CF-105

GROUND INSTALLATION

28 V DC POWER SUPPLY AND INTERPHONE

R E S T R I C T E D

LOG/105/7 May, 1955

A. V ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: CF-105

REPORT NO. LOG/105/7

FILE NO.

NO. OF SHEETS: 7

No. of Figures: 6

TITLE:

GROUND INSTALIATIONS
28 V DC POWER SUPPLY AND INTERPHONE

RESTRICTED

Classification cancelled / Changed to UNCLASS
By authority of AVRS
Date 27 Sept 56
Signature
Unit / Rank / Appointment AVRS

PREPARED BY J.P. Booth DATE May 25/55

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY DATE

ISSUE No.	REVISION No.	REVISED BY	APPROVED BY	DATE	REMARKS
1					Based on report C105-R-0008 issued by I. Liss. 15786196

FORM 1316A

T8274

INDEX

DIAGRAMS

1. INTRODUCTION

1.1 This report outlines proposed intercommunication and 28 V DC power supply requirements when the aircraft is on the ground. The electric leads for these services are contained in the same ground cable which also houses the engine starting electric control leads. This cable is plugged into the aircraft by means of an automatic quick disconnect coupling in the vicinity of the nosewheel.

The various conditions during which these services may be required, are as follows:

(a) Aircraft in Readiness Hangars.
(b) Aircraft on Flight Line Tarmac (or in Flight Line Shelter in bad weather).
(c) Aircraft in Maintenance Hangar.
(d) Aircraft being Turned-Around.
(e) Aircraft being Towed.
(f) Aircraft at an emergency air strip.

1.2 Aircraft In Readiness Hangar

In this condition it is planned that the aircraft crew will be in telephonic communication with the ground crew or with the hangar control officer.

In this condition all electric power is fed to the aircraft as 208/115 V, 400 cycle, 3 phase A.C. from stationary supply. Inside the aircraft the required amount of D.C. power is derived from the transformer-rectifiers and therefore no 28 V D.C. ground power supply to the aircraft is required.

1.3 Aircraft on Flight Line

In this condition the aircraft is serviceable and only minor maintenance and daily inspections will be carried out on it. If required, the aircraft may be in the stand-by readiness condition for periods not exceeding 2 hours at a time.

The aircraft crew will be in telephonic communication with the ground crew.

For normal peace time operation, when no urgent scramble is necessary, the only facility required to get a serviceable aircraft airborne is a means for starting the aircraft's engines and a small amount of 28V D.C. electric power prior to engine start. This electric power is required for the following systems:

Aircraft intercom AN/AIC-10
Aircraft UHF radio AN-ARC-34

Aircraft canopy actuation
Aircraft low pressure fuel cock
Aircraft fire detection
Aircraft fire extinguishing
Aircraft engine ignition
Starter vehicle control valves via cockpit control.

The maximum power required for these systems is 50 amps and should be derived from ground service in order not to drain the small aircraft battery. The starter unit may be carried on a separate trailer as distinct from the main A.C. electric and air conditioning power truck, for reasons of flexibility of operation. If this is going to be the case then the D.C. power supply and intercom facilities must be incorporated on this trailer. Power supply for minor maintenance on tarmac or in flight line shelter will be derived from the main power truck.

1.4 Aircraft in Maintenance Hangar

In this condition the aircraft is unserviceable and major maintenance will be carried out. Because of the distance between the aircraft cockpit and the tail and engine bay, telephonic intercom between aircraft crew and ground crew will be required, using the aircraft system.
In this condition all electric power is fed to the aircraft as 208/115 V, 400 cycle, 3 phase A.C., the same as in the readiness hangar.

1.5 Aircraft being Turned-Around

In this condition the aircraft crew must be in telephonic intercom with the ground crew. All electric power is fed to the aircraft from the main electric and air conditioning truck as 3 phase A.C. and no D.C. is required.

1.6 Aircraft being Towed

In this condition it has been decided by the RCAF that telephonic intercom will be required between the aircraft crew and the tractor driver. Also audible signal will be sounded into the earphones of air crew and driver if the maximum permissible turning radius is being approached. For intercom and for canopy actuation 28 V D.C. power supply is required in order not to drain the small aircraft battery.

1.7 Aircraft at an Emergency Air Strip

In this condition it is necessary to start the aicraft engines after refueling. If a separate starter trailer is being used as distinct from the main electric/air conditioning power truck then

a supply of 50 amps of 28 V D.C. power will be required as has been explained in para. 1.3. In this condition telephonic intercom between aircraft crew and starter crew will also be required.

2. 28 VOLT DC POWER SUPPLIES

2.1 Similar power supplies are used on the engine starter trailer and towing tractor installations. These two supplies are required to supply only the loads described in paragraph 1.3, 1.6 and 1.7.

2.2 Each power supply consists of a 24 volt battery charged by a generator capable of delivering 50 amps at 28 volts. Suitable reverse current cut-out relay, voltage regulator, protective breaker, and control switch are provided.

2.3 Figure 1 shows a block diagram of the supply.

3. PROPOSED INTERCOMMUNICATION SYSTEM

3.1 Interphone Connection to Aircraft

Only the AN/AIC-10 interphone line and its associated return, the "audio common", will be brought out from the aircraft for intercommunication purposes. While this procedure necessitates the use of a two-channel audio amplifier for each ground headset, there are advantages as outlined below:

3.1.1 Only a single shielded conductor has to be brought from the aircraft instead of two shielded pairs of leads.

3.1.2 The interphone line is a high-level audio line and therefore is much less susceptible to noise pick-up from external fields.

3.1.3 The external amplifiers used may be provided with gain controls to adjust the audio level to suit prevailing conditions. This is a useful feature as the ambient noise level may be extremely high.

3.1.4 The interphone line may be readily switched externally so that the ground crew may communicate with the crew of the aircraft they are serving; the control officer may speak to all air and ground crew in the shelter; or the control officer may speak with the aircrew and open the ground crew lines for purposes of secrecy. Direct switching of AN/AIC-10 headset lines is not recommended. A possible switching arrangement is shown in Figure 6.

3.1 Cont'd

3.1.5 The external amplifier, when used on the towing tractor, allows a convenient method of introducing the turn warning signal.

3.2 Amplifiers

3.2.1 Identical two-channel audio amplifiers will be used for all installations. Since interphone amplifiers AM-476/AIC-10 are unsuitable for the proposed circuits unless extensive internal changes were made, it is proposed that a special amplifier be designed for this purpose.

3.2.2 One channel of this special amplifier connects the microphone to the interphone line with a gain of 70 db (maximum). The second channel connects the interphone line to the headphones. The gain required in the second channel is small as its function is to permit somewhat higher headphone volume under difficult noise conditions, and to aid in the application of the turn warning signal to be described later.

3.2.3 Power supplies for the amplifiers will be either of the vibrator type operated from 28 V DC, or a "universal" 28 V DC - 115 V AC, 400 cycles, may be designed if more convenient.

3.3 Operation

From an operating point of view, it is desirable that the aircraft and the ground installation operate in the condition of "hot mic", that is, communication is carried on without the use of manually-operated switches. However, it may be possible that the ambient noise level at the ground installation may introduce excessive noise into the aircraft interphone system, the amount depending on the noise-cancelling properties of the microphone, as well as on the noise level itself. In this case, press-to-talk switches may be used at the ground installations with provision to lock these closed when the noise problem is not serious. Three-position toggle switches with maintained contact and momentary contact positions are proposed.

3.4 Figure 2 shows a block diagram of the intercommunication system.

4. PROPOSED TURN WARNING SIGNAL

4.1 Microswitches are installed in the drawbar strut of the towing tractor and are actuated by a mechanical device on the nose wheel assembly when the maximum safe angle of turn is approached.

4.2 When a microswitch is closed, part of the signal of the headset channel of the ground amplifier is fed back to the microphone channel. This causes a highpitched tone to be heard in all headsets in use. The constants of a network to produce a satisfactory tone will be determined experimentally.

4.3 Figure 3 shows a partial schematic diagram of the turn warning signal.

5. CABLES AND INTERCONNECTIONS

5.1 Each ground installation is connected to the appropriate points of the aircraft electrical and electronics systems by one cable terminated with a quick-disconnect plug which mates with the corresponding aircraft receptacle.

5.2 The cables from the main electric ground vehicle, the fixed ground power installations in the readiness hangar and maintenance hangar, and the starter trailer consist of one section each.

5.3 The cable from the towing tractor is in sections as follows:

(a) A section between the tractor installation and the drawbar.

(b) A section installed within the drawbar for mechanical protection and additional electrical shielding. This section has a branch to the turn warning microswitches on the strut.

(c) A section between the drawbar and the aircraft.

5.4 In Figure 4 are listed the required cable leads and wire sizes for the quick-disconnect connector.

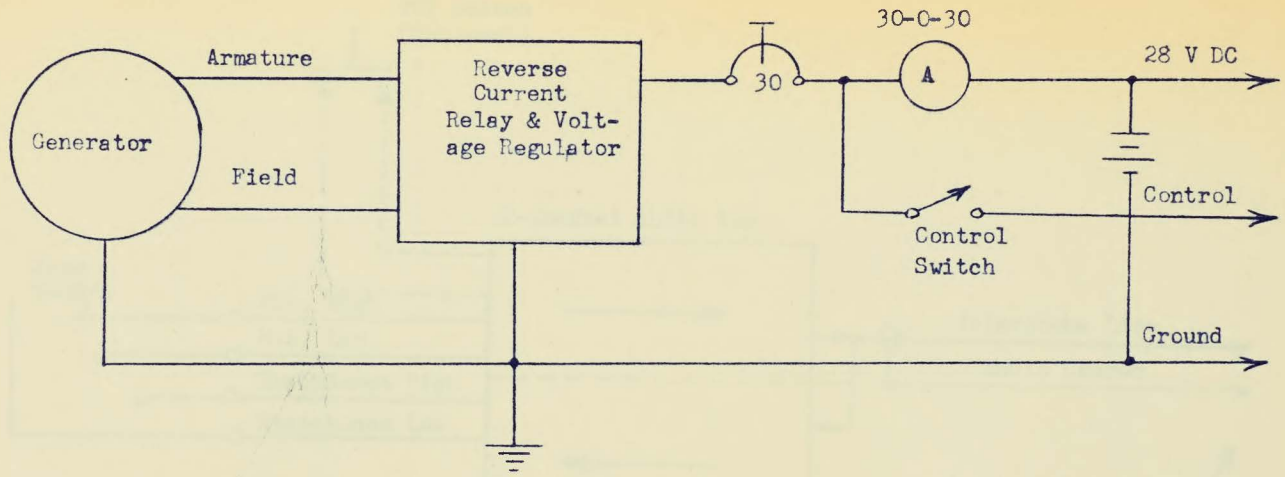
5.5 Figure 5 shows a cording diagram for the ground installations.

6. UHF COMMUNICATION - READINESS HANGAR

It may be a requirement that the control tower be able to communicate with the aircraft in the readiness shelter. As the shielding presented by the shelter will be relatively complete, some means will have to be employed to prevent serious attenuation of the UHF signal. It is proposed that a simple UHF receiving antenna be located outside the shelter

6. Cont'd

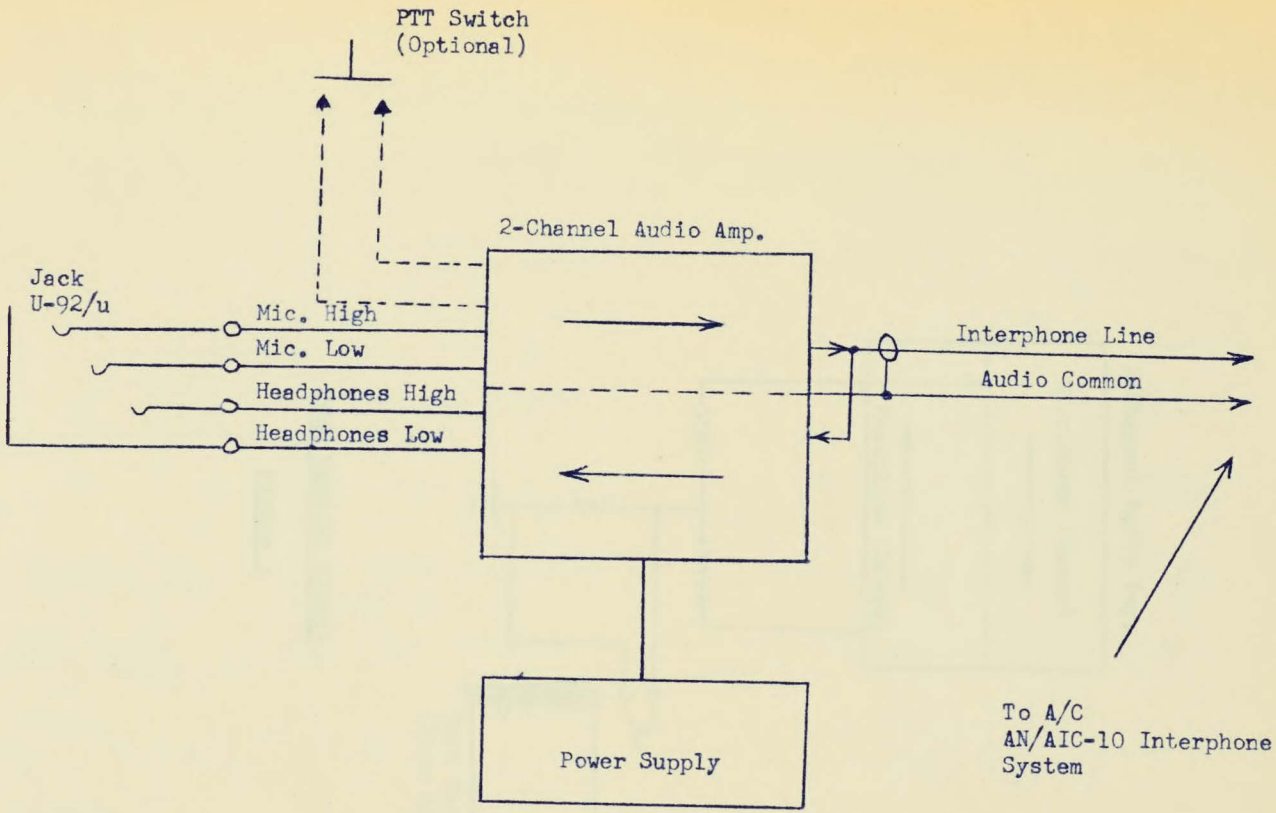
in a suitable position to receive the control tower signals. This antenna is connected by coaxial cable to two similar antennas, one of which is located close to the tail fin of each of the aircraft inside the shelters. These two antennas will re-radiate the UHF signal to the aircraft fin antennas. The exact location of the three antennas would be determined by trial. In this manner, direct connection to the aircraft is avoided.



28 V DC GROUND POWER SUPPLY

Starter-Trailer and Towing Tractor

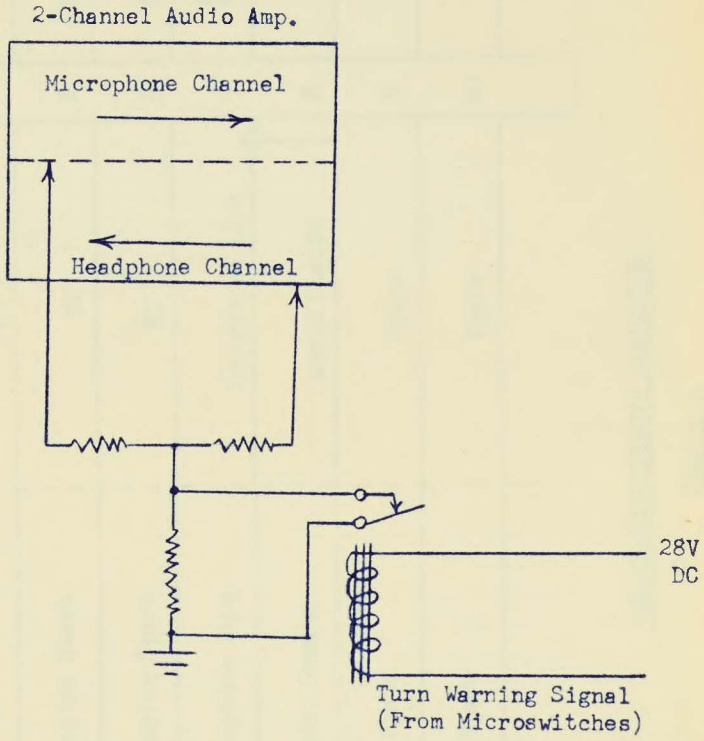
Figure 1



INTERCOMMUNICATION SYSTEM

Figure 2

AVRO AIRCRAFT LIMITED
TECHNICAL DEPARTMENT (Aircraft)
AIRCRAFT CF-105
RESTRICTED
REPORT NO. LOG/105/7
SHEET NO. Figure 2
PREPARED BY J.P. Booth DATE
CHECKED BY DATE



TURN WARNING SIGNAL

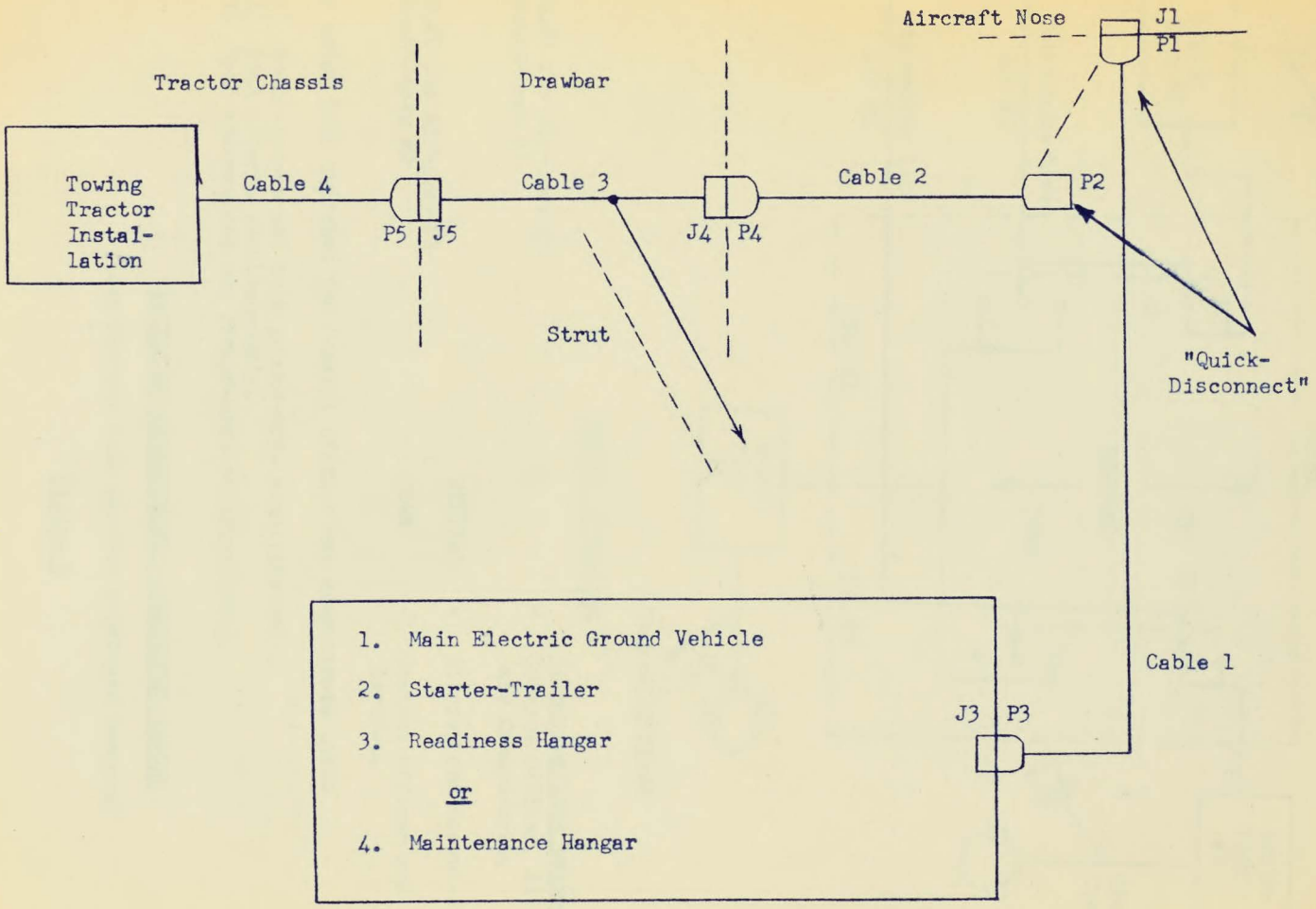
Figure 3

Readiness Hangar Maintenance Hangar Main Ground Power Vehicle	Starter-Trailer	Towing Tractor		Wire Size
NC	28 V DC	28 V DC	1	AN 8
NC	28 V DC Control	28 V DC Control	2	AN 16
NC	Ground	Ground	3	AN 8
Spare	Spare	Spare	4	
NC	Engine Start	NC	5	AN 16
NC	Engine Start	NC	6	AN 16
Interphone Line	Interphone Line	Interphone Line	7	AN 20 SSCJ
Audio Common	Audio Common	Audio Common	8	
Spare	Spare	Spare	9	
Spare	Spare	Spare	10	

"QUICK-DISCONNECT" CONNECTOR

Figure 4

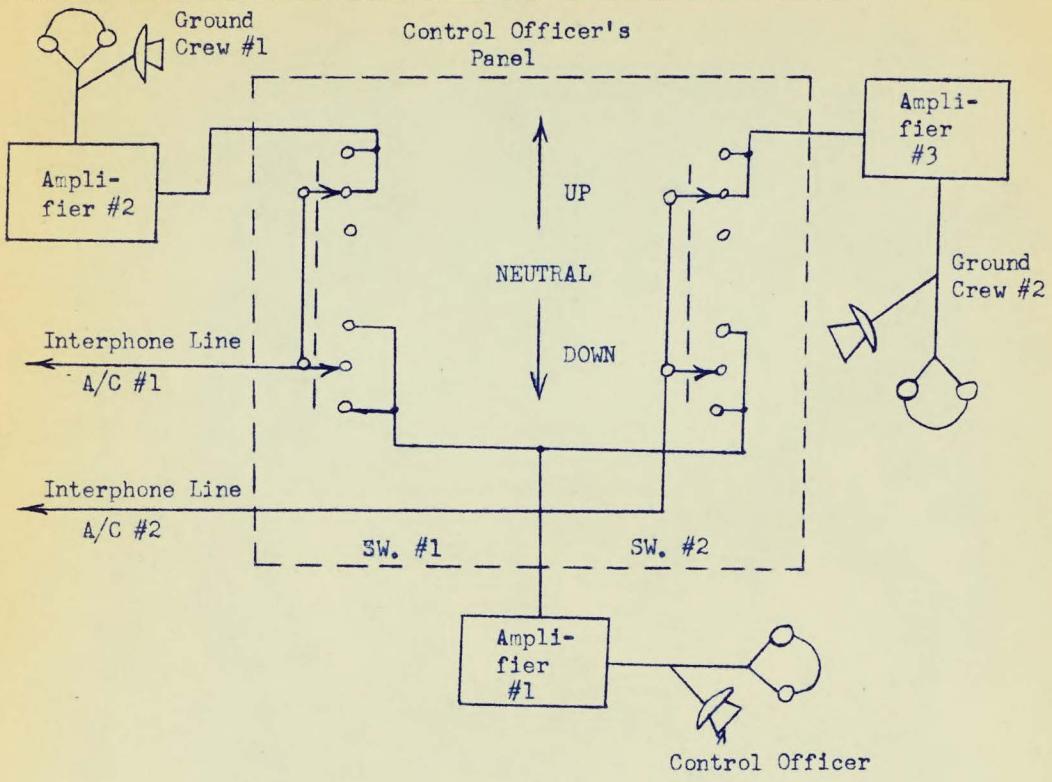
AVRO AIRCRAFT LIMITED
TECHNICAL DEPARTMENT (Aircraft)
AIRCRAFT CF-105
RESTRICTED
REPORT NO LOG/105/7
SHEET NO Figure 4
PREPARED BY J.P. Booth
CHECKED BY
DATE
DATE



CORDING DIAGRAM - GROUND INSTALLATIONS

Figure 5

AVRO AIRCRAFT LIMITED
TECHNICAL DEPARTMENT (Aircraft)
AIRCRAFT CF-105
RESTRICTED
REPORT NO LOG/105/7
SHEET NO Figure 5
PREPARED BY J.P. Booth
CHECKED BY
DATE
DATE



SWITCH OPERATION

SW.#1 for Air-crew #1 Ground-crew #1

SW.#2 for Air-crew #2 Ground-crew #2

		Communications between:
UP	-	Control Officer, Aircrew, and Ground-crew.
NEUTRAL	-	Aircrew and Ground-crew.
DOWN	-	Control Officer and Aircrew.

By using both switches the Control Officer may communicate with:

(1) Both aircrew and both ground-crew simultaneously.
(2) Both aircrew simultaneously.
(3) Both aircrew and one ground-crew simultaneously.

SWITCHING ARRANGEMENT - READINESS HANGAR

(One Control Room per two readiness hangars)

Figure 6