TECHNICAL MEMORANDUM NO. 74-87

ARCTIC SLED

by

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Mobility Branch

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Final Report

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U. S. ARMY LAND WARFARE LABORATORY
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Comparative tests were conducted with 200 lb capacity manually towed arctic sleds. The sleds tested were a standard US Army sled, a standard Canadian Army sled, and a modified Canadian Army sled. The tests were conducted for the purpose of determining whether the Canadian Army sled would better meet US Army requirements; or, if not, to provide guidance in the design of a new sled. The conclusions were that the dimensions of the slightly larger US Army sled are required to transport the required infantry load items, but

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that the rigid handle of the Canadian standard sled, and the plastic runner material and the plastic coating of the running surface of the modified Canadian sled were desirable features. It is recommended that consideration be given to dividing the infantry load and transporting it in two sleds.

PREFACE

This task was conducted by the Mobility Branch of the US Army Land Warfare Laboratory (USALWL). Testing was conducted by the Arctic Test Center, Fort Greely, Alaska; Captain James B. Morris, Test Engineer. Due to the disestablishment of the USALWL, the task has been transferred to the Mobility Equipment Research and Development Center, Fort Belvoir, VA. Canadian Army sleds were furnished by the Canadian Army.

INTRODUCTION

US Army troops in Alaska have reported that the standard 2-man arctic sled lacks durability at low temperatures, downhill control, and side slope steering control. During joint US-Canadian maneuvers, US personnel observed the standard Canadian Army sled, and expressed the opinion that it had features which would be desirable for a new-generation sled design.

DESCRIPTION

Three different sleds were tested:

1. Sled, US Army Standard, 200-pound capacity, FSN 3920-273-8211. The sled is towed by means of a rope. A canvas cover and lashing are provided. The construction is fiberglass, with linen base phenol-formaldehyde runners. The dimensions are 88 inches long, 24 inches wide, and 8 inches deep. The weight is 38 pounds.

2. Sled, Canadian Army Standard, 200-pound capacity, FSN 3920-102-3021. The sled is towed by means of either a rope and/or a pivoted rigid push/tow-bar. The push-bar may also be used for downhill braking and side slope steering control. A canvas cover and cargo lashing are provided. The construction is welded magnesium with linen base phenol-formaldehyde runners. The dimensions are 77 inches long, 20 inches wide, and 5 inches deep. The weight is 31.5 pounds. (See Figure 1.)

3. Modified Canadian Sled. The standard runners were replaced with ultra high molecular weight polyethylene (UHMWPE). Also, the bottom surface was first sandblasted to remove the existing epoxy finish, then coated with a fluorcarbon coating (Whitford Corp Xylan No. 2014).

Figure 1. Canadian Sled with Four-Man Towing Team

DEVELOPMENT AND TEST

The Canadian sled and the modified Canadian sled were tested to determine if one of these sleds would meet US Army requirements. Since the runner material used on the Canadian sled which is also used on the US Army sled, has been subject to failures in cold weather, one Canadian sled was modified by substituting UHMWPE for the runner material. The UHMWPE has excellent extreme cold weather impact strength. Also--to reduce towing resistance--the entire bottom surface was coated with a low friction and abrasion resistant fluorcarbon coating.

The Canadian sled and the modified Canadian sled were tested to determine the suitability of the over-all configuration and size, the utility of the rigid towing handle, the durability of the magnesium construction, and the durability and friction qualities of the plastic materials used in the modifications. The tests were conducted in comparison with a standard US Army sled. The detailed test results have been reported by the test agency.[1]

The conclusion of the test report was that the Canadian sled does not represent an over-all improvement over the US Army sled, but that it does possess desirable features. The desirable features were the rigid push-bar, and the low friction runner and bottom surface plastic materials.

The modified sled clearly required less force to initiate movement in snow. Once in motion, no less towing force seemed necessary; however the measured data of average towing force while in motion was inconclusive.

The rigid push-bar of the Canadian sled was considered to be useful in pushing and maneuvering the sled. However, when the sled was loaded, the push-bar could not be rotated back over the sled because of interference with the cargo. (A 260-pound Basic Tent Group Equipment Load[2] was used for the tests. A team of four soldiers was used for manual towing, using prescribed towing procedures.[3]) A detachable push-bar was recommended.

The unfavorable aspects of the Canadian sled performance resulted from its smaller dimensions. The smaller loading area required the cargo to be stacked higher, and this resulted in instability and overturning problems. Also, the ground pressure was higher. This is probably why the low friction material on the modified Canadian sled did not have lower towing resistance in motion - even though the initial break-away force was substantially reduced.

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[1]Feasibility Test of Arctic Sled, Final Letter Report, USA Arctic Test Center, 15 May 74.

[2]DA Pamplet 350-44, Soldier's Handbook for Individual Operations and Survival in Cold Weather Areas.

[3]Field Manual 31-70, Basic Cold Weather Manual.

Other user comments were made which would be useful to guide the design of a new-generation sled - involving cargo tie-down provisions, cargo cover, and hand-holds for lifting the sled.

DISCUSSION

Both sleds were over-loaded during the tests. This results from the necessary cargo requirements of an infantry squad, and only one sled per squad is authorized. The rated load of both sleds is 200 lbs; the test loads were 260 lbs; and a standard load in practice is 336 lbs. This over-loading increases the ground pressure and causes sinkage and towing resistance in soft snow, especially for the smaller Canadian sled. It is believed that the use of two sleds - and dividing the load between them - would reduce the total manual effort. The ground pressure, sinkage, and towing resistance would be reduced. If the user doctrine were changed to allow two sleds per squad, the smaller size of the Canadian sled might be more appropriate. Also, it is believed that two men sharing one-half the load would require less effort than four men sharing the full load, even without considering the reduced towing resistance. This reduction of effort could result from uneven terrain conditions and the impossibility of equally sharing the load at all times. Each member of the team will occasionally assume nearly the full effort, and with a heavier load this could increase strain and fatigue.

CONCLUSION

The Canadian Army sled is not suitable as a direct replacement for the US Army sled, but the rigid push-bar and the low friction materials used to modify the sled, are features which should be considered in the design of a new-generation sled.

RECOMMENDATION

It is recommended that additional tests be conducted with two Canadian size sleds as a replacement for the one US Army size sled, and if the results are favorable - in terms of lessening the load on the infantryman - the doctrine which allows only one sled per squad should be reconsidered.

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