

QCX
Avro
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TOWING EQUIPMENT
C-105
LOG/105/21
ANALYZED
A.R. Littleboy January, 1956

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ANALYZED

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C-105

REPORT NO. LOG/105/21

FILE NO. 12/J

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TITLE: TOWING EQUIPMENT

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PREPARED BY A.R. Littleboy DATE January, 1956

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TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C-105

TOWING EQUIPMENT

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C-105 AIRCRAFT TOWING EQUIPMENT.

Introduction

This report describes the towing equipment with particular reference to the Audio Warning System, and modifications required to the towing vehicle.

General Description

Owing to the aircraft configuration, it is not possible to see the towing vehicle from the cockpit. Therefore, some means of communication between the towing vehicle operator and the crewman in the cockpit is necessary. The turning radius of the nose undercarriage is limited to 55°. If this is exceeded, a shear pin in the tow bar fails. It is not easy for the towing vehicle operator to determine his position in maneuvering the aircraft. It is therefore proposed to install a turn warning device to give warning of excessive movement. A second warning device will operate when the main towing shear pin has failed. The whole system will function as follows:-

- (1) Normal intercom will exist between the towing vehicle and cockpit.
- (2) In the event of excessive turning, an oscillator triggered by a switch on the tow bar will sound continuous warning note in the towing vehicle head set only.
- (3) Should the main shear pin fail, the warning will sound in both head sets and will be the crewmans signal to apply the aircraft brakes.

To protect the driver from injury in the event of a nose leg failure, a structure as shown on figure 1 is required on the towing vehicle.

Tow Vehicle

The proposed vehicle is a model HT12D mulenobile tractor, manufactured by the Canadian Mobile Company, of Vancouver.

A framework within the envelope shown on figure 1 is required to protect the driver.

It is important to avoid back lash between the pintle hook and the tow bar eye. The hook presently fitted to the model HT12D tractor is not considered satisfactory. It is therefore requested that this shall be changed and that the hook shown on figure 1 be fitted.

Mounted behind the drivers seat in a waterproof box will be the intercom., amplifier and relay box with storage space for two headphones-mic. sets, one for the drivers use and one for use in the cockpit when the pilots head set is not available. On the instrument panel is an intercom. on-off switch with warning light and mechanical type dimmer.

On the rear of the vehicle adjacent to the tow bar hook will be a receptacle to Avro drawing LCS-C142, connecting the intercom. to the tow bar lead.

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Amplifier And Interphone.

The amplifier will be a modified version of the RCA "Walk-Away" Interphone station but requiring no push-to-talk switch. This unit will be mounted on shockmounts, with an audio oscillator inside the waterproof box. This audio oscillator is required (see figures 2 and 4 for details) to provide an aural warning as follows:-

Turn Signals

Actuated by a single micro switch mounted on the tow bar the oscillator will provide a continuous aural signal when the tow bar turns the front wheel more than 45° in either direction. This signal is to be heard by the vehicle driver only. The micro switch will be suitably protected against malfunctioning through snow, water or ice. Access will be provided to enable the micro switch to be closed by hand to test the oscillator.

Shear Pin Signal

This signal will be operated by the breaking of the shear pin (10,000 lbs.) and will be heard by both driver and cockpit occupant. The breaking of the pin will close a micro switch and start the signal and lock on a relay. Sufficient cable will be provided between the tow bar and the vehicle to keep the signal on with vehicle and tow bar up to 6 feet apart. When the vehicle and tow bar exceed this distance, the tow bar lead will pull out from the tractor. Since the noise of the signal will prevent interphone conversation, a cut-out push button will be provided on the relay box. Pressing this button will unlock the relay, cut off the signal and enable intercom conversation to be carried on while the tow bar is being reset and a replacement shear pin fitted. Without this facility, there would be no intercommunication after the tow bar shear pin had broken and the cockpit occupant would be isolated. The design of the tow bar will enable the shear pin to be very quickly and easily replaced.

Similar to the turn signal, it will be possible to manually operate the micro switch for test purposes.

Power Supply.

The aircraft intercom. and the amplifier mounted on the towing vehicle require a 24/28 v D.C. power supply, capable of supplying 4 amps, which is to be provided by the towing vehicle.

The suggested alternative method of producing this are as follows:-

- (1) Convert the tractors electrical system to 24v.
- (2) Add an additional 24v generator, voltage regulator, cut out and battery, the capacity of which could be as little as 15 amp. hours.

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- (3) Use a dynamotor with the tractor voltage input and 24v output together with a 24v battery and voltage control.

It is most essential that the power supply to the interphone system from the tractor has a negative ground. This is mentioned because some vehicle manufacturers follow the opposite practice.

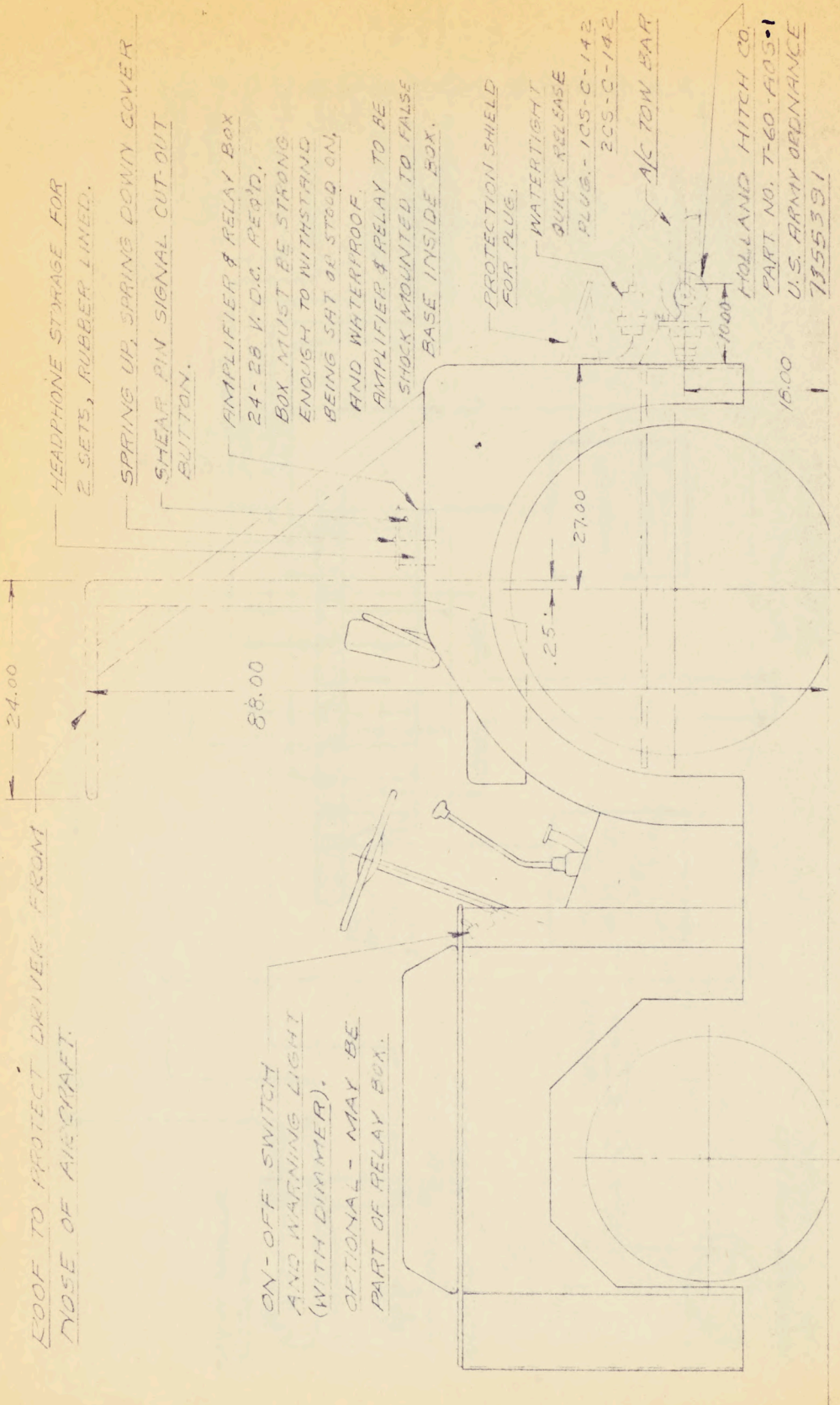
Note: The tractor electrical system must be noise suppressed.

Tow Bar

The tow bar will be of tubular construction. At the vehicle end will be the necessary eye for attachment to the vehicle tow hook. Also, the shear pin and micro switch and the cable connector to the vehicle. At the aircraft end will be a forked attachment fitting designed to be quickly secured to the aircraft nose undercarriage towing point. A second shear bolt (35,000 in/lbs.) is provided at this end to prevent excessive turning loads on the aircraft nose wheel leg. Mounted on the fork is the turn signal micro switch. A cable connector is supplied to connect to the nose wheel door disconnect. Also at the aft end will be two rubber wheels for towing the bar when not connected to the aircraft. Provision will be made to stow spare shear pins on the tow bar and for the loose cable ends when the tow bar is disconnected. As far as possible, all electrical wiring will be carried inside the tow bar and the entire system will be fully waterproof.

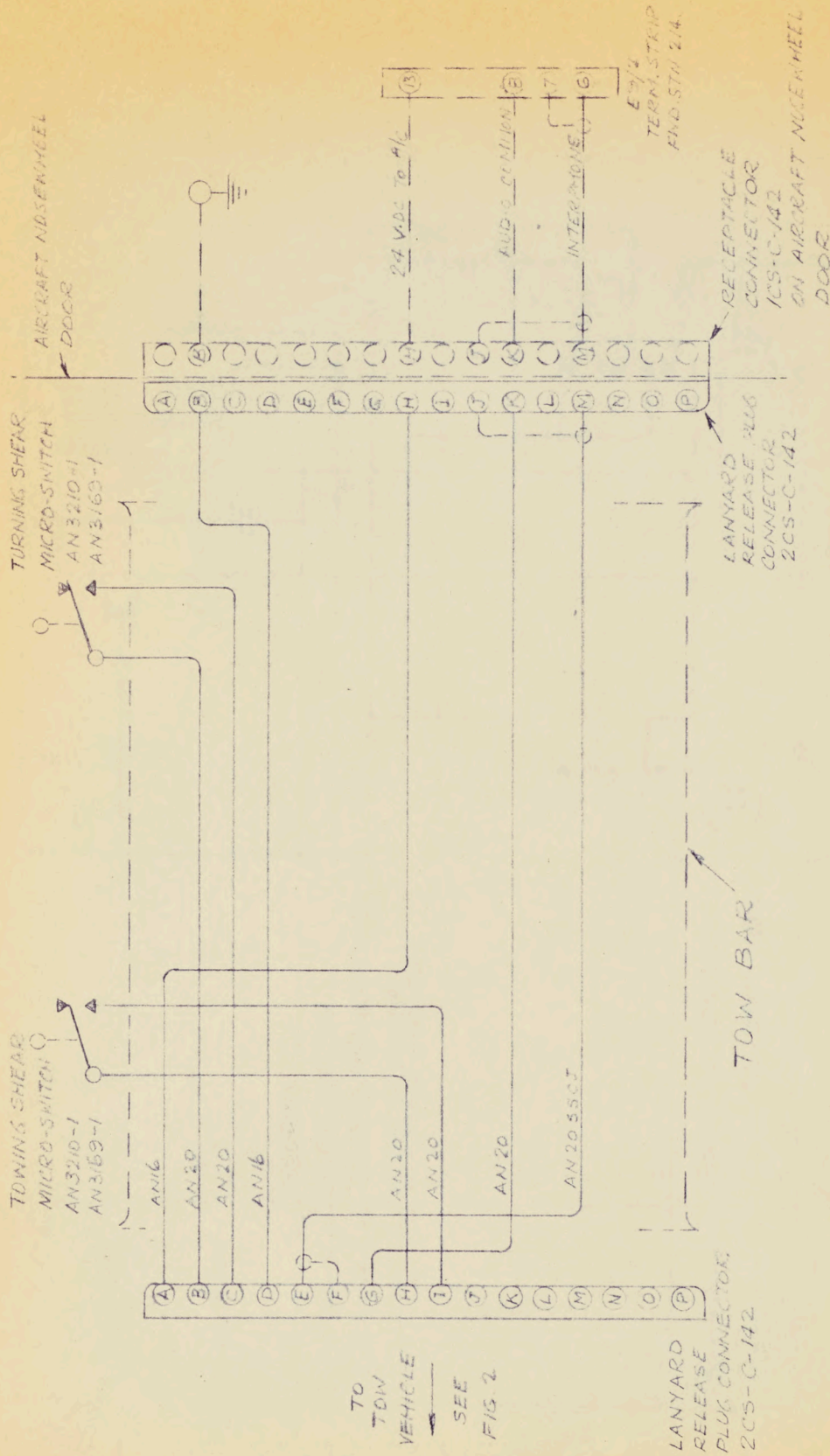
Aircraft Connection.

The nose wheel door disconnect is part of the aircraft wiring system and the necessary pins are wired to the pilots and navigators interphone system.



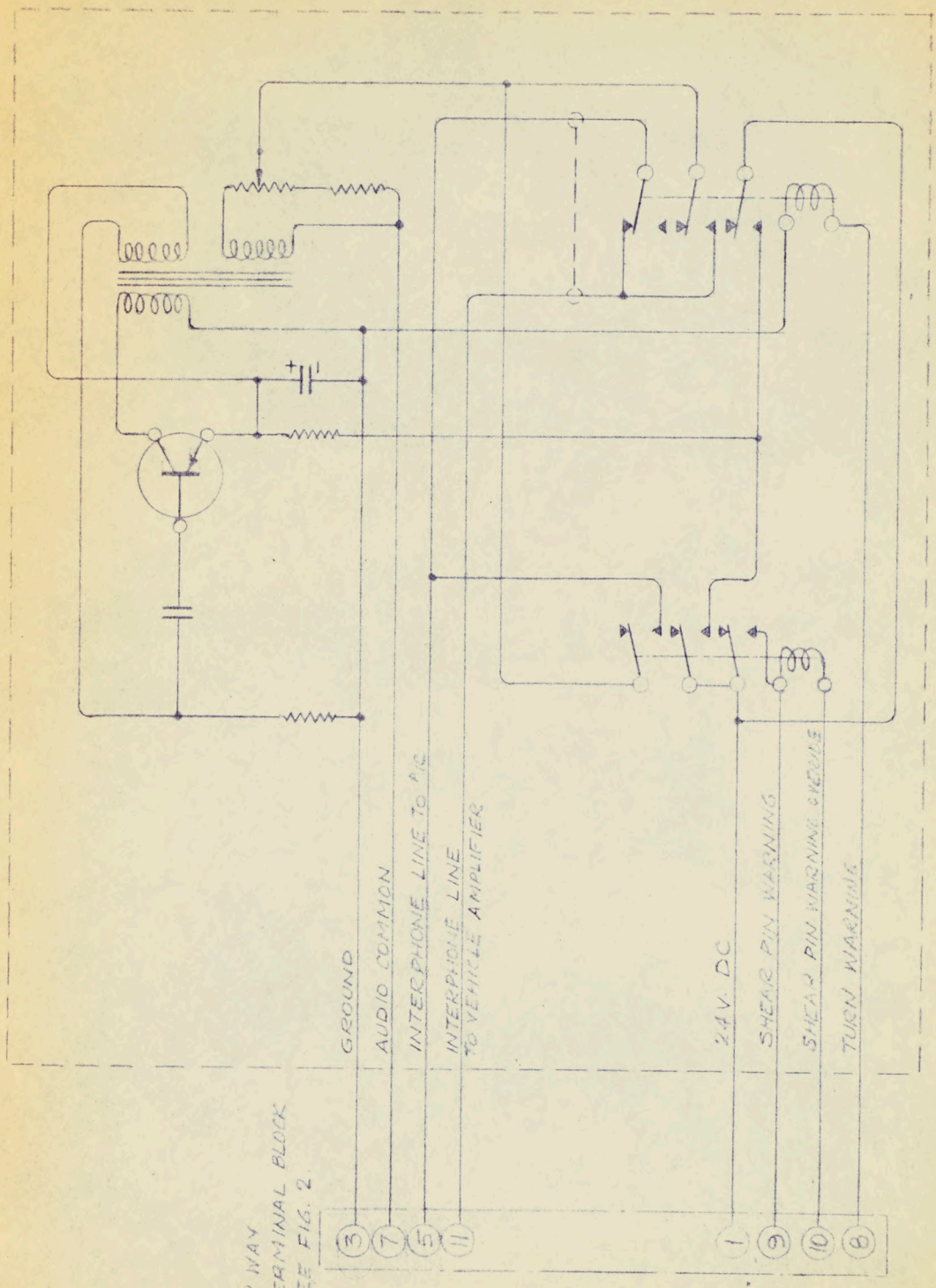
ALL DIMENSIONS APPROX.

MOD. TO MULEMOBILE MODEL HT 12D - C105 TOWING FIG. 1



SCHEMATIC WIRING DIAGRAM

FOR
C105 AIRCRAFT TOW BAR.



THEORETICAL SCHEMATIC WIRING DIAGRAM
FOR
WARNING OSCILLATOR.

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