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NOTES ON
AIR OPERATING

FOR SIGNALS AIR CREW

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A.M. PAMPHLET 180

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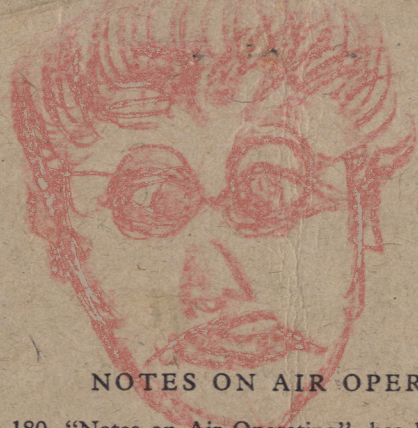
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ISSUED BY
AIR MINISTRY (A.M.T.)
DECEMBER 1944

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*James
on
Cair Board*

NOTES ON AIR OPERATING

Air Ministry Pamphlet 180, "Notes on Air Operating", has been produced to satisfy a long felt need for providing signals air crew with practical hints, tips and information on the operating of airborne communications equipment. It is for use by all Wireless Operator (Air), Wireless Operator Mechanic (Air) and Navigator (Wireless) pupils in the later stages of training.

The following subjects are briefly covered in general terms:—

- (i) Daily inspection of (Airborne) Radio equipment.
- (ii) Night flying and air tests.
- (iii) Intercommunication system.
- (iv) Aircraft Electrical system.
- (v) Danger of electrical storms: fire prevention.
- (vi) Fault finding.
- (vii) Air operating and procedure.
- (viii) Distress procedure.

Elementary fault finding tables with the remedial action necessary are given for the undermentioned installations and are laid out in each case in the following order:—Power Supply, Main Set, D/F Facilities, Intercommunication Equipment and R/T Set.

- (i) T.1154/R.1155 Installation
- (ii) S.C.R. 287N „
- (iii) G.O.9./R.U.19. „
- (iv) T.A.2.J./R.A.1.B. „

THIS PAMPHLET MAY NOT BE TAKEN INTO THE AIR EXCEPT ON TRAINING FLIGHTS.

DAILY INSPECTION OF RADIO EQUIPMENT

YOU have heard of the cyclist who covered hundreds of miles, omitting to grease the chain, oil the mechanical parts, and give the whole thing an occasional polish. The wheels 'seized up' and the chain broke, even the chromium plating started to come off. He should, to coin a phrase, have given his machine the 'once over'. How much more true is this of radio equipment, far more delicate and sensitive than anything mechanical.

You will hear many times throughout your Service career 'the lives of your crew depend so much on your skill, efficiency and devotion to duty'. Remember, you're not a passenger flying merely to listen to the B.B.C. or to carry out extensive studies of Wild West fiction. Yours is a definite and clearly defined responsibility; much depends on your zeal and efficiency in the air and on the ground. Do not think that a mere hurried visual inspection of your equipment is sufficient. The Service has provided you with the finest aircraft in the world, and it is surely a point of honour to maintain, in good working order, the section which concerns you most.

Due to lack of zeal on the wireless operator's part, there have been many abortive sorties and many aircraft have either had to jettison their bombs in the sea or bring them home, both methods being far from useful to the war effort. Apart from a fit remorse on your part, a W/T failure due to your carelessness will make you very unpopular in the mess and with your crew. It is easy to rush a daily inspection, but it gets you just nowhere! in the majority of cases not even off the ground, most certainly not to a target. Thirty minutes spent daily with your apparatus will eventually pay dividends far in excess of your original energies.

Detailed below are the items to be checked at each Daily Inspection. They will vary quite obviously

according to the type of aircraft and the nature of the equipment carried.

- Check accumulator stowage for corrosion
 - Check last few feet of trailing aerial for kinks and fraying
 - Check fixed aerial connections
 - Change 2-volt 20 A.H. accumulator for A.1134(A) supply
 - Check every inter-com. socket in the aircraft. This is best done by utilizing the services of another member of your crew
 - Check T.1154/R.1155 with your own H.F D/F station, using procedure laid down in local W/T orders
 - Check functioning of D/F portion of R.1155
 - Check T.R.1196 on each of the four studs or whichever are in use
 - Check all spares for serviceability
 - Report any defect to the N.C.O. i/c Signals Section Sign Form 700 in the appropriate column
 - Regularly check 120v. dry battery and spare on load
 - Change if below 110 volts
- Don't use internal accumulators for testing equipment on the ground, the heavy load taken will drain the supply in a very short time. Get your ground crew to plug in a starter trolley battery. Always bear in mind that a bad intercommunication system is a very fine way to produce bad tempers and lack of patience amongst the crew members.

Keep all inter-com. sockets dry during damp periods. Never accept a 2-volt 20 A.H. accumulator from the charging room until you have tested specific gravity of the acid, the voltage on load and checked the terminals for corrosion and greasing.

NIGHT FLYING AND AIR TESTS

A night flying or air test takes the form of a short flight in the vicinity of the aerodrome to test the airworthiness of the aircraft and all associated equipment. So far as you, the wireless operator, is concerned, it is really an extension of the Daily Inspection.

Generators, for instance, cannot be tested for correct functioning unless under flying conditions; vibrations set up in the airframe by the engines may cause your inter-com. to crackle, a fault probably not apparent on the Daily Inspection. Your crew's helmets may be satisfactorily tested under working conditions. You see, an N.F.T. gives you all essential opportunity for testing your equipment under actual flying conditions and acts as a check on your Daily Inspection.

Whilst your pilot is checking the engines and controls you should carry out the following drill:

- 1 Check all inter-com. positions
- 2 With engines running at normal cruising revolutions check voltage output and charging rate of the engine-driven generators

- 3 Reel out trailing aerial and obtain a frequency check from an allotted M/F section (if authorised by local orders)
- 4 Check serviceability of I.F.F.
- 5 Request pilot to check B.A. on known beam
- 6 Check T.R.1196 for two-way communication
- 7 Check inter-com. and turrets whilst they are rotating. This is best accomplished by the gunner rotating his turret over its full traverse and at the same time making a transmission with microphone switched on
- 8 Check lighting system in your own cabin or compartment
- 9 Ascertain that D/F circuits (R.1155) are functioning correctly, using a known M/F beacon
- 10 Personally report all faults immediately on landing to N.C.O. i/c Signals. Do not, in any circumstances, leave it until later—it may be too late to rectify the faults

AERIAL SYSTEMS AND PRECAUTIONS TO BE OBSERVED IN ELECTRICAL STORMS

It would be impossible, as you no doubt realize, to operate radio equipment without some form of aerial system. In fact, so important is this part of the apparatus that whole books have been devoted to this one subject.

AIRCRAFT EMPLOY TWO MAIN TYPES OF AERIALS

Fixed for H/F

Trailing for M/F

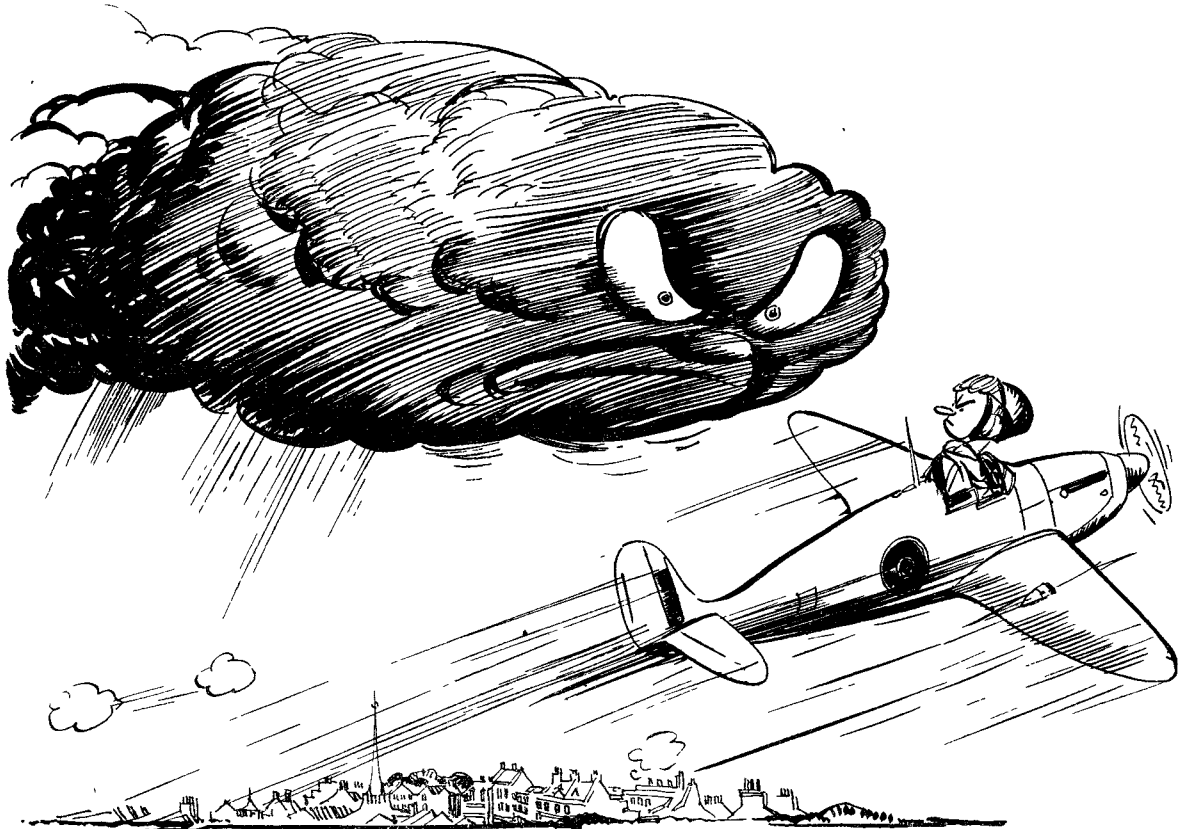
It is also necessary to have some arrangement whereby the fixed aerial may be used for M/F and the trailing aerial for H/F in the event of either aerial being

become kinked. Winches, ratchets and bead weights are all potential sources of trouble.

Don't let your trailing aerial run out at colossal speed with the ratchet set to 'free'. Even if you carry a spare, stainless steel is not without some value.

PRECAUTIONS TO BE OBSERVED IN ELECTRICAL STORMS

- 1 Avoid large cloud masses, particularly hail clouds, when weather reports give an indication of thundery conditions
- 2 When wireless apparatus is being operated and a heavy increase in atmospheric, indicating electrical storms, is observed, advise pilot



THE ANGRY CLOUD

lost. This is taken care of by the Type J Switch or aerial plugboard.

Faults can develop with aerials just as much as with any other piece of your equipment. It all boils down to a point stressed elsewhere in this pamphlet; look over and inspect *all* your equipment daily. Fixed aerials tend to fray, particularly at the insulators, and trailing aerials

- 3 If it is impossible to avoid danger areas, first earth the trailing aerial and then reel in unless already in area, when the trailing aerial is merely earthed
- 4 Don't touch a trailing aerial in heavy static unless it is earthed. The result may be rather startling

INTERCOMMUNICATION AMPLIFIER — A1134

You are just going to be unlucky if you do not 'nurse' your A1134 Amplifier the whole time. This small, inconspicuous part of your equipment can be more troublesome than the most complicated piece of Radar apparatus.

Inter-com. is a vital part of the aircraft; it allows bombs to be dropped, fighters to be shot down, and a hundred and one smaller details that you can only appreciate when you have to do without it. In the case of emergency, you just cannot do without it; yet it is the cause of many failures.

Why are there so many failures connected with this small box of tricks?

✕ First—operators forget that the amplifier does not exist by itself as a small unit tucked away in a dark place in the aircraft. It has, working with it, telephone sockets, headsets, great lengths of wiring and most probably an R/T set such as the TR1196. These items work together as a team, and as such, if one member is not up to scratch, the whole team fails. Second—operators fail to realise that prevention is far better

than cure. It is all very well being able to cure the trouble in the air, but why have trouble when it might be avoided?

Therefore, before take-off check that:

- 1 A new 2-volt 20 A.H. accumulator has been connected, and, if on an operational sortie, that a spare is carried
- 2 A spare 120-volt dry battery with a voltage well over 110 volts is available
- 3 The grid bias battery has been recently checked
- 4 A spare headset and an extension lead are available
- 5 The Emergency Inter-com. System (TR1196) is working properly

! Above, all, keep your crew's *Helmets Checked Regularly* according to the instructions issued at your own unit.

Inter-com. is VITAL to success. Are you letting your crew down? INTER-COM. IS VITAL.

HAVE YOU SEEN THE INSTRUCTIONAL FILM—BOOMERANG?

ELECTRICAL EQUIPMENT IN AIRCRAFT

Now an aircraft can't be connected up to the electric light mains and power plugs inserted at numerous points along the fuselage. There must be some method of producing the required power in the aircraft itself. Ordinary household supplies are derived from a dynamo built on the same principle as the simple apparatus in a bicycle-lighting set. In the case of an aeroplane, the electrical power is supplied by a dynamo or generator driven by the aero engine itself: (hence name—Engine-driven Generator). Such a generator may be designed to supply 500 or more watts at 12 or 24 volts. On a modern four-engined aircraft, a 24-volt 1,500 watt E.D.G. is normally employed, since very heavy loads are required.

As a typical installation, the Lancaster generator and charging set will be described:

The electrical supply is obtained from one of two sources as follows. When the engines are running above a certain speed and at all times during flight the supply is obtained from engine-driven generators. On the ground when the engines are stationary or running at very low speeds, and in the event of generator failure in the air, an alternative supply is obtained from storage accumulators.

Generators. The general arrangement of the electrical components is illustrated by the pictorial representation of the Lancaster power circuit. This comprises two 24-volt, 1,500 watt, engine-driven generators, type KX, one generator being mounted on the auxiliary gearbox of each inboard engine. The generators are connected in parallel. Each generator control circuit contains a voltage regulator, an accumulator cut-out, a 60-amp.

main fuse and an ammeter, all mounted on the main distribution panel on the starboard side of the fuselage.

Voltage Regulator. Variations in engine speed during flight necessitate some form of voltage control to prevent fluctuations in generator voltage, which at high speeds would rise sufficiently to damage equipment. Each generator is a shunt-wound machine and is used in conjunction with an external carbon-pile voltage regulator. Whenever the generator voltage tends to rise above 29 volts, the regulator automatically inserts resistance in the generator shunt-field circuit, reducing the field excitation and restoring the voltage to the regulated maximum of 29 volts.

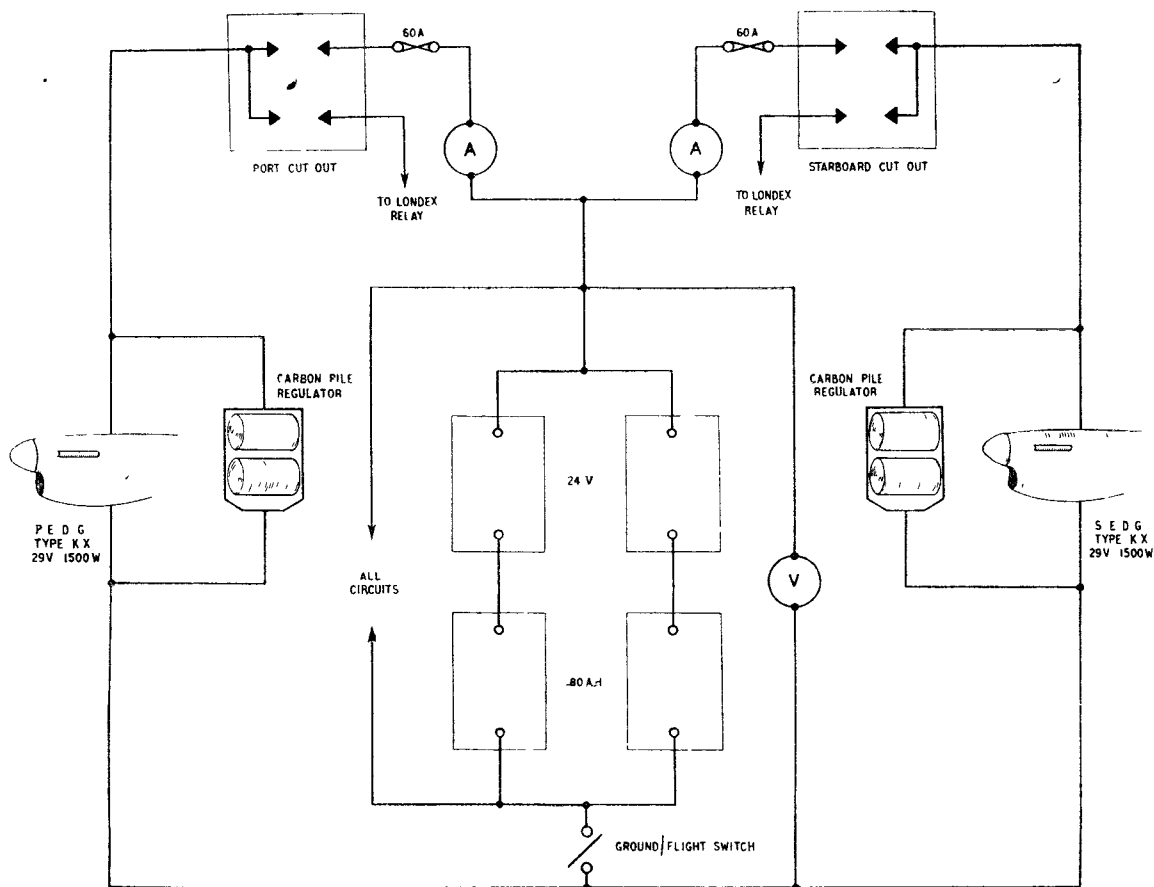
Accumulator cut-outs. As the engine is run up to speed, the generator voltage rises, energising the electro-magnet in the accumulator cut-out. At 26-27 volts the main contacts close and connect the generator to the accumulator, so that current flows through the main fuse and ammeter to charge the accumulators and to supply the various aircraft circuits. Conversely on shutting down the engine and in the event of generator failure, the generator voltage falls below that of the accumulator, the electro-magnet of the cut-out is de-energised and the main contacts open, preventing a heavy reverse current from the accumulator flowing through the generator. The auxiliary contacts, which close slightly before the main contacts, allow the Lon-dex relay to be energized. This relay inserts a resistance in the input circuit of the L.T. converter unit, preventing an increase in the converter unit output, which would occur as the generator cuts in.

Accumulators. The four 12v 40 A.H. accumulators are connected in series parallel to give a total accumulator

supply of 24v, 80 a.h. The ground/flight master switch in the accumulator negative lead is mounted on the starboard side of the fuselage. Before flight the switch is placed in the *FLIGHT* position to connect the accumulators to the aircraft services and to the generators. For engine starting, ground testing and when standing-by, the switch is moved to the *GROUND* position, when the various circuits can be operated if

required from a ground accumulator trolley plugged into the external supply socket.

Voltmeter. The supply voltage is indicated at all times by the voltmeter on the main distribution panel. This shows the accumulator voltage when the engines are stationary, and the generator voltage when the cut-out has closed.



LANCASTER ELECTRICAL CIRCUIT

PRECAUTIONS TO BE OBSERVED TO AVOID RISK OF FIRE IN AIRCRAFT

FIRE precautions in aircraft are becoming increasingly important. Petrol vapour, always existent in an aircraft, is extremely inflammable and requires only a very small spark to ignite it. Ignition will cause an explosion and you and the crew will be written off for R.A.F. purposes—and what a death!

SO:—

1 Never make or break any external circuit unless the

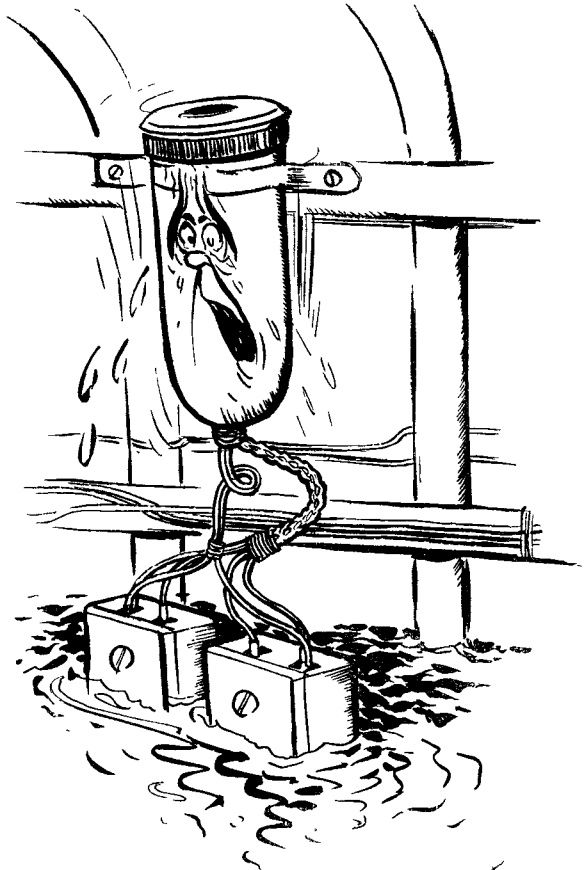
supply is switched off. This applies particularly to plugs and sockets.

2 Don't make or break accumulator or battery connections unless *all* the circuits have been switched off first.

3 Don't use thin strands of wire to connect up accumulators in aircraft.

TROUBLE BREWING

- 1 Always reel out your trailing aerial when over the sea.
- 2 Don't expect a Group Operational Frequency to provide such facilities as Fixes or Courses to Steer, except where such a frequency is known to provide D/F facilities
- 3 Pay special attention to briefing details. On operational sorties, don't attempt to tune your transmitter to any frequency and never touch the key when W/T silence is in force
- 4 If in doubt as to the serviceability of your I.F.F. identify immediately
- 5 Always keep your Captain informed as to the serviceability of your equipment and never tell him everything is O.K. unless it really is 100% serviceable
- 6 Make sure your telephones are plugged in securely
- 7 Always switch off your microphone after use
- 8 Don't clamp the plunger on to the cord at the end of a trailing aerial. Cord is quite a good insulator



- 9 Before reeling out your trailing aerial ask the Captain's permission and always inform him when it has been reeled in.
- 10 Always keep your watch synchronized with that of the navigator.
- 11 Make call signs slowly and distinctly
- 12 Dampness in inter-com. sockets causes howling
- 13 Never request emergency fixes unless vital to your safety
- 14 Never send at a greater speed than you are capable of receiving
- 15 Remember that the Captain of the aircraft is the only crew-member authorized to originate a signal
- 16 If in any doubt as to the authenticity of any transmission from a ground station--challenge, using normal procedure
- 17 If in difficulties over land, contact nearest H.F. D/F Station

FAULT FINDING

No W/O (Air) is supposed to possess detailed technical knowledge. Such 'gen' is left to Wireless Mechanics, whose jobs take them into the heart of receivers and transmitters. But he must possess just that right amount of technical 'gen' to prevent 'boobs' and remedy simple faults in the air. Whilst airborne you are members of the crew who will naturally be called upon to rectify any little things that may go wrong with the radio and electrical equipment.

There have been many cases in this war of wireless operators repairing faults in the air and thus allowing the aircraft to complete its allotted sortie. Ingenious remedies have been invented on the spur of the moment, chewing gum, for instance, having made an admirable substitute for solder in more than one instance.

When locating a fault, carry out your plan in a methodical fashion—don't immediately pull the set to pieces and sit on the floor amid a mess of valves and pieces of wire. Your crew may think you're awfully clever and a 'gen' man; but you're really due for a shock when you find it's just a plug out of position, or a loose connection.

Whenever you're flying, carry some sort of screw-driver, and, if possible, a pair of pliers, a few odd lengths of flex, and fuses of various values. They may mean all the difference at a critical period.

Finally, *DON'T PANIC!* Just relax, *THINK* and then carry out the correct drill.

Fault-finding tables for some installations in general use are given as appendices, for your guidance. If you can always cope effectively without them, then you're good.

GENERAL OPERATING

AIR operating demands even stricter attention to detail in procedure than its counterpart on the ground. For one thing, weather conditions sometimes conveniently produce a string of atmospheric just at the wrong moment, and what is more important, good operating procedure makes for swift communication. We all know that the study of procedure is one great bind, but It's just Got to be Done. There is no easy way of learning, you must knuckle down to some really serious work.

WATCH THESE POINTS VERY CAREFULLY IN YOUR OPERATING

- 1 Send call signs slowly and distinctly—avoid any tendency towards 'Baghdad' morse

- 2 The bad operator always send at least 5 w.p.m. faster than he can receive, thus causing the ground station to reply at great speed
- 3 If you are in any doubt as to whether you have received a message correctly, request a repetition of the whole or part. You won't be court-martialled for it
- 4 Don't bang out call signs for minutes on end never pausing to listen-out
- 5 Never attempt to answer an 'F' message. It inevitably brings the hand of wrath descending on you
- 6 Avoid surplus dots and dashes, G.Ms, G.Ns, etc. Such action merely shows ignorance of Service procedure

H.F.D/F ORGANIZATION AND PROCEDURE

THE main function of any H.F. D/F Station is to home aircraft, that is to pass magnetic courses to steer; other tasks are secondary. True bearings will never be passed to Bomber aircraft or aircraft of Flying Training and Technical Training Command, but aircraft of other Commands may be passed bearings, if requested, by the Ground Stations. H.F. D/F Stations may also be used for passing urgent operational messages, air to ground and ground to air.

Bearings are classified as Class A, B or C, according to the degree of accuracy

You must carefully note the following points when working H.F. D/F Stations:

An H.F. D/F Station is normally extremely busy day and night. Bad procedure only lenthens the time required to pass a bearing or a course to steer, and delays other aircraft who may be queuing up for assistance

Never request assistance from H.F. D/F Stations unless within a radius of 100 miles of that Station, or within specified limits of working a L.R.C.R. Station, and then only with good height (not less than 5,000 feet). Owing to the peculiar effects of radio waves, bearings outside this limit may possess such errors that, if used without due regard to limitations, may bring about tragic results

Correct procedure is essential. It gives the enemy the minimum amount of information

Make perfectly sure that it is your aircraft the Ground Station is answering. It is more than easy to log another aircraft's Q.D.Ms or Q.T.Es as your own. Make sure your Transmitter and Receiver are dead

on frequency. Since most H.F. D/F Stations send calibration signals every fifteen minutes at each quarter hour past the clock hour there is no excuse for bad tuning

Always pass courses to steer or bearings in writing to your Navigator, and always make sure to state that the information relates to a bearing or course to steer—*e.g.*:

The course to steer to reach Prangmoore is 180 degrees MAGNETIC (Class A) at 23.59 hrs.

'Bearing from Prangmoore is 270 degrees TRUE'

The strength of an H/F Signal is not necessarily to be taken as a true indication of the distance from aircraft to ground station.

THE USE OF THE D/F LOOP IN AIRCRAFT

THE Hun is very smart in picking up radio transmission on practically any frequency. You have only to press your morse key for a second on any particular frequency and the position of the aircraft is immediately given away. On certain sorties, such lack of security might be dangerous and thus an alternative to M/F Fixes and H/F Bearings has to be found. It is here that the D/F loop comes into its own. Bearings and fixes can be obtained and the aircraft homed to a position without touching the key and so breaking W/T Silence. Nearly every multi-seater aircraft is equipped with a D/F loop, many with radio compass as well, but unless you have the situation well weighed up, the value of this navigational aid is seriously reduced.

R.1155—D/F LOOP EQUIPMENT

- 1 Never adjust the Meter Balance Control with the Master Switch to Visual. A false indication of bearing will be given
- 2 So adjust the Meter Amplitude Control that the needles of the Visual Indicators intersect a third to half the distance up the centre line
- 3 Use the High position of the Meter Deflection Switch for bearings, and the Low position for homing and aural bearings. When homing, such action allows the pilot to keep the needles intersecting on the centre line with a minimum of effort
- 4 Use High Switch Speed for Visual D/F on W/T signals, and

Use Low Switch Speed for Visual D/F on R/T signals

- 5 When using aural D/F, remember that the volume control plays an important part. When a rough minimum has been obtained, reduce the volume until the note is scarcely audible. Rotate the loop to each side again and obtain the true minimum
- 6 Again, when using aural D/F, if the minimum is found to spread over more than 5 degrees of loop movement, adopt the following procedure:
 - (A) Obtain a rough minimum
 - (B) Rotate loop 10 degrees to the right and note signal strength and reading
 - (C) Rotate loop to the left until the same signal strength is heard. Note reading
 - (D) The mean of the readings obtained in (B) and (C) will give a true minimum
- 7 Remember the sensing rule *i.e.*
Visual D/F Decrease loop reading. If needles cross on Right, sense is Right
Aural D/F Decrease loop reading. Swing Aural Sense Switch from left to Right. If a louder signal is obtained on the Right, sense is Right
- 8 Always be ready to distinguish jamming. If the enemy is jamming a Radio Beacon, you will obtain four separate minima on rotating the loop through 360 degrees

DISTRESS PROCEDURE WHEN OVER THE SEA

ANY aircraft that is unlikely to reach land may be considered to be in a state of emergency even though a forced landing in the sea is not imminent. An aircraft is only in a state of distress when a forced landing or ditching is imminent.

The Captain originates emergency or distress messages and it is then left to you, the wireless operator, to carry out a drill (See A.P.3032 and A.P.3024) which

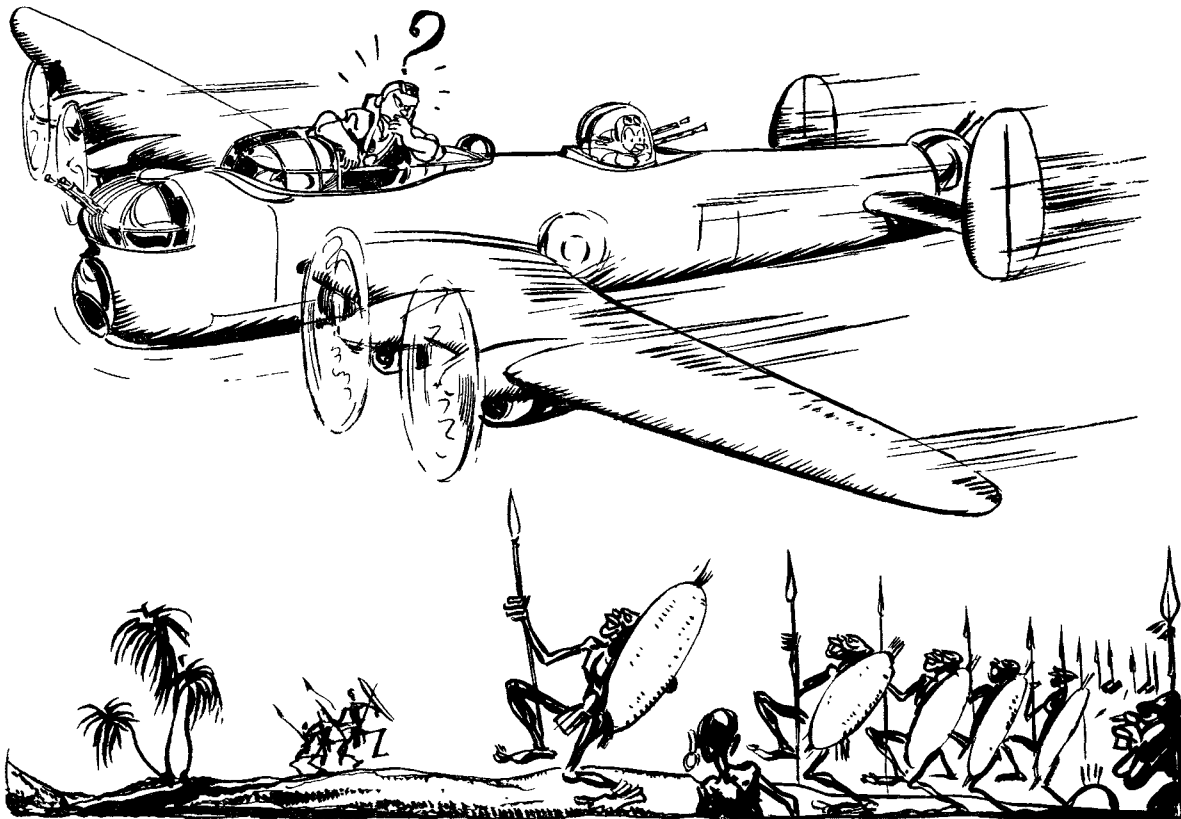
must be learned down to the smallest detail. It is in the case of emergency that you are able to prove your ability, and not only that, any speedy assistance you acquire may eventually save valuable lives. So concentrate on knowing exactly what you have to do in a case of distress over the sea, so that if through bad fortune, the opportunity does arise, you can acquit yourself with credit.

It has been stated that the Captain originates distress or emergency messages, and he may do it in two different ways:

If he considers that his aircraft is unlikely to reach land, although a ditching is not imminent, he will originate an emergency message using priority O, and if he considers ditching is likely to take place within 10 minutes, he will originate a distress message, to which S.O.S. procedure will be applied.

will find below a set of useful hints on general emergency and distress procedure:

- 1 Remember that you may not be the only aircraft in distress. Others may be awaiting assistance for more urgent reasons than your own. So again remember the golden rule *LISTEN OUT CAREFULLY*
- 2 The more 'gen' your navigator can supply regarding wind speed and direction, position, course, height, time, etc., the better.



“... considers that his aircraft is unlikely to reach friendly territory”.

Obviously a combination of the two may be used. For example, let us assume that your machine has been damaged by heavy flak, an engine is completely unserviceable, and apparently a fuel tank has been holed. The Captain considers he is unlikely to reach friendly territory. Therefore he originates an emergency message. But when some 50 miles from our coasts he discovers fuel is so short as to make ditching inevitable. He immediately originates a distress message.

Conversely, when an S.O.S. has been sent and conditions improve, the Captain must cancel the S.O.S., and substitute a message of lower priority if necessary.—(See A.P.3032 and A.P.3024.)

If the occasion arises, distress aid becomes vital, and it cannot be stressed too often just how important it is for you to be fully conversant with its procedure. You

- 3 Don't forget that the Captain originates an S.O.S. when the need for it is imperative. Therefore if you eventually make a landfall, remind him to authorize the cancellation of distress message, which is sent in this form:—AB2 V CDFA cancel distress. Priority fixes can still be requested after a cancellation.
- 4 Use plain language if the time taken to encode a message would seriously imperil your aircraft's safety.
- 5 When about to ditch *i.e.*, at a height of 500 feet above the sea, send call sign, clamp down your key, take up the proper ditching station and have the dinghy transmitter at hand, this being the only link you will have with the land when reposing comfortably or otherwise in the dinghy.

TRANSMITTER T.1333(B)

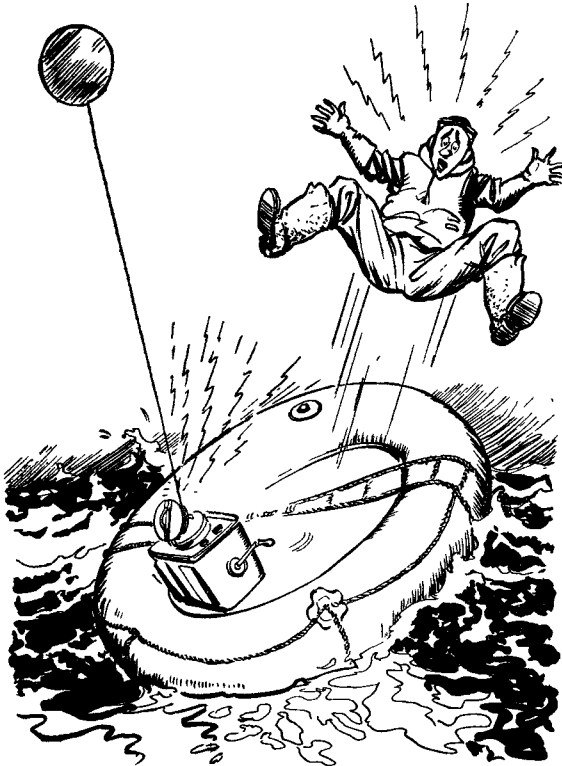
If you have carried out your ditching procedure correctly, the position of the dinghy should be known fairly accurately by the Air/Sea Rescue Service. However, to help them still more, you are provided with a Portable Transmitter for use in the dinghy itself. This very useful piece of equipment operates on the International Distress Frequency (500 kc/s) and its range is approximately 100 miles. It can either be hand-keyed or made to send out an automatic transmission of three S.O.S. signals, followed by twelve long dashes, both methods on C.W. or M.C.W. The aerial, which consists of some 200 ft. of stainless steel wire, is suspended from a hand-launched kite. The T.1333(B) has no receiver portion.

This is a most useful piece of emergency equipment if properly handled as it enables ground stations to fix your dinghy and saves many hours of fruitless sea searching.

Points to observe:

Do not touch an uninsulated portion of the aerial while the generator handle is being rotated.

In strong winds, tuning varies according to the angle of aerial wire. Tuning must therefore be checked periodically.



'... uninsulated portion of the aerial'.

INTERNATIONAL DISTRESS PROCEDURE

If you are in a state of emergency or distress and at too great a distance from a Service M/F Section to get good assistance, you should use the International Distress Frequency (500 KC/S). The procedure to be adopted is as follows:

THE DISTRESS CALL

In civil procedure, distress signals by W/T take the form of the group S.O.S. and by R/T, the word *MAYDAY*. The Distress Call itself takes the following form:

SOS SOS SOS de GEZAA GEZAA GEZAA

Normally this will be followed by a Distress Message giving particulars of distress and the assistance required in clear, such a message following the group GEZAA. If an aircraft is unable to give its position, it sends the aircraft call sign for a period long enough for Direction Finding Stations to fix its position. The position of the aircraft, if it is over the sea, must be given in Latitude and Longitude using figures for degrees and minutes together with one of the words North, South, East or West. When practicable, the true bearing and distance in nautical miles from a known geographical position may be given, but if the distance is expressed in kilometres, the abbreviation 'KM' must be used. When an aircraft is over land (but obviously not Britain) the position must be given, using Points of Reference, Boundary Points or large places and stating distance and bearing from them. The call and message must be repeated at intervals until an answer is received. The acknowledgment takes the following form:

GEZAA GEZAA GEZAA de GLD GLD GLD
RRR SOS +, where the group or call sign GLD represents the ground station acknowledging receipt.

The speed of transmission is not to exceed 16 *Words per Minute*.

Urgency Messages. W/T the Urgency signal consists of three repetitions of the Group XXX sent with the letters of each group and the successive groups clearly separated from each other. It is sent before the call. By R/T the Urgency signal consists of three repetitions of the expression PAN (corresponding to the French pronunciation of the word 'panne') which is emitted before the call. The above signals indicate that the station calling has a very urgent message to transmit concerning the safety of a ship or aircraft in which it is carried, or a ship or aircraft within sight, or finally of some person on board or within sight.

The Urgency signal PAN is also used to indicate by W/T or R/T that the aircraft transmitting it is in trouble and is forced to land, but that it is not in need of immediate assistance. This signal should, if possible, be followed by a message giving additional information.

When PAN is used on W/T, care should be taken that the three letters are well separated so that AN may not be read as P.

The Urgency signal has priority over all other communications except the Distress Signal, and all stations

which hear it must take care not to interfere with the transmission of the message which follows the Urgency Signal.

When the Urgency Signal is used by aircraft it is as a general rule addressed to a specific station.

In Urgency traffic the speed of transmission must not normally exceed 16 *words a minute*.

URGENCY messages should never be confused with normal *Urgent* messages which contain important information for despatch without delay bear the International prosign P.

Safety Messages. By W/T the Safety signal consists of three repetitions of the group TTT, sent with the letters of each group and the successive groups clearly separated from each other. This signal is followed by DE and the C/S of the station sent three times. This signal indicates that this station is about to transmit a message regarding the safety of navigation or giving important meteorological warnings. The speed of transmission must not normally exceed 16 *words a minute*. By R/T the word Securite, repeated three times is used as the Safety signal. Safety signals are usually sent on the normal control station frequency.

FAULT FINDING

T.1154/R.1155 INSTALLATION

Warning: Switch off H.T. before making adjustments.
Have you checked all external connections?

SYMPTOM	REMEDIAL ACTION
MAIN POWER SUPPLY Complete Failure	<ol style="list-style-type: none"> 1. If on ground, check external starter socket 2. If accumulator voltage adequate, when airborne <ol style="list-style-type: none"> (a) Check L.T. Power Unit fuse (b) Check Power Unit plugs and plug D of transmitter (c) Examine Type 52 Resistance for possible fracture 3. If accumulator volts are low <ol style="list-style-type: none"> (a) Check main charging fuse and charging switch if fitted 4. Check ground/flight switch
TRANSMITTER T.1154 1. No input indicated by Magnetic Feed Meter with key pressed	<ol style="list-style-type: none"> 1. If sidetone heard, check P.A. valves 2. If no sidetone heard, check if H.T. Power unit is running 3. If running, check: <ol style="list-style-type: none"> (a) H.T. power unit fuse (b) Plugs and sockets to power units and transmitters for security If not running, check: <ol style="list-style-type: none"> (a) H.T. power unit fuse (b) Position of Type J Switch (H.T. power unit will not run with switch on D/F) (c) Socket D on transmitter and power unit connections for security 4. Check key circuit
2. Frequency incorrect when transmitter set up on a click-stop	Fine tuning levers not in correct position <ol style="list-style-type: none"> 1. Reset fine tuning lever to second position from bottom 2. Back tune if necessary
3. Aerial current low	Incorrect tuning—P.A. tuned to Harmonic <ol style="list-style-type: none"> 1. Retune P.A. stage 2. Check plugs
4. No dip but Magnetic Feed slightly above normal	<ol style="list-style-type: none"> 1. Change M.O. valve 2. If no spare M.O. Valve, use Modulator Valve (front left hand of valve compartment). Under these conditions there will be no sidetone
5. No dip and Magnetic Feed low	<ol style="list-style-type: none"> 1. Check P.A. valves by simple emission test. Change faulty valve if spare available. If no spare, remove faulty valve
6. No sidetone	<ol style="list-style-type: none"> 1. If signals from receiver heard, change modulator valve 2. If no signals from R.1155-- Check phone circuit

SYMPTOM	REMEDIAL ACTION
7. Good dip on H/F range but little or no aerial current	1. H/F or fixed aerial disconnected or broken
8. Dip correct on H/F ranges but very high aerial current shown in aerial ammeter	1. H/F or Fixed Aerial shorted to earth
9. No Modulation	1. If no sidetone on TUNE or C.W., Modulator valve is faulty 2. If sidetone working on TUNE and C.W., check microphone circuit, A.1134, etc.
10. Dip correct on M/F Range but little or no aerial current. Position of P.A. tap appears abnormal	1. Trailing or M/F aerial disconnected
11. No dip on M/F Range and no aerial current	1. M/F or trailing aerial shorted to earth 2. Check earth lead on aerial winch 3. Check trailing aerial not caught in Bomb Doors
12. Anode current at 'Tune' position excessive	1. Check tuning 2. Check aerial plugs in correct position and secure
RECEIVER R.1155. 1. No Signals (Power supply faults)	1. If Magic Eye glowing green, H.T. and L.T. are applied 2. If Magic Eye is glowing, but filament is dim, L.T. volts are low. Check accumulator volts and charging circuits as for a complete failure. 3. If Magic Eye filament is alight, but there is no green glow, H.T. is off. Check power connections, <i>i.e.</i> plug and socket connections to receiver, transmitter and power units 4. If Magic Eye completely dead <i>i.e.</i> , No L.T. or H.T. to R.1155, check connections as above
2. No Signals (Valve faults)	1. If H.T. and L.T. are applied, tune to 280 Kc/s with HET switch on 2. If loud whistle heard, change V3 3. If no spare VR100 available, remove faulty V3 and join the grid connection (top flexible lead) to grid of V4 (top cap). Reasonably strong signals will be heard 4. If no whistle heard but magic eye deflects, V8 or telephone circuit is faulty 5. To check telephone circuit, switch transmitter to 'TUNE' and press key. If sidetone heard, telephone circuit is correct. Change V8 6. If no spare VR101 available use the B.F.O. valve (V7) placed in V8 position. No B.F.O. is available under these conditions, but if the screening cans are removed from V5 and V6, this will usually produce a heterodyne note and C.W. signals can be received

SYMPTOM	REMEDIAL ACTION
3. No signals on Ranges 1 and 2. Signals received on Ranges 3, 4, and 5.	1. Low emission of V4 (frequency changer). Use V1 or V2 as replacement
4. Weak signals on all ranges	<ol style="list-style-type: none"> 1. Check on 280 Kc/s as for NO SIGNALS 2. If weak whistle heard, change V5 and V6 3. If either V5 or V6 faulty and no spare VR100 is available, link grid across to V4 as previously described under NO SIGNALS (Valve faults) and use V3 as spare for V5 or V6
5. No C.W. signals with HET. switch on. R/T signals received	<ol style="list-style-type: none"> 1. Change V7 2. If no spare V7 available, remove screening caps from V5 and V6
6. Volume control inoperative on OMN1 and FIGURE OF EIGHT positions	1. Negative H.T. Earthing in power plug of receiver. Take off cover at rear of plug and insulate bare wire
7. Instability on all ranges	1. Check screens on V5 and V6

ACTION TO BE TAKEN WHEN NO SPARE VALVES ARE AVAILABLE FOR THE R1155
 Owing to the extreme shortage of radio valves, it is not always possible to carry spare valves in aircraft. You can get over the difficulty by carrying out the procedure outlined below:

<i>VALVE FAULTY</i>	<i>ACTION</i>
V3	Remove V3. Connect grid lead of V3 to cap of V4 after removing the flexible lead
V4	Replace with V1 or V2. Removing either V1 or V2 puts the D/F side of the Receiver R1155 inoperative
V5	Remove valve and remove grid lead from cap of V6. Connect grid lead of V5 to cap of V6 with insulated wire
V6	Replace with V5 and treat as for V5 above
V7	Remove screening cans from V5 and V6
V8	Replace with V7 and treat as for V7 above
D/F FACILITIES 1. Needles only rise slightly in 'Balance' position	1. If needles come up on 'visual' but do not swing left or right when loop is rotated, fixed aerial is disconnected. Check fixed aerial connections at Type J switch, aerial ammeter and connecting lead from transmitter to receiver
2. Needles balance; but no movement to left or right when loop rotated	<ol style="list-style-type: none"> 1. No input from loop 2. Check loop lead connections 3. Check condenser in loop lead plug not shorting

SYMPTOM	REMEDIAL ACTION
3. Both needles uncontrollable on strong signals	<ol style="list-style-type: none"> 1. Check Meter Amplitude Control 2. Fault may be in V7 (A.V.C. portion) or V8 (limiter diode)
4. Both needles kicking downwards	<ol style="list-style-type: none"> 1. Faulty V9
5. Needles do not rise in 'Balance' or 'Visual' positions	<ol style="list-style-type: none"> 1. Faulty V9 2. Common lead to meters broken
6. One side of Visual Meter u/s	<ol style="list-style-type: none"> 1. One meter faulty. Short A, B, C and D terminals at back of instrument
7. Visual Meter will not balance. Needles persist in crossing on one side	<ol style="list-style-type: none"> 1. Change V9 2. If no effect apply following check: <ul style="list-style-type: none"> Needles fall to left —V1 or part of V9 u/s Needles fall to right —V2 or part of V9 u/s Tune in signal, switch to 'Figure of Eight' position, check signal being received from loop <ul style="list-style-type: none"> Remove plug with loop connections from receiver. Move Aural Sense switch from left to right <ul style="list-style-type: none"> If signals equal—V9 is u/s If no signals on left—V2 is u/s. If no signals on right —V1 is u/s
<p>INTERCOMMUNICATION—Amplifier A.1134</p> <ol style="list-style-type: none"> 1. Telephones dead <ol style="list-style-type: none"> (a) All positions (b) All positions except W/Op's. 	<p>Check with T1154/R1155. Put ABC Switch to 'B'</p> <p>If signals from R1155 cannot be heard: Make sure 10-pin plug on Type 192 Panel is secure and making good contact</p> <p>If signals from R1155 can be heard:</p> <ol style="list-style-type: none"> (a) Ensure that A1134 is switched on (b) Switch to Emergency Inter-com. ensuring TR1196 is switched on and inform Captain that strength will be reduced under these conditions (c) If spare valves carried, change VR21 and VR35 (d) Check that power socket Type 39 on A1134 and 4-pin plug on Type 192 Panel are firmly pressed home and making good contact. If these are loose, open pins with a knife or other suitable appliance (e) Change 2-volt accumulator and 120-volt H.T. battery. Check wander plugs on H.T. Battery and spade terminals on 2-volt accumulator are clean and secure (a) Check that Normal/Emergency switch is at 'Normal' (b) Check over crew's telephone connections on Type 192 Panel

SYMPTOM	REMEDIAL ACTION
<p>(c) One position only</p> <p>(d) W/Op's. position only</p> <p>(e) Pilot's position only</p> <p>(f) Navigator's position only</p> <p>(g) Turret Gunner's position</p>	<p>(a) Check telephone plug is securely home in socket</p> <p>(b) Test telephones in a socket known to be working Use spare headset if u/s.</p> <p>(c) Check leads to socket concerned</p> <p>(a) ABC switch must be at 'B' or 'C' position</p> <p>(b) Check with R1155: If R1155 signals are heard, check connections from telephones to Type 192 Panel</p> <p>(a) Ensure B.A. Mixer Box Switch is at 'Mix' or 'Inter-com.'</p> <p>(a) Reverse position of navigator's on/off switch</p> <p>(b) Ensure navigator's 'D/F—Intercom.' switch is at 'Intercom.'</p> <p>(a) Check for broken leads to turret</p> <p>(b) Issue Extension Lead. Gunner must use nearest available inter-com. socket, and must be warned to remember lead when rotating the turret</p>
<p>2. Reception, but no speech</p> <p>(a) R1155 signals can be heard in all positions</p> <p>(b) All positions except wireless operator</p> <p>(c) No speech from any one position</p> <p>(d) Wireless operator's position only</p> <p>(e) Turret Gunner's position</p>	<p><i>MAKE SURE MICROPHONES ARE SWITCHED ON</i></p> <p>(a) Check 4-pin plug on Type 192 Panel is securely home. Open out pins if necessary</p> <p>(a) Check connections to crew microphones on Type 192 Panel</p> <p>(b) Check crew microphones connection in any accessible junction boxes</p> <p>(a) Test headset in a working position and if u/s, use spare headset</p> <p>(b) Examine leads to socket</p> <p>(c) Check connections from microphone through to operator's position on Type 192 Panel</p> <p>(a) Check connections from microphone through to Operator's position on Type 192 Panel</p> <p>(a) Oil may be present on Slip Rings</p> <p>(b) Microphone may be frozen. (If microphone is frozen, issue spare and thaw out frozen microphone in the cabin)</p>
<p>3. Continuous low-pitched howl</p>	<ol style="list-style-type: none"> 1. Dampness: Change socket if spare is carried. If on ground, dry out defective socket(s) 2. Broken microphone lead: Try another position. Change defective socket if spare available 3. Check L.T. and connections at accumulator end. Accumulator may be run down 4. Telephone plug not fully home in socket. Request all members of crew to check 5. VR21 u/s.

SYMPTOM	REMEDIAL ACTION
4. High pitched howl	1. Run down grid bias battery (a) If in flight, reduce H.T. volts, step by step, until howl ceases (b) If on ground, change grid bias battery
5. Bad crackling	1. Power supply plug not located securely in amplifier or accumulator crate. Open pins 2. Loose H.T. or L.T. connection 3. Loose 10-way plug. Examine for security 4. Faulty microphone. Check with other helmets 5. Check breeze sockets for security (green markings for "i/c" circuits)
6. Weak signals	1. Check anti-freeze gauzes in position and not frozen up
7. Faults in turrets	May be due to broken turret connections Always check undermentioned points when failure in turret is suspected 1. Security of connections to terminal block 2. In mid-upper turrets, check for oil on sliprings and protecting felt washer in position 3. Turrets provided with 'On-off' microphone switch should be checked for position of switch

SCR 287N INSTALLATION

Warning: Switch off H.T. before making adjustments

Have you checked all external connections ?

SYMPTOM	REMEDIAL ACTION
MAIN POWER SUPPLY Complete Failure	Check battery supply
TRANSMITTER BC—375 1. No filament voltage and dynamotor not running	Ensure lock-nut of interlock switch is not loose. Press home Tuning Unit and fasten snap slides
2. No filament voltage Dynamotor running	Replace 30 amp. fuse in dynamotor with spare carried in lid
3. Filament voltage satisfactory. Dynamotor not running	1. Replace 60 amp fuse in dynamotor with spare carried in lid 2. Check input brushes
4. Filament voltage satisfactory. Dynamotor running. No plate current when key is pressed	1. Replace $\frac{1}{2}$ amp fuse in transmitter with spare carried in bottom of set 2. Replace 1 amp fuse in dynamotor with spare carried in lid 3. Check by operating Test Key. If plate current obtained, examine Telegraph Key connections
5. Low plate current on 'C.W.' operation. P.A. control "C" will not resonate	1. Change M.O. valve V.T.-4C with modulator valve 2. Change P.A. Valve VT-4C with modulator valve 3. Try another Tuning Unit
6. Tuning of "C" is normal but total plate current does not increase with tuning of aerial circuit	1. Check all aerial connections between transmitter and Antenna Tuning Unit BC-306A 2. Short-out Antenna current meter with suitable wire 3. Try another Tuning Unit
7. Transmitter tunes normally but no side-tone	1. Replace S.A. Valve V.T.25 with spare 2. Check Monitor switch is at 'Normal' 3. Check Jack Box Switch is at 'Liaison' 4. Remove Jack Box and plug-in headphones at Receiver BC-348
8. Transmitter tunes normally on 'C.W.' with side-tone, but no modulation on 'Voice'	1. Replace Modulator Valve(s) with spare(s) 2. Change microphone

SYMPTOM	REMEDIAL ACTION
<p>RECEIVER BC—348</p> <p>1. No background noise or signals</p> <p>(a) Dynamotor not running. Dial lights off</p> <p>(b) Dynamotor not running. Dial lights on</p> <p>(c) Dynamotor running. Dial lights on</p>	<p>1. Check 5 amp fuse in bottom of Receiver If spare 5 amp fuse is not available use 10 amp spare from Command Receiver rack. Bend fuse clips to ensure good contact</p> <p>2. Ensure L.V. brushes making contact</p> <p>3. (i) Change headset (ii) Check Jack Box switch is at 'Liaison' (iii) Remove Jack Box and plug-in 'phones at Receiver (iv) Check valve cap connections and ensure they are not shorting to metal case (v) Replace Output Valve VT-152 or VT-48 with spare. A VT-66 (Radio Compass Audio Output Valve) will do in place of a VT-152 (vi) Replace 2nd Detector Valve VT-93 (vii) Replace 2nd I.F. Valve VT-70 (viii) Replace 1st I.F. Valve VT-86 (ix) Check output brushes on dynamotor</p>
<p>2. Background noise but weak or no signals</p>	<p>1. Check aerial connections and ensure not earthed</p> <p>2. Replace 1st and 2nd Amplifiers VT-86, mixer VT-91 or Het.-Osc. VT-65 valves as necessary Attaching the grid cap of one valve to the next is no good if filaments are unserviceable since the filaments of all these valves are in series. A VT-91 may be used in place of a VT-86 and vice versa</p>

D/F FACILITIES

(Radio Compass SCR.269-G)

Note : Check all plugs are correctly and securely connected, and then check for operation in the following order :

1. Signals on 'ANT' position
2. Signals and rotation of loop on 'LOOP' position
3. Signals and bearings on 'COMP' position

<p>1. No background noise or signals on 'ANT' position</p> <p>(a) No dial lights and no deflection of tuning indicator</p> <p>(b) Dial lights on but no deflection in tuning indicator</p> <p>(c) Dial lights on and deflection in tuning indicator</p>	<p>1. (i) Check that Inverter is switched on and operating If faulty, switch to other Inverter. Check 15 amp A.C. fuse on Fuse Panel and A.C. fuse on Relay BK-22-A (ii) Check D.C. fuse on Relay BK-22-A (iii) Press Control Button and hold until green lamp lights</p> <p>2. Replace Rectifier Valve VT-74</p> <p>3. (i) Replace Audio Output Valve VT-66 with a spare or a VT-152 from Liaison Receiver (ii) Plug-in headset to jack on Compass Control Box</p>
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SYMPTOM	REMEDIAL ACTION
2. Background noise but no signals in 'ANT' position	<ol style="list-style-type: none"> 1. Check Fixed Aerial connections. Note that a disconnected Fixed Aerial will usually cause loop to rotate continuously in 'COMP' position 2. Replace R.F. Amplifier valves by spares, or if one is unserviceable, place good valve in 2nd R.F. Amplifier position and remove top cap from 1st R.F. Amplifier and connect it to top cap of 2nd. If both valves are unserviceable, connect top cap of 1st R.F. Amplifier to top cap of Mixer VT-87 3. Replace Mixer Valve VT-87 4. Replace Het.Osc.Valve VT-94 by spare or VT-65 from Liaison Receiver if the latter is not required for immediate use. 5. Replace I.F. Amplifier valve VT-86 by a spare or by the 1st R.F. Amplifier Valve. In the latter case, connect the top cap for the 1st R.F. Amplifier to the top cap of the 2nd R.F. Amplifier
3. Signals on 'ANT' on one band only	<ol style="list-style-type: none"> 1. Check Band-Change switch 2. Use other Control Box
4. Signals on 'ANT' position but not on 'LOOP'	<ol style="list-style-type: none"> 1. Check connection of Loop cable to Compass Unit 2. Replace Loop Amplifier Valve VT-86 with spare or by 1st R.F. Amplifier Valve. In the latter case, connect the top cap for the 1st R.F. Amplifier to the top cap of the 2nd R.F. Amplifier 3. Replace Modulator Valve VT-105
5. Signals on 'ANT' and 'LOOP' positions but indicators do not rotate when 'L/R' switch is operated on 'LOOP'	<ol style="list-style-type: none"> 1. Check L/R Switch 2. Use other Control Box
<p>6. Signals on 'ANT' and 'LOOP' positions and 'L/R' switch when operated causes indicators to move correctly on 'LOOP' but not on 'COMP'</p> <p>(a) Indicators move in one direction only, and then stop or creep in same direction</p> <p>(b) Indicators do not move</p>	<ol style="list-style-type: none"> 1. Check Loop Control Valves VT-109 Replace back Loop Control Valve if movement is to left and replace the front Loop Control Valve if movement is to right 2. Check both Loop Control Valves VT-109, Cathode Follower VT-66, Audio Oscillator VT-96 or Compass Output Valve VT-98 and replace with spare(s) as necessary

SYMPTOM	REMEDIAL ACTION
INTERPHONE RC—36	
<p><i>Note :</i> If system is completely unserviceable the Modulator valve in the Command Set SCR-274-N may be used as an emergency interphone amplifier by putting the power switch on Command Transmitter Remote Control Box to 'ON', Emission switch to 'voice' and Selector switch to '3' or '4'. Crews may then speak to each other by putting their Jack Box switches to 'Command' position</p>	
<p>No communication between any of crew: (a) Dynamotor not running (b) Dynamotor running</p>	<ol style="list-style-type: none"> 1. Check that power is switched on 2. Examine dynamotor input brushes 3. Check output brushes 4. Replace valve VT-99 in Amplifier BC-347
<ol style="list-style-type: none"> 1. Dynamotor on Modulator Unit does not run when Transmitter is keyed 	<ol style="list-style-type: none"> 1. Check that Jack Box switch is on 'Command' 2. Switch to 'C.W.' on Control Box and if dynamotor starts, then fault is in microphone switch. Use built-in key on Radio Control Box or key from another Jack Box. 3. Check 20 amp fuses ('HEAT' and 'DYN') and change with spares on opposite side of unit if necessary 4. Short contacts of Starter Relay at bottom of Modulator Unit, if necessary, to make dynamotor run 5. Examine input brushes of dynamotor
<ol style="list-style-type: none"> 2. Dynamotor runs. Filaments light, but Magic Eye tubes in both Transmitters do not glow when key is pressed 	<p>Adjust or short contacts of H.V. Relay (S.P.S.T.) on top of Modulator Unit as necessary</p>
<ol style="list-style-type: none"> 3. Magic Eye does not light in one Transmitter when keyed 	<ol style="list-style-type: none"> 1. Check that Selector Switch on Remote Control Box is not in wrong position 2. If filament of M.O. will only just glow, check filament of Magic Eye VT-138 and replace, if necessary, with that from other Transmitter 3. Replace M.O. valve with spare or one from other Transmitter 4. Check Selector Relay in base of Transmitter and adjust or short contacts as necessary
<ol style="list-style-type: none"> 4. No reading in antenna current meter for one Transmitter only 	<ol style="list-style-type: none"> 1. Check if M.O. valve VT-137 (1626) is serviceable by tuning dial to frequency of crystal, when a shadow on Magic Eye will prove M.O. is in order 2. Check P.A. valves VT-136 (1625) and change with those in other Transmitters if necessary 3. See if Aerial Relay inside top of Transmitter is faulty and adjust as necessary. <i>N.B.</i> If contacts have been shorted, the shorting link must be removed before the other Transmitter is used 4. Check aerial circuit inside transmitter for continuity, particularly at wheel contact of aerial inductance

SYMPTOM	REMEDIAL ACTION
<p>5. No reading in antenna current meter for either Transmitter</p>	<ol style="list-style-type: none"> 1. Check aerial connections, including those between Antenna Relay Unit and Transmitter. Ensure aerial is not earthing 2. See if meter is unserviceable. This will not affect transmission. Check radiation by removing Voltage Regulator RCA-991 from Liaison Receiver, hold it on Transmitter Aerial terminal and tune for maximum glow 3. Check relay inside Antenna Relay Unit. If it is unserviceable, connect terminal on Transmitter to 'ANT' and remove lead from Receiver terminal. Use one of the Liaison aerials for Receiver
<p>6. Transmitter tunes on 'C.W.' but there is no modulation nor side-tone on 'Voice'</p>	<ol style="list-style-type: none"> 1. Change microphone or try operating from another Jack Box 2. See if Modulator Valve V.T.136 (1625) is unserviceable and if necessary change with a P.A. valve from the Transmitter not in use 3. If Tone Oscillator is unserviceable replace it with a spare or any octal base valve
<p>7. Modulation satisfactory but no side-tone</p>	<ol style="list-style-type: none"> 1. Inspect Side-Tone Relay (D.P.S.T.) on top of Modulator Unit. Check that the contacts 'make' when mic. switch is 'closed' 2. Check all 'A/B Tel.' switches are at 'B'
<p style="text-align: center;">RECEIVERS</p> <p>1. No background noise and no signals</p> <p>(a) Dynamotor not running</p> <p>(b) Dynamotor running</p>	<ol style="list-style-type: none"> 1. Inspect 10 amp fuse on rack at back of dynamotor and replace with a spare if necessary 2. Examine input brushes. Change with Dynamotor on other Receiver if necessary 3. Check Jack Box switch is at 'Command' 4. Check 'A/B Tel' switch is at 'B' 5. Check 'phones by listening to another set 6. Plug headphones into Receiver Control Box 'A' tel. jack and put 'A/B Tel' switch to 'A' 7. Inspect output of Dynamotor and change with one on other Receiver if necessary 8. Check Output valve VT-134 (12A6) and replace with a spare or one from other set if necessary 9. Check 2nd Det. valve and replace by a spare or one from other set if necessary
<p>2. Background noise but weak or no signals</p>	<ol style="list-style-type: none"> 1. Check aerial connections and ensure that aerial is not earthed 2. Check if R.F. Amp VT-131 (12SK7), Converter VT-132 (12 K8) or 1st or 2nd I.F. Amp valve (VT-131) is unserviceable and replace with spares or valves from other Receiver as necessary

G.O.9./R.U.19. INSTALLATION

Warning : Switch off H.T. before making adjustments

Have you checked all external connections ?

SYMPTOM	REMEDIAL ACTION
<p>MAIN POWER SUPPLY. (Rectifier Unit G.O.-9)</p> <p>1. No filament volts</p>	<ol style="list-style-type: none"> 1. Check that Radio Power Switch is 'on' 2. Check connections to Alternator Plug Board. Try changing to another alternator 3. Check both 10 amp. A.C. fuses behind front panel. In emergency use spares from emergency panel 4. Check Power Plug on back of transmitter. Ensure plug pushed home and locking ring screwed up
<p>2. Relays fail to operate when key is pressed</p>	<ol style="list-style-type: none"> 1. Check that battery supply voltage is over 20 volts 2. Check all panels are in place, catches fastened and panel safety interlock switches made. (Safety switches on H.F. side affect I.F. and vice versa) 3. Check 10 amp D.C. fuse behind front panel 4. Check external key circuit:— <ol style="list-style-type: none"> (a) Key plug in correct socket (b) Lead from plug to key (c) Key connections (d) Key contacts 5. Check power plug on back of transmitter
<p>3. Key relays chatter when key pressed</p>	<ol style="list-style-type: none"> 1. Check battery supply voltage 2. Check D.C. supply connections for high resistance
<p>G.O.9 TRANSMITTER (H.F. UNIT)</p> <p>1. No reading in I.A. Grid Current Meter</p>	<ol style="list-style-type: none"> 1. Re-tune Doubler 2. Operate M.O., Doubler and I.A. range switches to ensure proper contact 3. Switch to quarter power and key. If P.A. plate current very low (needle only flickers) change low voltage rectifier valve (5Z3) 4. Check M.O. stage by listening on monitor or receiver. If no note can be heard change M.O. valve 5. Change I.A. valve
<p>2. No reading in P.A. Grid Current Meter</p>	<ol style="list-style-type: none"> 1. Retune I.A. stage 2. Operate I.A. and P.A. range switches to ensure proper contact 3. Change I.A. valve 4. Change P.A. valve

SYMPTOM	REMEDIAL ACTION
3. No reading in Plate Current Meter	<ol style="list-style-type: none"> 1. Check power switch <i>NOT</i> at 'TUNE' 2. Switch to I.F. Transmitter <ol style="list-style-type: none"> (a) if plate current meter reads, change P.A. Valve (b) if plate current meter still fails to read, change high voltage rectifier valves (1616)
4. P.A. Stage will not load up	<ol style="list-style-type: none"> 1. Check aerial in use and aerial/earth connection 2. Short aerial ammeter by suitable length of wire 3. Reel out some trailing aerial, connect to H/F output terminal and retune
(M.F. UNIT) 1. No reading in P.A. Grid Current Meter	<ol style="list-style-type: none"> 1. Operate M.O. range switch to ensure proper contact 2. Switch to quarter power and key. If P.A. plate current very low (needle only flickers), change low voltage rectifier valve (5Z3) 3. Check M.O. by listening on monitor or receiver. If no note can be heard, change M.O. valve 4. Change I.A. valve 5. Change P.A. valve
2. No reading in P.A. Plate Current Meter	<ol style="list-style-type: none"> 1. Check Power Switch is <i>NOT</i> at 'tune' 2. Operate P.A. range switch to ensure proper contact 3. Switch to H.F. Transmitter <ol style="list-style-type: none"> (a) If plate current meter reads, change P.A. valve (b) If plate current meter still fails to read, change high voltage rectifier valves
3. P.A. Stage will not load up	<ol style="list-style-type: none"> 1. Check aerial in use, and aerial/earth connections 2. Short aerial ammeter with a suitable length of wire 3. Transfer to fixed aerial and retune
R.U.19 RECEIVER 1. No signals or background noise	<ol style="list-style-type: none"> 1. Check that Dynamotor is running <ul style="list-style-type: none"> If not running: <ol style="list-style-type: none"> (a) Check all switches 'ON' (b) Check battery voltage (c) Check dynamotor fuse If running: <ol style="list-style-type: none"> (a) Check interphone selector switch is at correct position (b) Check all plugs (including remote control) inserted and secure (c) Check output valve

SYMPTOM	REMEDIAL ACTION
2. Background noises but signals absent or weak	<ol style="list-style-type: none"> 1. Check 'A/L' switch is at 'A' 2. Check aerial connections 3. Check coil pushed right home 4. Vary 'Align Input' control adjustment 5. Change R/F and detector valves in turn
3. R/T or M.C.W. but no C.W. signals	<ol style="list-style-type: none"> 1. Check remote control switch is on 'C.W.' 2. Change output valve
D/F FACILITIES (Loop Coupler Unit) <ol style="list-style-type: none"> 1. No signal on 'R' position of switch 	<ol style="list-style-type: none"> 1. Check aerial connected from aerial panel to 'A' terminal of coupler 2. Check aerial lead from coupler connected to ARB terminal 'L.I.' 3. Check ARB Receiver
2. Signal normal on 'R', no signal on 'B'	<ol style="list-style-type: none"> 1. Check Coupler switched 'on' and correct range selected 2. Alter position of loop by 90 degrees and retune 3. Check all power plugs and connections to ARB and Coupler secure 4. Replace valve V102 in Coupler Unit. In emergency, replace by valve V101. If latter remedy effective, bearings but not sense will be obtainable
3. Signal normal on 'R.' and 'B.' No directional indications on 'D'	<ol style="list-style-type: none"> 1. Replace valve V101 in Coupler Unit
4. Two equal maxima on 'D'	<ol style="list-style-type: none"> 1. Tune out incorrect maximum by means of gain control
5. Broad signal indications on 'B' and 'D'	<ol style="list-style-type: none"> 1. Check that receiver on 'manual' volume control (AVC MUST NOT BE USED FOR D/F)
6. Operation Noisy	<ol style="list-style-type: none"> 1. Check security of all aerial connections including plug at back of Coupler Unit
INTERPHONE SYSTEM <ol style="list-style-type: none"> 1. No speech 	<ol style="list-style-type: none"> 1. Check that dynamotor is running <ul style="list-style-type: none"> If not running: <ol style="list-style-type: none"> (a) Check switches 'ON' (b) Check fuse located behind power plug (c) Check battery voltage If running: <ol style="list-style-type: none"> (a) Check pilot's and W/Op's. selector switches (b) Check volume controls (c) Check all microphones and telephones (d) Check all microphone and telephone plugs right home

SYMPTOM	REMEDIAL ACTION
<p>A.T.B./A.R.B. SET A.T.B. TRANSMITTER</p> <p>1. Dynamotor will not start</p>	<p>1. Set 'Voice/Code' switch to 'Code' If Dynamotor starts: (a) Check microphone plugged in correctly (b) Try another microphone If Dynamotor still does not start: (a) Check all supply connections (b) Check 30 amp. and 10 amp. fuses (c) Check starter relay contacts</p>
<p>2. Dynamotor running, but no meter readings</p>	<p>1. Check 500 m/a fuse in box on top of dynamotor</p>
<p>3. Nil or poor modulation</p>	<p>1. Check microphone plugged in correctly 2. Check interphone selector switch is in correct position 3. Check that beam filter switch (behind first pilot) is on position '2' 4. Check that tuning units are locked securely in position</p>
<p>4. No communication</p>	<p>1. Check that 'channel selector' switch is in correct position 2. Check that 'Tune/Operate' switch is in the 'Operate' position 3. Check aerial connections, and examine aerial</p>
<p>A.R.B. RECEIVER</p> <p>1. No signals or background noise</p>	<p>1. Check that dynamotor running If not running: (a) Check switched on (b) Check battery voltage (c) Check fuse in front panel of receiver If running: (a) Check interphone selector switch at correct position (b) Check 'Local/Remote' switch (c) Plug phones directly into remote control panel (d) Check all connections to receiver and remote control panel correct and secure (e) Exchange with other ARB</p>
<p>2. Background noise but signals absent or weak</p>	<p>1. <i>W/Op's ARB</i>—check aerial connections at receiver and aerial panel 2. <i>Pilot's ARB</i>—check aerial connections at receiver and ATB 3. Check all plugs and connections secure 4. Exchange with other ARB</p>
<p>3. Unable to change frequency band</p>	<p>1. Check 'Motor Drive' Switch is 'on' 2. Rotate frequency band switch by hand</p>

TA2J/RA1B INSTALLATION

Warning : Switch off H.T. before making adjustments

Have you checked all external connections ?

SYMPTOM	REMEDIAL ACTION
MAIN POWER SUPPLY Complete Failure	1. Check 100 amp. main fuse 2. Ensure power plug firmly home
TRANSMITTER TA - 2J 1. Transmitter will not operate	1. Check 75 amp. input and 1 amp. output fuses on Power Pack 2. Check Aerial Selector Switches all in correct positions 3. Check that meter plug is in 'AMP' position 4. Verify that Emission Switch is at 'C.W.' 5. Plug meter into GRID position, put Grid Current Switch at 'Osc. and Amp 1'. If no readings, M.O. or P.A. unserviceable
2. Channel Selector inoperative	Put Selector Switch to 'OFF', and rotate crank on transmitter by hand
RECEIVER RA - 1B 1. 'I/C' working, but receiver inoperative	1. Check 20 amp. and 250 ma. fuses in Power Pack 2. Check that 'Local/Remote' Switch on receiver is at 'Local' 3. Check that Aerial Selection Switch on Receiver is at 'F.A.' 4. Ensure that 'A.V.C.' and 'C.W.' switches are not both on together 5. Check that Station Box Switch is at 'R1' or 'R2'
2. Receiver operative, but no 'I/C'	1. Check I/C fuse on W/Op's. Station Box 2. Put 'I/C Amplifier' to 'Maximum' 3. Check that Station Box Selector Switch is at 'I/C' and volume control is at 'maximum'
D/F FACILITIES Radio Compass Receiver inoperative	1. Check fuse in Receiver Remote Control Panel 2. Check that Station Box is at 'Compass' and Volume Control is at 'maximum'
INTERCOMMUNICATION No Inter-Com.	1. Check 5 amp. fuse on Transmitter control panel 2. Check 'I/C Radio—Radio Only' switch is on 'I/C Radio' position 3. Put volume control on 3611 Amplifier at 'maximum' 4. Put volume control on Station Box at 'maximum'

SYMPTOM	REMEDIAL ACTION
<p>T.A. 12B/RA.100A SET TRANSMITTER</p> <p>1. Set dead</p>	<p>1. Check that aircraft master switch is 'ON' 2. Check aircraft fuses 3. Verify that all plugs are firmly home</p>
<p>2. Transmitter Power Pack not running</p>	<p>Check 60 amp. fuse in power pack</p>
<p>3. Transmitter valve, filaments not alight, but Power Pack running</p>	<p>Check 10 amp. fuse in MP.28B</p>
<p>4. No H/T input to transmitter—Power Pack Running</p>	<p>1. Check 1 amp. fuse 2. Verify that meter plug is in Jack marked 'P.A.' 3. Check key leads</p>
<p>5. P.A. will not tune</p>	<p>1. Try other channel—if satis. suspect M.O. (Note: Channels 142,394, will most likely show similar symptoms if M.O. is u/s.) 2. Check Aerial Selector Board 3. Check Wheel Contact on P.A. C/V Inductance is in position 4. Plug meter into Jack marked 'I.P.A.' If no reading obtained, change I.P.A. valve</p>
<p>6. Channel Selector Switch inoperative</p>	<p>Check cap is on 'Local/Remote' Control on Transmitter</p>
<p>7. Low or no P.A. Current</p>	<p>1. Inspect P.A. valves 2. Check H.T. supply 3. Look for faulty meter</p>
<p>8. Low input on Channel 1.</p>	<p>Check loading switch on transmitter is in correct position i.e. 'AA', 'BB' or 'CC'</p>
<p>9. Low modulation on 'RT'</p>	<p>Check 'I/C Radio—Radio only' Switch on Control panel is set to 'I/C Radio'</p>
<p>RECEIVER</p> <p>1. Receiver inoperative</p>	<p>Check 10 amp. fuse in Receiver Remote Control Panel</p>
<p>2. Receiver operating, but no signals</p>	<p>1. Check telephone on 'I/C'. If working switch on transmitter and press key for sidetone If no sidetone, V7 is u/s and should be replaced 2. Put Station Box volume control to 'Maximum'</p>