AD NUMBER: AD0862497

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to US Government Agencies only; Export Control; 1 Dec 1968. Other requests shall be referred to Air Force Armament Laboratory, Eglin AFB, FL 32542.

AUTHORITY

USAFATL ltr dtd 10 Mar 1977

AFATL-TR-68-142

DEVELOPMENT OF MHU-110/M MUNITIONS TRAILER

T. B. ALFRIEND
AAI CORPORATION

TECHNICAL REPORT AFATL-TR-68-142

DECEMBER 1968

AIR FORCE ARMAMENT LABORATORY

AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE

EGLIN AIR FORCE BASE, FLORIDA

16

DEVELOPMENT OF MHU-110/M MUNITIONS TRAILER

T. B. Alfriend

FOREWORD

This report was prepared by AAI Corporation, Cockeysville, Maryland, under Contract F08635-68-C-0057 with the Air Force Armament Laboratory, Eglin Air Force Base, Florida. The report covers work done during the period 1 February 1968 through 9 August 1968. Mr. Parker R. Buckley (ATZS) was program monitor for the Air Force.

Information in this report is embargoed under the Department of State International Traffic In Arms Regulations. This report may be released to foreign governments by departments or agencies of the U. S. Government subject to approval of the Air Force Armament Laboratory (ATZS), Eglin AFB, Florida 32542, or higher authority within the Department of the Air Force. Private individuals or firms require a Department of State export license.

This technical report has been reviewed and is approved.

ROY L. COMPTON
Acting Chief, Engineering Division

ABSTRACT

This was a program to study, design and manufacture a Forward Area Munitions Trailer capable of transporting up to 15,000 pounds of payload. The initial effort on the program was to perform a trade-off study to establish the optimum deck height, empty weight, payload capacity and tire flotation. The remainder of the program concerned the detail design and fabrication of a prototype based upon the characteristics determined during the study.

(The reverse of this page is blank)

TABLE OF CONTENTS

(The reverse of this page is blank)

SECTION I

INTRODUCTION

The MHU-110/M Munitions Trailer has been developed by AAI Corporation for the Air Force Armament Laboratory, Eglin Air Force Base, under Contract F08635-68-C-0057. This trailer is a light weight, high load capacity towed vehicle with low ground pressure for good off-road mobility. The trailer can carry fully loaded MER and TER racks, or, by using a set of bomb chocks and rails, can carry individual bombs up to 30 inches in diameter.

Briefly, the requirements for the trailer are as follows:

1. Payload capacity - 15,000 pounds.

2. Empty weight - 4,000 pounds or less.

3. Deck height - 30 inches or less.

4. Off-road mobility superior to the existing MHU-85 trailer.

These four requirements constituted the basic parameters around which a trade-off study was performed as described in Section III of this report.

The original contract called for the completion of the trade-off study and a design program. After the study had been completed and a particular concept had been selected, the contract was modified to include development of a prototype and test liaison at the Government test facility. The sections which follow give a description of the trailer prototype and a history of its development.

SECTION II

DESCRIPTION

1. GENERAL

The table below gives the dimensions and general characteristics of the MHU-110/M Munitions Trailer. Figures 1 and 2 are photographs of the completed prototype.

TABLE I. DIMENSIONS AND GENERAL CHARACTERISTICS
MHU-110/M MUNITIONS TRAILER

Capacity	15,000 pounds
Deck Height	30.0 inches unloaded
Width	91.0 inches
Length	196.0 inches (less towbar) 261.0 inches (with towbar)
Ground Clearance	11.0 inches
Wheel Configuration	Singles on front axle; Duals on intermediate and rear axle
Number of wheels	10
Tire Size	9:00 x 10, 10 ply rating
Towing Speed	35 mph (unloaded) highway 20 mph (loaded) paved roads 10 mph (loaded) rough terrain
Weight	3600 pounds less rail system 4200 pounds with rail system
Wheel Base	94.0 inches
Turning Radius	175.0 inches
Service Brakes	Inertia actuated brakes on all wheels with mechanical back-up release
Parking Brakes	On rear wheels, manually applied
Steering	Automotive, with $\pm$ 45° cramping angle and oversteer mechanism
Lights	24 volt and 12 volt systems

2. CHASSIS

The trailer chassis is a weldment of heat treated aluminum alloy. The deck is a 1/2 inch thick plate of 5086-H34 aluminum. Welded to the bottom of this is a U-shaped channel section, approximately 11 inches deep, which runs longitudinally the full length of the trailer. This channel section, together with the top deck, forms the primary structural member for reacting bending and torsional loads. Further stiffening of the chassis is provided by eight transverse bulkheads and by a longitudinal stringer along each outboard edge of the top deck. Local reinforcements are provided at the point of attachment of the suspension system.

Figure 1. MHU-110/M Munitions Trailer Without Rail System

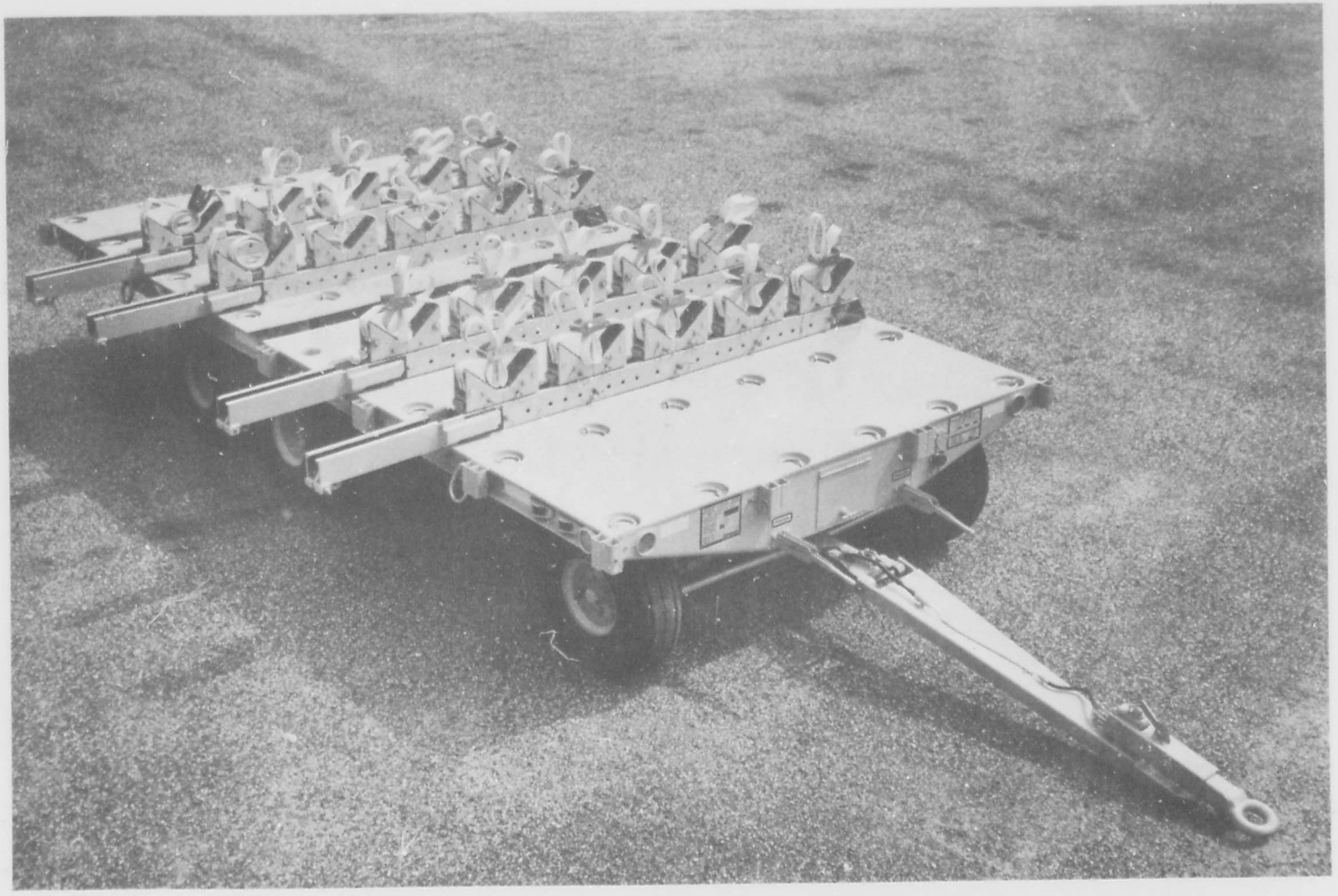

Figure 2. MHU-110/M Munitions Trailer With Rail System

3. RUNNING GEAR

The trailer uses 10 wheels arranged in a 2-4-4 configuration; that is, 2 wheels on the front axle, 4 wheels each on the intermediate and rear axles. The tires used are size 9:00 x 10, 10 ply rating, in a multi-rib tread configuration. These tires are 26.8 inches O.D. and 12.3 inches rolling radius at rated load. Inflation pressure is 32 psi.

The front axle consists of a 2-3/4 inch square bar of 1045 steel with suitable ends and attachments for the spindles, tie rods, towbar, and springs. The entire front axle assembly was supplied by the United Manufacturing Company, Cleveland, Ohio.

The two rear axles are identical in construction. The basic axle is a 2-3/4 inch square bar of heat treated 4340 steel. Two wheels are ganged together on a special adapter on each end of the axle and are supported by roller bearings. To provide for inflation of the inside tire, a valve extension is used and is brought out through the flange of the outside wheel rim.

On the front axle, one 8-1/2 inch by 2-1/4 inch brake assembly is provided in each wheel. On the rear axles, one 11 inch by 2-1/4 inch brake assembly is provided for each pair of wheels. All brakes are the automotive expanding shoe type and were supplied by the Dico Company, Des Moines, Iowa.

The brakes are hydraulically actuated by a master cylinder mounted on the draw bar. The master cylinder is carried in a sliding assembly such that the system is pressurized when the trailer surges forward against the towing vehicle. The brakes are thus applied in proportion to the deceleration of the towing vehicle. No hydraulic or electrical connection between trailer and towing vehicle is required to operate the brakes.

To permit the trailer to be backed up by the towing vehicle, a mechanical release is provided in each brake cluster. This mechanical release cams the brake shoes away from the drums when the wheels are rotated in reverse, thus preventing braking action although the hydraulic system will be pressurized due to the force on the towbar. Lever operated parking brakes are provided on the eight rear wheels.

4. RAILS AND CHOCKS

Figure 2 shows the tailer with all rails and chocks installed. Four rails are provided, each with five chock assemblies. Each chock assembly can be adjusted to accommodate stores up to about 30 inches in diameter. The chocks can be located in a variety of positions along the rail and are locked in position by ball detent pins.

A rail extender is located at one end of each rail. These are detachable parts which are stored in the forward storage compartment when not in use. The rail extenders permit a store (on a pair of chocks) to be rolled out beyond the edge of the deck. Then the lift cradle of the MHU-83 loader can be brought in between the rails and the bomb lifted directly off its chocks.

The trailer deck contains 48 10,000 pound tie down fittings. Each side of the trailer has four 25,000 pound tie down fittings. In addition, there are twenty 5,000 pound ratchet buckle strap assemblies (one for each chock) and eight 5,000 pound ratchet buckle assemblies (for use when the rail system is removed).

The trailer also has 18 removable side stakes. These are U-shaped pieces 40 inches high which are held in pockets fastened to the side of the trailer bed. All of the stakes are interchangeable and can be mounted in any adjacent pair of pockets.

5. STOWAGE COMPARTMENTS

Three storage compartments are provided:

a. Forward compartment for storage of rail extenders and miscellaneous parts.

b. Left rear compartment for storage of fuzes.

c. A right rear compartment for tools and unused ratchet buckle assemblies.

Each storage compartment has a door which is hinged at the top and has a locking handle.

6. LIGHTING SYSTEM

The MHU-110/M trailer is equipped with a lighting system meeting the requirements of MIL-M-8090. The system operates from either a 24 volt or 12 volt prime mover electrical source and provides the trailer with clearance lights on three sides and tail, stop and turn signaling lights on the rear. The lighting system provides also for operation during blackout conditions. In addition to the lighting system, reflective sheeting is mounted on all sides of the trailer to increase its night time identification.

SECTION III

INITIAL TRADE-OFF STUDY

Work on this program was started on 1 February 1968. The initial task was to perform a trade-off study to determine the optimum combination of deck height, empty weight, payload capacity and mobility, within the limits established by the basic specification. The basic specification is R&D Specification No. ATZ 67-79, dated 6 March 1967 which specifies the following:

1. Deck height - maximum of 30 inches; desirable 24 inches or less.

2. Empty weight - not more than 4000 pounds.

3. Payload capacity - 12,000 pounds to 15,000 pounds.

4. Mobility - to negotiate terrain having a California Bearing Ratio of 7.

These four requirements generally determined the trailer design. Other requirements which were secondary but non the less important were:

1. Trailer bed dimensions to be 91 inches wide by 180 inches long.

2. Trailer bed to be flat with removable chocks and rails for handling a variety of bombs and aerial stores.

3. The steering, braking and side slope stability of the trailer must meet the requirements of MIL-8090D for type III mobility.

4. The trailer is to be compatible with existing bomb loaders such as the MHU-83 and MJ-1.

Another requirement which is implied by the specification is that the trailer design be fairly conventional. Use of materials such as magnesium and titanium is not desirable because of their high cost. Likewise, exotic suspension systems such as "air bag" tires or tracks were not encouraged. If at all possible, the trailer should use pneumatic tires which are readily available from commercial suppliers.

With this background, the first task was to contact the leading tire manufacturers for data on existing low pressure, high capacity tires with overall diameters which would permit a deck height of 30 inches or less. Four tire sizes were found to meet the basic requirements:

1. 9.00 x 10 Industrial Tire

2. 25 x 24.00-8R Terra Tire

3. 26 x 12.00-12 Terra Tire

4. 31 x 15.50-15 Terra Tire

Based on these four tires, five concepts for the munitions trailer were developed. These designs were carried far enough to establish the deck height, estimated empty weight and mobility characteristics for various payloads. These designs were presented at the Armament Laboratory on 19 March 1968 to personnel of the Armament Laboratory and other members of the using commands. At this meeting a 3 axle, 10 wheel version was selected as most nearly meeting all of the desired trailer characteristics and AAI Corporation was instructed to proceed with a detail design of this concept. Additional information on the other concepts and on the trade-off study is given in AAI report ER-5248, "Study Report on Forward Area Munitions Trailer", dated March 1968.

SECTION IV

DETAIL DESIGN AND PROTOTYPE DEVELOPMENT

Immediately after the 19 March meeting at the Armament Laboratory, work was started on preparing detail drawings of the selected trailer concept. On 5 April 1968, a proposal was submitted to the Laboratory for the fabrication of a prototype based on this design. This proposal was successful, and on 13 May 1968 AAI received authorization to proceed with fabrication of one prototype. The requested delivery date for the prototype was 20 June 1968.

The design of the trailer proceeded as rapidly as possible. Purchase orders for the front axle assembly, the 9:00 x 10 tires, rims, brake shoes and inertia brake actuator were issued early in the program. By 1 June, all drawings had been released for manufacturing and many subassemblies were complete. Every effort was made to complete the trailer by 20 June; however, late delivery of some purchased parts, particularly the tires, prevented completion of the trailer until 8 July, about 2½ weeks late.

The trailer was given a preliminary loading test before delivery. This consisted of 15 to 20 mph tests on a gravel road when loaded with 16,000 pounds of sandbags. The trailer towed well with no failures observed. Towing tests on paved roads with the trailer empty were also made. The top speed obtainable was about 40 mph. At this point, lateral oscillation developed which did not appear to damp out until the speed was reduced. The maximum safe operating speed was determined to be 35 mph. No oscillations were noted at this speed.

On 9 August 1968, the trailer was delivered to Aberdeen Proving Ground per instructions received from the Armament Laboratory. After an initial inspection by Aberdeen personnel, formal testing was started on 21 August. The results of this testing program will be reported in a subsequent APG test report.

(The reverse of this page is blank)

DISTRIBUTION LIST

DDR&E Tech Lib	2
Hq USAF (AFRDDA)	1
(AFRDQ)	1
AFSC (SCS)	2
(SCTS)	2
TAC (DMA)	2
(DORQ)	2
ASD (ASJ)	2
SAAMA (SANRTB)	2
AFWL (WLD)	1
(WLAS)	1
CINCUSAFE (MMD)	1
CINCPACAF (DORQ)	1
(DMW)	2
7AF (DAFSC)	2
Hq USMC (Code A03H0)	1
DDC	20
AFATL (ATW)	1
(ATZ)	1
(ATZS)	4
ADTC (ADAMB)	1
(ADBPS-12)	4
(ADW)	1

(The reverse of this page is blank)

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
AAI Corporation
P.O. Box 6767
Baltimore, Maryland 21204

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE

DEVELOPMENT OF MHU-110/M MUNITIONS TRAILER

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Final Report - 1 February 1968 through 9 August 1968

5. AUTHOR(S) *(First name, middle initial, last name)*

T. B. Alfriend

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
December 1968	16	

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
F08635-68-C-0057	
b. PROJECT NO.	
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	AFATL-TR-68-142

10. DISTRIBUTION STATEMENT
This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Air Force Armament Laboratory (ATZS), Eglin AFB, Florida 32542.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Available in DDC	Air Force Armament Laboratory Air Force Systems Command Eglin Air Force Base, Florida

13. ABSTRACT

This was a program to study, design and manufacture a Forward Area Munitions Trailer capable of transporting up to 15,000 pounds of payload. The initial effort on the program was to perform a trade-off study to establish the optimum deck height, empty weight, payload capacity and tire flotation. The remainder of the program concerned the detail design and fabrication of a prototype based upon the characteristics determined during the study.

DD FORM 1 NOV 65 1473

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Trailer						
Munitions Trailer						
Handling Equipment						
Vehicle						
Munitions Handling						