF CANADAIR FISHER VEHICLE

ARMY GENERAL EQUIPMENT TEST ACTIVITY
FORT LEE VA

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FINAL REPORT

BY

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FORT LEE, VIRGINIA
SECTION 1. INTRODUCTION

1.1 BACKGROUND

The U. S. Army Tank-Automotive Command (USATAC) was directed to investigate and test the possibility of producing, at reasonable cost, lightweight vehicles with improved mobility capability on swamp and muddy terrain. That Command acquired a commercially produced vehicle (identified as the Canadair Fisher Vehicle) which embraces a unique system of propulsion and showed possible capability of meeting necessary requirements.

USAGETA was directed to test the acquired vehicle to determine its military potential for use on marginal terrain and to determine a number of engineering type objectives particularly regarding the vehicle's propulsion system.

1.2 DESCRIPTION OF MATERIEL

The test vehicle (Canadair Fisher Vehicle, Serial No. 213001) is a tracked amphibian (Figs. 1 and 2), intended for use as a small load carrier on water, swamp, and muddy terrain. It has a molded fiberglass hull and utilizes a "rolling track" principle of propulsion powered by a 9-hp. single cylinder, two-cycle engine of Austrian manufacture, integrally coupled to a torque converter and a two forward speed and reverse differential transmission. Engine fuel is a mixture at the volume rate of 20 parts gasoline to 1 part nondetergent oil. Roller chains transfer power from the transmission to the two final drive shafts. A wheel, with a pneumatic rubber tire (size 5.70 x 8), fixed to each final drive shaft transmits power, by friction, to each track belt. Idler wheels are the same as the drive wheels. The two track belts are made of conveyor type belting, specifically 6 ply 33- to 36-ounce hard duck fabric covered on sides and edges with 1/16-inch-thick rubber. Both belts are 7 inches wide and endless length (mechanically spliced) is 14 feet 7 5/8 inches. Eight equally spaced road wheel tire axles are connected to each belt. On soft muddy terrain, the road wheels in contact with the terrain act as grousers and do not rotate about their individual axles; therefore, speed of travel is the same as the linear speed of the track belt. On hard level ground the road wheels are caused to rotate, about their individual axles, by friction against the underside of the outriggers; therefore, on hard level surface the speed of travel is approximately (allowing for losses) twice the linear speed of the track belt. Seating space is provided for two persons and
Figure 1. Canadair Fisher Vehicle with engine covers removed.

Figure 2. Canadair Fisher Vehicle with engine covers in place.
standing room for a third. The manufacturer's payload rating for the vehicle is 600 pounds including the operator; its curb weight determined during test is 960 pounds. Overall maximum clearance dimensions are: length--103 inches; width--64 3/4 inches; height--47 inches. If necessary, for shipping purposes, dimensions can be shortened by removing the headlight and fenders, and rotating the track-tire assembly to shorter projection. Fore and aft towing eyes are provided, but no lifting eyes. Though drawings furnished indicate that a cab is available for the test item, a cab was not furnished for the test; nor were items such as small tool kit, tire pump, and jack furnished. A general arrangement of the test item is shown in Figure 3.

The XE-4 Armadillo (Fig. 4), used for mobility comparisons during the test, was an experimental item developed by USAMERDC for operation over terrains generally the same as those intended for operation of the Canadair Fisher Vehicle. It is propelled by tracks that travel around sealed pontoons filled with a material resembling polyurethane. Power is supplied by a military standard 4 cylinder gasoline engine of approximately 40 bhp rating. Space available for carrying an operator and other payload is about 50 percent greater than that of the test vehicle (Canadair Fisher). Its curb weight is about 3,000 pounds and the overall length, width, and height dimensions are 127, 71, and 58 1/2 inches respectively.

A second comparison vehicle, the T116E1 (M116) Cargo Carrier, Amphibious, Tracked, was used during the first phase of the test operations. Because a replacement for a broken drive axle was not available and the vehicle would not perform comparably to the test vehicle at the first soft mud terrain site traversed, use of the T116E1 was abandoned.

1.3 TEST OBJECTIVES

a. To determine the military potential of the Canadair Fisher Vehicle and its overall mobility capability, with emphasis on water, swamp, and muddy terrain mobility (VGI from 0–30). Objectives were determined by conducting specific engineering tests regarding performance of the drive train-propulsion system and other tests including Logistics-Over-The-Shore operations and Movement Adaptability (Highway).

b. To determine the safety characteristics of the test vehicle.
Figure 4: Armadillo (comparison vehicle).
1.4 SUMMARY OF RESULTS

The test vehicle characteristics and performances did not meet all of the test criteria; however, the vehicle was found capable of operating over swamp and mud terrains at all the test sites mentioned in this report. It negotiated all approximately level soft terrains including that with lily pads ranging in height to 4 feet above terrain surface, that with grass ranging from several inches to about 5 feet and more above muddy terrain surface, and that muddy terrain having no vegetative growth. On all of those terrains the cone index of the soil, to the depth of track penetration was less than 10. On two occasions, the test vehicle was immobilized by submerged limbs that could not be detected from the surface; one occurred in a swamp area, the other in a marsh area. For that reason, operation over visible logs and large limbs was purposely avoided during subsequent operation. On both occasions the limbs became lodged between the track belt and the vehicle body in a manner such that track movement in either direction would have either torn the belt or unseated it from its position on the drive or idler wheels. Personnel within the vehicle were unable to free the vehicle. The test item was found capable of carrying its rated payload capacity over all reasonably level terrains and over slopes, with varying degrees of performance. Maximum travel speeds on muddy terrains were between 2 and 3 mph and were generally limited by the depth of track penetration and terrain irregularities such as submerged and exposed growths of vegetative matter that affected steerability. On still water, the vehicle is capable of achieving a maximum speed of about 1.7 mph. It has little or no propulsion capability for overcoming water current, waves, and wind. Performance on steep slopes was limited by slippage between one or the other drive wheel and its track belt, which condition could be remedied but not quickly and not without tools to cut (shorten) the belt and redrill it for mechanical splicing. The vehicle power unit and propulsion capabilities are more than enough to break the castings of the road wheel axle assemblies attached to the track belt, while exerting drawbar pull during operation on beach sand surface and pavement. Space for payload, either passenger seating or cargo or both, is inadequate except when a compromise in space occupation is tolerable. Disregarding the payload space limitation, and provided that severe concentrated loads are not placed directly on the hull bottom, the vehicle seems capable of carrying at least 50 percent more than its rated payload over smooth water and reasonably level soft terrain; however, no such test determination was attempted. The fiberglass hull has areas of
structural inadequacy. Areas vulnerable to significant abrasion exist on both of the outrigger ends and on the hull bottom and sides.

1.5 CONCLUSIONS

a. The Canadair Fisher Vehicle, in its present configuration, does not meet enough of the test criteria requirements to be suitable for potential use by the U. S. Army under intermediate climatic conditions. Its inadequacies are primarily attributable to its limited space for accommodating payload and its structural and mechanical weaknesses.

b. The performance of the unique track system on soft mud terrain having Rating Cone Indexes of 10 and less is impressive enough to justify considering redesigning the vehicle if a need exists for such a vehicle. Due to the materials of construction of the hull (fiberglass) and the track system (rubber), a redesigned version of the vehicle would be useful only in noncombat situations unless it could be equipped with armor.

c. The test vehicle's characteristics and performances adequately met eight and partly met four of the 22 applicable test criteria (App. II). Most of the criteria not met pertained to Maintenance, Safety, and Human Factors.

1.6 RECOMMENDATIONS

a. If a military requirement exists for a vehicle such as the test item, it is recommended that a redesigned vehicle, correcting the shortcomings (App. III) and those criteria not met (App. II), be procured and tested.

b. A new item should incorporate the seating spaces in accordance with U. S. Army Human Engineering Laboratory Standard S-6-66. Generally, the occupiable space for payload (personnel or cargo) should be increased 6 to 12 inches in width and 12 to 18 inches in length. Engine horsepower should be increased accordingly with any increase in the size of the hull.
Figure 12. Drawbar pull test operation at Fort Eustis (Mulberry Island).

Figure 13. Drawbar pull test operation at Camp Wallace.
Figure 14. Drawbar pull test (moving condition) on dry sand beach at Fort Story.

Figure 15. Road wheel axle failure occurred at 850-pound drawbar pull intensity while testing in stall-condition on dry sand beach.
Figure 17. Vehicle track snagged onto a tree limb that was submerged until vehicle manipulation exposed the limb. Vehicle was freed by cutting off the limb.

Figure 18. Track belt torn by snagging onto a submerged log during operation on marsh terrain.
Figure 21. Operation in mud at Fort Eustis.

Figure 22. Operation on muddy terrain under 8 to 10 inches of water at Fort Eustis.
Figure 26. Armadillo descending ramp of LCU in reverse travel. Note test vehicle in background.

Figure 27. Test vehicle ascending LCU ramp while carrying 600-pound payload.
Figure 29. Two men seated in test vehicle.

Figure 30. Three men seated in test vehicle.