GL MARK III*C: preliminary description

National Research Council of Canada. Radio Branch

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NATIONAL RESEARCH COUNCIL OF CANADA

RADIO BRANCH

GL MARK III*C
PRELIMINARY DESCRIPTION

OTTAWA

OCTOBER, 1943

GL MARK III*C

SUMMARY

The GL Mark III*C is an improved version of the GL Mark IIIC and as such will be a 10 cm. radar unseen fire control set for use primarily with H.A.A. guns. Experience with the GL IIIC in the field and in production has indicated the necessary improvements to be made.

The chief difference between the GL IIIC and the GL III*C are as follows:

1. A single 6 foot paraboloid replaces the original two 4 foot paraboloids.
2. The cabin is stationary, the paraboloid assembly alone being rotated and elevated.
3. The following range will be increased from 17,000 yards to 25,000 yards.
4. An improved thyratron-controlled aided laying tracking system is employed and slewing switches will be added to both azimuth and elevation controls.
5. The PPI unit and associated IFF equipment have been moved to the #2 trailer. The equipment will be adaptable for permanent site operation with the PPI unit or a parallel PPI unit operating in the Command Post.
6. An additional IFF unit will be added to the #1 trailer to permit interrogation of targets being tracked.
7. In the GL IIIC data was transmitted by magslip only at the following shaft values:

Range	2000 yards and 36,000 yards per turn
Elevation	10° and 180° per turn
Azimuth	10° and 360° per turn
	20° and 360° per turn
	400 mils and 6400 mils per turn

In the GL III*C data will be transmitted by magslip at the following shaft values:

Range	2000 yards and 36,000 yards per turn
Elevation	10° and 180° per turn
	20° and 360° per turn
Azimuth	10° and 360° per turn
	20° and 360° per turn
Height	10,000 feet and 60,000 feet per turn

It will be possible also to attach Bell potentiometers for Range, Elevation and Azimuth as well as I potentiometers for Range and Magslip Resolvers for Elevation and Azimuth.

The equipment is being designed to have average errors of:

Range 25 yards
Elevation 10 mins.
Azimuth 10 x secant A/S (mins.)

and smoothness figures of:

Range 10 mins.
Elevation 4 mins.
Azimuth 4 mins.

These smoothness figures are the average moment to moment variation of the error taken at 2 second intervals.

The performance figures above should be maintained between angles of sight of 8° and 75°, at rates up to 8°/sec (1-1/3 r.p.m.) in azimuth and 6°/sec (1 r.p.m.) in elevation and in wind speeds up to 40 m.p.h. but a reduced performance will be acceptable up to 60 m.p.h. The range system will be capable of handling range rates up to 700 m.p.h. and a range slewing switch will be provided.

The trailers will be capable of being towed by standard Army towing vehicles and will be as mobile as the 3.7" Mk. III H.A.A. gun. A trained crew should be able to bring the equipment into action from the travelling position in not more than 20 minutes and the time of warming up should not exceed 4 minutes, the set being dry.

The three trucks used with the GL IIIC are retained. The #2 trailer proper is retained but the #1 trailer has been completely redesigned as indicated above. The paraboloid mount is raised and lowered on a platform by an electric motor. The hoist compartment occupies the rear seven feet of the trailer. A partition with a door separates this compartment from the main cab in which are located the A.P.F. and thyratron racks and the auxiliary IFF gear.

The new Diesel power unit will supply 20 KVA, 0.9 P.F., 18 KW, 115/230 volt, Single phase, 60 cycle power in a 3 wire Edison system with 2% voltage and 1% frequency regulation at any one load between 25% and 100% load.

Extensive changes have been made in the APF rack wiring and chassis; these and other changes are discussed in the Preliminary Description of the GL III*C.

GL MARK IIE*C

PRELIMINARY DESCRIPTION

C O N T E N T S

GL MARK III*C

PRELIMINARY DESCRIPTION

1. Introduction

A. Role and Frequency.

The GL Mark III*C is an improved version of the GL Mark IIIC and as such will be a 10 cm. radar unseen fire control set for use primarily with H.A.A. guns. Experience with the GL IIIC in the field and in production has indicated the necessary improvements to be made.

B. Chief Differences GLIIIC - GLIII*C

The chief differences between the GL IIIC and the GL III*C are as follows:

1. A single 6-foot paraboloid replaces the original two 4-foot paraboloids. Rear wave guide feed and a soft Sutton T-R switch are employed.

2. The cabin is stationary; the paraboloid assembly is rotated in azimuth about a king pin and is elevated and depressed about a horizontal axis on the rotating assembly. The difficulties entailed in large turntable manufacture and in the rotation of a heavy cabin and the alignment of the horizontal axis are thus obviated.

3. Increased power is had by operating the 3EX with a rotary spark gap modulator and increased magnetic field produced by a strong permanent magnet. The large paraboloid and increased output power will make possible the extension of the range system to 30,000 yards.

4. An improved thyratron-controlled aided laying tracking system is employed. A redesigned control circuit and the use of feedback voltage from a d-c generator directly coupled to the drive motor instead of from the motor armature, provides good regulation, greater sensitivity, and stability of operation at all speeds. Slewing switches have been added to both azimuth and elevation controls.

5. The PPI unit and its associated IFF equipment have been moved to the #2 trailer. The ZPI will be adaptable for use in permanent sites by having the PPI or a parallel PPI operating in the Command Post. In the case of two PPI units operating in parallel, the IFF display will be in the #2 trailer.

6. An additional IFF antenna will be mounted on the APF paraboloid assembly for interrogating targets that are being tracked. The interrogator, responsor and display units for this IFF will be located in the #1 trailer.

7. In the GLIIIC data was transmitted by magslip only at the following shaft values:

Range	2000 yards and 36,000 yards per turn
Elevation	10° and 180° per turn
Azimuth	10° and 360° per turn
	20° and 360° per turn
	400 mils and 6400 mils per turn

In the GLIII*C data will be transmitted by magslip at the following shaft values:

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Azimuth	10° and 360° per turn
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Height	10,000 feet and 60,000 feet per turn

It will be possible also to attach Bell potentiometers for Range, Elevation and Azimuth as well as I potentiometers for Range and Magslip Resolvers for Elevation and Azimuth.

II. Performance

A. Range.

The range system has been extended to 30,000 yards. Range scales and transmission facilities for a maximum of 36,000 yards are provided for possible future developments. The maximum following range has been extended to 25,000 yards. By this is meant that with an average 3BX tube, and an average crystal it should be possible to follow a Bolingbroke bomber to 25,000 yards with ease on any aspect of the plane. It should be possible (with the range system extended to 36,000 yards) to follow the same aircraft to 33,000 yards "tail-on" with a direction-finding accuracy of the order of 1/2°. The Bolingbroke gives a 2:1 increase in the "head-on" aspect, providing a sufficiently good signal on which to direction-find at greater than 33,000 yards.

B. Errors.

The equipment is being designed to have average errors of:

Range	25 yards
Azimuth	10 x sec A/S (Mins)
Elevation	10 mins.

The average error is defined as the arithmetic mean (without regard to sign) of the differences between the observed readings and the standard readings at the time of observation.

C. Smoothness.

The equipment is being designed to have smoothness figures of:

Range	10 mins.
Azimuth	4 mins.
Elevation	4 mins

The smoothness figure is defined as the average moment to moment variation of the error at specified time intervals, in this case 2 seconds.

D. Tracking and Slewing.

The performance figures in B and C above should be maintained between angles of sight of 8° and 75°, at rates up to 8°/sec (1-1/3 R.P.M.) in azimuth and 6°/sec (1 R.P.M.) in elevation, and in wind speeds up to 40 m.p.h., but a reduced performance will be acceptable in wind speeds up to 60 m.p.h.

The paraboloid assembly will be capable of being slewed 180° in azimuth in 6 seconds (5 r.p.m.) and 60° in elevation in 4 seconds (2-1/2 r.p.m.).

The range system will be capable of handling range rates up to about 340 yards per second (700 m.p.h.) and may be slewed at 3000 yards per second.

E. Discrimination.

The equipment will discriminate between targets separated 250 yards in slant range. The bearing discrimination has not yet been determined but it will be the best possible with a 6-foot paraboloid. It will be possible, with the aided laying control to track one of two planes flying through coincidence.

F. Mobility.

The trailers will be capable of being towed by standard Army towing vehicles and will be as mobile as the 3.7" Mk. III H.A.A. gun.

G. Time Into Action.

A trained crew should be able to bring the equipment into action from the travelling position in not more than 20 minutes, the set being dry. The time of warming up should not exceed 4 minutes at normal temperatures, the set being dry.

H. Operating Conditions.

Steps are being taken to make the equipment capable of withstanding without damage extreme temperatures of minimum -50°F desirable, -20°F acceptable and maximum -160°F when not in operation, and -40°F to +130°F desirable, -20°F to +120°F acceptable when in operation.

III. General Description of Convoy Equipment.

A. Trucks and Trailers.

In general the GL III*C convoy consists of three trucks and two trailers. Truck "A" is an FWD vehicle which carries the diesel power unit and tows the #1 trailer. Truck "C", a GMC vehicle is equipped to carry the intelligence, intertrailer, and power cables on reels mounted on the truck body. Truck "B" is another FWD towing the #2 trailer and carrying essential spares boxes.

B. Power Unit.

The trailers are described elsewhere; the power unit has a smaller rated output than that in the GLIIIC convoy. The diesel engine will be a four cylinder Caterpillar diesel of the four stroke cycle type. Starting will be possible at -40°F and optimum operating temperature will be maintained in ambients over the range -40°F to +120°F. The generator will be capable of supplying 20 KVA, 0.9 PF, 18 KW, 115/230 volt, single phase, 60 cycle power in a 3 wire Edison system with 2% voltage and 1% frequency regulation at any one load between 25% and 100% load. A voltage regulator will not be used as the generator is self-regulating.

IV. Description of #1 Trailer and Contents.

A. General.

The new #1 trailer differs from the original model chiefly in that a turntable will not be used. Replacing the 4-foot paraboloids will be a single 6-foot paraboloid mounted on a platform over the rear wheels. This platform will be elevated to roof level when in operation, and when in this position the bottom lip of the paraboloid will clear the top of the roof by atleast one foot. For travelling the paraboloid is pointed vertically upward and the whole mount is lowered by a hoist down into the trailer and a portion of the roof will slide over the hole for weather protection.

The hoist compartment will occupy the rear seven feet of the trailer. A partition with a door will separate this from the front of the cab in which will be located the APF rack and operators, the auxiliary IFF chassis and the thyratron control rack.

The approximate dimensions of the trailer compared to those of the present model are as follows:

	GL IIIC	GL III*C
Wheel base	17' 3-1/2"	13' 7"
Overall length	22' 6"	19' 6"
Overall width	8' 6"	7' 8"
Overall height	10' 6"	10' 6"

The trailer complete will weigh approximately 20,000 lbs.

B. External.

Double wheels are used at the rear of the trailer as before. Double wheels will not be used at the front for the following reasons:

1. The distribution of weight is such that the rear wheels support most of the load.

2. Double wheels at the front would mean lengthening the wheel base and body by 18 inches.

One jack at the rear and two at the sides on jack arms are provided for levelling the trailer. The side jack arms will be shorter than those on the original model. Modified Bofors type jacks will be fixed rigidly to the chassis rear and jack arms. As on the British GL III, the jacks will rest on "self-aligning sole plates". One plate has a circular ring in which the jack rests and cannot move. Another has two parallel guide bars which permit lateral movement of the jack. The third is a flat plate which allows movement in any direction. Thus the jack arms can adjust themselves as the trailer is being levelled. The trailer may be lifted off the ground and remain in position rigidly supported by the jacks.

The triangular tow bar will be fitted with steps leading up to the door in the front end of the cabin. This door is sufficiently large to allow the APF rack to slide through it during assembly. To the left of the door, facing in the direction of travel, is the ladder leading to the roof.

On the left side of the trailer are two large horizontal doors which may be opened when servicing the rack or to provide additional ventilation in hot weather. They are approximately the length of the

APF rack. The upper panel opens upward, and is supported by two angle supports which may be snapped into place. The lower panel opening downward is protected by a single action aeroplane type shock absorber to prevent it falling too rapidly and it is supported by chains at either end.

Intelligence, intertrailer and power cables are brought into the trailer through a junction box on the lower centre of the left side of the trailer.

On the right side of the trailer are four ventilation exhaust vents from the APF rack blower as well as others for cabin ventilation. An electric braking system is to be provided on all wheels and will be operated from the cab of the towing vehicle. In addition to this, there will be a mechanical parking brake operated by a lever under the chassis. A provision will be made for locking the steering dolley in position to facilitate backing up.

The rear section of the roof is fitted with an octagonal cover over the hoist compartment. When coming into action the cover is unclamped, pushed forward on a track and clamped again in place. The roof over the operator's compartment is sloped slightly for water drainage. The flat lift cover is sealed by a lip pressing up into a rubber pad on the cover.

C. Internal Layout.

Inside the trailer the rack occupies the position a little to the left of the centre of the compartment. In front of the rack (right side of the trailer facing door) are the operators' seats, and under these the thyratron rack. On the operators' right is the switch and fuse box which controls rack and cabin heaters and blowers, lighting and convenience outlets.

As a safety measure, there will be a three pole master switch controlling the a-c power input to the trailer.

On the partition separating the hoist from the operators' compartment are mounted the hoist motor control panel, a terminal box, and the cabin blower and air filter. The location of the IFF gear has not yet been decided.

The paraboloid hoist is a winch and cable device and will require five minutes to raise or lower into position. The movement of the platform is controlled by a motor and directed by three guide tubes. Provision will be made for raising or lowering the platform by a hand crank. The paraboloid mount is fastened in three places to the lift platform. The mount supports a yoke casting to which other apparatus is attached. At the front of this casting is mounted the paraboloid support casting.

The horizontal axis runs through the yoke casting, at one side of which are the elevation drive motor and gears, and on the other side, the elevation information gear box. At the centre of the mount is the king pin vertical axis surrounded by a slip ring assembly. On one side of the slip ring housing is the azimuth drive motor, and on the other side the azimuth information gear box.

A telescope is mounted on the elevating part of the assembly and a 3.7" H.A.A. gun level is bolted to the yoke casting.

Collimation of radar and optical "lines of sight" is to be done as a workshop job with the aid of a special telescope which may be clamped on in place of the operating one. This telescope will be equipped with two bubbles mounted so as to line up the assembly at both 0° and 90° elevation. The vertical axis will be made vertical and the elevation axis made horizontal by levelling with the aid of a clinometer on a pad at the base of the paraboloid mount. The paraboloid axis will be made level by using the clinometer on a pad 6 inches long and 2 inches wide in the line of the elevation axis.

As was the original model, the #1 trailer is equipped with heaters, ventilators, four ceiling lights (which may be dimmed) and convenience outlets. Junction box #1 distributes power and signal leads to Junction box #2 under the APF rack, to Junction box #3 under the Switch and Fuse box, and to Junction box #4 in the hoist compartment. Telephone circuits will be installed so that in any location of the PPI unit there will be communication simultaneously between the APF #1 trailer roof, the #2 trailer and command post. An additional channel is provided for communication to the command post.

It is intended that in the production model, provision will be made for essential spares, coat hooks and clips for the operators' rifles.

V. APF Chassis and Rack Changes.

A. Transmitter.

The original vacuum tube modulator has been replaced by a rotary spark gap modulator. The pulse applied to the 3BX tube in this way is of higher amplitude but of about the same duration as before, viz. 21 KV for 1 microsecond. A permanent magnet is used which gives a field strength of about 1800 gauss whereas the original electromagnet produced about 1200 gauss. The net effect is to step up the instantaneous output to approximately 200 Kw. The power supply as used in the original model is retained but is rated now 15 Kv. at 40 m.a. continuous load. The rotary gap modulator, magnet and oscillator occupy the position of the former modulator, the top of Bay 1.

B. Antenna.

The output of the 3BX is fed into a rectangular wave guide in which it is carried up to the cabin ceiling around an "E-corner" and into the hoist compartment.

On the platform a similar piece of rectangular wave guide receives the energy through a choke coupling. A rotatable coaxial line carries the energy up through the king pin and to the side of the yoke casting. Through another rotatable joint it is here fed to a rectangular guide, then to another length of coaxial line, and finally to a cylindrical guide. The cylindrical guide is in two sections, fixed and rotating, choke-coupled together. The rotating section is belt-driven and is bent so that the front end is offset about 1 inch to provide the beam split. The energy is reflected back into the paraboloid by an 8 inch disc, the curvature of which has yet to be determined experimentally.

C. Receiver.

Located a few inches above the 3BX socket is a soft Sutton T-R switch. The received signal passes through this, is mixed with the Sutton oscillator output, and the 31 mc. I.F. is amplified in an improved high gain wide band pre-amplifier. The new amplifier employs 5 stages of amplification with degeneration giving a gain of about 5000 and a band width greater than 10 mc. An automatic gain control is included to decrease the gain at low ranges to prevent overloading the AVC. A new type of construction is being considered in which no individual shielding is required as smaller coils interspaced by condensers effectively eliminate regeneration. The chassis will be mounted as close as possible to the T-R switch.

The main receiver chassis has been modified slightly. The range channel is not strobed, but the wide strobe is applied to the azimuth and elevation channel in order to keep the ground wave out of the integrators. The gain of the range video has been decreased a small amount so that it will not be overloaded by the ground wave.

The range presentation system is essentially the same. Three degrees of sweep expansion are provided, however, the minimum expansion displaying the complete range. The other two as before display 2000 yards for tracking or a contracted sweep for putting on at long ranges.

The range will be increased by paralleling the two precision condensers. The sweep voltage and therefore the sweep expansion is held constant at the higher range.

The azimuth and elevation presentation is the same as in the original model, although the quadrant switch and integrator system has been radically revised. The sinusoidal amplitude variation of the signals

received when the radar is a few degrees off target is combined with the sinusoidal output of a quadrant alternator in a phase discriminating circuit. The output activates the integrator needle to indicate the off-target angle. The test C.R.T. may be used to display the integrator waveforms. Steadier operation of the integrator needles, the use of a single integrator chassis in lieu of the original two, and the elimination of several controls has been obtained by the use of the new system.

D. Other Units.

The test C.R.T. now has a separate sweep chassis mounted on the original C.R.T. chassis. The sweeps may be keyed by four methods and display 5 sweep speeds - including a low frequency sawtooth wave for examining integrator waveforms. With keying and sweep switches, both in position "operate", only the video signals are displayed. In other positions various test leads may be connected to the vertical plates of the C.R.T.

The use of a separate test C.R.T. sweep chassis clears considerable space on the original Sweep-Keying chassis for a redesigned strobe circuit. A variable width, 150 volt amplitude wide strobe and a fixed width, 150 volt amplitude narrow strobe are provided. Strobe drift and variation of strobe wave shape with range have been eliminated. A strobe positioning control for viewing portions of the sweep above maximum and below minimum range has been added on the range control panel. A spring is attached to the knob in order to return the strobe to the centered position when not in use.

The original Sutton chassis contained both the regulated power supply and the Sutton local oscillator. The removal of the strobe chassis made possible the location of the oscillator components at the front of Bay 3 so that all oscillator adjustments are available on the front panel. The new supply is located immediately below the original position in Bay 2. An 813 replaces the 807 as regulator and improved regulation is had by using a two stage d-c amplifier. In the new model a separate metering bleeder ensures that switching the meter in or out does not effect oscillator or crystal current. A tuning indicator employing a phase detector has been added. Its display utilizes three pilot lights; the centre one glows when the I.F. is 31 mc. and either one of the side lights glows when a drift from this frequency occurs.

In the space vacated by the original Sutton supply chassis, a height convertor will be provided. Although not yet developed at the time of this writing, the requirements for the convertor may be stated. Its purpose is to transmit height as an alternative to slant range. It will not be possible to transmit ground range in place of slant range. Height dials, however, will be provided inside the cabin at the rear

of the rack inside the rack doors. The accuracy of the transmitted height will be consistent with the accuracy of range and elevation plus a height convertor error not exceeding 75 feet. The smoothness figure for observations at 2 second intervals will be consistent with the smoothness of the input data of range and elevation.

The various possible magslip ratios for Range, Height, Azimuth, and Elevation have been stated under I, B, 7. Only one high and one low speed value is required at one time; the time required to change ratios should not exceed 3 hours. In addition to the number of magslips at present in use, four magslip transmitters are required in the height convertor.

Provision will not be made for mechanically pinning magslip transmitters, as this would require a redesign of several gear boxes now in production. Instead an electrical pinning method using a magslip receiver in a suitable case will be provided with each convoy. This unit will have leads which can be clipped on to any magslip transmitter and a pointer attached to it will indicate when centered on a line that the magslip transmitter is properly oriented. An orientation check switch will be provided on the receiver magslip case to check the alignment of the test instrument itself. Mechanical dials will not be provided on the high and low speed magslip transmitter rotors as this would entail the redesign of the gear boxes mentioned previously. A device will be provided on the azimuth magslip assembly to allow for orientation.

The thyratron control aided laying tracking system has been modified to increase performance and reliability. In the control circuit, 60 cycle sawtooth bias replaces the phase-shifted sinusoidal bias employed on the original model. The feedback control voltage instead of being taken from the motor armature is provided by a d-c generator coupled directly to the motor. In this way spurious armature voltages are excluded from the control circuit. Slewing buttons are provided enabling the paraboloid assembly to be slewed at 5 r.p.m. in azimuth and 2-1/2 r.p.m. in elevation. Flywheels have been added to the azimuth and elevation motors and to both aided laying generators to smooth operation. Tracking will be further improved through the use of a variable aided laying ratio.

The main rack structure has been retained although minor changes as mentioned above have been made. The exact relocation of units has not yet been finally determined. An improved rack ventilation outlet has been devised. The outlet duct carries the blower output along the ceiling to four vents above and behind the operators. The vent cover may be closed to divert the air into the cabin in cold weather to retain in the cabin the heat dissipated in the rack. Strip heaters will be installed in the rack and in mechanical parts to warm up the equipment when starting in extreme low temperatures. They will be controlled by a lock switch. The fuse and distribution panel, Unit 29B, will be

hinged to provide room behind it for the tuning indicator chassis, and the auxiliary sweep keying switch. Telcothene coaxial cable will be used extensively to improve wear and reduce circuit capacitance to ground.

VI. Description of #2 Trailer and Contents.

A. General

The #2 trailer proper is identical with the present model and will include changes to the present model made by DCI's.

B. Internal Layout

Within the trailer the transmitter and monitor receiver racks will occupy their present positions. It is intended to locate the IFF interrogator and responsor on the table beside the monitor receiver and the PPI rack on the floor space in front of this table.

VII. ZPI Chassis and Rack Changes.

A. Transmitter

An increase in transmitter output power and ease of adjustment have been sought in the redesign of the modulator unit. The original self-squegging modulation system rendered tuning adjustments critical in the desirable operating range of 145 - 155 mc. In addition to this, it was found that the ZPI transmitter was triggering the IFF equipment which operates between 160 and 175 mc. It is hoped that these difficulties will be overcome by the use of a vacuum tube grid modulator and the redesign of the antenna to operate in the 145 - 150 mc. band. Motor - type time delays will replace the oil dashpots on the ZPI transmitter rack. In the GLIIIC the dashpots have given some trouble especially at extremes of high or low ambient temperatures. For the sake of uniformity it is intended to use the same type as installed in the APF rack.

B. Monitor

The use of unbalanced coaxial line input and a new T-R spark coil at the input to the monitor receiver are being considered. Better protection for the receiver with negligible loss of signal can be obtained with this system. If sufficient improvement can be had a new R.F. amplifier may be used. Knob controls mounted behind a door panel will replace the original screw-driver tuning adjustments. To the I.F. section, a noise silencer has been added to suppress interference above a given threshold value. Its actual location has not yet been determined but it will be constructed as an independent unit.

The monitor Scanner-calibrator unit has been completely redesigned. A saving of 5 tubes and many components as well as simplification of operation and adjustment has been achieved. The calibration, brilliance, focus and centering controls are placed behind a hinged panel, leaving only the "Rec-Cal", keying and range switches outside. The chassis is both electrically and mechanically interchangeable with that in the original model. It may be keyed either internally or externally and sends a negative pulse to key the transmitter. Two ranges, 30,000 yards and 60,000 yards are provided as before.

C. Indicator

Arrangements are being made so that the convoy may be operated in any one of three ways: (a) PPI in the #2 trailer, (b) PPI in the Command Post, and (c) two PPI units in parallel, one in the #2 trailer and the other in the Command Post. The equipment may be adapted for use in a permanent side using either (b) or (c). This entails only minor changes in the scanner chassis, and is chiefly a problem of supplying the necessary junction box connections and cables. An additional Selsyn generator will be required on the ZPI antenna as it has been found impossible to run the two rotating sweeps in parallel. The wiring and mounting only for the additional Selsyn will be provided on all ZPI antennas. The necessary equipment and instructions for coverting a convoy for permanent site operation will be supplied in kit form where required.

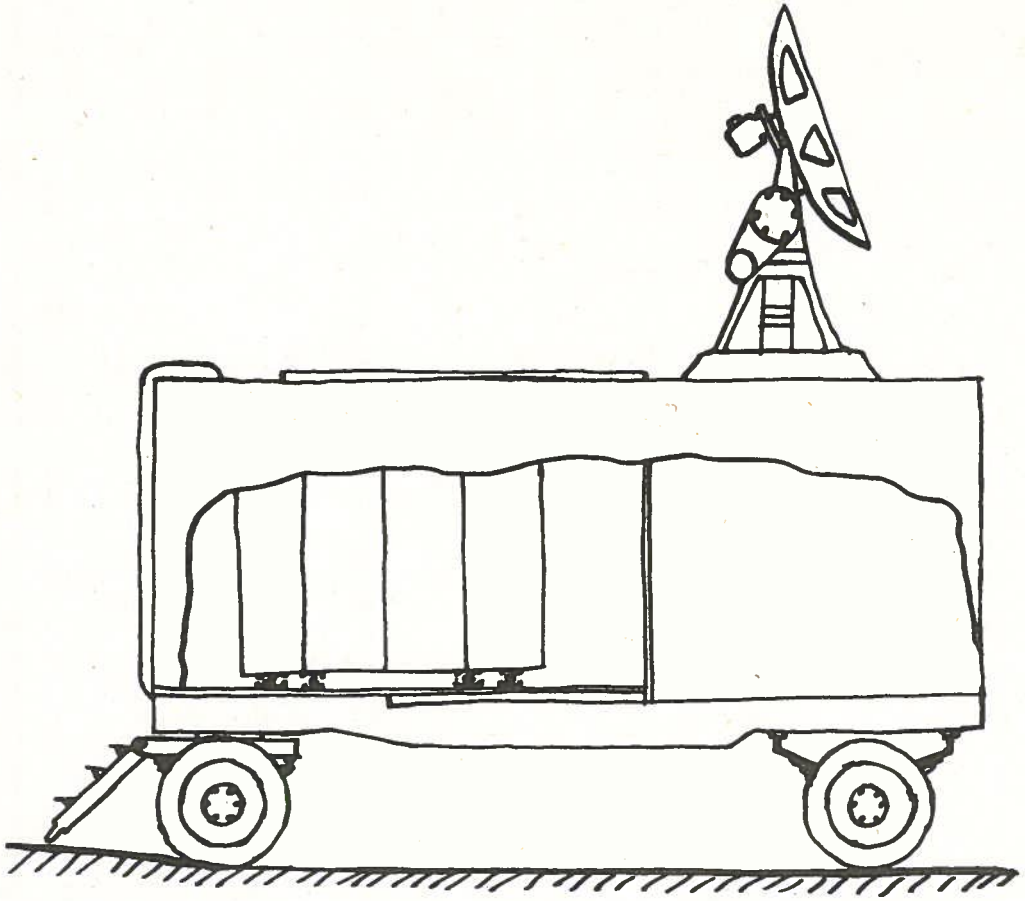
A more suitable azimuth cursor is being investigated. A light will be provided to illuminate the scale and pointer but will not be bright enought to obscure the picture on the PPI tube, the scale to move with the cursor so that azimuth is read at the top.

D. IFF

The IFF equipment in the main is the same as that being provided with the GL IIIC. As previously mentioned, the interrogator and responsor are located in the #2 trailer. The IFF antenna has been removed from the #1 trailer roof and placed on a collapsible stand in the field about 100 feet from the #2 trailer, or in the case of (b) above, near the Command Post. The antenna servo mechanism can thus be simplified as it no longer has to account for the rotation of the #1 trailer.

Ottawa

October 1943.

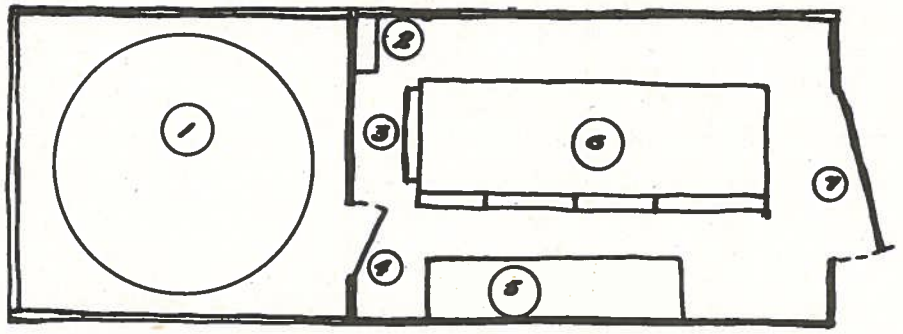


ITEM	PART NO.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY [illegible]	DATE 5/9/43	SUPERSEDES
CHECKED	DATE	SCALE
ENG. APPROV. JCB	DATE 15/10/43	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME	DWG. NO.
G.L III *C- TRAILER No 1	562



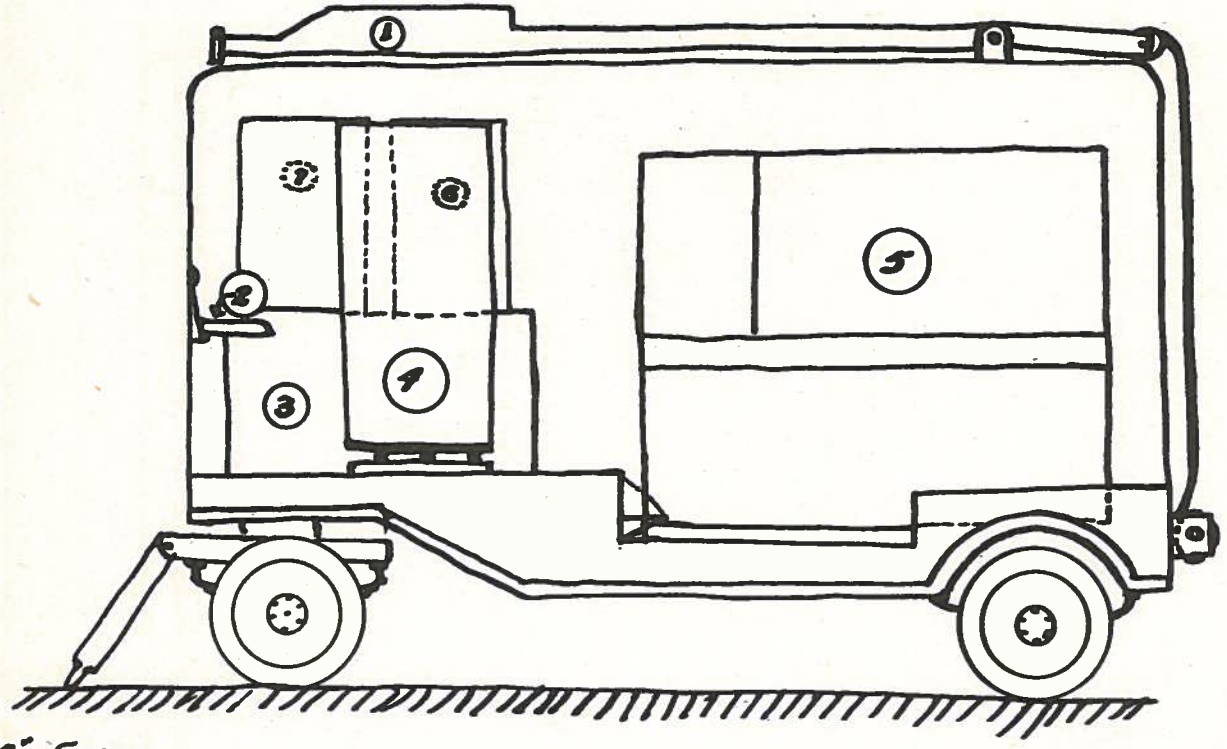
(1) 6ft Dia Parabloid on mount
(2) Cabin Blower
(3) R.F. Gear mounted on end of rack
(4) Door entrance to lift compartment.
(5) Thyratron Unit located below seats
(6) A.P.F. Rack
(7) Main door - wide enough for rack.

ITEM	PART No.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY JBG	DATE 5/9/43	SUPERSEDES
CHECKED	DATE	SCALE
ENG. APPROV. JCB	DATE 19/10/43	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME	DWG. NO.
G.H. III # C - TRAILER No 1 Plan layout	563



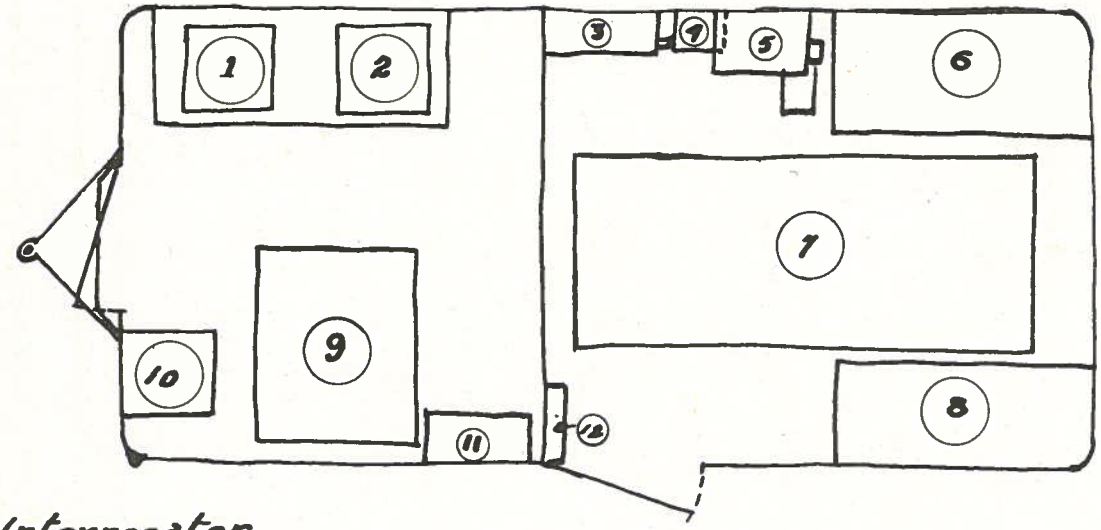
1. "A" Frame
2. Seat
3. Table
4. I.P.I. Indicator Rack
5. Transmitter
6. Monitor Receiver
7. I.F.F Interrogator

ITEM	PART No.	QUAN.	MATL.	DESCRIPTION
DRAWN BY JBL	DATE 5/9/43			SUPERSEDES
CHECKED	DATE			SCALE
ENG. APPROV. JCB	DATE 15/10/43			FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: G.L. III mod C No. 2 TRAILER

DWG. No. 564



1. I.F.F. Interrogator
2. Monitor Receiver
3. Junction Box No.1.
4. Battery Box
5. Blower
6. + 8. Wheel housing
7. Transmitter
9. Indicator Rack
10. Seat
11. Junction Box No.2
12. Step

ITEM	PART NO.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY HBel	DATE 5/9/43	SUPERSEDES
CHECKED	DATE	SCALE
ENG. APPROV. JCB	DATE 15/10/43	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME	DWG. NO.
Plan layout G.L III *C No. 2 Trailer	565