RESTRICTED

# RADIO OPERATOR'S INFORMATION FILE

RESTRICTED

WAR DEPARTMENT ★ A.A.F. FORM No. 24-RA ★ APPROVED 11-23-44

# RADIO OPERATORS' INFORMATION FILE

## TEMPORARY RECORD OF COMPLIANCE

**December, 1944.**

In accordance with provisions of AAF Regulation 62-15, all AAF communications officers and radio operator-mechanics in the United States will certify that they have read all instructions contained in the Radio Operators' Information File and revisions and/or additions thereto.

When you receive the ROIF material listed below, sign the bottom portion of this form, and detach at the perforation. Return the receipt (properly executed) to the operations office from which you received the material. When you have read and understand the material in the File, certify below and turn the rest of the form over to your operations officer so that it may be placed in your Form 5 file.

**Items printed in red will be changed on the form to correspond to the material it accompanies**

## *Certificate* (To be turned over to the Operations Officer of your Home Station)

I certify that I have:

Read and understand all the subjects contained in the copy I have received of the **Radio Operators' Information File dated November, 1944.**

*Signed*_____ *Rank*_____

*Organization*_____ *Date*_____

# RADIO OPERATORS' INFORMATION FILE
# TEMPORARY RECORD OF COMPLIANCE

**March. 1945**

AAF Reg. 62-15 requires all AAF communications officers and radio operator-mechanics in the United States, to certify that they have read and understand all instructions contained in ROIF revision sheets listed and numbered below.

When you receive the ROIF material listed below, sign the bottom portion of the form, detach at the dotted line, and return the receipt (properly executed) to your operations officer.

AAF Reg. 15-24 requires that within 30 days after you receive this revision you must do the following:

(1) Read the revision so that you understand it.

(2) **Remove and destroy** the sheets of your ROIF that are listed on the envelope containing this revision.

(3) Place the revision sheets **in their proper place** in your copy of ROIF.

(4) Sign the compliance certificate (upper section) and turn this form over to your operations officer so that it may be placed in your form 5 file.

## CERTIFICATE

**(To be turned over to the Operations Officer at your Home Station)**

***I certify that I have:***

a. Read and understand the following ROIF revisions and/or additions contained in **REVISION No. 1, dated March 1945.**

| | | | | |
|---|---|---|---|---|
| 3-7-1 | 3-9-3 | 3-16-1 | 6-1-2 | 8-6-1 |
| 3-7-2 | 3-9-4 | 3-16-2 | 8-1-1 | 8-7-1 |
| 3-8-3 | 3-14-1 | 3-16-3 | 8-4-5 | 8-7-2 |
| 3-9-1 | 3-15-1 | 4-1-8 | 8-4-6 | 8-8-7 |
| 3-9-2 | 3-15-2 | 4-2-8 | 8-4-7 | 8-11-1 |

b. Removed from my copy of ROIF and destroyed the sheets listed on the envelope which contained this revision.

c. Placed the pages listed above in their proper place in my personal copy of ROIF.

*Signed*_____ *A.S.N.*_____ *Rank*_____

*Organization*_____ *Crew No.*_____ *Date*_____

# Notes on Revision No. 1

**Dated March 1945**

**DO NOT PLACE THIS SHEET IN YOUR ROIF**

**Read it through carefully, then destroy it.**

### General

This sheet discusses briefly all the new changes in ROIF appearing in Revision No. 1. It tells you what to look for and explains why certain changes have been made.

Read these comments before you place the revisions in your copy of ROIF. However, be sure you read the revisions too. This sheet by no means relieves you of the responsibility of reading and understanding the revised pages.

REMEMBER, you must **remove and destroy** the old pages listed on the back of the revision envelope before inserting the new revised pages. This is important.

### Table of Contents, Form 24R

This revision contains a new Table of Contents for March, April, May 1945. Remove the old Table of Contents. Sign it at the end of the second page, if you have complied with the provisions, and turn it over to your Operations Officer who will, in turn, place it in your Form 5 file. The new Table of Contents (with the BLUE band) will stay in your book for three months.

**3-7, Direction Finding**

Contains expanded information on direction finding and gives the new approved classifications for the accuracy of fixes and bearings.

**3-8-3, Safeguarding Classified Material**

Revised to include the classifications of military information and the proper handling of such material. Section title changed to conform with the revision.

**3-9, Weather Codes**

This completely revised section describes the new weather codes. These new codes now replace the codes originally described.

**3-14-1, Radio Logs**

Approved radio log sheet. The new illustration shows AAF Form 35, which is to be used whenever available.

**3-15, Q Signals**

Additional Q signals are listed.

**3-16, Prosigns**

Additional prosigns and prowords are listed.

**4-1-8, Calibration (AN/ART-13)**

Corrects a printer's error—the omission of the constant 2.5 at the right of each column in the calibration table. There is no change in the content of page 4-1-9, which backs it up.

**4-2-8, Interpolation (SCR-287)**

Corrects interpolation example so that it agrees with the calibration table. There is no change in the content of Page 4-2-7, which backs it up.

**6-1-2, Compass Control Box**

Revised to clarify the main differences between the two types of radio compass control boxes. There is no change in the content of Page 6-1-1, which backs it up.

**8-1-1, Distress Procedures**

Contains information on the new U. S. Emergency and Safety frequency, and expanded instructions for distress procedures. Page 8-2-1 which backs it up is a direct pick-up. No change in text.

**8-4-5 through 8-4-7, Gibson Girl**

Additional information on the use, frequency, and

range of the Gibson Girl emergency radio.

**8-6-1, Forced Landings**

Contains additional information.

**8-7-1 and 8-7-2, Ditching**

Contains revised information on the ditching of aircraft. These two pages replace four pages (8-7-1, 8-7-2, 8-7-3, and 8-7-4) which must be removed from your File and destroyed.

**8-8-7, Parachutes**

Contains new and important information on free-fall parachute jumps. Page 8-8-6, which backs it up, is a direct pick-up. No change in text.

**8-11-1, Emergency Kits**

This page describes the new survival vest (kit) and the newest life raft kit. Page 8-10-1, which backs it up, is a direct pick-up. No change in text.

# Table of Contents

# RADIO OPERATORS' INFORMATION FILE

In accordance with the provisions of AAF Regulation 62-15, dated 24 November 1944, all AAF communications officers and radio operator-mechanics in the domestic area will certify that they have read and understand all instructions and information in the Radio Operators' Information File.

They will do so by signing in the space provided at the end of the Table of Contents. After it has been signed it must be forwarded to your Base Operations Officer for placement in your record file.

Subjects preceded by an asterisk (*) have been revised or added to ROIF since Dec. 1944. Be sure your copy of ROIF contains all amendments. Read them carefully before signifying compliance on form 24RA.

Check regularly to be sure you have all current amendments to ROIF and the correct Table of Contents. The Table will be revised quarterly and distributed on the same basis as the File revisions.

**KEEP THIS FORM 24R IN YOUR ROIF UNTIL YOU RECEIVE A NEW TABLE OF CONTENTS DATED JUNE, JULY, AUGUST, 1945**

**AUTHORITY FOR ROIF—AAF REGS. 62-15; 15-24**

**TABLE OF CONTENTS—AAF FORM 24R**

**I CERTIFY THAT I HAVE READ AND UNDERSTAND ALL SUBJECTS IN THE RADIO OPERATORS' INFORMATION FILE LISTED IN FORM 24R, DATED MARCH, 1945.**

*Signed*_____

*Rank*_____ *A.S.N.*_____

*Organization*_____ *Crew No.*_____

*Date*_____

**When you receive a new Form 24R (Dated June, July, August, 1945), remove this form, sign it, and forward it to your Base Operations Officer.**

# HOW TO KEEP YOUR ROIF UP-TO-DATE

Your ROIF is designed to keep you well informed on all matters affecting your operational efficiency and your personal safety. It is designed to help you do your job better. However, it can do none of these things if you fail to keep it up-to-date.

Just as soon as you receive a revision and/or addition to your File, read the instructions on the front of the envelope. Follow them step-by-step. If it is a revision, first remove and destroy the pages listed on the envelope. Then place the new revised pages in their proper places in your File. Finally, list the revision by date in the convenient table below.

**TO COMPLY WITH THE REGULATIONS YOU MUST KEEP YOUR ROIF CURRENTLY CORRECT**

| Revision No. | Date | Revision No. | Date |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Revision No. | Date | Revision No. | Date |
|---|---|---|---|
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**HOW TO USE YOUR ROIF . . .**

**page 1-3-1**

EXTRACT

**AAF REGULATION No. 62-15**

**HEADQUARTERS, ARMY AIR FORCES • WASHINGTON, 24 NOVEMBER 1944**

# *Flying Safety Information Files*

**(This Regulation supersedes AAF Regulation 62-15, 28 February 1944 and 62-15A, 1 May 1944.)**

## 1. GENERAL

To promote safe flying and operational efficiency, AAF pilots, navigators, bombardiers, flight engineers, flight surgeons, aviation medical examiners and airborne radio operators who are on flying status must be familiar with many items of a general nature, with the results of current research, and with other instructions and information found in a variety of War Department, AAF, and other pertinent publications which are not always readily available to them. These items will be selected, organized, and presented in simple, non-technical form in loose-leaf books, to be designated as follows:

a. * * *
b. * * *
c. * * *

d. For airborne radio operators: The "Radio Operators' Information File" (ROIF).

## 2. * * *

## 3. PUBLICATION OF ROIF

Headquarters, Eastern Technical Training Command, Radio Publications Division, Scott Field, Illinois, will be responsible for the initial selection, coordination, form, treatment and proper illustration of that part of the text and necessary revisions thereto which deals with communications. It is authorized to deal directly with all AAF agencies in gathering and coordinating such instructions and information for the File. Such material and illustrations for ROIF as initially prepared by the Headquarters, Eastern Technical Training Command, Radio Publications Division, Scott Field, Illinois, will be forwarded to the Office of Flying Safety, Information Files Branch, Buhl Building, Detroit 26, Michigan. The Office of Flying

Safety will be responsible for the final selection of items, the final coordination of the material, the form and treatment of the subject material, the proper illustration of the text, and the publication of the Radio Operators' Information File. That office will be responsible for the publication of necessary revisions. It is authorized to deal directly with the Headquarters, Eastern Technical Training Command, Radio Publications Division, Scott Field, Illinois, and all other AAF agencies in gathering and coordinating instructions and information for the File. All AAF establishments will submit items which they desire to have included in the File directly to Office of Flying Safety, Information Files Branch, Buhl Building, Detroit 26, Michigan.

## 4. TABLE OF CONTENTS

A table of contents, listing, numbering, and dating all current subjects, will be published for each File. Each table of contents will be revised every three months. The use of the tables of contents is outlined in AAF Reg. 15-24.

## 5. DISTRIBUTION IN CONTINENTAL UNITED STATES

These Information Files and revisions thereto will be distributed by the Chief, Office of Flying Safety on the following basis:

a. * * *

b. * * *

c. * * *

d. ROIF: Through Base Operations Officers, one copy to each communications officer and one copy to each radio operator-mechanic in the domestic area. Two copies to each base communications office, group, and squadron. Copies as required to the regularly established files of AAF organizations and establishments. Copies to AAF schools and training establishments as required for the airborne radio operator training program and such additional copies as the Chief, Safety Education Division, Office of Flying Safety shall determine as necessary.

## 6. DISTRIBUTION IN OVERSEAS THEATERS

If commanding officers in overseas theaters and "alerted" areas so direct, PIF, NIF, BIF, ROIF, and revisions thereto will be procured by requisition to the Director, Air Technical Service Command, Wright Field, Dayton, Ohio, through Air Service Command distribution centers located in the theaters concerned.

## 7. COMPLIANCE

Commanding officers will be responsible that personnel specified in paragraph 5 certify that they have read and understand all instructions and information contained in their respective Files; and that they place the revision sheets issued to them in their personal copies of the Files so that their Files are currently correct. Compliance with this directive will be recorded as follows:

a. * * *
b. * * *
c. * * *

d. For communications officers and radio operator-mechanics: Form 24R (the ROIF table of contents) will be signed and used as a permanent record of compliance. When ROIF and revisions are distributed, they will be accompanied by compliance forms (AAF Form 24RA), which will provide temporary record of compliance. The use of AAF Forms 24R and 24RA is set forth in AAF Reg. 15-24.

e. For all other personnel authorized to receive PIF, NIF, BIF or ROIF as set forth in paragraph 5 and for whom no Form 5 files are maintained, the record of compliance shall be as directed by commanding officers.

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**8. RETENTION OF PERMANENT FORMS**

Commanding officers will be responsible that permanent forms referred to in paragraph 7 are retained for record as directed in AAF Reg. 15-24.

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**9.** * * *

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**10. ACTIVITIES EXEMPT FROM THESE PROVISIONS**

AAF activities operating in overseas theaters and AAF activities operating in domestic areas under "alert" orders will be exempt from the provisions outlined herein to the extent determined by the commanding officer concerned.

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**11. DEFINITIONS**

a. * * *
b. * * *
c. * * *
d. * * *
e. * * *
f. * * *

g. The terms "communications officer" and "radio operator-mechanic" will be construed to mean all personnel with any of the following primary MOS's or in duty assignment in any of the following specialties: Communications Officer, 0200; Radio Operator and Mechanic, AAF, 2756; Radio Operator Mechanic-Gunner, AAF, 757.

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**By command of General ARNOLD:**

HEADQUARTERS ARMY AIR FORCES
OFFICIAL
WAR DEPARTMENT

**BARNEY M. GILES**
**Lieutenant General, United States Army**
**Deputy Commander, Army Air Forces and Chief of Air Staff**

# AAF REGULATION No. 15-24

**HEADQUARTERS, ARMY AIR FORCES • WASHINGTON, 23 NOVEMBER 1944**

## BLANK FORMS

**AAF Form 24 — PIF Table of Contents**
**AAF FORM 24A — Temporary Compliance Certificate for PIF**
**AAF Form 24N — NIF Table of Contents**
**AAF Form 24NA — Temporary Compliance Certificate for NIF**
**AAF Form 24B — BIF Table of Contents**
**AAF Form 24BA — Temporary Compliance Certificate for BIF**
**AAF Form 24R — ROIF Table of Contents**
**AAF Form 24RA — Temporary Compliance Certificate for ROIF**

**(This Regulation supersedes AAF Regulation 15-24, 28 February 1944 and AAF Regulation 15-24A, 2 August 1944.)**

## TABLE OF CONTENTS OF INFORMATION FILES

**1.** AAF Form 24 is the table of contents for the Pilots' Information File.

AAF Form 24N is the table of contents for the Navigators' Information File.

AAF Form 24B is the table of contents for the Bombardiers' Information File.

AAF Form 24R is the table of contents for the Radio Operators' Information File.

Each has two uses:

**a.** As a part of the Information File for which it is the table of contents for a three-month period (until it is replaced by a revised current table of contents). Each will list date, and number all current subjects in its pertinent Information File. An asterisk (*) prefixing any subject will indicate that the subject has been revised or added since the previous table of contents was issued.

**b.** As a compliance certificate for its pertinent Information File:

Personnel specified in AAF Reg. 62-15 as being required to comply with pertinent information files and for whom a Form 5 file is maintained will sign the Form 24, 24N, 24B or 24R (whichever applies). When a new table of contents is issued, it will replace the one in the Information File, and the replaced Form (24, 24N, 24B or 24R), properly signed, will be placed in the Form 5 file of the individual concerned, where it will remain as a record of compliance until the next issued form (24, 24N, 24B or 24R) replaces it. Compliance records for personnel authorized to receive pertinent Information Files and for whom Form 5 files are not maintained will be kept as directed by Commanding Officers.

**2. Publication.** Under the authority contained in AAF Reg. 62-15, the Chief, Flying Safety will revise and publish AAF Form 24, 24N, 24B and 24R every three months. In order to facilitate identification of the date of issue, there will be

a color band along one border of the respective Forms as follows:

| | | |
|---|---|---|
| Form 24 | Issue of 1 August (any year) | —Blue |
| | Issue of 1 November (any year) | —Yellow |
| | Issue of 1 February (any year) | —Red |
| | Issue of 1 May (any year) | —Gray |
| Form 24N | Issue of 1 July (any year) | —Blue |
| | Issue of 1 October (any year) | —Yellow |
| | Issue of 1 January (any year) | —Red |
| | Issue of 1 April (any year) | —Gray |
| Form 24B | Issue of 1 September (any year) | —Blue |
| | Issue of 1 December (any year) | —Yellow |
| | Issue of 1 March (any year) | —Red |
| | Issue of 1 June (any year) | —Gray |
| Form 24R | Issue of 1 Dec. (any year) | —Gray |
| | Issue of 1 March (any year) | —Blue |
| | Issue of 1 June (any year) | —Yellow |
| | Issue of 1 Sept. (any year) | —Red |

**3. Distribution.** AAF Form 24, 24N, 24B or 24R will be distributed by the Chief, Office of Flying Safety through Base Operations Officers:

**a.** As a part of every complete volume of the Information File for which it is the table of contents.

**b.** As one sheet of revisions to the Information File to which it belongs, issued as follows:
Form 24: PIF Revisions dated 1 August, 1 November, 1 February, and 1 May.
Form 24N: NIF Revisions dated 1 July, 1 October, 1 January, and 1 April.
Form 24B: BIF Revisions dated 1 September, 1 December, 1 March, and 1 June.
Form 24R: ROIF Revisions dated 1 December, 1 March, 1 June, and 1 September.

**c.** Upon letter request to:
**Office of Flying Safety**
**Information Files Branch**
**Buhl Building**
**Detroit 26, Michigan**

## TEMPORARY CERTIFICATES OF COMPLIANCE

**4.** Since Forms 24, 24N, 24B and 24R are retained in their respective Information Files for the three-month period for which they are the current tables of contents, it is necessary to use temporary certificates of compliance for revisions which may be issued in the interim. Such temporary certificates will be issued as follows:

Form 24A for Pilots' Information File
Form 24NA for Navigators' Information File
Form 24BA for Bombardiers' Information File
Form 24RA for Radio Operators' Information File

Each such temporary certificate of compliance consists of two sections: a small detachable bottom section, the use of which is described in sub-paragraph a, below and a main upper section, the use of which is described in sub-paragraph b, below:

**a.** The detachable section at the bottom of each form is provided as a receipt for revision sheets (or for the complete volume of the pertinent Information File issued to any individual entitled to it). The individual receiving any Information File material will indicate by signature thereon that he has received it. Operations Officers will hold such receipts for their records until the compliance (main upper section of Form 24A, 24NA, 24BA, or 24RA) is received. Whenever Information File material is issued to any individual entitled to it at any station other than his home base, his receipt (the lower detachable section) will be forwarded by the issuing agency to the base operations officer of the recipient's home station.

**b.** The main (upper) section of Forms 24A, 24NA, 24BA, and 24RA will list in red the revision number and the page numbers for which each is to serve as a temporary compliance certificate. When issued with the complete volume of the Information File, it will indicate that it applies to the complete volume of the pertinent Information File and indicate

(in red) the revision numbers contained as an integral part of that edition of the Information File. An individual concerned will sign this portion of the Form to certify that:

(1) He has read and understands the Information File material listed therein.

(2) He has **removed** from the Information File and **destroyed** all sheets that specific instructions printed on the envelope which contains the Information File material direct him to remove and destroy.

(3) He has placed each revision sheet listed in the compliance certificate in its proper place in the Information File.

When the individual concerned has complied with (1), (2), and (3) above, **and not before)**, he will sign the compliance certificate (the upper section of Form 24A, 24NA, 24BA or 24RA) and return it to the base operations officer at his home station.

**5.** Operations Officers will be responsible that the properly executed compliance certificate (upper section of Forms 24A, 24NA, 24BA, or 24RA) is returned within a reasonable time (but in no case longer than 30 days after receipt) and, in the case of personnel for whom Form 5 files are maintained, placed in the Form 5 file of the individual concerned. It will remain there until the individual has executed the next dated table of contents (Form 24, 24N, 24B, or 24R, whichever applies) and turned it in, when all previously dated temporary receipts and compliance certificates (Forms 24A, 24BA, 24NA, or 24RA) and the previous table of contents will be removed and destroyed. Compliance certificates for personnel for whom Form 5 files are not maintained will be retained for record as directed by commanding officers.

**6. Distribution.** AAF Forms 24A, 24NA, 24BA and 24RA will be published by the Chief, Office of Flying Safety and distributed:

**a.** Through Operations Officers, automatically inclosed with each set of revisions and each complete volume of any Information File.

**b.** Upon letter request from Operations Officers to:

**Office of Flying Safety**
**Information Files Branch**
**Buhl Building**
**Detroit 26, Michigan**

**7. Destruction of Unused Forms.**

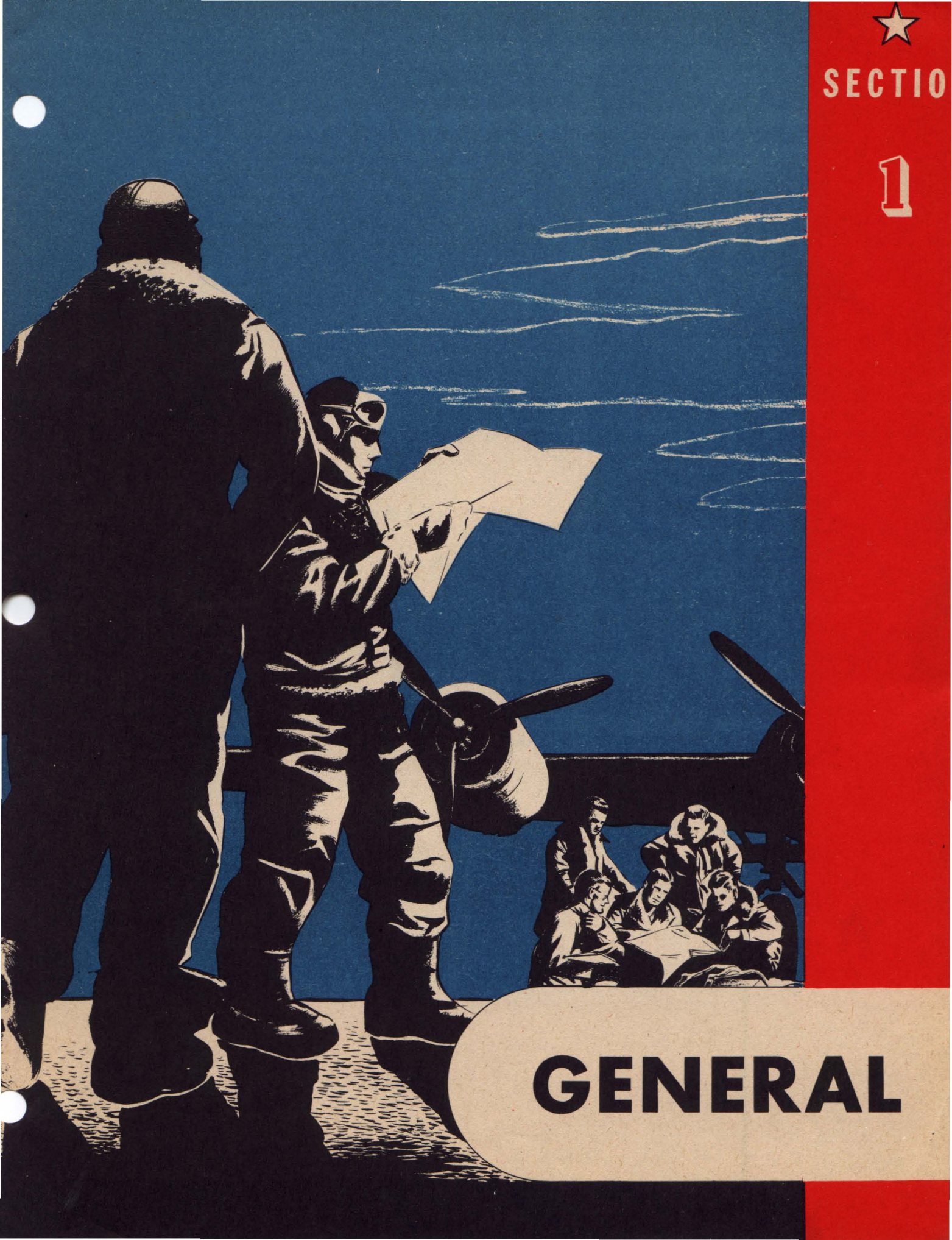
**a.** Unused Forms 24, 24N, 24B and 24R become obsolete and will be destroyed six months after the date of issue.

**b.** Forms 24A, 24NA, 24BA and 24RA held in excess of the material to which they apply will be destroyed.

**By command of General ARNOLD:**

HEADQUARTERS ARMY AIR FORCES
OFFICIAL
WAR DEPARTMENT

**BARNEY M. GILES**
**Lieutenant General, United States Army**
**Deputy Commander, Army Air Forces and Chief of Air Staff**



SECTION

1

# GENERAL

SECTION

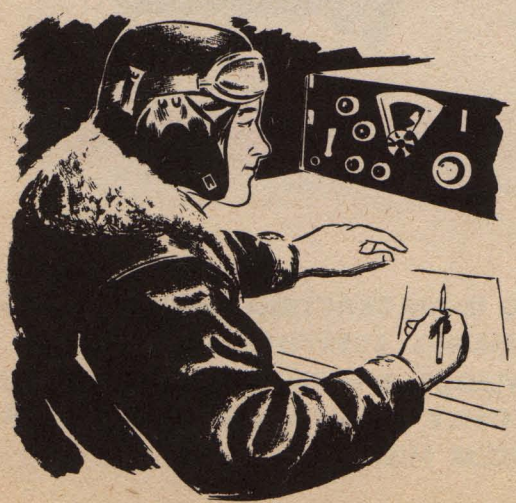
1

# GENERAL

## TABLE of CONTENTS



# RADIO OPERATORS' RESPONSIBILITIES



## BRIEFING

1—To thoroughly understand everything covered at briefing.
2—To ask questions on any point not made clear at briefing.

## S O I

1—To check your flimsy for completeness and to make sure it is up to date before every mission.
2—To be familiar with every extract contained in your SOI.
3—To refer to your flimsy whenever in doubt.

## OPERATING PROCEDURE

1—To have a thorough working knowledge of all procedure authorized for the area in which you are operating.
2—To know location, call signs, frequencies, and services of all direction finding facilities in your area.
3—To be well informed of all distress frequencies and procedures used in your area.

## RADIO DISCIPLINE

1—To maintain a constant listening watch on your assigned frequency whenever possible.
2—To transmit only when absolutely necessary.
3—To monitor the frequency you intend to use before beginning any transmission.
4—To maintain strict radio silence when ordered by proper authority.

## RADIO LOGS

1—To keep an accurate and complete log of all transmissions and the frequency you are guarding.

## LOCATION OF EQUIPMENT

1—Major Units.
2—Tuning Units.
3—Dynamotors.
4—Antenna Systems.

## OPERATION OF EQUIPMENT

Know how to operate all radio equipment in your airplane. Consult the communications officer for instructions on radar operation.

## FUSE LOCATIONS

Are all fuses readily accessible? Be sure there are spares. Know their locations.

## EMERGENCY OPERATIONS

Know how to operate on a minimum number of tubes. Know how equipment can be substituted in emergencies.

## MINOR MAINTENANCE

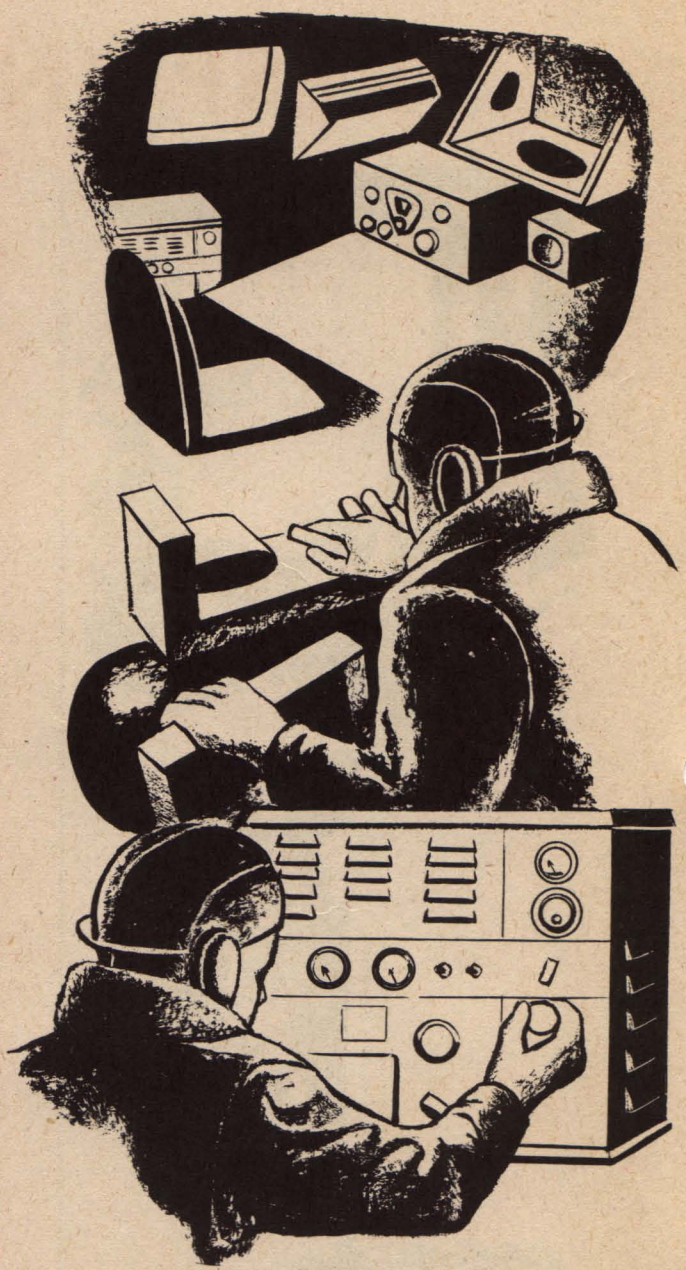
Know what is required in a preflight inspection, care of dynamotors, use of Form 1-A. Be sure you have all necessary technical orders and wiring diagrams in your G files.

## TUNING

Be familiar with all tuning procedures.

Don't jam frequencies while tuning.

Be sure the frequencies tuned are accurate.



**Remember!**

**FLYING IS AN EXACTING, SERIOUS BUSINESS. IT DEMANDS EVERYTHING YOU HAVE OF KNOWLEDGE, EFFORT, AND SKILL. MISTAKES ARE COSTLY. DON'T MAKE YOUR CREW PAY FOR YOUR MISTAKES.**

# CREW COORDINATION

Crew teamwork is the foundation of successful air operations. You, as radio operator, are an important member of your crew and unless you know your job, and have learned to cooperate and coordinate with your pilot, your copilot, and your navigator, you will fail in your job.

Strive for good teamwork in training and it will come easy in combat where it pays off the dividends. Remember, a great measure of the success, or failure, of every mission you fly will depend on you. If you fail you are short-changing your crew mates.

Personal proficiency is part of teamwork. Know your duties, know your equipment, and keep abreast of new techniques and procedures.

# Aid from the Crew

**The primary aids the various crew members are able to supply are as follows:**

**PILOT**

Correct flying technique while you are taking radio bearings; furnish you with heading information if navigator is not available.

**CO-PILOT**

Give necessary heading information; make minor adjustments on command-radio equipment.

**BOMBARDIER**

Monitor stations if you must leave your position.

**NAVIGATOR**

Furnish you with any necessary information concerning radio navigation; operate radio compass if you have other duties.

**ENGINEER**

Take over your position for relief; check the calibrations of remote equipment.

**GUNNERS**

Keep you abreast with the progress of your formations; warn you of any emergencies so you can send distress messages for your own or any other plane in the formation.

# HOW TO USE YOUR ROIF

## General

The Radio Operators' Information File is a manual of instructions and information of a general nature, with which all airborne radio operators and communications officers in the Continental United States are required to comply, in accordance with the provisions of AAF Regulation 62-15.

ROIF is designed to keep you informed of matters affecting your operational efficiency and your personal safety. It contains basic material not discussed in detail in Technical Orders or other publications available.

Familiarize yourself with the Radio Operators' Information File. Check frequently to be sure that you have read and understand the information in it.

## How Subjects Are Numbered

Each subject listing is numbered. *The first number* indicates the section. For example, 5, which is the COMMAND EQUIPMENT section. *The second number* refers to the subject. For example, 5-2, SCR 522 COMMAND EQUIPMENT. *The third number* lists the page, thus the third page of SCR 522 COMMAND EQUIPMENT will be marked 5-2-3.

## Revisions

It is particularly important that you keep all of the subjects and pages in your book in proper order, so that you may use your ROIF as a quick reference guide.

To make the process as simple as possible, you receive revisions in an envelope upon which is printed a list of the pages you are to remove from your copy of ROIF before you put the new revisions into the book.

## *Important*

You must follow the directions printed on the envelope in which you receive your revision sheets. You must first *remove and destroy* the pages listed on the envelope to keep your File correct. To comply with the regulation you must keep your File currently correct.

Revised sheets bear a new date line at the top of the page thus: REVISED March 1, 1945. If the page is new and does not replace an old one, it will bear a line thus: ADDED March 1, 1945.

Once in awhile, a whole subject will be revised completely and the revised pages may number more or less than the pages they replace. In such cases,

## WANTED: YOUR CORRECTIONS AND CRITICISMS OF ROIF

May we call your attention to the provision of Paragraph 3 of AAF Regulation 62-15, which directs all AAF establishments to submit items they desire to have included to the address at the right. This also means any criticism of material already in ROIF—corrections, questions of interpretation, and mistakes which may have inadvertently crept into the text or the art.

In any case we welcome free criticism and prompt correction of mistakes from you.

Our aim is to keep ROIF accurate, current, and fully useful. If you can help us do that, we will appreciate it. Write direct to:

**OFFICE OF FLYING SAFETY,**

**INFORMATION FILES BRANCH,**

**BUHL BUILDING,**

**DETROIT 26, MICHIGAN**

all the pages will merely bear the REVISED notation, with the date. So don't become confused if you have more or fewer pages than you have removed.

Revisions and additions will be issued regularly through your operations office. Make a habit of checking with your operations office periodically.

## To Comply with Revisions

When you receive a set of revision sheets, it will be accompanied by a temporary certificate of compliance (Form 24RA).

Before you sign it to certify that you have read and understand all the revisions and/or additions, be sure you *do read the revised pages.*

You will find that often only minor changes have been made on some pages. There is no special indication to show what sentences or paragraphs have been revised. It is felt that you should re-read the whole page in order to get the context of the old material in relation to the new.

## Index

An index is provided which lists alphabetically the principal items treated in ROIF. It is revised from time to time to keep it as useful and up-to-date as possible. You may find occasionally, however, that an index listing is in error; but by using the Table of Contents you will be able to trace almost any item you are looking for.

When a revised index is printed, it will be distributed along with the regular quarterly revisions.

## Distribution of Revisions

Revisions are distributed to individual communications officers and radio operator-mechanics by Base Operations Officers who receive the revisions automatically from the publisher of the File.

If any operations officer does not receive the correct number of revisions (plus a 10% overage) he will communicate at once with

Office of Flying Safety,
Information Files Branch,
Buhl Building,
Detroit 26, Michigan,

stating the number of revisions required at his station. He will also send a letter request to the above for any copies he may need of the complete File.

Operations officers will also report promptly on the activation or deactivation of any station.

## The Table of Contents (Form 24R)

Every three months you will receive a new Table of Contents in the envelope with the revisions for that month. The new Table of Contents is published on the first of March, June, September, and December.

In order that you may identify it, and be sure that you have the current table in your ROIF, the following color key is used:

| | | | |
|---|---|---|---|
| **JUNE** | **: YELLOW** | **SEPTEMBER** | **: BLUE** |
| **DECEMBER** | **: GRAY** | **MARCH** | **: RED** |

Check your copy of ROIF against the Table of Contents regularly.

Subjects preceded by an asterisk (*) contain material revised or new since the last Table of Contents was issued.

You will find that all the pages of any one subject may not bear the same date. But the date following the subject listing in the Table of Contents is the *latest revision date for any of the pages included in that subject.*

## Don't Destroy Table of Contents

When you replace the Table of Contents with a new one, *don't destroy the old one.* Sign it to show that you have read and understand all the subject matter it lists. Then turn it over to your operations officer. It is the record of your compliance with ROIF in accordance to provisions of AAF Regulation 62-15.

## Base Operations Officers' Responsibilities

1—Operations officers are responsible for seeing that every communications officer and radio operator-mechanic attached to his base receives a copy of ROIF and all subsequent revisions.

2—That every communications officer and radio operator-mechanic on his base signs a compliance form certifying that he has read and understands all material contained in ROIF and revisions and additions thereto.

3—That the compliance certificates (Form 24RA and Form 24R) are placed in the record files of the individuals concerned.

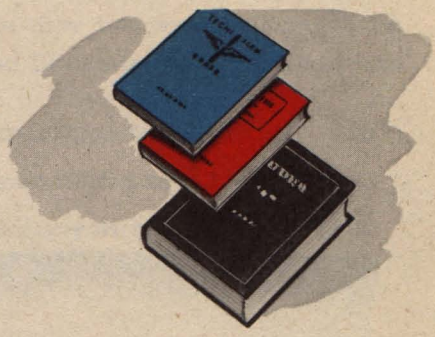
When communications officers and radio operators turn in their Forms 24R at the end of the three-month period for which the Forms are the current Tables of Contents for ROIF, the operations officer will see that previously dated Forms 24R and 24RA which are in the Form 5 Files are removed and destroyed.

### Keep Up to Date

No matter where you are, at your home station or on cross-country, ask for any new ROIF revisions.

Never fail to ask for new material. You must keep your File up-to-date.

# TECHNICAL ORDERS



All radio operators must know how to use the Technical Order files. Use of the RADIO OPERATOR'S INFORMATION FILE does not obviate the need for using Technical Orders. The R.O.I.F. contains material of a general nature and does not attempt to supply the specific engineering, maintenance and supply information contained in technical orders.

For detailed information on specific pieces of equipment or higher echelon maintenance instructions the technical orders should be consulted.

## WHAT ARE TECHNICAL ORDERS?

AAF Technical Orders are directives published by order of the COMMANDING GENERAL, Army Air Forces, for the purpose of issuing specific instructions and information of a technical nature covering the operation, maintenance, storage and inspection of AAF equipment and materials, and for the establishment of a uniform system of files wherein such technical data will be readily accessible.

## T. O. NUMBERING SYSTEM

Technical Orders are numbered by a group of three numbers, separated by dashes.

The **first number** always has two digits. It corresponds to the AAF property classification number. For instance, if the first number in the designation is 08 the Technical Order contains information about electrical equipment and supplies; 01, airplanes and maintenance parts; 00 series contain information of a general nature such as distribution, inspection system, kits and such matter. The first numbers are assigned property class numbers as follows:

01 Airplane and maintenance parts.
02 Engines and maintenance parts.
03 Aircraft accessories.
04 Aircraft hardware and rubber materials.
05 Aircraft instruments.
06 Fuels and lubricants.
07 Dopes, paints and related material.
08 Electrical equipment and supplies.
09 Aerial targets and gliders.
10 Photographic equipment and supplies.
11 Aircraft combat material.
12 Fuel and lubricating equipment and supplies.
13 Clothing, parachutes, equipment and supplies.
14 Hangars and demountable buildings.
16 Balloon equipment and supplies.
17 Machinery, shop and warehouse equipment.
18 Special tools.
19 Flying field and hangar equipment.
21 Cordage, fabrics and leathers.
22 Woods.
23 Metal and composition material.
24 Chemicals.
25 Office equipment and supplies.
26 School equipment.
27 Excess and surplus property.
29 Commercial hardware and miscellaneous supplies.
30 Publications, processed motion picture films and film strips.

**A COMPLETE BREAKDOWN OF THESE CLASSES MAY BE FOUND LISTED IN T.O. 00-35A-1**

The **second number** represents the SUB DIVISION of the general property class identified by the first number. It is impractical to list all the sub divisions of each property class, but to explain the system a few examples are shown here. Since the radio operator is mainly concerned with electrical equipment and supplies the 08 series will be used:

08-5 Aircraft Radio Equipment and Accessories

08-10 Signal Corps Publications

08-15 Radio Aids to Navigation

The **third number** in most cases is merely the serial number of the Technical Order concerning the general subject or title identified by the first two numbers:

| Elec. Equip. and Sup. | | Signal Corps | | SCR 274 N |
|---|---|---|---|---|
| 08 | — | 10 | — | 50 |

The third number is a definite identification in the 01 series Technical Orders:

| Airplane and Maint. Parts | | Boeing | Bomber | Model |
|---|---|---|---|---|
| 01 | — | 20 | E | G |

**1**—Handbook of Flight Operating Instructions
**2**—Erection and Maintenance
**3**—Structural Repair Manual
**4**—Parts Catalog

The location of all radio equipment and fuses in an dirplane may be found by consulting the section on COMMUNICATION EQUIPMENT in the 01 series Technical Orders.

## TECHNICAL ORDER INDEX

The index is the only exception to the numbering system. It contains only two sets of numbers, and is referred to as the 00-1 or the first Technical Order in the complete library. The property classes, 01-08, etc., are listed in numerical sequence in the front part of the index. Immediately behind it is a numerical index of Technical Orders.

## TO USE THE INDEX

Locate in numerical sequence the first number 08, the second number 10, then run through to the third number until you find the subject title. The Technical Order bearing the corresponding number will contain information on the subject. All Technical Orders are listed numerically.



### ELECTRICAL EQUIPMENT AND SUPPLIES

| *Number* | *Title* | *Date* |
|---|---|---|
| **08-10** | **SIGNAL CORPS PUBLICATIONS (Form 3070-4, C-32, F-12) (CONT)** | |
| **AN 08-10-157** | Handbook of Maintenance Instructions—Radio Receivers—BC-1033-A, -1033-B.....(*Rev. 17 Aug 43*) | 3 Apr 43 |
| **AN 08-10-158** | Handbook of Maintenance Instructions—Radio Set SCR-AS-183..... | 29 Jun 43 |
| **AN 08-10-159** | Handbook [illegible]ing Instructions—Radio Set SCR-718-A..... | 19 Jun 43 |
| | [illegible]ions—Radio Receiving Equipment—AN/ARR-3..... | 30 Apr 43 |
| | [illegible] | 17 Apr 43 |
| | [illegible] | [illegible] Jul 43 |

# WHERE TO FIND A TECHNICAL ORDER

Each station, base or sub-depot has four complete files, assigned to the supply office, engineering office, technical inspector's office and transient aircraft crew. Complete information about Technical Order files in overseas theaters is given in T.O. 00-25-3.

## AIRPLANE FILES

The following Technical Orders and current amendments thereto must be maintained in each airplane.

1—T.O. 00-201A visual inspection system for airplanes.
2—T.O. 00-20A-2 airplane maintenance instruction form.
3—Pilot's Handbook Of Instructions for the particular airplane model.
4—Erection And Maintenance Manual for the particular airplane model.
5—Engine Handbook Of Service Instructions.
6—Handbook Of Weight And Balance Data.
7—T.O. 08-15-1 Radio Facility Charts.
8—T.O. 08-15-2 Radio Data and Flight Information.
9—T.O. 08-15-3 Instrument Approach Procedures.
10—A 08-10 T.O. for all radio equipment contained in the particular airplane model.

## COMPLIANCE IN COMBAT AREAS

Compliance with Technical Orders and Technical Radiograms in combat areas will be subject to local conditions involving tactical employment of all equipment and at the discretion of the respective Air Force or Task Force commanders concerned.

# UNSATISFACTORY REPORTS

WAR DEPARTMENT
AAF Form No. 54
(Revised 2-18-43)

**WAR DEPARTMENT**
**ARMY AIR FORCES**
**UNSATISFACTORY REPORT**
(See AAF Reg. 15-54 for Information on Proper Use of this Form)

| TO BE FILLED IN BY STATION | |
|---|---|
| STATION SERIAL No. | DATE SUBMITTED |
| 14 - 008 | 6-11-44 |

| LEAVE BLANK | | |
|---|---|---|
| A. S. C. SERIAL No. | REFER TO | CLASS |
| | | |

UR

| | | | |
|---|---|---|---|
| STATION: Scott Field, Ill. | | ORGANIZATION: 94th Sub Depot | |
| SUBJECT OF REPORT | Property Class—Name: 08 PL 108 Four Connector Plug | Manufacturer: Signal Corps | AAF Order or Shipping No. |
| AIRCRAFT—Model & AAF Serial No.: B-17F 20-176470 | ENGINE—Model & AAF Serial No. | UNIT OR ACCESSORY—Type, Model and Serial No.: PL 108 | |
| AIRCRAFT REPORTS ONLY | LAST D. I. R.—Depot | Date | Flying Time Since / Total Flying Time |
| ENGINE REPORTS ONLY | LAST OVERHAUL—Depot / Hours Since | Depots and Hours At Each Previous Overhaul | |

| PART | | | | | | |
|---|---|---|---|---|---|---|
| Name: Plug PL 108 | | | Part Drawing, Serial and Specification No.: SPEC. NO. SC-D-2203 | | | |
| Time in Use: 75 Hrs. | Quantity on Hand: 25 | Quantity Known Defective: 1 | No. Previous Failures: 15 | Manufacturer: Signal Corps | Inspector's No. or Identification | |

| Indicate by "X" Disposition of Exhibit | Photographed and Prints Enclosed | Held for Instructions | Sent Under Separate Cover | Sent in Attached Package | Repaired and Returned to Service | Disposed of (Explain Below.) | To Overhaul Facility (INITIALS) |
|---|---|---|---|---|---|---|---|
| | ☐ | ☐ | ☒ | ☐ | ☐ | ☐ | ☐ |

GIVE COMPLETE DETAILS, PROBABLE CAUSES AND RECOMMENDATIONS BELOW:
(Use Only Applicable Spaces Above—Avoid Unnecessary Repetition)

**EXPEDITE**

DESCRIPTION OF TROUBLE

1. Subject plug shorted to ground because it was inserted improperly causing the put transformer in the radio compass burn out.

UR

Information concerning even the smallest failure may be of great value if reported to proper authorities in time. Everyone is encouraged to submit Unsatisfactory Reports whenever he sees an opportunity to contribute to greater efficiency by suggesting correction of faults.

As a radio operator, you are in close touch with both procedures and equipment. A great ground organization is behind the men who fly. But both flying and ground operations always can be improved. *Unsatisfactory Reports* are designed to speed improvements and to permit the individual to present a maintenance problem and his suggested correction, through channels.

Unsatisfactory Reports usually fall into these general classes:

1—Failure of equipment.
2—Unsatisfactory design.
3—Defects due to faulty material, workmanship, or inspection.
4—Unsatisfactory maintenance or supply methods, systems, or forms.

### How to Prepare a U. R.

AAF Form No. 54, obtainable from the Engineering Officer, is used for Unsatisfactory Reports.

Each report must be a complete description of an individual case. It must explain the unsatisfactory condition, including all pertinent information, to enable investigation and correction of the trouble reported without the need for further requests for information. See AAF Regulation 15-54 for details about how to file different types of U. R.'s.

### Coordination

All Unsatisfactory Reports originating at a station are routed through the Engineering Officer, who investigates and enters his endorsement. He sends the U. R. to the Commanding General, Air Service Command at Patterson Field, Fairfield, Ohio.

# FORM 1A

WAR DEPARTMENT
A. A. F. FORM NO. 1 A
REV. (1 JAN. 44)

## AIRPLANE FLIGHT REPORT - ENGINEERING

### INSPECTION STATUS

| | DATE OF OR HOURS DUE | INSPECTED TODAY BY | INSPECTED TODAY STATION |
|---|---|---|---|
| PREFLIGHT | 8-26-44 | S | Scott |
| DAILY | 8-26-44 | S | Scott |
| 25 HOURS | 148:00 | | |
| 50 HOURS | 150:00 | | |
| 100 HOURS | 200:00 | | |
| | | | |
| | | | |

### SERVICING AT STATION OF TAKE-OFF
(CHECK IMMEDIATELY BEFORE TAKE-OFF)

| SERVICE | FUEL (GALLONS) SERV-ICED | FUEL (GALLONS) IN TANKS | OIL (QUARTS) NO. 1 SERV-ICED | NO. 1 IN TANKS | NO. 2 SERV-ICED | NO. 2 IN TANKS | NO. 3 SERV-ICED | NO. 3 IN TANKS | NO. 4 SERV-ICED | NO. 4 IN TANKS | RADIATOR CHECKED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1ST | 1150 | 2300 | 15 | 100 | 20 | 100 | 22 | 100 | 18 | 100 | |
| 2ND | | | | | | | | | | | |
| 3RD | | | | | | | | | | | |
| 4TH | | | | | | | | | | | |
| 5TH | | | | | | | | | | | |

### INSPECTION OF AUXILIARY EQUIPMENT

| EQUIPMENT | SYMBOL | INSPECTED BY | STATION |
|---|---|---|---|
| BOMBARDMENT | — | | |
| GUNNERY | — | | |
| ~~CHEMICAL~~ | — | | |
| COMMUNICATIONS | B | Sgt. Burns | Scott |
| ~~PICTOGRAPHIC~~ | | | |
| NAVIGATION | — | | |
| | | | |
| | | | |

STATUS TODAY: 1. / 2. / 3. / 4.

EXPLANATION: Rough bearing on landing gear assembly.

### EXCEPTIONAL RELEASE

WHEN THE "STATUS TODAY" IS INDICATED BY A RED SYMBOL, AND AN "EXCEPTIONAL RELEASE" HAS NOT BEEN GRANTED BY AN AUTHORIZED MAINTENANCE OFFICER, THE PILOT OF THE AIRCRAFT WILL SIGN THIS RELEASE BEFORE FLIGHT.

RELEASED FOR FLIGHT { 1 John Doe 3 / 2 4

### REMARKS: PILOTS AND MECHANICS - SEE INSTRUCTIONS INSIDE FRONT COVER.

#1 LEFT BRAKE. WEAK - John Doe 1ST LT. AC.
#2 Defective Interphone dynamotor - loose disconnector cord for microphone RAD op.pos.
T/Sgt. Jones
695 IFF INSTALLED
#1 Serviced by Sgt. A. Jones. Scott Fld. 8-26-44
#2 Serviced by Sgt. J. Burns. 94TH Sub Depot 8-26-44

### AIRCRAFT AND ENGINE TIME RECORD
(ENTER IN HOURS AND MINUTES)

| ENGINE | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| HOURS TO DATE | 143:00 | 143:00 | 143:00 | 143:00 |
| HOURS TODAY | 5:00 | 5:00 | 5:00 | 5:00 |
| TOTAL | 148:00 | 148:00 | 148:00 | 148:00 |
| OIL CHANGE DUE | H.T. | H.T. | H.T. | H.T. |
| CUNO. CLEANING DUE | 150:00 | 150:00 | 150:00 | 150:00 |

| AIRCRAFT | | |
|---|---|---|
| | HOURS TO DATE | 143:00 |
| | HOURS TODAY | 5:00 |
| | TOTAL | 148:00 |

Form 1A is a daily maintenance report. Its purpose is to indicate to the ground crews defects in the equipment which have been noticed during flight. The crew chief is responsible for its complete execution, but it is the radio operator's job to see that any defects in the radio equipment are recorded on the form. Defects in highly classified radio or radar equipment should be indicated with red pencil on the Form 1A. Be sure the radio operator's part of the remarks column is properly filled in. When making remarks about equipment defects, use brief, concise terminology.

**REMEMBER—It is the radio operator's job to make all remarks concerning airborne communications equipment on Form 1A.**

# JOINT ARMY-NAVY

## NOMENCLATURE SYSTEM

The Army-Navy nomenclature system known as the AN system has been developed to establish one standard plan of nomenclature for communications and the associated equipment of the two services.

### POLICY OF SYSTEM

A nomenclature will be assigned to: 1) Complete sets and major special designed equipment. 2) Component parts of complete or major equipment. 3) Major units, usually not a part of any set.

### COMPLETE EQUIPMENT NOMENCLATURE

*(Basic Indicator)*

The major title of the equipment follows a slant bar after the letters AN. Usually this title contains three letters and sometimes a number.

*Example:*

AN/ART-13—The first letter of the title indicates the type of installation (A—Airborne). The second letter indicates the type of equipment (R—Radio). The third letter indicates the general purpose of the equipment (T—Transmitting). The number 13 indicates that it is the 13th Airborne radio transmitter to which this nomenclature has been assigned. The type of installation, type of equipment, and general purpose of the equipment will be found in the proper sequence in APPENDIX A for Basic Indicators.

### COMPONENTS NOMENCLATURE

*(Component Indicator)*

The component parts of a complete set are designated by one, two, or three letters called Component Indicator and a number followed by a slant bar and a Basic Indicator. The slant bar indicates that the item is a part of or used with the set indicated by the Basic Indicator.

*Example:*

Test equipment designed to be used specifically with one certain radio set would be indicated as follows: TS-2/ARC-5. This indicates that TS-2 was designed to be used with AN/ARC-5.

If test equipment is designed to be used with several airborne radio communications sets it would be indicated as follows: TS-1/ARC. All the component indicators will be found in APPENDIX B.

### MAJOR UNITS NOMENCLATURE

Since a Major Unit is not a Basic Indicator or a Component Indicator, it must be dealt with differently. A Major Unit may, however, be a component of any set, yet it will be capable of performing a major function by itself.

The type of number for a major unit consists of a Component Indicator and a number followed by a slant bar and a Basic Indicator. The Basic Indicator is used here to indicate the general installation, type, and purpose for which the unit is to be used.

*Example:*

Microphone Amplifying Equipment AM-1/URC comprises an amplifier with cords, plugs, tubes, and mountings for amplifying the output of low level microphones. AM is the Component Indicator for amplifiers and /URC is the Basic Indicator which indicates that the equipment is used for General Utility Radio Communications as found in APPENDIX A.

### TRAINING EQUIPMENT

The letter T is added to the Basic Indicator if the equipment is designed for training purposes.

*Example:*

If the AN/APG-1 were made for training purposes it would be designated as AN/APGT-1.

### MODIFICATIONS

If a set has been modified, a letter denoting the modification will follow the Basic Indicator number.

*Example:*

If the AN/ART-13 were modified for the first time it would be an AN/ART-13A.

# HOW TO WORK THE SYSTEM

An appendix A is provided to determine the meanings of the Basic Indicators. Three columns are provided in the Appendix. The basic indicator is found by using the first column for the first letter, the second column for the second letter and the third column for the third and last letter.

**EXAMPLE:**

RESTRICTED

**APPENDIX A**

**LETTER SYMBOLS USED IN MAKING BASIC INDICATORS**

| Installation | Type Equipment | Purpose |
|---|---|---|
| A—Airborne (installed and operated in aircraft). | G—Telegraph or teletype (wire). | C—Communications, receiving and transmitting. |
| C—Air transportable (designed to be air transportable as stated in specification or military characteristics). | I—Interphone and public address. | D—Direction finder. |
| | N—Sound. | G—Gun directing. |
| | P—Radar. | |

The letters APG as taken from the Appendix A, and as used for a Basic Indicator will designate: *Airborne Radar Gun Directing Equipment.*

# APPENDIX A

## LETTER SYMBOLS USED IN MAKING BASIC INDICATORS

### INSTALLATION

**A** Airborne (installed and operated in aircraft).

**C** Air transportable (designed to be air transportable as stated in specification or military characteristics).

**U** General utility, includes two or more general installation classes, airborne, shipboard, and ground.

### TYPE EQUIPMENT

**G** Telegraph or teletype (wire).

**I** Interphone and public address.

**N** Sound.

**P** Radar.

**R** Radio.

**T** Telephone.

**V** Visual and light.

**X** Facsimile or television.

### PURPOSE

**C** Communications, receiving and transmitting.

**D** Direction finder.

**G** Gun directing.

**M** Maintenance and test assemblies (including tools).

**N** Navigational aids (including altimeters, beacons, compass, and instrument landing).

**Q** Special.

**R** Receiving.

**S** Search and/or detecting.

**T** Transmitting.

**W** Remote control.

**X** Identification and recognition.

# APPENDIX B

## TABLE OF COMPONENT INDICATORS USED IN THE AN SYSTEM

| COMPONENT INDICATORS | FAMILY NAME | DEFINITIONS OR EXAMPLES |
|---|---|---|
| AB | Antenna base | Mast bases and antenna supports. |
| AM | Amplifier | Power, audio, interphone, radio frequency, panoramic, etc. |
| AS | Antenna system | Complex: arrays, parabolic type, etc. |
| AT | Antenna | Simple: wire, whip or telescopic, loop di-pole, etc. |
| BA | Battery, dry | Dry-battery packs, B-batteries. |
| BB | Battery, storage | Lead-acid, Edison. |
| C | Control box | For: radio, interphone, antenna, remote antenna tuning reel, etc. |
| CM | Comparator | Analyzes or compares two or more input signals. |
| CN | Compensators Regulators | Electrical and/or mechanical compensating or regulating apparatus. |
| CP | Computer | Basic component of electronic equipment. |
| CR | Crystal units | Crystal in crystal holder. |
| CU | Coupling units | Special impedance matching or coupling devices. |
| CV | Converter (Electronic) | Detectors and other electronic apparatus for phase or frequency changing, or changing direct current to alternating current. |
| CW | Cover | Field protective covers for protecting equipment from dust and weather. |
| CW | Cord | Interconnecting cords complete with plugs or other type terminals. |
| CY | Case | Rigid and semi-rigid structure for housing or carrying equipment. |

*(Continued)*

# TABLE OF COMPONENT INDICATORS USED IN THE AN SYSTEM

| COMPONENT INDICATORS | FAMILY NAME | DEFINITIONS OR EXAMPLES |
|---|---|---|
| DY | Dynamotor unit | Plug-in type, separate dynamotor power unit when a major component. |
| F | Filters | Band pass, noise, telephone. |
| G | Generators (see PU) | Electrical generators without prime movers. |
| H | Headsets, handsets, head and chest sets | |
| ID | Indicator | Azimuth, plan position, elevation. |
| J | Junction, jack and terminal boxes | |
| KY | Keyers, copers and interrupters | Mechanical and automatic. |
| LS | Loudspeaker | Separately housed loudspeakers. |
| M | Microphone | Radio, telephone, throat, hand. |
| MD | Modulator | Devices for varying amplitude, frequency or phase of an alternating current. |
| MK | Maintenance kit | Radio, telephone, general utility. |
| MT | Mountings | Mountings, racks, frames, stands, etc. |
| MX | Miscellaneous | Mechanical and electrical equipment not otherwise classified. |
| O | Oscillator | Master frequency, audio, beat frequency, or heterodyning. |
| PP | Power packs | Non-rotating machine types such as vibrator packs, rectifier, battery chargers, etc. |
| PU | Power units and motors | Rotating power equipment with prime mover except dynamotors. Includes converters, inverters, etc. |
| R | Radio receiver | Radio receiver, compass unit, responsor, combined receiver-indicator, etc. |
| RD | Recorder | Type, facsimile. |

*(Continued)*

# TABLE OF COMPONENT INDICATORS USED IN THE AN SYSTEM

| COMPONENT INDICATORS | FAMILY NAME | DEFINITIONS OR EXAMPLES |
|---|---|---|
| RE | Relay assembly | |
| RF | Radio frequency unit | Isolated radio frequency apparatus. |
| RL | Reel assembly | |
| RT | Radio receiver and transmitter | Transceiver, responder, transponder (may include integral antenna). |
| S | Shelter | Enclosure for transportable radio sets. Housing for ground electronics equipment. |
| SA | Switching assembly | Matching switching assemblies. |
| SN | Synchronizer | |
| R | Radio transmitter | Range, marker beacon, interrogator (may include integral antenna). |
| TD | Timing device | Mechanical and electrical timing devices. |
| TK | Tool kits | |
| TN | Ignition unit | For: receiver, transmitter, antenna. |
| TS | Test and measuring apparatus | Field intensity, frequency meter, analyzer, portable ammeter, ohm-meter, etc. |
| VS | Visual signaling equipment | Flag sets, aerial panels, signal lamp equipment. |
| * WD | Wire, cable or cordage | Double conductor. |
| * WF | Wire, cable or cordage | Four conductor. |
| * WM | Wire, cable or cordage | Multiple conductor (more than 4). |
| * WS | Wire, cable or cordage | Single conductor. |
| * WT | Wire, cable or cordage | Three conductor. |

*The terms wire, cable or cordage are restricted in meaning to cover these items in bulk without terminals.

SECTION

2

# TACTICAL OPERATION

SECTION

2

# TACTICAL OPERATIONS

## TABLE of CONTENTS



TACTICAL OPERATIONS DEMAND ALL THE MENTAL AND PHYSICAL STRENGTH YOU CAN OFFER. KNOW HOW TO CONSERVE THIS VITAL STRENGTH AND BE AT YOUR BEST WHEN THE ZERO HOUR APPROACHES. BE PREPARED IF YOU ARE FORCED DOWN IN ENEMY TERRITORY.

# EFFECTS OF HIGH ALTITUDE

## GENERAL

The effects of high altitude flying on the human body include:

**1**—Oxygen want (Anoxia).

**2**—Expansion of gases in the body.

**3**—Need for clearing (equalizing pressure in) the middle ear and nasal sinuses.

**4**—Escape of dissolved blood gases in the form of bubbles (Bends, Chokes, Creeps).

**5**—Increasing cold with altitude.

All but the last of these effects are due to a decrease in the total barometric pressure with higher altitudes. The atmospheric pressure at 18,000 feet is one-half that at sea level; at 27,000 feet, one-third, and at 40,000 feet, one-fifth.

## OXYGEN WANT (ANOXIA)

Oxygen want means lack of oxygen in the body tissues due to a decrease in the quantity of oxygen in the air breathed. Oxygen want increases with altitude, since as the air becomes less dense, a given lungful of air contains less oxygen (and, of course, less of all other gases as well).

In flight, oxygen want begins at about 5,000 feet, but, except for less ability to see in dim light, it is not noticeable to the flyer until an altitude of about 10,000 feet is reached. Healthy persons may occasionally become unconscious while breathing air at 18,000 feet after short exposure, and unfit persons may suffer collapse at lower altitudes.

**The chief symptoms of oxygen want are:**

**1**—Loss of insight and lack of realization of danger.

**2**—An early false sense of well-being.

**3**—Lessening of judgment, inability to think clearly, and tendency to make errors.

**4**—Smaller field of vision and decreased hearing.

**5**—Sluggishness and clumsiness.

**6**—Lack of emotional balance.

**7**—Greatly reduced vision at night or in dim light.

## KNOW WHAT HAPPENS

**All practical rules for the use of oxygen equipment and the probability of your having bends or oxygen want depend on the reading of the altimeter in the airplane (indicated altitude above sea level).** That is, regulations call for your use of oxygen at any time you fly above an indicated altitude of 10,000 feet **above sea level,** not above a zero setting for a given field.

**Become thoroughly familiar with the various stages of oxygen want.** In the first stages the senses are dulled and you have a false feeling of well-being. This may start at 10,000 feet or less. At any altitude above 10,000 feet the effects of anoxia may develop without warning. Always judge your need for oxygen by the altimeter. Never wait for symptoms.

**At 10,000 feet,** the effects of oxygen want are definitely present, but they may be subtle and insidious. You may not be aware that anything is wrong. Use oxygen, however, at this altitude if you are going higher, and under all circumstances, **start it on the ground for night flying, except for low level training flights.**

**At 15,000 to 18,000 feet** the first effects on the brain become marked, and you may experience loss of judgment, dulling of the mind, loss of emotional balance, and the development of fixed irrational ideas. Muscular control is impaired, memory fades temporarily, and the ability to solve navigational and other problems is impaired seriously.

**At 20,000 feet** there may be fits of laughing or crying, impatience, rage, or other emotional disturbances, and great muscular weakness or paralysis. Vision is affected at this altitude. Depth perception may become faulty, and double vision occur. With some there is a feeling of high efficiency, even though unconsciousness is approaching. Others get sleepy and pass into a stupor.

**Above 20,000 feet** most people lose consciousness within a short time and death follows.

These symptoms may develop in different sequences and in various forms, depending upon:

**1**—Rate and duration of ascent to altitude.

**2**—Activity or excitement, cold, and the presence of dangerous gases.

**3**—Differences in the individual's reaction.

If oxygen has been supplied up to **30,000 feet,** sudden removal of the supply produces great mental and physical inefficiency in from 30 to 60 seconds, and unconsciousness in 30 to 90 seconds.

**After having suffered from oxygen want, see your flight surgeon.**

**Maintain physical fitness.** This has a great deal to do with your ability to withstand high altitudes.

**If you must fly at altitudes in excess of 40,000 feet, be absolutely sure that your oxygen equipment is functioning perfectly, that you know how to use it, and that you know what to do in an emergency.**

## BODY GASES

Expansion of body gases in the stomach and intestines occurs as the atmospheric pressure decreases. At about 18,000 feet, the stomach might contain more than a half-pint of air; normally it contains one-quarter pint. The expansion of gases in the intestinal tract may cause some discomfort, but only rarely serious difficulty in a normal person. Relief usually can be obtained by belching and the passing of flatus. In severe cases descent to a lower altitude may be necessary.

When you are flying frequently, avoid foods that tend to produce gas. Beans, cabbage, beer, and other carbonated beverages are likely to make trouble. There probably are others that affect you. Notice which they are and save yourself distress.

Practice clearing your ears rapidly by swallowing, yawning, or closing your mouth and nose and gently attempting to exhale while swallowing. This will considerably increase the rate of descent you can stand comfortably.

**Do no flying when you have a head cold** unless it is absolutely necessary. Congestion of the lining of the nose and throat causes difficulty in the equalization of pressure, and pain in the ears or sinuses often results. Infection sometimes spreads to the sinuses and ears.

## AEROEMBOLISM (BENDS, CHOKES, AND CREEPS)

Decreasing the pressure on the body not only affects the gas already present, but allows the gases dissolved in the body fluids (carbon dioxide, oxygen, and especially nitrogen) to escape and form bubbles. Trouble seldom develops below 30,000 feet, but the likelihood of it increases the higher you go, the longer you stay, the colder you get, the more you exercise, and the faster you ascend, particularly if you have not taken oxygen from the ground up.


Bubble formation usually is indicated by pain in or near the joints (bends). A feeling of oppression in the chest or tightening and pain in the throat (chokes), and itching and irritation of various parts of the skin (creeps) sometimes are felt. Any of these symptoms may gradually or suddenly become worse and force you to descend. The symptoms then become less noticeable, and descent to 20,000 feet usually brings complete recovery.

If you have had any physical difficulties, especially with your ears or sinuses, during a flight, see your flight surgeon as soon as possible.

### Four Golden Rules for Oxygen:

1—Use oxygen above 10,000 feet.

2—Use oxygen from the ground up for all night flying, except for low-altitude training flights.

3—Judge your need for oxygen by your altimeter, not by your sensations.

4—Check all oxygen matters with your personal equipment officer.

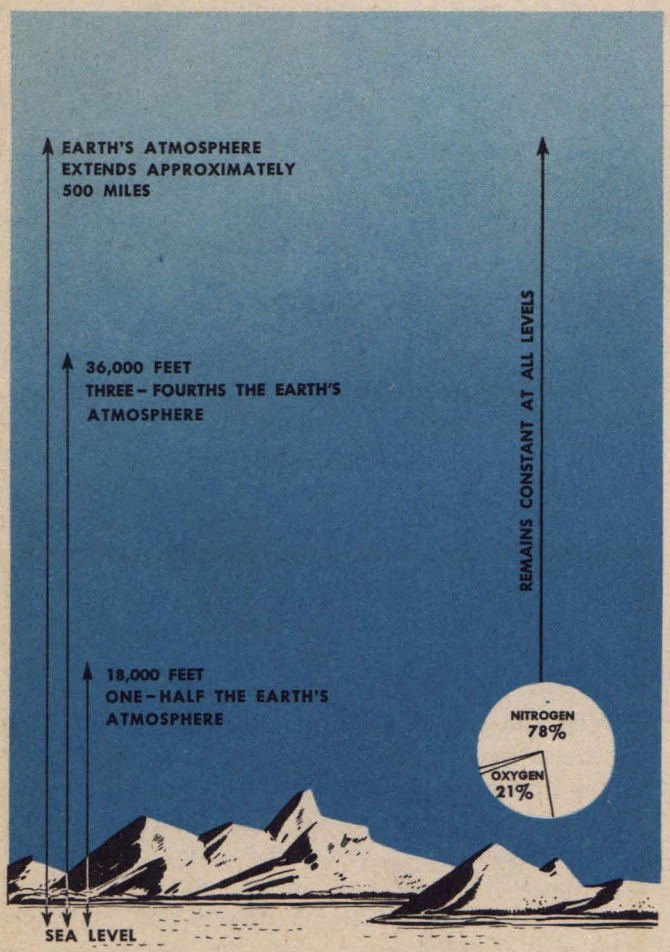
*REFERENCE: Your Body in Flight, T. O. 00-25-13, T. O. 03-50-1, Physiology of Flight.*

As we ascend into the atmosphere, the pressure drops at an approximately even rate of about 1 inch of mercury, or about 34 millibars, for every 1,000 feet of climb. The higher we climb, the less dense the atmosphere becomes. In other words, although the atmosphere extends for hundreds of miles, if we ascend to approximately 3 miles above sea level, half of all the existing air in the atmosphere is below us.

To explain this in another way, as you will encounter it again in the section on Your Body in Flight, although nitrogen and oxygen are present in their **usual proportions** at 18,000 feet, only **half the quantities** are present. If we ascend to 36,000 feet, we find only about half as much as at 18,000. At higher altitudes, the lowering of pressure is more rapid.

Human beings, who are accustomed to breathing oxygen at the normal air pressure of about 30 inches of mercury, or 1,016 millibars, find it hard to breathe when their supply of oxygen is cut in half.

At an altitude of about 24,000 feet, you will become unconscious unless you provide yourself with an additional supply of oxygen.




## ASCENT TO 25,000 FEET WITHOUT OXYGEN

A sample of normal handwriting in flight at 2000 ft

**Control specimen of normal handwriting.**

10000 ft - breathless

**No apparent effect.**

15000 ft - feel uneasy generally numb feeling some numbness in legs and hands

**Beginning muscular incoordination.**

18000 ft very bad

**Definite physical and mental inefficiency.**

20000 ft: faint - numbness in legs: vision fading

**Last zero off both 18,000 and 20,000—marked incoordination.**

22000 ft. pale or red bubbles pale to me feel better

**Feeling better? Evidence of false feeling of well-being.**

23000 ft: feel good elapse for deep breathing open legs numb

**Feel good, Insight, judgment and coordination very faulty.**

24000 ft - Oxygen turned on

**Mental and physical helplessness.**

25000 ft oxygen turned on

**Improvement with few breaths of oxygen.**

3600 ft. - very cool lightheaded - Hearing returning feel o.k. now -

**Last zero left off—general improvement, but not completely normal.**

# OXYGEN EQUIPMENT

## GENERAL—OXYGEN SYSTEMS

Aircraft oxygen systems in use by the Army Air Forces consist of two general types:

**1—Demand system.**

**2—Continuous flow system.**

**The demand system** is automatic and furnishes the oxygen on demand in just the right quantities for all altitudes. Every time the user inhales, a shot of oxygen with the proper mixture of air is supplied. The demand system is now being installed in all Army Air Force combat aircraft.

**The continuous flow system,** on the other hand, supplies the oxygen in a continuous flow. In use, an altitude dial on the regulator must be manually adjusted to correspond with the reading of the altimeter to insure the delivery of the proper amount of oxygen for that altitude. Until recently, Army Air Forces aircraft were provided with this type of equipment.

**The A-14 demand oxygen mask is the latest type of demand mask available.**

## DEMAND SYSTEM

The demand oxygen system includes a demand type mask, A-12 type regulator, pressure gage, pressure indicator lamp, and ball or blinker type flow indicator. In addition, a portable recharger hose is supplied at each crew position in heavy bombardment aircraft for recharging portable (walk-around) oxygen equipment from the oxygen system of the airplane.

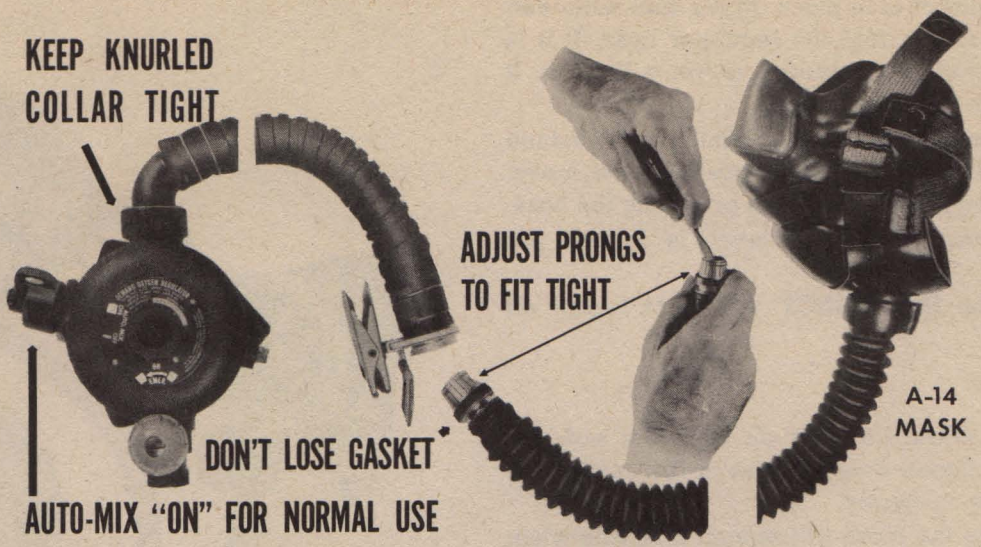
**The A-10 Revised demand oxygen mask. Fit is important in all demand masks. Let your Oxygen Officer check the fit.**

Three types of demand oxygen masks are available—type A-10, type A-10 Revised, and type A-14. They are used with the demand type regulators, the A-12 regulator for permanent installations within the airplane and the A-13 regulator for portable use.

The demand regulator (A-12) is essentially a diaphragm-operated flow valve which is opened by suction when the user inhales and closed when he exhales.

The demand regulator (A-12) is provided with two manual controls for use under special conditions—the AUTO-MIX lever and the EMERGENCY VALVE.

**With the AUTO-MIX lever in the normal (ON) position, the A-12 demand regulator automatically mixes just the right amount of oxygen with the air for the altitude at which the plane is flying.** This is accomplished by an evacuated metal bellows like the aneroid control used in the altimeter. At sea level, the bellows is fully contracted and the air intake port is wide open while the oxygen port is closed. However, as the altitude increases and the pressure decreases the metal bellows expands and as it does so it gradually closes the air intake port. Finally, at an altitude of approximately 30,000 feet,




the air intake port is entirely closed and the oxygen port is wide open to deliver pure oxygen to the mask.

**Remember, the normal position for the AUTO-MIX lever is ON.** When it is in that position the regulator automatically furnishes the proper amount of oxygen for all altitudes. **When the AUTO-MIX lever is in the OFF position, the air intake port is closed and pure oxygen is supplied at all altitudes.**

**Note: It is not necessary to turn the AUTO-MIX lever to the OFF position above 30,000 feet.**

When the red colored EMERGENCY VALVE knob on the regulator is turned on, the oxygen by-passes the demand mechanism in the regulator and enters the mask in a steady flow, regardless of breathing and of altitude. The valve, therefore, should not be opened except in case of emergency, as the oxygen supply will be quickly exhausted.

**Use the AUTO-MIX lever in the OFF position ONLY in the following cases:**

1—Below 30,000 feet to give a wounded man pure oxygen as treatment for shock due to wounds.
2—In special cases where the flight surgeon may advise breathing pure oxygen on the ground before flight and from the ground up as a protection against bends.
3—As protection against poison fumes, like carbon monoxide, or poison gas used by the enemy.
4—When you feel a lack of oxygen.

**Turn on the EMERGENCY VALVE only:**

1—To revive an unconscious crew member.
2—In the case of failure of the regulator. (Watch the flow indicator!)
3—In case of obvious failure of oxygen. In this case, turn on the emergency until the cause of the failure is discovered and corrected.

## PRECAUTIONS

**Pre-Flight Check:**

**1—Make sure mask fits properly.** Check for leaks by holding thumb over end of hose and breathing in gently. **Have Oxygen Officer check size and fit, with special Oxygen Officer's Test Set whenever possible.**
**2**—Check the pressure of the oxygen system. It should not be less than 400 pounds per square inch.
**3**—Crack the emergency valve on the regulator and see that you get a flow. (Caution: When the emergency valve is open do not pinch the hose or block the outlet or the regulator diaphragm will blow out.) Then be sure to close the valve tightly.
**4**—Check knurled collar at outlet end of regulator. It should be tight.

**5**—Check rapid-disconnect fitting on mask hose. Be sure rubber gasket is in place. Make sure male end of fitting fits snugly into the regulator hose. If it is too loose, pry open the prongs to get a tight fit. It should require a 12-pound pull.

**6**—Clip oxygen-supply hose to clothing or parachute harness close enough to your face to allow movement of the head without kinking or pulling the hose.

**7**—Be sure the AUTO-MIX lever is in the ON position.

**8**—Be sure the EMERGENCY VALVE is turned off firmly.

**In the Air:**

**1**—When the mask is first put on, check for leaks by holding your thumb over the end of the mask hose and breathing in gently.

**2**—Manipulate the mask at frequent intervals when the temperature is low, to free it of any ice that may form.

**3**—Check the oxygen pressure gage frequently. Note: the regulator does not function properly with a pressure of less than 50 pounds per square inch.

**After a Flight:**

**1**—Wipe the mask dry. Wash it frequently with soap and water, rinse well, and dry thoroughly. Note: Masks with microphones should not be immersed in water; they should be washed with a cloth.

**2**—Inspect mask and mask hose for cracks and possible punctures.

**3**—Don't lend your mask to anyone except in an emergency.

**4**—Take care of your mask and it will take care of you.

## CONTINUOUS FLOW SYSTEM

Three types of masks—the A-7A, A-8A, and A-8B—are used with the continuous flow oxygen system.

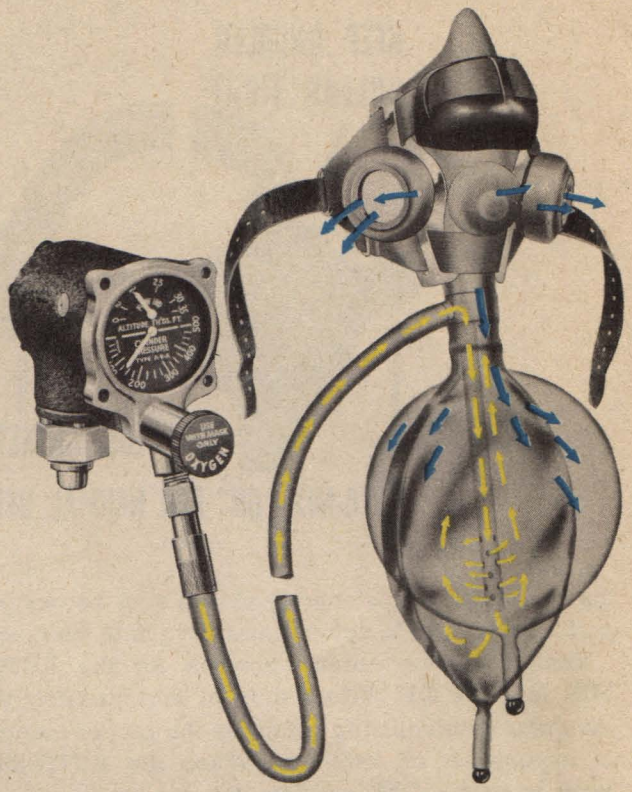
These are rebreather types of masks. The function of the bag is simply to conserve useful oxygen from the exhaled air. These masks must be used with the oxygen regulators A-9 and A-9A. The A-9 and A-9A regulators consist of an altitude flow indicator and a pressure gage. The flow indicator must be set at the altitude at which the plane is flying.

The A-7A mask, used with the A-11 regulator, is procured for use in cargo aircraft only. Since it leaves the mouth uncovered, it would be dangerous for general use above 20,000 feet.

## PRECAUTIONS

**Maintenance:**

**1**—Have rate of flow checked every ten days with a flow meter.



**2**—Never apply oil to any part of your oxygen equipment.

**3**—See that all parts are free of dirt.

**4**—Check entire system for leaks. Pressure should be maintained overnight with all regulators in the OFF position, if there has been no appreciable change in temperature.

**5**—Make sure that the valve adjustment knob of the regulator has fair resistance against turning to prevent any possibility of its being accidentally moved during flight. If it is loose, tighten the valve gland packing nut.

**6**—Never allow carbon-tetrachloride to get in the supply.

**Before Take-Off:**

**1**—Check the cylinder pressure. It should show 400 to 450 pounds per square inch for A-9 or A-11 regulators.

**2**—Check connections between mask, bag, and plastic connecting tube.

**3**—Check the rebreather bag for holes. Be sure plug is in bottom of bag.

**4**—Check to see that the exhalation discs are in proper position.

**5**—Know where your regulator is located.

**6**—Carry extra sponge rubber discs and protective shields for the exhalation turrets, or a protective

fabric bag for the entire mask. Take along an extra mask whenever possible.

**In the Air:**

**1**—Be sure regulator is set at proper altitude.
**2**—Check the cylinder pressure occasionally.
**3**—Breathe normally; overbreathing accomplishes nothing. In fact, it is dangerous; it may produce dizziness and other more serious consequences, if persisted in.
**4**—Put protective shields on the exhalation turrets or use the fabric bag whenever the temperature falls below 10°F (—12.3°C). If shields and bag are not available, examine the sponge discs at intervals and remove any ice that forms by squeezing them, or change the sponges. Whenever possible carry an extra mask.
**5**—Above 30,000 feet, the rebreather bag should never be completely collapsed when breathing in. If it does collapse, the valve should be opened further no matter what the flow indicator reads.
**6**—When exercise is necessary, be sure the valve is open far enough to prevent the bag from collapsing at 25,000 feet.
**7**—When you change your station at altitude be sure the new cylinder valve is **FULL ON and that the bayonet fitting is locked.**

**After a Flight:**

**1**—Shut all flow valves and make sure they are tightly closed.
**2**—Wash mask frequently with soap and water, rinse well, and hang up to dry.
**3**—Don't lend your mask to anyone except in an emergency.
**4**—Keep your mask in a safe place and away from sunlight.
**5**—Check the bayonet connection to see that the rubber seat is in place.

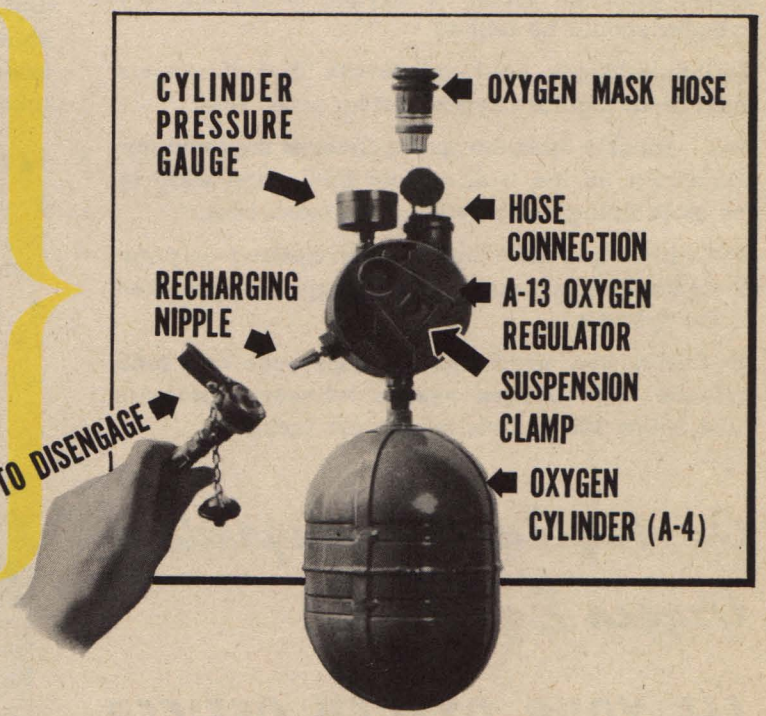
**WARNING**

Extreme caution must be exercised in the use of oxygen equipment to insure that none of it becomes contaminated with oil or grease. **FIRE OR EXPLOSION** may result if slight traces of oil or grease come in contact with oxygen under pressure. Be sure that all lines, fittings, instruments and other parts are free of oil, grease, and other foreign matter. **NEVER USE LUBRICANTS ON ANY PART OF THE OXYGEN SYSTEM.**

**WHEN RECHARGING BOTTLE BE SURE TO SEAT NIPPLE COMPLETELY HOME IN HOSE. AFTER RECHARGING DISENGAGE HOSE BY TURNING LEVER CLOCKWISE**

**RECHARGER HOSE AT EACH STATION IN PLANE**

**WARNING**
Keep Oil Away From Recharging Nipple



# PORTABLE OXYGEN EQUIPMENT

## WALK-AROUND BOTTLE

In large airplanes, portable oxygen equipment in the form of a walk-around bottle fitted with an A-13 pure demand regulator is provided for use by the crew when changes of station are necessary. When movement from one part of the airplane to another is necessary, the mask hose is simply disconnected from the regular oxygen system hose and connected to the outlet on the walk-around bottle.

The walk-around bottle holds about a six-to-eight minute oxygen supply. The supply may last a shorter or longer time, depending on the altitude, depth of breathing, and the pressure in the bottle. The bottle can be replenished directly from the airplane oxygen system, but obviously only up to the remaining pressure in the system. The bottle is replenished by means of the portable recharging hoses at each station in the plane.

**To Use the Portable Unit:**

1—Before using, check the pressure gage. If the pressure gage shows less than 100 pounds per square inch, the supply of oxygen is low and the cylinder should be refilled.

2—Inhale deeply, hold your breath, then disconnect mask from regular oxygen system hose. Then . . .

3—. . . quickly open the spring cover of the regulator connection on the walk-around bottle and snap in the male fitting on the end of the mask hose.

4—Clip the portable unit to your clothing or parachute harness by means of the spring clamp attached to the cylinder.

**5—During use, watch the pressure gage and refill cylinder from oxygen system whenever pressure falls below 100 pounds per square inch.**

*On Any Question Regarding Oxygen Equipment*

**SEE YOUR OXYGEN OFFICER**

## BAIL-OUT OXYGEN CYLINDER

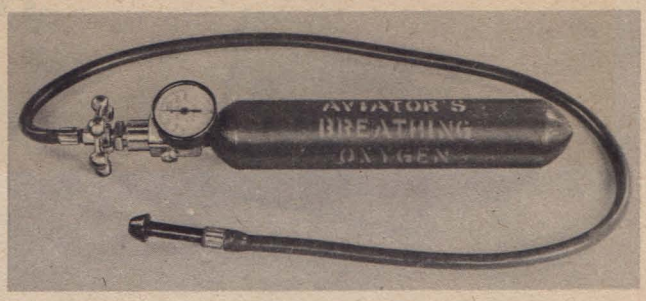
The bail-out oxygen cylinder for use in parachute descents from high altitudes is a completely self-contained unit with pressure gage, release valve, and pipe-stem mouthpiece. The oxygen cylinder should at all times be securely tied in a pocket sewed on the parachute harness or secured in an auxiliary pocket on your clothing.

**To Use the Bail-Out Oxygen Cylinder:**

1—Before take-off, check the cylinder's pressure gage. It should read at least 2,000 pounds per square inch.

2—Before jumping, grip pipe stem firmly between your teeth and completely open flow valve on cylinder.

*REFERENCE: Technical Order 03-50-1, dated July 1, 1943.*




# VISION AT NIGHT

## TO DEVELOP NIGHT VISION

**1**—Insure adaptation to dark preceding any night operation by staying in a dark room or by wearing red lensed goggles (Goggles, Assembly, Polaroid Type D. A., Class 13, Stock No. 8300-343575), for 30 minutes.

**2**—Protect this adaptation by not exposing your eyes to any bright light, either inside or outside the airplane.

**3**—Keep all nonessential lights within the airplane turned out, and all essential lights dimmed.

**4**—Use red light within the airplane whenever possible.

**5**—Read instruments, maps, and charts rapidly; then look away. Or, use only one eye; the other eye will retain its dark adaptation.

**6**—Use oxygen from the ground up on all night flights, except in low altitude training.

**7**—Keep all windows scrupulously clean.

**8**—Avoid casual paper or unpainted spots on the instrument panel—they reflect light.

Be sure to adapt your eyes to night vision before taking off. The sense organs for night vision become insensitive under strong light and require time for "adaptation to dark." During this period nothing brighter than candlelight should be used. If a dark room is not available, red goggles will do almost as well. Then when you take off a 10,000 fold increase in sensitivity will have been achieved.

**9**—Experience brings much improvement in night vision. Practice off-center seeing on dark nights whenever possible.

Keep goggles, enclosure windows, and windscreens clean and free from scratches. Scattered light reduces the contrast between faint lights and their backgrounds; reflected light from wind-screens does the same.

Be sure you have an adequate supply of oxygen from the ground up. Without it, night vision is impaired at an altitude of only 5,000 feet, and is only one-half as efficient at 12,000 feet.

Eat food rich in vitamin A. This is a chemical factor essential to good night vision. Eggs, butter, cheese, liver, apricots, peaches, carrots, squash, peas, and especially cod liver oil and all types of greens are rich in vitamin A. Too much vitamin A will neither help nor harm you.

Remember that in dim light, or at night, you cannot see what you look at directly. A night blind spot, unrecognized by most people, lies at the center of the eye. Therefore, in the dark, look to one side of the thing you want to see.

For reading maps and instruments, or when caught in searchlight beams, close one eye and avoid looking at the source of light. The eye which is kept closed will retain its power to see in the dark independently.

Use roving vision when searching the night sky. Keep your line of sight fixed in one direction for about one second, then move on a short distance to another position, thus covering your entire field in a series of eye movements and pauses. Small adjustments of the line of sight are sometimes made more easily by moving the head than by moving the eyes alone.

## SNOWBLINDNESS

This condition may result from exposure of your eyes, even for brief periods, to the glare which exists in snow-covered regions. The resultant damage to your eyes may cause intense pain and seriously interfere with your vision for several days—sometimes even longer. Always protect your eyes by wearing colored goggles or sunglasses. In the Arctic, snowblindness may be brought on by merely lifting your goggles a half dozen times.

# Physical Fitness

Every crew member must be physically fit. Your unit provides a program of games or calisthenics, and it is important that you, as an individual, make the most of it. Your full cooperation in these daily exercises is an essential part of your job.

Haphazard exercise is of little value. It must be regular, intense, and of proper duration to do you any good. You should be really tired out when you are finished.

Of course physical exercise alone will not keep you fit. It must be supplemented with good food, and with sufficient sleep, rest, and relaxation. Otherwise the fatigue and strain will ultimately wear you down.

You couldn't operate successfully with poor equipment. Neither should you set out on any mission in less than perfect physical shape. Air combat requires perfection. You cannot attain perfection nor maintain it without daily exercise. If you can't get in a game, get a half hour of conditioning exercises each morning, and some running during the day. Join in at least one or more of the following activities as the occasion and facilities permit. Above all make exercise a daily routine.

Some sports listed here can always be used as part of your personal physical conditioning program. Team Activities: touch football, basketball, soccer, speedball, volley ball, softball, baseball.

Dual Activities: badminton, tennis, handball, squash, medicine ball.

Individual Activities: swimming, cross-country running, weight-lifting, rope skipping, setting-up exercises.

Mix these up as practical needs require. The main thing is to get a maximum of fun and hard physical exercise out of them. In this way they become literally recreational.

Remember your physical condition is, in the last analysis, strictly up to you. You can and should check up on your physical fitness from time to time by giving yourself the work-out prescribed in the AAF Physical Fitness Test. The test is simple, practical, and specific, and you and your crew can find out how you compare with men in top physical shape by trying your own ability against the standards. Use the sit-ups, chinning, and 300-yard shuttle run as you would use a scale to keep yourself informed of your physical state.

A man takes justifiable pride in knowing that he is trim and fit; when he is fighting a war as a member of a team like the AAF more than pride is involved. He has a direct responsibility to himself and to other members of his fighting team to keep himself ready for high precision physical performance at all times.

# Electrically heated FLYING SUITS

Flying at high altitudes, 10,000 feet or above, your body requires special attention. The body extremities in particular are susceptible to unusual stresses and strains. Below 10,000 feet the physically fit body can make its own adjustments, but above this altitude it will labor and eventually stall if not provided with protective equipment. The body runs out of breath; consequently, special oxygen equipment must be used to survive. The effects of cold on the extremities are different at high altitudes than at ground levels. Exposed parts of the body in extreme degrees of cold are in great danger from only a few seconds' exposure. Frostbite incurred at these altitudes will ground a radio operator just as surely as flak or bullet wounds, and perhaps for weeks, months, or even permanently.

## FACTS WORTH KNOWING

*Low temperatures prevail at altitudes.* Regardless of ground temperatures, it is ordinarily very cold at high altitudes. The thermometer usually drops 3.5 degrees Fahrenheit for every 1,000 feet of altitude, starting from an assumed ground temperature of 60 degrees Fahrenheit. Frequently the thermometer drops more than that, and at the altitudes flown in combat the outside temperature may be 65 degrees below zero.

*Wind blast increases cold.* If you are in an exposed position, wind blast will increase the effect of cold. Open waist windows, radio hatches, or windows that have been shot out mean you must take extra precautions to prevent frostbite.

*Experience is valuable.* A new combat crew man going on his first mission is much more likely to get frostbitten than an old-timer. There is always more frostbite among new crews and new groups than in older and more experienced outfits. Profit by the previous experiences of other combat men and follow the advice given by them, by your Flight Surgeon, and by your Personal Equipment Officer.

## TYPES OF SUITS

The *F-2 and F-2A* electrically-heated suits consist of a removable liner carrying the electrical heating elements, and a wool elastique covering. Many combat crew men use only the liner, over which the heavy flying suit is worn; this combination gives better protection in case of failure of the electrically-heated liner. When severe temperatures are not expected, the entire suit alone gives adequate protection. However, always take heavy flying clothing with you for use in case of electrical failure.

The *F-3* electrically-heated suit consists of only a liner carrying the heating elements. This is a two-piece suit, one piece being a trouser-overall and the other a jacket, to be worn over the overall. This suit is to be worn over an ordinary uniform and under the intermediate alpaca flying clothing. The type of uniform worn under this suit will depend somewhat upon the temperatures anticipated in flight. Variations in instructions for using the equipment will depend on the requirements of the operating temperatures of the particular theater of operations.

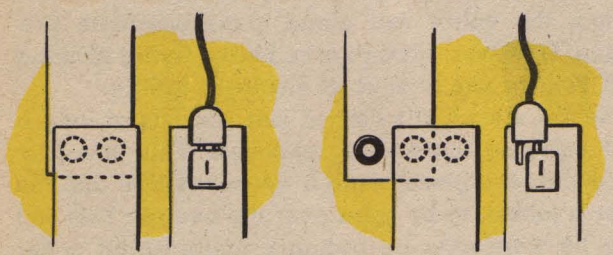
## F-2A SUIT

This suit is identical with F-2 models except that if you turn the rheostat to HIGH or plug into 24 VOLTS receptacle the heat supply will be controlled automatically by built-in thermostats.

## PREFLIGHT CHECK OF ELECTRICALLY-HEATED CLOTHING

**1**—Make sure all electrical connections are properly made between jacket, trousers, gloves, and shoes.

**2**—Plug suit into outlet box making certain you plug into socket marked HEATED CLOTHING.



**3**—Turn rheostat full on.

**4**—Within three to five minutes you should feel heat, especially at back of hand, on thigh, on chest, and on ball of foot. Press suit against these first three areas to intensify sensation of heat.

**5**—If heat is felt in all areas, the suit, shoes, and gloves are functioning.

**6**—If no heat is felt, check connections thoroughly.

**7**—If faulty connections are not found, the suit should be replaced by one that functions properly and the faulty one will be inspected by the Personal Equipment Officer.

**8**—Do not wait until take-off time to check your suit. If you do, you may be forced to fly with a suit that does not function.

## SUGGESTIONS AND PRECAUTIONS

**1**—Take all heavy winter flying clothing on all missions for use in the event of failure of electrically-heated equipment.

**2**—Take very good care of all clothing between missions.

**3**—Always test all equipment on the ground. Do this before every mission.

**4**—Follow instructions given by the Flight Surgeon and the Personal Equipment Officer.

**5**—Never touch cold metal with bare hands.

**6**—Do not abuse electrically-heated equipment.

**7**—Do not get wet either through water or sweating, and never "ride hot." Adjust rheostat to a setting that is comfortable.

**8**—Do not wear any clothing that fits too tightly.

## SYMPTOMS AND TREATMENT OF FROSTBITE

*Frostbite doesn't hurt much.* You may feel a little tingling in your fingers or toes but soon they become numb, stiff, and pale. If you have no feeling in fingers, toes, or cheeks, they are frostbitten.

*Early treatment will help.* If hands or fingers are frostbitten, put them under an armpit, inside the suit, or between your legs. Try to improve circulation by swinging the arms. If the feet or toes are frostbitten, jumping up and down, stamping the feet, etc., may aid circulation somewhat. Do not rub a frostbitten part and do not warm it too quickly. Report to your flight surgeon immediately upon landing.

**REMEMBER**

**Frostbite may mean permanent grounding, loss of toes or fingers, week or months in a hospital, and permanent sensitivity to cold.**

# Booby Traps and Land Mines

If you ever move into territory the enemy has just left—watch out. Land mines and booby traps are among the deadliest weapons of war, and the enemy is an expert at using them. Many an American soldier has been killed because he couldn't restrain his curiosity or his urge to pick up trinkets.

Usually engineers will move in ahead of you to clear out land mines. Booby traps are something else again. Until the engineers have carefully gone over every building or every object in the area, you will have to protect yourself.

Booby traps can be hooked up to a package of cigarettes or concealed in an abandoned hospital. They can be arranged to go off when you pick up a wine bottle, open the hood of an automobile, turn a doorknob, flip a light switch, lift a telephone receiver, step on a carpet, or move a chair.


# *Be especially careful of:*

**SOUVENIRS**—If you pick up an enemy helmet or rifle, the chances are you won't live to show it to your friends.

**EQUIPMENT**—Any trucks, carts, abandoned guns, planes, or other equipment left behind by the enemy are probably loaded with enough TNT to blow up a regiment.

**TRIPWIRES**—Watch out for them, especially around interesting objects. One enemy trick is to leave incendiary bombs in buildings—in the hope that you will rush up to put out the fire and trip over the wire. The wire usually sets off an explosive nearby.

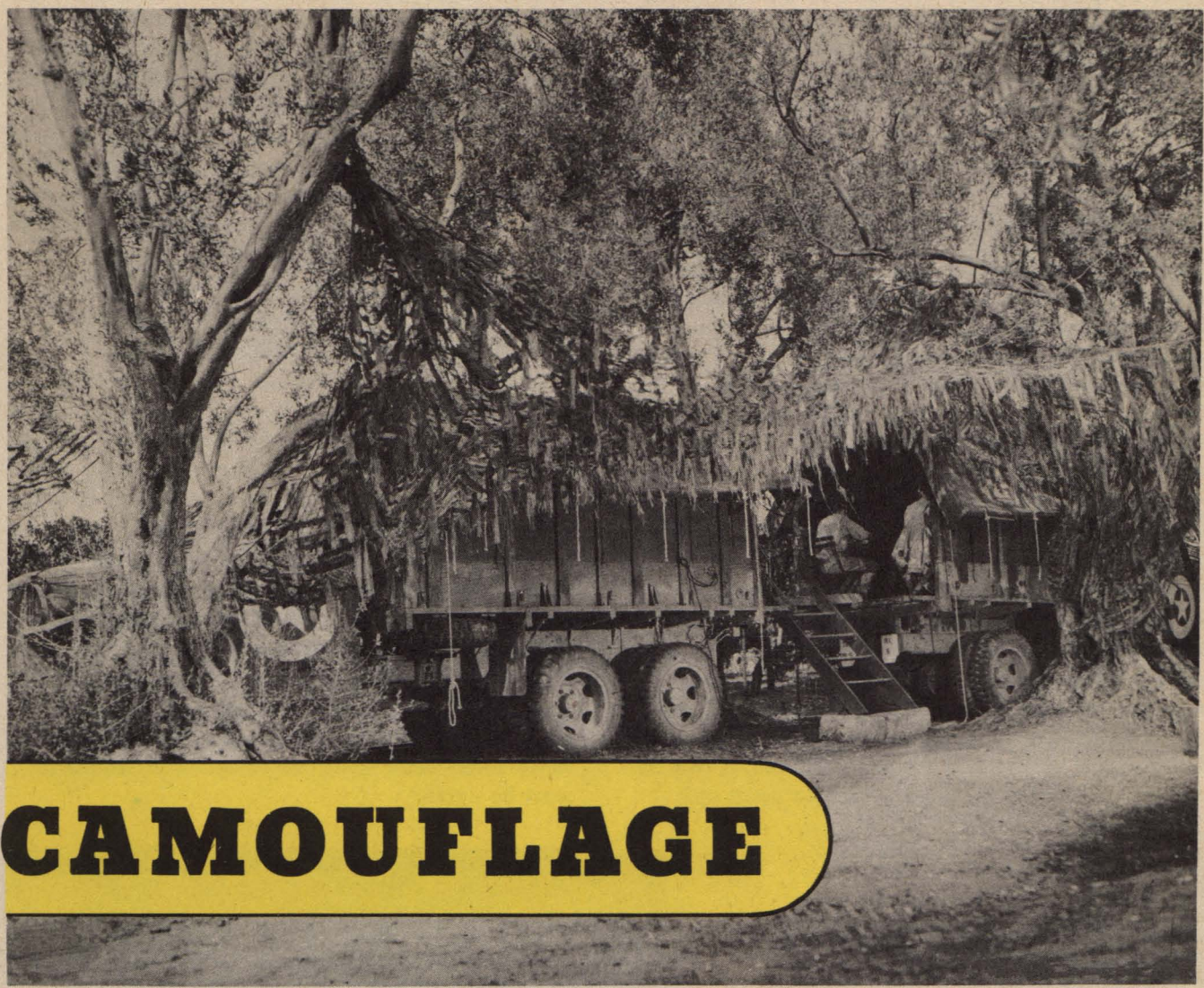
**DOUBLE CROSS**—If a booby trap is left right out in the open, where you can't miss seeing it, the chances are that another one is carefully hidden nearby.

**HOUSES**—Beware of doors or windows that have been left invitingly open. Beware of moving furniture that stands in your way.

Just because you see one booby trap go off, don't take for granted that the area is safe—there may be dozens more nearby.

If you find a trap, mark and report it, so that engineers can put it out of business. Don't try to set it off or disarm booby traps and land mines yourself—amateurs don't live long at that business.

**Don't touch anything that the enemy has left behind**



# CAMOUFLAGE

Large scale camouflage installations will be accomplished by engineer troops, but it is a command responsibility to see that squadron or individual camouflage activities are carried out. There are basic considerations in gaining concealment which you, as a radio operator, must understand in order to cooperate in concealing likely targets from the enemy. The most important are *choice of position, camouflage discipline,* and *construction.*

In the choice of position use a background which will absorb the elements of the position. Natural cover is to be sought under all circumstances, and in some cases complete concealment can be obtained with no construction work at all, when there is enough natural cover. Concealment may also be possible in sparsely covered areas by taking advantage of irregularities in the terrain.

Camouflage discipline is the avoidance of activity that changes the appearance of an area or reveals military objects to the enemy. Tracks, spoil, and debris are the commonest signs of military activity that give away concealed objects. The same discipline that applies during the day must be observed at night. Light discipline is especially important at night. Sound discipline is always important.

Construction is necessary when there is not enough natural cover to hide an installation. Either natural or artificial materials are used to supplement any existing concealment. The natural materials must be similar to those at the site and resemble them in form, texture, and color. Both natural and artificial materials require special maintenance. Construction activity must be hidden and work parties must not betray an installation.

There are three basic ways of concealing installations and activity: blending, hiding and deceiving. In blending, both the materials and the object must be arranged so that they seem a part of their background. The aim is to prevent disclosure of the object by a change in the natural appearance of the

site. Hiding means concealing the identity of an object with a screen, though the screen itself may be seen sometimes. Deceiving simulates objects or activities of military significance or disguises them so that they appear to be something else. For example, by offering more targets than actually exist the enemy attack may be divided.

## AVOIDING CAMOUFLAGE MISTAKES

The best possible camouflage job will not work if somebody leaves a mess kit, an undershirt, or even an empty cigarette package lying in the open. The enemy's aerial cameras will see everything; from 30,000 feet in the air, out of sight and out of hearing, they can take a photograph of railroad tracks that will show every tie. Therefore, it is imperative for every person in a theater of operations to be very cautious not to give away any position to the enemy. The following rules will help in effective camouflage discipline:

**1**—*Do nothing that will change the appearance of the landscape.* The enemy has photographed the place before you get there, and any changes will make him suspicious. New tracks, made by feet or wheels, are easily spotted from the air. Use old paths and roads; make no short cuts. If it is necessary to make a path or track to a cluster of trees, it will be carried on beyond to avoid a telltale dead end.

Hide all refuse; when it is buried, keep the freshly-turned earth out of sight. In digging fox holes follow the contours of the land, or the existing man-made landscape pattern. Never dig holes out in the open or at right angles to existing ridges.

**2**—*All objects cast shadows.* One German field headquarters was discovered because a reconnaissance photograph revealed the shadow of a telephone wire running to the slope of a hill. The wire itself did not show on the picture.

**3**—*Never face light-reflecting surfaces into sun.* Windshields or any shining surface facing the sunlight will make them plainly visible from the air.

**4**—*Make no camouflage slips; remedy any observed.* Build only those fires that are absolutely necessary, and then use very dry wood to prevent smoke. Do not place personnel or equipment on the skyline so that they might be visible to ground observers or low-flying airplanes.

**5**—*Never look up, for a face stands out like a beacon.* A person out in the open when a reconnaissance plane flies over should stand perfectly still; a moving object attracts attention.

The radio operator, along with all other personnel, must avoid any slight breach in camouflage discipline that might betray the camouflaged position. There is no such thing as passable camouflage; it must be perfect.

SECTION

3

# RADIO
## OPERATING PROCEDURE

SECTION

3

# RADIO OPERATING PROCEDURE

## TABLE of CONTENTS



**THE USE OF PROPER RADIO-OPERATING PROCEDURE IS A MUST. IT IS UP TO YOU TO FURNISH ALL OUTSIDE INFORMATION TO YOUR CREW MEMBERS. KEEP UP-TO-DATE ON ALL PROCEDURES AND KNOW WHERE AND WHEN TO GET INFORMATION VITAL TO YOUR MISSION.**

# ARMY AIRWAYS COMMUNICATIONS SYSTEM

# AACS

The Army Airways Communications System is responsible for airways communications and navigational aids to facilitate the operation of Army service aircraft over military airways covering the entire globe. AACS operates point-to-point and ground-to-air radio telegraph and radio telephone communications (manual, automatic, or radio teletype). It also operates control towers, direction finding stations, instrument approach systems, weather reporting and weather broadcast systems, radio ranges, beacons, land line teletype, cryptographic units and message centers.

These stations will relay traffic to any point by radio, teletype, interphone, dispatch mail, or any other available method. They will also relay to other Government agencies such as the Civil Aeronautics Administration, and the Navy Department. In providing the communications necessary for flights along army airways, the AACS accomplishes the following: It maintains contact with military aircraft to provide information regarding weather, traffic in the air and on the ground, and any other subject that may be required. In this way AACS makes possible continuous control of army air traffic through Communications along the airways.

For frequencies consult your facility charts, route guide, or flimsy.

**REMEMBER**

**The operator at a ground station may be having difficulties. Try calling another station if you are sure your equipment is operating properly.**

It also maintains contact with point-to-point stations in order to permit the handling of freight, military aircraft, and personnel being moved from one place to another.

The primary purpose of AACS is to safeguard life and property. Make use of their facilities whenever you need them; be familiar with their facilities offered.

While AACS facilities are used by the aircraft of the U. S. Army, Navy, Marines, and Allied Forces, the two largest users of its services are the Air Transport Command and the Army Air Forces Weather Service.

### TO PREARRANGE A CHANNEL

Before departing from a base where an AACS station is located you may file a message at that station to notify airways stations along your scheduled route and at your destination to stand by on any air-ground channel.

AACS stations guard continuous wave (CW), modulated wave (MCW), or voice channels.

Consult your facility charts, route guide, or flimsy for the frequencies of the nearest AACS station.

### CONTACTING AACS STATIONS

The following procedure may be used when contacting AACS stations by wireless telegraphy (W/T).

WYF V 7321 QTC K

If the net is congested, indicate the number of messages you have to send. If no answer is received to the first call, repeat the same procedure, except make the call sign of the station called twice; the prosign V; and the call sign of your station twice; and then the ending prosign K thus:

WYF WYF V 7321 7321 K

Before starting any transmission monitor the frequency you are going to use; thus avoiding transmitting simultaneously with another station. If no answer is received after making a second call, check the operation of your equipment; and check the frequency of both your transmitter and receiver. After all the equipment has been checked, call again as shown in the second example until an answer is received.

Use the following procedure when contacting AACS stations by radio telephone (R/T):

SCOTT ARMY AIRWAYS THIS IS ARMY SEVEN THREE ONE OVER

If no answer is received, make the same call with the exception that the station call is made twice as follows:

SCOTT ARMY AIRWAYS SCOTT ARMY AIRWAYS THIS IS ARMY SEVEN THREE ONE OVER

All answers to calls by voice (A-3) will be made on 4220 kc unless you have definite information that some other frequency is being used.

When contact has been established, speak slowly and distinctly. Some letters and phrases sound the same by radio telephone. If any of these words or phrases are encountered, accentuate them. If necessary spell out the words using the phonetic alphabet. When transmitting code or cipher messages use the phonetic alphabet to assure accurate reception.

**There are 19 different types of stations scattered throughout all theaters of allied operations. These are listed as follows:**

**A**—Airways Communications Station providing two simultaneous channels: point-to-point and ground-to-air (two operating positions), plus Airdrome Control Tower.

**B**—Airways Communications Station providing two simultaneous channels: point-to-point and ground-to-air (two operating positions).

**C**—Airdrome Control Tower.

**D**—Direction Finding Station.

**E**—Weather Reporting Station.

**G**—Ground Control Approach System.

**ILa**—Instrument Landing Unit (mobile).

**ILb**—Instrument Landing Unit (fixed).

**LS**—Long Range Air-Navigation Station.

**P**—Direction Finding Evaluation Station.

**R**—Radio Range, Fan Marker, Radar Beacon (Racon), Radio Station, point-to-point (one operating position), or Homing Beacon.

**RT**—Radio-teletype Station (one operating position).

**T**—Teletype Station (one operating position).

**X**—One additional operating position added to either a class A or class B station.

**Y**—Automatic Radio-Telegraph Station.

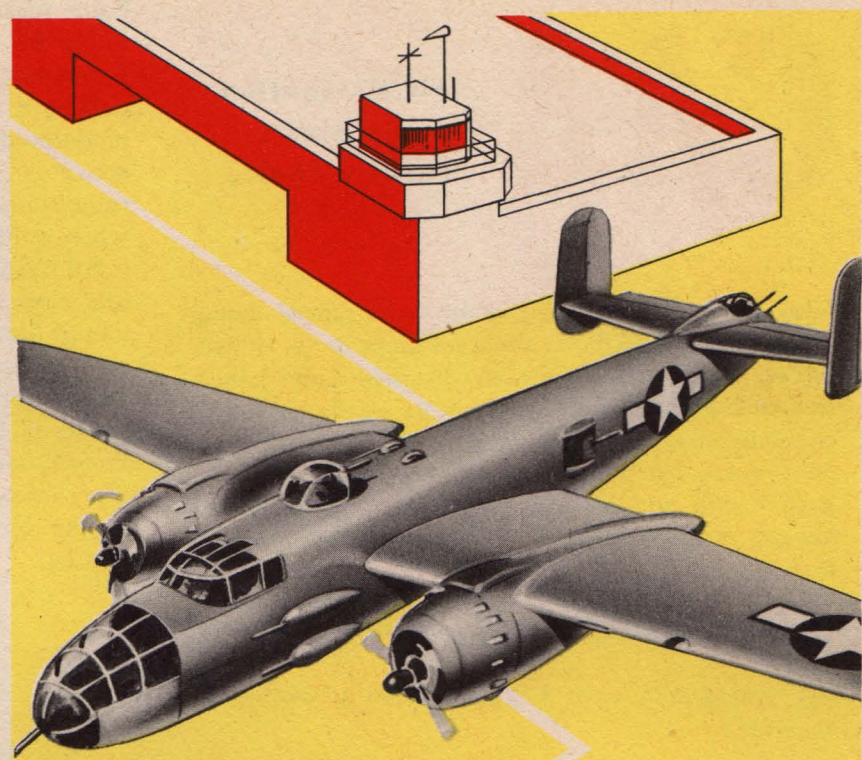
**Z**—One additional operating position added to Radio-Teletype Station.

**I**—Cryptographic Section where traffic volume normally requires more than 8 crytographers.

**II**—Cryptographic Section where traffic volume normally requires less than 8 cryptographers.

**MC**—Message Center.

# CAA



## Civil Aeronautics Administration

## CONTACTING CAA STATIONS

CCA stations guard 6210, 3105, and 4495 kc (others on request). An asterisk (*) in the remarks column of the Radio Facility Charts indicates that the station guards 6210, 3105, 4495. If any other frequencies are guarded by that station they will be indicated alongside the asterisk.

The answer to any call will be by type A-3 (voice) emission, on the frequency the station has been assigned. The frequency can be found by reference to the correct facility chart.

The above frequencies are normally used for radio-telephone communications, but they may be used for continuous wave in an emergency. (See information on CW communication with CAA.)

Standard radio-telephone procedure should be used for all contacts.

The CAA maintains and operates radio-range and beacon stations. Most CAA stations have facilities for voice transmissions. By reference to the facility chart for the section in which the particular station is located, it will be noted that the frequency and call sign of the station are given. If the station is not equipped with voice facilities the frequency will be underlined. CAA stations will furnish weather information for any station, airway, or region.

There are facilities available for relaying traffic to other Government agencies through inter-phone and teletype circuits. Change of flight plan or requests for clearance will be relayed to the Airways Traffic Control (ATC) and position reports will be relayed to the point of departure, destination, or both. When information relative to the flight of your aircraft is necessary, the Civil Aeronautics Administration is the most logical outlet.

# CAA

**Air Navigation Radio Aids Facility Charts**

CAA stations are located at strategic places along all airways within the continental limits of the United States. They are never a great distance apart, hence radio-telephone should normally be employed when contacting them. CAA stations, however, will answer calls made by wireless telegraph. The answer to such a call will be made on the radio-range frequency of the station, using Type A-3 (voice) emission.

### TYPES OF SIGNAL EMISSIONS

**A-1**—continuous wave (CW). (Requires an oscillating receiver.)

**A-2**—modulated continuous wave (MCW). (Does not require an oscillating receiver.)

**A-3**—voice modulated wave. (Does not require an oscillating receiver.)

Since radio receivers at CAA stations are used normally for voice reception, they do not use a beat frequency oscillator for monitoring. Therefore when calling a CAA station by CW, always use a tone modulated signal (MCW), unless a prearranged schedule has been made for CW operation. The radio-range identification letters should be used when calling.

All CAA radio-range stations, regardless of class, and class H radio beacon stations within the continental United States having voice facilities broadcast their local weather report hourly in uncoded voice. For security reasons these broadcasts are made on the 29th minute of the hour or not at all. Each broadcast is started with the announcement of the station immediately followed by the statement of the local time correct to the nearest quarter minute.

**REMEMBER**

**ALL ANSWERS WILL BE MADE BY VOICE UNLESS OTHERWISE PREARRANGED**

## STATION CLASS DESIGNATION

**AC**–Approach Control Tower, CAA

**B**–Scheduled Broadcast Station (29 min. after only)

**C**–Control Tower, CAA

**CA**–Control Tower, Army

**CI**–Control Tower (City, Country, Private, etc.)

**CN**–Control Tower, Navy

**D**–Distantly Controlled

**FM**–VHF Fan Type Marker (100 Watts)

**H**–Non-directional Radiobeacon (Homing) Power 50 Watts or Greater

**IM**–VHF Inner Marker

**LFM**–VHF Fan Type Marker Low Powered (5 Watts Not Over 10 Miles From Range)

**MH**–Non-directional Radiobeacon (Homing) Power Less Than 50 Watts

**ML**–Range (Loop Radiators) Power 50 Watts or Less

**MRA**–Range (Adcock, Vertical Radiators) Power 50 to 150 Watts

**MRL**–Range (Loop Radiators) Power Greater Than 50 Watts; Maximum 150 Watts

**OM**–VHF Outer Marker

**P**–Point-to-Point Radio

**RA**–Range (Adcock, Vertical Radiators) Power Greater Than 150 Watts

**RL**–Range (Loop Radiators) Power Greater Than 150 Watts

**S**–Simultaneous Transmission of Range Signals and Voice

**T**–Teletype

**TX**–Principal Teletype

**V**–Voice Communication With Aircraft

**W**–Without Voice Facilities

**Z**–VHF Station Location at a Range Station

**ZM**–VHF Station Location Marker, Not at a Range Station

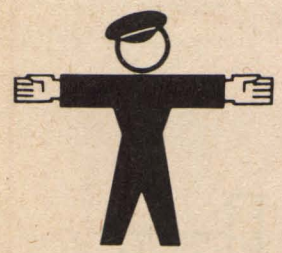
# Body Signals

If a rescue plane flies low and circles your location and you are sure that you have attracted the pilot's attention, messages can be transmitted by the emergency body signals shown on this page. When performing the signals stand in the open, make sure that the background as it will be seen from the plane is not confusing, make the motions deliberately and slowly, and repeat each signal until the pilot indicates that he understands.

NEED MEDICAL ASSISTANCE—URGENT (Lie prone)

ALL O K
DO NOT WAIT

CAN PROCEED SHORTLY—
WAIT IF PRACTICABLE



NEED MECHANICAL HELP
OR PARTS—LONG DELAY

PICK US UP—
PLANE ABANDONED

DO NOT ATTEMPT
TO LAND HERE

LAND HERE (Point in
Direction of Landing)

OUR RECEIVER
IS OPERATING

USE DROP
MESSAGE

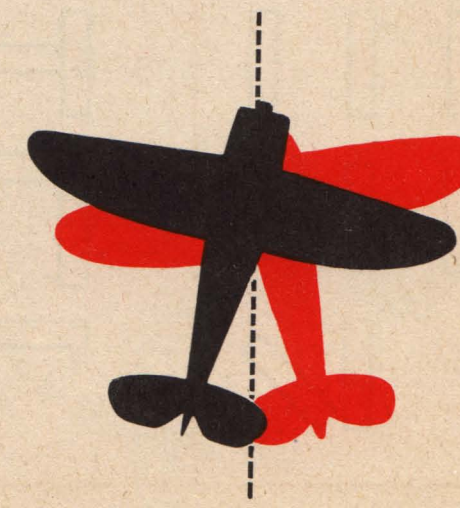
AFFIRMATIVE (Yes)

NEGATIVE (No)

## HOW PLANE ANSWERS

The pilot of the rescue plane will answer your messages either by dropping a note or by dipping the nose of his plane for the affirmative (yes) and fishtailing his plane for the negative (no).

AFFIRMATIVE (Yes) DIP NOSE OF PLANE



NEGATIVE (No) FISHTAIL PLANE

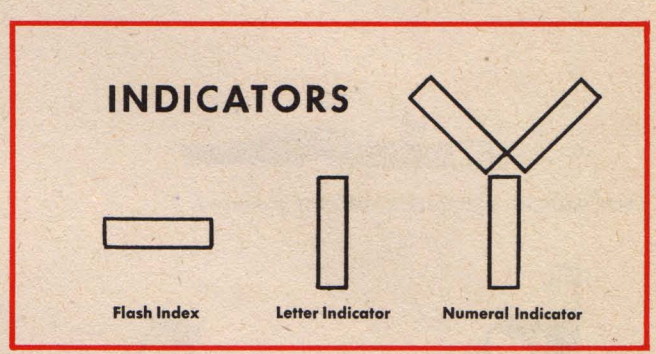
# COMBINED PANEL SYSTEM

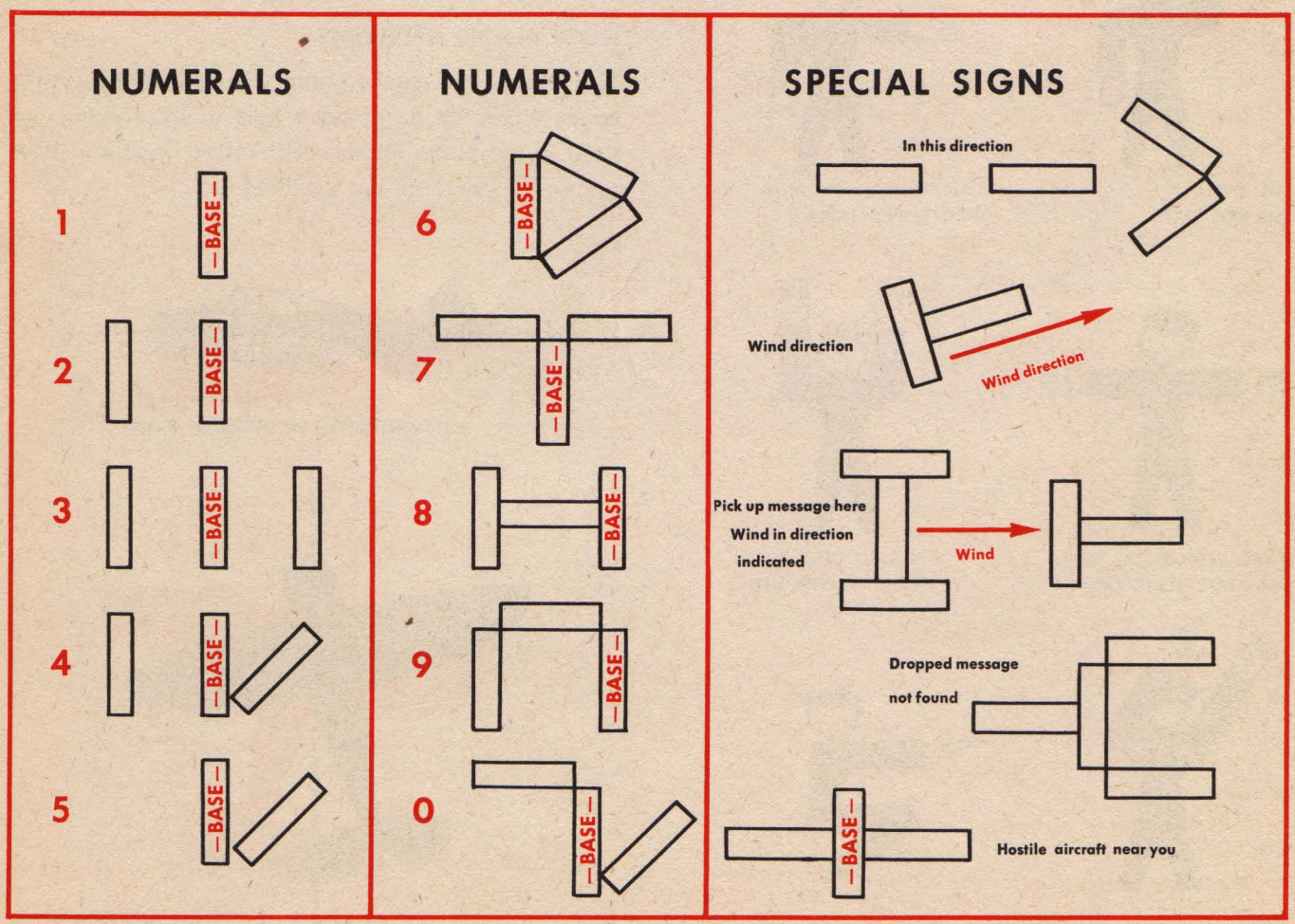
The combined panel system was designed to facilitate communications between aircraft and ground troops not equipped with radio transmitters, or when it is inadvisable for security reasons to use radio.

Panel display grounds are usually located near radio stations. This enables radio operators to use the panels whenever necessary.

The panel signalling equipment issued to a unit consists of 13 panels measuring 12 feet in length and 2 feet 4 inches in width. Each panel is provided with grommets so they may be staked to the ground. These panels are usually black or white, depending on the background available.

The illustration outlines the way in which the numerals, indicators, and special signs are joined using panel strips.



# VOCABULARY—*Essential Battle Messages*

0—OK to land here.
1—We are attacking.
2—Do not land or drop here.
3—Require food.
4—Require water.
5—Require small-arms ammunition.
6—Require medical supplies.
7—Require gasoline (petrol) and lubricants.
8—Have gained objective.
9—OK to drop here.

## INFORMATION—FRIENDLY ACTION

00—
01—Our attack has failed.
02—In position and ready to attack.
03—We are taking up defensive position in this area.
04—Held up by anti-tank obstacle (in direction indicated).
05—Our troops at—(followed by coordinates).
06—We are surrounded.
07—We are withdrawing.
08—We intend to move (direction or coordinates of new location may be indicated).
09—Am moving headquarters. (May be followed by coordinates of new location).

## PROSIGNS

10—Wait (figures may follow to indicate time).
11—I have a message for you.
12—Message received.
13—Repeat message.
14—Cancel last display.
15—Separative sign.
16—Nothing more to communicate.
17—No or negative.
18—Yes or affirmative.
19—

## COMMUNICATIONS

20—I am not receiving your signals.
21—Your signals are weak.
22—Radio not ready or unserviceable.
23—Your message not understood.
24—Are you receiving my signals?
25—I have no other means of communication.
26—Use visual.
27—Message understood.
28—
29—

## ARTILLERY OBSERVATION

30—Not ready to fire.
31—Ready to engage target.
32—Cannot engage target.
33—Check my reference.
34—I have no further need of you.
35—
36—
37—
38—
39—

## SPECIAL REQUIREMENTS

40—Require—(letter groups follow).
41—Require reinforcements.
42—Require mortar ammunition.
43—Require anti-tank ammunition.
44—Require artillery ammunition. (Numbers following code groups 42, 43, and 44 denote caliber.)
45—Require instructions for further action.
46—
47—
48—
49—

## INFORMATION—ENEMY ACTION

50—Enemy attacking.
51—Enemy in possession of landing ground.
52—Enemy at—(followed by coordinates).
53—Enemy attack has broken through.
54—Enemy attack has failed.
55—Enemy preparing to attack.
56—Enemy aircraft reported approaching.
57—
58—
59—

## INSTRUCTIONS TO AIRCRAFT

60—Reconnoiter—(in direction indicated).
61—Following is a compass direction (letter or figure groups follow denoting bearing).
62—Request direct air support.
63—Target of opportunity in direction indicated.
64—If you can see any of our forces, circle and fly in their direction.
65—Report my position to headquarters.
66—
67—Indicate nearest water by circling and flying in that direction.
68—Do not attack.
69—Drop message here.

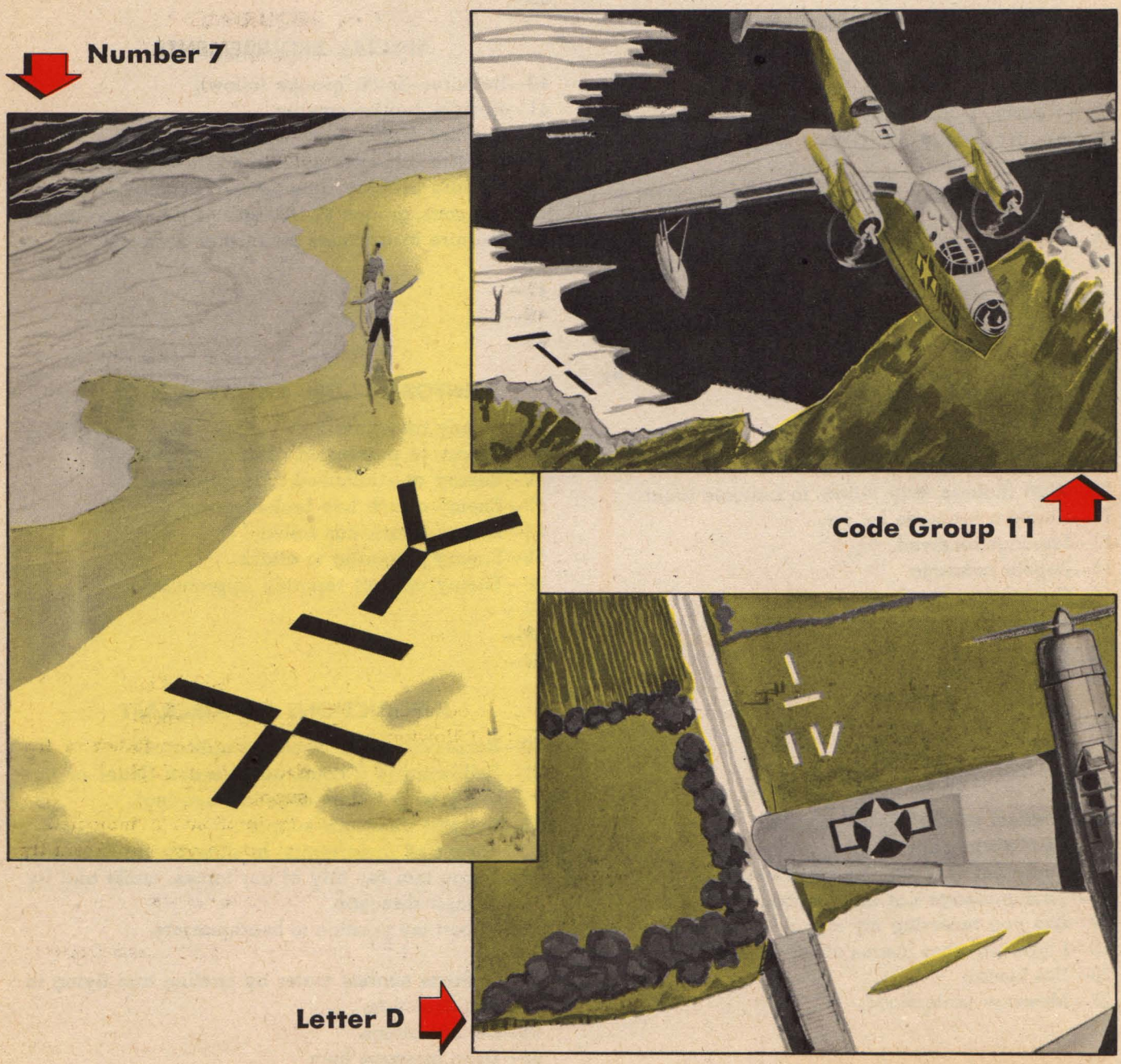
## PANEL OPERATING PROCEDURE

The FLASH index is a single panel laid at right angles to and centered above the base panels of the numerals. It is the last panel laid out upon completing a display, and indicates that the display is ready to read.

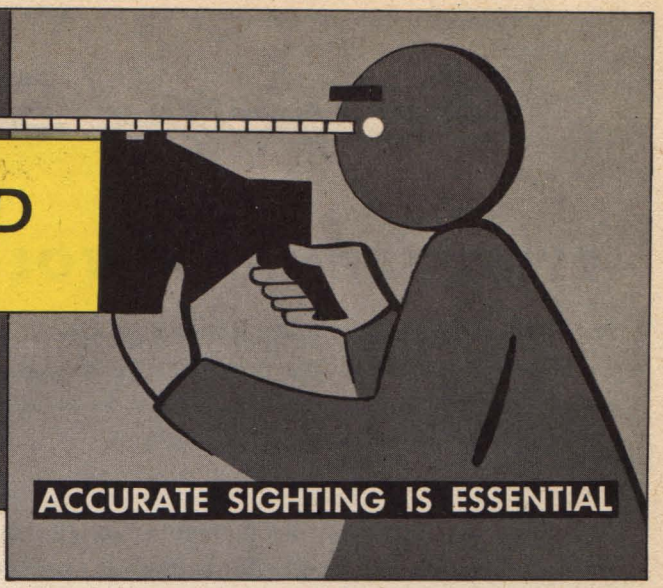
The FLASH index alone indicates that the numerals below will be read as a code group. Code groups may be translated by reference to the vocabulary furnished in this section.

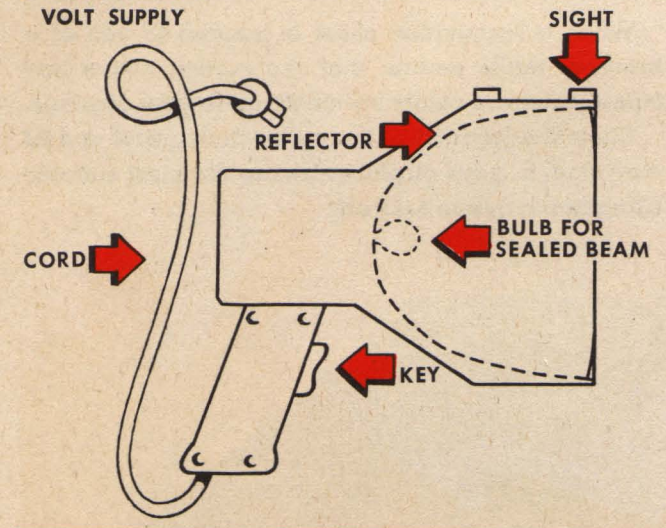
The FLASH index preceded (one-half panel length above) by the letter Y indicates that the display will be read as numerals. 1 to 26 represent respectively the 26 letters of the alphabet. The FLASH index preceded (one-half length above) by the numeral I indicates that the display will be read as letters.

Following are illustrations of the way in which the display will be jointed when they are to be read as codes, numerals, or letters.



# SIGNAL LAMP




**WARNING** — Do not flash the signal lamp using a red filter when signalling another aircraft. It might be mistaken for gun fire.

There is a variety of signal lamps in current use. The lamp illustrated is known as the Aldis Lamp (C3-A).

Basically each lamp is composed of a light bulb, a reflector, a sighting device, and a method for keying. The keying is accomplished either by making and breaking the light circuit or by opening and closing the shutter on the front of the lamp while the lamp remains lighted during use. There are four color filters available for use with the signal lamp, namely, red, green, amber, and violet.

Red and green filters are usually used for safety signals. The violet filter is designed to be used primarily for night operation of the lamp; the amber for brilliant sunlight conditions.

Identification to approaching airplane or surface vessels is made by flashing the proper signals for such craft.

An airplane should identify itself upon approaching a surface vessel. Flashing signals must be promptly answered with the proper signal, otherwise the plane unable to identify itself will be fired on.

The chart indicates the method used for visual recognition. It covers one day's operation. Pyrotechnic pistol cartridge colors are also indicated. Their abbreviations are, R for red, G for green, and Y for yellow.

## VISUAL RECOGNITION CHART

| DATE | TIME G M T | BLINKER CHALLENGE OR REPLY | | PYROTECHNIC PISTOL COLORS |
|---|---|---|---|---|
| | | SURFACE CRAFT | AIRCRAFT | |
| 11-15-44 | 0004 | B | N | R-R |
| | 0408 | Y | S | G-Y |
| | 0812 | T | O | R-G |
| | 1216 | X | V | Y-Y |
| | 1620 | R | Z | R-Y |
| | 2024 | N | H | G-G |

# Recognition Signals

## PYROTECHNIC PISTOL—Aircraft Type

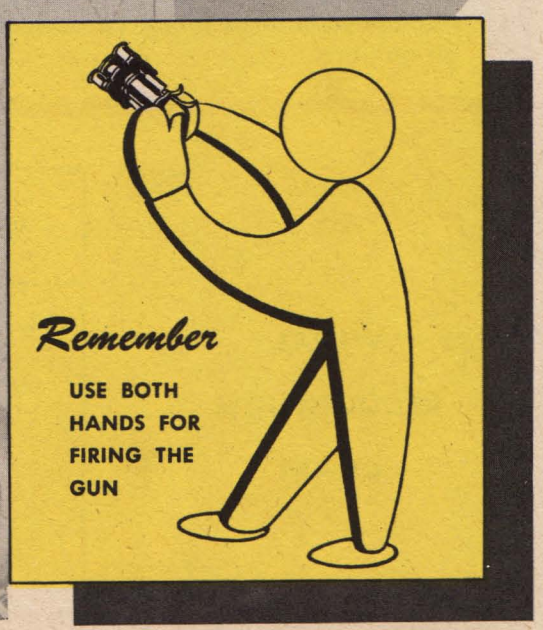
This type of pyrotechnic pistol is designed especially for airborne operation. The barrel of it is equipped with a locking device which permits it to be fired from a special firing hatch in the airplane.

The firing hatch prevents flarebacks into the airplane and absorbs the recoil, which permits the pistol to be fired with one hand. If there is no firing hatch in your airplane, great care must be exercised when firing the pistol. It should be fired straight up or down. The bomb-bay doors or upper hatches are the best positions from which to fire. In some medium bombers, a flare chute or flare hatch may be provided. These also make excellent firing hatches. Be sure cartridges will clear the airplane before firing. The pistol could be held in one hand without the use of a firing hatch, but due to its severe recoil, it is recommended that both hands be used. The cartridges are discharged by percussion, hence they should be protected from moisture so their nonmetallic cases do not become softened.

When a recognition sheet is handed to you at a briefing, make certain that the correct colors and combinations of colors specified are in your airplane.

Know the location of the pyrotechnic pistol and its cartridge, in your airplane. Locate the most suitable firing hatch before take-off.


AIRCRAFT TYPE



# DIRECTION FINDING

There are four types of Direction Finding. They are classified according to the frequency the radio operator uses to reach the DF station.

1. Low-frequency (LF/DF) 30 kc to 300 kc
2. Medium-frequency (MF/DF) 300 kc to 3000 kc
3. High-frequency (HF/DF) 3000 kc to 30 mc
4. Very-high-frequency (VHF/DF) 30 mc to 300 mc

Direction finding facilities are available to you in all theaters of operations. In the AAF, these facilities consist of fixes (QTF), magnetic course to steer (QDM), and true course to steer (QUJ).

When you request a fix, a master control station alerts a net and instructs it to sense bearings on your airplane. The net stations report these bearings at once to the master control station. There the operator projects them on a map, and transmits to you the **position at which the lines intersect.** This was your approximate position at the time the bearings were taken.

The DF station also specifies the degree of accuracy of any bearing or position (fix) it gives you. For this purpose, both bearings and fixes are divided into three classes and designated A, B, or C. Here are the limits within which you can regard these classes as accurate:

**Bearings**

A . . . . . Plus or minus 2 degrees
B . . . . . Plus or minus 5 degrees
C . . . . . Liable to an error exceeding plus or minus 5 degrees.

**Positions (Fixes)**

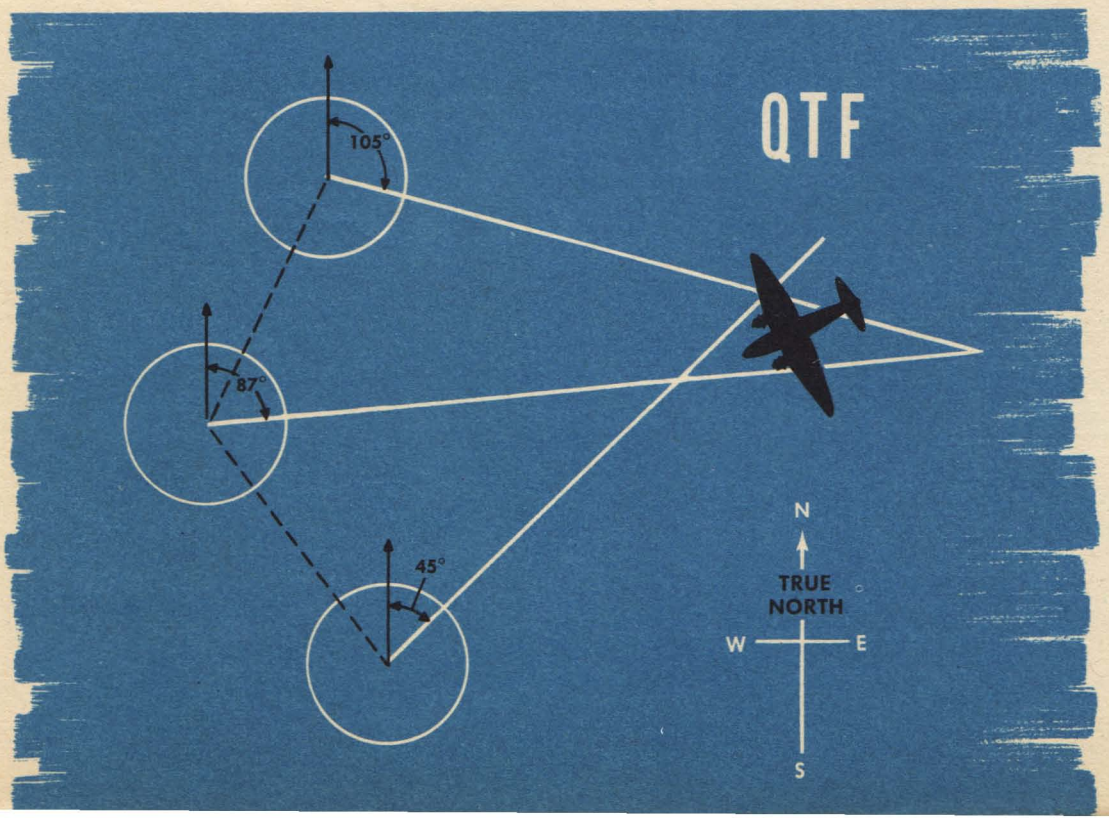
A . . . . . Within 5 miles
B . . . . . Within 20 miles
C . . . . . Liable to an error of more than 20 miles. If the error exceeds 50 miles you will be told so.

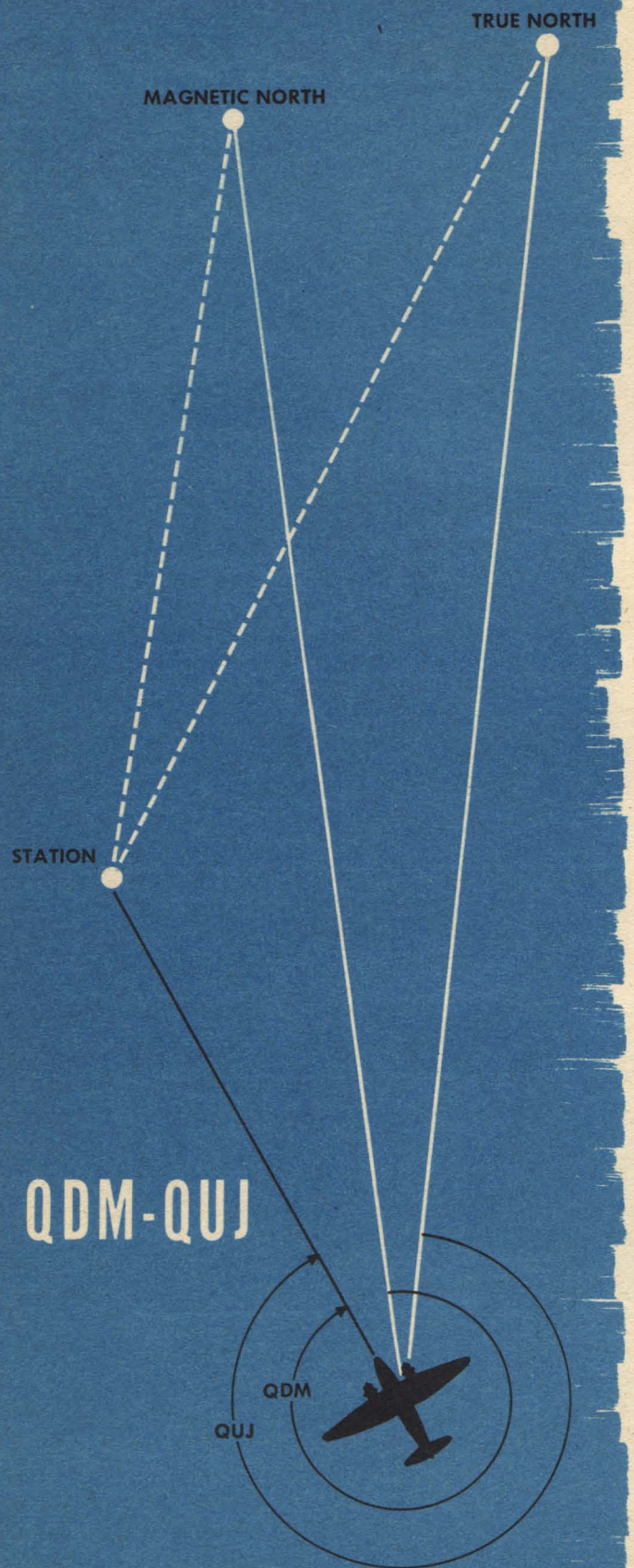
DF stations may refuse to give you a course or position if you fail to give them proper authentication, or otherwise transmit unsatisfactory information. However, if you give them as much help as possible, they will always furnish you the best information they can.

If a DF station is not ready to give you a course or fix, the operator will tell you to wait. As soon as he can handle your request, he will notify you.

Here is an example of how to obtain a position fix by CW:

**Airplane:** WYYY V 9WV $\overline{\text{INT}}$ QTF K
**DF station:** 9WV V WYYY K
**Airplane:** WYYY V 9WV (20-second dash) 9WV K






# QDM-QUJ



**DF station:** 9WV V WYYY AS AR (indicates airplane is to wait while fix is plotted).

**DF station:** 9WV V WYYY QTF 3315N 733ØW A 1745Z IMI QTF 3315N 733ØW A 1745Z K

**Airplane:** WYYY V 9WV QTF 3315N 733ØW A 1745Z K

**DF station:** 9WV V WYYY C AR

If the DF station is busy or must be alerted and cannot give you an immediate fix, it will reply to your original call as follows: 9WV V WYYY AS AR. When the station is ready, it will transmit the message 9WV V WYYY K.

Here is an example of the CW procedure for obtaining a QDM (magnetic course to steer with zero wind to reach the ground station) or a QUJ (true course to steer).

**Airplane:** WYYY V 9WV INT QDM (or QUJ) K

**DF station:** 9WV V WYYY K

**Airplane:** WYYY V 9WV (20-second dash) 9WV K

**DF station:** 9WV V WYYY QDM (or QUJ) Ø75 A 1745Z K

**Airplane:** WYYY V 9WV QDM (or QUJ) Ø75 A 1745Z K

**DF station:** 9WV V WYYY C AR

Note that your call sign is transmitted after your 20-second dash. If a DF station requires more than one dash it will ask for them by sending 9WV V WYYY QTN2 (or 3, etc.) K.

The airplane replies with WYYY V 9WV (20-second dash) 9WV (20-second dash) 9WV K.

When the DF station comes back with 9WV V WYYY AS AR, follow the initial contact procedure.

Use one of the following procedures to request a course or fix **by voice.** In this example **Viola** is the airplane call word and **Ginger** is that of the station.

1. **Airplane:** Ginger—this is Viola—Request fix (or magnetic or true course). Over.

(Or)

2. **Airplane:** Ginger — this is Viola — Request Queen Tare Fox (or Queen Dog Mike, or Queen Uncle Jig). Over. (Use of Q signals is optional.)

The DF station gives any necessary instructions, and says, "Transmit for fix (or course). Over."

The airplane replies, "Ginger—this is Viola—Transmitting for fix (or course). Over."

To transmit for a fix:

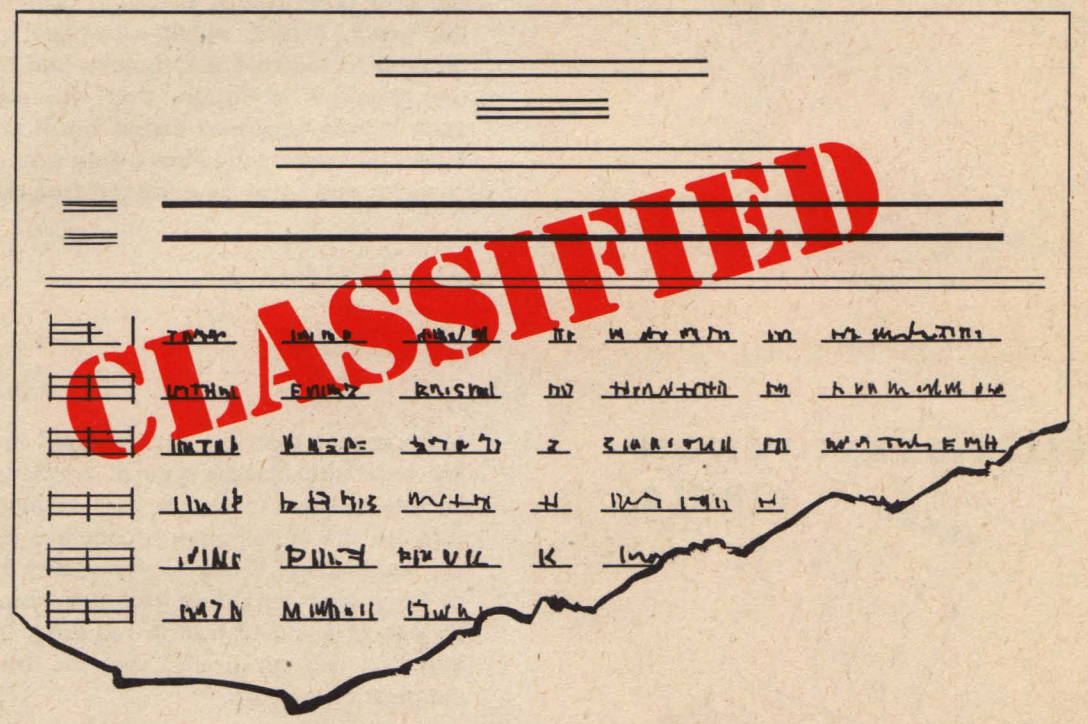
**On VHF,** count 1 to 5 and back.

**On HF,** transmit a 20-second dash by holding down the microphone button switch.

When authentication is required, be sure you know and follow the system locally in use.

Check with Base Communications Officer, and SOI or Route Guide for further DF procedures.

# Cryptographic PUBLICATIONS




Normally the average radio operator considers that air-to-ground communication is simply a conversation either by radio-telegraph or radio-telephone to a ground station. However, to achieve surprise it is necessary to conceal from the enemy the contents of messages.

The concealment of the clear text of a message is performed through the use of a cryptographic system. A cryptographic system may be extremely simple and locally prepared, or it may be more elaborate and afford a very high degree of security.

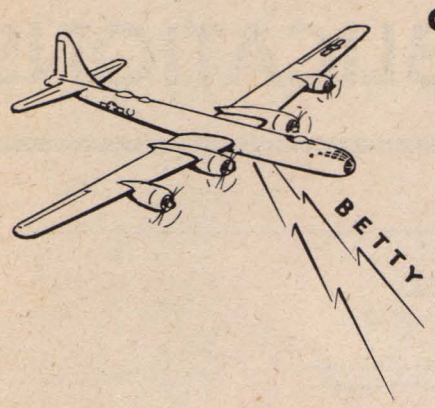
A cryptographic system will enable you to advise the ground station of the: type and number of enemy aircraft; the condition of your operating equipment; the nature of an objective; your exact position; or the amount of enemy resistance encountered. It may enable the unit commander at the ground station to give the aircraft a bearing, furnish additional combat information or intelligence, advise of enemy aircraft which might intercept the mission, or simply cancel the mission and advise the aircraft to return.

There are three fundamental types of systems which are employed in theaters of operations for air-ground communications. Possibly, you, as a radio operator, will encounter all three of these systems. It is the intent of this document to furnish you as much information as possible concerning these systems. The complete details of the structure, method of operation, and procedure employed, unfortunately, cannot be explained in a document bearing this Restricted classification.

In your service as a radio operator you may find yourself assigned to a theater of operations in which all three of the fundamental types of cryptographic systems are employed.

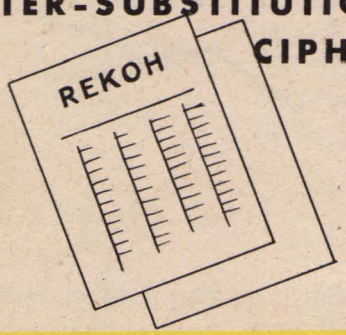
# CODE SYSTEMS

## ★ PREARRANGED MESSAGE CODE



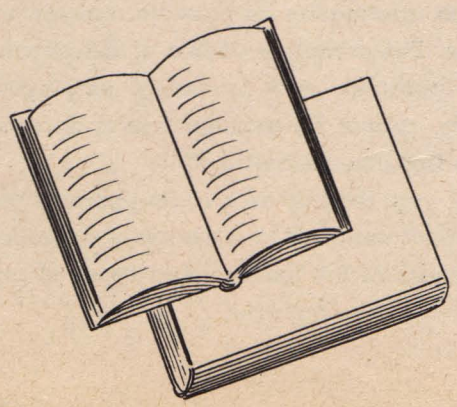

The prearranged message code is usually prepared locally and consists of one, two, or more random selected letters or numerals which represent a complete sentence or thought. Thus a prearranged message code might have a symbol "RUG" which, when transmitted by the radio operator will indicate to the ground station "Bombs away on primary objective. Opposition nil. Returning." Another famous example of a prearranged message code was the use of the word *"Betty,"* which was used by a B-29 commander to indicate that bombs had been loosed on the objective in Japan. You will encounter many such locally prepared codes, but it must be remembered that such codes have only a limited amount of security and must be changed frequently.

## ★ LETTER-SUBSTITUTION CIPHER




More secure than the prearranged message code is the letter-substitution type of cryptographic system. In this system the clear text is made unreadable through the substitution of another letter for one in the legible text. Such systems may be very simple or they may be rather complex, depending on the degree of security that is required. In general, you will find that air-ground systems are limited to the simplest types only.

## ★ VOCABULARY CODE



The vocabulary code is the type most often met and used by radio operators in certain theaters. This type of code consists of a book which resembles an abridged or shortened dictionary with two columns, one in code and the other in clear text, words, or messages. The words in this vocabulary are best suited to meet the tactical and operational needs of military aircraft in flight and in combat. The security of a vocabulary code depends very much on the amount of use that is made of it. In some theaters a vocabulary is changed every 10 days; in others every 5 days, and in one very active theater the vocabulary codes are changed daily.

# SAFEGUARDING CLASSIFIED MATERIAL

Military information and devices are classified as top secret, secret, confidential, or restricted. All classified material is clearly marked with its classification. If it is not so marked, it is unclassified. Treat all classified material as follows:

### Top Secret

May be read or handled only by specifically designated persons. No one may have access to it merely because of his rank or office. Special procedures for handling top secret material are covered by letter instructions to the people concerned.

### Secret

Only persons directly concerned should read it. It should be discussed only with those who may read it. It must be kept in a 3-combination safe when not in use. It must be mailed in two envelopes, an inner envelope addressed properly and marked or stamped **Secret;** an outer envelope addressed properly, **but with no marking to indicate its classification. Send it by registered mail.**

To destroy secret or confidential material, burn it, or use an approved shredding machine. Until you can do one or the other, tear it in small pieces and safeguard it as you would the original material.

### Confidential

May be read only by persons in the military establishment and by civilians whose duties require that they read it. It may be discussed with those authorized to read it, **but never over the telephone.** Mail and guard it the same as secret material.

### Restricted

May be read by, and discussed with anyone whose loyalty is unquestioned. It is never to be released for publication, or discussed with the general public. It is to be kept in a guarded area, behind locked doors, or in a safe.

Mail by first class mail unmarked.

To destroy, tear up the material before throwing it into a wastebasket.

### Inspection

At every Headquarters an inspection will be made each day immediately before closing to insure that classified material is properly taken care of.

### Classified Equipment

When forced down in or near enemy-held territory, destroy all classified equipment, either by using detonators if installed, or by manual means. Make certain that the essential parts of such equipment are destroyed beyond recognition.

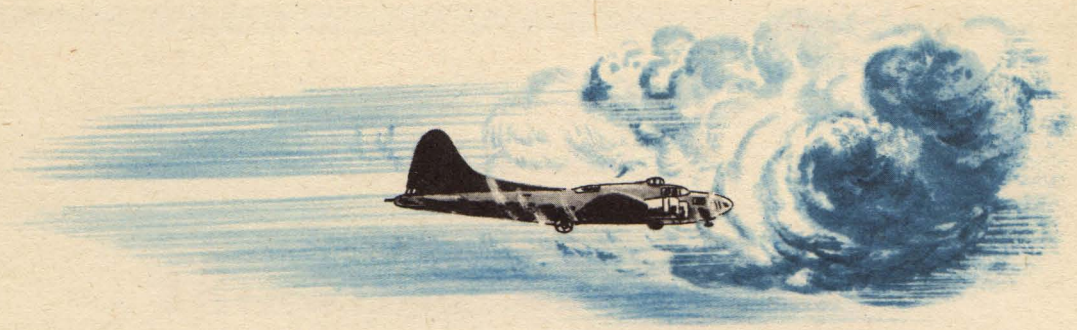
### Codes and Ciphers

You, as radio operator, have control of the one contact between the airplane and ground stations. You must be sure that what you transmit is properly enciphered and encoded, and that you follow the correct radio procedure. **Don't** give the enemy any clue to the purpose of your mission, or any other information that will be helpful to him.

Codes, ciphers, and certain other classified materials are issued to you by the pilot. You are responsible to him for their safety.

Remember that these codes and ciphers are being used by many planes operating in your own theater, and even in others. Therefore, the safety of many lives and missions depends on your safeguarding the material entrusted to you.

**Always** report the loss, or compromise, of any document immediately. Compromised codes and ciphers are usually useless, and other units employing them must be notified quickly.



# WEATHER CODES

Weather reports are transmitted by code whenever the military situation makes it necessary to classify them. You are concerned primarily with two types of weather code:

1. **In-flight** weather reports, which relay weather observations from plane to ground stations. Aircraft Weather Reports and United Nations Ferimet are used for this purpose.

2. **Landing** reports, which relay weather information about landing conditions from ground stations to the airplane. For this, you generally use UCO (Universal Landing Code) forms or its simplified version UCOPAC.

## IN-FLIGHT WEATHER REPORTS

### WAF-2 Forms

The master Aircraft Weather Report form is called WAF-2. Usually an extract or modification of it, rather than the form itself, is carried in the airplane. There are a number of modifications of WAF-2 since different portions of the form are needed in different theaters. The forms most widely used are WAF-3 and the 25 Series (25P, 25Q, 25R, etc.).

### False Subtraction

In order to use WAF codes, you must understand the principle of false subtraction. In false subtraction, each of the lower digits is **subtracted directly** from the digit above it. If the lower digit is the smaller, subtract in the normal way. If the lower digit is the greater, **add 10 to the upper digit,** and subtract. For example, if 3 is to be subtracted from 2, the result is 2 + 10 −3, or 9. Treat each column individually, even though the numbers may contain 2 or 3 digits.

| | | |
|---|---|---|
| 3 | 11 | 123 |
| 7 | 72 | 467 |
| 6 | 49 | 766 |

False subtraction is not required when the upper digit is already larger than the lower digit, for example:

| | | |
|---|---|---|
| 9 | 37 | 428 |
| 3 | 23 | 216 |
| 6 | 14 | 212 |

In some cases, both normal and false subtraction are called for in the same problem. Handle each column by itself, using whichever kind of subtraction is necessary.

| | | | |
|---|---|---|---|
| 29 | 93 | 123 | 747 |
| 33 | 27 | 217 | 392 |
| 96 | 76 | 916 | 455 |

### Use of WAF Code Forms

The section of a WAF form with which you are chiefly concerned is shown on page 3-9-2. The top line of this section consists of standard weather symbols (YY for the date, LLL for latitude, lll for longitude, etc.). These are not coded symbols, but are in general use as weather symbols.

The second line contains the **cipher** numbers, entered in red by the weather station officer before you take off.

During the flight, the pilot or navigator fills in the third line (or furnishes you) with the coded numbers of his weather report.

The numbers of the fourth line are the difference **by false subtraction,** between the coded weather report numbers and the cipher numbers above them. **This is the message you transmit.**

| | YY LLL | lll GG | Q hhh $F_c$ | B dd vv | ww WW V | 1 C n HH | 2 C n HH | 3 C n HH |
|---|---|---|---|---|---|---|---|---|
| CIPHER | 09 352 | 706 91 | 2 474 5 | 9 22 18 | 77 96 4 | 3 9 8 01 | 5 0 8 62 | 7 9 2 41 |
| REPORT | 14 227 | 559 15 | 1 109 1 | 1 14 14 | 10 81 7 | 1 7 3 25 | 2 7 3 08 | 3 2 8 12 |
| TRANSMIT: 15092 | 95 135 | 257 86 | 1 375 4 | 8 18 04 | 67 15 7 | 2 2 5 86 | 3 3 5 64 | 4 7 4 39 |

| 4 C n HH | 6 $P_d$ $d_w$ TT | 8 $I_c$ ww $D_w$ | 9 D F S $D_k$ | 0 PPPP | |
|---|---|---|---|---|---|
| 2 3 9 21 | 7 7 6 32 | 4 0 95 6 | 1 7 8 6 3 | 0 2579 | CIPHER |
| 4 2 8 14 | 6 4 5 04 | 8 0 81 6 | 9 1 2 3 1 | 0 0000 | REPORT |
| 8 1 1 17 | 1 3 1 38 | 6 0 14 0 | 2 6 6 3 2 | 0 2579 | 15092 TRANSMIT |

To send the message:

1. Start the text of your message with the **cipher indicator,** a 5-letter group entered in red at the left of the TRANSMIT line of the form.
2. Send the **results of the false subtraction,** in 5-letter groups.
3. Repeat the cipher indicator.

Note that there are as many figures for each weather element as there are letters assigned to it in the standard symbols of the top line. Thus, YY (date of the month) would be encoded 01 for the first day of the month; GG (time) ould be encoded 08 for 0800 GCT, etc. Encoding tables appear on the forms.

Here is an explanation of the data included in the first five weather groups of the WAF-3 form at the top of the page.

Date — 14 — encode YY as 14.

Latitude — 227 — encode LLL as 227.

Longitude — 155.9 — encode lll as 559.

Time — 1455 GCT — encode GG as 15.

Octant — 1 — encode Q as 1.

Altitude — 10,900 ft. — encode hhh as 109.

Flight conditions — contact flight — encode $F_c$ as 1 below clouds.

Turbulence — slight — encode B as 1.

Wind direction — 145° from north — encode dd as 14.

Wind velocity — 14 knots per hour — encoded vv as 14.

**Each WAF form is marked with its proper classification. Be sure you know and observe the regulations for safeguarding it.**

Present weather — precipitation within sight — encode ww as 10.

Past weather — moderate showers — encode WW as 81.

Visibility — 8 miles — encode V as 7.

**Note:** On the backs of WAF forms there are spaces in which you can enter any terminal conditions or forecasts you request from stations along your route.

### United Nations Ferimet

This is a simplified, automatic enciphering form used to record and report weather during flight. Enter the following items in this way:

**Wind direction:** Record the nearest 10 degrees.

**Wind force:** Record in knots.

**Cloud conditions:** Amount of cloud both above and below the airplane.

**Weather conditions:** Report hazardous conditions.

**Time of observation:** Enter the nearest 10 minutes, omitting the final zero.

**Remarks:** Enter additional information not covered by other entries.

Circle the correct figure for each weather element.

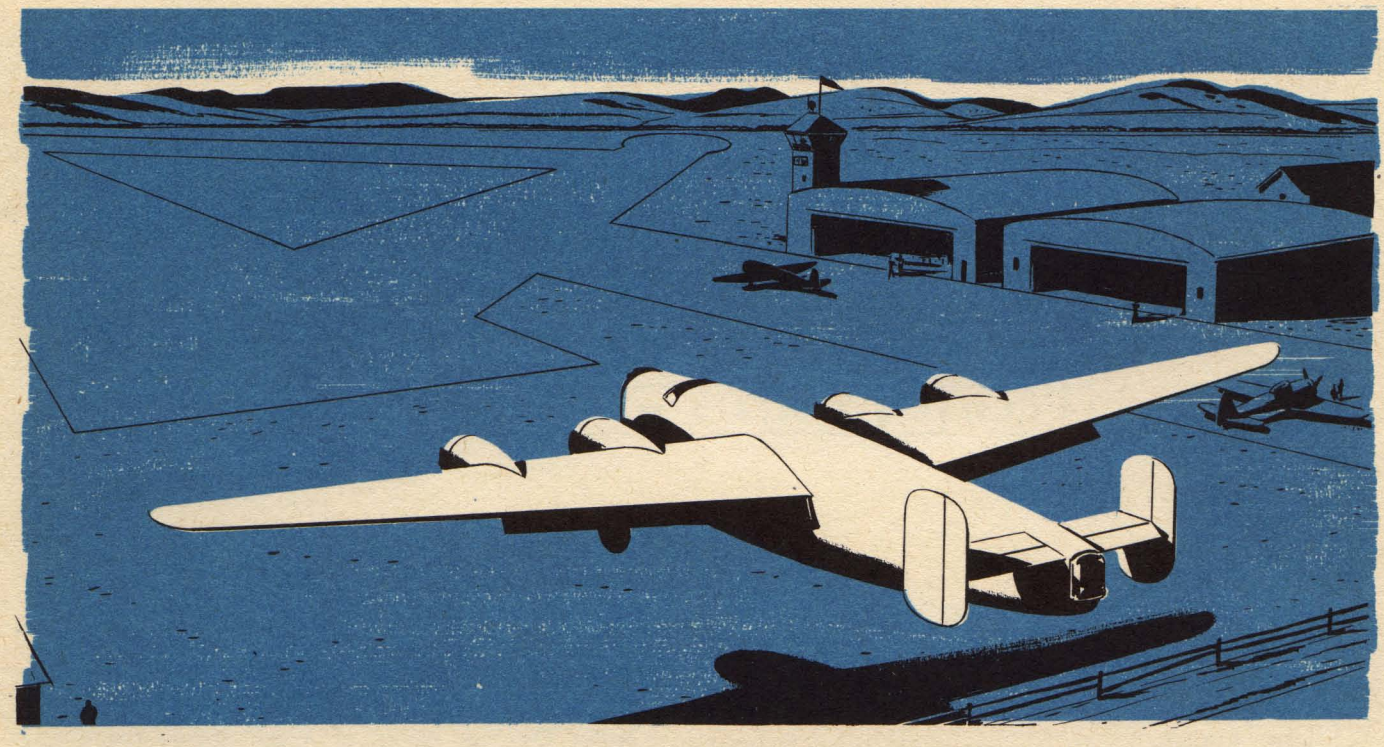
Enter these figures in the proper columns at the bottom of the form.

Transmit the horizontal row of figures. This is your weather report.

## AIRCRAFT LANDING CODE FORMS

### Universal Landing Code

The Universal Landing Code (or UCO) forms are used to encode weather observations made at ground stations and transmitted on request to airplanes in flight. Reports are filed at the station, and the operator can answer requests immediately.



As a general rule, observations encoded in UCO are made on the hour and on the half hour. Special observations are made as conditions require them.

UCO forms vary according to the needs of the theaters in which they are used.

Here are some points to remember when you decode an observation in UCO:

1. Each item of the observation is identified by a number.

2. The altimeter setting is given in 4 numbers; that is, in whole inches, tenths, and hundredths.

3. All other observations are reported by single code letters.

4. When Item 7 is reported as a letter which designates a sky-condition symbol, Item 8 is omitted.

5. Item 10 (visibility over the sea) is not reported by inland stations.

Here is the CW procedure to use when you request weather by UCO:

If you wish a complete weather report, call the ground station and transmit $\overline{\text{INT}}$ QAM, the code word UCO, and the call letters of the weather station from which you want the observation. The ground station will reply with QAM UCO, and the complete report. The number of each item in the UCO form precedes the encoded observation.

**Airplane:** WYYY V CGBQ $\overline{\text{INT}}$ QAM UCO WYTD K.

**Ground:** CGBQ V WYYY QAM UCO WYTD 123ØZ 4 2991 5N 6S 7H 8D 9T 1ØT 11E 12C 13D 14B 15A 16S 17J $\overline{\text{IMI}}$ 4 2991 5N 6S 7H 8D 9T 1ØT 11E 12C 13D 14B 15A 16S 17J K.

If, however, you need only certain selected items of weather, ask for them by number immediately after the code word UCO:

**Airplane:** WYYY V CGBQ $\overline{\text{INT}}$ QAM UCO ITEMS 5 7 WYTD K.

**Ground:** CGBQ V WYYY QAM UCO WYTD 123ØZ 5N 7H $\overline{\text{IMI}}$ 5N 7H K.

### UCOPAC

The UCOPAC code, used in the Pacific, is a modification of the basic UCO. It is a cipher device for landing weather reports, and may be used both for requests and replies. UCOPAC is also often used for scheduled broadcasts of terminal weather conditions.

**UCOPAC may not be used for air-to-ground reports.**

The UCOPAC device is a slotted frame on which are printed a number of items of weather information. A sliding card (UCOPACARD), covered with numerical and alphabetical scrambles, fits into the frame. These cards are changed daily.

Set the card according to the ground station's encoded weather report. You can then read the

**UCOPACARDS are classified. Their classification always appears on them. Treat them accordingly.**

correct weather information on the UCOPAC frame, which carries partial instructions for its use.

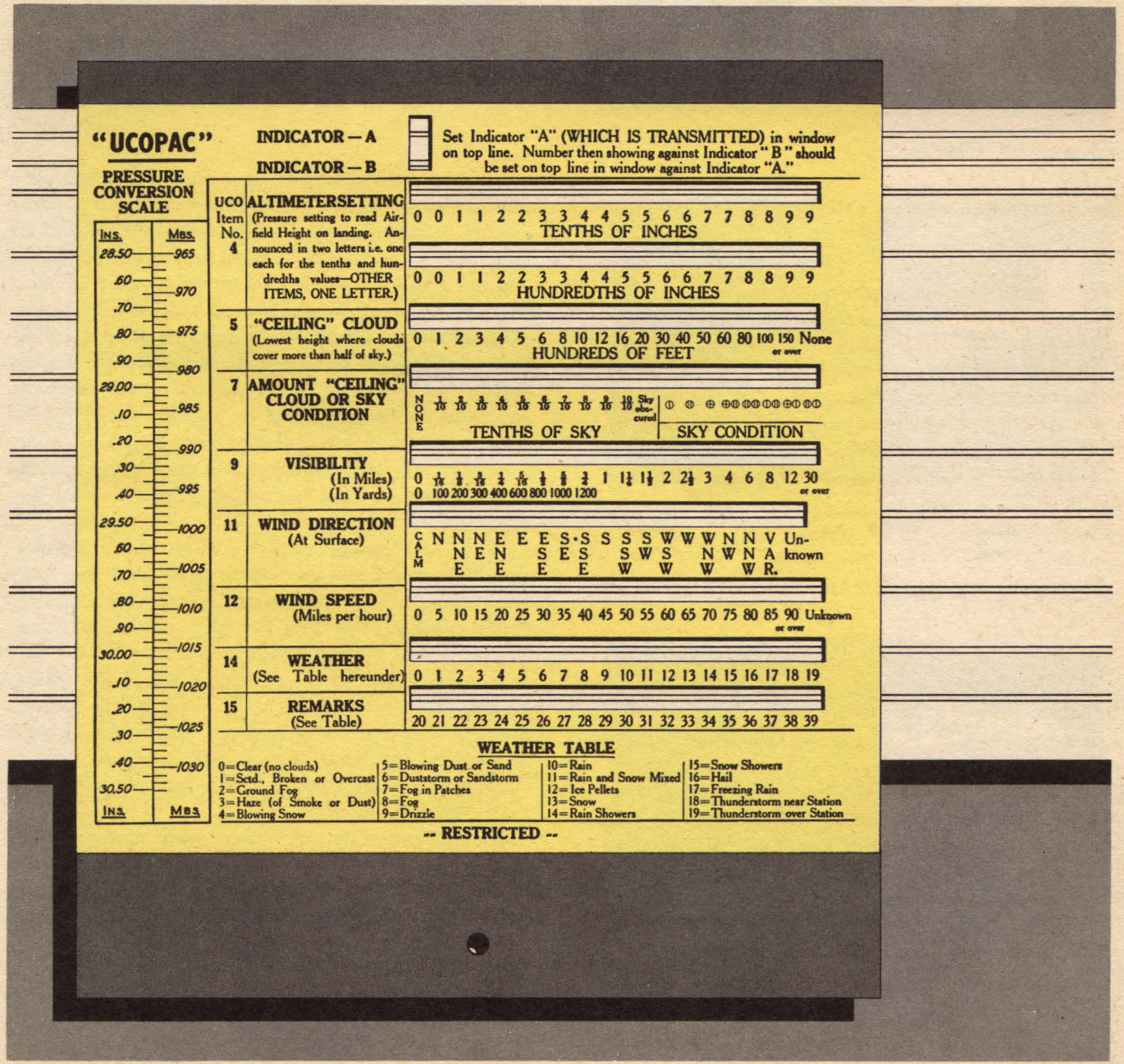
**Consult your weather briefing officer for more detailed instructions on this and other weather codes.**

To request a UCOPAC weather report:

Call the ground station in the usual way. If you want a weather report **from the station you are calling,** send the word UCOPAC, then the day number (twice) of your UCOPACARD. That is, if the card is for the 16th of the month, send UCOPAC 16 16.

If you want a weather report from a station **other than the one you are calling,** follow the date with its name, thus: UCOPAC 16 16 BRISBANE.

If you want an individual UCOPAC item, add the number of the item as it appears on the UCOPAC frame, thus: UCOPAC 16 16 ITEM 4.



**AUTHENTICATE**

**Plane to Plane**

**Plane to Ground**

**Ground to Plane**

# MESSAGE AUTHENTICATION

Message authentication is a means of assuring a station that messages it receives come from friendly sources. It is also used to assure transmitting stations that their messages have reached friendly stations.

Some method of authentication is used in most theaters of operations. Local conditions determine whether or not all messages must be authenticated. Those containing instructions, for example, usually require it. In combat areas, however, **any message you send or receive** must be authenticated by the system locally in effect. Remember that the enemy is monitoring your messages. He may try to mislead you. **Be sure** you are in contact with a friendly station.

Types of message authentication vary considerably. In general the procedure is to send the operating signal QKA, followed by an authentication group based on the time (usually the time of transmission), and certain prescribed letters of the text or message heading. You can find the proper group by taking these variables and consulting the authentication table currently in force. Each type of table is designed to serve a particular purpose, and to allow for enough variety within itself to afford security from the enemy.

Some theaters do not require each message to be authenticated by a procedure such as the one above. Instead, they provide a pre-arranged table of challenges and replies which radio stations exchange when there is any doubt of their identity.

**Always** find out from your briefing officer the authentication procedure you must use. **Never** start on a mission without obtaining from him the effective authentication code.

## THE PHONETIC ALPHABET

Below are the words of the phonetic alphabet. They are of utmost importance and should be learned thoroughly. When necessary to identify any letter of the alphabet or to spell a word, use the phonetic alphabet.

| LETTER | SPOKEN AS | LETTER | SPOKEN AS |
|---|---|---|---|
| A | Able | N | Nan |
| B | Baker | O | Oboe |
| C | Charlie | P | Peter |
| D | Dog | Q | Queen |
| E | Easy | R | Roger |
| F | Fox | S | Sugar |
| G | George | T | Tare |
| H | How | U | Uncle |
| I | Item | V | Victor |
| J | Jig | W | William |
| K | King | X | X-ray |
| L | Love | Y | Yoke |
| M | Mike | Z | Zebra |

Difficult words will be both spoken and spelled, for example: "Solved—I spell— Sugar Oboe Love Victor Easy Dog—Solved."

## PRONUNCIATION OF NUMBERS

When you transmit numbers by radio telephone use the following standard procedure.

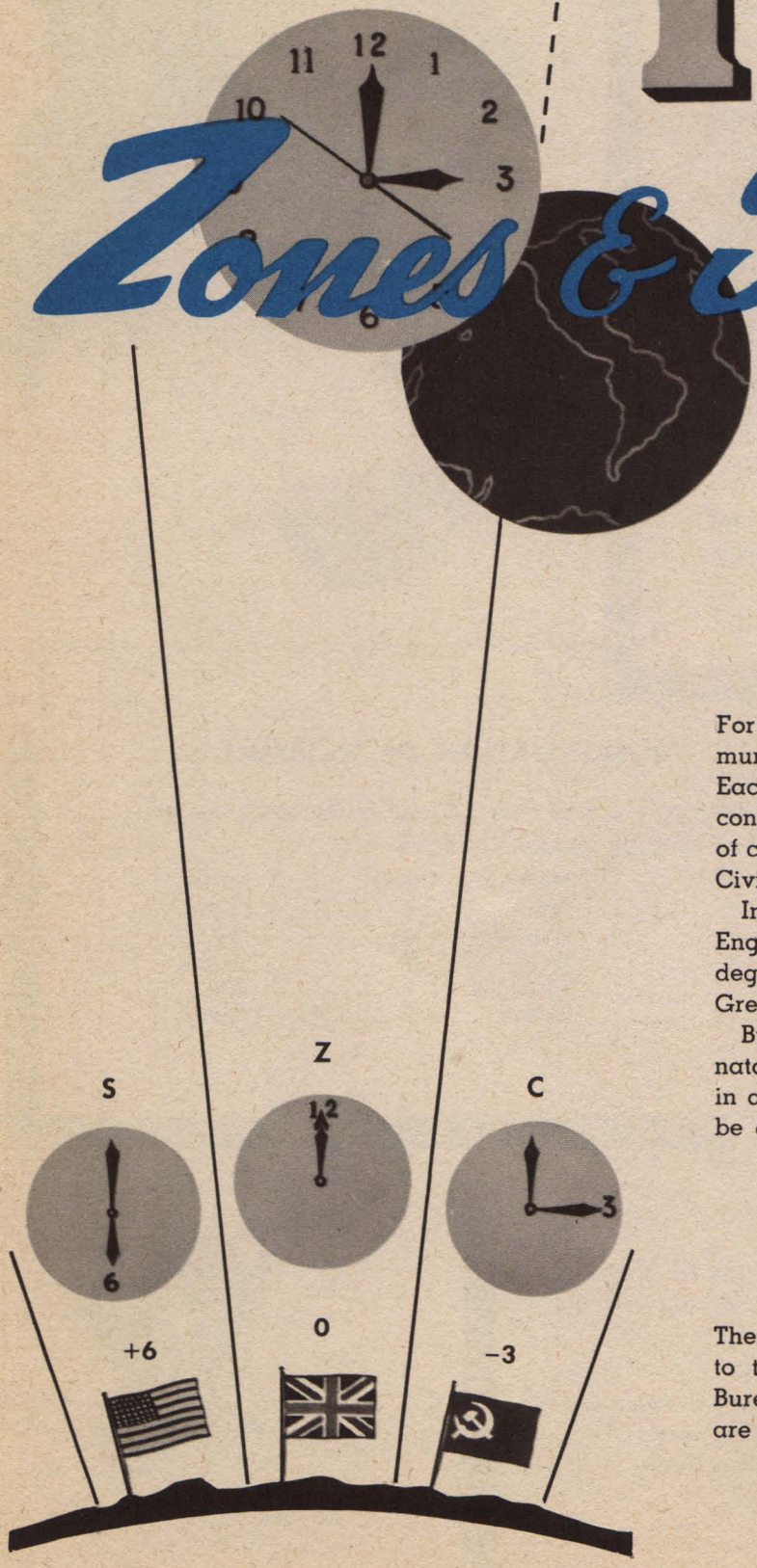
| NUMERAL | SPOKEN AS | NUMERAL | SPOKEN AS |
|---|---|---|---|
| 0 | Ze-ro | 5 | Fi-yiv |
| 1 | Wun | 6 | Six |
| 2 | Too | 7 | Seven |
| 3 | Thuh-ree | 8 | Ate |
| 4 | Fo-wer | 9 | Niner |

## STATEMENT OF TIME

State time in exactly 4 numbers using the 24 hour clock. State the hour by the first two numbers and the minute by the last two numbers.

| TIME | STATEMENT |
|---|---|
| 0000 (midnight) | Time, zero zero zero zero |
| 0920 (9:20 A.M.) | Time, zero nine two zero |
| 1643 (4:43 P.M.) | Time, one six four three |

# TIME Zones & Signals




## TIME ZONES

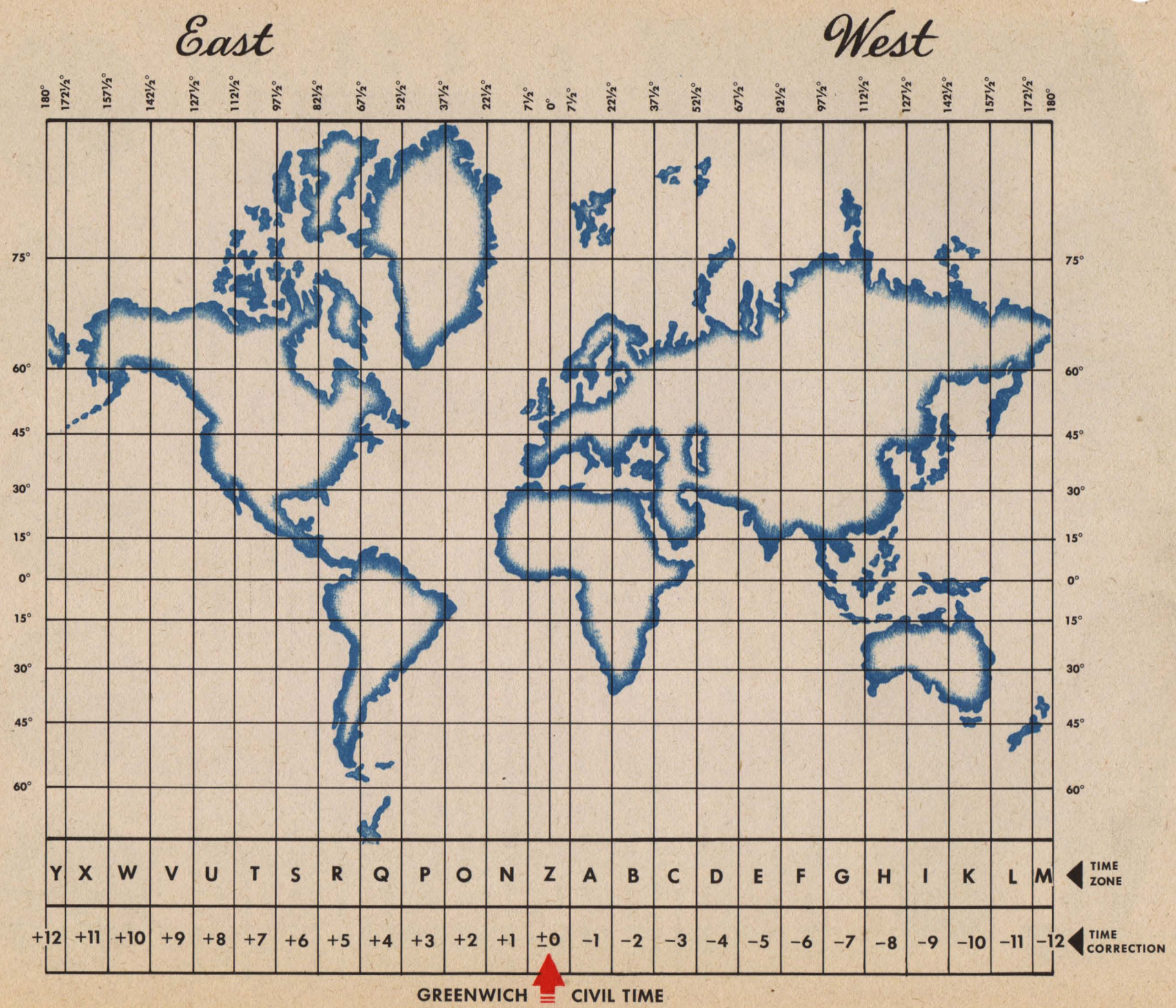
For the purpose of computing time, in military communications, the world is divided into 25 zones. Each zone is given a letter designator to be used in conjunction with a correction chart, for the purpose of converting time in the various zones to Greenwich Civil Time.

In this system of computing time, Greenwich, England, is considered zero meridian. The area 7½ degrees east and west of 0 meridian, covered by Greenwich Civil Time, is designated Zone Z.

By reference to the time chart, the time-zone designator and correction to be applied to the local time in any given zone, to convert it to GCT, may easily be determined.

## TIME SIGNALS

There are various sources of correct time available to the radio operator. The most frequently used, Bureau of Standards and Naval Observatory Times, are outlined in detail for your convenience.


East
West
180° 172½° 157½° 142½° 127½° 112½° 97½° 82½° 67½° 52½° 37½° 22½° 7½° 0° 7½° 22½° 37½° 52½° 67½° 82½° 97½° 112½° 127½° 142½° 157½° 172½° 180°
75°
60°
45°
30°
15°
0°
15°
30°
45°
60°
Y X W V U T S R Q P O N Z A B C D E F G H I K L M
TIME ZONE
+12 +11 +10 +9 +8 +7 +6 +5 +4 +3 +2 +1 ±0 −1 −2 −3 −4 −5 −6 −7 −8 −9 −10 −11 −12
TIME CORRECTION
GREENWICH CIVIL TIME


## NAVAL OBSERVATORY TIME SIGNALS

The United States Naval Observatory at Washington, D. C., transmits accurate time signals 11 times daily from 4 different stations. These stations are strategically located in the United States and its possessions.

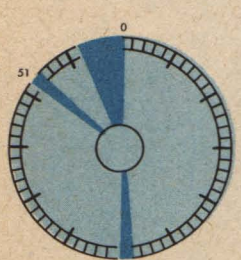
Time signals are transmitted for 5 minutes beginning at 55 minutes 00 seconds of the scheduled hour. During each of these 5 minutes there are 29 dashes followed by a pause 1 second long. This pause is to warn you that the beginning of the next dash marks the beginning of the half minute. There will then be another series of dashes followed by another pause. This pause is to warn you that the number of dashes following it indicates the number of minutes left in the hour. If 4 dashes follow the pause, there are 4 minutes left; if there are 3 dashes, there are 3 minutes left; these dashes are followed by a 4-second pause. The dash at the end of this pause marks the beginning of another minute. After the 51st second of the 5th or last minute of this time check there will be a 9-second pause followed by a long dash, the beginning of which indicates the exact scheduled hour.

The blue portions in the diagram indicate the pauses in the transmission.

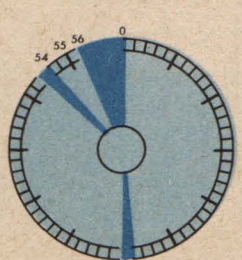
## SCHEDULE OF NAVY TRANSMISSIONS

| TIME (GMT) | STATION | FREQUENCY KC |
|---|---|---|
| 0000 | NPG | |
| 0300 | NPG | 9090, 12540 |
| 0400 | NSS | 4390, 9425, 12630 |
| | NPM | 9090, 12540 |
| 0500 | NBA | 5540, 11080 |
| 1000 | NSS | 4390, 9425, 12630 |
| 1500 | NPG | 9090, 12540 |
| 1600 | NSS | 4390, 9425, 12630 |
| | NPM | 9090, 12540 |
| 1700 | NBA | 5540, 11080 |
| 2000 | NPM | 9090 |
| 2200 | NSS | 4390, 9425, 12630 |

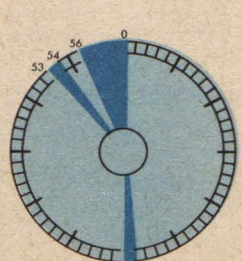
These frequencies and schedules are subject to change by the Navy Department at any time. Consult your facility charts.



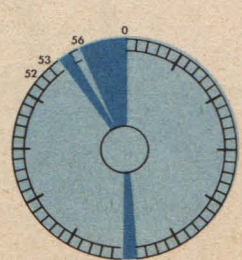
FIRST MINUTE



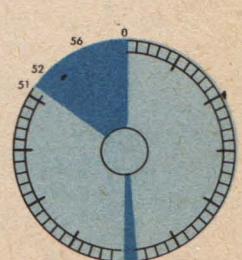
SECOND MINUTE



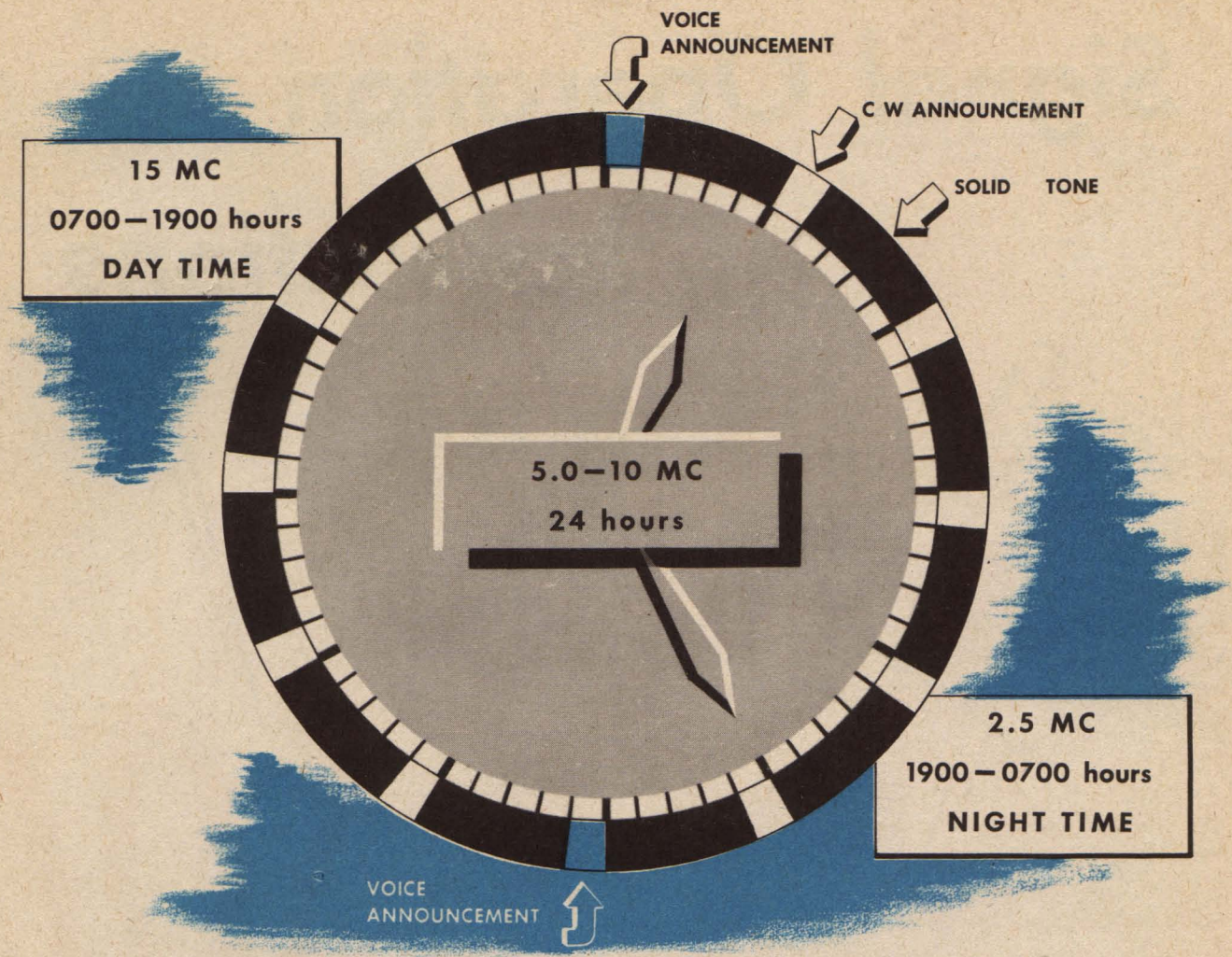
THIRD MINUTE



FOURTH MINUTE



FIFTH MINUTE




## U. S. BUREAU OF STANDARDS

The United States Bureau of Standards radio station WWV provides an accurate time service 24 hours daily. The primary purpose of WWV is to transmit a frequency standard by which all radio stations in the United States may calibrate their frequencies. WWV's transmitting frequencies are accurate to one part in ten million.

Four different frequencies are used for transmitting these signals. They are 2500 kc, 5000 kc, 10000 kc, and 15000 kc.

The 2500-kc frequency is transmitted from 1900 to 0700 hours. The 15000-kc frequency is transmitted from 0700 to 1900 hours. The 5000- and 10000-kc frequencies are transmitted for the entire 24-hour period. The carrier is modulated with a 440-cycle tone (standard musical pitch A above middle C). In addition there is a 4000-cycle pulse which is heard as a faint tick every second except the 59th. This tick may be used for timing whenever such timing is required.

## TIME CHECKS

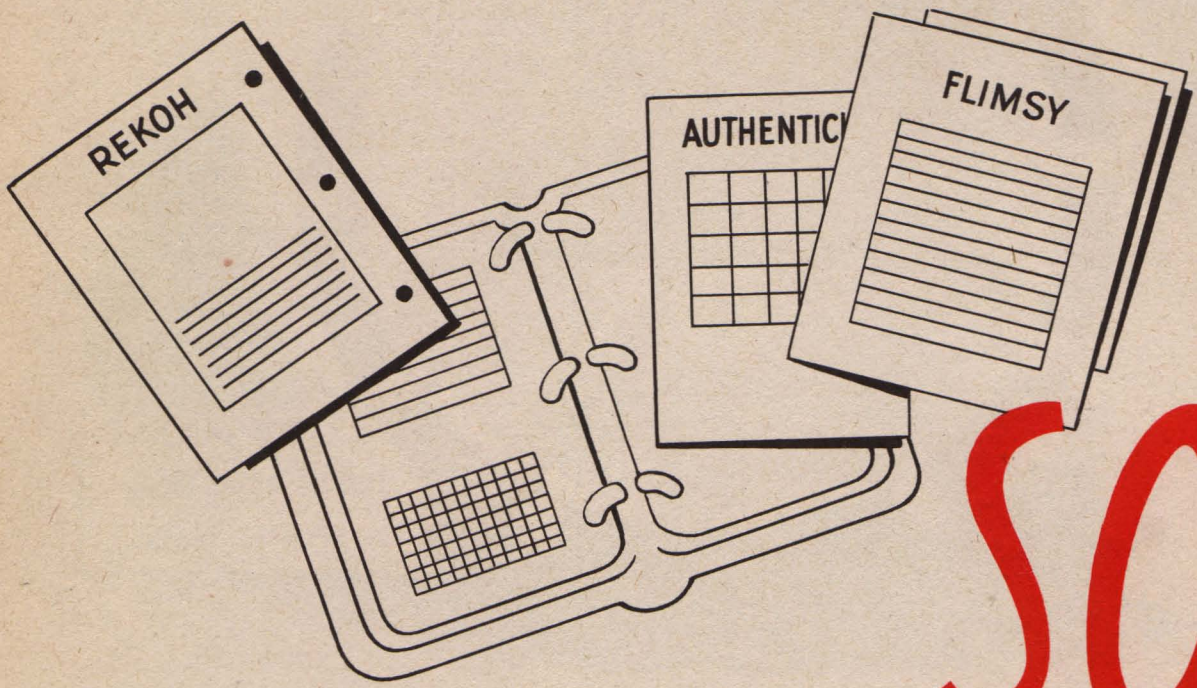
The 440-cycle tone signal begins exactly 1 minute after each hour, continues for 4 minutes, and ends at exactly 5 minutes past each hour. The call sign WWV is given in code twice. The steady tone then begins again at exactly 6 minutes past each hour and continues for 4 minutes ending at exactly 10 minutes after each hour. This sequence of a 4-minute transmission with a 1-minute pause for station identification continues throughout the 24-hour period.

A voice announcement giving the call letters and complete information on the facilities of WWV is made on the hour and half-hour. Because the modulating tone is of a very low percentage, it is advisable to use the BFO of your receiver to locate the carrier. Once located, however, the BFO must be turned off. Otherwise it would be difficult to determine when the tone signal started or stopped. Keep in mind that the carrier of WWV is on continuously.

## SCHEDULE OF TONE SIGNALS

A chart is included to show the exact sequence of these transmissions.

# Signal Operation Instructions




## S.O.I.

It is important that radio operators have at their disposal for immediate reference all frequencies, call signs, authenticators, pyrotechnic charts, IFF stud settings, maps and all other information that facilitate the handling and security of highly classified communications in the area or theater in which they will operate.

Complete signal operation instructions are usually compiled in loose-leaf booklet form. This complete booklet is usually kept in the Post Operations office. Supplements of the SOI pertaining to a particular mission are handed to you at briefing in the form of a flimsy. The flimsy consists of one or more sheets of rice paper on which the operations for the day are printed. The proper use of an accurate, complete, and up-to-date flimsy may determine whether or not your crew accomplishes its mission, whether or not you find your way home after completing a mission, or whether or not you are shot down by your own anti-aircraft guns upon attempting to land at your home base.

If you are forced down over enemy territory be sure to destroy the flimsy. Since flimsies are printed on rice paper, they may be effectively destroyed by swallowing. Be sure to weight down your flimsy while in flight. If you are on a mission with the side-hatches and bomb bay doors opened a strong gust of wind might blow it out of the airplane.

**REMEMBER**

**Before every flight check your flimsy for correctness and completeness.**

# RADIO LOGS

A neat, accurate, and complete log is certain evidence of a radio operator's ability and efficiency.

In combat zones a good operator spends most of his time listening to, or monitoring, his assigned frequency. Everything he hears should be entered in his log in complete detail. Some of the things he records may mean little to him, but in the right hands these entries may be extremely valuable information.

Since the requirements for keeping logs vary in the different theaters and air forces, no attempt will be made here to list them.

The standard radio log, AAF Form 35, is usually available and should be used whenever possible.

| RADIO CALLS |
|---|
| INTERNAL |
| EXTERNAL 9APQ |
| PHONE PETER QUEEN |
| COLLECTIVE |
| SPECIAL |

WAR DEPARTMENT
AAF FORM NO. 35
REVISED 4-4-43

ARMY AIR FORCES

## RADIO LOG

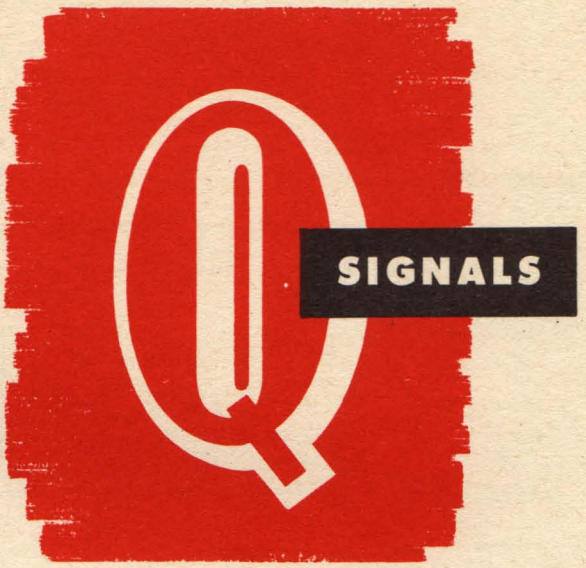
PAGE NO. 1

| A/C | FLIGHT NO. | FROM | TO | DATE |
|---|---|---|---|---|
| 12Ø141 | 21 | EAGENSVILLE | KINDLEY | 11/11/44 |

| TIME GMT | TO | FROM | FREQ. | EMISSION A1, A2, A3 | MESSAGES/REMARKS |
|---|---|---|---|---|---|
| 23ØØ | | | | . | ENGINES STARTED RADIO ON |
| Ø2 | KINGSWILL | 9APQ | 644Ø | A3 | CLEARED TO RUNWAY TWO |
| Ø4 | " | " | " | " | CLEAR FOR TAKEOFF |
| Ø5 | | | | | AIRBORNE |
| Ø8 | " | " | " | " | CHANGING CONTROL (TOWER TO CW) |
| 13 | | | | | IFF ON CKED |
| 15 | | | | | TRAILING ANTENNA OUT |
| 17 | TB9 | 9APQ | 4575 | A1 | INT QRK + QMF/QRK5 QMF INT QRU/QRU/QJC |
| | | | | | ØØ17/R |
| 45 | | | 5ØØ | | NIL |
| 5Ø | | WWV | 5ØØØ | A2 | TICK (MASTER WATCH 5 SEC SLOW) |
| ØØ ØØ | | | | | CHANGE 11/11 TO 11/12 |
| 13 | | | | | IFF CKED |
| 15 | | | 5ØØ | | NIL |
| 17 | 9APQ | TB9 | 4575 | A1 | QTC QAM/QRV/R QAM QRU/QJC Ø117 |
| Ø1ØØ | 9APQ | PN1 | 4575 | A1 | INT QSA/QSA5 INT QRK4 INT QRU/INT QDP QRU/ |
| | | | | | QDX |
| | | | | | |

NOTICE - IF ENTRIES ON THIS LOG CONSIST OF CLASSIFIED INFORMATION EACH MUST BE STAMPED OR MARKED WITH PROPER CLASSIFICATION.
(SEE REVERSE SIDE FOR DISTRIBUTION OF COPIES)

AIRCRAFT C/C James H. Mauker




Listed below, with their meanings, are the Q signals most commonly used in operating, authentication, and direction finding procedures. These signals, preceded by INT, become interrogative. Preceded by QQZ they become negative.

Refer to Air Extract FM 24-13 for a more complete list of Q signals.

## DEPARTURE AND DESTINATION

**QAA** I expect to arrive at ..... (time). (ETA.)

**QAL** I am going to land at ..... (or land at .....).

## MESSAGE HANDLING

**QRJ** I cannot receive you. Your signals are weak.

**QRK** The readability of your signals is ..... (1 to 5).

**QRM** I am being interfered with. (.....).

**QRS** Send more slowly (..... words per minute).

**QRU** I have nothing for you.

**QSA** The strength of your signals is ..... (1 to 5).

**QTC** I have ..... messages for you (or for .....).

**QMM** I have (or ..... has) ..... messages (numeral indicating number of messages may be followed by O, OP, or D to indicate precedence other than routine) for you (or .....).

## FREQUENCY AND TUNING

**QHF** Your frequency is slightly (or ..... kc's) high.

**QLF** Your frequency is slightly (or ..... kc's) low.

**QMF** Your frequency is correct.

**QSV** Send a series of V's.

**QSY** Change to transmission on ..... kc's without changing the type of wave (or change to transmission on another wave).

**QSF** Zero beat your transmitter to my frequency (or freq. of .....).

## AUTHENTICATION

**QIA** Check your authentication of last transmission (or message .....).

**QKA** Authentication of this message or transmission (or message .....) is .....

**QPA** Authentication challenge is ..... (based on time in the zone indicated by the suffix letter .....).

## WEATHER AND WEATHER ELEMENTS

**QAM** Here is the latest meteorological weather report for ..... (place of observation).

**QFE** The present barometric pressure not reduced to sea level, at the surface of airdrome (name of airdrome) is .....

## BEARING AND DIRECTION FINDING PROCEDURE

**QDL** I intend to ask for a series of bearings.

**QDM** The magnetic course to steer, with zero wind, to reach me (or .....) is ..... degrees at ..... (time).

**QDY** The magnetic course to steer, with zero wind, to reach me (or .....) is ..... degrees at ..... (time). There is a balloon barrage within 60 miles of me on that track.

**QPN** Increase height to enable more accurate bearing to be completed.

**QTF** The position of your station according to the bearings taken by the D/F stations which I control is ..... latitude, ..... longitude.

**QTH** My position is ..... latitude ..... longitude (or by any other way of showing it).

**QTG** I will send my call for fifty seconds followed by a dash of ten seconds on ..... kc's in order that you may take my bearing.

**QTN** Send a 20 second dash followed by your call sign (repeated ..... times).

**QUJ** The true course to steer, with zero wind, to reach me (or to reach .....) is ..... degrees at ..... (time).

## AIR RAID SIGNALS

**QQQ1** Warning

**QQQ2** In progress.

**QQQ3** All Clear.

# PROSIGNS

Prosigns are used to convey, in standard condensed form, certain orders, instructions, requests, reports, and information which appear regularly in communications. The prosigns and their uses are listed below.

| | |
|---|---|
| A | Originator's sign. |
| $\overline{AA}$ | Unknown station. |
| AA | All after. |
| AB | All before. |
| $\overline{AR}$ | End of transmission. |
| $\overline{AS}$ | Wait. |
| B | More to follow. |
| $\overline{BT}$ | Long break. |
| C | Correct. |
| D | Deferred. |
| EEEEEEEE | Error. |
| F | Do not answer. |
| G | Repeat back. |
| GR | Group (s). |
| $\overline{HM}$ $\overline{HM}$ $\overline{HM}$ | Emergency silence. To cancel silence, send silent sign preceded by QQZ. |
| II | Separative sign. |
| $\overline{IMI}$ | Repeat. |
| $\overline{INT}$ | Interrogatory. |
| $\overline{IX}$ | Execute to follow. |
| $\overline{IX}$ (5 second dash) | Executive signal. |
| J | Verify and repeat. |
| K | Go ahead. |
| N | Not received, or exempted. |
| NR | Station serial number. |
| O | Urgent. |
| OP | Operational priority. |
| P | Priority. |
| R | Received (also, routine). |
| T | Transmit to. |
| V | From. |
| W | For information to. |
| WA | Word after. |

# R/T VOICE PROWORDS

Radio telephone voice prowords are used to simplify traffic handling, to direct net operation, or to convey certain instructions from the originator of a message.

Here is a list of the authorized procedure phrases, which it is your responsibility to know and use correctly. In some cases, where the meaning is unmistakable, it has been omitted from the right-hand column.

| | |
|---|---|
| Acknowledge | Used between originator and addressee: "Let me know that you have received and understand this message." |
| All after | Used in conjunction with verification, repetition, and correction to indicate portion of message. (Equivalent to AA.) |
| All before | Used in conjunction with verification, repetition, and correction to indicate portion of message. (Equivalent to AB.) |

**Break** ..... "I hereby indicate the separation of the text from other portions of the message." To be used **only when there is no clear distinction** between the text and other portions of the message. (Equivalent to BT.)

**Correction** ..... "An error has been made in this transmission (or message indicated). The correct version is_____."

**Disregard this transmission** ..... To be followed by "Out" and means, "This transmission is in error. Disregard it."

**Do not answer** ..... "Stations called are not to answer this call or to receipt for this message, or otherwise to transmit in connection with this transmission." (Equivalent to F.)

**Groups** ..... "The number of groups in this message is_____." (Equivalent to GR.)

**How do you hear me?**

**I read back** ..... "The following is my response to your instructions to read back."

**I say again** ..... (Equivalent to IMI.)

**I spell**

**Message for** ..... "I wish to transmit a message to_____."

**Numerals** ..... "Numerals follow."

**Out** ..... "This is the end of my transmission to you and no response is required or expected." (Equivalent to AR.)

**Over** ..... "Go ahead. Transmit. This is the end of my transmission to you and a response is necessary." (Equivalent to K.)

**Read back** ..... "Repeat the text of this message back to me exactly as received, after I have given 'Over'."

**Relay to** ..... "Transmit this message to the station indicated." (Equivalent to T.)

**Roger** ..... "I have received your last message." (Equivalent to R.)

**Say again** ..... "Say again all of your last transmission." Followed by identification data, means "Say again your message or portions indicated." (Equivalent to IMI.)

**Send your message**

**Silence** ..... "Cease radio telephone transmission immediately until message which follows has been transmitted." Where an authentication system is in force, a station must always authenticate itself when the proword "Silence" is used.

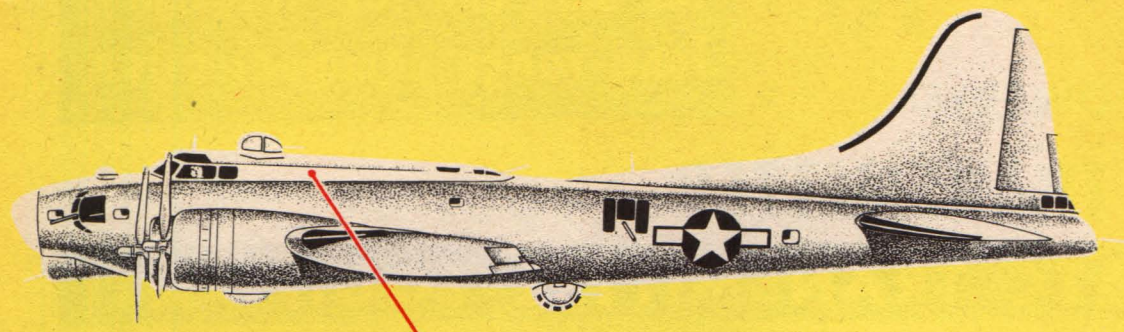
| | |
|---|---|
| **Speak slower** | |
| **Stand by to write** | "A message which will require a permanent record is about to follow." |
| **That is correct** | (Equivalent to C.) |
| **This is** | "This transmission is from the station whose call sign or other identification follows." (Equivalent to V.) |
| **Time** | Used as a prefix to the time group of message being transmitted. |
| **Verify** | "Verify entire message (or portion indicated) with the originator, check cryptographing, and send correct version." (Equivalent to J.) |
| **Wait** | If used by itself: "I must pause for a few seconds." If the pause is to be longer than a few seconds, "Wait-Out" shall be used. If "Wait" is used to prevent another station from transmitting, it must be followed by the ending "Out." (Equivalent to $\overline{AS}$.) |
| **Wilco** | Used between addressee and originator only: "Your last message (or message indicated) received and understood, and will be complied with." |
| **Word after** | Used in conjunction with verification, repetition, and correction to indicate portion of message. (Equivalent to WA.) |
| **Words twice** | (As a request.) "Communication is difficult. Please send every phrase (or every code group) twice." (As information.) "Since communication is difficult every phrase (or every code group) in this message will be sent twice." |
| **Wrong** | "What you have just said is incorrect. The correct version is_____." |

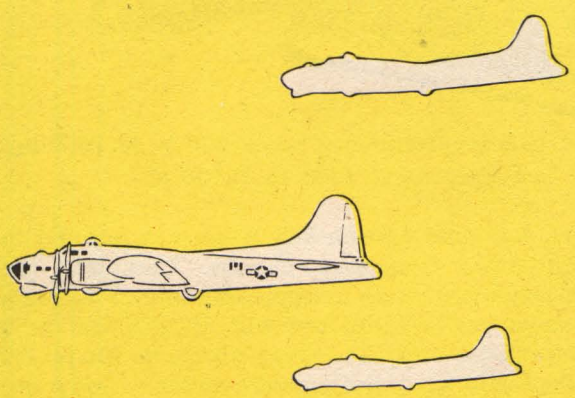
**For more complete voice or CW procedures consult CCBP 2-2, CCBP 3-2, CCBP 7, FM 24-10, FM 24-13, and FM 1-46.**

***Remember:* The use of standard R/T procedures is the responsibility of all radio operators.**

SECTION

4





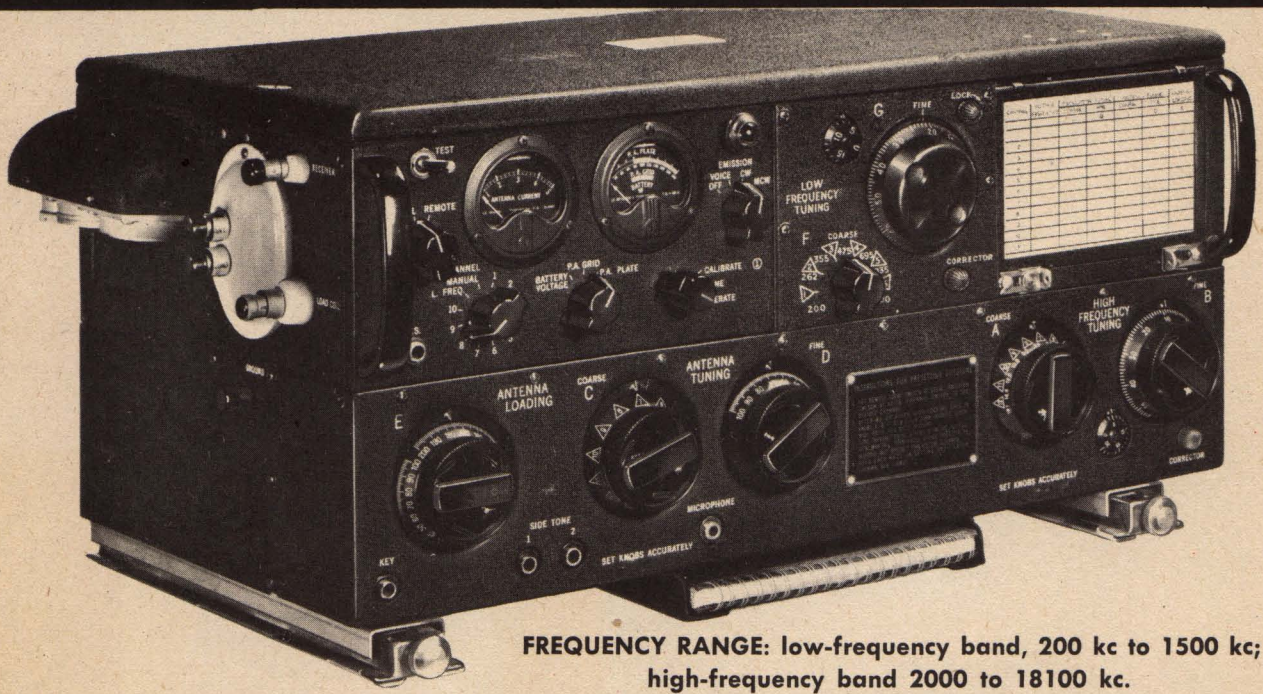
# HIGH POWERED
# LIAISON
# EQUIPMENT

# AN/ART 13

## HIGH-POWERED LIAISON TRANSMITTER

**for high and low frequency long-range communication**

## MODEL ATC TRANSMITTER EQUIPMENT



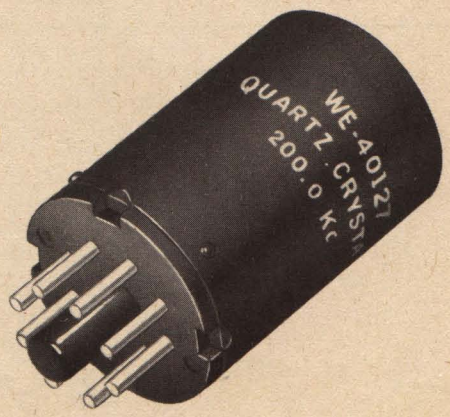

**FREQUENCY RANGE: low-frequency band, 200 kc to 1500 kc; high-frequency band 2000 to 18100 kc.**

The transmitter operates on any one of eleven pretuned, automatically selected channels. The channels are controlled from the transmitter panel or from a remote-control unit located in the pilot's compartment. One channel can be preset anywhere in the low-frequency range (200 to 1500 kc). The other ten channels can be preset anywhere in the high-frequency range (2000 to 18100 kc).

An Autotune system has been incorporated to permit rapid frequency change. Complete channel changes are made in approximately 25 seconds. The transmitter will operate with VOICE CW or MCW emission on any frequency within its range. Either a fixed-wire or a trailing-wire antenna may be used when operating in the low-frequency range.

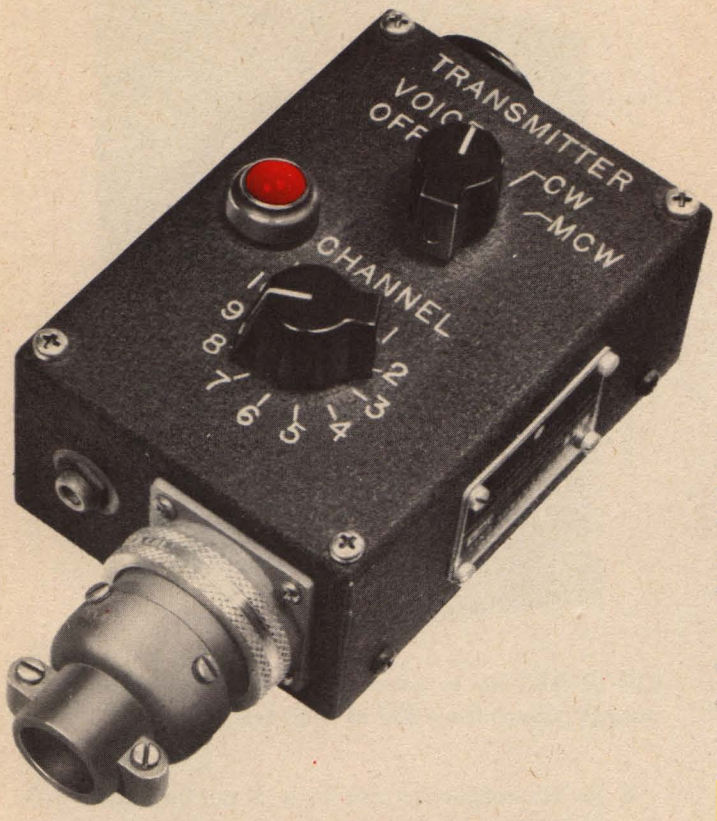
### CRYSTAL FREQUENCY INDICATOR

A crystal frequency source, used to calibrate the transmitter's oscillator, is built into the transmitter. This is used to set the frequency of each channel accurately when tuning. The audio signal, resulting from the difference of the crystal calibration oscillator frequency, and the transmitter's master oscillator frequency is fed into the sidetone circuit for monitoring. The crystal has a fundamental frequency of 200 kc. It plugs into a standard octal socket.




**CRYSTAL CHECK POINTS ARE SHOWN IN HEAVY-BLACK TYPE ON THE CALIBRATION CHARTS**

## REMOTE-CONTROL UNIT




**...to enable the Pilot to control the transmitter**

The transmitter can be remotely controlled from the pilot's compartment if the installation includes the necessary equipment. Remote operation of the equipment is possible only when the selector switch on the transmitter panel is turned to REMOTE position. If the remote-control unit has control of the equipment, the red light on the unit will glow when the transmitter is turned on (except while cycling).

## DYNAMOTOR UNIT

The dynamotor unit has two high-voltage commutators, one delivering 400 volts, the other 750 volts. The required voltage for normal power output of the transmitter is obtained by connecting the outputs of both commutators in series. To prevent flashovers in the transmitter at altitudes exceeding 25,000 feet, a pressure-operated switch reduces the total voltage applied to the transmitter from 1,150 to 750 volts by disconnecting the 400-volt commutator's output. This reduces the transmitter output approximately 50 percent.

The 400-volt output is protected by a 1-ampere fuse located on the connection end of the unit.

Two thermal-type overload relays are mounted in the dynamotor units; one controls the dynamotor input circuit, the other controls the low-voltage circuits in the transmitter. Reset buttons, for returning the relays to their normal operating positions, are located on top of the filter unit.

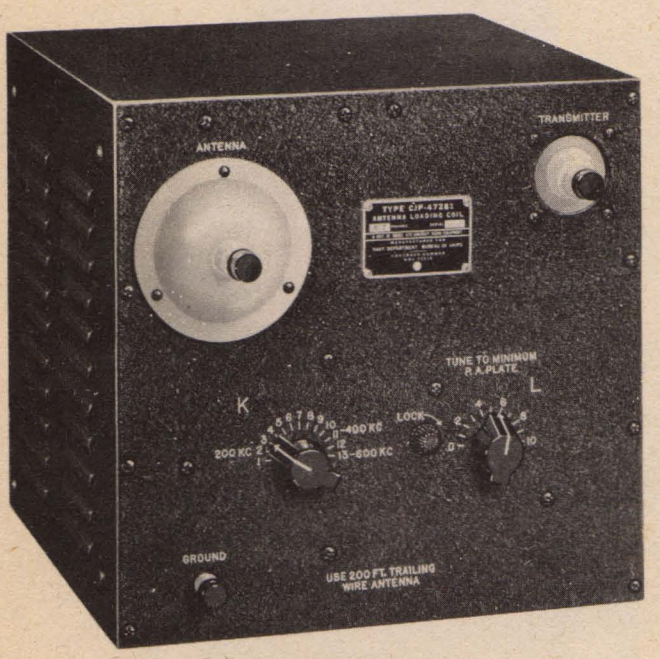
# ANTENNA TUNING UNITS

There are two antenna tuning units available for use with the model ATC transmitter equipment. These units operate only with the low-frequency oscillator unit installed in the transmitter. They are designed to load a trailing-wire antenna over the entire low-frequency range of the transmitter.

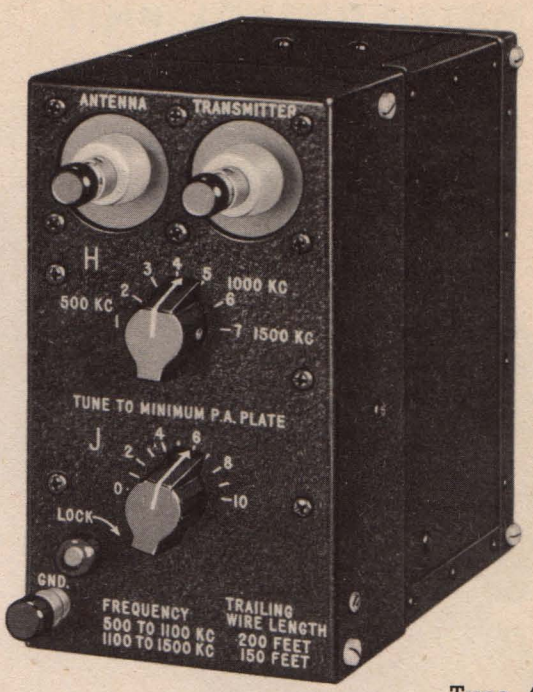
It is possible to load a fixed-wire type antenna when operating in the upper part of the low-frequency range. The tuning reactance present in the 200 to 600 kc unit may not be sufficient to load most fixed-wire antennas down to 200 kc. It will resonate a 200 foot trailing-wire antenna over the frequency range of 200 to 600 kc.

The tuning reactance present in the higher frequency tuning unit may not be sufficient to resonate all fixed-wire antennas down to 500 kc. It will also resonate a 200 foot trailing-wire antenna over its entire frequency coverage.

Operating instructions for both these units are printed on their front panels.

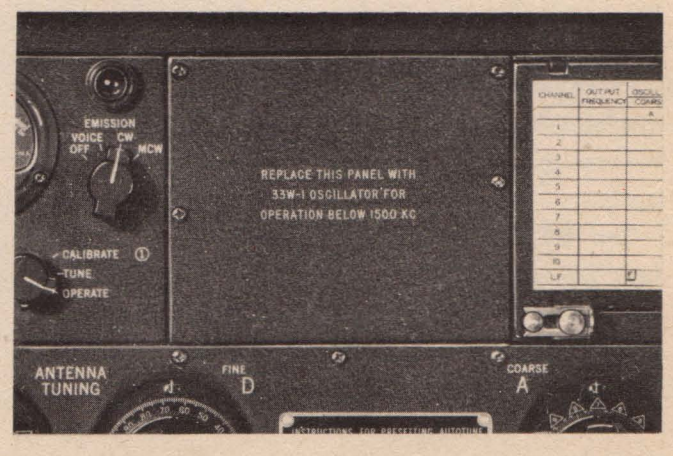



Type 47281 (CU-25/ART-13) ANTENNA LOADING COIL is used when it is desired to operate in the frequency range from 200 to 600 kc.

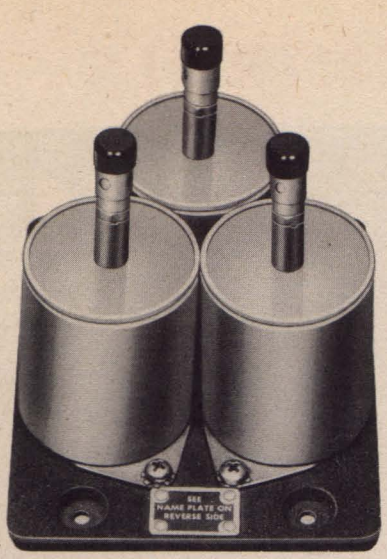



Type 47282 (CU-26/ART-13) is used when operating in the frequency range from 500 to 1500 kc.

If the low-frequency oscillator is not furnished with the transmitter, a dummy low-frequency oscillator containing duplicate low-frequency oscillator plugs, a 28 ohm 10 watt filament substitute resistor and a blank panel assembly will be installed in the space normally provided for the oscillator unit. If the dummy oscillator is installed the transmitter may be operated normally in every respect in the frequency range above 1500 kc.




Complete instructions for interchanging a dummy unit with a low-frequency unit will be found in the maintenance technical order.




Type 481628 SHUNT CAPACITOR designed to permit operation on a fixed-wire antenna at frequencies from 2000 to 3000 kcs. Either 25, 50 or 75 mmfd of capacitance may be used.

These capacitors should only be used when it is necessary to tune the transmitter to a frequency requiring them.

They should not be in the antenna circuit on any other frequencies as a decrease in transmitter output will result. Since no arrangements are provided for switching in the capacitors it will be necessary to connect them in the circuit manually as they are needed. The capacitors should be mounted so that the lead from the COND terminal to the antenna does not exceed 12 inches in length and has at least 1½ inches clearance to any metallic object. To determine the lowest frequency that may be tuned for a particular length of antenna, proceed as follows:

1—Connect the estimated amount of capacitance in the circuit.

2—Place the LOCAL REMOTE switch on LOCAL position.

3—Place the EMISSION switch on VOICE position.

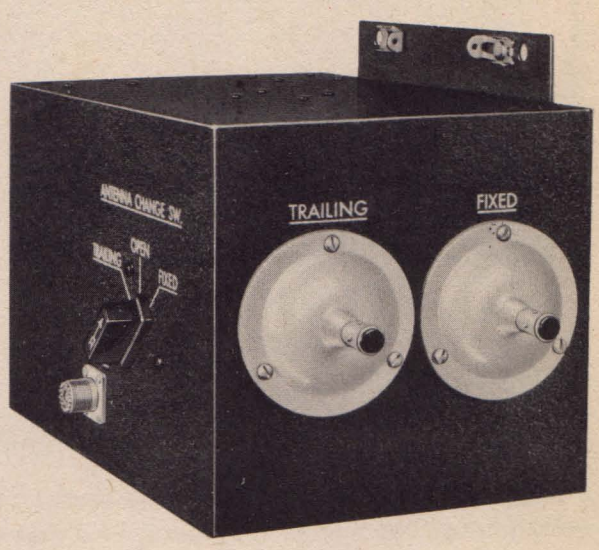
4—Place the CHANNEL switch on desired channel.

5—Place the METER SELECTOR switch on PA PLATE position.

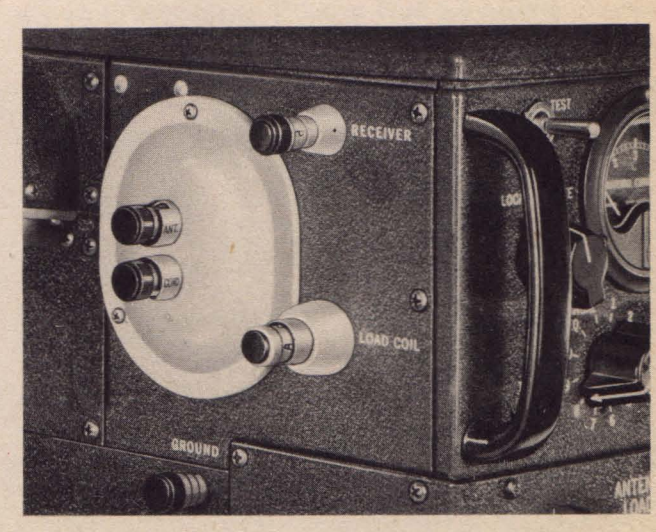
6—When the Autotune motor stops and the pilot light comes on, set control A on position 2 and control B on 200.

7—Tune and load the power amplifier according to the instructions contained in the regular tuning procedure.

If the power amplifier will not load properly, insert another condenser and repeat the above procedure. It may appear the proper operation is obtained by continuing the tuning procedure to higher positions of control C. This would result in harmonic operation of the transmitter and a complete lack of communication.

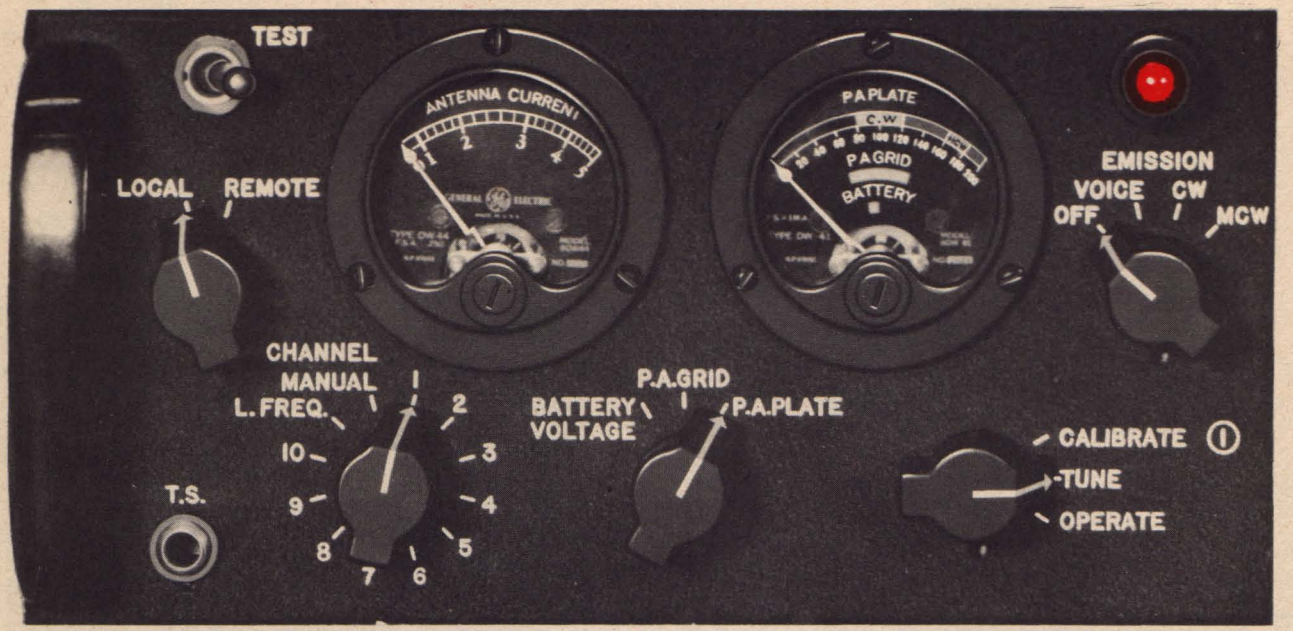



ANTENNA SWITCHING UNIT SA-22/ART-13 permits a rapid changeover from a trailing-wire to a fixed-wire antenna or vice versa. This unit was not installed with the earlier models of the ART-13 transmitter equipment.




All necessary antenna connections are made to the five binding posts mounted on the left end of the transmitter. Leads should be kept as short as possible. Keep the insulators clean.

# TRANSMITTER CONTROLS

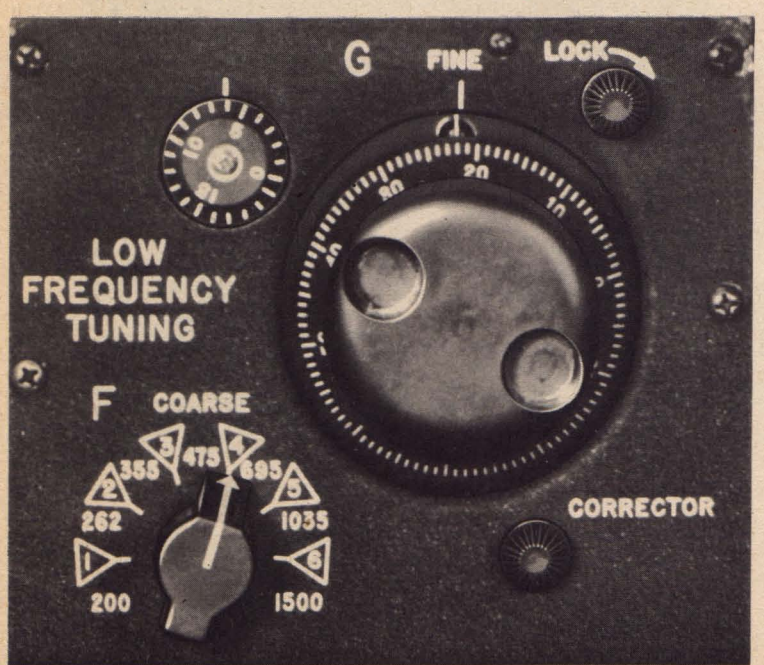



The transmitter controls are arranged in sections to simplify tuning. Two meters are provided for tuning:

1—A thermocouple-type of ammeter for indicating ANTENNA CURRENT.

2—A triple-purpose meter for determining the battery (central power system) voltage or the P A plate or P A grid currents. Any one of these three readings may be selected by use of the three-position selector switch.

The TEST switch is a spring-return-type toggle switch. It must be held in TEST position to close the keying relay circuit.




The CALIBRATE - TUNE - OPERATE (power-level) selector switch performs the following functions:

CALIBRATE position: switches in the calibration-frequency indicator, disables the power amplifier and multiplier stages, and connects the sidetone circuits.

TUNE position: reduces power-amplifier plate current to prevent damage to the power-amplifier during preliminary tuning.

OPERATE position: provides normal operation. The switch must be left in this position except when tuning the transmitter.

EMISSION switch: controls the type of emission and also the central power system or battery power to the equipment.

LOCAL-REMOTE switch: transfers control from the transmitter panel to the remote-control unit.

## LOW-FREQUENCY TUNING CONTROLS:

A separate low-frequency oscillator is provided in some transmitters for tuning in the frequency range from 200 to 1500 kc. Controls F and G select the transmitter's operating frequency. The power-amplifier plate-tank and antenna-coupling circuits must be tuned from one of the antenna loading-coil units.

The Autotune mechanism is not attached to the low-frequency oscillator controls.

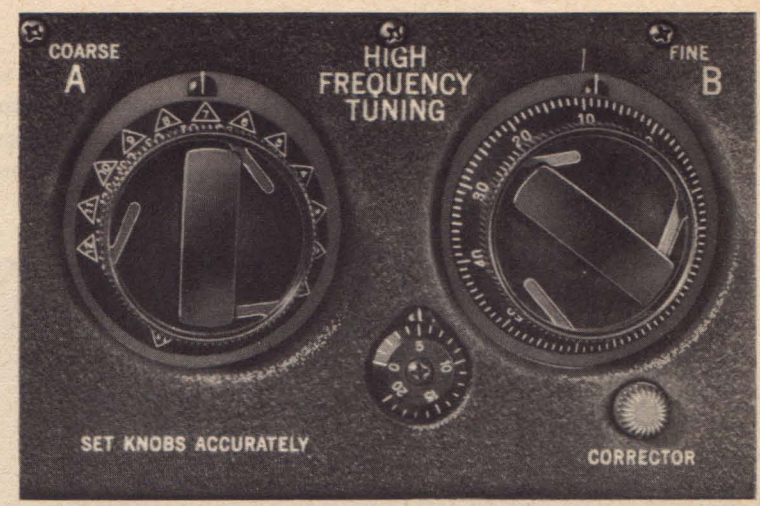
A lock is provided to keep control G in position.

# HIGH-FREQUENCY TUNING CONTROLS

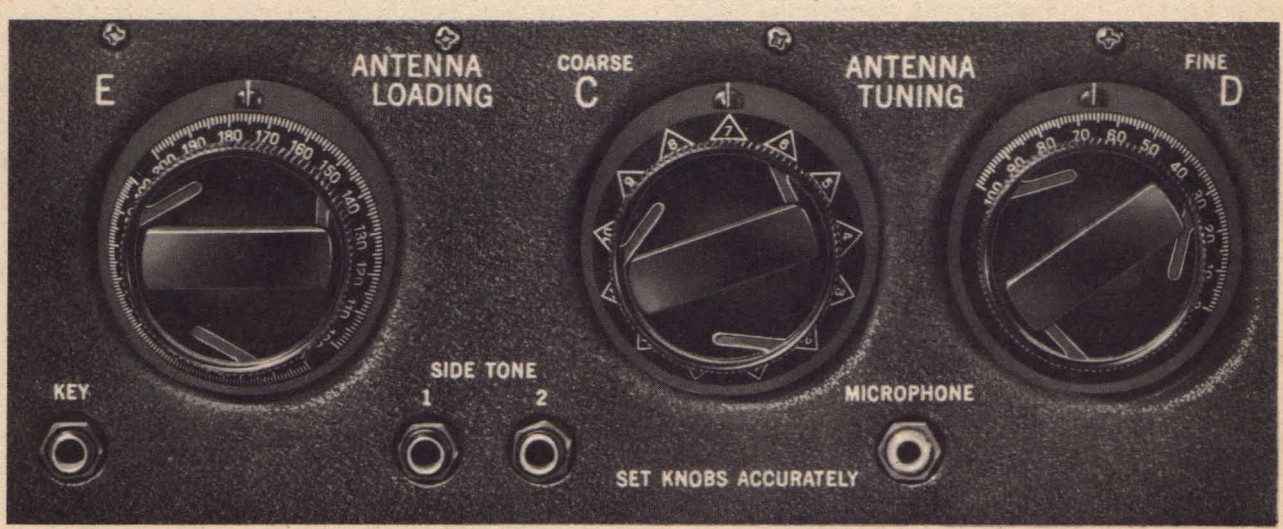
A high-frequency oscillator is used for tuning in the range from 2000 to 18100 kc. Control A is a COARSE control of the high-frequency oscillator. It also selects the proper frequency-multiplier circuit.

Position 13 on this dial switches the low-frequency oscillator into operation.

**Any of the channels may be used for the low-frequency channel by placing the A dial on position 13, and proceeding the same as if the L.FREQ channel were the one being tuned.**




**Control B is a FINE-TUNING control of the high-frequency oscillator. Both A and B controls are connected to the Autotune mechanism.**




When operating at high frequencies, the power-amplifier and antenna-coupling circuits are tuned by antenna controls C, D, and E.

Control C selects the most advantageous type of antenna-matching network for tuning and coupling the power-amplifier to the antenna system.

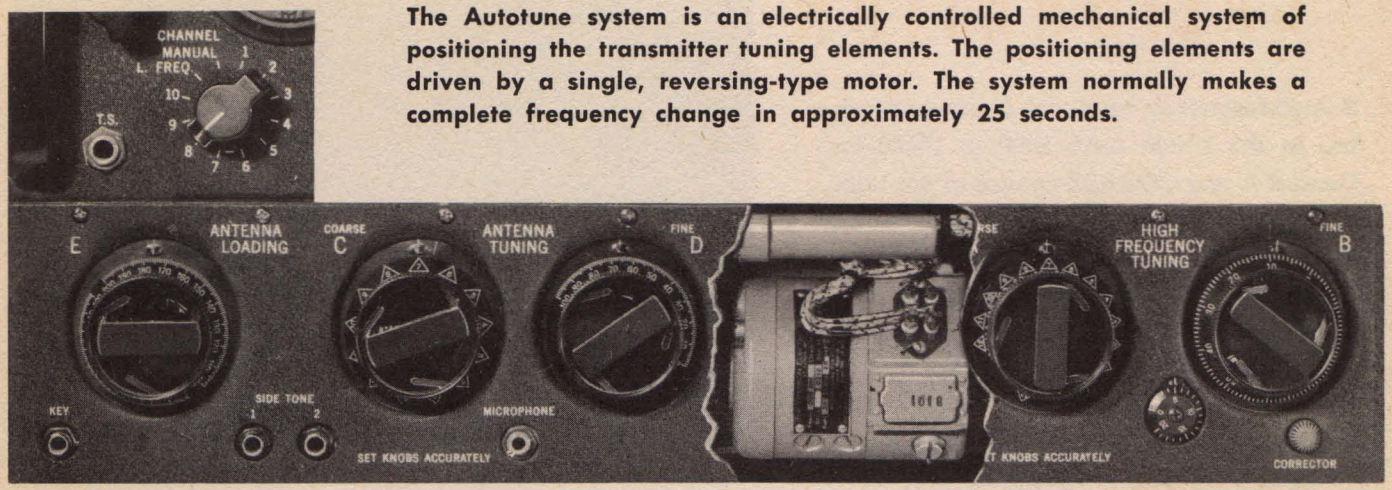
Controls D and E are power-amplifier tuning and antenna-loading controls.

## IMPORTANT!

When control C is on a setting **BELOW 8,** the power-amplifier is tuned by control E, and control D is the antenna-loading control.

When control C is on a setting **ABOVE 8,** the power-amplifier is tuned by control D, and control E is the antenna-loading control.

# AUTOTUNE SYSTEM




**The Autotune system is an electrically controlled mechanical system of positioning the transmitter tuning elements. The positioning elements are driven by a single, reversing-type motor. The system normally makes a complete frequency change in approximately 25 seconds.**

Each Autotune dial is equipped with a combined clutch-and-stop ring assembly for positioning its tuning elements. This assembly must be properly engaged before it will accurately position the tuning elements.

**To insure proper engagement of this mechanism, the desired dial settings must always be approached through one-quarter turn of clockwise rotation.**

After the proper dial setting has been approached the dial must be locked in position. This is accomplished by holding the dial in position and rotating the locking bar clockwise with a firm but not heavy pressure. The setting should now be checked by applying a firm pressure on the dial in a clockwise direction. **The dial should not move beyond its proper setting. If it does, the locking procedure must be repeated.**

# HIGH-FREQUENCY TUNING

# PROCEDURE 2000 TO 18100 KC

## PREPARATION

1—Make certain that the transmitter is connected to the fixed antenna and that the microphone key and throttle switches are open.

2—Place LOCAL-REMOTE switch on LOCAL position.

3—Place EMISSION switch in VOICE position.

4—Place CHANNEL switch on the position to be tuned and let the Autotune complete its cycle.

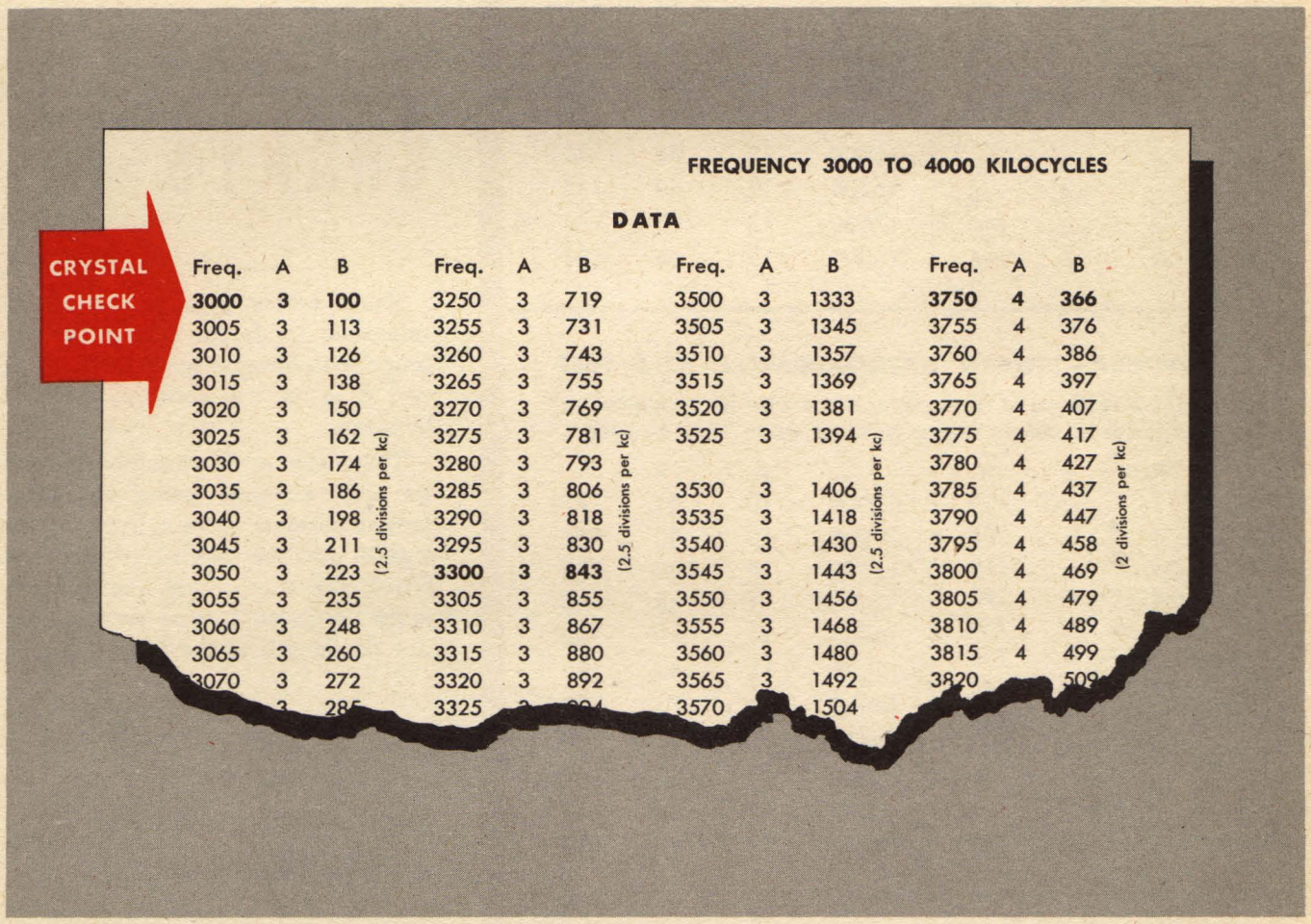
5—Unlock the five Autotune controls by turning the locking bars counterclockwise.

**THE CHANNEL SELECTED IS NOW READY TO BE CALIBRATED**

# CALIBRATION

Consult a calibration table to find the crystal check point nearest the frequency you intend to tune. Crystal check points are printed on the table in bold faced type.

You can set the transmitter to any frequency falling between two shown on the calibration table in this way:




| Freq. | A | B | Freq. | A | B | Freq. | A | B | Freq. | A | B |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3000** | **3** | **100** | 3250 | 3 | 719 | 3500 | 3 | 1333 | **3750** | **4** | **366** |
| 3005 | 3 | 113 | 3255 | 3 | 731 | 3505 | 3 | 1345 | 3755 | 4 | 376 |
| 3010 | 3 | 126 | 3260 | 3 | 743 | 3510 | 3 | 1357 | 3760 | 4 | 386 |
| 3015 | 3 | 138 | 3265 | 3 | 755 | 3515 | 3 | 1369 | 3765 | 4 | 397 |
| 3020 | 3 | 150 | 3270 | 3 | 769 | 3520 | 3 | 1381 | 3770 | 4 | 407 |
| 3025 | 3 | 162 | 3275 | 3 | 781 | 3525 | 3 | 1394 | 3775 | 4 | 417 |
| 3030 | 3 | 174 | 3280 | 3 | 793 | | | | 3780 | 4 | 427 |
| 3035 | 3 | 186 | 3285 | 3 | 806 | 3530 | 3 | 1406 | 3785 | 4 | 437 |
| 3040 | 3 | 198 | 3290 | 3 | 818 | 3535 | 3 | 1418 | 3790 | 4 | 447 |
| 3045 | 3 | 211 | 3295 | 3 | 830 | 3540 | 3 | 1430 | 3795 | 4 | 458 |
| 3050 | 3 | 223 | **3300** | **3** | **843** | 3545 | 3 | 1443 | 3800 | 4 | 469 |
| 3055 | 3 | 235 | 3305 | 3 | 855 | 3550 | 3 | 1456 | 3805 | 4 | 479 |
| 3060 | 3 | 248 | 3310 | 3 | 867 | 3555 | 3 | 1468 | 3810 | 4 | 489 |
| 3065 | 3 | 260 | 3315 | 3 | 880 | 3560 | 3 | 1480 | 3815 | 4 | 499 |
| 3070 | 3 | 272 | 3320 | 3 | 892 | 3565 | 3 | 1492 | 3820 | 4 | 509 |
| | 3 | 285 | 3325 | | | 3570 | | 1504 | | | |

If you want to work on 3003 kc, for example, look for the next **lower** frequency given by the table (3000 kc). Multiply the difference between these frequencies (3 kc) by the number that appears in parentheses at the right of the column (2.5).

Add the result (7.5) to the number appearing alongside 3000 kc in the B dial column (100). The dial setting for 3003 kc, therefore, is 107.5.

**After you have determined the proper crystal check point, calibrate the dial in the following steps:**

1. Place control A on the position shown on the calibration chart. Approach this setting through one-quarter turn of clockwise rotation, then tighten the locking bar.

2. Place control B on the crystal check point nearest the frequency to be used.

3. Place EMISSION switch on CW and CALIBRATE-TUNE-OPERATE switch on CALIBRATE position.

4. Accurately adjust control B for a zero beat in headphones plugged into the sidetone-circuit jack. If the dial does not indicate the exact check-point frequency, adjust the movable indicator mark by use of the CORRECTOR knob until it does. Return power-level switch to TUNE position.

**The channel is now ready to be tuned.**

### B-24 ANTENNA—LENGTH APPROXIMATELY 50 FEET, NO SHUNT CAPACITANCE REQUIRED

| KC | C | D | E | KC | C | D | E |
|---|---|---|---|---|---|---|---|
| 2100 | 1-2 | — | 0 | 8000 | 8 | 65 | 152 |
| 2500 | 3-4 | — | 19 | 9000 | 8 | 85 | 148 |
| 3000 | 4-5 | — | 55 | 10000 | 11 | 40 | 200 |
| 3105 | — | — | 65 | 11000 | 11 | 53 | 200 |
| 4000 | 6-7 | — | 120 | 12000 | 11 | 72 | 200 |
| 4220 | 6-7 | — | 130 | 13000 | 13 | 82 | 200 |
| 4495 | 7 | — | 140 | 14000 | 13 | 100 | 0 |
| 5000 | 7 | — | 160 | 15000 | 13 | 52 | 125 |
| 5500 | 7 | 100 | 180 | 16000 | 13 | 69 | 136 |
| 6000 | 8 | 38 | 90 | 17000 | 13 | 71 | 164 |
| 6210 | 8 | 42 | 110 | 18000 | 13 | 68 | 184 |
| 7000 | 8 | 48 | 148 | | | | |

### B-17 ANTENNA—LENGTH APPROXIMATELY 27.5 FEET

75 mmfd. (three sections) of shunt capacitance must be connected to the antenna circuit to permit tuning in the 2000-to-2600 kc range.

| KC | C | D | E | KC | C | D | E |
|---|---|---|---|---|---|---|---|
| 2600 | 1 | — | 0 | 12000 | 10 | 65 | 185 |
| 2000 | 2 | — | 75 | 14000 | 10 | 80 | 195 |
| 3500 | 3-4 | — | 110 | 15500 | 10 | 100 | 195 |
| 4000 | 4-5 | — | 130 | 9000 | 11 | 45 | 40 |
| 5000 | 6 | — | 150 | 10000 | 11 | 40 | 140 |
| 6000 | 6-7 | — | 165 | 12000 | 11 | 55 | 195 |
| 8000 | 7 | 70 | 190 | 14000 | 11 | 75 | 200 |
| 9100 | 7 | 100 | 200 | 16500 | 11 | 95 | 200 |
| 9000 | 10 | 59 | 10 | 16000 | 13 | 0 | 180 |
| 9500 | 10 | 57 | 80 | 17000 | 13 | 45 | 190 |
| 10000 | 10 | 55 | 110 | 18000 | 13 | 60 | 195 |
| 11000 | 10 | 60 | 175 | | | | |

### B-26 ANTENNA—LENGTH APPROXIMATELY 40 FEET, NO SHUNT CAPACITANCE REQUIRED

| KC | C | D | E | KC | C | D | E |
|---|---|---|---|---|---|---|---|
| 2300 | 1-2 | — | 3 | 8000 | 8 | 70 | 121 |
| 2500 | 2-3 | — | 10 | 9000 | 8 | 83 | 111 |
| 3000 | 3-4 | — | 60 | 10000 | 8 | 97 | 121 |
| 3105 | 3-4 | — | 70 | 11000 | 10 | 60 | 200 |
| 3500 | 4-5 | — | 95 | 12000 | 10 | 70 | 200 |
| 4000 | 5-6 | — | 120 | 13000 | 10 | 80 | 200 |
| 4290 | 5-6 | — | 128 | 14000 | 12 | 88 | 200 |
| 4495 | 6 | — | 140 | 15000 | 12 | 76 | 200 |
| 5000 | 6-7 | — | 150 | 16000 | 12 | 84 | 200 |
| 6000 | 7 | — | 170 | 17000 | 12 | 100 | 141 |
| 6210 | 7 | — | 180 | 18000 | 12 | 100 | 146 |
| 7000 | 8 | — | 50 | | | | |

# CHARTS

These tables give you a quick-reference guide for tuning the antenna-matching network dials, C, D, and E in several common types of bombers.

They are approximately correct for any airplane using the same length antenna system. Include the lead-in and the down-lead in calculating the total length of the antenna. With an L-type antenna, figure the length of the longest leg.

### B-25 ANTENNA—LENGTH APPROXIMATELY 30 FEET

75 mmfd. of shunt capacitance must also be used to operate in the range from 2000 to 2500 kc.

Settings for control C are the same as those shown on the B-17 chart.

Settings for control D should be from three to five numbers lower.

Settings for control E are approximately the same as those on the B-17 chart.

**NOTE: No provisions have been made in the installation of the equipment to switch the capacity unit automatically into the circuit. It must be connected in manually.**

# TUNING—*high-frequency*

**1**—Place control B on the correct position as shown in the calibration table. Use the movable indicating mark as the index against which to set the dial.

**2**—Lock controls A and B in their proper positions.

**3**—Place control D on zero and EMISSION switch on CW.

**4**—Place the meter selector switch on PA GRID and close TEST key. The meter should read in the area marked PA GRID. If it does not, check the positioning of control A. If the meter does not read correctly after repositioning control A, the transmitter is defective.

**5**—Place the meter selector switch on PA PLATE position.

**6**—Hold TEST switch closed and rotate control E throughout its range, seeking a plate-current dip indicating resonance of the circuit.

**7**—If no resonance dip is found, place control C on the next higher position and rotate control E again, seeking a dip in plate current.

**8**—Repeat the foregoing procedure until resonance is found or until control C is placed on position 8 without finding resonance.

**9**—If resonance was found on positions 1 to 7 inclusive, place the power-level switch on OPERATE position.

**10**—Load the power-amplifier by increasing the reading on control D in steps, resonating with control E each time. When control D has been rotated throughout its range, place control C on the next higher position, control D on zero, and repeat until the resonance dip falls within the area marked PA PLATE. *Do not leave the controls on any position other than that at the resonance dip.*

**11**—If resonance was not found before control C was placed on position 8, leave control C on position 8, control E on zero, and seek the resonance dip in plate current by rotating control D throughout the range of 0 to 100.

**CAUTION**

**Do not move control E through the space between 100 and 200 or between 0 and 100 while the test switch, microphone button, or key is closed. Damage to an internal switch will result if this precaution is not observed.**

**12**—If resonance is not found, place control C on next higher position. Rotate control D again, seeking the resonance dip.

**13**—Repeat the foregoing procedure until resonance is found or until control C has been tried on position 13 without finding a resonance dip.

**14**—If the resonance dip was found with control C on position 13, leave that control on position 13, place control D on 100, and seek the dip with control F.

**15**—When resonance is found, place the power-level switch on OPERATE position.

**16**—Load the power-amplifier by increasing the reading on control E in steps, re-resonating with control D each time until the resonance dip falls in the area marked CW. *Do not leave the controls on any position other than that at the resonance dip.*

**17**—After controls C, D, and E are properly tuned they must be locked. Observe their settings closely, then back the dials off their settings and approach them through one-quarter turn of clockwise rotation. Make sure the power-amplifier is at its minimum setting.

# LOW-FREQUENCY TUNING

## PREPARATION

1—Lock all Autotune-controlled dials.

2—Place CALIBRATE-TUNE-OPERATE switch to TUNE position.

3—Place CHANNEL switch to L FREQ position.

4—After making certain the microphone or key circuits are open, place EMISSION SWITCH to VOICE position.

5—Wait for the Autotune mechanism to stop, then loosen the dial locking bar.

6—If control A does not stop on position 13, unlock it and place it on that position. Approach this setting through one-quarter turn of clockwise rotation.

**The low-frequency channel is now ready to calibrate.**

## CALIBRATION

1—Set dial F to the position shown in the CALIBRATION table. Since the Autotune mechanism is not connected to the low-frequency tuning controls, the controls may be locked without approaching their settings through one-quarter turn of clockwise rotation.

2—Set dial G to the CRYSTAL CHECK POINT nearest the frequency to be used.

3—Turn EMISSION SWITCH to CW and CALIBRATE-TUNE-OPERATE switch to CALIBRATION position.

4—Accurately adjust G dial for a zero beat in headphones. If the dial does not indicate the exact check-point frequency, adjust the indicating mark by use of the CORRECTOR KNOB until it does.

**The low-frequency channel is now ready to be tuned.**

# TUNING—*low-frequency*

1—Place dial G on its correct position as shown in the calibration chart. Lock it in position. The low-frequency oscillator is now tuned. The power-amplifier and antenna circuits must be tuned from the low-frequency-antenna loading-coil unit.

2—Reel out trailing-wire antenna to the length shown on the loading-coil unit.

3—Turn meter selector switch to PA PLATE position.

4—Turn CALIBRATE-TUNE-OPERATE switch to TUNE position.

5—See that dial A is on position 13.

6—Place the tap switch on the loading-coil unit to the closest frequency calibration.

7—Screw the key closed or hold TEST switch in closed position.

8—Rotate PA control on loading-coil unit for a minimum power-amplifier meter reading. If no sharp dip is obtained, move the tap switch and try again until a sharp dip is obtained.

9—Release the TEST switch or key and place CALIBRATION-TUNE-OPERATE switch to OPERATE position.

10—Place the meter selector switch on PA GRID position.

11—Hold TEST switch in TEST position and note the meter reading. *For normal operation the meter should register in the yellow PA grid portion of the scale.* This indicates normal power-amplifier operation.

12—Release TEST switch and return meter switch to PA PLATE position.

## *Important!*

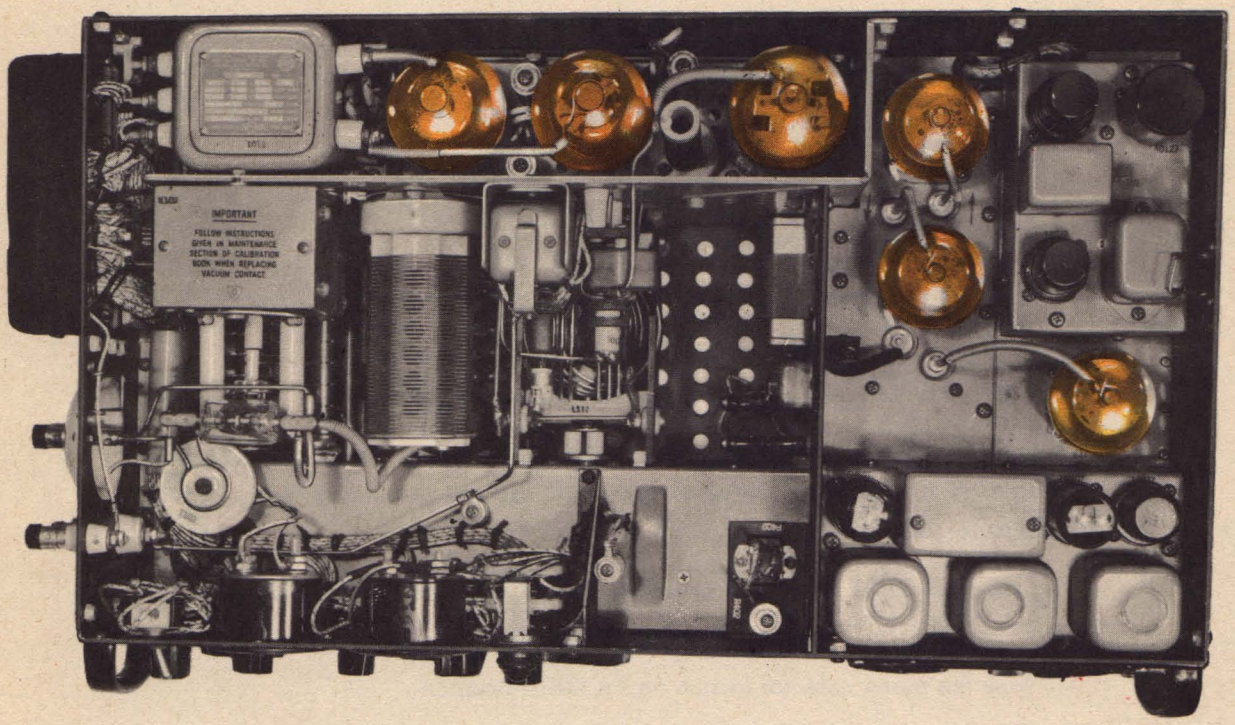
**The lowest frequency resonance point must be found to prevent frequency doubling in the output circuit.**

**The correct tuning point is at the minimum power-amplifier-plate meter reading. The actual value of the power amplifier meter reading is of little importance, and will vary from 20 to 110 on the meter scale, depending upon the operating frequency.**

**The transmitter is purposely operated below maximum loading on some frequencies to prevent flashovers at high altitudes.**

# EMERGENCY OPERATIONS

In case of tube failures, the transmitter can be operated at low-frequencies on CW using its minimum number of tubes for operation.




The 1625 tubes used in the frequency-multiplier stages can be interchanged with the low-frequency oscillator tube. The frequency-multiplier tubes must be intact to enable high-frequency operation.

CW operation can be carried on without using any of the audio, calibration frequency oscillator, MCW oscillator, or sidetone amplifier tubes.

Replace the speech amplifier with either MCW or calibration frequency oscillator tubes. The calibration frequency oscillator and the MCW oscillator will be disabled but CW and VOICE operation will still be possible.

## SWITCHING UNIT FAILURE

Connect the ANT post on the transmitter directly to the antenna lead-in. This will enable high-frequency operation.

## VACUUM SWITCH FAILURE

Remove the wire from the ANT post and connect it to the COND post. Connect a wire from the RECEIVER post on the transmitter to the antenna not being used for transmission (either fixed- or trailing-wire). Be sure the trailing-wire antenna is reeled out. This operation may result in damage to the receiver especially if the same frequency is being used for transmission and reception. As a precaution the wire should be disconnected from the ANT post on the receiver during each transmission period.

## AUTOTUNE FAILURE

If the Autotune fails to position all dials properly, proceed as follows until proper positioning is obtained:

1—Place all controls that did not position properly on an extreme counterclockwise position by hand, and then turn them clockwise until they stop.

2—If that fails place CHANNEL switch on MANUAL and place the controls on the proper position as indicated on the transmitter chart and resonate by adjusting the tuning control (either dial) to the plate-current dip.

3—If controls are tight and the foregoing procedure fails, loosen the locking bars and place the controls the same as for MANUAL position.

# MAINTENANCE AND INSPECTION

## PREFLIGHT OPERATIONAL CHECK

**Before each flight the operation of the transmitter should be checked. The following operational checks will indicate whether or not the transmitter is operating normally:**

1—Turn on the liaison receiver.
2—Place the EMISSION switch on VOICE and LOCAL-REMOTE switch on LOCAL.

3—Place the channel-selector switch on a position corresponding to one of the frequencies to be used on the mission.

4—Place the meter-selector switch on BATTERY VOLTAGE position and the power-level switch on OPERATE position. The meter should read in the shaded area of BATTERY on the scale. A primary voltage of 28 volts will make the pointer read in the top part of the shaded area; 24 volts will make it read in the lower part of the shaded area.

5—Place the meter selector switch on PA PLATE position and the EMISSION switch on CW position.

6—Close TEST switch. The plate current should read in the area marked PA PLATE on the meter scale.

7—Place the meter-selector switch on PA GRID. Close TEST switch. If the meter reads in the proper area, place the switch back on PA PLATE position.

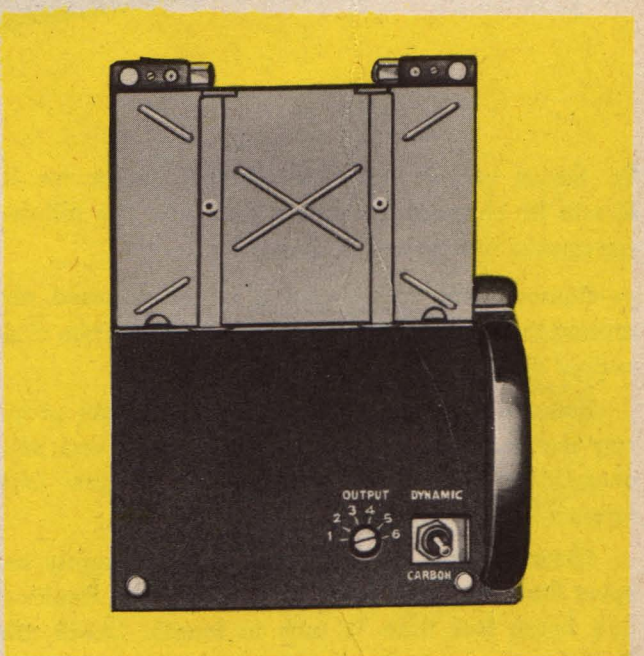
8—Place EMISSION switch on MCW position.

9—Plug headsets into the sidetone circuit; then close TEST switch. The receiver hiss should stop and the sidetone signal should be heard. The plate current should be in or near the area marked MCW.

10—Place EMISSION switch on VOICE. Press the microphone button. The plate-current meter should read about 20 or 30 points higher than on CW. Speak or whistle into the microphone. The plate-current meter should read near the MCW portion of the dial; it may read full scale on some tones.

11—Check the control settings and the PA GRID and PA PLATE readings on CW for each of the other channels likely to be used on the mission. Connect the shunt capacitors into the circuit for the channels requiring them, as indicated on the chart.

12—Check the rest of the channels using the same procedure as outlined.

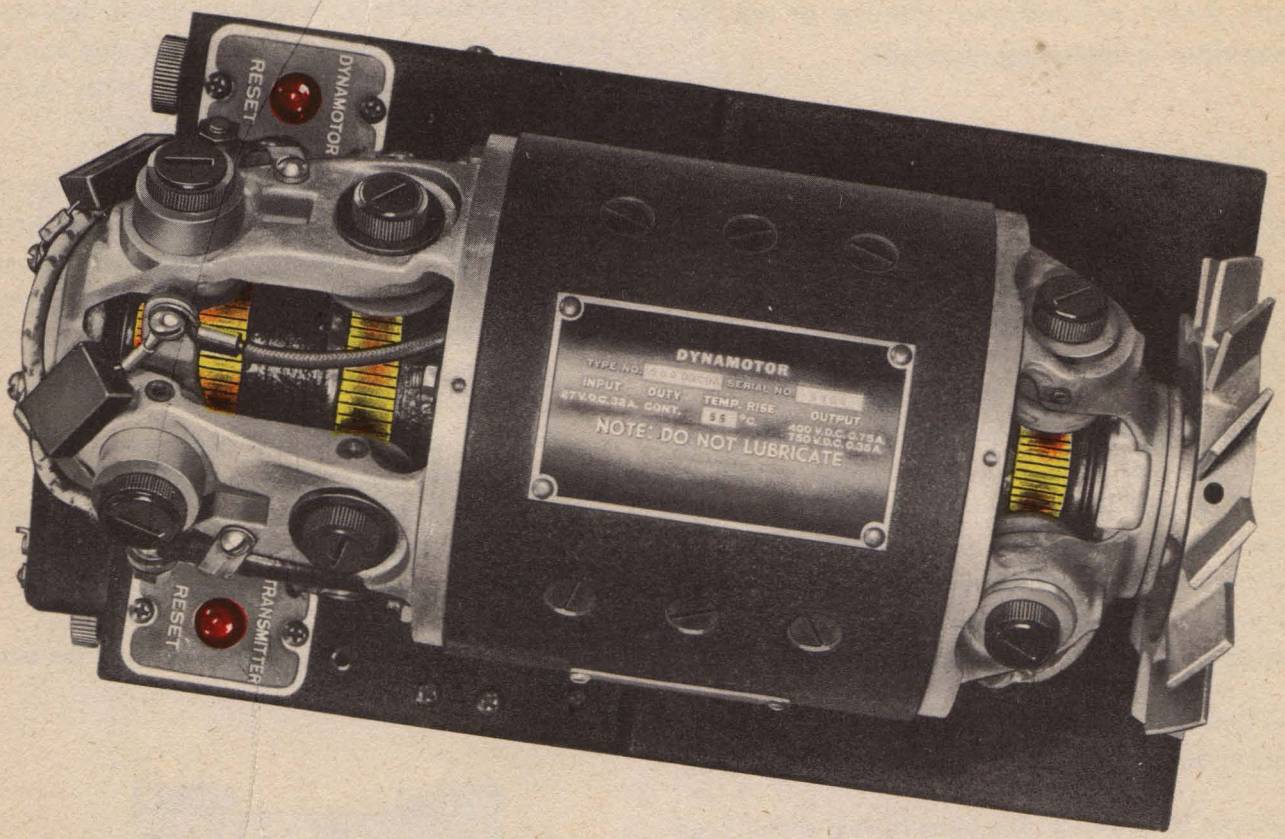



## MICROPHONE-SELECTOR SWITCH AND SIDETONE-GAIN CONTROL

For most AAF installations the DYNAMIC-CARBON microphone selector switch should be on CARBON position. The OUTPUT adjustment controls the volume of the sidetone amplifier. It should be adjusted until the sidetone volume is at a comfortable level. Both of these controls are readily accessible by lifting the calibration-chart cover in the upper right-hand corner of the transmitter's panel.

# DYNAMOTOR

**Extreme care must be exercised to prevent personal injury when working around the Dynamotor unit. Under normal operating conditions the positive output circuit is at a potential of 1150 volts above ground.**




To insure proper operation of the Dynamotor it should be checked at regular intervals. The following checks are recommended:

1—Remove end covers and blow compressed air around the commutators to remove loose carbon and copper dust.

2—Remove all the brushes (be sure they are properly marked), clean the brush holders and end bell assemblies with carbon-tetrachloride — blow out again with compressed air.

3—Clean brushes with gasoline and thoroughly inspect them for chips, hard spots and wear. Replace any brush less than ¼ inch in length. Check the flexible wire connections and springs.

4—Replace brushes carefully. Be sure they are properly seated—don't re-install defective brushes.

Check the relays in the bottom of the power unit. These relays require frequent cleanings. Always use a burnishing tool to clean the contacts. Never use sandpaper.

Dynamotor does not require lubrication—the bearings are sealed for the life of the unit.

**To gain access to these relays loosen the mounting plate clamp nuts on the connector end of the unit. Remove power unit from mounting plate and loosen the four screws in the corner of the control unit that hold the bottom cover plate to the chassis.**

# SCR 287—HIGH-POWERED LIAISON EQUIPMENT

## TRANSMITTER EQUIPMENT

**FREQUENCY RANGE**

**200 to 500 kc**

**1500 to 12500 kc**

## for high- and low-frequency LONG-RANGE communication

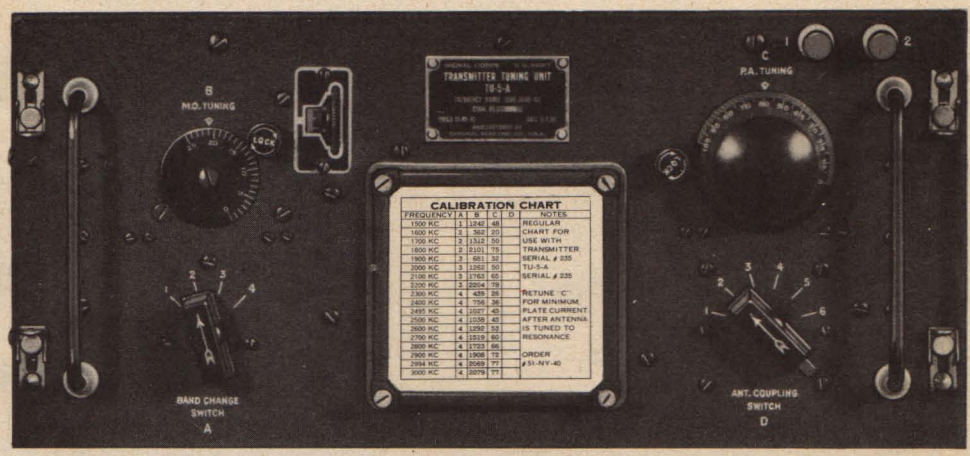
The entire frequency range of the transmitter is covered by seven interchangeable TRANSMITTER TUNING UNITS. Therefore the operating frequency range in the airplane depends upon the number of TRANSMITTER TUNING UNITS carried.

The transmitter may be operated using VOICE, CW, or MCW emission on any frequency within its range.

In some airplanes the transmitter may be operated from either the pilot's, co-pilot's, or radio operator's interphone jackbox.

# TRANSMITTER TUNING UNITS

The TRANSMITTER TUNING UNIT contains the tuning circuits for the master-oscillator and power-amplifier. This unit plugs into the transmitter forming a part of the transmitter's front panel.

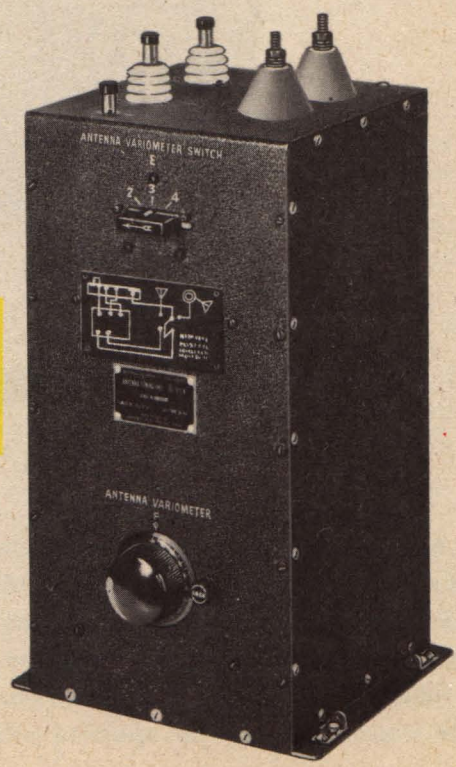



*Seven of these units cover the frequency range of 200 to 500 kc and 1500 to 12500 kc.* They are as shown in chart.

| | |
|---|---|
| TU-5-B | 1500 to 3000 kc |
| TU-6-B | 3000 to 4500 kc |
| TU-7-B | 4500 to 6200 kc |
| TU-8-B | 6200 to 7700 kc |
| TU-9-B | 7700 to 10000 kc |
| TU-10-B | 10000 to 12500 kc |
| TU-26-B | 200 to 500 kc |

# ANTENNA TUNING UNIT BC-306-B

This unit provides sufficient loading to permit tuning on frequencies from 150 to 500 kc. It consists of a tapped inductance, with a variometer in series, plus a condenser one side of which is grounded and the other side connected to a terminal on top of the unit. The extra condenser provides for operation of the transmitter into a fixed-wire antenna on frequencies as low as 250 kc.




***Never use voice or tone emission on frequencies below 1500 kc while operating into a fixed-wire antenna.***

Satisfactory CW operation can be obtained up to altitudes of approximately 15,000 feet when operating below 1500 kc into a fixed-wire antenna.

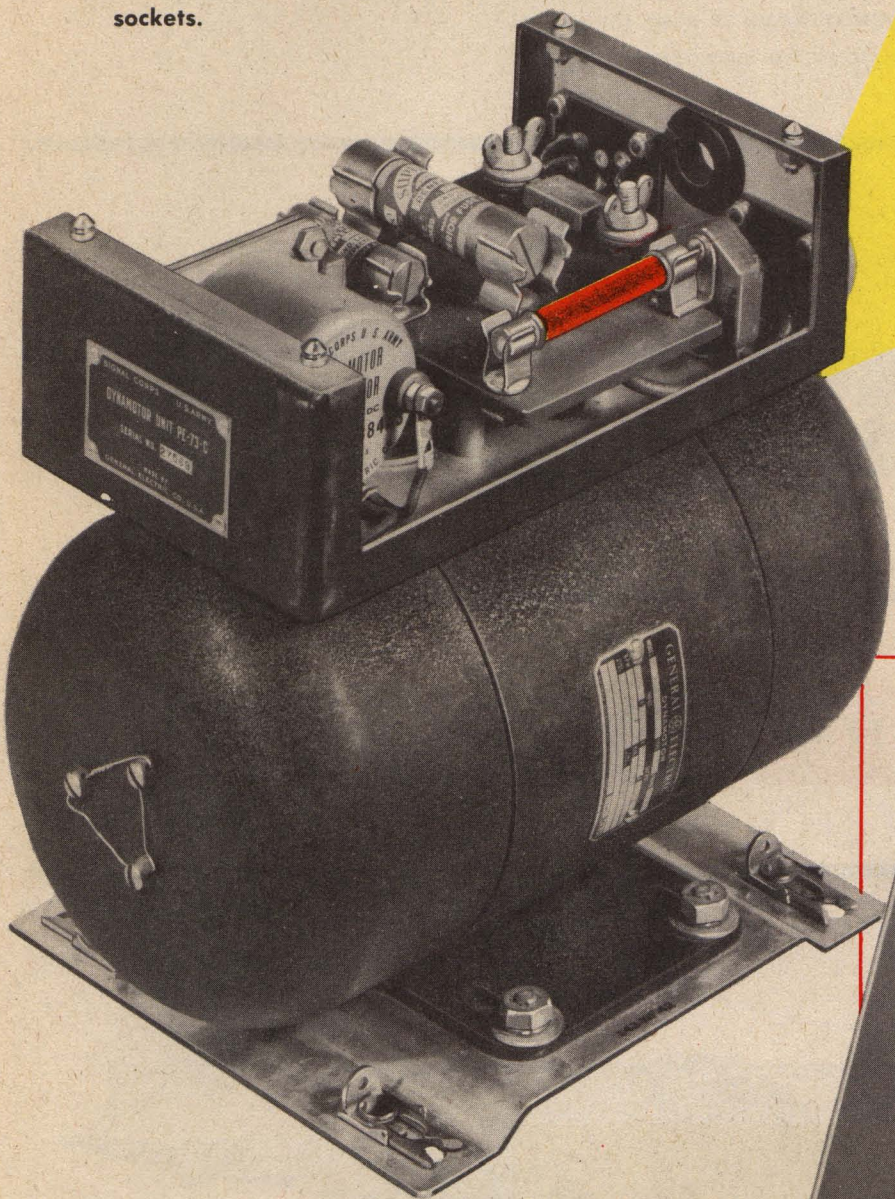
Because of the type of insulation used in this unit occasional flashovers will not be injurious.

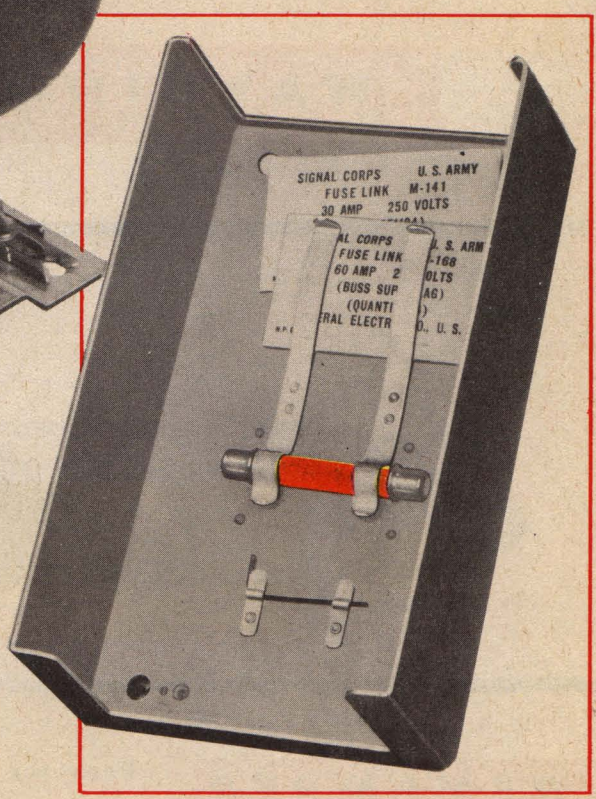
In general, instructions for antenna tuning unit BC-306-A are also applicable to the BC-306-B. The BC-306-B is modified for use with a fixed-wire antenna at lower frequencies. It operates normally as an A-type when used with a trailing-wire antenna.

# DYNAMOTOR UNIT PE-73

**The dynamotor unit consists of a dynamotor and a box containing a contactor unit, fuses, filter condensers, and connector sockets.**

Danger 2000 Volts






The output of the dynamotor is approximately 1,000 volts. A radio-frequency interference filter is included to eliminate objectional brush noises in the receiving equipment within the airplane. The filter consists of condensers connected so as to by-pass the various sources of radio-frequency interference voltages generated by the commutators.

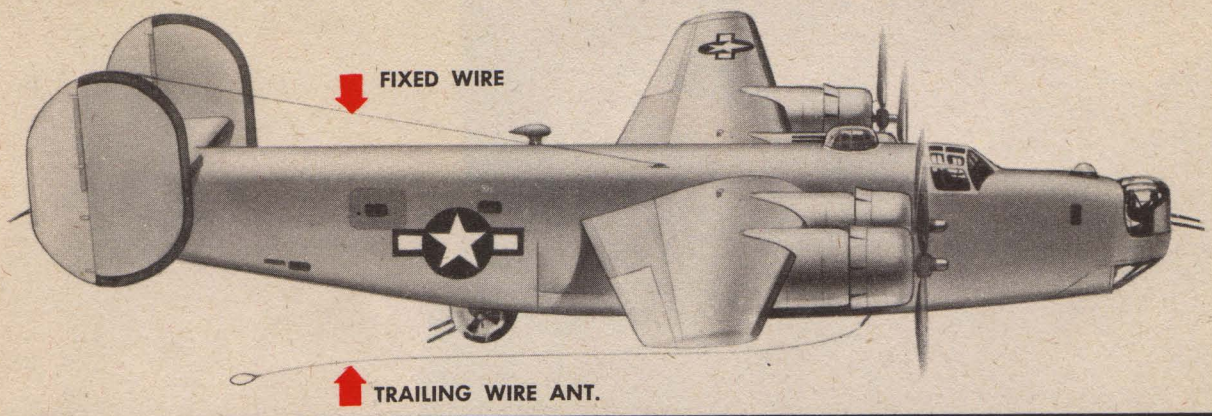
All transmitter fuses, except one, are located in the top of the unit. These include the starting fuse (60-ampere), the transmitter low-voltage-circuit fuse (30-ampere), and a dynamotor high-voltage fuse (1-ampere). An additional high-voltage fuse (½-ampere) is located inside the transmitter.

A spare high-voltage fuse, spare fuse links, and a hex wrench are carried in clips inside the cover. The hex wrench is for making brush-holder adjustments.

# ANTENNA SYSTEM

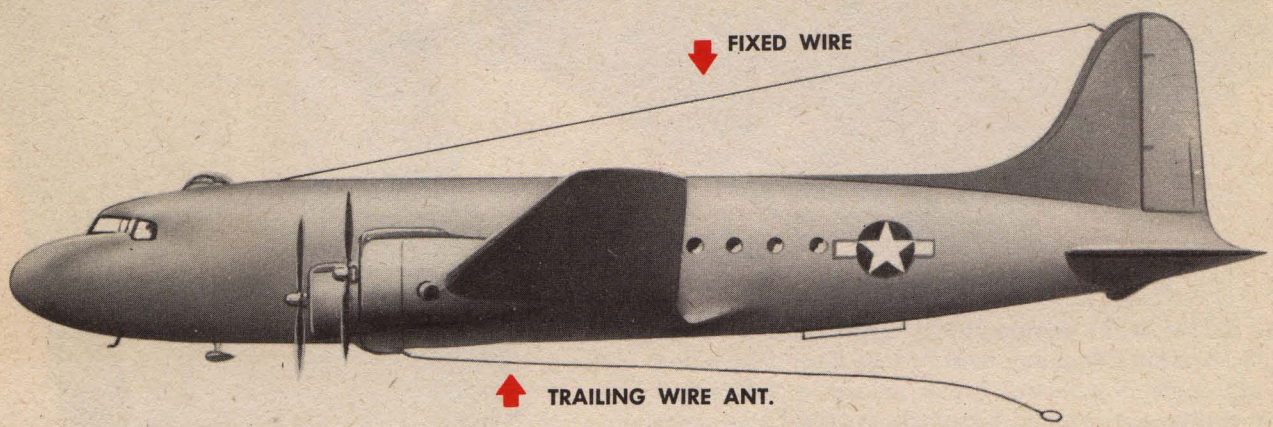
Two types of antenna systems are provided for the liaison equipment on all aircraft so equipped. The fixed-wire type is used for formation flying and medium- or high-frequency operation. The trailing-wire type is used for long-range transmission on medium or low frequencies.

On some types of airplanes a skin-type antenna is used instead of a fixed-wire type. The skin antenna employs the airplane's wing surface for the antenna.




**WARNING**

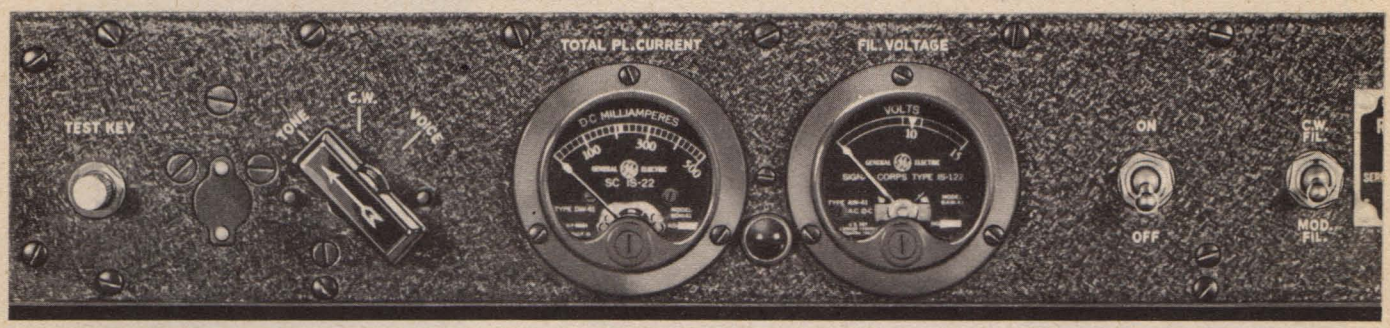
**The trailing-wire antenna must be reeled in before landing or when not in use. Never reel it out at speeds exceeding 240 mph.**




**REMEMBER**

**Know the length of the antennas with which you are operating. Full transmission mileage may save the life of your crew.**

# TRANSMITTER CONTROLS




TEST KEY is a spring-return, plunger-type switch used to close the keying circuits of the transmitter.

TONE-CW VOICE switch controls the type of emission used by the transmitter.

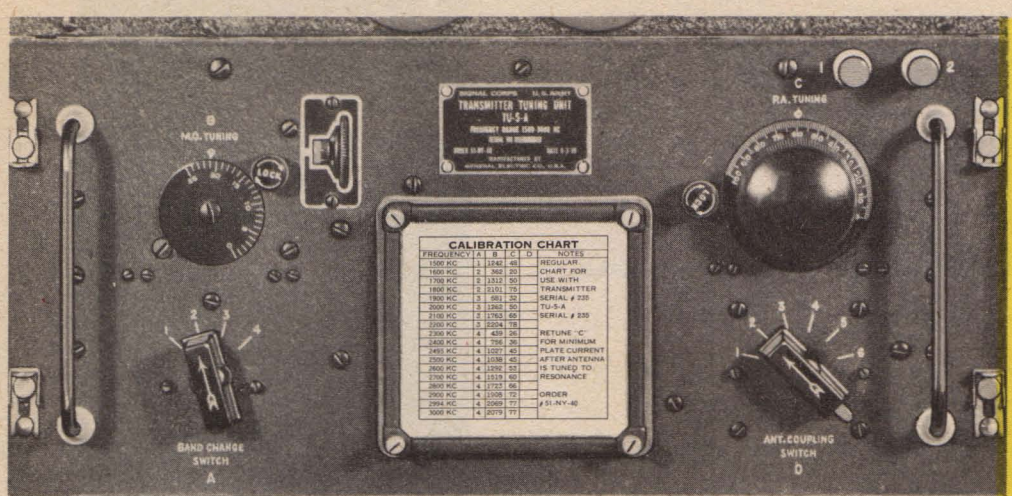
ON-OFF switch controls the input (central-power-system) voltage applied to the dynamotor unit.

TOTAL PLATE-CURRENT meter is used primarily for tuning the power-amplifier.

FIL-VOLTAGE meter registers the filament voltage applied to the transmitter tubes.

CW FIL-MOD FIL toggle makes it possible to measure the filament voltage when operating with or without the two modulator tubes.

RED LIGHT, when lighted, indicates the equipment is turned on.




**The B settings are all reasonably accurate if the serial numbers on the tuning units correspond with those on the transmitter.**

The transmitter tuning-unit panel, provides the necessary controls for tuning the master-oscillator and power-amplifier circuits.

The A control is a BAND-CHANGE SWITCH. This control is not found on all tuning units. It is provided only when the tuning controls do not cover the complete frequency range.

The B dial controls the Master-Oscillator's operating frequency. On the small round dial 0-25, the calibration numbers are indicated in hundreds. The drum tuning provides for finer adjustment and is calibrated in unit numbers.

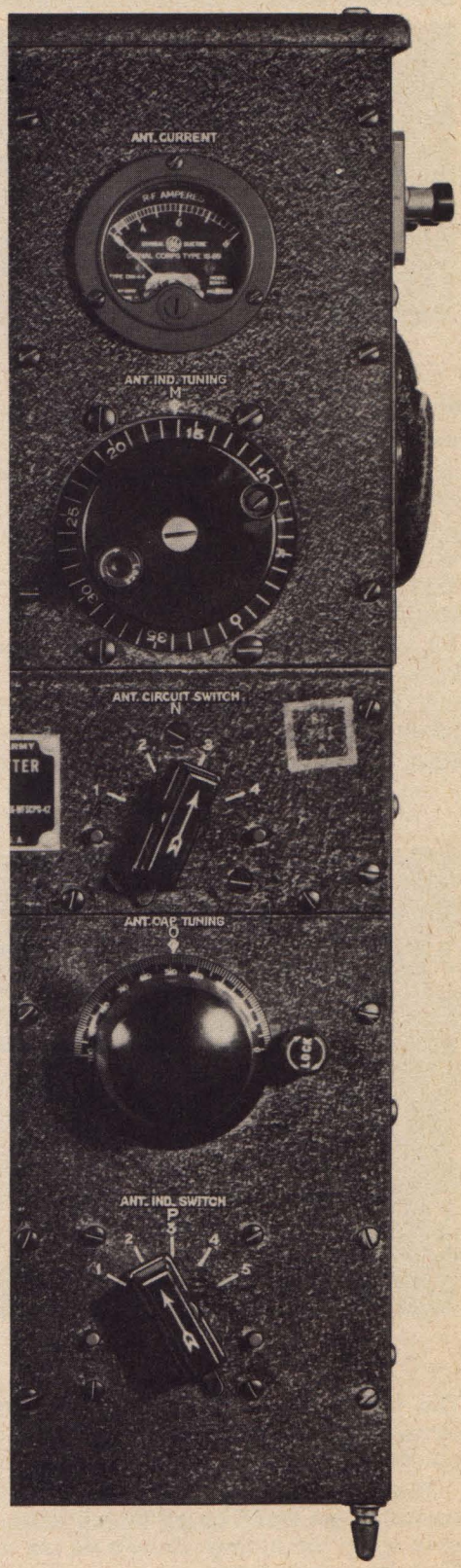
The C or PA TUNING dial is the power-amplifier plate-tank tuning control.

ANTENNA COUPLING SWITCH (D) controls the amount of coupling from the power-amplifier tank to the antenna circuits within the transmitter.

The CALIBRATION CHART gives the settings for all of the tuning controls on the unit. The C settings are all approximate.

# ANTENNA TUNING CONTROLS

The antenna tuning equipment in the transmitter is designed to resonate airplane antennas at any frequency from 1500 to 12500 kc. Over this range it is necessary to resonate antennas above and below their fundamental operating frequencies. Therefore, the circuit constants may be selected so as to permit either current (¼ wave length) or voltage (½ wave length) tuning of the antenna.




## ANTENNA CIRCUIT SWITCH N

**selects either a series (current) or parallel (voltage) resonant circuit for tuning the antenna system. There are four positions as follows:**

**1**—*First position* (voltage) for very long antennas when operating at higher frequencies, usually 10000 to 12500 kc.

**2**—*Second position* (current) for antennas approximately correct in length for the operating frequency.

**3**—*Third position* (current) for antennas slightly too short.
**4**—*Fourth position* (current) for very short antennas.

## ANTENNA IND TUNING M

A rotating inductor provided to compensate for slight variations in the inductive reactance of the antenna.

## ANTENNA CAP TUNING O

A variable condenser used to provide for any variations in the capacitive reactance of the antenna. This control must be varied when tuning on the first or second positions of switch N. Satisfactory operation may be obtained by leaving it on 50 for the third and fourth positions of switch N.

## ANTENNA IND SWITCH P

A tapped inductor. It provides additional inductance only when switch N is on position 4.

**When switch P is not in the circuit, it should be placed on position 2 for TRANSMITTER TUNING UNITS 5, 6 and 7 and on position 5 for units 8, 9, and 10.**

## ANTENNA CURRENT METER

A thermocouple-type meter. It indicates the radio-frequency current feeding into the antenna system. **Always figure the length of antenna required and compare it with the length of the antenna on the airplane.** Use the following formula for determining the required length: (for ¼ wave length antenna)

$$\text{Length in feet} = \frac{234}{\text{frequency in mc}}$$

# MEDIUM-HIGH FREQUENCY TUNING

## 800-12500 KC

1. Select the TRANSMITTER TUNING UNIT that covers the operating frequency you want, and put it into the transmitter.

2. Set controls A, B, and C according to the calibration chart, and put D on position 1. If the operating frequency falls between those shown on the chart, you must interpolate to find the correct B-dial (master oscillator) setting. (See ROIF, page 4-2-8.)

3. Turn the TONE-CW-VOICE switch to CW.

4. Put the E switch of the BC-306 ANTENNA TUNING UNIT on position 1.

5. Set the N switch according to the length of your antenna. The chart below gives you approximate settings for the antennas of several common airplanes. It is also applicable to any other airplane using an antenna of the same length.

6. Adjust the O control as required, if the N switch is on positions 1 or 2. If it is on positions 3 or 4, set control O on 50.

7. If you are using TUNING UNITS 5, 6, or 7, put the P switch on position 2. With units 8, 9, or 10, put the P switch on 5.

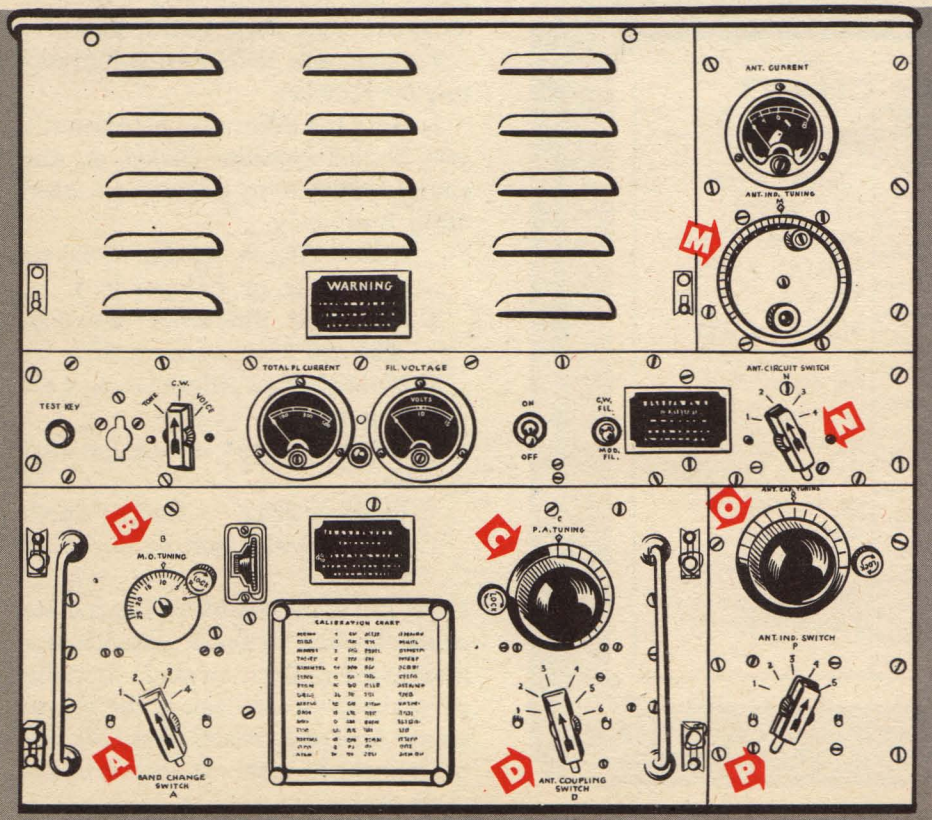
8. Turn the ON-OFF switch ON, and open the antenna change-over knife switch.

9. Press the TEST KEY, and adjust the C dial until you have a **minimum reading** on the plate current meter.

10. Close the antenna change-over knife switch. Make sure it is in the proper position.

11. Rotate the M inductor for maximum plate current (200-220 ma). If the meter reading does not reach this value, increase the power-amplifier coupling, by setting the D switch to a higher value. Do not exceed 230 ma.

12. Repeat steps 9, 10, and 11 until any movement of the C control produces an **increase** in plate current, and any movement of the M control produces a **decrease** in plate current.




B-26 and C-47, approx. 40 ft.
1500-2000 kc—N on 4
2000-5800 kc—N on 3
5800-12500 kc—N on 2

B-17 and B-25, approx. 30 ft.
1500-2000 kc—N on 4
2000-7800 kc—N on 3
7800-12500 kc—N on 2

B-24, approx. 50 ft.
1500-1800 kc—N on 4
1800-4600 kc—N on 3
4600-12500 kc—N on 2

# INTERPOLATION

If the frequency on which you wish to operate does not appear on the chart, but falls between two others shown there, you must interpolate to find the proper B-dial setting. To do this:

On the calibration chart, find the frequencies directly above and below the one you want to use.

Find the number of B-dial divisions per kilocycle between these frequencies.

Find the difference between your operating frequency and the listed frequency below it.

Multiply this difference by the number of divisions per kilocycle, and add the result to the B-dial setting for the lower frequency.

**Interpolation is possible only when the A (band switch) setting is the same for both listed frequencies.**

**Example:**

To find the B-dial setting for 2585 kc.

1. Subtract the nearest listed B-dial settings (100 kc apart) above and below 2585:
   1292 –1038 = 254 (for 100 kc) or 2.54 divisions per kc.
2. Find the difference between 2585 and 2500:
   2585 –2500 = 85.
3. Multiply the above difference by 2.54:
   85 ×2.54 = 215.9.
4. Add this to the setting for 2500 kc:
   1038 + 215.9 = 1253.9, the B-dial setting for 2585 kc.

**CALIBRATION CHART**

| FREQUENCY | A | B | C | D | NOTES |
|---|---|---|---|---|---|
| 1500 KC | 1 | 1242 | 48 | | REGULAR |
| 1600 KC | 2 | 362 | 20 | | CHART FOR |
| 1700 KC | 2 | 1312 | 50 | | USE WITH |
| 1800 KC | 2 | 2101 | 75 | | TRANSMITTER |
| 1900 KC | 3 | 681 | 32 | | SERIAL # 235 |
| 2000 KC | 3 | 1262 | 50 | | TU-5-A |
| 2100 KC | 3 | 1763 | 65 | | SERIAL # 235 |
| 2200 KC | 3 | 2204 | 78 | | |
| 2300 KC | 4 | 439 | 26 | | RETUNE "C" |
| 2400 KC | 4 | 756 | 36 | | FOR MINIMUM |
| 2495 KC | 4 | 1027 | 45 | | PLATE CURRENT |
| 2500 KC | 4 | 1038 | 45 | | AFTER ANTENNA |
| 2600 KC | 4 | 1292 | 53 | | IS TUNED TO |
| 2700 KC | 4 | 1519 | 60 | | RESONANCE |
| 2800 KC | 4 | 1723 | 66 | | |
| 2900 KC | 4 | 1908 | 72 | | ORDER |
| 2994 KC | 4 | 2069 | 77 | | # 51-NY-40 |
| 3000 KC | 4 | 2079 | 77 | | |

### Extrapolation

When the A settings above and below the frequency you want are different, you must extrapolate.

For example, to find the B-dial setting for 2260 kc:

1. Find the difference between the two B-dial settings (listed on the chart) **immediately above** your operating frequency.
   (2204 –1763 = 441 dial divisions per 100 kc, or 4.41 per kc.)
2. Find the difference between 2260 and 2200, which is 60.
3. Multiply this difference by 4.41, to get 264.6.
4. Add this to the setting for 2200 kc.
   (2204 + 264.6 = 2468.6, which is the B-dial setting for 2260 kc.)

Note: If it is impossible to interpolate or extrapolate by these methods, use a different calibration chart. Usually several charts are back of the one in place. You can reach them by removing the four thumb screws of the chart frame.

# LOW FREQUENCY 200-800 KC

## TUNING PROCEDURE

1—Insert the TRANSMITTER TUNING UNIT, covering the desired operating frequency, in the transmitter.

2—Place controls A, B, and C to the settings indicated on the calibration chart. Set D on position 1.

3—Place TONE-CW-VOICE switch on CW position.

4—Place N switch on position 3.

5—Start switch E (on BC-306) on position 2.

6—Place O control on 50.

7—Place transmitter ON-OFF switch on ON position.

8—Press TEST KEY and tune C for minimum plate-current reading.

9—Tune VARIOMETER F control (on BC 306) for maximum plate-current reading. **If no rise in plate current can be obtained increase E control until the correct reading can be obtained with F.**

10—Adjust switch D until a plate-current reading of from 200 to 220 ma is obtained.

11—Recheck C dial setting. Any change in C should cause an increase in plate current. Any change in F should cause a decrease.

## VOICE OPERATION—Transmitter must first be tuned up on CW

1—Note total plate-current reading for CW operation.

2—Place TONE-CW-VOICE switch to VOICE position.

3—Remove front tube cover from transmitter.

4—Place transmitter ON-OFF switch on ON position.

5—Press TEST KEY. Insert a screwdriver in the MOD BIAS adjustment and rotate until an increase of from 20 to 35 ma in the total plate current is obtained.

6—Speak or whistle a sustained note into the microphone with the button pressed, and note the rise in total plate current. It should read 300 ma. If it does not, adjust the INPUT LEVEL until a reading of approximately 300 ma is obtained.

**THE TRANSMITTER WILL NOT REQUIRE ANY ADDITIONAL ADJUSTMENT FOR TONE OPERATION—TOTAL PLATE CURRENT ON TONE SHOULD BE FROM 300 TO 350 MA.**

# TRAILING-WIRE ANTENNA

## TUNING PROCEDURE

If necessary, the trailing-wire antenna can be used to extend the transmitting range on the lower frequency ranges.

The following procedure is recommended for use with the trailing-wire antenna:

**1**—Request the pilot's permission to reel out the antenna.

**2**—If the reel control-box indicator does not read 000, set it there by means of the reset knob on left side of the control box.

**3**—Make certain the antenna-changeover knife switch is in the trailing-wire-antenna position.

**4**—Place N switch on position 3 and D switch on position 2.

**5**—Set ANT IND TUNING M at 10.

**6**—Press TEST KEY and turn the trailing-wire antenna control box OFF-IN-OUT switch to OUT position. Watch for a rise in plate current (each rise indicates resonance on an odd quarter-wave length).

If a rise is not found the first time, reel the wire in and place D switch to position 3 and try again.

**7**—Stop the wire as closely as possible to the rise in plate current. This will minimize the amount of loading necessary and will result in greatly increased power output.

**8**—Rotate M indicator for maximum plate-current reading. **Do not exceed 230 ma.** If maximum plate current is less than 210 ma move control D to the next highest number.

**The following tables give approximate antenna lengths and their respective counter readings for the most common operation frequencies.**

**For frequencies below 1500 kc, use full length of the trailing wire.**

●

**There may be more than one point at which a rise in plate current is found. Best operation is obtained when the rise in plate current employing the greatest length of wire is used.**

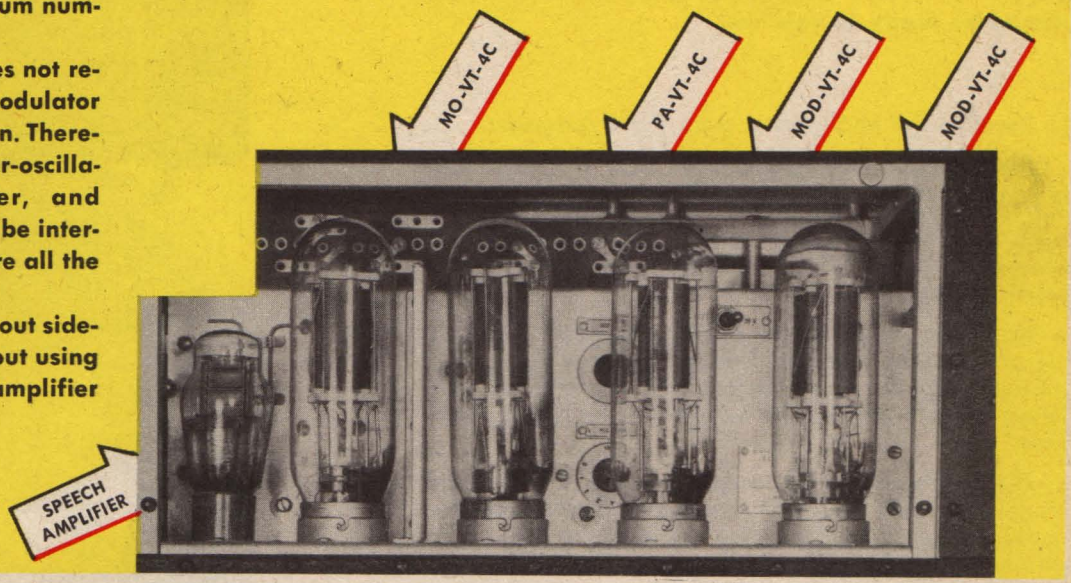
| KC | ¼ WAVE LENGTH | | ¾ WAVE LENGTH | |
|---|---|---|---|---|
| | Length (feet) | Counter reading | Length (feet) | Counter reading |
| 2000 | 123 | 108 | | |
| 2000 | 82 | 72 | | |
| 4000 | 62 | 54 | | |
| 5000 | 49 | 44 | 147 | 130 |
| 6000 | 41 | 36 | 123 | 108 |
| 7000 | 35 | 30 | 105 | 92 |
| 8000 | 31 | 28 | 93 | 82 |
| 9000 | 27 | 24 | 81 | 72 |
| 10,000 | 24 | 22 | 73 | 84 |

# EMERGENCY OPERATION

**In case of tube failures the transmitter may be operated on CW using a minimum number of tubes.**

**The transmitter does not require the use of the modulator tubes for CW operation. Therefore the VT-4C master-oscillator, power-amplifier, and modulator tubes may be interchanged since they are all the same type.**

**CW operation, without sidetone, is possible without using the VT-25 speech amplifier tube.**




## ANTENNA SYSTEM

By carrying a spare piece of wire with battery clips on both ends the command-equipment antenna can be connected to the liaison equipment and be used as a substitute in an emergency.

## KEYING

The transmitter can be keyed by using the TEST KEY on its front panel, or by plugging a microphone into the jack on the left side of the transmitter and using the hand switch of the microphone for a key.

# MAINTENANCE AND INSPECTIONS

To insure proper transmitter operation a routine check on the condition of the transmitter equipment should be made daily.

The following checks are recommended:

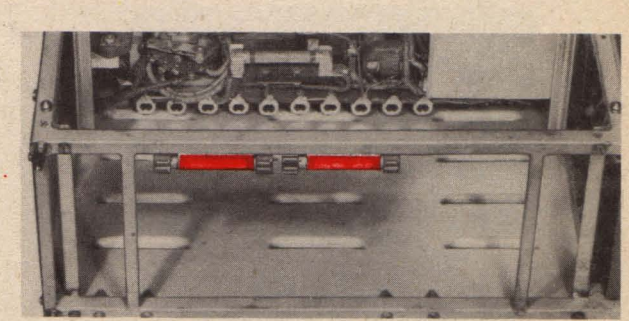
1—Check all connecting cords for breaks and for frayed bonding or shielding.

2—Inspect the antenna system thoroughly. Wipe insulators clean. Be sure the antenna leads are not bent close to metallic objects where high antenna voltages might cause sparkovers.

3—Inspect the microphone and key circuits.

4—Give the transmitter a complete operating check.

Note the total plate- and antenna-current readings. If they are not normal make further checks to determine why they are not.



## FUSES

The high-voltage circuits within the transmitter are protected by a ½-ampere 1,000-volt fuse.

Two spare high-voltage fuses are carried in clips inside the transmitter.

A safety interlock switch is provided to turn the dynamotor off when a tuning unit is removed.

**CAUTION:** Be sure the dynamotor has stopped running before replacing a high-voltage fuse. Be sure the main switch is in the OFF position. The high voltage present while the dynamotor is running at full speed is dangerous to life.

# DYNAMOTOR

**The transmitter dynamotor must be checked at periodic intervals to insure proper operation. This should be made as follows:**

**1**—Remove the end covers from the dynamotor.

**2**—Remove the brushes from one end at a time, being very careful to note their polarity markings.

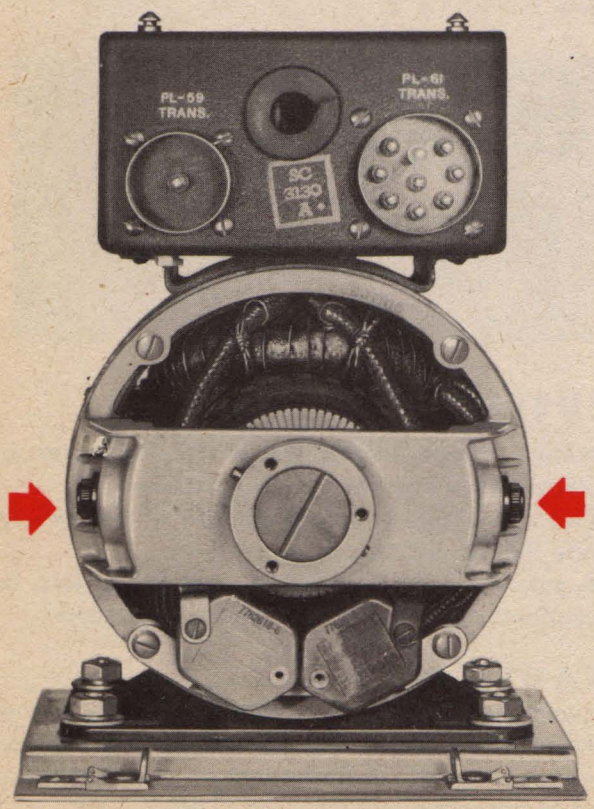
**3**—If gasoline or kerosene is available clean the brushes thoroughly. **Do not clean them with carbon-tetrachloride.**

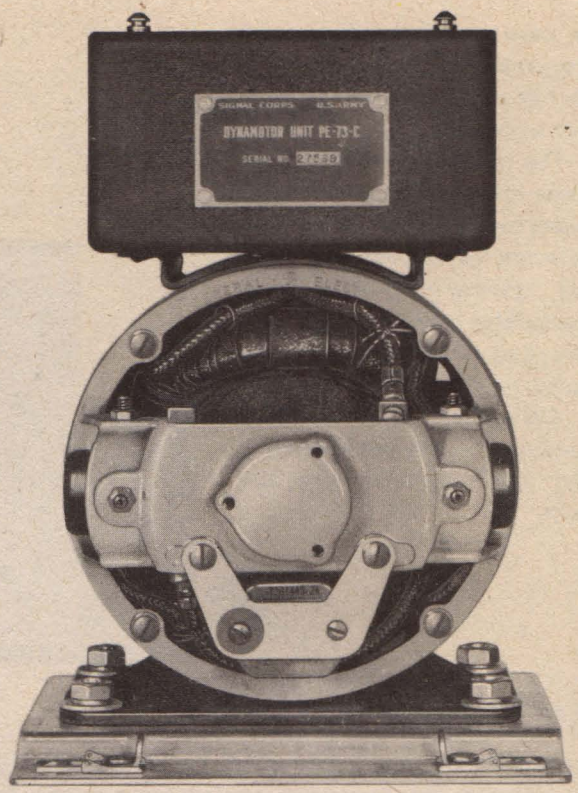
**4**—Note the condition of the commutator. Wipe it clean with a lintless rag. Remove scum with carbon-tetrachloride. **Do not attempt the remove the polished discoloration. This indicates normal operation.**

**5**—If the commutator is rough or pitted it should be sanded smooth with 00 sandpaper. Determine the cause of the rough or pitted commutator. This condition is usually caused from poor brush contact, loose brush springs, or defective brushes and brush holders.

**6**—Check the condition of the brushes thoroughly. **Replace any brush less than ⅜ inch in length.** Be sure there are no hard spots or chipped corners on the brushes.

**7**—Spin the armature. It should spin freely. If it does not, check for cracked or dirty bearings or oxidized grease in the bearings.




## LUBRICATION

Under normal operating conditions the bearings should be greased after 5,000 hours of operation. If the bearing brackets are equipped with oil holes three drops of SAE 20 oil should be inserted every 1,000 hours or at 6-month intervals. Refer to technical orders for more complete instructions.

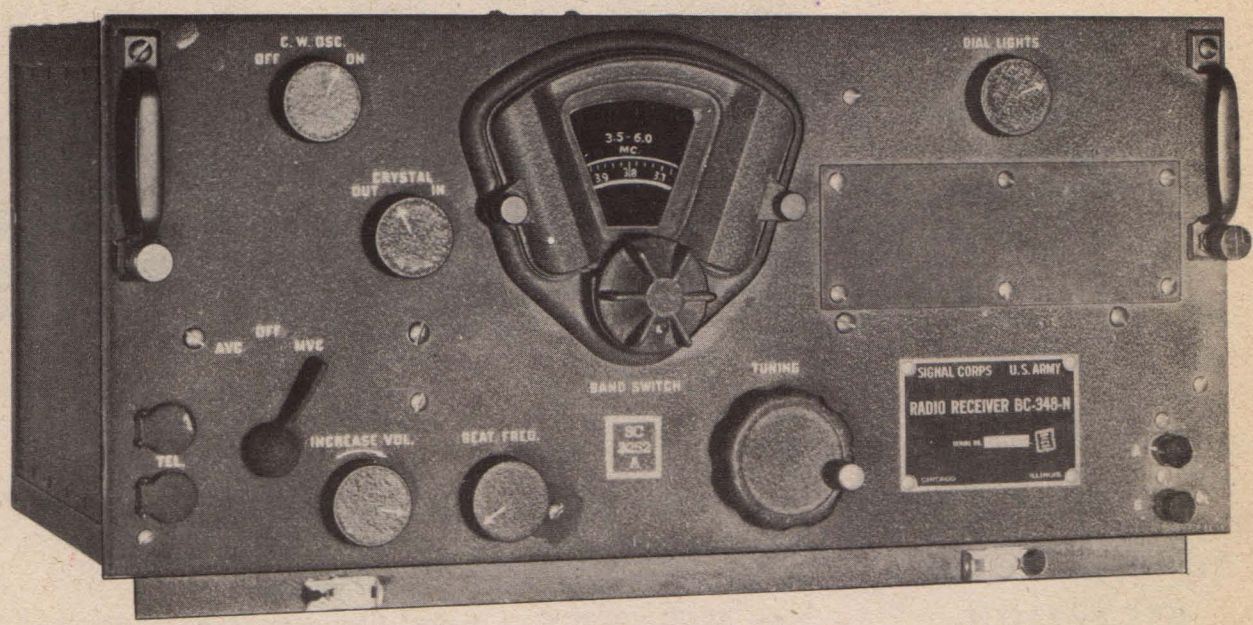
## WARNING:

**Never use emery cloth or a file for cleaning the commutator. Do not allow carbon-tetrachloride to come in contact with the brushes.**

**Do not allow any cleaning fluids to splash on armature or field windings. Do not lubricate too frequently.**

# SCR 287 HIGH-POWERED LIAISON EQUIPMENT

## LIAISON RECEIVER




**The BC 348 Receiver is a six-band, eight-tube super-heterodyne designed for operation with the BC 375 or the AN/ART-13 transmitter equipment. It is capable of receiving CW, MCW, or VOICE signals with MANUAL or AUTOMATIC VOLUME CONTROL. A built-in dynamotor is provided to furnish the high voltage necessary for its operation.**

**AVC-OFF-MVC** switch applies power to the receiver and selects either AUTOMATIC or MANUAL VOLUME CONTROL.

**INCREASE VOL** control is a sensitivity adjustment when on MVC, and an output level adjustment when on AVC operation.

**TUNING** control rotates tuning condensers to select desired operating frequency.

**BAND SWITCH** selects the desired frequency band and changes the dial mask so that it indicates the operating-frequency range.

**CW-OSC ON-OFF** toggle switch controls the operation of the CW oscillator as well as the automatic volume-control time constant for CW reception.

**BEAT FREQ** varies the pitch of the CW signal being received. When tuning the receiver it should be set in zero-beat position (pointer straight up).

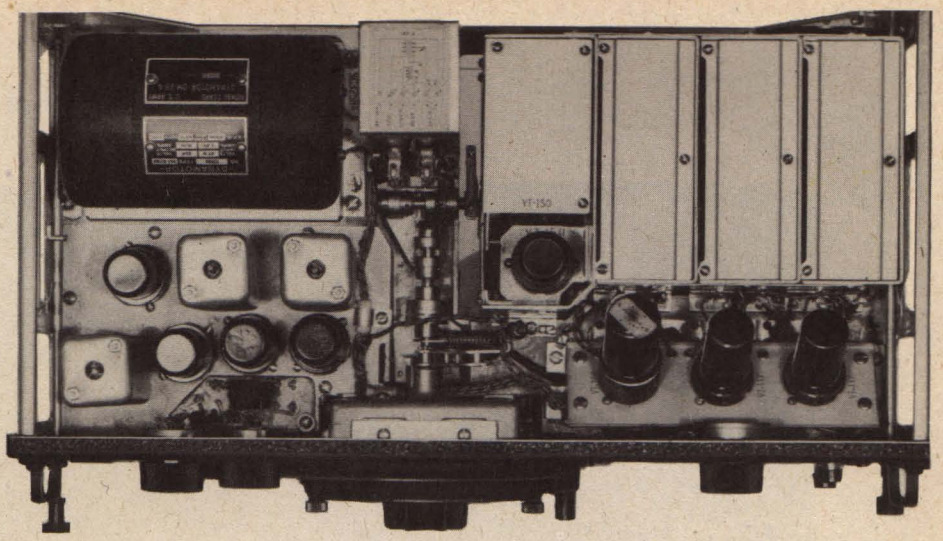
**CRYSTAL OUT-IN** control permits insertion of a CRYSTAL FILTER when extreme selectivity is desired.

**DIAL LIGHTS** knob permits control of the intensity of the dial-light illumination.

**ANT ALIGN** control aligns the input circuits of the receiver to a given antenna for maximum operating performance.

# DYNAMOTOR

The high voltage is supplied by a dynamotor unit mounted on the receiver chassis.



# RECEIVER OPERATION

## TONE or VOICE RECEPTION

1—Place AVC-OFF-MVC switch on MVC position.

2—Place CW OSC toggle switch on OFF position.

3—Place CRYSTAL filter switch on OUT position.

4—Place BAND SWITCH on desired frequency range.

5—Tune in the station with TUNING control. Always tune for maximum volume of the signal being received.

●

## CW RECEPTION

1—The procedure is the same as outlined for tone or voice with the exception that the CW OSC switch is ON, and the BEAT FREQ control is set with the arrow pointing straight up.

2—After the signal has been received the BEAT FREQ control may be varied until the pitch of the signal is desirable to the ear.

3—When extreme selectivity is desired to minimize interference the crystal filter should be switched to IN position. A slight readjustment of the TUNING and BEAT FREQ controls may be necessary after this is done.

**NOTE:** The CRYSTAL FILTER is intended primarily for CW reception. However, the added selectivity may prove helpful in receiving modulated signals through heavy atmospheric interferences.

**AVC should not be employed while tuning in a signal**—Initial tuning should always be accomplished in MVC position with the VOL control set to a comfortable output level. **The volume control must not be turned to maximum-volume position while tuning. A strong signal will block reception.**

# ANTENNA ALIGNMENT

The ANT ALIGN control may be adjusted for maximum background noise at approximately 500 kc. This will align the receiver for all frequencies.

It is recommended, however, that this control be adjusted for maximum signal strength at the frequency of the signal being received.

# MAINTENANCE AND INSPECTIONS

To insure proper operation, the receiver should be given a daily operational check as follows:

1—Place AVC-OFF-MVC switch on MVC position. Check dial lamps.

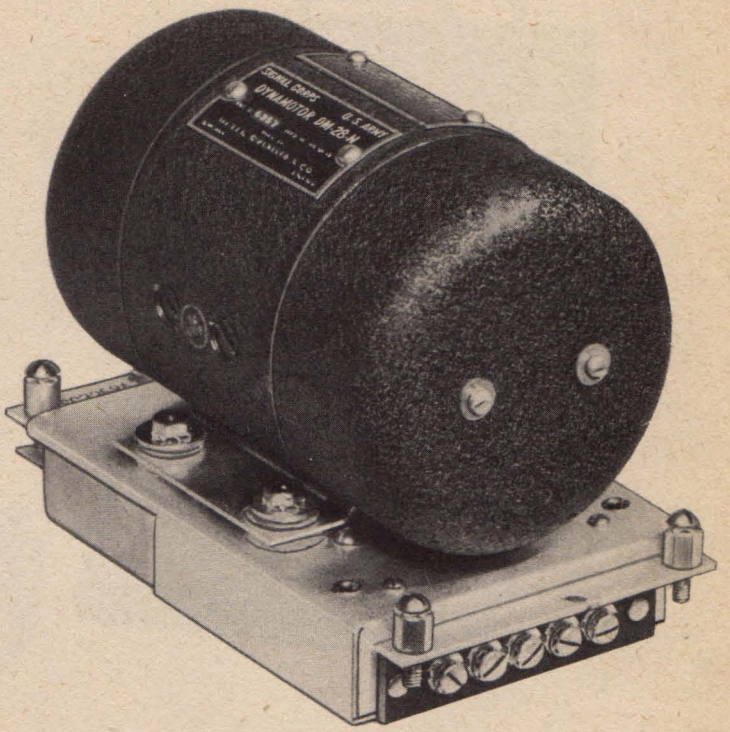
2—Check for proper operation on all bands with CW OSC switch ON. This test can be made by listening to background noise with the volume control near its maximum position.

3—Check the ANT and GND connections. Be sure they are secure.

## DYNAMOTOR

The dynamotor requires lubricating after 1,000 hours or approximately 6 months of ordinary service.

Complete lubricating instructions will be found inside the end covers.

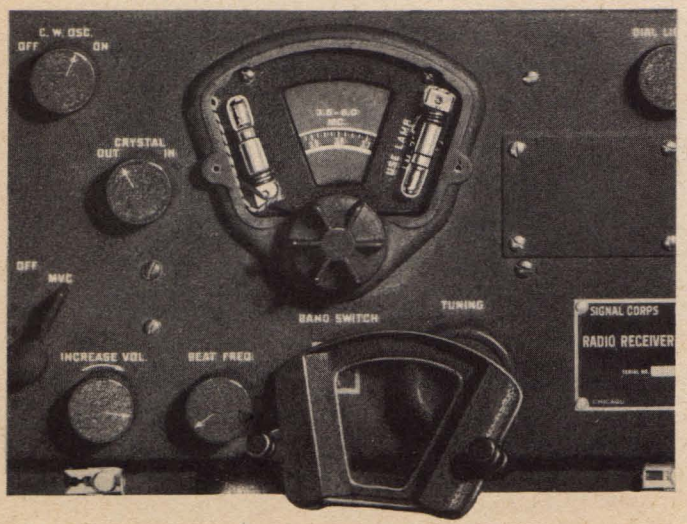



### To Remove from Receiver

1—Remove receiver from case by loosening the two thumbscrews under the handles on the front panel.

2—Remove the five spade terminals from the dynamotor-terminal strip (under the chassis).

3—Loosen the four screws from the top of the dynamotor assembly, and lift the assembly out of the receiver.




## DIAL LIGHTS

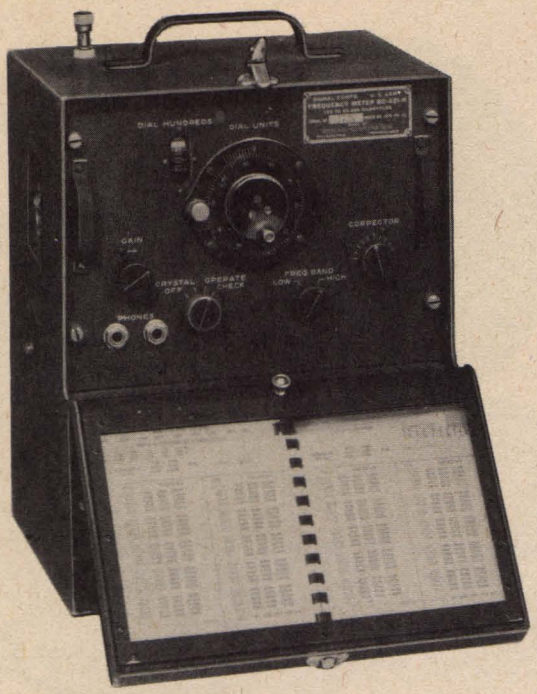
The dial lights are located behind the dial-mask cover. These lights are wired in series, which means if one burns out the other will not light.

They are easily accessible by removing the dial-mask cover, which is removed by loosening the two small thumbscrews on each side of the cover.

**FUSE** The receiver is protected by one 5-ampere, 25-volt fuse located under the chassis near the front and center.

# SCR 211 FREQUENCY METER

Frequency meter SCR 211 is a portable, self contained instrument for accurately checking the frequency of a radio receiver or transmitter. It operates within the frequency range of 125 to 20,000 kc.




**Low Band . . . . . 125 to 2000 kc**
**High Band . . . . . 2000 to 20,000 kc**

## FREQUENCY COVERAGE

There are two frequency ranges, namely 125 to 250 kc and 2000 to 4000 kc. By the use of the 2nd, 4th, and 8th harmonics of the low-frequency range any frequency between 250 and 2000 kc can be obtained. By the use of the 2nd, 4th, and 5th harmonics of the high-frequency range any frequency between 4000 and 20,000 kc can be obtained.

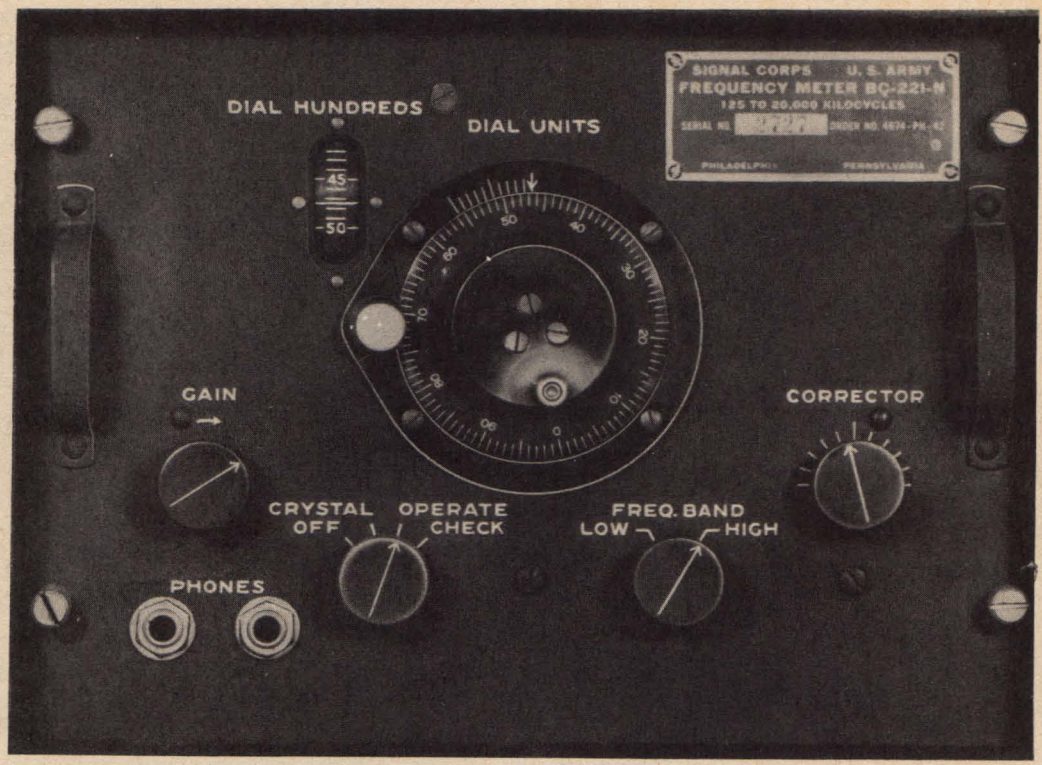
The crystal (check) oscillator has a fundamental frequency of 1000 kc with a rich harmonic output. Therefore, heterodyne frequency oscillator can be checked at a number of points in each band by using the harmonics of the crystal oscillator.

## CALIBRATION BOOK

The calibration book contains dial settings and crystal check points for the low- and high-frequency bands. The first half of the book contains the low-band calibration; the last half contains the high-band calibration. A complete index will be found in the center of the book. Operating instructions are printed in the back part.

**NOTE: Make sure the serial numbers of the calibration book and the frequency meter correspond before using.**

# FREQUENCY METER CONTROLS




## TUNING DIAL

The tuning dial controls the frequency of the heterodyne frequency oscillator. It consists of three parts: a drum marked DIAL HUNDRDEDS, a disk dial marked DIAL UNITS, and a vernier scale immediately above the dial units.

Each division on the DIAL HUNDREDS dial corresponds to one full rotation of the DIAL UNITS dial which has 100 divisions. The vernier scale reads in tenths of one division on the DIAL UNITS dial. The vernier scale has ten divisions which occupy the same space as nine divisions on the DIAL UNITS scale. If the DIAL UNITS dial is set so that the vernier index arrow points between two divisions on the scale, there will be some line on the vernier scale which coincides or very nearly coincides with a line on the DIAL UNITS dial. The number of vernier divisions between the index arrow and the coincident mark denotes tenths of a dial division.

**Example:** The dial reading on the control panel shown is 4746.6.

## CORRECTOR

The CORRECTOR knob is a fine-adjustment control of the heterodyne frequency oscillator.

## OFF-CRYSTAL-OPERATE-CHECK

This switch permits the insertion of the crystal oscillator for checking purposes. It is also the power switch.

## FREQ BAND LOW-HIGH

This switch selects the band on which the frequency meter will operate.

## PHONES

PHONES jacks are for two headsets. They also control the filament circuit. The headsets must be plugged in to complete the filament circuit.

**CAUTION: Be sure power switch is off and headsets are not plugged in these jacks when the equipment is not in use.**

# OPERATION

**1**—Plug headsets into one of the PHONES jacks. Allow approximately 2 minutes for the tubes to heat. (For extreme accuracy 15 minutes will be required.)

**2**—Refer to the INDEX in the center of the CALIBRATION BOOK for the page on which the desired frequency appears.

**3**—Turn to the proper page in the CALIBRATION BOOK. Note the CRYSTAL CHECK POINT at the bottom of the page. Place the TUNING DIALS on the CHECK POINT frequency.

**4**—Place the FREQ BAND low-high switch to the proper band depending upon the operating frequency.

**5**—Place OFF-CRYSTAL-OPERATE CHECK switch on CHECK position.

**6**—Rotate GAIN control fully clockwise.

**7**—Adjust CORRECTOR knob for zero beat in the headsets.

**8**—Place OFF-CRYSTAL-OPERATE CHECK switch on OPERATE position.

**9**—Rotate the TUNING DIALS to the setting for the desired operating frequency. This setting is also found in the CALIBRATION BOOK. The frequency meter is now ready for operation.

# ZERO BEATING

## TRANSMITTER TO FREQUENCY METER

Calibrate and tune the frequency meter to the desired operating frequency. Place frequency meter so that its antenna is near the transmitter's antenna but not touching it. Tune the transmitter on CW by use of the transmitter's calibration chart. Key the tramsitter and vary master-oscillator control B on the transmitter until a zero beat is obtained in the frequency-meter headsets.

## RECEIVER TO TRANSMITTER

Place MVC-OFF-AVC switch on receiver on MVC position. Place CW OSC ON-OFF toggle switch on ON position. Rotate the BEAT FREQ control to zero-beat position, arrow straight up. Tune the receiver to the approximate frequency of the transmitter. Vary the tuning control until a zero beat is obtained. *Caution: If the receiver's VOL control is tuned to a high level (fully clockwise) all reception might be blocked.*

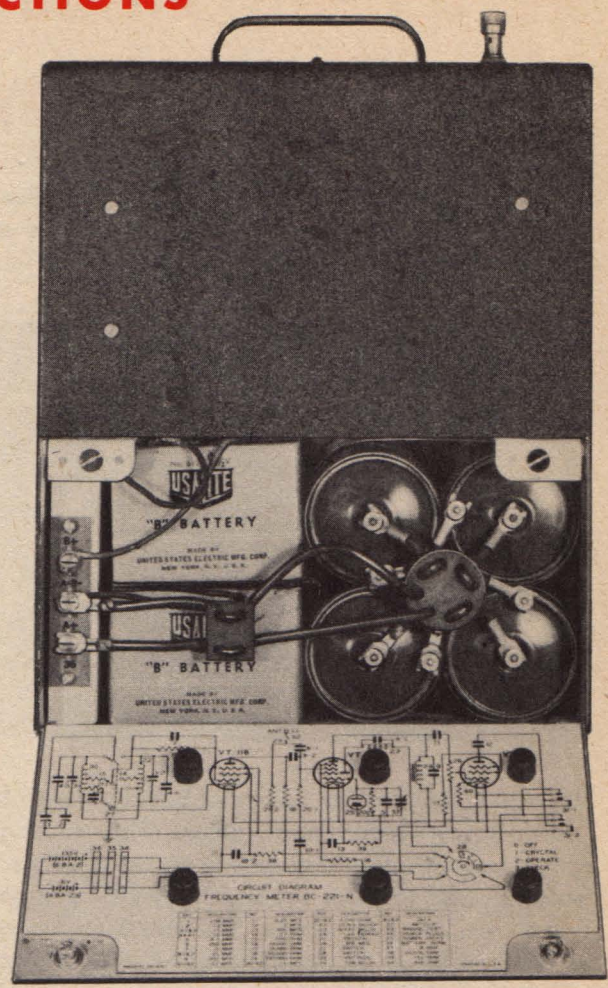
## TRANSMITTER TO RECEIVER

Zero beat the receiver to a net station. Tune the transmitter to the approximate frequency desired. Place MONITOR switch on MONITOR position (no sidetone position). Vary the master oscillator control on the transmitter until a zero beat is obtained in the phones plugged into the receiver.

# MAINTENANCE AND INSPECTIONS

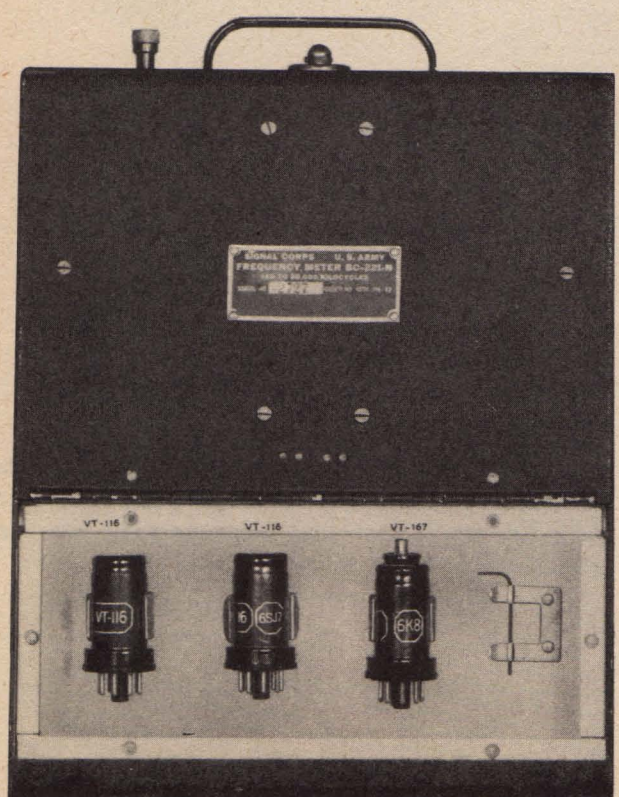
## BATTERIES

The frequency meter contains A and B batteries for its operation. Four (BA-23) A batteries furnish the 6 volts required for the filament circuit; and six (BA-2) B batteries furnish the 135 volts required for the high-voltage circuits. In each case the batteries are connected in series. The batteries should be replaced whenever they show a 10-per cent decrease in their rated voltages.




## SPARE PARTS

**TUBES.** A spare set of tubes is carried in the compartment in front of the frequency meter. This compartment is readily accessible by loosening the screws on the lower front panel and removing the cover from the case.




**CRYSTAL.** A spare crystal is furnished with each frequency meter. It is mounted in the bottom of the chassis.

Faulty operation of the frequency meter may be caused by failure of either the crystal circuits or the heterodyne oscillator circuits. The following tests may be made to isolate troubles.

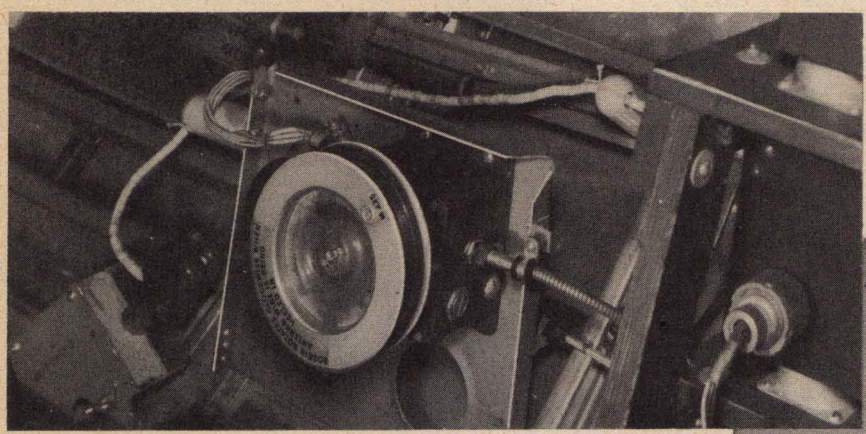
1—To check crystal circuits: Place operating knob on CRYSTAL position. Under normal operating conditions a signal should be heard in the receiver at 1000 kc when the receiver's CW OSC is ON.

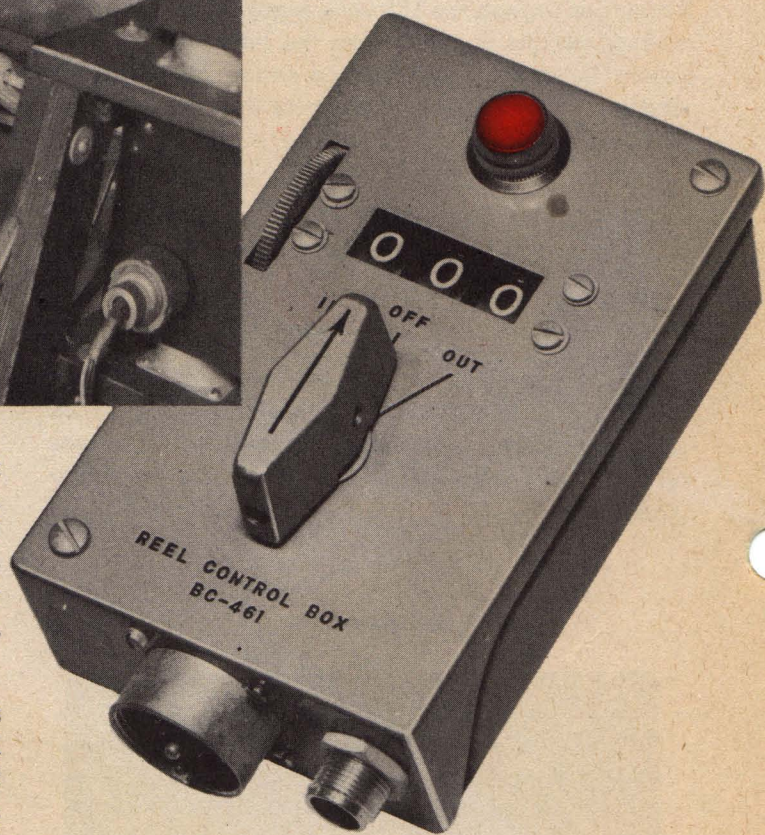
2—The heterodyne oscillator circuits can be tested by placing the operating knob on OPERATE and making the above test. If either of the above tests indicate a defective circuit, replace the crystal or the tubes with the spare parts provided.

# RL-42-A TRAILING-WIRE ANTENNA REEL

# BC-461 REMOTE-CONTROL BOX

The RC-42-A Reel and BC-461 Remote-Control Box are designed to control remotely the trailing-wire antenna system; the control box registers the approximate number of feet of wire extended.






The reel consists of an insulated bobbin driven by a geared-down, high-speed motor. The reeling-out speed in a moving airplane is approximately 300 feet per minute. The reeling-in speed is approximately 130 feet per minute. The maximum capacity of the bobbin is about 500 feet of wire. However, usually only 250 feet of wire are used.

The reel is equipped with special limit switches which will not allow the wire to reel out if the lead weight (fish) is missing. These switches also turn off the reel when the wire is reeled into the position where the lead weight is snug against the fair-lead bell. A red warning light on the control box indicates whether or not the motor is energized.

## MAINTENANCE AND INSPECTIONS

A preliminary check of the reel operation should be made with the airplane on the ground. This check can be made as follows:

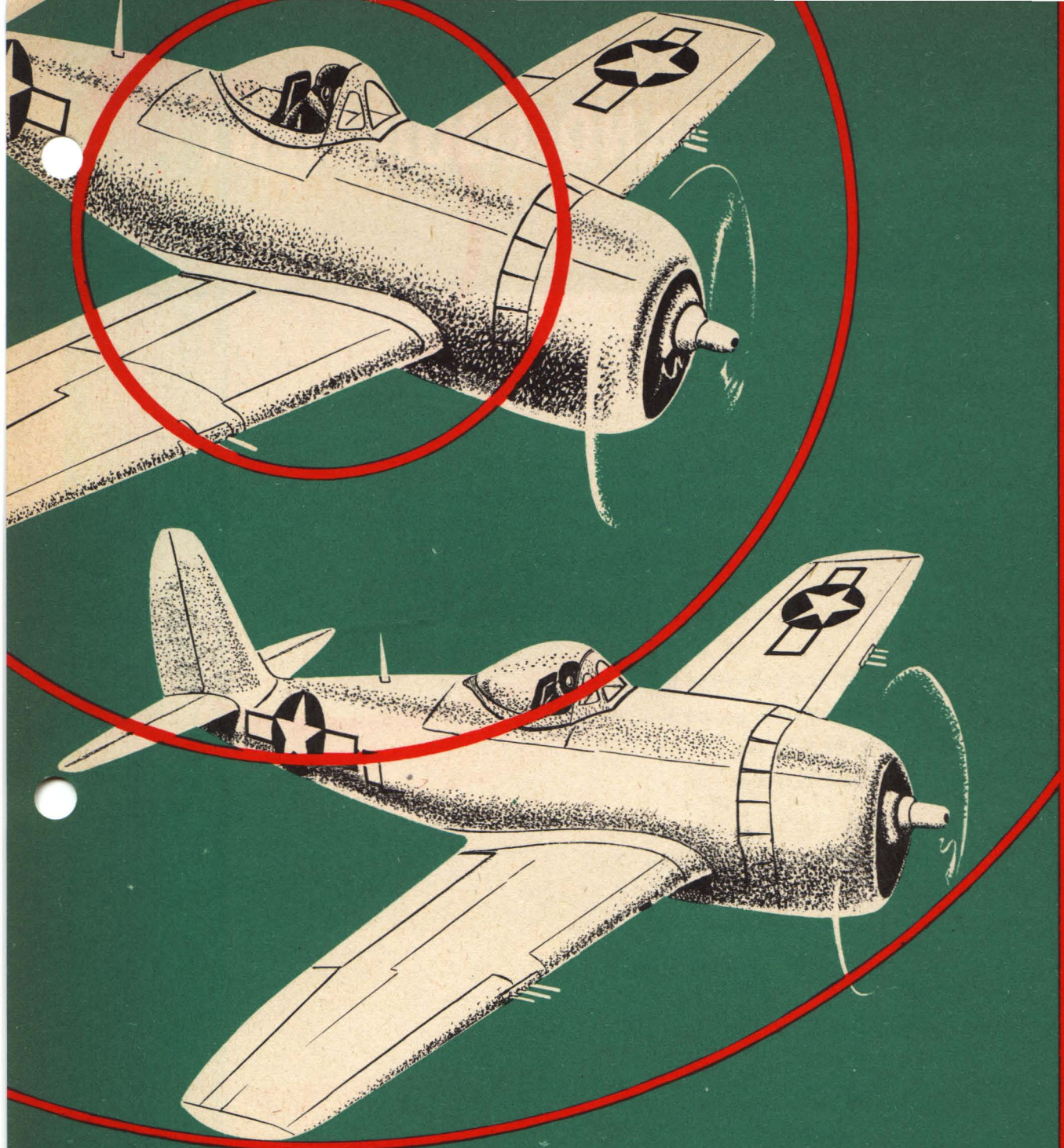
**1**—Place the IN-OFF-OUT switch on the control box on OUT position. The wire should reel out until the lead weight touches the ground, at which time the reel should stop. The red warning light should be on.

**2**—Place the IN-OFF-OUT switch on IN position. The reel should reel in the wire until the lead weight is snug against the fairlead, when it will stop and turn the warning light off. The IN-OFF-OUT switch should then be placed in the OFF position.

A further check on the condition of the wire may be made by reeling it out, carrying the lead weight back 150 to 175 feet, and inspecting the wire as it is reeled in.

### LUBRICATION

**The inspection plate on the side of the reel box should be removed occasionally and a small amount of lubricant applied to the worm gear. Care should be exercised not to apply the lubricant to the worm itself.**



SECTION

5

# COMMAND EQUIPMENT

SECTION

5

# COMMAND EQUIPMENT

## TABLE of CONTENTS



COMMAND SETS ARE USED BY THE PILOT MAINLY FOR PLANE-TO-PLANE AND PLANE-TO-GROUND COMMUNICATIONS. IT IS YOUR RESPONSIBILITY TO SEE THAT THEY ARE MAINTAINED AT THE HIGHEST POSSIBLE STANDARDS AT ALL TIMES.

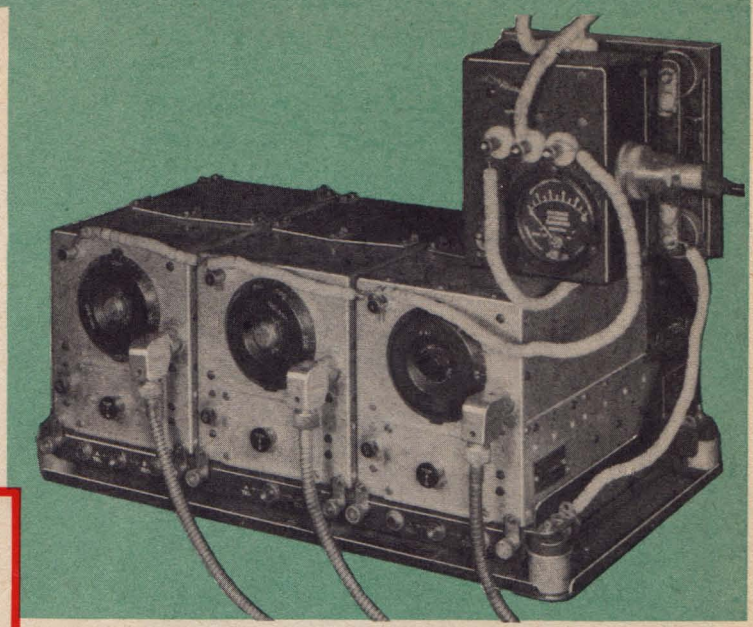
# SCR 274-N COMMAND EQUIPMENT

***Remotely Controlled***

***or***

**1—Auxiliary liaison equipment**

**2—Emergency interphone system**



## RECEIVING EQUIPMENT

The most common installations include three receivers:

## FREQUENCY RANGES ARE:

| | |
|---|---|
| BC 453 | 190 to 550 kc |
| BC 454 | 3000 to 6000 kc (3.0 to 6.0 mc) |
| BC 455 | 6000 to 9100 kc (6.0 to 9.1 mc) |

The receivers are all six-tube superheterodynes with built-in beat-frequency oscillators to permit CW reception.

Each receiver has its own dynamotor for supplying the required high-voltage.

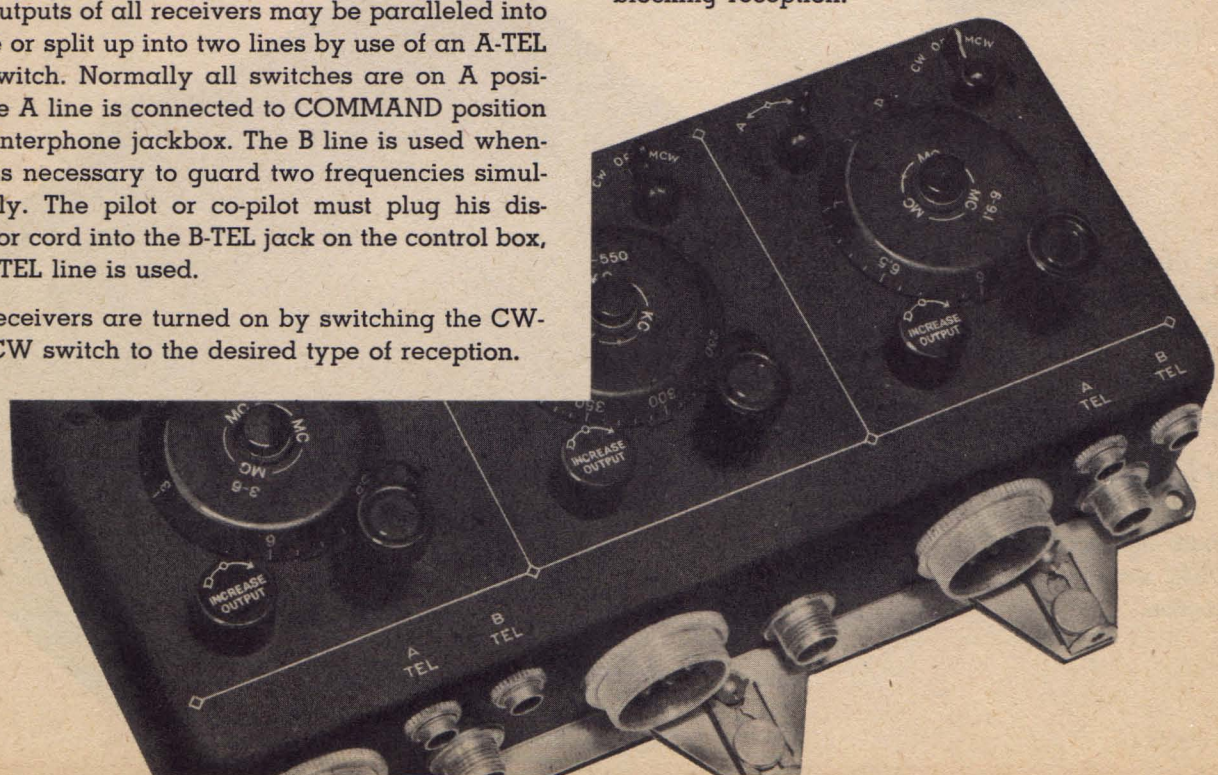
## CONTROLS

The receivers are remotely controlled from the pilot's compartment.

The outputs of all receivers may be paralleled into one line or split up into two lines by use of an A-TEL B-TEL switch. Normally all switches are on A position. The A line is connected to COMMAND position on the interphone jackbox. The B line is used whenever it is necessary to guard two frequencies simultaneously. The pilot or co-pilot must plug his disconnector cord into the B-TEL jack on the control box, if the B-TEL line is used.

The receivers are turned on by switching the CW-OFF-MCW switch to the desired type of reception.

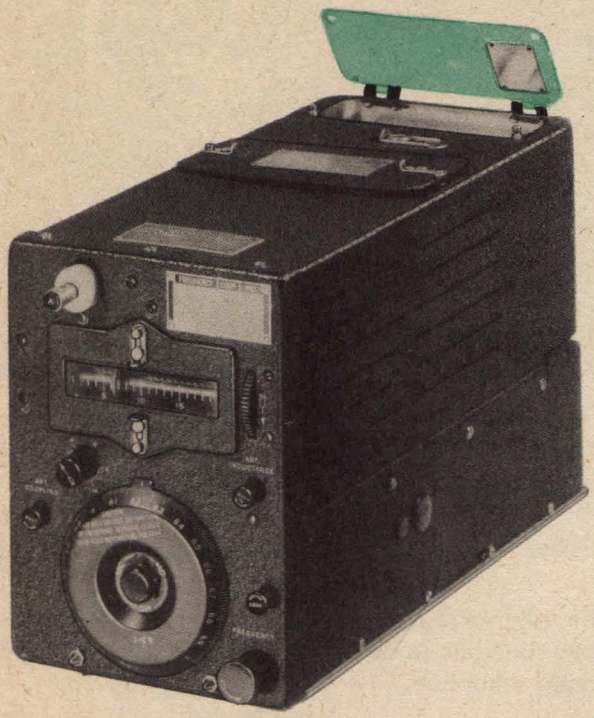
The volume is manually controlled. A signal suppressor is built in to prevent strong signals from blocking reception.



# TRANSMITTING EQUIPMENT

## TRANSMITTER

Most airplanes are equipped with two transmitters in operation and a third one stowed.



The transmitter dials are calibrated directly in megacycles (mc).

Each transmitter is provided with a special, built-in, frequency-checking device.

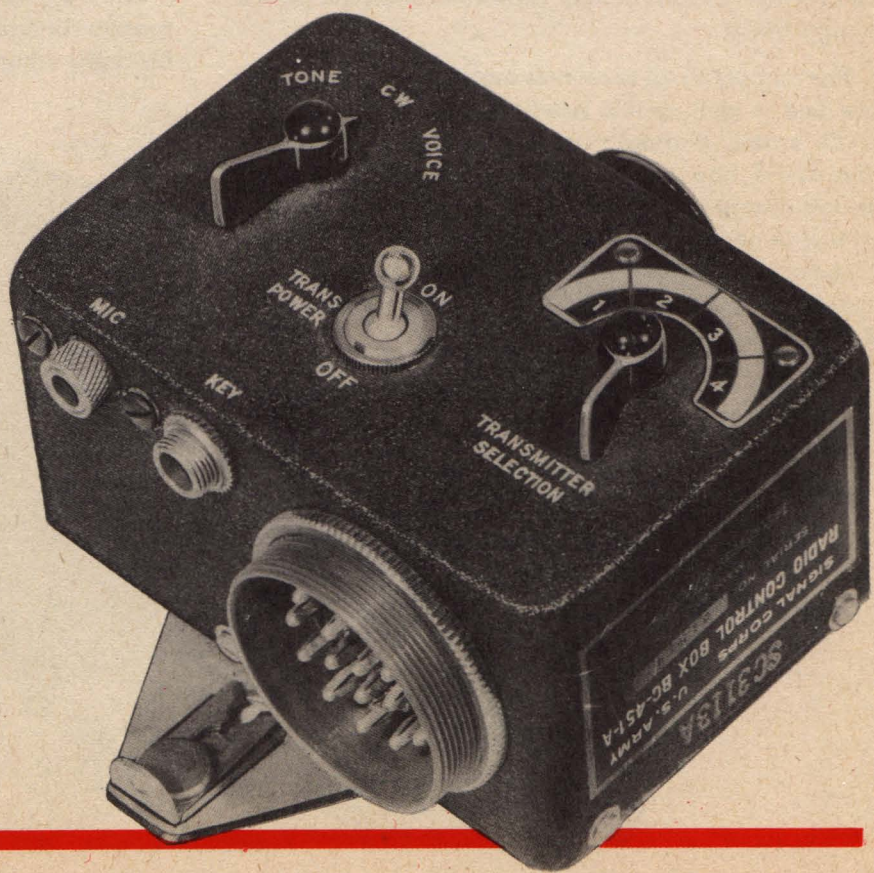
### CONTROLS

All transmitters are remotely controlled from the pilot's compartment.

Four transmitters are available for selection.

### FREQUENCY RANGES ARE

| | |
|---|---|
| BC 696 | 3000 to 4000 kc (3.0 to 4.0 mc) |
| BC 457 | 4000 to 5300 kc (4.0 to 5.3 mc) |
| BC 458 | 5300 to 7000 kc (5.3 to 7.0 mc) |
| BC 459 | 7000 to 9100 kc (7.0 to 9.1 mc) |

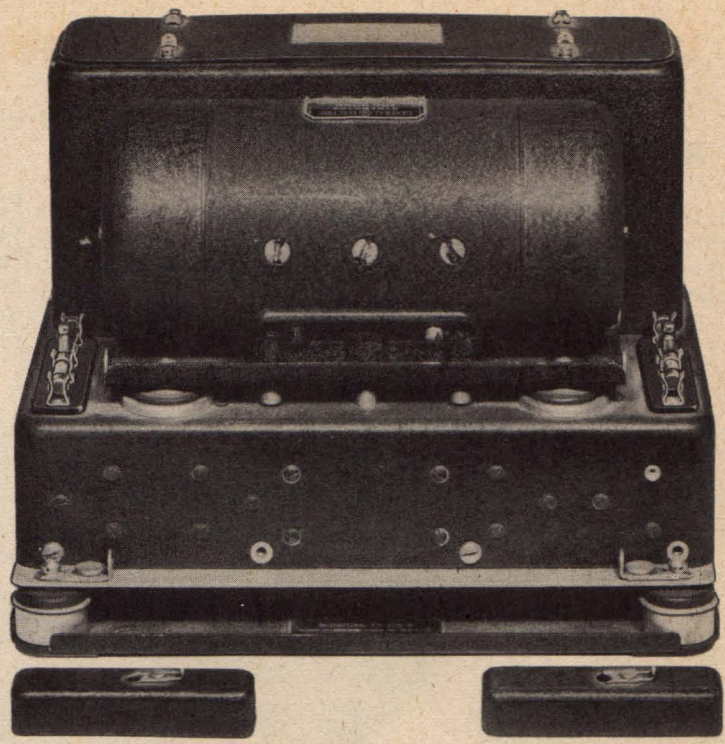



The four-position TRANSMITTER-SELECTION switch remotely selects any one of the installed transmitters.

The ON-OFF switch controls the transmitter's power input.

It is possible to key the transmitter by use of the test key on top of the remote control box. The TONE-CW-VOICE switch controls the type of emission.

# MODULATOR UNIT

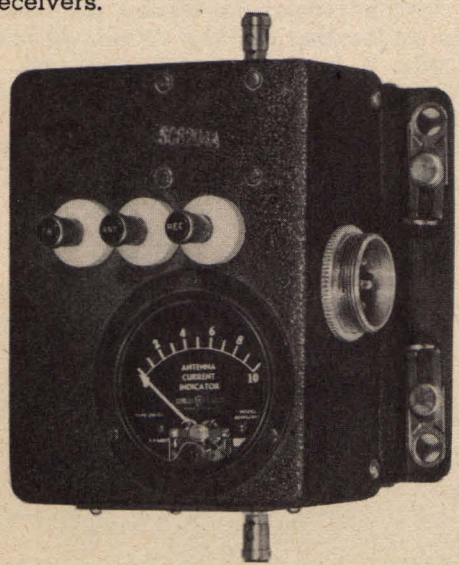


High-voltage and modulating power is furnished to any one transmitter at a time from a separate modulator unit, BC 456-A.

This unit contains the tone-oscillator, speech-amplifier modulator, and voltage-regulator tubes; also the transmitter fuses.

# ANTENNA-SWITCHING RELAY UNIT

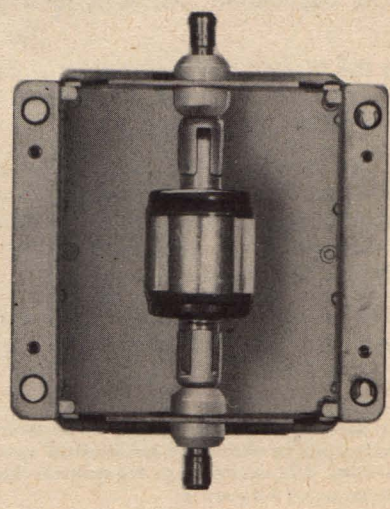
The antenna-switching relay unit switches the command antenna to the transmitters when the keying circuit is closed. Normally the antenna is connected to the receivers.




A thermocouple type ammeter is connected in the circuit to register antenna current.

The LOCAL-REMOTE switch makes it possible to supply an antenna-current reading to a remotely-placed antenna meter.

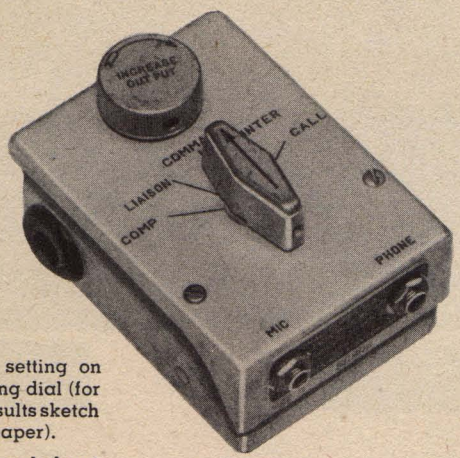
A high-voltage vacuum condenser (50 mmfd) is connected between the two terminals on the front and back of the relay unit. This is used to shorten the command antenna electrically for the higher frequency ranges of the transmitters. The BC-459 (7.0-9.0 mc) antenna post is usually connected to this condenser.



# OPERATION OF EQUIPMENT

## RECEIVER TUNING

It is important that the frequency calibrations on the receivers and remote-control dials correspond. If they do not correspond, the remote-control dial should be realigned.




**TO REALIGN:**

**1**—Observe the setting on the receiver-tuning dial (for more accurate results sketch this setting on paper).

**2**—Loosen the knurled nut on the center of remote-control dial and set this dial to the same reading as on the receiver-tuning dial.

**3**—Tighten the knurled nut finger-tight.

## TRANSMITTER CALIBRATION

Before tuning the transmitter the frequency calibration should be checked in the following steps:

**1**—Turn on transmitter. Allow it to warm up for 1 minute.

**2**—Open the hinged cover (top-rear of transmitter) so that the mirror on the cover will reflect the image of the tuning-indicator tube.

**3**—Place the transmitter dial on the lowest frequency that will open the three-cornered shadow on the green resonance indicator. Spurious responses may be observed but they will always be higher than the fundamental crystal frequency.

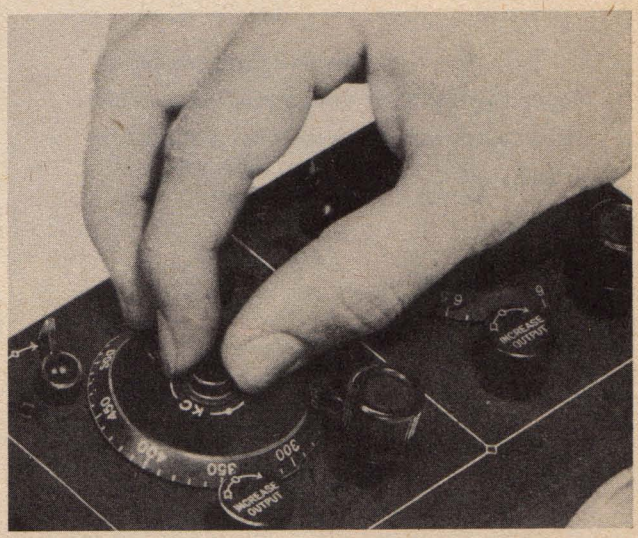
At this point, the indicated dial frequency should correspond with the frequency of the crystal.

**Since the built-in frequency device is crystal-controlled, it will be necessary to check the transmitter against the crystal's operating frequency. Each transmitter has a different crystal-check-point frequency.**

| TRANSMITTER | CHECK-POINT FREQUENCY |
|---|---|
| BC 696 3.0 to 4.0 mc | 3.5 mc |
| BC 457 4.0 to 5.3 mc | 4.6 mc |
| BC 458 5.3 to 7.0 mc | 6.2 mc |
| BC 459 7.0 to 9.1 mc | 8.0 mc |

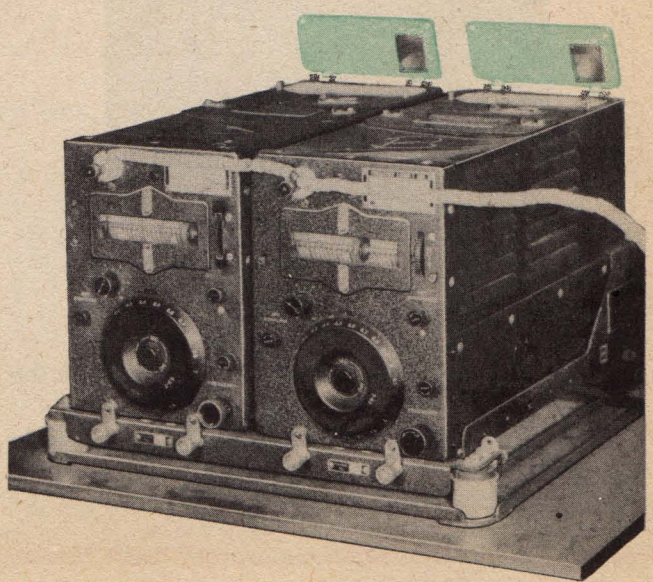
## ANTENNA ALIGNMENT

Place CW-OFF-MCW switch on CW position. Rotate the tuning dial to the high-frequency end of the band. Adjust ALIGN INPUT for maximum background noise. If the receiver is tuned to a squadron frequency, adjust the ALIGN INPUT control for maximum background noise at that frequency.




If the Dial Setting Differs:

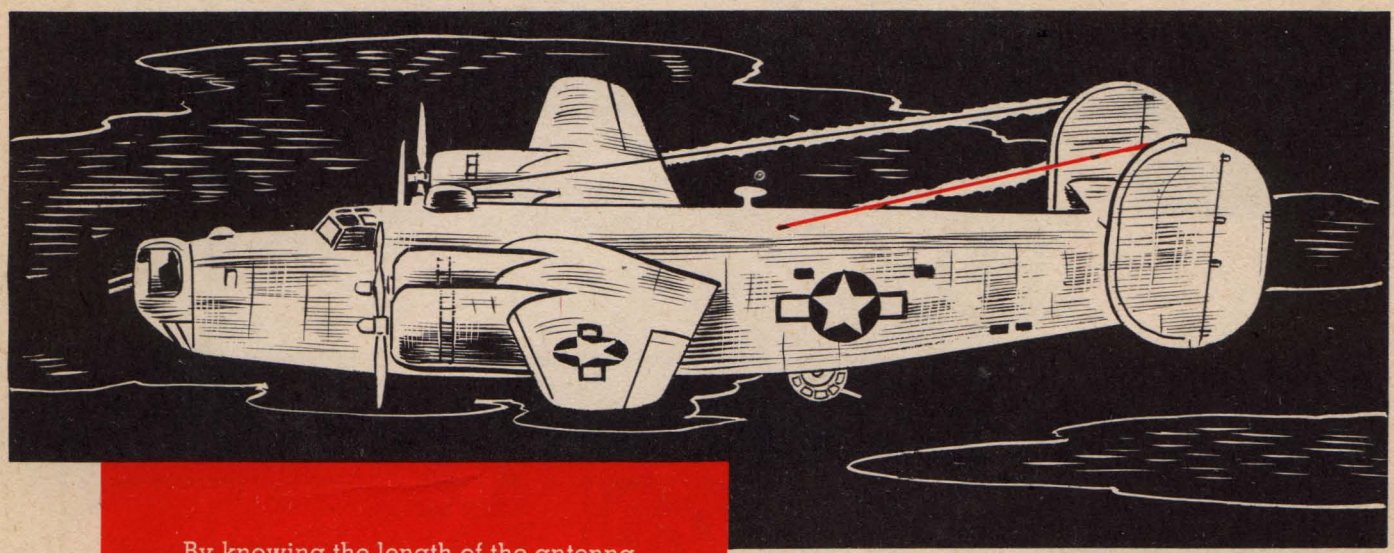
Set it to the crystal-check-point frequency and adjust the calibration trimmer. When adjusting the trimmer turn it fully clockwise and then turn it counterclockwise until the first shadow appears. A small thin screwdriver is necessary to make this adjustment. The dial setting should now be reasonably correct at all points on the dial.



# ANTENNA SYSTEMS

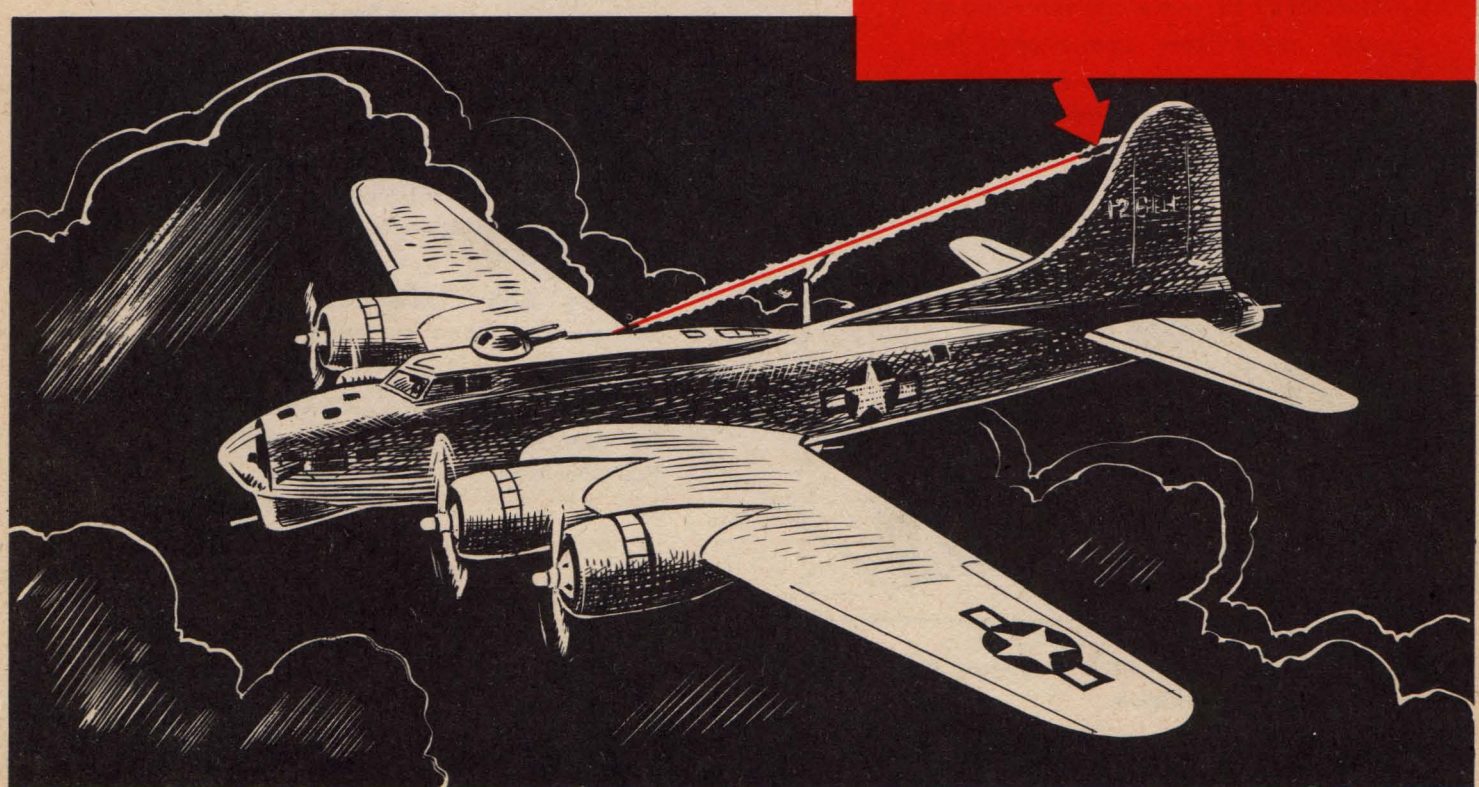
A fixed-wire antenna system is used for the 274 command equipment.

Most airplanes employ only one antenna to tune the entire frequency range of the transmitters.



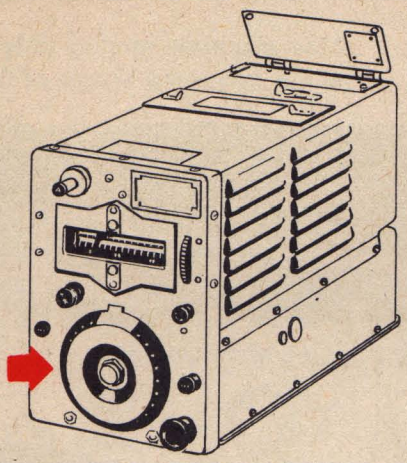
By knowing the length of the antenna system, including the lead-in, transmitter tuning can be greatly simplified.

For best results on higher frequencies see that this insulator is more than 2 feet from the airplane's tail surface.



# TRANSMITTER TUNING STEPS

## At the Transmitter

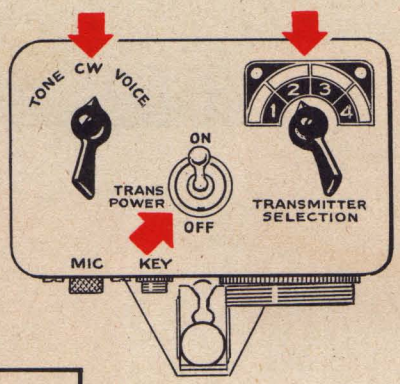


**1**—Set calibrated dial on the desired transmitting frequency.

**2**—Place ANT COUPLING control on 3.

**3**—Place toggle switch on antenna-relay unit on LOCAL.

## In the Pilot's Compartment




**4**—Select the proper transmitter with the TRANSMITTER SELECTION switch.

**5**—Place TUNE-CW-VOICE switch on CW.

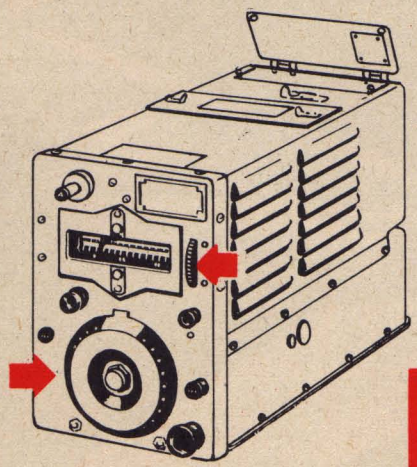
**6**—Place TRANS POWER switch on ON. Make sure the microphone switch or test key is not closed.

**7**—If the transmitter cannot be keyed from the interphone-jack box have someone hold down the test key on the control box.

**REMEMBER! Extreme caution must be taken not to jam operational frequencies while tuning the transmitter.**

**If no one is available, lock the key by rotating it clockwise.**

## At the Transmitter



**8**—Resonate the antenna circuit by adjusting ANTENNA INDUCTANCE for a maximum antenna-current reading.

**9**—Vary ANT COUPLING until maximum antenna current is obtained.

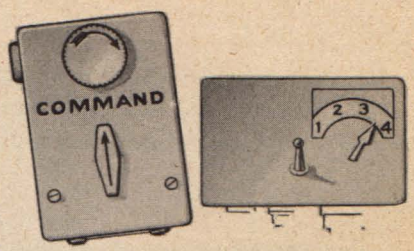
**10**—Retrim ANT INDUCTANCE for maximum antenna current. **Do this carefully!**

**Never retrim for maximum-antenna current on tone or voice positions. This would make the transmitter incapable of being properly modulated.**

**Lock controls of transmitter by turning lock knobs clockwise.**

If a remote antenna-current meter is used, place the toggle switch on the relay unit on REMOTE position.

# EMERGENCY OPERATIONS



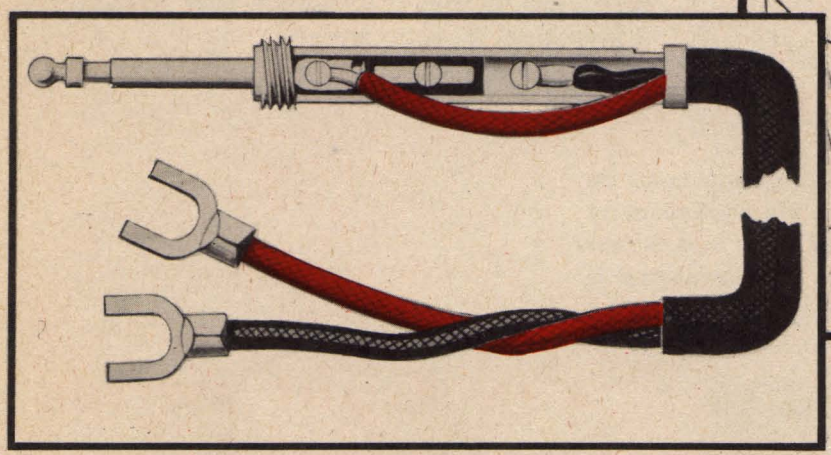

## INTERPHONE

By placing the TRANSMITTER-SELECTION switch on position 3 or 4 and the interphone jackbox on COMMAND position, the sidetone from the modulator unit may be used for interphone communication. Make sure one of the A-B switches on the receiver control box is turned to the A position.

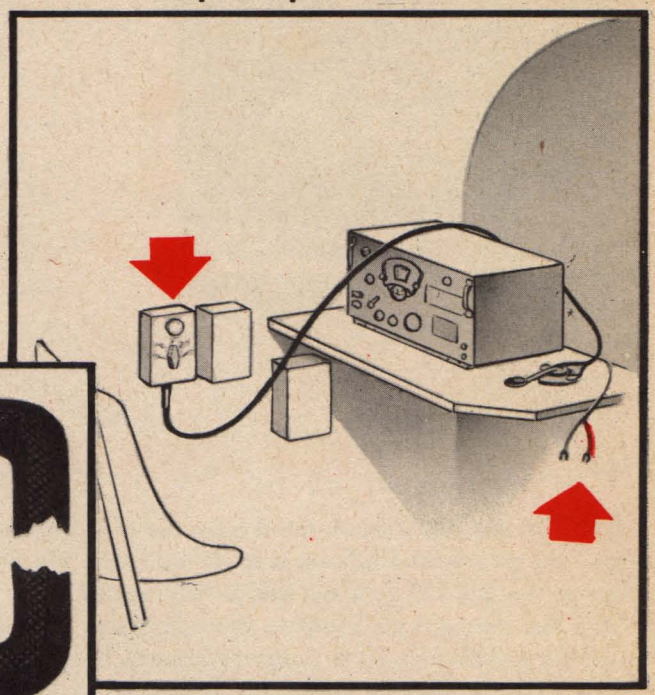
**Consult G FILES in your airplane to determine which interphone positions key the command transmitters.**

## AUXILIARY LIAISON

When the command transmitter is properly tuned to its antenna system, an output of 40 watts is possible. This is approximately one-half the power of the BC 375 liaison transmitter. Its range using CW emission would be great enough to enable it to be used as a liaison transmitter.



The command transmitter may be keyed on CW from the radio operator's position by using a special cord made up by using a Pl-68 and about 6 feet of two-conductor cable. Plug the Pl-68 into the Mic jack on the interphone jackbox. Remove the liaison key terminals and fasten the terminal ends of the special cord to the key terminals.



By using a 12-foot piece of insulated wire with battery clips on each end, the command transmitter may be connected to the trailing-wire or another antenna of proper length.

Proper antenna length required can be figured by the following simple formula:

$$\text{Length in feet} = \frac{234}{\text{Freq in mc}}$$

It is not necessary to use more than one decimal place, eg., if frequency is 3105.75 kc use 3.1 mc, etc.

**Do not send faster than 12 words per minute when using the command transmitter for code messages.**

The transmitter may be operated on CW without using any of the modulator-unit tubes.

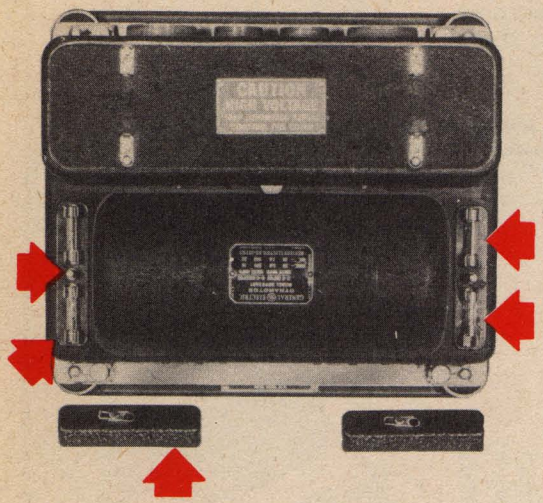
If a tube fails in one transmitter, a replacement may be obtained from one of the other transmitters since the tubes are identical in all 3 transmitters.

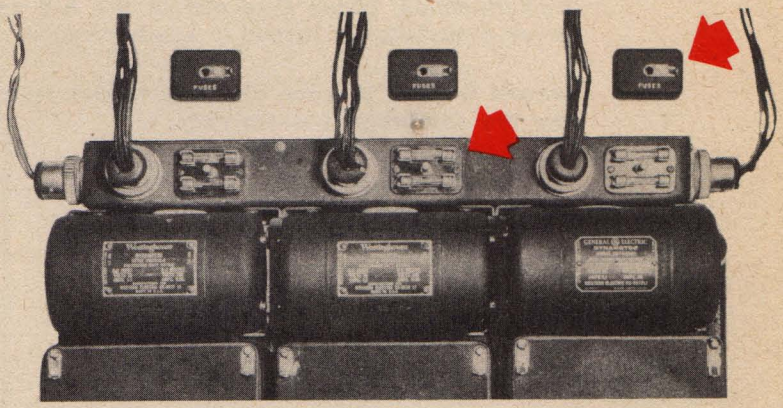
# FUSES

Care must be exercised not to short accidentally the metal fuse covers from ground to the live side of the fuse clip when removing or replacing them.

Each transmitter uses a 20-ampere fuse, located on the modulator unit. Two spares are kept on the opposite side of this unit.

Do not allow the fuse to touch the center post when replacing it. This post is grounded.

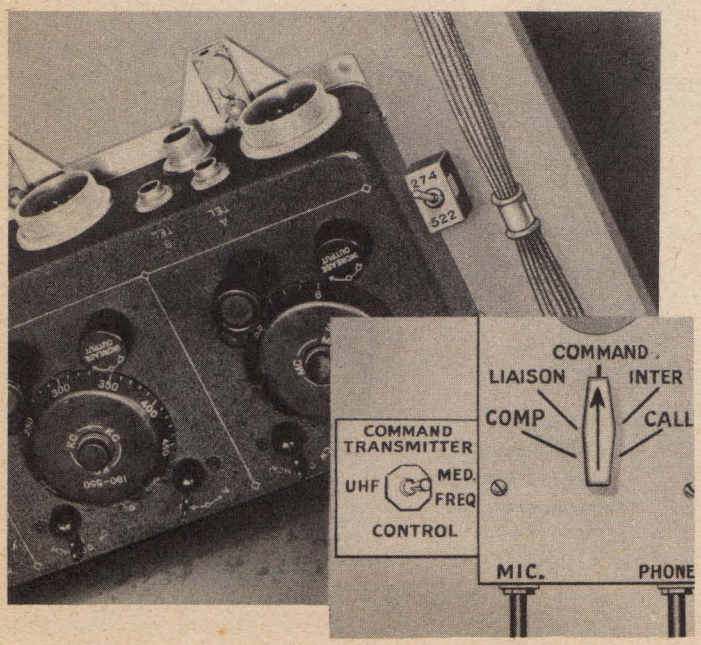




Each receiver uses a 10-ampere fuse. A spare fuse is kept under the same cover.

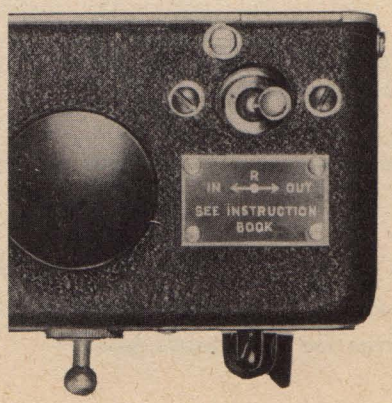
# TRANSMITTER CONTROL SWITCH

If the transmitter is modulated from the pilot's compartment be sure the pilot's microphone is switched to the 274 equipment by use of the 274-522 or MED FREQ-VHF switch. This switch controls the microphone input to the command equipment and is usually mounted next to receiver control box or alongside the interphone jackbox in the pilot's compartment.




# R-IN R-OUT SWITCH

An R-IN R-OUT switch is provided to furnish either 3 or 6 volts to the microphone. R-IN furnishes 3 volts. R-OUT furnishes 6 volts.




**FOR FURTHER MAINTENANCE INSTRUCTIONS CONSULT YOUR TECHNICAL ORDER FILES**

# MAINTENANCE AND INSPECTIONS

## TRANSMITTER AND RECEIVER

If the transmitter is properly calibrated the dial settings should be accurate to within ± 0.05% of the indicated frequency—to make certain this calibration is correct check it against the SCR 211 frequency meter.

If a transmitter or receiver fails to operate properly, look for simple causes of troubles first.

***See that all switches are in their proper positions.***

***Check cords and plugs—be sure that they are properly tightened.***

***Check antenna and ground connections.***

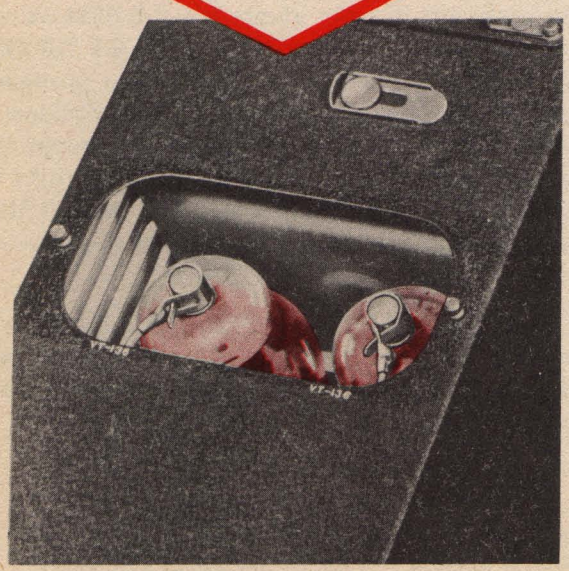
Rack connections, dynamotors, receivers, transmitters, and other component parts may be checked by substitution.

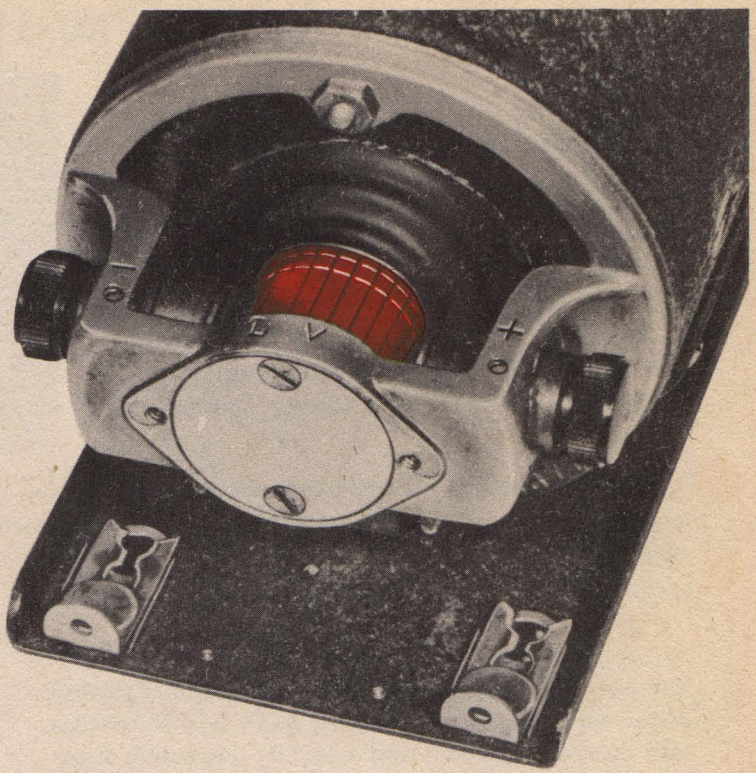
Every advantage of substitution of parts should be taken before considering the 274 command equipment inoperative.

Relays may be checked by listening for clicks when keying.

**Danger 600 Volts**

**Extreme caution must be observed when working around the transmitters or the modulator unit, the top connection on VT-136 tubes is the plate or high voltage lead.**





## DYNAMOTORS

The transmitting and receiver dynamotors should be routinely checked as follows:

Remove the end caps and check the condition of the brushes and the commutator. The brushes should slide freely in their holders. Carbon and copper dust must be removed from around the holders and commutator.

*An even band of brown discoloration around the commutator is an indication of normal operation—this should not be removed.*

Always check the tension on the brushes, replace them if they are cracked, worn or contain hard spots.

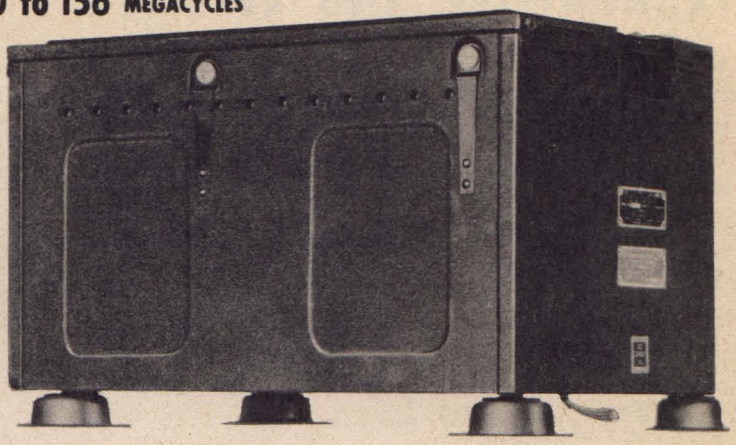
Lubrication is required after every 1,000 hours of use. Instructions will be found printed inside one of the end caps.

**FREQUENT SANDINGS OF COMMUTATORS, MANIPULATION OF BRUSHES OR EXCESSIVE GREASING WILL DO MORE HARM THAN GOOD.**

# SCR 522

## Very-High Frequency

100 to 156 MEGACYCLES



## COMMAND EQUIPMENT

### *REMOTELY CONTROLLED*

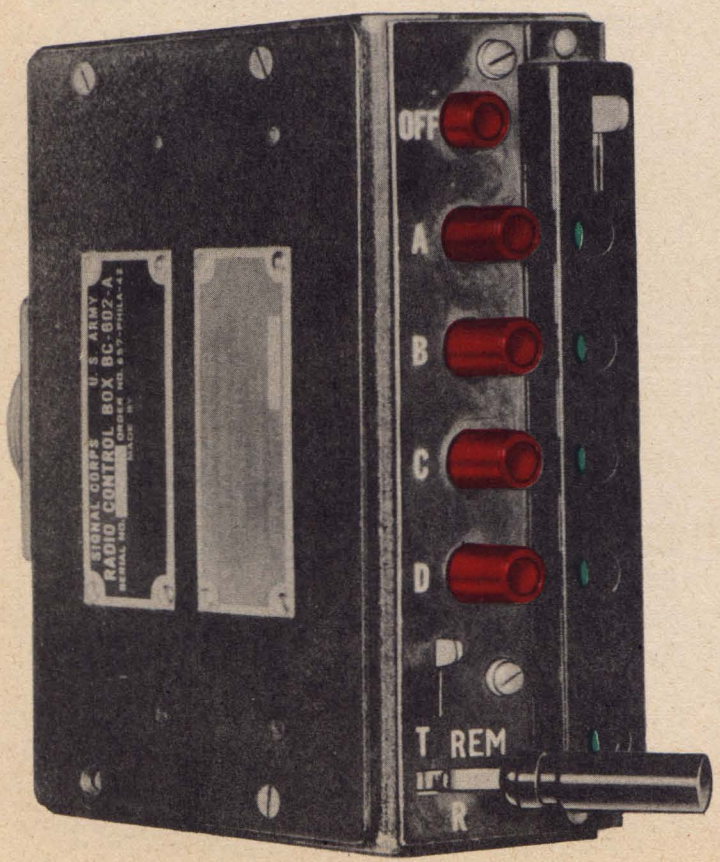
**The SCR 522 command equipment is used for:**

**Two-way, line-of-sight voice communication from plane to plane and from plane to ground. Very-high-frequency homing.**

The transmitter and receiver operate on four pre-tuned crystal-controlled channels. Any one of the channels may be selected remotely from the pilot's compartment.

## CONTROL BOX

The control box provides complete remote control of the equipment functions. A, B, C, and D buttons turn on the equipment and select its respective channels. The green lamp alongside the buttons indicates the channel selected. The OFF button turns the equipment off.




## FUNCTIONS OF T-R-REM SWITCH

When this switch is at T, the equipment is in transmitting position. When switch is at REM position, the equipment is normally in receiving position, but switches to transmitting position when the microphone switch is closed.

The lever tab directly above the T-R-REM switch has two positions. When the tab is up, the T-R-REM switch may be turned to any of its three positions. When the tab is turned down the REM position is blocked and a spring is inserted which keeps the switch on R position unless it is manually held at T position. The white lamp alongside the T-R-REM switch lights up when the equipment is in receiving position.

The lever tab opposite the OFF button, controls a dimmer mask which prevents glare from the channel lights. The mask is in position when the lever tab is down.

**NOTE: In the future, some airplanes will have the control wired so that the T-R-REM switch will function as though it were in REM regardless of its position.**

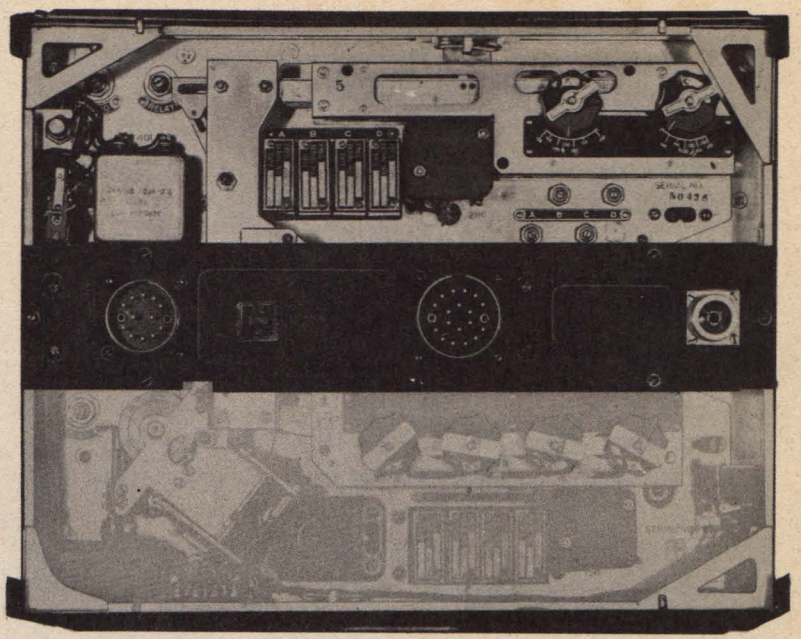
# RECEIVER BC-624

The receiver is a 10-tube superheterodyne. It is crystal-controlled by one of four crystal circuits which operate from the 11th to 18th harmonic. Thus four crystal-controlled channels operating anywhere between 100 and 156 mc may be made available for selection.

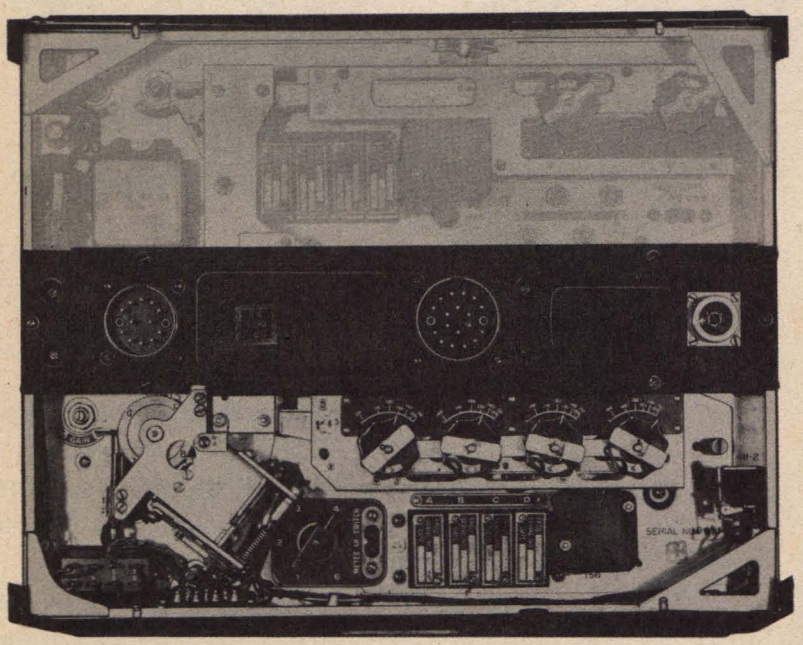
The audio input section of the receiver is energized by a special bridge network from the microphone circuit of the transmitter to make interphone operation possible and to furnish sidetone. Interphone operation is not possible in all airplanes.

A squelch system is built into the receiver to eliminate undesirable noises when no signals are being received. It also enables noise-free interphone and sidetone operation.

The intermediate frequency of the receiver is 12 mc.



# TRANSMITTER BC—625



*The transmitter operates on four crystal-controlled channels of from 100 to 156 mc.*

*The output frequency is always 18 times the fundamental crystal frequency.*

**The transmitter is designed to operate on VOICE only.**

*It is possible to key channel D to obtain an MCW signal for homing purposes.*

## TUNING SYSTEM

The receiver and transmitter are automatically tuned by a special, synchronized slider system. This slider mechanism is actuated by an interrupter-type ratchet motor. It places in position the receiver and transmitter-tuning condensers and selects the proper operating crystal.

# DYNAMOTOR UNIT PE-94B

The dynamotor unit is the source of three regulated voltages required for operation of the transmitter and receiver.

Three commutators supply the following output voltages:

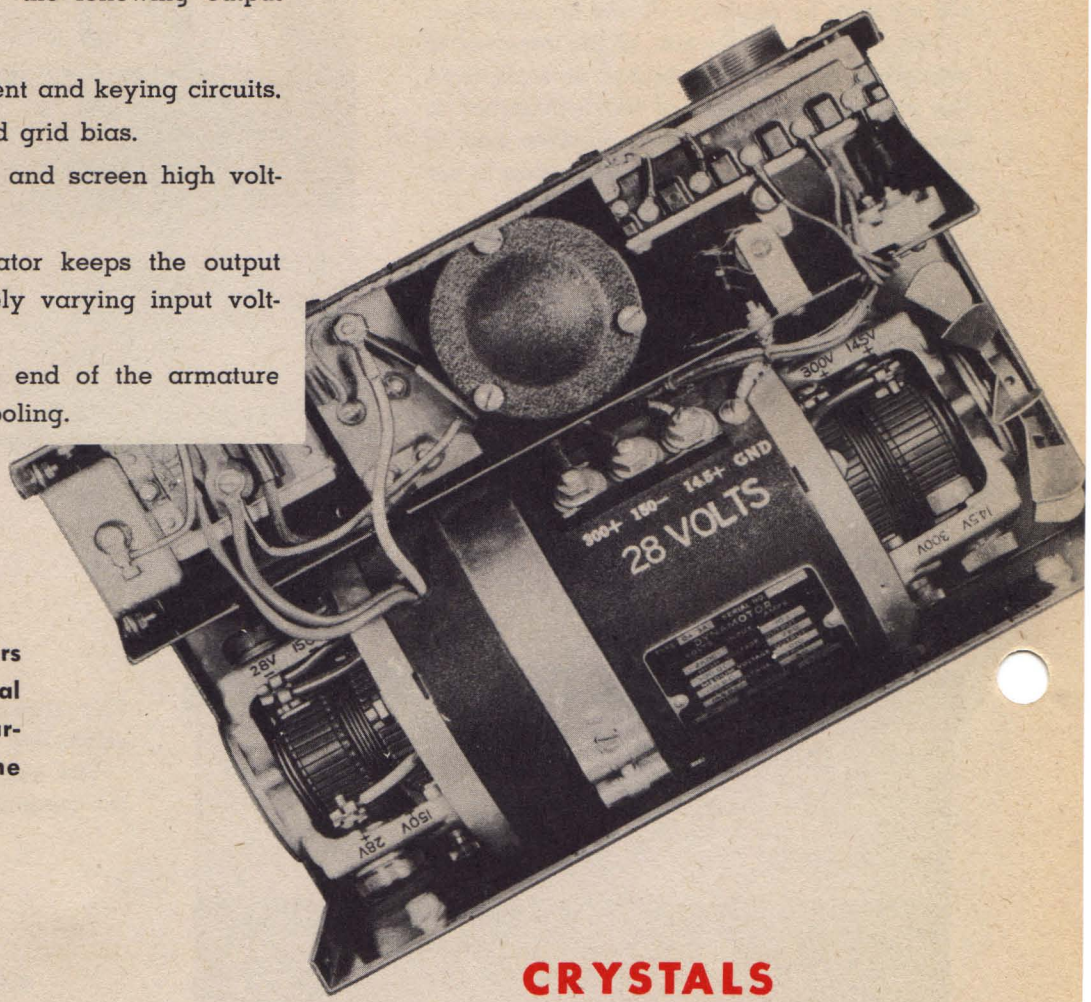
**1**—Plus 14.5 volts for filament and keying circuits.

**2**—Minus 150 volts for fixed grid bias.

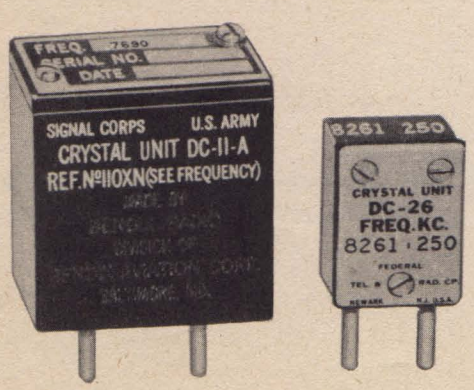
**3**—Plus 300 volts for plate and screen high voltages.

A special carbon-pile regulator keeps the output voltage constant under widely varying input voltages.

A fan is mounted on one end of the armature shaft to provide forced-air cooling.




**Dynamotor unit PE-94-A differs from the PE-94B in mechanical construction. The operating characteristics, however, are the same.**




**TWO TYPES OF CRYSTALS ARE AVAILABLE FOR USE WITH THE EQUIPMENT**

# CRYSTALS

The frequencies of the 522 command equipment are controlled by crystals for frequency stabilization.

Since it is not possible to design a stable crystal to operate at VHF, both the transmitter and receiver operate on harmonics of low-frequency crystals.

The receiver will operate anywhere between the 11th and the 18th harmonic of the fundamental crystal frequency. Twelve megacycles must always be added to the harmonic to determine the operating frequency.

The transmitter always operates on the 18th harmonic of the crystal frequency.

The fundamental frequency of each crystal furnished with the transmitter and receiver appears on the name-plate of the crystal.

# RECEIVER TUNING

**Remove the top covers of the receiver-transmitter case by turning the DZUS fasteners counterclockwise.**


Before attempting to tune the receiver, the proper operating crystal must be selected.

It must be remembered that the crystal controls the heterodyne-oscillator frequency which is always 12 mc less than the frequency to be received. The fundamental operating frequency of this oscillator is from 8.0 to 8.8 mc.

A harmonic generator and amplifier are used to generate the required operating frequency from the fundamental frequency of the crystal.

The harmonic generator and multiplier are tuned to a harmonic of this fundamental frequency. This harmonic ranges from the 11th to 18th depending upon the frequency of the signal to be received.

## THE TABLE FOR DETERMINING THE PROPER OPERATING HARMONIC FOLLOWS:

| FREQUENCY TO BE RECEIVED (MC) | HARMONIC | FREQUENCY TO BE RECEIVED (MC) | HARMONIC |
|---|---|---|---|
| 100 to 108 | 11 | 132 to 140 | 15 |
| 108 to 116 | 12 | 140 to 148 | 16 |
| 116 to 124 | 13 | 148 to 156 | 17 |
| 124 to 132 | 14 | 156 | 18 |

## Crystal Frequency Formula (for determining fundamental crystal frequency):

$$\text{Frequency crystal } (F_x) = \frac{\text{Frequency received } (F_r) - 12 \text{ mc}}{\text{harmonic (H)}}$$

$$\text{or } F_x = \frac{F_r - 12}{H} \qquad F_x \text{ and } F_r \text{ are both in mc.}$$

Since the frequencies are stamped on the crystal holder in kc, the resultant frequency should be converted into kc by multiplying by 1000, or

$$F_x = \frac{F_r - 12}{H} \times 1000$$

To determine the proper crystal to be used for any one channel subtract 12 mc from the frequency to be received on that channel and divide the remainder by the proper harmonic.

*Example:* $F_r = 120$ mc

$$F_x = \frac{120 - 12}{13} = 8.30769 \text{ mc}$$

or $8.30769 \times 1000 = 8307.69$ kc

# RECEIVER CHANNEL TUNING

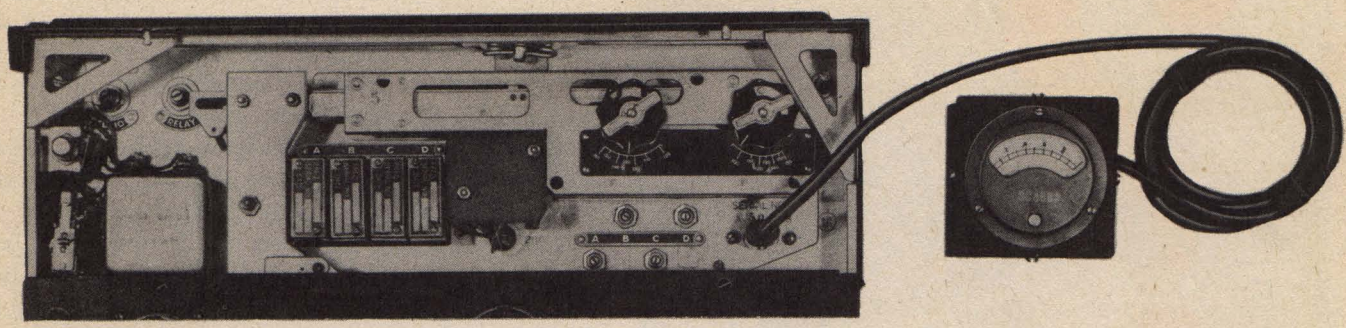
**PRELIMINARY**—Connect either an output meter (0- to 30-volt) or a pair of headsets to the output of the receiver, this is the COMMAND position on the interphone jackbox in most airplanes. However, the 522 might be connected to the LIAISON position on all jackboxes except the radio operator's.

A tone-modulated signal must be available for tuning the receiver. This can be obtained from one of three possible sources:

**1**—Signal generator I-130-A.

**2**—Channel D on any transmitter tuned to the proper frequency.

**3**—Signal generator (buzzer) IE-36.



**TUNING STEPS**

**1**—Press CHANNEL PUSHBUTTON on control preceding the channel to be tuned.

**2**—Press CHANNEL RELEASE BUTTON on rack.

**3**—Loosen TUNING CONTROL LOCKNUTS until only a slight pressure remains on the cams.

**4**—Press CHANNEL BUTTON on control to the channel to be tuned.

**5**—Turn OSCILLATOR TUNING SCREW of channel being tuned so that three, four, or five threads extend above the sleeve.

**6**—Rock TUNING DIALS across the frequency to be received and locate the point of maximum output. If no signal is found, turn out the oscillator tuning screw one turn at a time and repeat the rocking procedure until the maximum signal is located.

**7**—Turn the OSCILLATOR TUNING SCREW clockwise until the signal drops off abruptly.

**8**—Turn OSCILLATOR TUNING SCREW slowly counterclockwise about a three-quarter turn beyond the point at which the signal reappears.

**9**—Carefully adjust both TUNING CONTROLS for maximum output.

**USE THE SAME PROCEDURE FOR TUNING THE REMAINING CHANNELS**

Before pressing another channel pushbutton hold the tuning controls with your fingers and tighten the locknuts just enough to exert a slight pressure on the cams. This lessens the possibility of disturbing the channels already tuned.

After the required number of channels have been tuned, press the channel-release button and tighten the tuning-control locknuts. Tighten the locknuts as tightly as possible with your fingers. Do not use pliers.

**Remove the test cord from the antenna socket on rack and replace the plug from the airplane's antenna.**

## AUDIO AND RELAY ADJUSTMENTS

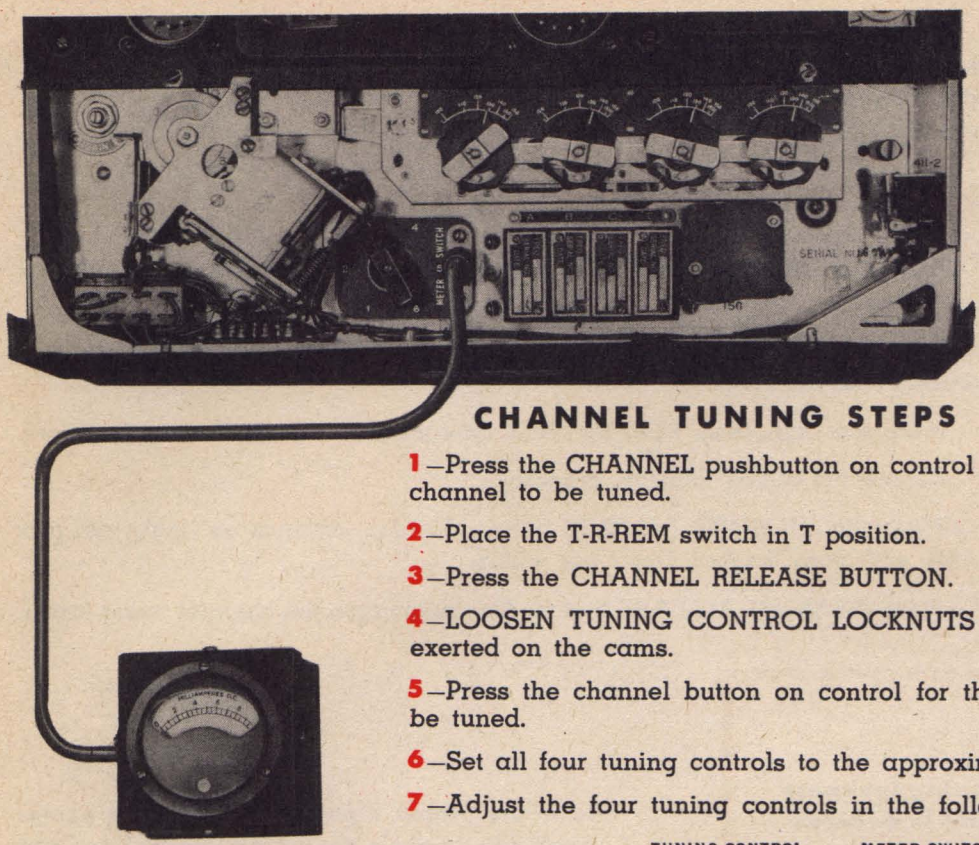
The AUDIO control should be left in its maximum clockwise position unless the pilot complains of too much volume.

The RELAY control should be the last adjustment made and should be made with the airplane's antenna connected and with no signal being received.

Adjust it as follows: turn RELAY control counterclockwise until a noticeable drop in background noise results. Then turn the control *a very small fraction* of a turn further. This adjustment is very critical. When tuning is completed press at least two different channel bushbuttons before pressing the OFF pushbutton.

**Do not use the relay to suppress high ignition noises. This would affect the operating range of the receiver.**

# TRANSMITTER TUNING



The transmitter always operates on the 18th harmonic. To select the proper crystal frequency divide the required transmitting frequency by 18.

***EXAMPLE:***

If the operating frequency is to be 126.18 mc, the Crystal frequency should be $\frac{126.18}{18} = 7.010$ mc or 7010 kc.

## CHANNEL TUNING STEPS

**1**—Press the CHANNEL pushbutton on control preceding the lowest frequency channel to be tuned.

**2**—Place the T-R-REM switch in T position.

**3**—Press the CHANNEL RELEASE BUTTON.

**4**—LOOSEN TUNING CONTROL LOCKNUTS until only a slight pressure is exerted on the cams.

**5**—Press the channel button on control for the lowest frequency channel to be tuned.

**6**—Set all four tuning controls to the approximate transmitting frequency.

**7**—Adjust the four tuning controls in the following order:

| TUNING CONTROL | METER-SWITCH POSITION | METER READING |
|---|---|---|
| 1 | 1 | Maximum |
| 2 | 2 | Maximum |
| 3 | 3 | Maximum |
| 4 | 3 | *MINIMUM* |
| 3 | 3 | Maximum |
| 4 | 3 | *MINIMUM* |

If the reading obtained on the lowest frequency channel is lower than or exceeds 0.65 ma the antenna coupling must be adjusted.

**A final reading of more than 0.65 ma is not acceptable in any case, as tube failures will result.**

**The transmitter and receiver assembly must not be removed from the case when tuning.**

## ANTENNA-COUPLING ADJUSTMENT

This adjustment must only be made on the lowest transmitter operating frequency.

If the reading is too high loosen the antenna-coupling lockscrew and move it away from the controls until the correct reading 0.63 ma is obtained.

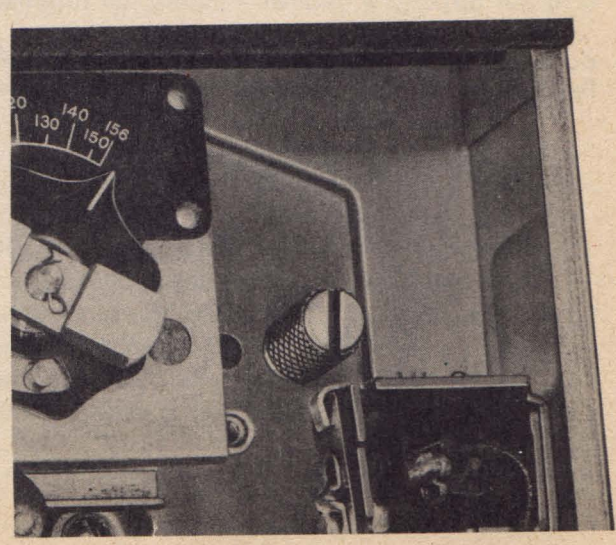
If the reading is too low move it towards the controls.

Tighten lockscrew when adjustment has been completed. **Extreme care must be observed when tightening this lockscrew. Excessive tightening will damage the coil mounting.**

Readjust tuning dial No. 4 for minimum reading with the meter switch on position 3.

Satisfactory results will be obtained with a meter reading as low as 45 ma on higher frequencies.

The airplane's antenna must be used when making this adjustment.



# CHECKING CHANNEL TUNING

The transmitter channels should be checked by turning the METER SWITCH to position 3 and observing the current readings on the meter. If the reading for any channel is not between 0.45 and 0.65 ma that channel must be retuned.

## How to Reset One Channel Without Disturbing the Settings of the Others...

1—Press the CHANNEL PUSHBUTTON on the control preceding the channel to be tuned.

2—Press the CHANNEL RELEASE button. Loosen the locknuts leaving a slight pressure on the cams.

3—Press the CHANNEL PUSHBUTTON on control to the channel to be tuned.

4—Retune the tuning controls properly.

5—Press the CHANNEL RELEASE button. Tighten locknuts as tightly as possible with your fingers. Don't use pliers.

6—Press CHANNEL RELEASE button. This reengages the channel being tuned.

### NEVER

**Loosen or tighten the tuning locknuts unless the tuning slides are in a released position.**

**Turn equipment off with the slides in a released position.**

**Remove transmitter or receiver from the rack unless the slides are released.**

**Use pliers.**

**To insure proper flight operation of the equipment the channels should be checked for stability by pressing the CHANNEL PUSHBUTTONS in rotation 8 to 10 times. Then recheck the meter readings.**

# GAIN-CONTROL ADJUSTMENT

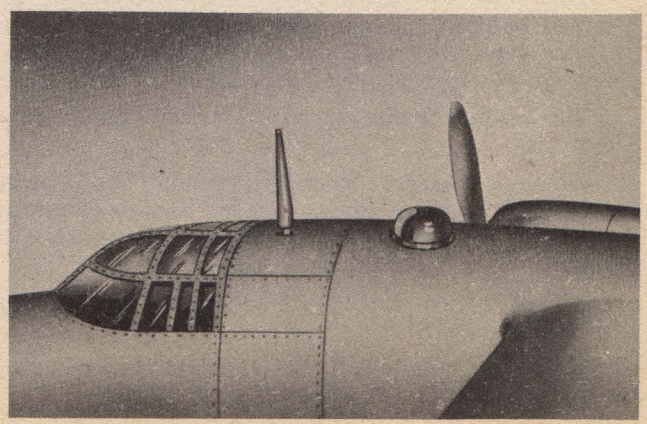
This adjustment should be made after all the channels are tuned. It may be made on any channel, with the airplane's engines running, as follows:

The gain, or percentage of modulation, of the transmitter is usually found to be satisfactory when the GAIN control is rotated one-half turn clockwise from the extreme counterclockwise position.

If the noise picked up from the airplane is too great the control should be turned slightly counterclockwise. A further check may be made by contacting another airplane or the control tower.

# ANTENNA SYSTEM

Antenna AN-104 is a stub-mast type. Its general length is 29¾ inches. Its conducting length is 21½ inches. The most durable type is made of sugar maple treated with phenol-formaldehyde. The conducting surface is a thin coating of either iron or copper.

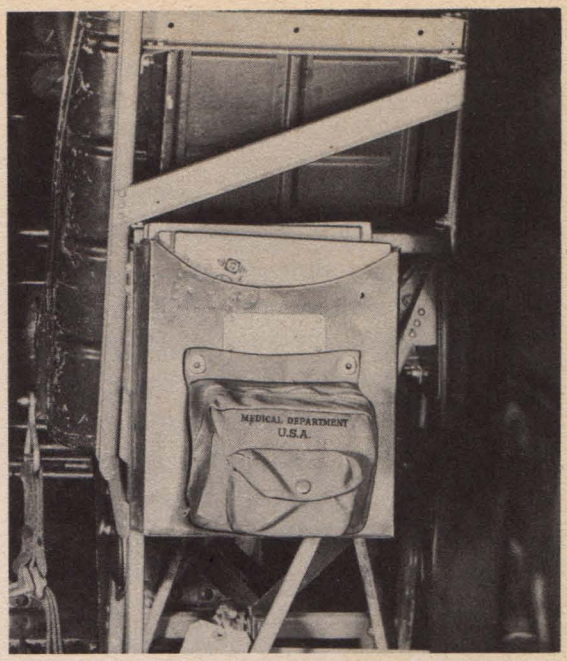


# INTERPHONE OPERATION

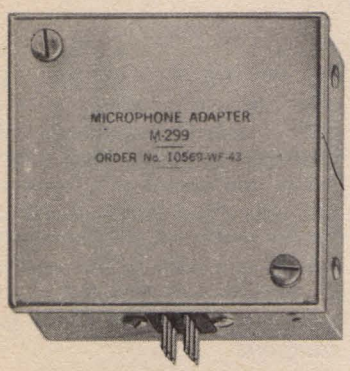
In most of the present types of airplanes the 522 microphone and sidetone circuits are connected to COMMAND positions of the interphone jackboxes. In the future all theaters will connect the 522 to the LIAISON position on all interphone jackboxes except at the radio operator's position.

Interphone communication will be possible by placing the T-R-REM switch on the control until on R position. By placing the T-R-REM switch on REM position the crew members in some types of airplanes can transmit from their jackbox positions.

If the T-R-REM switch is wired to REM position, switch to a channel which does not contain a crystal for interphone operation.




# MICROPHONE ADAPTER UNIT




G*Files should be consulted for the type of installation in your airplane.*

In order that a T-17 or T-30 microphone or the equivalent may be used with the 522, adapter unit M-299 must be used.

The unit is mounted in the most convenient location on each airplane. Only one adapter is necessary for the entire airplane's installation.

# MAINTENANCE AND INSPECTIONS

The milliammeter reading obtained on the I-139-A TEST INDICATOR with the transmitter's METER SWITCH on position 3 is an excellent indication of the general functioning of the transmitter. Dynamotor, antenna, relay, and tube defects will be directly reflected by this reading. **A record of this reading taken on the lowest frequency channel should be made daily.** Investigate any deviation from normal meter readings.

Observing the action of the control lamps will show whether or not the channels are operating properly. The green lamps should flash on in rotation when the channels are making complete cycles. The action of the white receiver light is a quick check of the antenna change over switching relay.

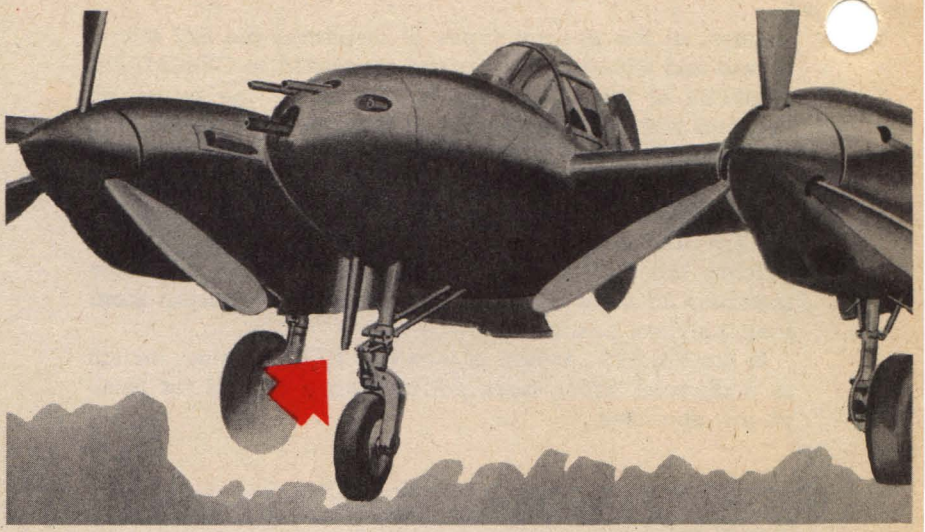
## CHECKING THE ANTENNA SYSTEM

Moisture and grease collections around the rubber mounting of the antenna will absorb a high percentage of radiation. Trouble is often encountered in defective coaxial cables. **A field-strength indicator should be used to check the transmitter's output from the antenna.**

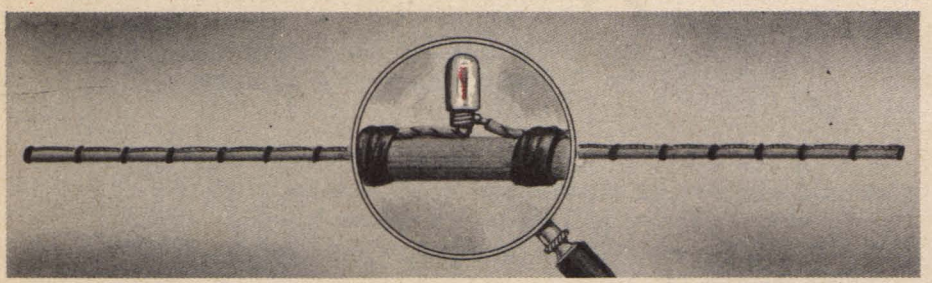
## FIELD-STRENGTH METER I-95-A

The I-95-A is designed to read the relative field strength and frequency of radiation at a distance not to exceed 25 feet from the 522 antenna. Normal indication is usually about a mid-scale reading. A modulated signal will cause greater deflection on the meter. Therefore modulation may be detected by observing the additional deflection on the meter.

# TRICYCLE LANDING GEAR



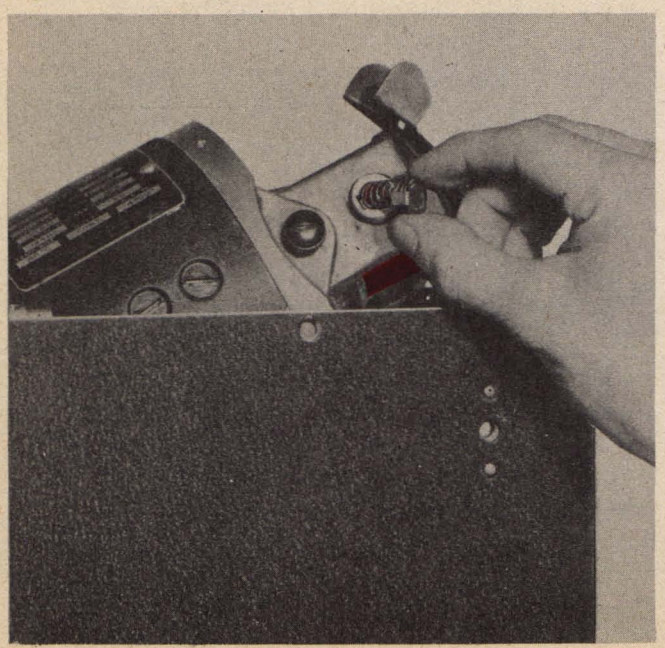
It has been found in some cases that the added capacitance to the antenna from the tricycle gear on some airplanes tends to detune the transmitter. This is sometimes compensated for by adding the additional capacitance to the circuit when in flight. **If the additional capacitance is not added, the transmitter should be tuned to a maximum of 50 ma on the lowest channel. Whenever possible the lowest frequency channel should be checked in flight.**



If an I-95 field strength meter is not available, a simple yet accurate indicator may be made to give visual indication of field strength present. This consists of a 44-inch wooden or fibre rod with two 22-inch pieces of wire taped to the rod and connected to a 2-volt 60 ma bulb at the center point. It should be used at a distance of approximately ten feet from the antenna.

## DYNAMOTOR

Brush connections especially low voltage connections should be checked periodically for loose connections. **Loose low voltage brush connections will result in poor regulation and high output voltages.**



Brushes should be checked thoroughly for free movement in their holders, sufficient tension, chipped corners, hard spots or uneven wear.

Brushes may be replaced without disassembling the dynamotor, by removing the two end plates and lifting the dynamotor out of the case high enough to make them accessible.

Keep the brush holders and commutators free from dirt and grease by cleaning them with a rag saturated in carbon-tetrachloride. Remove the brushes when doing this. **Do not clean brushes with carbon-tetrachloride. Use gasoline or kerosene.**

Brushes are stamped plus or minus. The stamped side of the brush must face the corresponding stamp on the end of the bracket.

Brush noise may be checked by using a .01 mfd condenser in series with a pair of headsets or an output meter. An output meter reading should not exceed 2.5 volts.

**REMEMBER:**

**The success of the entire 522 equipment depends upon proper dynamotor performance.**

# TEST EQUIPMENT IE-19-A

To tune the 522 command equipment properly in the airplane, test equipment IE-19-A should be used. The components pertinent to tuning are the only ones listed in the following paragraphs.

## TEST SET I-139-A

Test set I-139-A is a direct reading 0-to-1 milliameter used for measuring currents of the tuning circuits in the receiver and transmitter.

A cord with a special plug to fit the transmitter and receiver meter sockets is attached to the meter.

**Remove coaxial cable and insert in antenna socket on rack.**


## SIGNAL GENERATOR I-130-A

Signal generator I-130-A generates a 1000-cycle tone-modulated signal at any crystal controlled frequency from 100 to 156 mc. For tuning the receiver, the generator output frequency is 18 times that of the fundamental crystal frequency.

Power is supplied to the signal generator from a type BX-33-A battery box.

### *Preparation for Use:*

**1** —Insert a transmitter crystal of 1/18th the receiver frequency to be tuned.

**2** —Connect the cord provided from the RF output socket to the antenna socket on the rack. Connect test set I-139-A to the signal-generator meter socket.

**3** —Set MO-CRYSTAL switch to CRYSTAL position.

**4** —Turn OUTPUT CONTROL to MAX and OUTPUT STEPS to step No. 5.

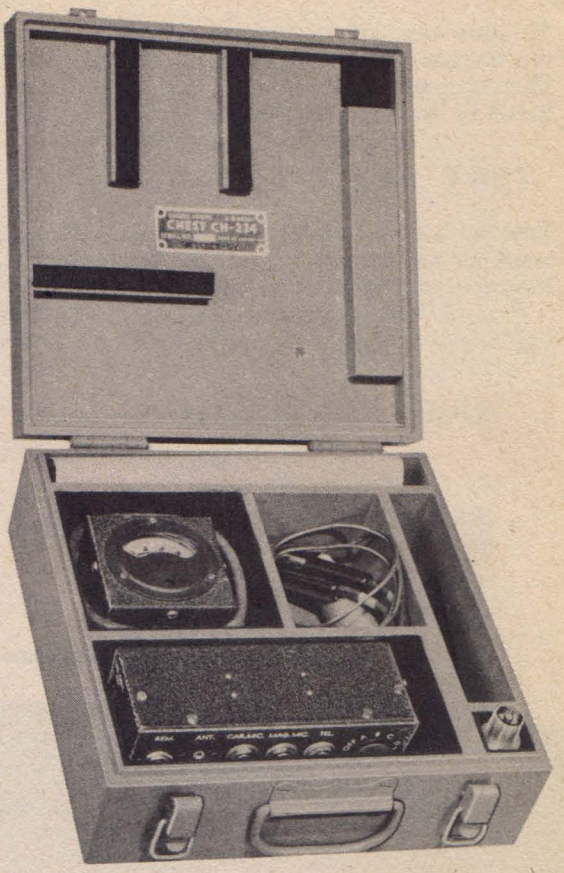
**5** —After allowing about 1 minute for the tubes to heat, adjust the CRYSTAL TUNING control for the frequency to be tuned. A small dip should be noted in the meter. Adjust MEGACYCLES dial control for an additional dip. (This should be about the same setting as that of the receiver channel being tuned.) Remove the plug-on meter I-139-A. The signal generator is now ready to use.

After the signal appears in the receiver, the output steps should be lowered to position 2 or 3 to allow for more accurate tuning of the receiver.

# TEST EQUIPMENT IE—36

Test equipment IE-36 reproduces the operating functions of the 522 control box and the interphone jackboxes. It also provides a signal generator (buzzer) for receiver tuning, a phantom antenna for transmitter tuning, and the necessary connecting cords and plugs.

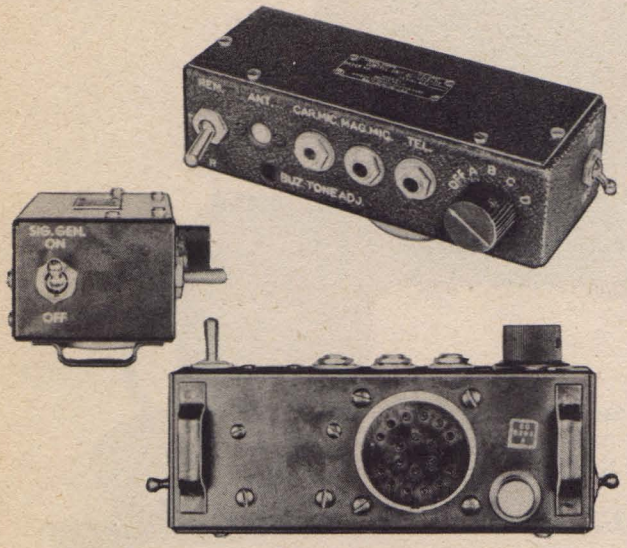
A spanner wrench and lamp extractor are included as part of the test set. Space is provided in the carrying case for Test Set I-139-A. The test set, however, is not furnished as part of the IE-36 equipment.



# CONTROL UNIT BC—1303

Control Unit BC 1303 plugs directly into the receiver-transmitter rack. It is equipped with all the controls necessary to allow complete tuning and operational checking of the 522 equipment.

The top and rear comprise the cover, which is removable. On the bottom is the 18-contact rack plug, and a pilot lamp.

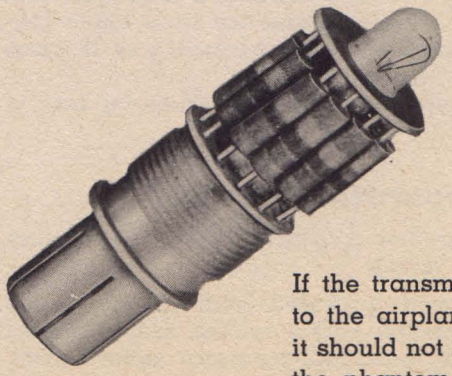



On the front from left to right, a T-R-REM toggle switch, an ANT jack for coupling the SIG GEN buzzer signal to the antenna socket on the rack, a BUZ TONE ADJ, a CAR MIC and a MAG MIC input, a TEL output and an OFF-A-B-C-D channel selector switch.

The SIG GEN ON-OFF switch is mounted on the left side of the control. A CONT ON-OFF switch, for testing the contactor circuit of the transmitter is mounted on the right side of the control.

# PHANTOM ANTENNA—29

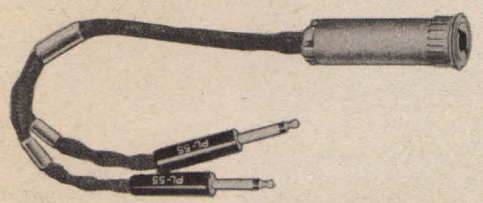
Phantom Antenna A-29 is designed to be used as an aid in testing the transmitter. This phantom antenna consists of 12 resistors, each 820 ohms, connected in parallel. A bayonet-base pilot lamp, mazda-type 44, is connected in parallel with the resistors. The antenna plugs into the antenna socket on the rack.



If the transmitter is tuned to the airplane's antenna, it should not be retuned to the phantom antenna because the capacitance and reactance of the two antennas differ.

## CORD CD-1169

Cord CD-1169 is an adapter cord made up of four wires connecting a jack JK 49 to two plugs PL-55. It is designed to receive the plug from the British-style combination helmet, headset, and throat microphone. One pair of wires connected to the plugs PL-55 are marked MIC, the other pair are marked TEL. By using this cord or a direct connection to the control unit, any combination of microphones and headsets in the airplane may be tested.



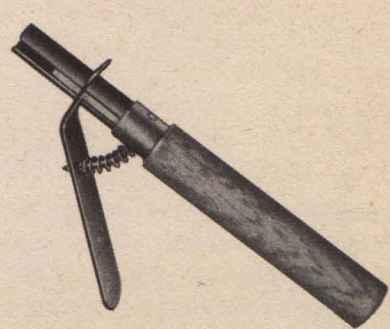

## CORD CD-1170

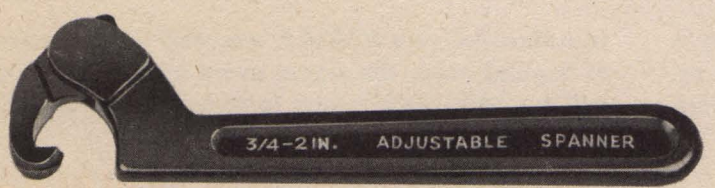
Cord CD-1170 is made up of approximately 3 feet of ⅛-inch cord with an alligator clip on one end and a pin probe on the other. It is used to couple the SIG GEN to the antenna socket on the rack.

## SPANNER WRENCH AND LAMP EXTRACTOR

The spanner wrench, type 471, is continuously adjustable to fit adequately the various plugs used with the 522 equipment.

The lamp extractor is for removal of the small lamps in the control box.






## CAPABILITIES

*Test equipment IE-36 provides a means for making the following tests on the SCR 522.*

**1**—A test of the starting and stopping mechanisms.

**2**—A test of the channel selection circuits.

**3**—A test of the T-R-REM switching functions.

**4**—A test of contactor circuit operation in the transmitter.

**5**—A test of relative modulation and output of the transmitter as indicated by the brightness of the phantom antenna lamp.

**6**—A test on the condition of the jackbox positions, by eliminating the jackboxes as necessary in trouble shooting.

**CAUTION: When tuning the receiver BC-624-A with the buzzer, avoid tuning to an undesired harmonic by making certain that the receiver tuning controls are turned to the desired frequency on the calibrated scale. It is essential that these tuning dials indicate within plus or minus 3 mc of the desired operating frequency. A greater error than this may mean that the receiver has been tuned using the wrong harmonic.**

# SIGNIFICANCE OF METER READINGS

In general, a meter reading on Test Set I-139-A greater than 0.75 with the transmitter METER SWITCH in position 1, 2, or 3, indicates a defect in the equipment or improper adjustment.

**The following chart shows the significance of these meter readings:**

| Position | Normal | Trouble |
|---|---|---|
| 1 | 0.4 | Greater than 0.75 |
| 2 | 0.5 | Greater than 0.75 |
| 3 (Average for channels A, B, C, D.) | 0.63 | Greater than 0.75 |
| 5 | Full Scale | Less than 0.5 |
| 6 | OFF | |

# NOTES

Final receiver adjustment should be made using a weaker signal. A weaker signal can be obtained by removing the alligator clip of CORD CD 1770 from the center pin of the antenna socket on the rack.

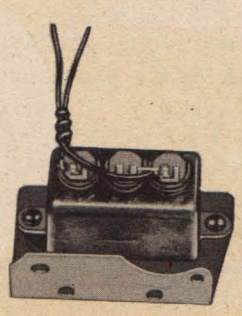
In radio receivers BC-624-A modified for suppression of impulse noise, the signal heard in the headphones will be considerably less than before the modification.

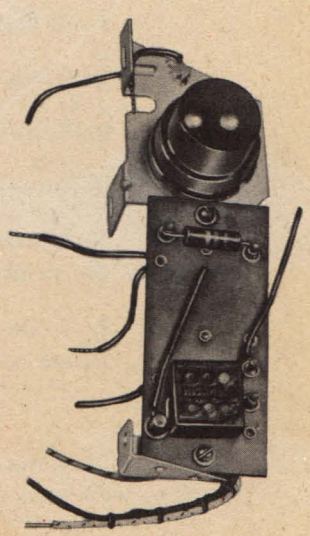
For modified receivers, most accurate tuning is obtained if the tuning controls are peaked, using only circuit noise or hiss and with the SIG GEN switch in the OFF position. This fine adjustment should be made after the signal has been received with the SIG GEN switch in the ON position.

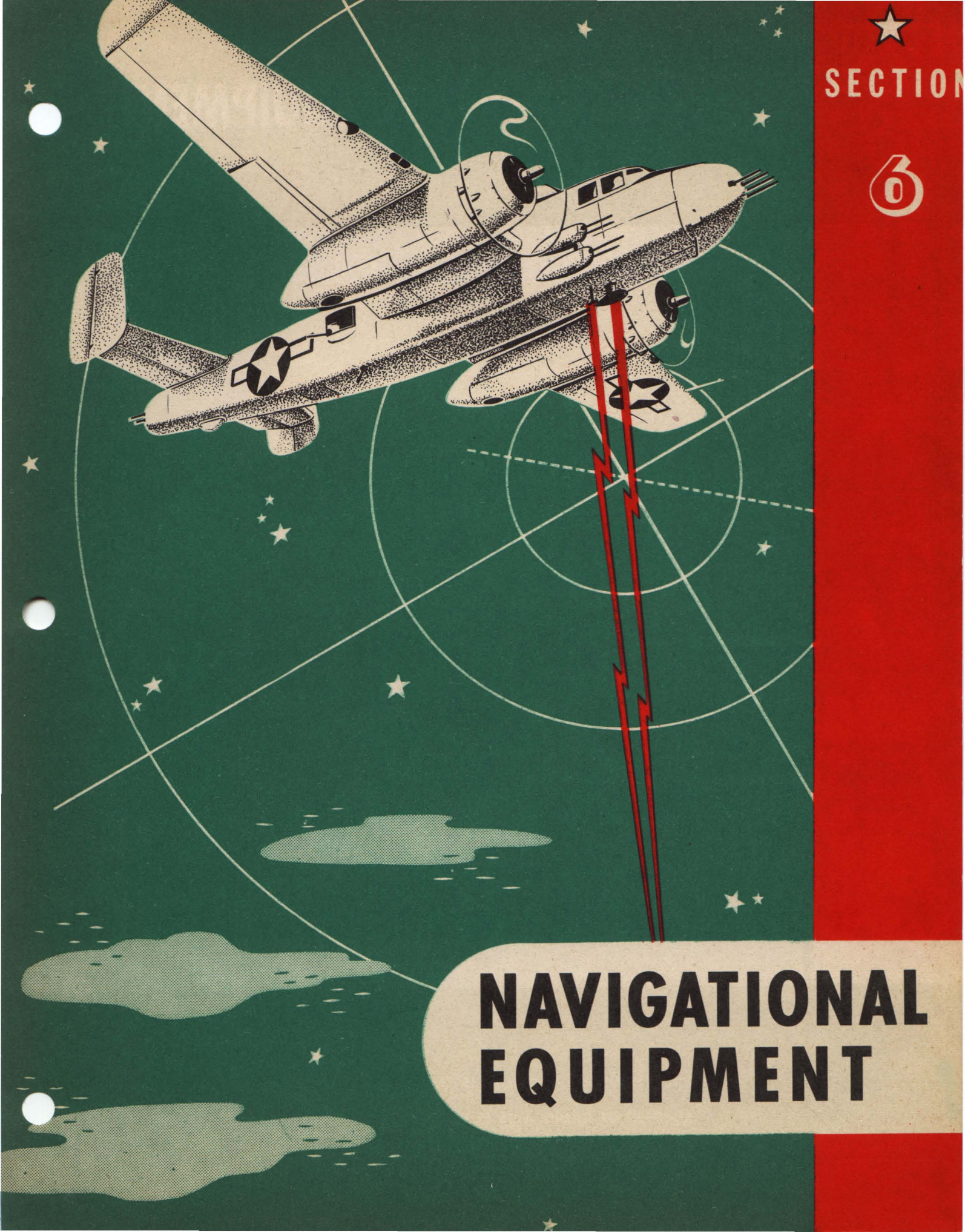
# NOISE SUPPRESSION KIT

A noise-suppression kit is now available for the BC-624-A receiver. When properly installed, this kit will permit satisfactory reception in the presence of all manner of pulse-like interference such as ignition noise. The major performance characteristics of the receiver will not be materially changed. The most obvious change in performance will be a reduction of approximately 3 or 4 to 1 in the intermediate frequency amplifier gain.

This kit is distributed by the Signal Corps. The Signal Corps stock number is 2C-4424 A/K1.







SECTION

6

# NAVIGATIONAL EQUIPMENT

SECTION

6

# NAVIGATIONAL EQUIPMENT

## TABLE of CONTENTS



SUCCESSFUL NAVIGATION IS DEPENDENT UPON RADIO AIDS. THE SUCCESS OF RADIO AIDS IS LARGELY DEPENDENT UPON YOU. TEAMWORK WITH THE NAVIGATOR IS ESSENTIAL FOR A SUCCESSFUL MISSION.

# SCR-269 AND AN/ARN-7

## RADIO COMPASS UNITS

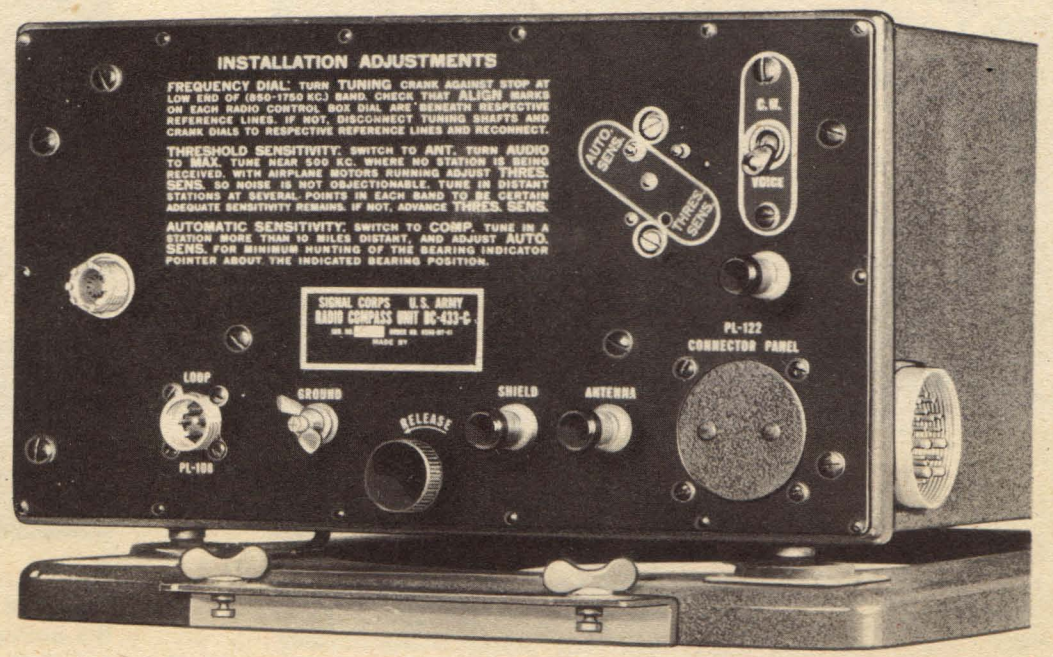
The radio compass is used to take bearings, to home on radio stations, and to receive radio range or other navigational signals. Such operations require the use of both directional (loop) and non-directional (whip or fixed-wire) antennas.

Basically the radio compass sets SCR-269 and AN/ARN-7 are the same.

They are both 8-tube superheterodyne receivers having the additional stages necessary for automatic radio compass operation. This gives each set a total of 15 tubes. Both sets have CW modulation for the reception of CW signals. Their frequency ranges are:

| SCR-269 | AN/ARN-7 |
|---|---|
| 200—410 | 100—200 |
| 410—850 | 200—410 |
| 850—1750 | 410—850 |
| | 850—1750 |

The AN/ARN-7 differs from the SCR-269 in that it has a 100 to 200 kc band, no threshold sensitivity adjustment, and no shield binding post. The CW-VOICE switch is on the control box rather than on the receiver unit.



# COMPASS CONTROL BOX

The control box provides complete control of the radio compass from a remote position. Most airplanes have dual control systems.

The OFF-COMP-ANT-LOOP switch controls the functions of the radio compass. Here are the purposes of each position, the number of tubes involved, and the antennas used:

COMP—Automatic position-finding or visual homing. 15 tubes. Both antennas.

ANT —General reception, control tower, range, etc. 8 tubes. Whip or fixed-wire antenna.

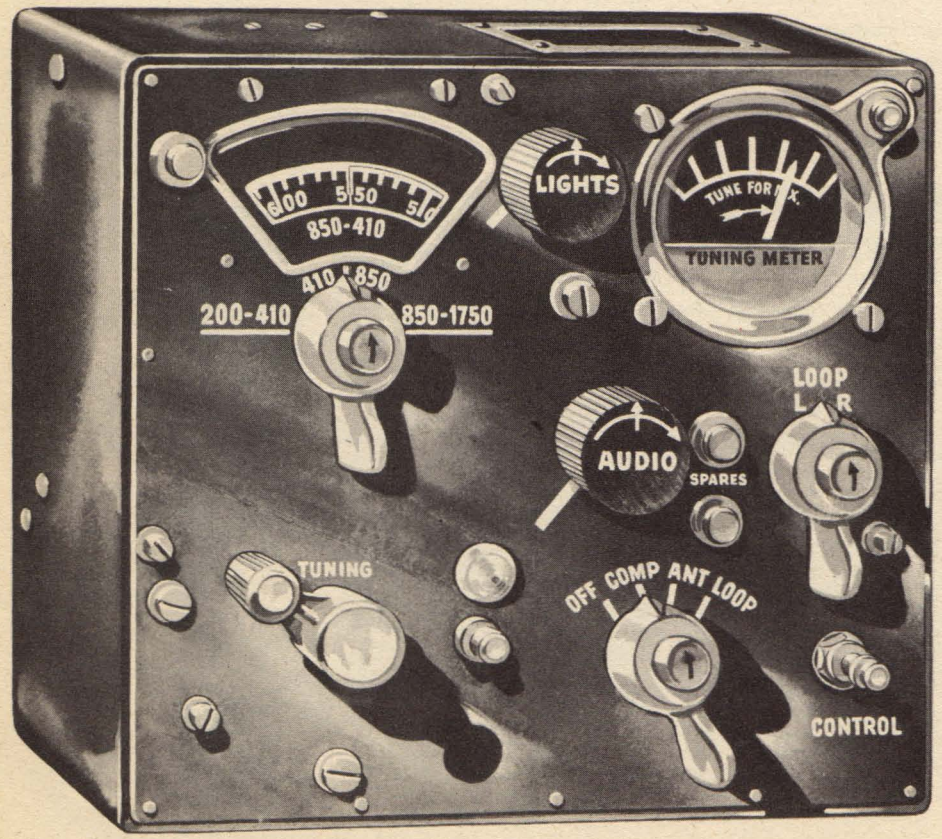
LOOP —Bad weather reception, aural null homing, or position-finding. 10 tubes. Loop antenna.

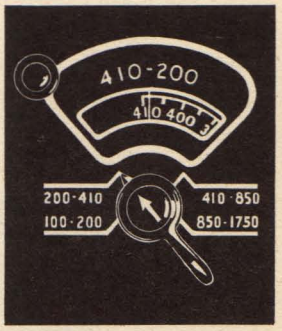
The LOOP-L-R switch controls the movement of the loop antenna when the function switch has been set on LOOP position. You can rotate the loop at a higher speed by pressing down on the switch as you turn it.

The TUNING METER shows maximum deflection when a station is properly tuned.

The AUDIO control regulates the volume of the signal in the headphones.

The CONTROL pushbutton transfers control of the compass from one control box to the other. The green light burns on the box which has control. There are spare bulbs for the light in the compartments so marked.




**The C4/ARN-7 control box has an additional low - frequency band, 100-200 kc.**


**The CW-VOICE switch of the C4/ARN-7 is on the bottom of the control box and to the right.**

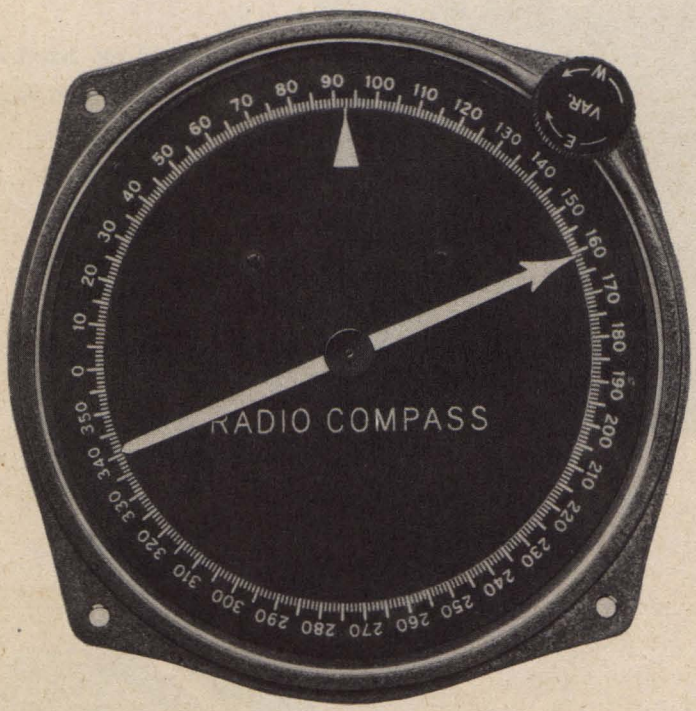
# INDICATOR I-81-A (PILOT'S)


Indicator I-81-A is located on the pilot's instrument panel. It is used primarily for Visual Homing.

When the indicator points to zero, the airplane is headed directly toward the transmitting station.

The scale is graduated in 5-degree intervals.

# INDICATOR I-82-A (RADIO-OPERATOR'S) (NAVIGATOR'S)




Indicator I-82-A will be found either in the radio operator's or navigator's position.

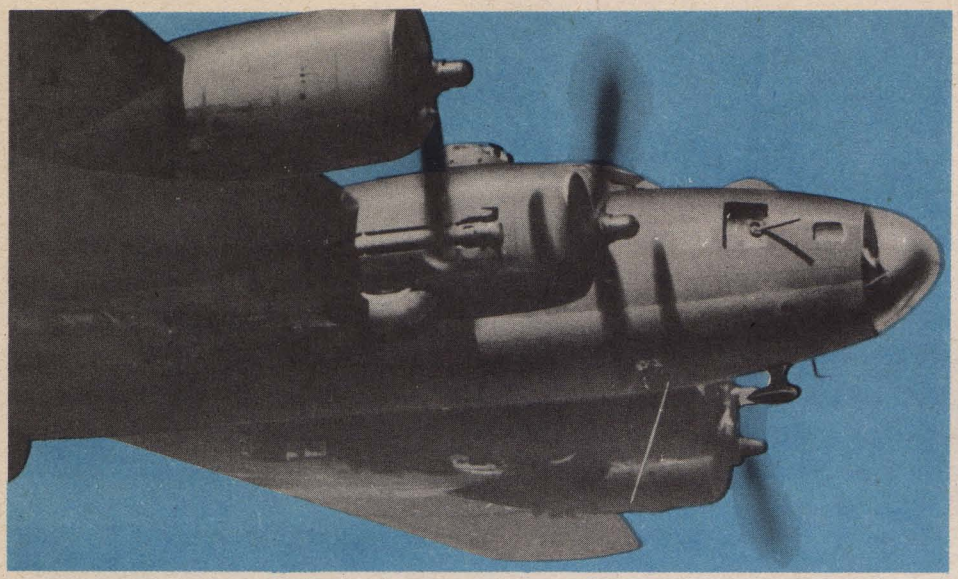
By use of the VAR knob the graduated AZIMUTH scale can be rotated so that the TRUE HEADING of the airplane can be set up at the INDEX TRIANGLE.

The scale is graduated in 1-degree intervals.

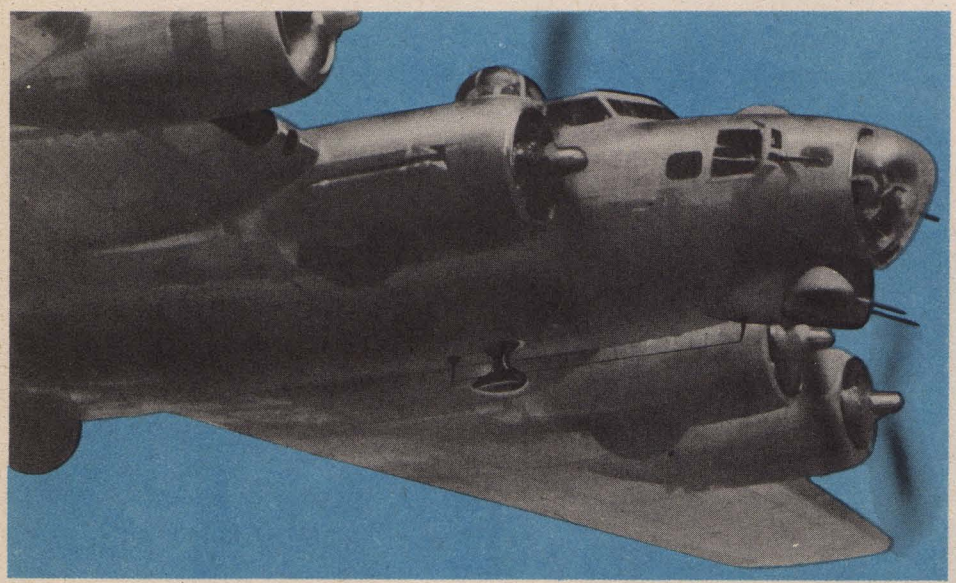
## POWER SOURCES

Two input power sources are required for operation of the radio compass. They are 24 to 28 volts from the central-power system and 115 volts, 400 cycles. This is obtained from an inverter unit.

# ANTENNA SYSTEM



The antenna system for the radio compass includes a motor-driven loop antenna and a vertical whip or fixed-wire antenna.



The whip or fixed-wire antenna must be at least 3 feet from the loop.

# DEHYDRATOR UNIT

The dehydrator unit consists of a plastic tube filled with silica gel which has been impregnated with cobalt chloride. It is connected to the loop assembly by a rubber hose. Any moisture in the air entering or leaving the loop assembly is absorbed by this unit. The gel is dark blue when dry and light blue or pink when moist.

# VARIATION

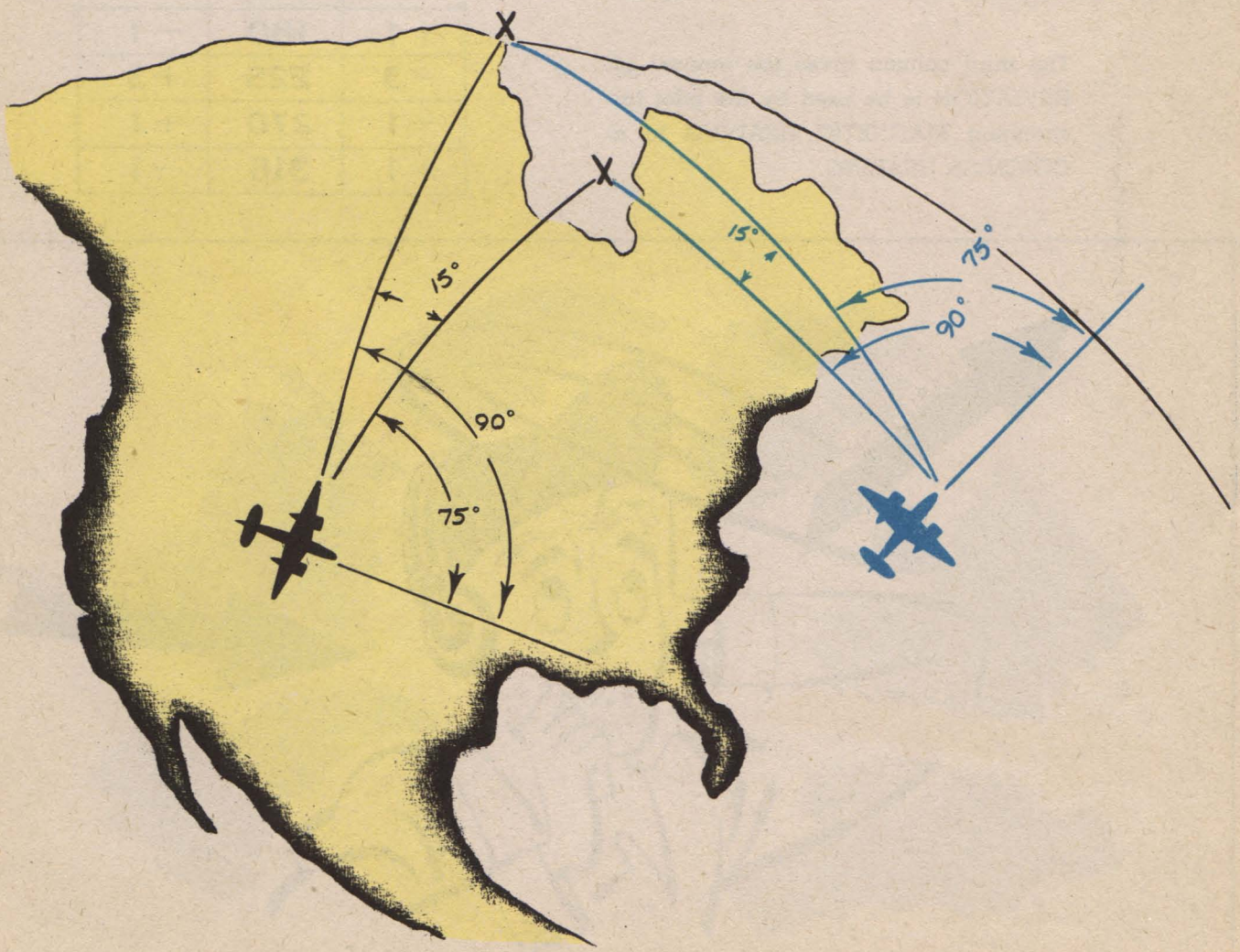
Before bearings can be obtained on radio stations, the TRUE HEADING of the airplane must be determined. TRUE HEADING is the direction the airplane is pointing as measured clockwise from true north.

The magnetic compass is used to obtain the TRUE HEADING of the airplane. However, since the magnetic north and the true north do not coincide, the magnetic compass will give the MAGNETIC HEADING or the heading of the airplane with respect to magnetic north. The angle between true north and magnetic north is called VARIATION.

If the magnetic compass points east of true north, VARIATION is said to be east. If it points west of true north, VARIATION is said to be west.

**East VARIATION must be added** to the MAGNETIC HEADING to obtain the TRUE HEADING. **West VARIATION must be subtracted.**

Aeronautical charts are provided with dotted lines to indicate the amount of east or west VARIATION.



# DEVIATION

The magnetic compass should point to MAGNETIC NORTH but because of influences within the airplane, it may be pulled to the east or west of MAGNETIC NORTH. This error in the magnetic compass is called DEVIATION.

The amount of DEVIATION must be predetermined by swinging the airplane on several different headings. These values are placed on a COMPASS CORRECTION CARD which is mounted in the airplane near the magnetic compass.

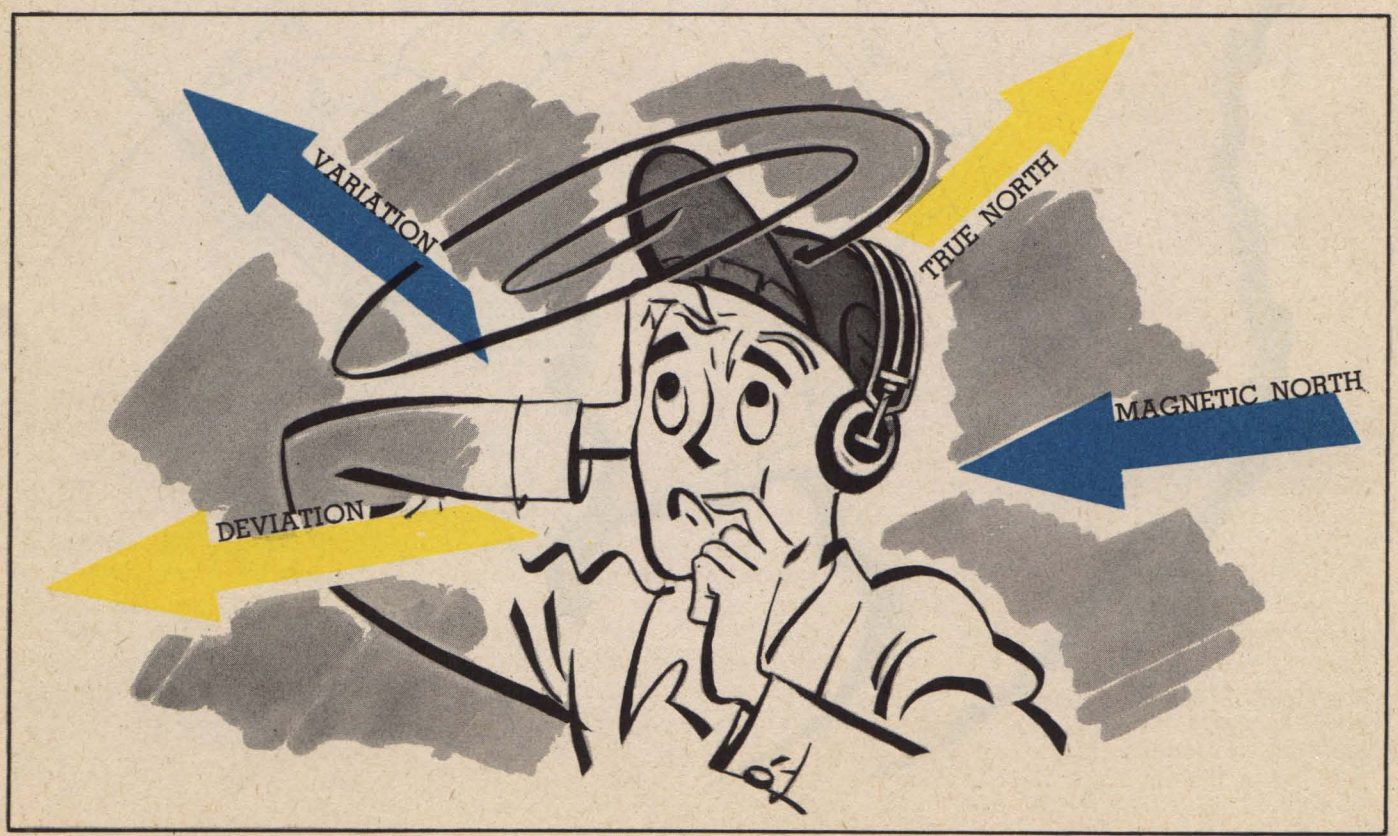
The center column of the card contains the compass reading.

The first column, C to M, gives the DEVIATION to be used when changing a COMPASS HEADING to a MAGNETIC HEADING.

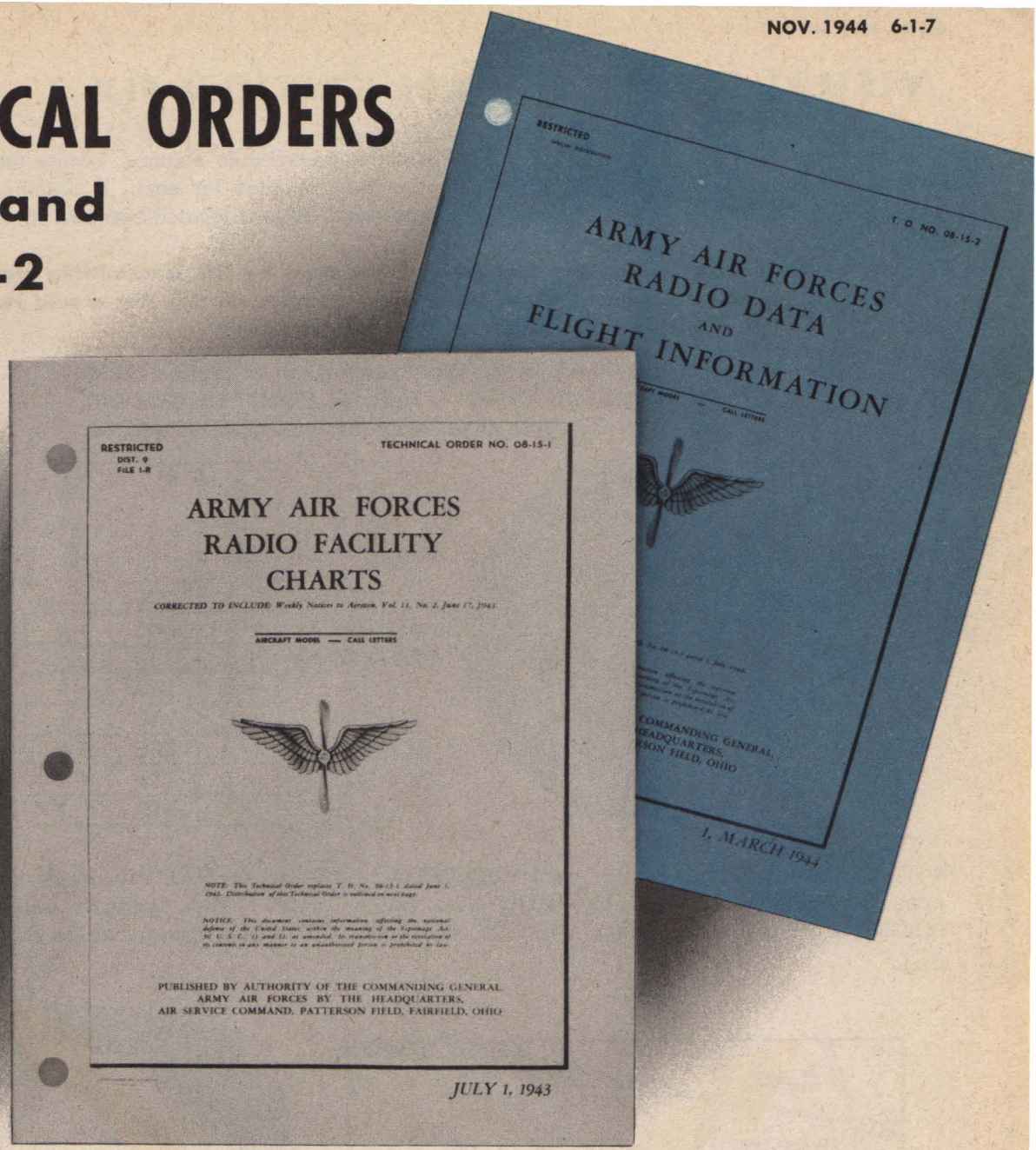
***Example:*** If magnetic compass reads 45 degrees, it is reading 3 degrees too high. Therefore 3 degrees must be subtracted from that COMPASS HEADING to obtain the actual MAGNETIC HEADING which would be 42 degrees.

The third column gives the amount of DEVIATION to be used by the pilot for changing MAGNETIC HEADING to a COMPASS HEADING.

| C *to* M | | M *to* C |
|---|---|---|
| +1 | 000 | −1 |
| −3 | 045 | +3 |
| +1 | 090 | −1 |
| +2 | 135 | −2 |
| +1 | 180 | −1 |
| −3 | 225 | +3 |
| −1 | 270 | +1 |
| +1 | 315 | −1 |



# TECHNICAL ORDERS 08-15-1 and 08-15-2




Technical Order 08-15-1 (ARMY AIR FORCES RADIO FACILITY CHARTS) contains information on radio-range stations and their associated facilities. It is revised monthly to include all data available as of the 25th of the current month. Changes occurring subsequent to that date are published in WEEKLY NOTICES TO AIRMEN, and should be entered in the record of correction on page 1 of the technical order.

These facility charts give such information as the name, identification, and frequency of the station; the magnetic bearing and distance in miles from the station to the airport; the magnetic bearing of each course toward the station; and the airport tower frequency and field elevation. Additional information given includes planning and mileage charts, and fuel and oil locations in the United States. An index is found on the outside of the back cover.

Technical Order 08-15-2 (ARMY AIR FORCES FLIGHT DATA AND INFORMATION) gives data for use by pilots and radio operators while in flight. In Section II will be found an index to Aeronautical Charts of the United States. Section V contains the lists of some of the broadcasting stations in the United States from 550 to 1550 kc suitable for use in aerial navigation. All broadcast stations are not included in these lists, since their usefulness for aerial navigation is limited because of their low power and the number of other stations nearby operating on the same frequency. Additional information given includes daylight and darkness tables, Civil Air Regulations, a time and distance graph, and emergency and taxiing signals.

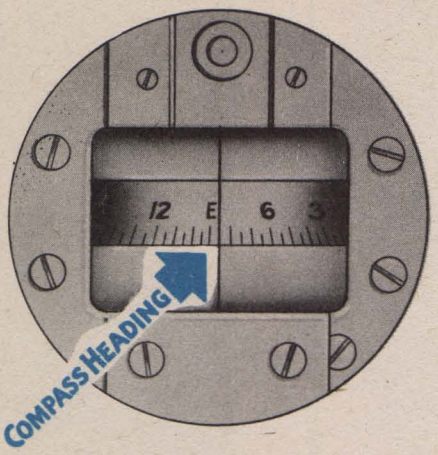
# VISUAL METHOD THREE-STATION FIX

**1**—Place the OFF-COMP-ANT-LOOP switch on the control box on COMP position.

**2**—Select three suitable stations. Locate them on the chart and log the dial readings for each. If possible, use low-frequency, high-powered stations located between 30 and 150 degrees apart.

**Be sure to note the type of emission used by the transmitting stations. In some theaters, all of the stations operate on cw: This would require use of the cw-voice switch on the receiver panel.**

**3**—Read the magnetic compass to obtain the COMPASS HEADING. Correct the COMPASS HEADING for DEVIATION to obtain the MAGNETIC HEADING.

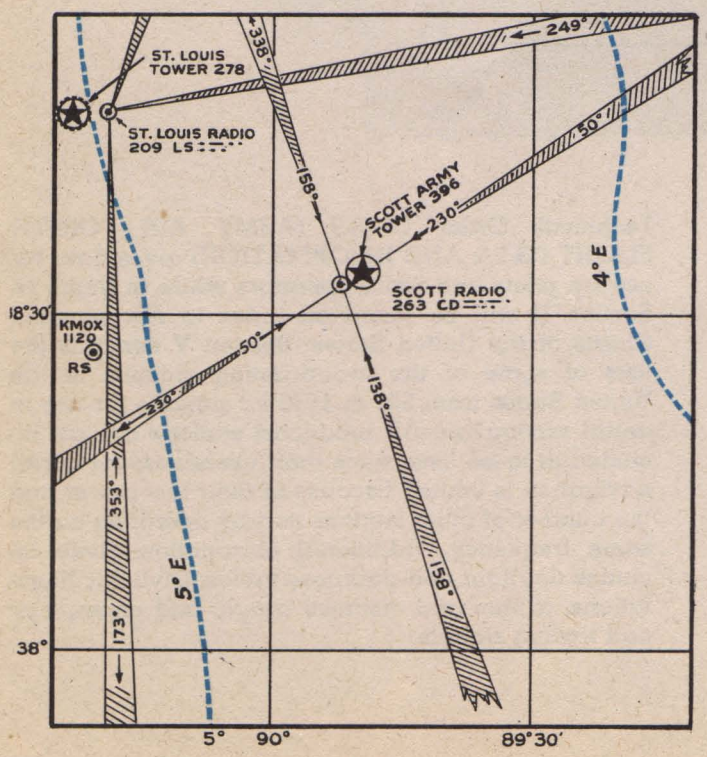


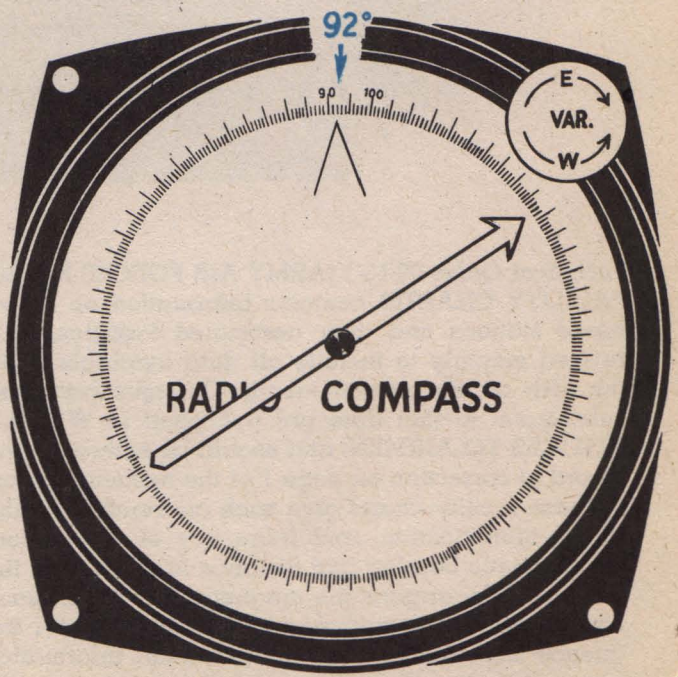

DEVIATION

| C *to* M | | M *to* C |
|---|---|---|
| +1 | 000 | −1 |
| −3 | 045 | +3 |
| +3 | 090 | −3 |
| +2 | 135 | −2 |
| +1 | 180 | −1 |
| −3 | 225 | +3 |
| −1 | 270 | +1 |
| +1 | 315 | −1 |

**4**—Obtain the amount of east or west VARIATION from the Aeronautical Chart and apply it to the MAGNETIC HEADING to obtain the TRUE HEADING.

**5**—Use the VAR knob and rotate the AZIMUTH scale of the 1-82-A indicator until this value of TRUE HEADING appears at the INDEX TRIANGLE.




***EXAMPLE:***

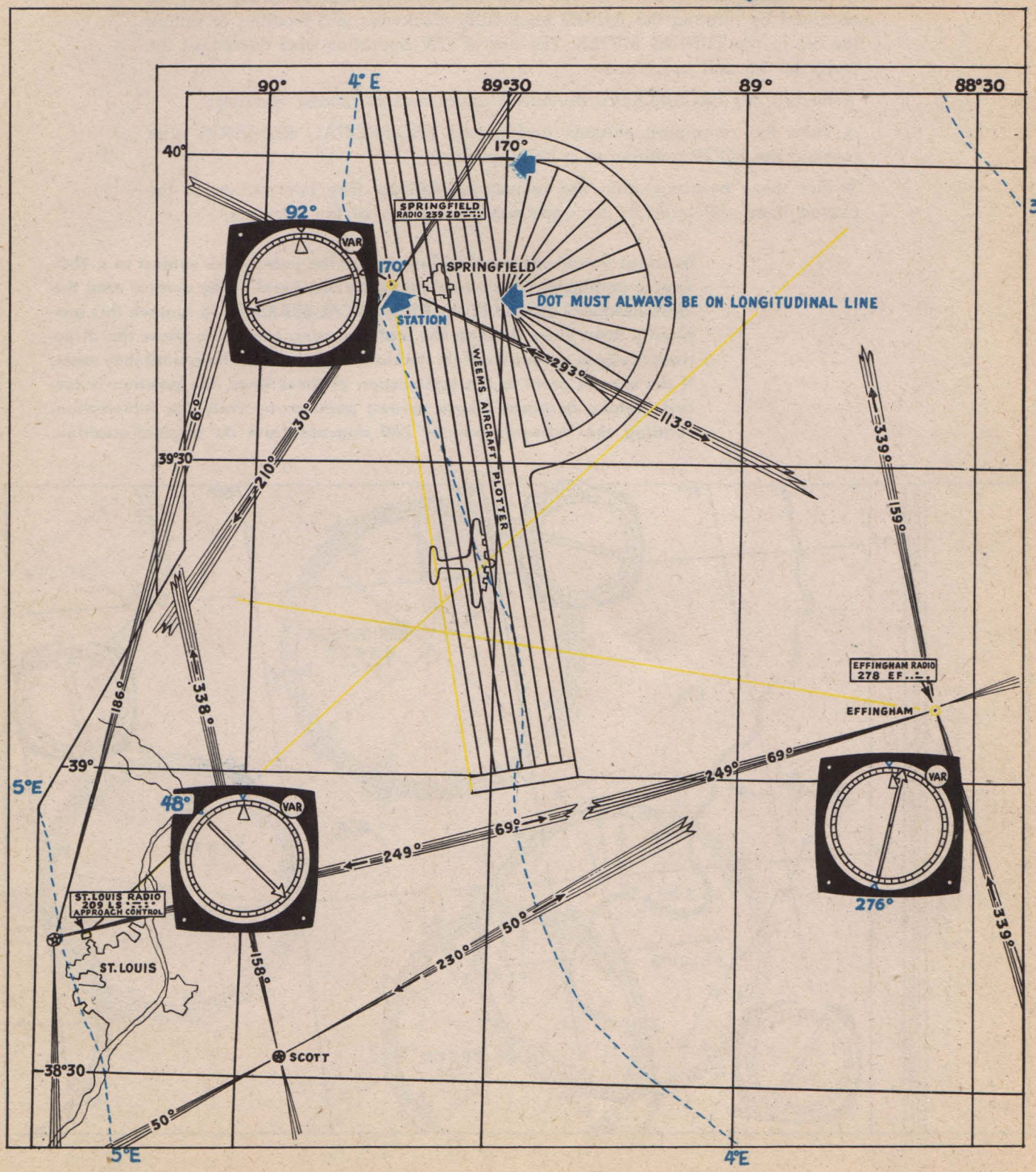
True heading = magnetic heading ± variation
= 88° + 4°
= 92 degrees.

**6**—Tune in the first station and record the RECIPROCAL BEARING obtained from the tail end of the indicator pointer.

**7**—Tune in the two remaining stations and record their RECIPROCAL BEARINGS. **Make certain that the magnetic heading of the aircraft does not change while making these bearings!**

**8**—Using a Weems Plotter plot the RECIPROCAL BEARINGS from a longitudinal north line. The intersection of the plotted lines will indicate the approximate location of the aircraft.

**EXAMPLE**



# AURAL NULL THREE-STATION FIX

1—Perform the first five steps listed under the visual method.

2—Place the OFF-COMP-ANT-LOOP switch on LOOP position.

3—Tune in the first station.

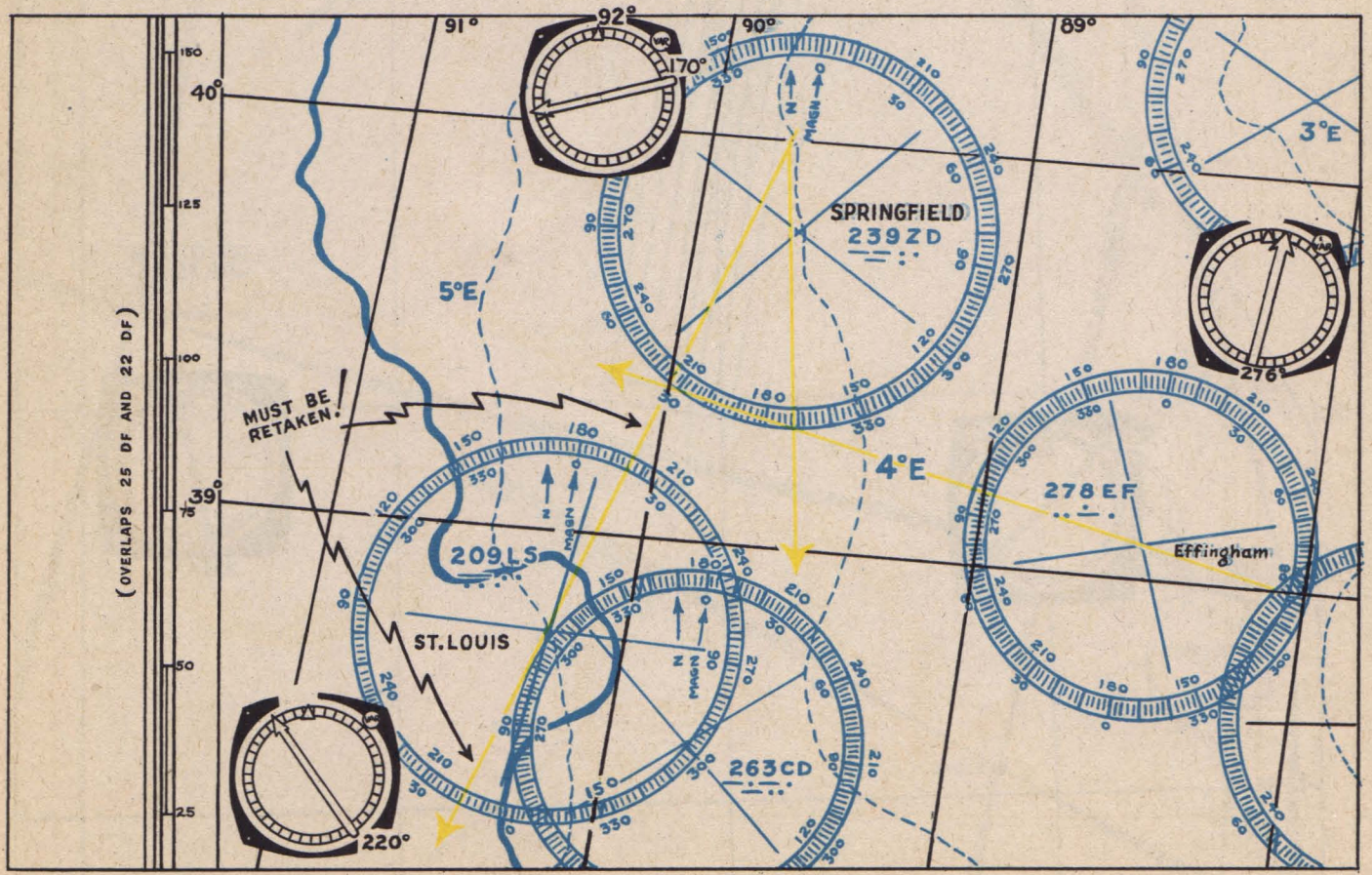
4—Use the LOOP L-R switch to rotate the loop for minimum headset volume. If the signal null exists over too wide an angle, greater accuracy may be obtained by rotating the AUDIO knob fully clockwise and locating or noting the dip in the TUNING METER. The use of CW operation also decreases the width of the null indication.

5—Record the RECIPROCAL BEARING (blunt end of pointer reading).

6—Tune the remaining stations and record RECIPROCAL BEARINGS after rotating the LOOP antenna to a NULL position.

7—Plot these bearings from the respective stations. The intersection of the plotted lines will indicate the approximate location of the airplane.

**Bearings obtained from the blunt end of the pointer are subject to a 180-degree ambiguity. This would make the blunt end of the pointer read the TRUE BEARING instead of the RECIPROCAL BEARING. To remove this ambiguity draw lines through the stations using arrows to show the directions the lines are drawn from the stations. Extend the lines until they meet. If the arrows point to the intersection of these lines, the position is correct. *Retake bearings whose arrows point away from the intersection, rotating the indicator pointer 180 degrees from its original position.***

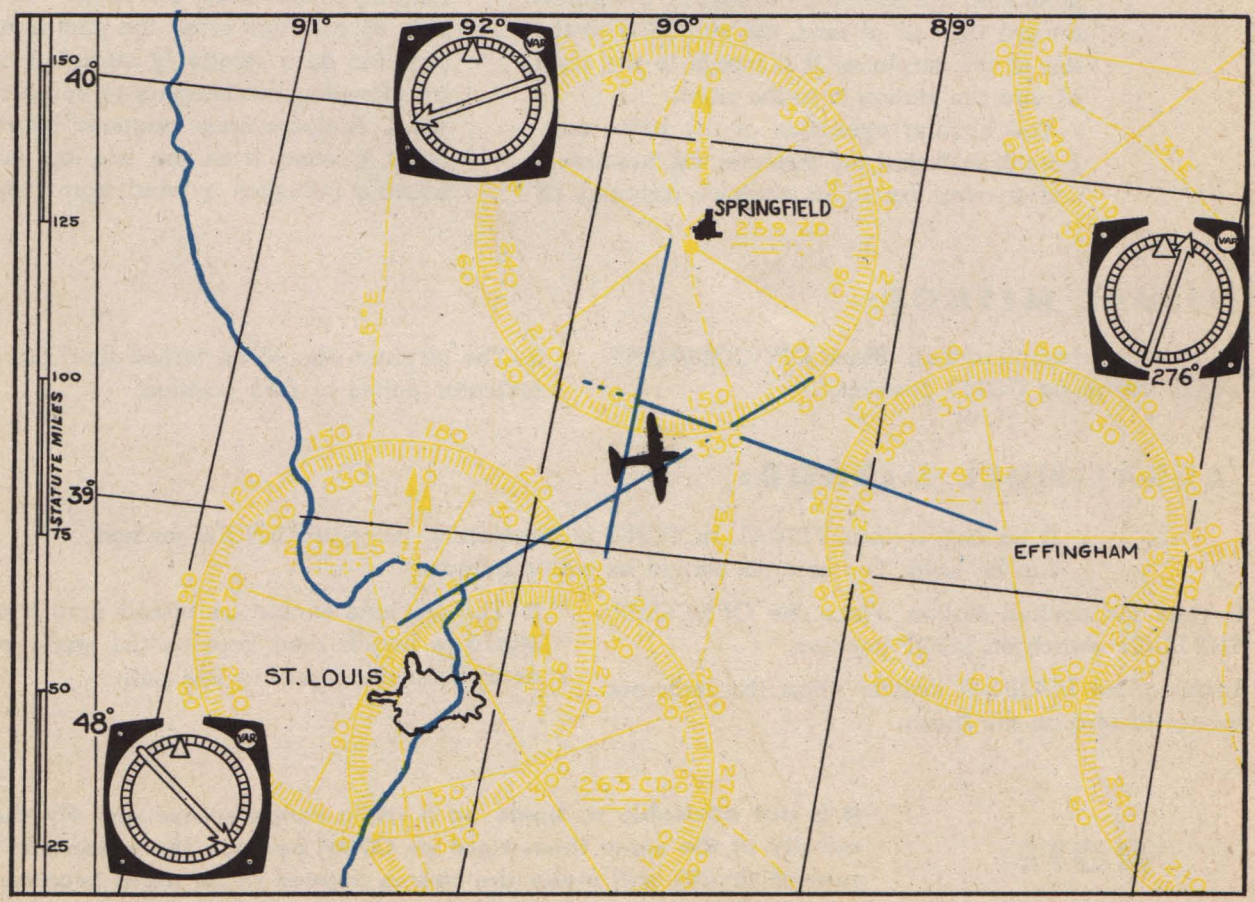


# USE OF AERONAUTICAL CHARTS FOR DIRECTION FINDING

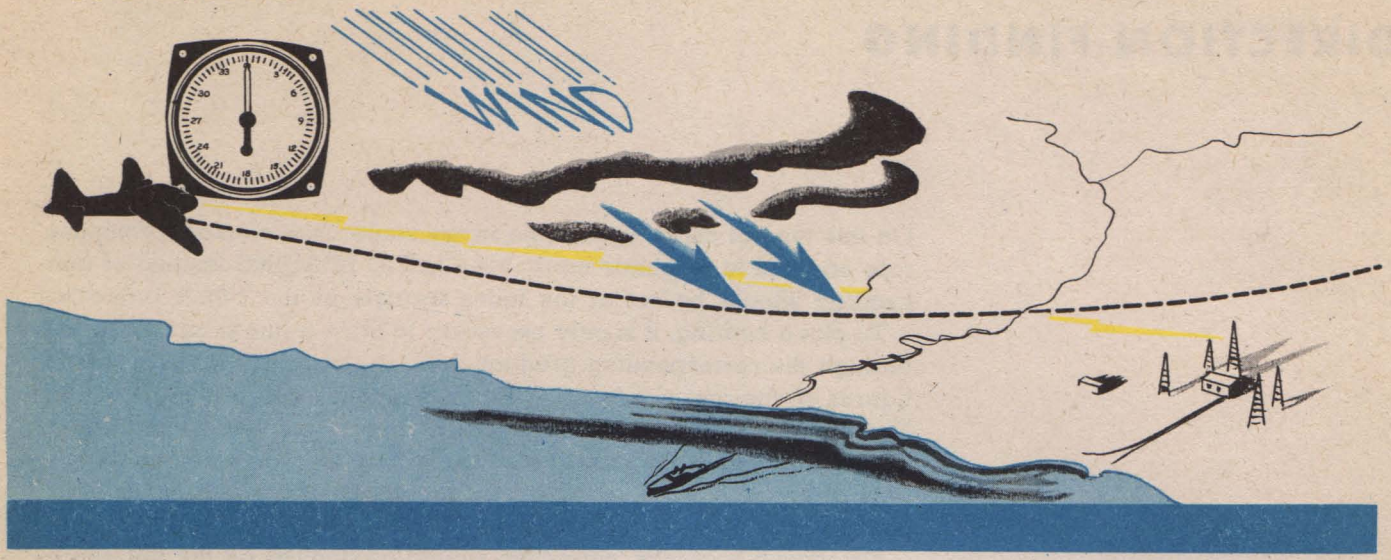
On this type of chart, each radio range station has a special compass rose oriented to magnetic north. MAGNETIC HEADING instead of true heading should be set at the index triangle of the 1-82-A indicator.

To plot a bearing, it is only necessary to draw a line from the station through the corresponding graduation on the compass rose. The outer figures on the rose are for *true bearings* (pointed end of the indicator). The inner figures are for *reciprocal bearings* (tail end of indicator). Thus either end of the indicator's needle may be read when using this type of chart. Always be sure you use the proper scale on the compass rose.

For utmost accuracy, correction should be applied for the difference in the variation at the airplane and at the station. This difference must be added if the variation at the airplane is smaller westerly or greater easterly than at the station. It must be subtracted if the variation is greater westerly or smaller easterly than at the station.



# HOMING




The radio compass may be used for either VISUAL or AURAL-NULL homing. When the pilot's indicator points to zero, the airplane is headed toward the radio station. If it points toward the left of zero, the station is to the left of the airplane; if it points to the right of zero the station is to the right.

The homing operation of the radio compass is such that the airplane will ultimately arrive over the radio station's antenna regardless of probable drift due to cross winds. However, the flight path will be a curved line and coordination with ground fixes or landing fields along the route will be difficult. By trial and error, the pilot may fly the airplane on a relatively straight-line course by offsetting the heading to compensate for wind. A decreasing magnetic bearing indicates a wind from the left, an increasing bearing indicates a wind from the right.

## VISUAL METHOD:

**1**—Tune the desired station. Place OFF-COMP-ANT-LOOP switch on COMP position.

**2**—The airplane should be turned until the compass indicator points to zero position.

## AURAL-NULL METHOD:

If for any reason VISUAL HOMING is impossible, the AURAL-NULL method can be used. The controls should be set as follows:

**1**—Tune the desired station. Place the OFF-COMP-ANT-LOOP switch on LOOP position.

**2**—Using the LOOP-L-R switch, align the indicator pointer to zero on the Index.

**3**—The airplane should be turned until a minimum signal is heard; then kept on the same course so as to keep the signal at this null.

## NOTE:

**It is not advisable to home on a radio range course and fly the course aurally at the same time, since on COMP position the automatic volume-control circuits will make the course appear to be much broader than it actually is.**

# RECEIVER OPERATION

## ANTENNA RECEPTION

For general reception, switch to ANT position and tune in the station for best headset volume and maximum deflection on the TUNING METER.

ANT position should be used when flying the radio range in good weather by the aural method. MVC is employed on this position.

## LOOP RECEPTION

LOOP reception is desirable for receiving signals during severe static conditions. In this case, switch to LOOP position and rotate the loop antenna by use of the LOOP-L-R switch for best headset volume and maximum deflection on the TUNING METER.

### POLARIZATION ERRORS

The radio compass was designed to serve primarily as a navigational aid in flying. So long as it is used in this capacity and its limitations recognized, it is a useful and valuable device. Unfortunately, in actual flight, there are certain periods when the instrument's indications are not correct. This is caused by radio wave polarization errors. Failure to recognize these errors can throw you far off course, and make you mistrust the compass.

The principal polarization error is *night effect.* Other causes of faulty bearings are *mountain effect, shore-line effect,* and *magnetic disturbances,* such as those found in auroral zones of polar regions.

Ordinarily, for homing, the radio compass receiver depends on reception of vertically polarized radio waves. However, when these waves are reflected from the sky they may change polarity and become horizontally polarized. These horizontally polarized waves conflict with the vertically polarized waves and cause fluctuations in the reading of the radio compass indicator.

### NIGHT EFFECT

Since radio waves are reflected in greater strength by night than by day, the opposition of horizontally opposed waves is stronger at night. Errors caused by this phenomenon are called night effect.

Polarization errors may flare up for a few seconds at intervals through the day, and cause the needle to hunt more than normally about the bearing. Real night effect causes hunting of more than 30 seconds' duration. Variations in the intensity of this hunting may be conveniently classified into two types.

In less severe form, the indicator hunts over a total angle of 15° or less around the true bearing; and often a bearing with an accuracy of 5° can be taken by computing a mean reading. In more severe cases the indicator moves constantly, usually through a wide angle and not around the proper bearing. Therefore, taking an average of the fluctuations is not possible. You sometimes encounter short periods of nearly normal operation during these periods of extreme instability.

The times at which night effect begins vary considerably, even on the same station. Usually, the first and last disturbances appear during the periods just before sunset and just after sunrise. The errors increase with an increase in frequency, or in the distance of the airplane from the station.

### REMEDIES

Night effect recurs frequently. However, there are definite steps with which to combat it. First, recognize it by remembering that a period of fluctuation in the bearing indications lasting more than 30 seconds is a sure sign. Then try the following:

**1**—Use other methods of navigation to check the bearings.

**2**—Increase altitude.

**3**—Average the fluctuations if possible.

**4**—Select a station of lower frequency.

**5**—Remember that comparatively large errors are tolerable for purposes of homing, since accuracy increases as the distance diminishes.

### OTHER EFFECTS

You may notice fluctuations when flying across coast lines when the radio waves cross the coast at acute angles. Errors may occur, also, when you are flying over certain mountainous regions, and, to a limited extent, through cold fronts.

## PRECAUTIONS

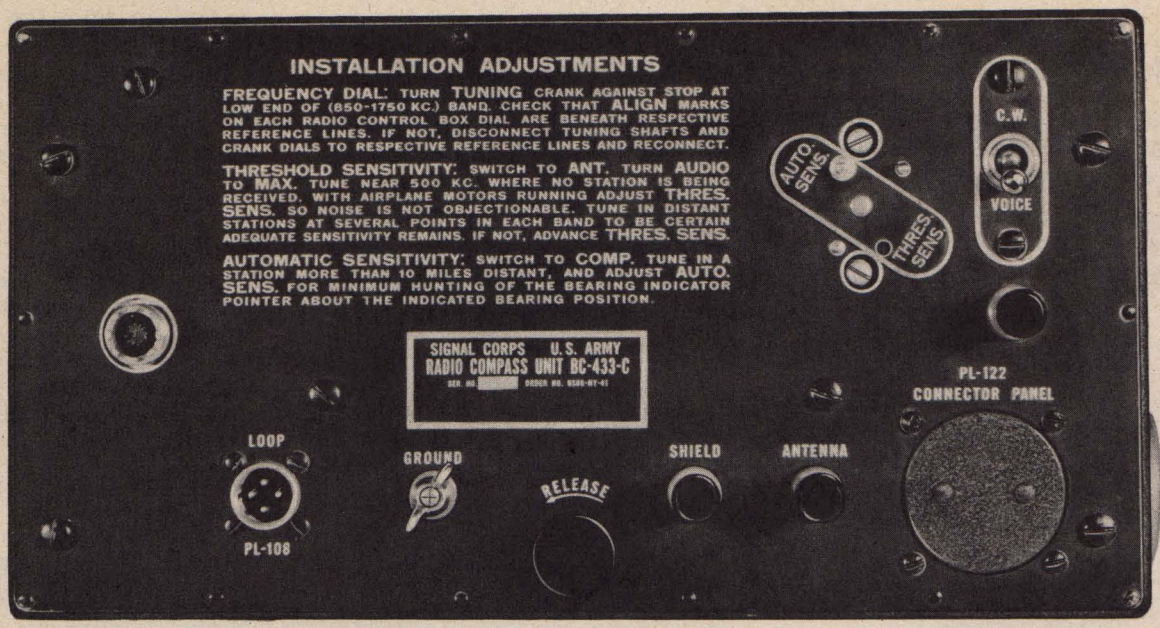
If the loop is in the null position when flying on a radio range course, the signal may fade in and out and be mistaken for a cone of silence.

Cone-of-silence indications are not reliable on loop-type range stations when the receiver is on LOOP position. The signal may increase in volume to a strong surge instead of a silent zone when directly over the station.

*Never use comp position for flying the radio range as the course might appear much broader than it actually is!*

Do not use a station for obtaining bearings unless it can be identified by the headset signal on COMP position.

# ADJUSTMENTS AND INSPECTIONS




## AUTOMATIC SENSITIVITY

The AUTO SENS Automatic Sensitivity control, located on the front panel of the receiver, adjusts the sensitivity of the loop control circuits so that the loop antenna will respond to a small change in the bearing of the transmitting station. It also controls the amount of hunting of the loop antenna. Instructions for making the AUTO SEN adjustment are printed on the front panel of the receiver.

## THRESHOLD SENSITIVITY

The Threshold Sensitivity THRES SENS control located on the front panel of the receiver, governs the noise output of the receiver when tuning between stations. The instructions for adjustment are also printed on the front panel of the receiver.

## TUNING DIAL ALIGNMENT

Complete instructions for aligning the dial are printed on the front panel of the receiver. Make certain both control boxes are properly aligned.

## DEHYDRATOR UNIT

The crystals should be replaced or reactivated when approximately one-half of them have turned pink. They may be reactivated by placing them in a shallow pan and heating to a temperature of 350° to 400° Fahrenheit until they assume their deep blue colors. Continue heating for about 2 hours, stirring occasionally.

**CAUTION!** Do not exceed a temperature of 400° F. or the activity of the silica gel may be permanently impaired. Immediately after cooling pour the crystals back into the transparent tube, reassemble, and remount.

Be sure the tape is removed from the air hole on the end cover.

## INSTALLATION ADJUSTMENTS

**Frequency Dial:** Turn tuning crank to the stop at the low end of the 850 to 1750 kc band, being sure the ALIGN mark on the radio control-box dial is aligned with its respective reference mark. If it is not, disconnect the tuning shaft and crank the dial until its respective reference mark does align.

**Threshold Sensitivity:** Place the function switch to ANT position. Turn the AUDIO control fully clockwise. Set the tuning dial to approximately 500 kc, where no station is being received. With the airplane's motors running adjust the THRES SENS control until no objectional background noises are heard. Tune in distant stations at several points on each band to be certain adequate sensitivity remains. If there is not adequate gain advance the THRES SENS control.

***Automatic Sensitivity:*** Switch to COMP position. Tune in a station located more than 10 miles away, and adjust the AUTO SENS for minimum hunting of the bearing-indicator pointer about the indicated bearing position.

# SCS 51

## INSTRUMENT-LANDING SYSTEM

**The airborne components of this system include the following:**

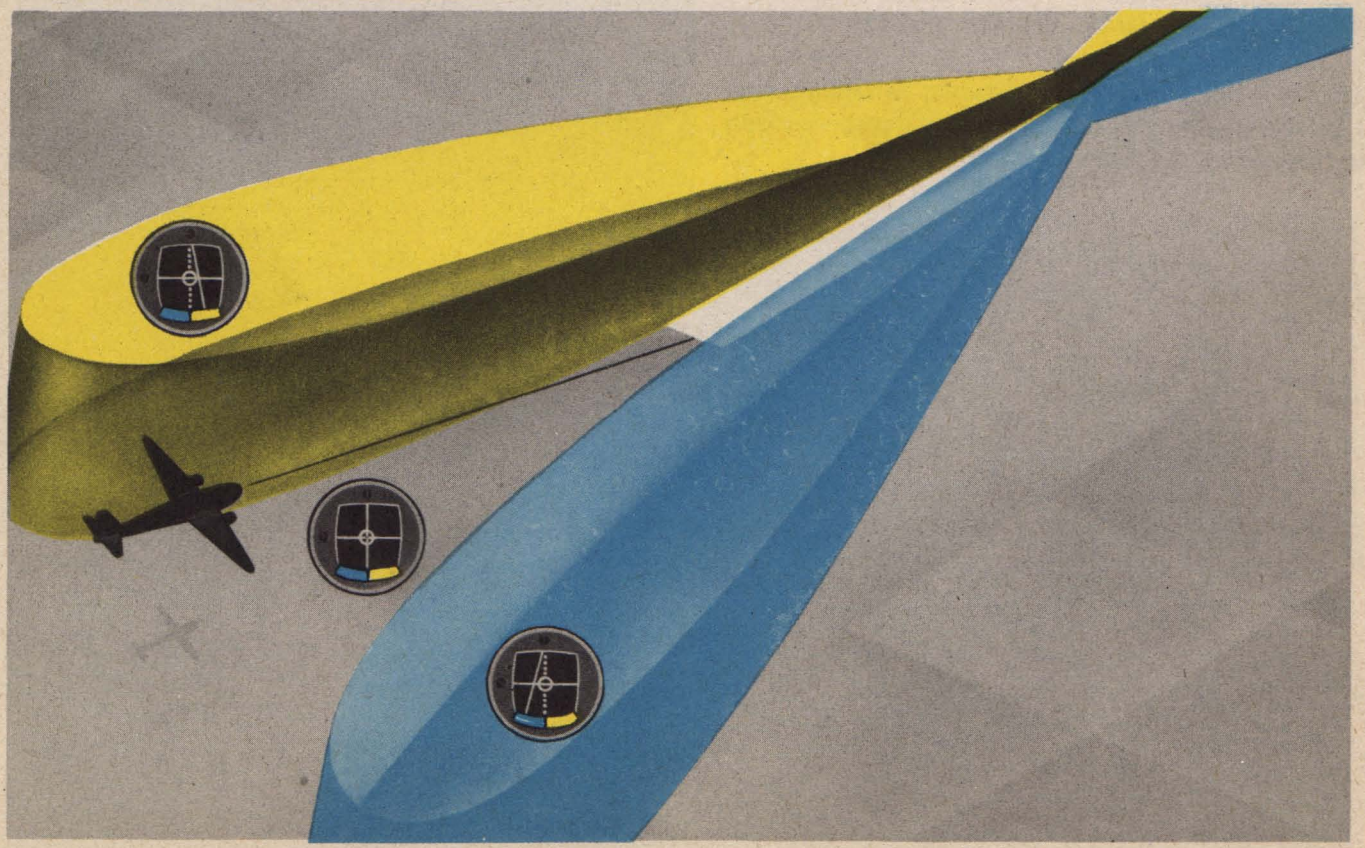
**RC-103**
**LOCALIZER RECEIVER**

**AN/ARN-5**
**GLIDE-PATH RECEIVER**

**RC-43 or RC-193**
**MARKER-BEACON RECEIVER**

**The localizer receiver is designed to furnish lateral or on-course guidance when making an instrument-approach landing. Vertical guidance is furnished by the AN/ARN-5 glide-path receiver. The marker-beacon receiver is used to furnish indications of the distance the airplane is from the runway.**

## RC 103 VHF LOCALIZER



# RECEIVER BC-733

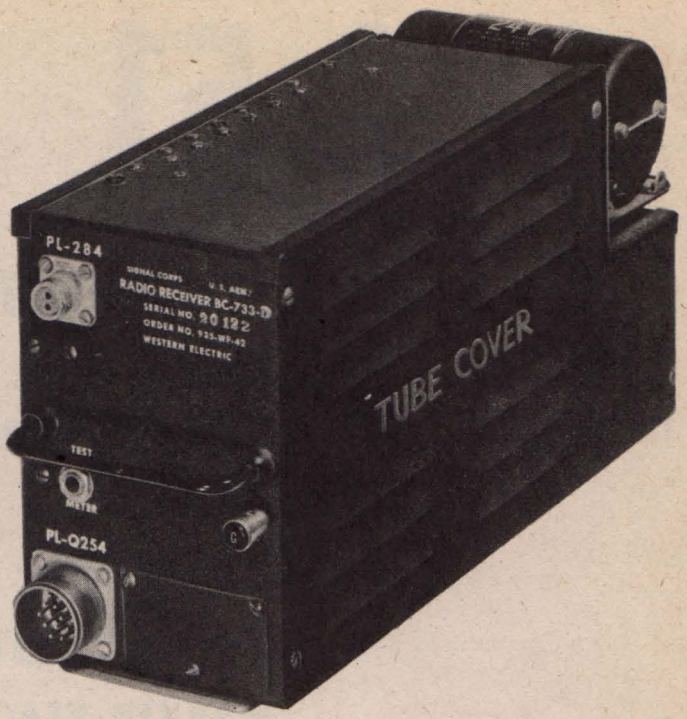
Radio Receiver BC-733 is a crystal-controlled superheterodyne. It operates on six channels, namely, 108.3, 108.7, 109.1, 109.5, 109.9, and 110.3 mc.

The received signal, radio frequency, containing 90 and 150 cycle modulation, is amplified and then detected. The resultant 90 and 150 cycle output is fed into a jack on the control box, or to COMMAND position on the interphone jackbox for aural reception. It is also applied to a special audio-filter and rectifier network for visual indication. This network separates the 90 and 150 cycles, then rectifies them. The leads carrying the rectified signals are connected to the visual indicator terminals.

The visual indicator pointer will indicate by swinging to the left or right, which of the two signals is the stronger.

Since the two transmitted signals are of equal strength on the center of the runway, no indication will be noted when the airplane is on course. Any deviation of the pointer from the center will indicate the position of the airplane from the center of the runway. The indicator does not provide heading information.

When the airplane is approaching for a landing, the blue area of the indicator indicates that it is to the right of the runway and the yellow area indicates that it is to the left of the runway.

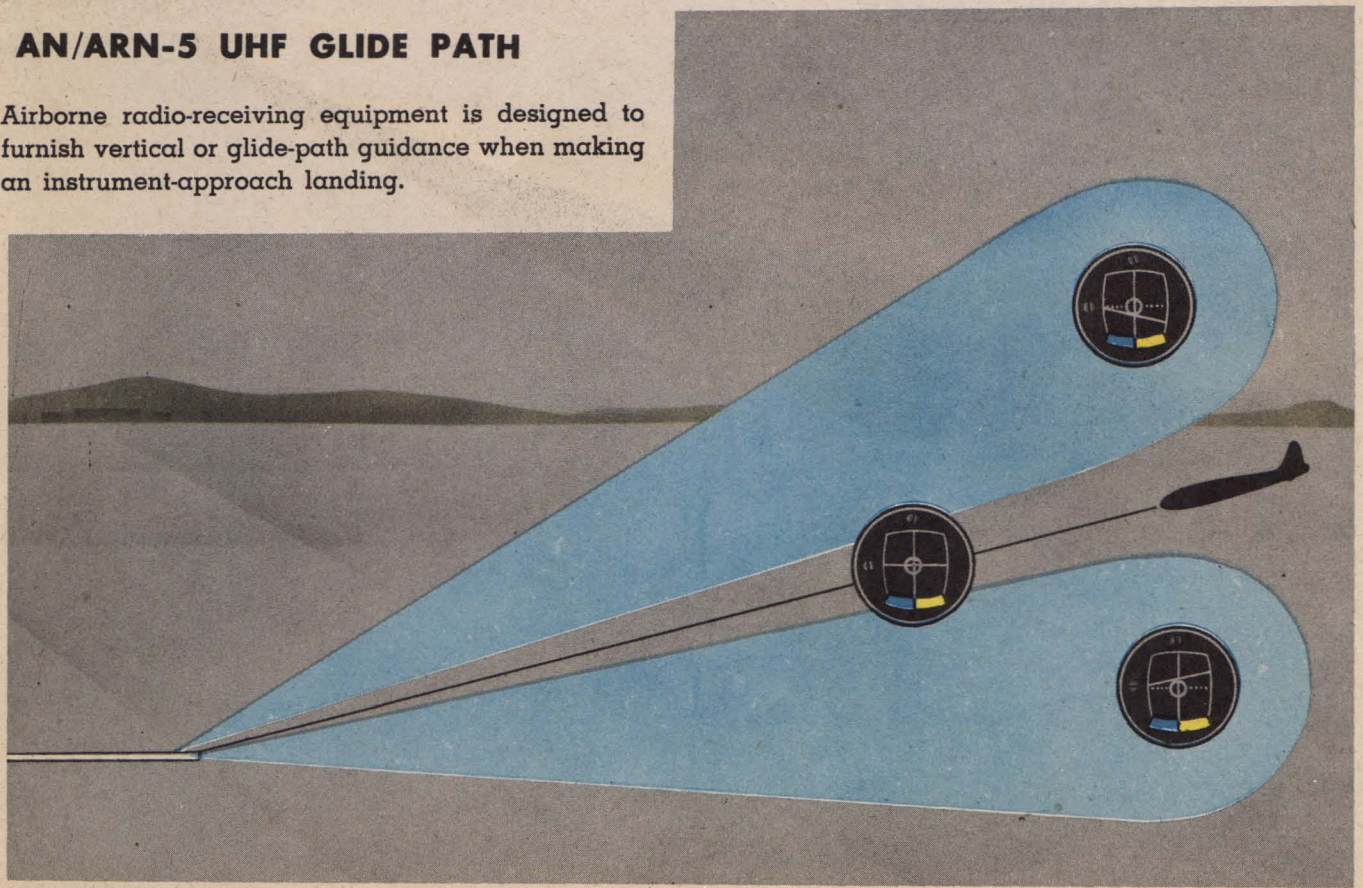



The normal range of the localizer beam is in excess of 25 miles at an altitude of 2,500 feet. The range increases with altitude.

High voltage required by the receiver is furnished by dynamotor DM-33. Its mountings are on the back of the receiver box.

## AN/ARN-5 UHF GLIDE PATH

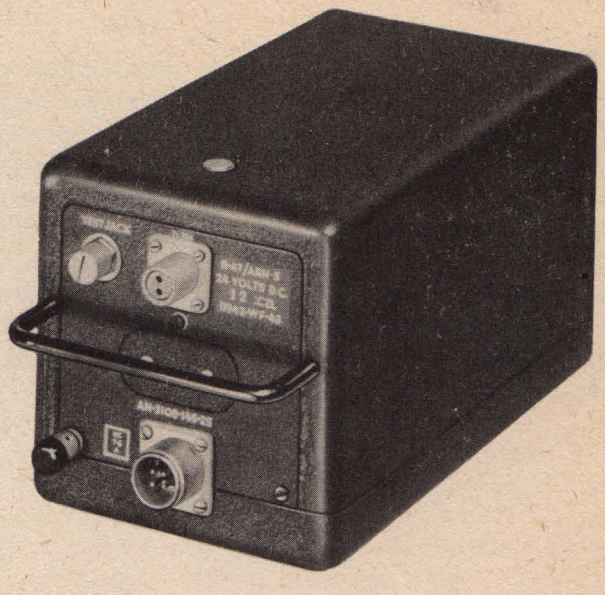
Airborne radio-receiving equipment is designed to furnish vertical or glide-path guidance when making an instrument-approach landing.



# RECEIVER R-89/ARN-5

Radio receiver R-89/ARN-5 is a crystal-controlled superheterodyne. It operates on three channels, namely, 332.6, 333.8, and 335.0 mc.

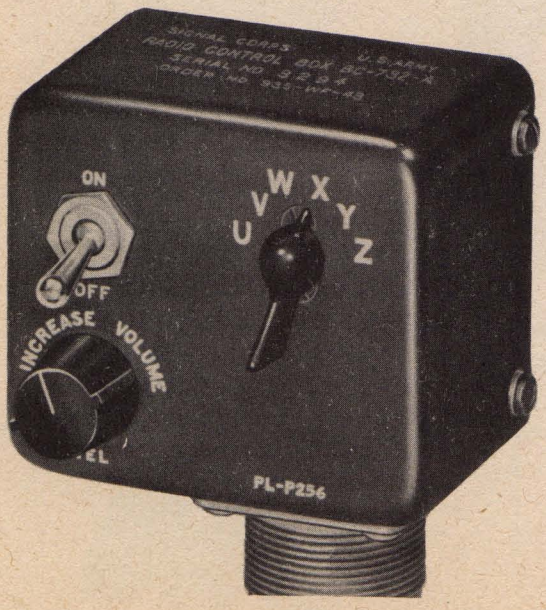
The electrical characteristics of the R-89 are very similar to those of the BC-733 receiver. Its output actuates the horizontal pointer of the same indicator that is used with the localizer receiver. When the airplane is above the flight path or glide path, a predominance of 90-cycle signals will be received and the pointer will drop below center. As the airplane meets the intersection of the two transmitted signals, an equal amount of 90- and 150-cycle signals will be received and the horizontal pointer will be centered. Below the glide path the pointer will rise above center, the amount depending upon how far the airplane is from the glide path. The receiver is very sensitive; a full-scale deflection of the pointer will be noted if the airplane is 0.3 degrees above the glide path or 0.5 degrees below it. High voltage is not required for operation of the receiver.



## NOTE:

The earlier models AN/ARN-5 Glide-Path receiving equipment employs a model R-57/ARN-5 receiver. No relay-switching equipment is included in this receiver. It is a single-channel receiver with two other crystals mounted under the cover. The cover must be removed to change the channel frequency of the receiver. It operates directly off the 24-volt supply.

**CAUTION: At a vertical angle of 17½ degrees a false course, with reversed indications, exists. A false course with true indications occurs at an angle of 22½ degrees. These two false courses will be readily noticed because of their steepness, their weak signal strength, and the fact that they occur only at low altitudes and close to the airport with the airplane well above its normal course.**




# CONTROL BOX BC—732

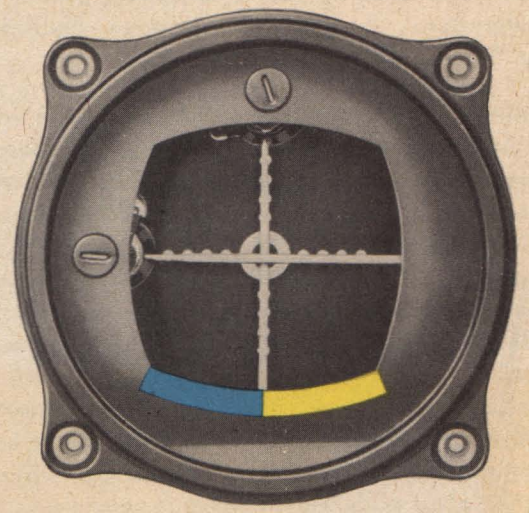
The operations of both the localizer and glide-path receivers are controlled by control box BC-732.

The ON-OFF toggle switch controls the power input to both receivers. INCREASE-VOLUME control regulates the strength of the audio signals. U-V-W-X-Y-Z Selector switch controls the selection of the channel frequency circuits in both receivers. The channel frequencies in megacycles are as follows:

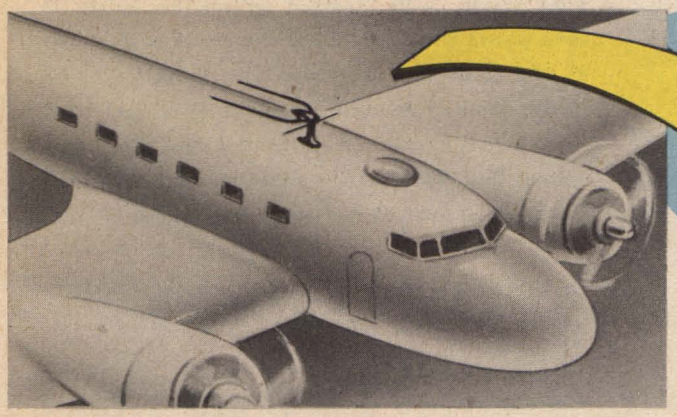
| CHANNEL | RC-103 | AN/ARN-5 |
|---|---|---|
| U | 108.3 | 332.6 |
| V | 108.7 | 333.8 |
| W | 109.1 | 335.0 |
| X | 109.5 | 332.6 |
| Y | 109.9 | 333.8 |
| Z | 110.3 | 335.0 |

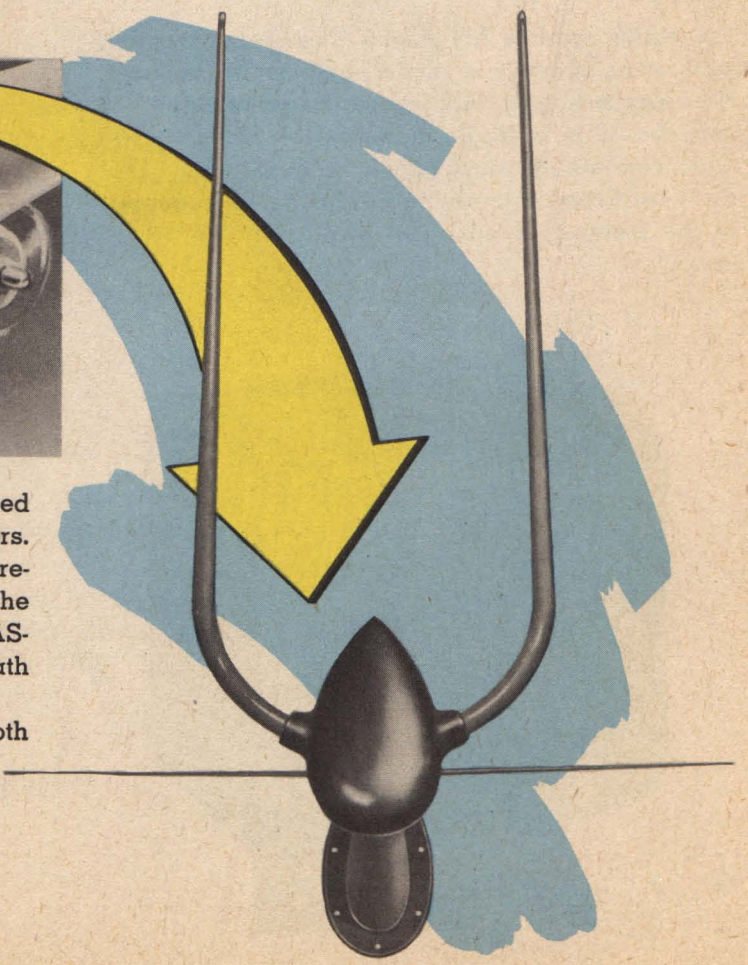
# VISUAL INDICATOR I-101

Indicator I-101 consists of two micro-ammeters mounted in the same case. One is mounted vertically, the other horizontally. The vertical indicator is connected to the localizer receiver and registers the blue and yellow areas of the transmitted signals. The horizontal indicator is connected to the glide-path receiver and registers the relative strength of the glide-path transmitter signals. Both pointers should line up with the dots on the scale when the equipment is off. Centering is controlled by the screws on the front of the meter.



# ANTENNA SYSTEM AS-27/ARN-5





The AS-27 is a combination antenna system designed to operate with the localizer and glide-path receivers.

The wishbone-type is used with the localizer receiver. The conventional di-pole is used with the glide-path receiver. A separate di-pole antenna (AS-61/ARN-5) is sometimes used with the glide-path receiver.

Balanced transmission lines are used with both antennas.

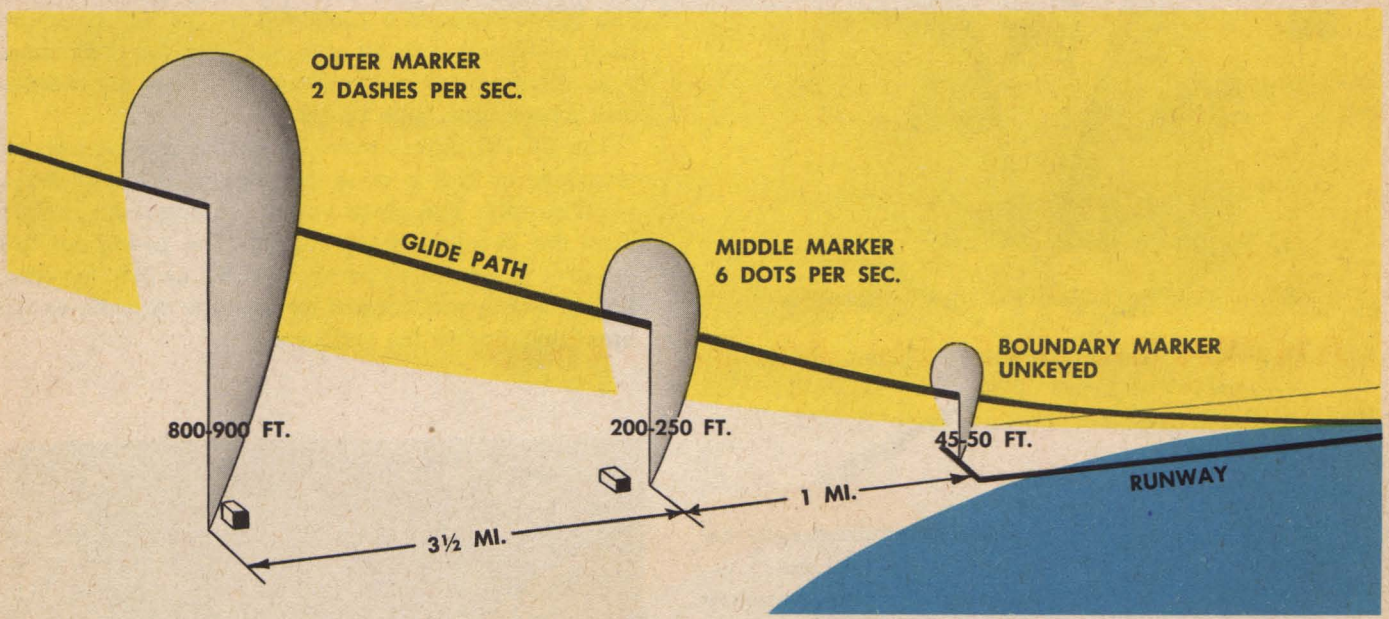
# RC-193 MARKER-BEACON RECEIVER

Sometimes the marker-beacon equipment is used with the SCS-51 system to give visual indications of the distances the airplane is from the runway when making an instrument approach landing. There are three marker stations located along the glide path. They are referred to as the *outer marker, middle marker,* and *boundary marker.*

The outer marker is placed 4½ miles from the approach end of the runway and is keyed at two dashes per second. The middle marker is placed 1 mile from the approach end of the runway and is keyed at six dots per second.

The boundary marker is located near the approach end of the runway. It is unkeyed.

The marker-beacon signals are modulated with 1300 cycles.




## MAINTENANCE AND INSPECTIONS


## DYNAMOTOR UNIT DM-53

There are two dynamotor units available for use with RC-103 equipment: the A model for 24-volt operation and the AZ model for 12-volt operation. A 12-volt AZ model receiver may be converted to a 24-volt A model, or vice versa, by changing the dynamotor units. Provisions are made in the plug of DM 53 AZ to convert the receiver for 12-volt operation. The voltage stamped on the dynamotor determines the operating voltage of the set.

Lubricate after every 300 hours of dynamotor use with a recommended type of lubricant.

## FUSE

The fuse is usually located in the receiver's junction box.

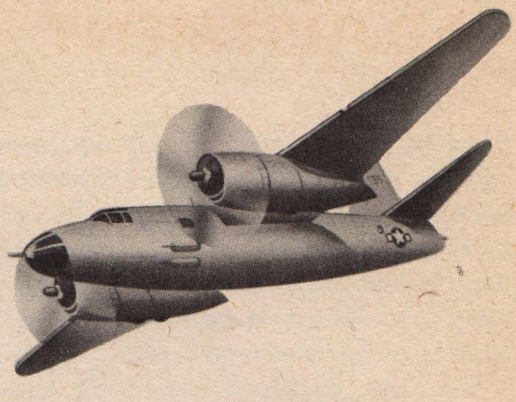
The wiring diagrams in the G file should be consulted for the exact size and location of the fuse.

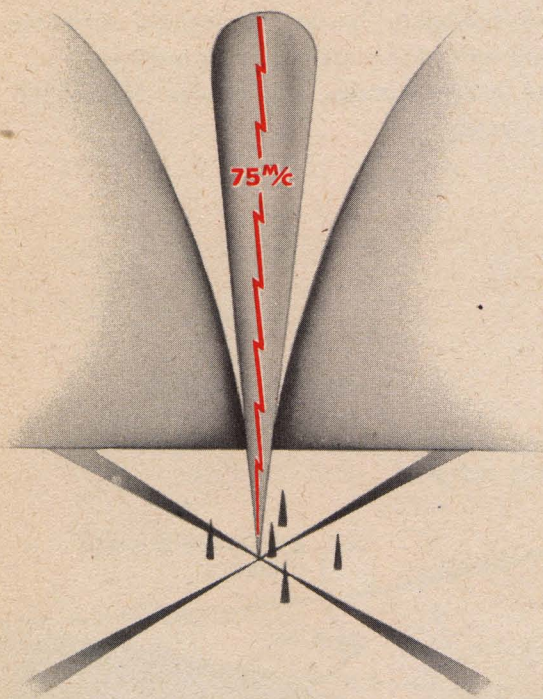
A 5-ampere fuse should be used for the 24-volt A model.

A 10-ampere fuse should be used for the 12-volt AZ model.

# MARKER BEACON

## RC-43 RC-193 RECEIVERS






The RC-43 is a two-tube, tuned radio-frequency receiver. It employs a VT-153 and a VT-104 tube.

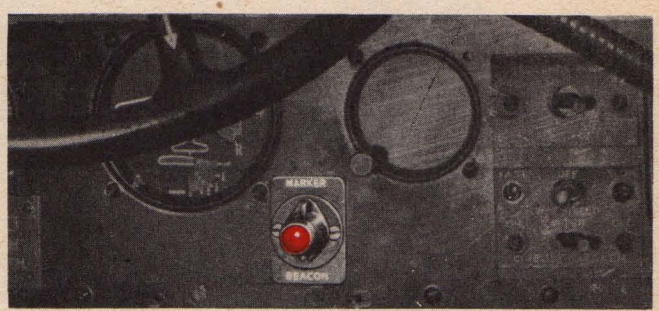
The RC-193 is a three-tube, tuned radio frequency receiver. It employs a 6SH7-6SL7GT and a 12SN7GT tube.

Both receivers are tuned to receive horizontally polarized 75-mc signals modulated at 3000 cycles. The received radio-frequency signal is amplified, then detected. The resultant audio frequency, usually 3000 cycles, is amplified then detected. The final output is direct current. The direct current is applied to a relay which controls the MARKER BEACON visual indicator on the pilot's instrument panel.


### POWER SOURCES

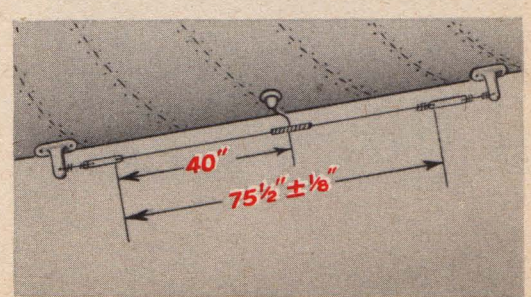
The RC-43 requires a high voltage for its operation. High voltage is usually obtained from the radio compass. However, it is sometimes furnished by a separate dynamotor, type PE-86.

The RC-193 differs from the earlier marker-beacon receivers in that it does not require a high-voltage plate supply. The plate voltage is supplied directly from the 24-volt battery supply. The power for this receiver is controlled by an ON-OFF switch, the location of which will depend on the type of radio equipment installed in the airplane.




### ANTENNA SYSTEM

The antenna is a resonant, fixed-wire type. It is tapped slightly off center to obtain an impedance match to a concentric transmission-line lead in.




**Since the antenna is resonant, its length is very critical.**

# ADJUSTMENT OF RELAY

**If the relay does not check properly, it will require adjustment.**

## TO ADJUST:

1—Insert a piece of paper 2 or 3 mils thick between the armature and the pole piece.

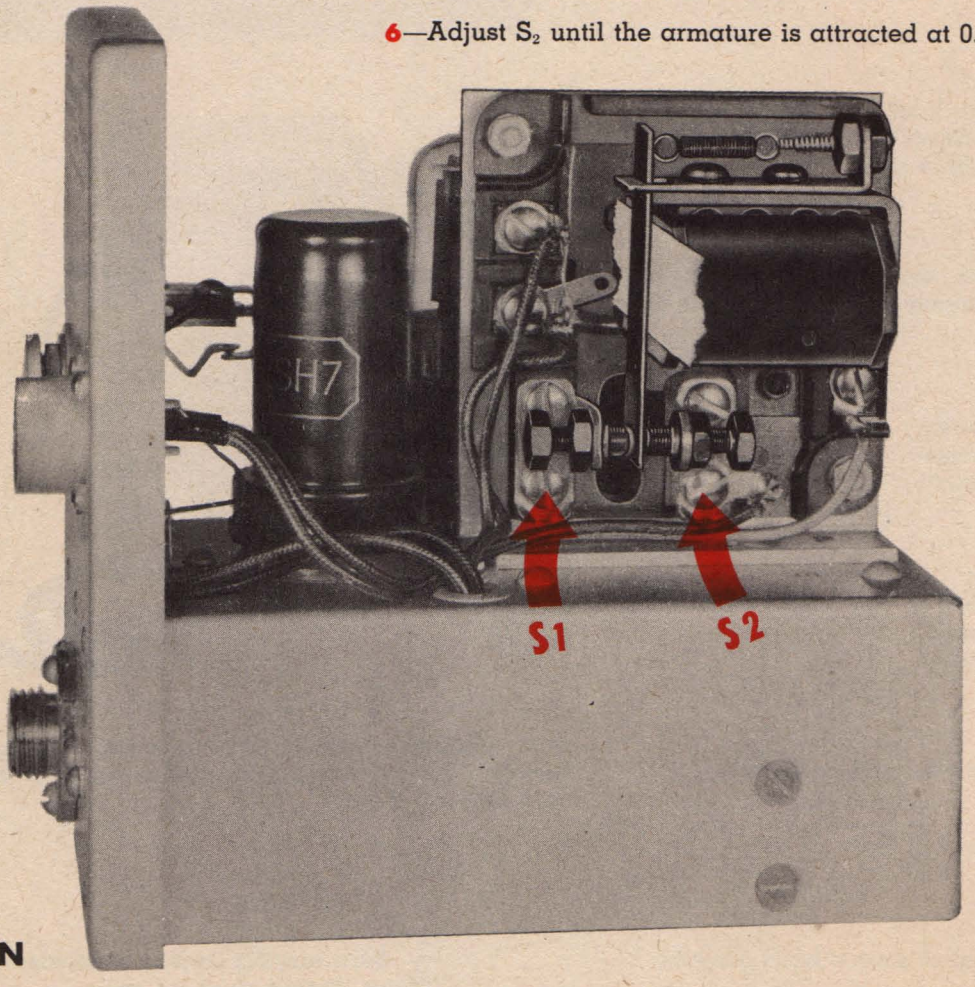
2—Release adjusting screw $S_1$ so that the armature does not touch it, and exert a slight pressure on the armature just above the pole piece.

3—Turn screw $S_1$ until contact is just made. The visual indicator will light when contact has been made. Lock screw $S_1$ in place.

4—Remove the paper, still exerting a slight pressure on the armature. The paper should come out without excessive rubbing. This insures the proper air gap. Without this, air-gap residual or remaining magnetism would hold armature when the current through the relay is released.

5—Adjust the spring tension until the armature pulls away with 0.2 ma flowing through the coil.

6—Adjust $S_2$ until the armature is attracted at 0.4 ma.




## FUSE LOCATION

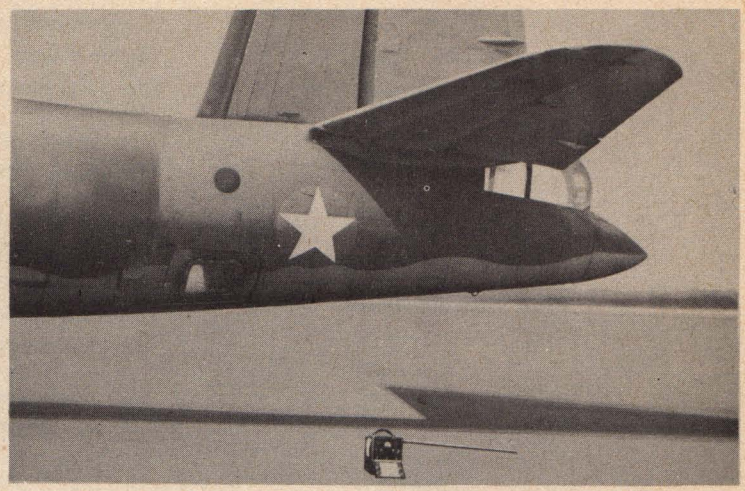
Usually the 5-ampere and 20-ampere fuses in the radio-compass junction box protect the receiver.

Extreme care must be taken when inserting the power plug PL-108 into its socket on front of the receiver. It is possible to insert the plug incorrectly and cause serious damage to the radio-compass receiver.

**CONSULT G FILES IN AIRPLANE FOR EXACT LOCATION**

# MAINTENANCE AND INSPECTIONS

## TUNING RECEIVER



Always leave the receiver in its case while tuning. Place the test oscillator (Part of I-76) on the ground about 15 feet from the marker-beacon antenna and parallel to it.

Extend the oscillator antenna full length. Set MOD on oscillator to 3000 cycles. Turn the battery switch on.

Turn on the radio compass or the other marker-beacon power source, allowing the tubes 1 minute to heat.

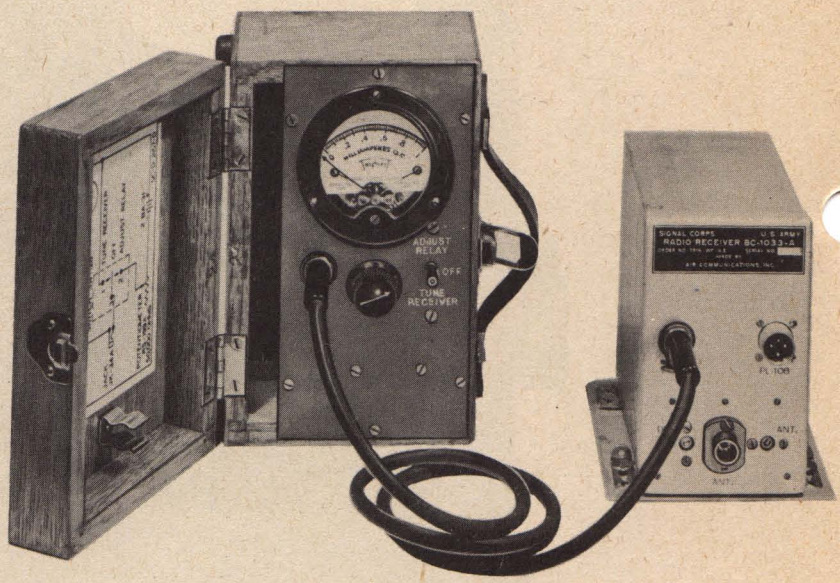
Insert the plug from the BE-67 Test Indicator into the RELAY jack on the front of the marker-beacon receiver.

Turn switch to TUNE RECEIVER position.

Using a 1/8-inch blade screwdriver set all controls for a maximum reading in the following order:

| | |
|---|---|
| Two Control Receivers | DET |
| | ANT |
| | DET |
| Three Control Receivers | DET |
| | RF |
| | ANT |
| | DET |

**Make sure ANT is tuned to maximum.**




The milliameter should read from 0.4 to 0.5 ma. If the reading exceeds 0.5 ma move the oscillator further away. If it reads less move it closer.

## CHECK RELAY AS FOLLOWS:

1—Remove signal source from receiver.

2—Hold the switch on test indicator to ADJUST RELAY position. To avoid injury to the meter, turn the control knob completely counterclockwise before starting.

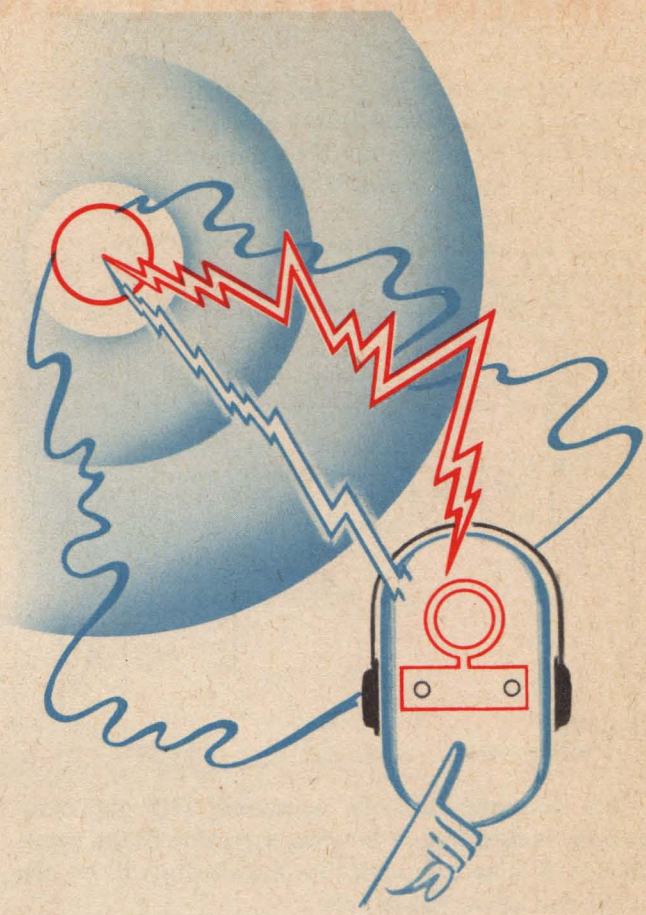
3—Start turning control clockwise until relay closes. Meter should read 0.4 ma.

4—Turn control counterclockwise until the relay opens. The meter should read 0.2 ma.

**IF THE VISUAL INDICATOR LIGHT CANNOT BE OBSERVED WHILE CHECKING THE RELAY, METER KICKS CAN BE USED FOR AN INDICATION**

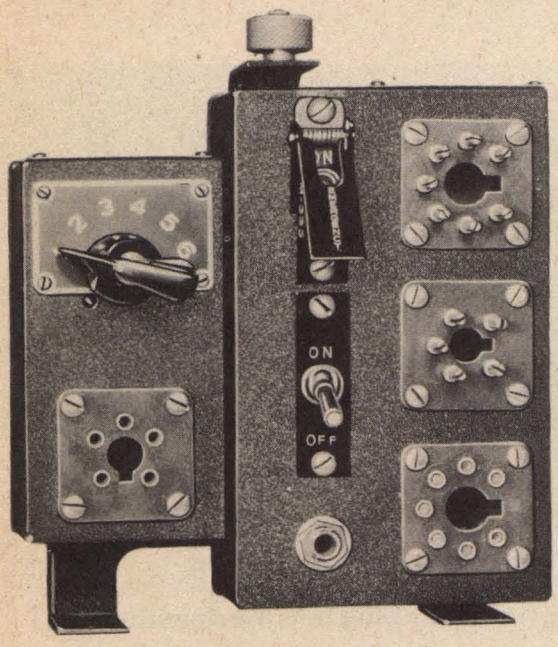
# RADAR
# IFF

### *IDENTIFICATION OF FRIEND OR FOE*



IMPORTANT

Be sure you know how and when to use your IFF equipment. Consult your Communications Officer prior to each mission.

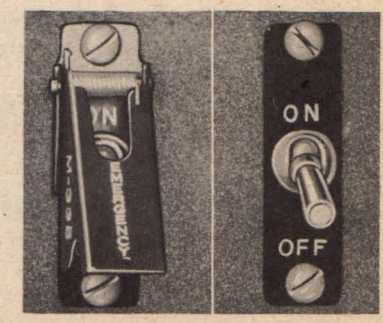



## OPERATION

Place the six-position coding switch to the position indicated on the SOI flimsy. If no specific information is given, set it to number 1 position.

The EMERGENCY switch, with spring-hinged guard, is used to operate a special emergency signal.

Details of this may be obtained from the communications officer. This switch is usually safety-wired to OFF position.




***Place the ON-OFF switch on the control box to ON position. The pilot is also furnished with an ON-OFF switch.***

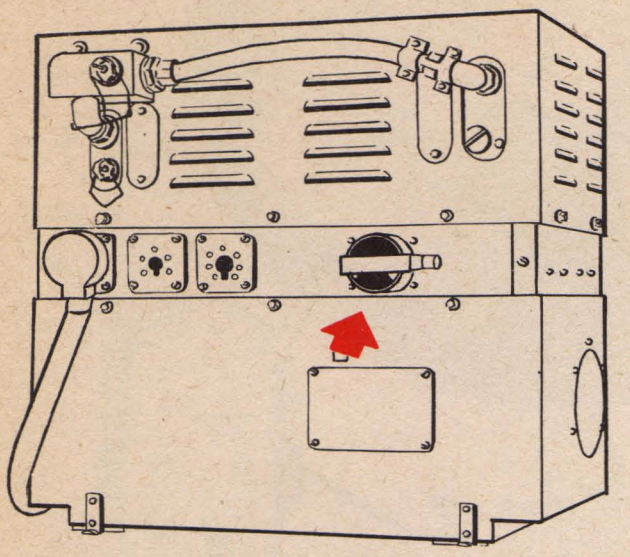
The phone jack provided on some of the controls makes it possible to monitor the IFF equipment. If the set is operating, background noise should be heard; if it is challenging, a note should be heard.

## *REMEMBER!*

**Before operating the EMERGENCY switch be sure the equipment is turned on.**

# DETONATOR

Since the special wiring and operating frequencies of radar equipment are highly classified, a detonator is provided to destroy the IFF equipment in case the airplane is forced down in enemy territory.



The detonator (usually containing TNT and magnesium) is mounted in the center portion of the transponder. It is so arranged that the wiring will be disintegrated when it is set off.

The detonator unit is energized when the required voltage (14 volts for AZ, 28 volts for A models) is placed across its terminals.

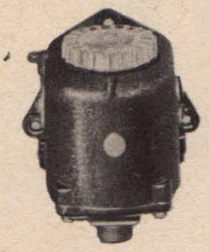
This voltage is obtained through a 20-AMP fuse, directly from the airplane's batteries.

There are two types of switches in this circuit.

## 1. PUSH BUTTONS

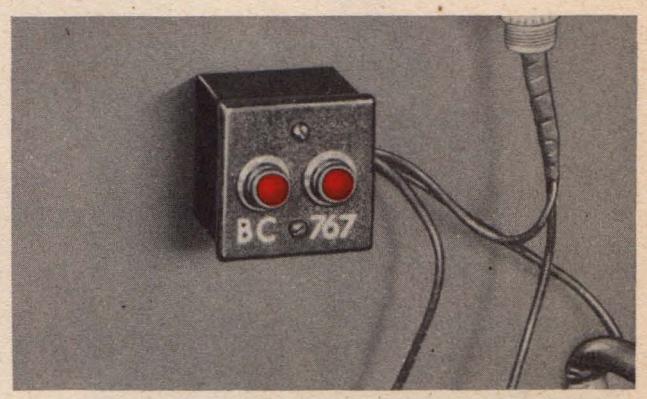

**These two buttons are mounted in the red safety box. They must be pressed simultaneously to energize the detonator.**

## 2. INERTIA SWITCH



**The inertia (or impact) switch is used to destroy the equipment in case of crash landing in enemy territory.**

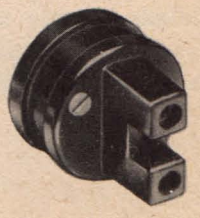
A pair of red warning lights (located near the transponder) are connected across the detonator plug to indicate voltage present at the plug.




**Caution!**

**Do not insert plug into the detonator if there is voltage present. Bodily harm will result.**

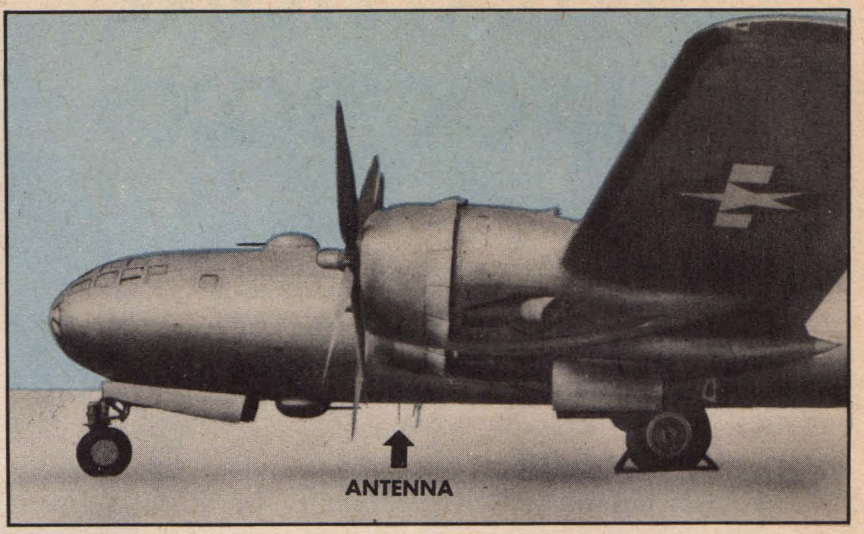
**Reset the inertia switch. After resetting tap it on the side to be sure it is properly set. The plug should be inserted in the detonator as soon as the airplane enters enemy territory. When the airplane returns to friendly territory, remove the plug. This is important because a rough landing will sometimes cause the inertia switch to trip. More complete details will be contained in your SOI flimsy.**

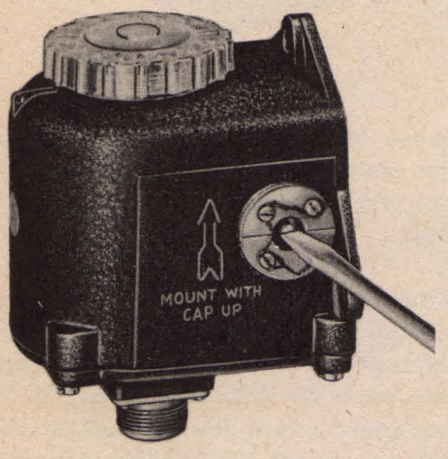


# ANTENNA SYSTEM

The antenna is the vertical-rod type. It usually projects from the lower surface of the airplane.

The rod is about 14 inches in length. A coaxial line is used for connection to the transponder. The earlier installations of IFF equipment used a portion of the tail or the wing skin surface for the antenna.




The inertia switch may be reset by inserting a screw driver in the reset slot and turning counterclockwise to the stop. Release screwdriver gently. This resets the switch. After resetting inertia switch tap it on the side to be sure it is properly set.

## MAINTENANCE SUGGESTIONS

If frequent tripping of the inertia switch occurs, have it set to a higher value; it is usually set for 9 G or 9 times normal gravity.

**Check**—Coaxial cable and antenna mountings for possibility of leakages. Leakages decrease efficiency.

**Check**—Cords and plugs for proper contact and secureness.

**Check**—Mounting screws for secureness.

*Be sure this detonator plug is disconnected whenever you work on the inertia switch.*

# FUSES

**1—DETONATOR CIRCUIT**

20-ampere (FU-42)

**2—EQUIPMENT (TRANSPONDER)**

For A models—20-ampere (FU 42 28 volts)
For A-Z Models—40 ampere (FU 54 14 volts)

*Acquaint Yourself*

**WITH THE LOCATION OF FUSES**

# INTERPHONE JACK BOX


The interphone jackbox is used for communication between crew members and for switching the microphones and headsets to the various equipment installed in the airplane.

## JACKBOX POSITIONS

### Compass

The COMP position is used to listen to the radio compass receiver. You cannot transmit with the jackbox in this position. The compass does not include transmission facilities.

### Liaison—VHF

In this position you may transmit or receive with the liaison equipment. To transmit press microphone switch. To receive, release microphone switch.

In some airplanes all other jackboxes in the plane will have the VHF command set wired to LIAISON-VHF position.

### Command

Operation is the same when in LIAISON-VHF position, except that the command equipment is being controlled.

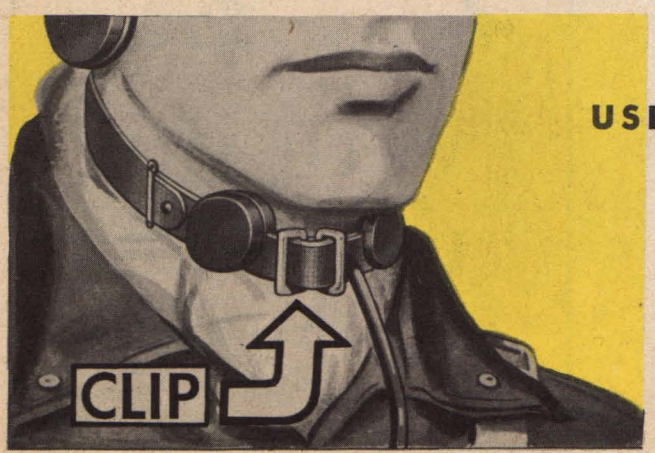
Consult the airplane's G file for wiring diagrams to determine whether it is possible for you to key the command transmitters through your jackbox.

### Inter

Use this position when you want to communicate with any other crew member whose jackbox is also on this position. Press microphone switch to talk. Release it to listen.

### Call

When you want to call another crew member to the INTER POSITION use CALL. To operate you must hold the jackbox switch in the CALL position, and at the same time press the microphone switch. After calling, immediately return the jackbox to INTER while awaiting an answer. CALL position blocks all other reception and gives precedence to the person calling. To answer, the person called switches to INTER and proceeds with normal interphone communication.




## USE YOUR MICROPHONE PROPERLY

1—The microphone should fit firmly about your throat with the buttons spaced equally on each side of your Adam's Apple and slightly above it.

2—Place the strap slightly higher than the microphone level to maintain this position.

3—Don't allow clothing to get between the microphone buttons and your throat.

4—You will get better reception by placing the positioning clip between the buttons.

5—Be sure the proper ends of the buttons are against your throat.

6—Speak as loudly as you can, but don't shout.

If you are using a T-17 hand-held microphone, observe the following steps for proper operation:

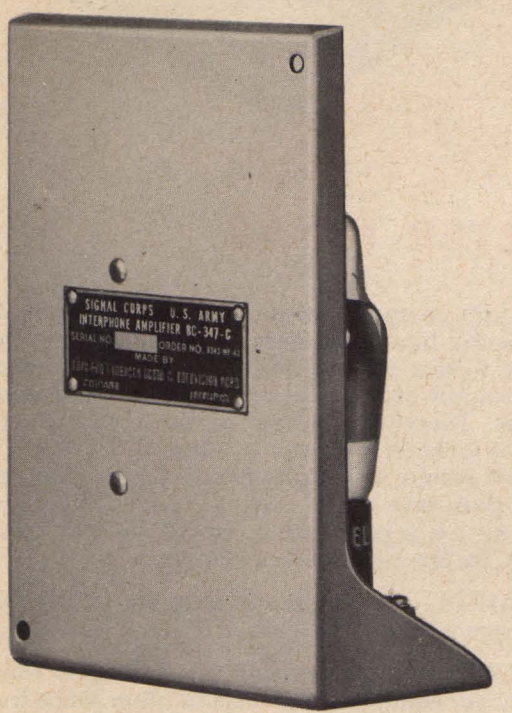
a. Hold the microphone squarely in front of your mouth, with your lips slightly touching the mouthpiece when speaking.

b. Speak as loudly as you can, but don't shout.

**Always use your Oxygen-Mask Microphone when flying at high altitudes.**

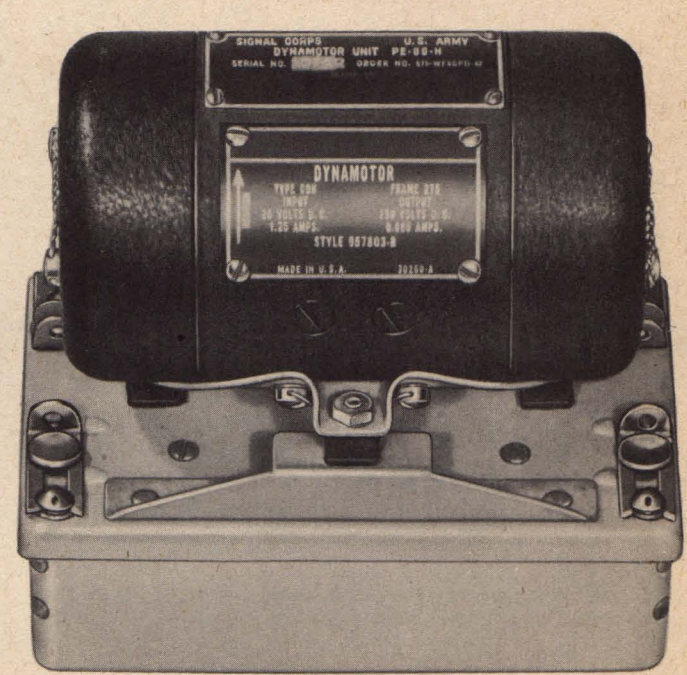
CAUTION: Interphone operation will be impaired if more than one microphone switch is closed at a time. **Don't attempt to speak while someone else is using the system unless your message is urgent.**

## AMPLIFIER AND DYNAMOTOR




**A separate interphone amplifier is provided for the interphone system.**

**Most installations employ a separate dynamotor to furnish the necessary high voltage.**




## TURNING ON EQUIPMENT

Since the interphone amplifier requires 24 to 28 volts for its filaments and 150 to 250 volts for its plate supply it must be turned on at two different points.

1—**LOW VOLTAGE**—is turned on when the airplane's battery and master switches are turned on.

2—**HIGH VOLTAGE**—is obtained from one of three possible sources:

(1) Command-(283) receiver dynamotor.

(2) Liaison-receiver dynamotor.

(3) A separate dynamotor similar to the command-receiver dynamotor.

If the command- or liaison-receiver dynamotor is used that receiver must be turned on to make interphone operation possible.

If a separate dynamotor is used it will be connected to the same source as the low voltage.

## MAINTENANCE AND INSPECTIONS

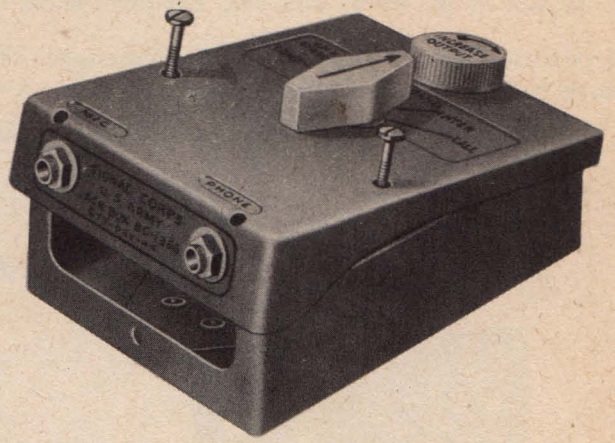
Weak or noisy reception is often encountered in interphone reception. This is due to excessive vibration of the tube. Trouble of this sort can usually be eliminated by remounting the amplifier on rubber or other vibration absorbing material.

Loose or corroded microphone contacts will also cause weak reception.

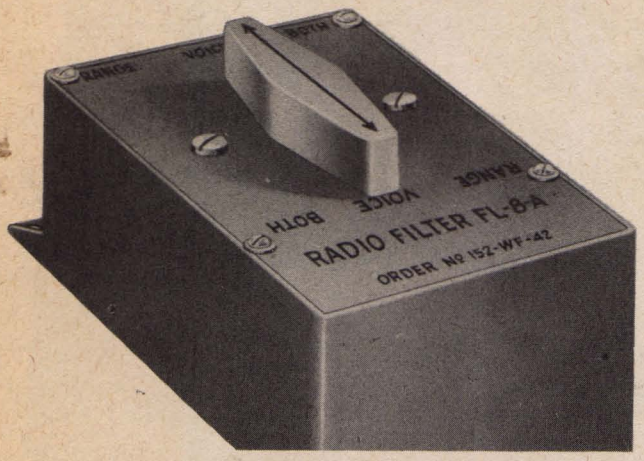
If trouble is encountered in any one of the jackboxes, they can easily be removed or replaced by removing the two screws on the front cover and pulling the front of the box straight out. All jackboxes are interchangeable.

Disconnector cords should be thoroughly checked by slightly flexing them near the plugs and checking for loose connections or shorts.

While operating, loose connections and shorts can be detected by listening for cracks and pops in your headsets while flexing the cords.



# RADIO RANGE FILTER RC-32




**The Radio Range Filter System is designed to separate the 1020-cycle range signal from voice transmissions.**

The unit comprises two filter systems contained in the same box. One system passes 1020 cycles, the other rejects 1020 cycles. The filter is connected to the outputs of the pilot and co-pilot interphone jackboxes. Therefore it may be used with their interphone jackboxes on any position.

The system is installed only in the pilot and co-pilot positions.

A switch is provided to control the functions of the filter. Its functions are as follows:

RANGE—position allows only the 1020-cycle radio range signal to be passed.

VOICE—position rejects the 1020-cycle range signal so weather broadcasts or other voice transmissions may be received.

BOTH—position allows normal operation, no filter is employed in this position.

## OPERATION

Since the filter is designed to separate voice and range signals, it should be used only during periods of simultaneous transmissions of these signals.

Normally the filter switch should be in the BOTH position for interphone operation; although the VOICE and RANGE positions may be used to advantage under the following conditions:

(a) Use of the VOICE position for voice reception from stations other than range stations will reduce interference of range signals on adjacent frequencies.

(b) With the switch in RANGE position, the filter tends to reduce objectionable static noises.

**BEFORE FLIGHT**—Always warn the pilot and co-pilot against having both their filters on RANGE position. This would make interphone operation between them and the rest of the crew practically impossible.

**NOTE—The RC-32 Filter System was designed to operate with the HS-23 high-impedance headsets. Therefore, if low-impedance headsets are used it will be necessary to use the high- to low-impedance adapters.**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7

# CLIMATIC EXTREMES

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YOUR KNOWLEDGE OF HOW TO MAINTAIN AND OPERATE YOUR EQUIPMENT IN CLIMATIC EXTREMES WILL FURTHER YOUR CHANCES OF MAKING SUCCESSFUL MISSIONS. DON'T GIVE THE ELEMENTS A CHANCE TO DESTROY YOUR EQUIPMENT.


Experience has proved that a systematic plan of preventive maintenance is the way to secure maximum performance from RADIO and RADAR equipment, and is also the simplest way to prolong the life of such equipment under adverse climatic conditions.

For quick reference, the operations and maintenance problems created by arctic, tropic, desert, and high-altitude conditions are covered separately.

# ARCTIC

Little difficulty is experienced with RADIO or RADAR equipment in the Arctic until temperatures drop below the freezing point. However, at temperatures below freezing many precautions must be taken. The troubles experienced are often difficult to overcome because of the personal discomforts and inconveniences involved. All work takes longer to do in cold weather than in warm. Simple operations such as applying safety wire or checking dynamotor brushes may become heartbreaking experiences because there are two evils to choose from—either one risks metal burned (frozen) fingers or one must wear bulky gloves and wrestle awkwardly with a pair of pliers.

**Clothing**—Wear your underclothing loose so that it provides plenty of air space. Several layers of light underclothing are much warmer than a single heavyweight layer.

**Footgear**—The mukluk boot is the most practical and serviceable footgear for extremely cold weather.

**Gloves**—Because cold metal sticks to flesh in subzero weather, some type of hand protection must be worn which will not impede work too much. The most satisfactory compromise is to use basic silk, rayon, or light cotton gloves, plus the D-3 mechanics gloves, which have knit-wool inner linings with outer horsehide covers. They are hung around the neck by a thong and used for warming as required.

## PRECAUTIONS

**Don't Sweat**—Sweating is dangerous; it causes ice to form in damp clothing so that your body freezes more readily. To avoid sweating, remove articles of clothing as necessary. Take every opportunity to dry out your socks and underclothing. If you perspire indoors, dry your body and change or dry your clothes before going outside.

**Don't get gasoline or cleaning fluids on your skin**—Gasoline spilled on the hands or clothing in sub-zero weather has an effect similar to liquid air. It will freeze flesh in a few seconds after contact.

**Don't touch cold metal without gloves**—The moisture of your hand will freeze to a metal surface or the metal may freeze the part of the hand in contact with it. Don't try to force separation of skin from metal; you'll tear your skin. Warm the metal first; if possible, have someone help you by pouring water heated to body temperature on the metal at the point of contact.

**Tools**—Insulate your tools with cloth covers or wrap them with twine. Choose tools that lend themselves to cold-weather use, such as end wrenches, and insulated screwdrivers.

## ARCTIC MAINTENANCE

**Antennas**—Remove ice and snow before takeoff. Insulators should be wiped clean and dry if possible.

**Storage Batteries**—At sub-zero temperatures storage batteries must be kept fully charged and as warm as possible. The specific gravity should always be above 1.260. At —40° F. the capacity of a battery is approximately 20 percent of its normal capacity; at 0° F. its capacity is 65 percent of normal. Never operate radio equipment directly off the battery's supply while the airplane is on the ground. Use a fully-charged battery cart or a gasoline-driven generator.

**Dry-Cell Batteries**—Dry-cell batteries should be stored so that they are not exposed to temperatures below 0° F. Under normal drain conditions the capacity of dry cells at 0° F. is approximately 25 percent that of normal, and at —10° to —20° F. they become inoperative. If the batteries are exposed to below-zero temperatures they should not be used. When their internal temperatures again reach normal, the batteries will regain their normal operating characteristics and ordinarily will show no permanent injuries.

**Electric cables**—Interconnecting cables become very stiff at low temperatures. They should not be bent quickly or at sharp angles. Coaxial cables should not be flexed at sub-zero temperatures; such flexing will result in fracture of the internal dielectric material as well as the cable covering. Sub-zero temperatures have no effect on the dielectric properties of the cable.

**Condensers**—Paper and mica condensers are not likely to fail at low temperatures. However, electrolytic condensers are subject to a considerable variation in capacity and in effective resistance, especially at temperatures below 0° F. As capacity decreases, resistance increases. *At temperatures below —40° F. electrolytic condensers have very little value as audio by-pass or power-filter condensers* because of their greatly reduced capacitance. They will usually return to normal when the temperature rises above zero.

**Dynamotors**—Dynamotor circuits should be provided with heavier fuses than normally required. This is made necessary by the lowered resistivity of the dynamotor windings at lower temperatures which results in a heavier current flow, and also by the additional starting torque required to loosen up the grease in the bearings. The specific Technical Order instructions for greasing should be followed.

**Flexible mechanical shafts**—In some cases, tuning shafts have been found frozen. The grease should be removed from such shafts, and they should be relubricated with a small amount of light oil.

**Microphones**—Heavy coatings of frost caused by moisture from the breath collect and freeze in the small holes of the caps of hand or oxygen-mask microphones. Thin rayon-impregnated protective caps have been devised to overcome this difficulty in the most popular types of microphones.

Use cover M-368 for the T-17 hand microphones and cover M-369 for T-44 or ANB-M-CL mask microphone.

REMEMBER—Allow the tube filaments plenty of time to warm up the rest of the equipment before operating.

Be sure the proper type of grease is being used in all movable parts. All equipment or components that have been modified for low-temperature operation are marked with conspicuously-located yellow dots not smaller than ¼ inch in diameter.

# TROPIC

RADIO and RADAR equipment receive their most severe tests in the tropics and it is there that the necessity for continual preventive maintenance is greatest. Here as in the Arctic, much can be done by wearing the proper type of clothing and by understanding the effects of the climate on equipment so that the problems encountered may be approached and overcome with greatest effectiveness.

**Clothing**—The trick in tropic maintenance and operations is to keep cool, and yet to wear clothing that protects the body from the sun and from disease-carrying insects. Generally speaking, long-sleeved shirts and long pants are the most practical clothing in areas where disease-carrying mosquitoes are found. While shorts may be worn in the daytime, long clothing has further advantages in affording protection against skin cuts and burns caused by contact with hot metal surfaces. It is desirable to wear underclothing which helps trap the sweat long enough to allow evaporation to produce a cooling effect.

**Effect of moisture**—Most equipment failures are due to prolonged exposure to warm moist air. The temperature variations which result in evening condensation cause moisture to penetrate small cracks or minute holes in the protective covering of component parts.

The primary effects of moisture on equipment are:

**1**—Resistance leakages in insulators and wire insulations.

**2**—Corrosion of metal parts.

**3**—Electrolytic corrosion of fine wires.

**4**—Collapse of wood construction.

**Effect of fungus growth**—Fungus growth causes decay and accelerates the deterioration of insulating materials. The fungus itself acts as a conductor and causes the surface resistance of insulators to become lowered so that wherever high voltages are present arc-overs will result. Under the most favorable conditions for its formation, fungus will develop within a day or two of exposure; most species will survive at temperatures from 50° F. to 100° F.

**Effect of insects**—In most tropical regions, insects are numerous enough to be a frequent cause of equipment failure. One of the worst pests is the white ant or termite. Termites invade and thrive on practically every kind of wood. The numerous tropical spiders may build masses of moisture-collecting webs in equipment. Many insects take a fancy to impregnating waxes and varnishes and eat away these types of insulation; they also die in the equipment and their bodies cause corrosion.

## GUARDING AGAINST MOISTURE AND FUNGUS

**Drying methods**—From the foregoing, it is apparent that in order to prevent failures, it is vital to keep equipment as dry as possible. Apart from frequent checking and cleaning of components, usually some method must be devised for drying components which are continually exposed to the humid atmosphere. If a suitable oven is available—or if one can be improvised from empty drums, scrap metal, or empty packing cases—components can be dried thoroughly. Such drying is especially helpful for components which are used intermittently and which are not kept sufficiently dry by the heat that develops when electric power is dissipated in their operation. It should be remembered that equipment may absorb moisture slowly over a period of weeks or perhaps months before failures occur. Therefore thorough drying is required. Usually it is necessary to heat the equipment to about 160° F. for a period of 2 to 3 hours, allowing adequate ventilation for the escape of moisture.

Any method which keeps equipment warmer than the surrounding air—even by a few degrees—usually will prevent moisture condensation and fungus formation.

When heating is impracticable, free circulation of air over the equipment will reduce somewhat the rapid condensation of moisture during hours of darkness.

For the removal of fungus growth, it is advisable to wipe the affected surface with a cloth saturated with a solution of 50 to 70 percent ethyl alcohol in fresh water. This treatment should not be applied to textile insulating materials. Experience has indicated that even though a textile insulator is immediately and thoroughly dried after removal of fungus growth with ethyl alcohol solution, the growth will reappear and develop even more rapidly when high humidity again occurs. Fungus growth and mildew in the case of textile insulating materials can best be retarded by the use of genuine camphor gum.

Condensation and fungus growth can be controlled further by the use of silica gels. This is practical only in equipment having closely fitting covers.

## TROPIC MAINTENANCE

**Antennas**—Remove all moisture from stub-mast-type antennas. All insulators must be kept dry. If fungus growth or moisture is present arc-overs will result whenever high voltages are involved. Make frequent checkups on the condition of the silica-gel dehydrator unit used with the radio-compass loop antenna.

**Storage batteries**—Storage batteries will operate satisfactorily if specific gravity of the electrolyte is maintained at the recommended level of 1.275 to 1.300. All contacts and terminals should be kept clean and free of corrosion.

**Dry-cell batteries**—The only dry batteries that have given satisfactory service in the tropics are those in which both inner and outer cases are well-impregnated with wax. Batteries which are mounted in cases should be separated from metal surfaces with a high-quality moisture-resistant insulation. The output of dry cells is increased at high temperatures. In general, dry cells will not be damaged by operation at high temperatures until a point is reached where the sealing compound begins to melt.

**Electrical cables**—The insulation on some types of wire will decompose because of prolonged exposure to moisture. Always replace these cables with celanese-insulated or spun-glass insulated wires.

Coaxial cables should be checked frequently for tightness at their connecting points. The ends must be well sealed. Moisture in the cables will lower their dielectric qualities.

**Condensers**—All types of condensers are subject to failure because of moisture. Variable condensers should be cleaned frequently and kept well lubricated. Paper, mica, and electrolytic condensers should be treated with impregnating waxes to prevent leakages.

**Dynamotors**—In many cases the high-voltage output connection has been found shorted to the frame because of poor wire insulation. Where there is excessive leakage, arc-overs will occur, resulting in burned-out armature windings.

Failures of this sort can be eliminated by the use of better insulation and by rearranging the high-voltage leads so that they are kept away from the frame or other areas of ground potential. Proper greasing of the bearings is also very important. Soft greases with high melting points are usually the most satisfactory.

**Mechanical flexible cables**—Flexible cables must be kept well greased and oiled to prevent corrosion. Mountings should also be checked for corrosion. Keep the cables away from dissimilar types of metals as dissimilar metals tend to accelerate corrosion by an electrolytic process.

**Insulating materials**—Certain sheet fibers and hygroscopic materials will warp and yield. These characteristics, together with differential expansion, will result in misalignment of component assemblies and will cause consequent changes in circuit constants. All insulating materials should be kept as dry as possible. Any troublesome insulating material should be replaced by airplane plexiglas, which is very suitable and can be found in scrap form around most airfields.

**Microphones**—The same cover as used for the Arctic should be employed to prevent excessive moisture from packing the carbon granules or corroding the inside of microphones.

**Resistors**—Bakelite resistors, even when thoroughly dried after exposure to moisture, will be found to retain resistance leakages. When arc-overs occur along bakelite strips, they must be replaced. Minute deposits of carbon along the arc-over path will cause subsequent and repeated breakdowns.

**Soldering**—Proper soldering is of great importance. Many failures will be avoided if corrosion of soldered connections is prevented. Always use rosin-core solder. The soldering iron should be tinned by filing clean and applying rosin-core solder.

# DESERT

In the dry climate of the desert, high temperature is the primary factor affecting the performance and life of the equipment. The life of equipment is reduced largely by the progressive deterioration of most types of seals and impregnated components. Another cause of equipment failure is the presence of large quantities of sand and dust which attack all moving parts.

The clothing and precautions recommended for the tropics also apply to the desert regions.

## DESERT MAINTENANCE

**Antennas**—Fixed-wire antennas will require more frequent inspections. Sand and dust will blast off the copper plating and also decrease the tensile strength of the wire.

**Storage batteries**—Water is the main battery problem in the desert. It is usually difficult to obtain suitable water and distilled water frequently is not available. Rain water is more suitable than water from springs or creeks because the latter usually contains objectionable mineral matter.

**Dry-cell batteries**—The performance and life of dry cells is greatly affected by high temperatures. Temperatures above 70° F. will increase the voltage both in open and normal-drain circuits. Although the output tends to be increased, it is more than offset by the increased depreciation that results at temperatures above 95° F.

**Condensers**—Condensers of wax-impregnated paper construction with end seals are not suitable for high-temperature operation. Only hermetically-sealed condensers should be used for replacements.

**Dynamotors**—Most dynamotor failure is due to the injurious action of sand and dust. When mixed with oil or grease this dust becomes an efficient grinding agent. The brush holders, commutator, and bearings must be inspected frequently and continuously. Lubricate the bearings sparingly and only where absolutely necessary. Sacrifice lubrication rather than risk the abrasive action of sand and dust. This abrasive action will also wear down brushes much faster than normal. Remove sand and dust with compressed air if it is available.

**Relays**—Most relays are susceptible to injury by dust. Every attempt should be made to protect relays and all types of switching mechanism from dust entry.

Moving parts of such equipment should be inspected and cleaned at regular intervals.

# HIGH ALTITUDE

The lowered barometric pressures at high altitudes are responsible for several types of equipment failures.

The barometric pressure at 35,000 feet is about one-fourth that at sea level. Under this lowered pressure, components protected against moisture develop a considerable internal pressure which subjects the seals and bushings to unusual strains. Another major effect of low barometric pressure is to reduce the insulating strength of insulating materials. High-voltage arc-overs occur at about one-half the voltage normally required to break down insulating materials. The lower density of the air at high altiudes reduces the rate of heat transfer. Heating is usually found to be greater, even though the ambient temperature is lower.

A reduction in physical coordination, primarily in speech, is also the cause of some troubles experienced at high altitudes.

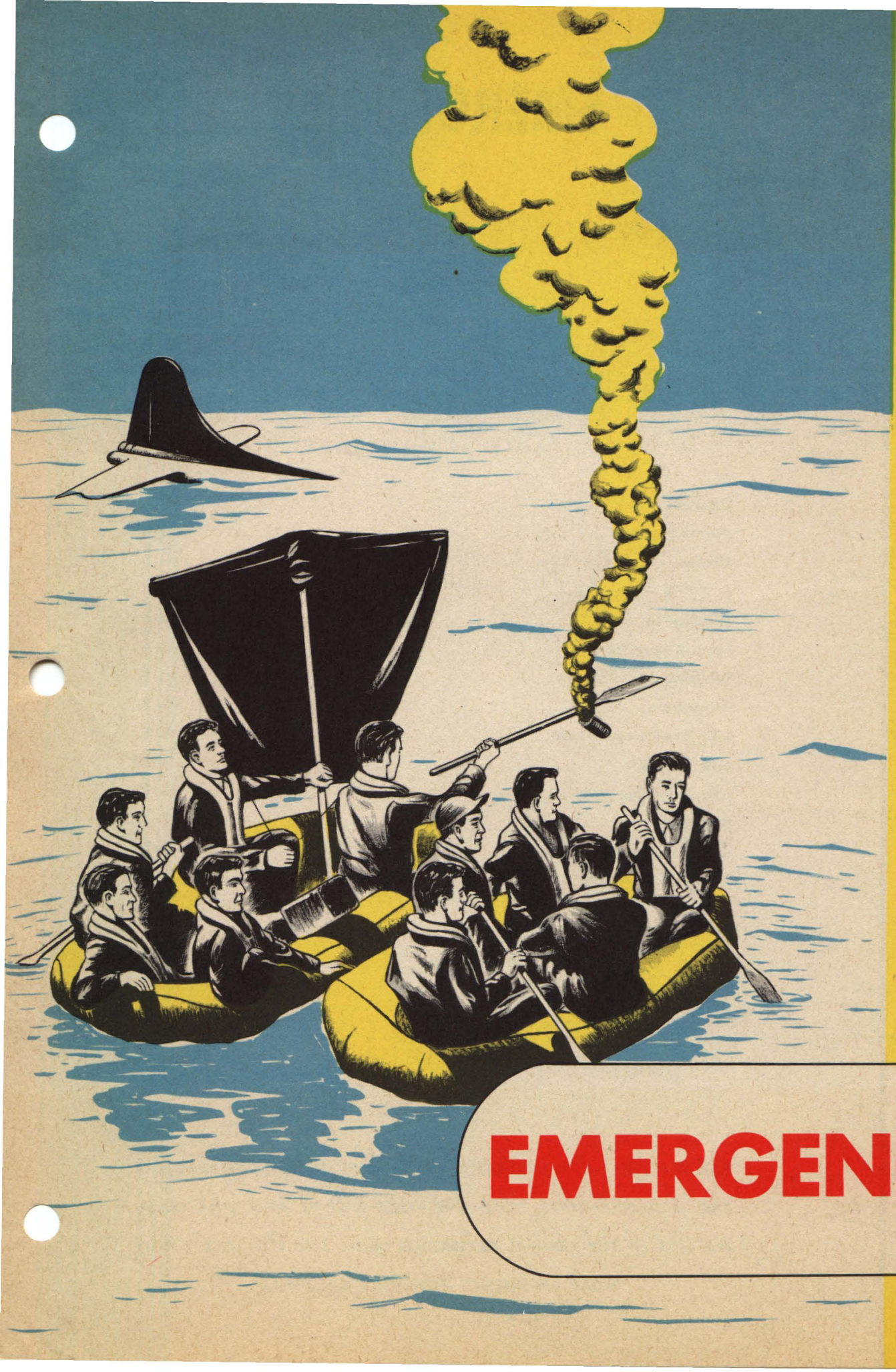
## HIGH ALTITUDE MAINTENANCE

**Antennas**—Transmitting-antenna insulators and switches must be kept clean to prevent arc-overs. The lead-in wires should be kept as far as possible from metal parts within the plane. Avoid sharp edges on all high-voltage wiring and terminal connections.

**Dynamotors**—Since reduced pressure causes increased intensity of arc-over, commutator brush wear is greatly increased at altitudes above 15,000 feet.

More frequent checks should be made on all dynamotor brushes.

**Interphone**—Recent tests have shown that failures in interphone operations at high altitudes are often due to improper use of microphones and headsets. These troubles can be minimized by using the type ANB-M-C1 oxygen-mask microphone and the type ANB-H-1 headsets in the NAF 1092 helmets.



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# EMERGENCIES

SECTION

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# EMERGENCIES

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**TIME IS SHORT IN AN EMERGENCY. YOUR ACTIONS MUST BE ABSOLUTE AND INSTANTANEOUS. CONSERVE YOUR ENERGY AND STAY CALM. THE REST OF THE CREW IS DEPENDING UPON YOU FOR HELP. STUDY THESE EMERGENCY MEASURES CAREFULLY.**

# DISTRESS PROCEDURES

Distress frequencies, procedures, and call signs, and the geographical locations of rescue units vary among theaters of operations. **Study and know** all those in force in your theater. Make a list of them and keep it in your airplane.

In general, distress signals should first be transmitted on your assigned air-to-ground frequency. If you can't make contact using this frequency, use the following:

1. The U. S. Emergency and Safety frequency, 8280 kc. This is guarded by the AAF, Navy, and Coast Guard.

2. The International Distress frequency, 500 kc. By international law, all surface vessels maintain a watch on 500 kc for 3 minutes after the first and third quarters of each hour.

3. Any other available frequency on which you can make contact.

There are three basic types of distress signals.

1. **Security:** Used when your pilot is uncertain of his position, or when an emergency is expected, but **when you can proceed, or can land at a suitable field** with the aid of a ground station.

On CW, use the International Safety signal, TTT. On voice, use the word SECURITY.

**Example (for CW)**

**Airplane:** TTT TTT TTT V ABC ABC ABC $\overline{\text{INT}}$ QTF K
**Station:** ABC V DEF R K
**Airplane:** DEF V ABC (20-second dash) ABC K
**Station:** ABC V DEF QTF 3315N 733ØW A 1745Z K

**Example (For voice)**

**Airplane:** Security, Security, Security. This is Shoeblack. This is Shoeblack. This is Shoeblack. Request fix. Over.
**Station:** Shoeblack. This is Michael. Transmit for fix. (Here station transmits any special instructions.) Over.
**Airplane:** Michael. This is Shoeblack. Transmitting for fix. (For VHF, count 1 to 5 and back. For HF, depress microphone button for 20 seconds.) This is Shoeblack. Over.
**Station:** Shoeblack. This is Michael. Your position is three three one five North—Seven three three zero West. Able. Time one seven four five Zebra. Over.
**Airplane:** Michael. This is Shoeblack. Roger. Out.

2. **Urgent** or **Emergency:** Used when the airplane is in trouble and requires immediate navigational aid.

If you are on CW, contacting an unknown station, use the International Urgent signal XXX, following the same procedure as you would in asking for TTT. Or, call a known ground station in the normal way, using the precedence prosign O.

If you are on voice, use the International Urgent signal PAN or EMERGENCY. Proceed in the same way as you would in asking for SECURITY.

Request your fix (or course) and:

On CW transmit a 20-second dash and your call sign.

On voice, VHF, give your call sign.

On voice, HF, depress the microphone button for 20 seconds before continuing voice transmission.

Include in your transmission:

Your best estimated position and the time it was calculated.

Course, speed, and altitude.

The pilot's estimate of the time he can remain airborne, and whether he means to ditch, bail out, or crash land.

3. **Distress:** Used when your airplane is threatened with serious or imminent damage, and you need immediate help.

On CW, use the International Distress signal, $\overline{\text{SOS}}$, in this way: $\overline{\text{SOS}}$ $\overline{\text{SOS}}$ $\overline{\text{SOS}}$ V ABC ABC ABC (20-second dash) ABC K. Listen, and if there is no reply, repeat.

On voice, VHF, transmit MAYDAY three times, followed by the call sign of your airplane three times.

On voice, HF, transmit MAYDAY three times followed by the call sign of your airplane three times, then depress your microphone button switch for 20 seconds, and give the call sign once more.

Before ditching turn the IFF EMERGENCY switch ON.

Just before ditching, bailout, or crash, screw down the key.

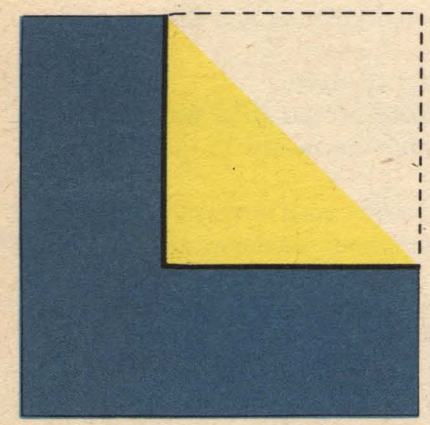
If you are no longer in distress, send a message immediately on the same frequency cancelling the state of distress.

Take special care to authenticate cancelled messages in areas where an authentication system is used.

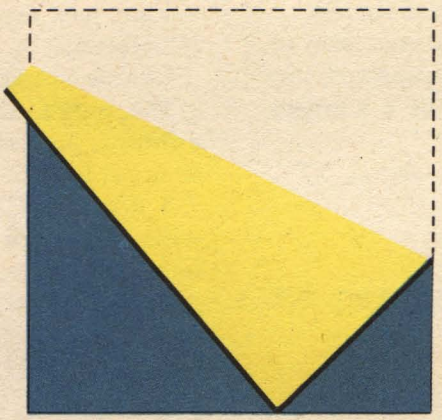
# Panel Signals

Many of the emergency kits now supplied contain a large signal panel (roughly 10 ft. by 10 ft.). It is arc fluorescent yellow on one side and blue on the other. Immediately after you are forced down this panel should be spread out on the ground flat—yellow side up on dark backgrounds and blue side up on light backgrounds—the color will help rescue pilots to find you. Once a rescue pilot has located you, messages can be transmitted by folding the panel as indicated in the illustrations on these pages. If it is windy, hold the folds in place with rocks, sand, sticks, or improvised stakes if it is necessary. If several messages are to be transmitted don't change the folds too quickly—allow enough time for the pilot of the rescue plane to read each signal and indicate that he understands it (generally by dipping the nose of his plane several times). These same signals can be transmitted with the square yellow-and-blue sail now a part of the equipment supplied with the large inflatable rubber life raft.

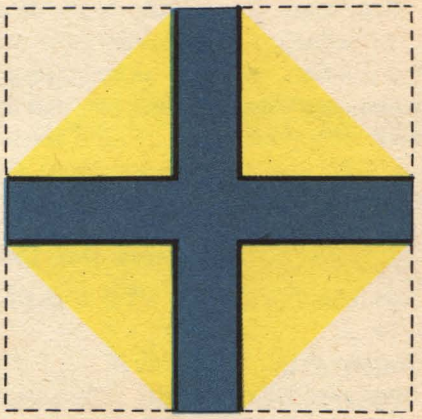
The emergency signal panel also can be used as a tent since its blue side is coated with a waterproof compound. Also, the blue side can be used as an excellent camouflage cover for a life raft if enemy aircraft are sighted.



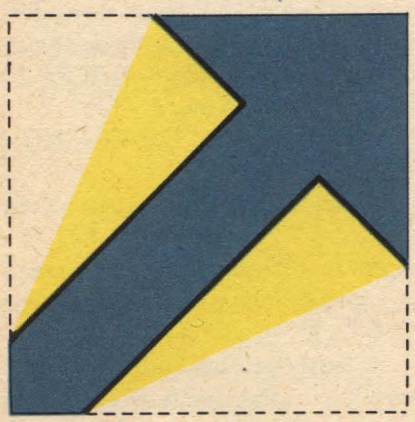
**Need Gasoline and Oil, Plane is Flyable**



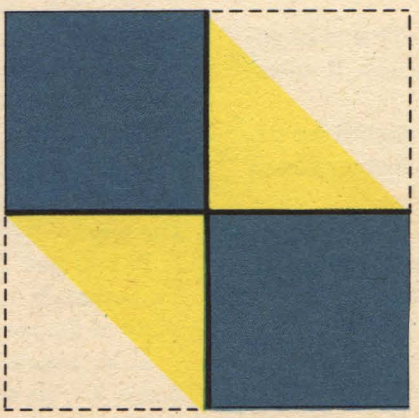
**Need Tools, Plane is Flyable**



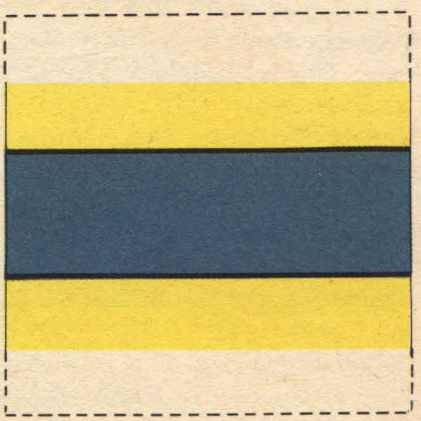
**Need Medical Attention**



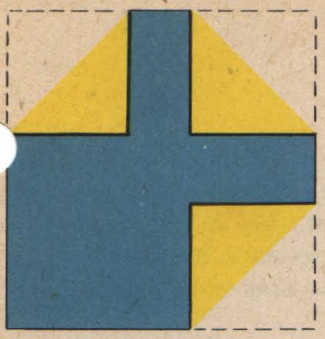
**OK to Land, Arrow Shows Landing Direction**



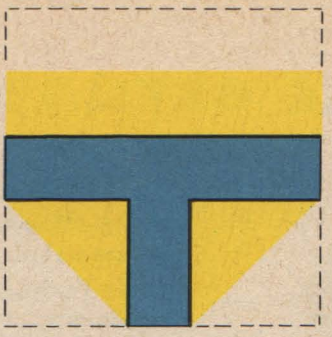
**Do Not Attempt Landing**



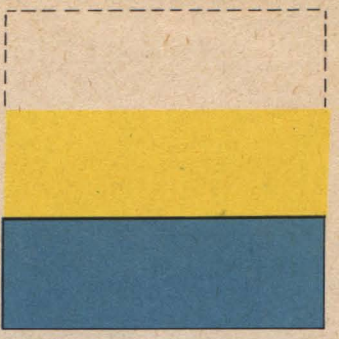
**Indicate Direction of Nearest Civilization**



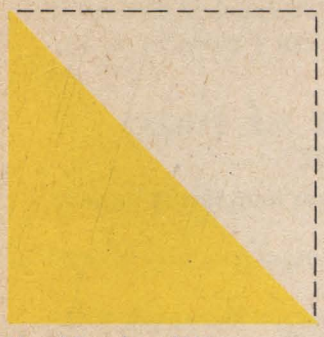
Need First-Aid Supplies



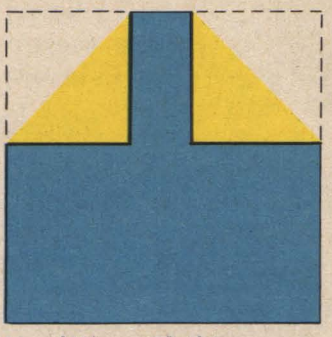
Need Quinine or Atabrine



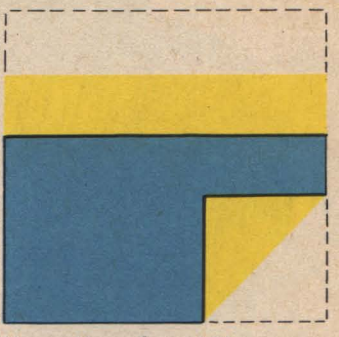
Should We Wait For Rescue Plane?



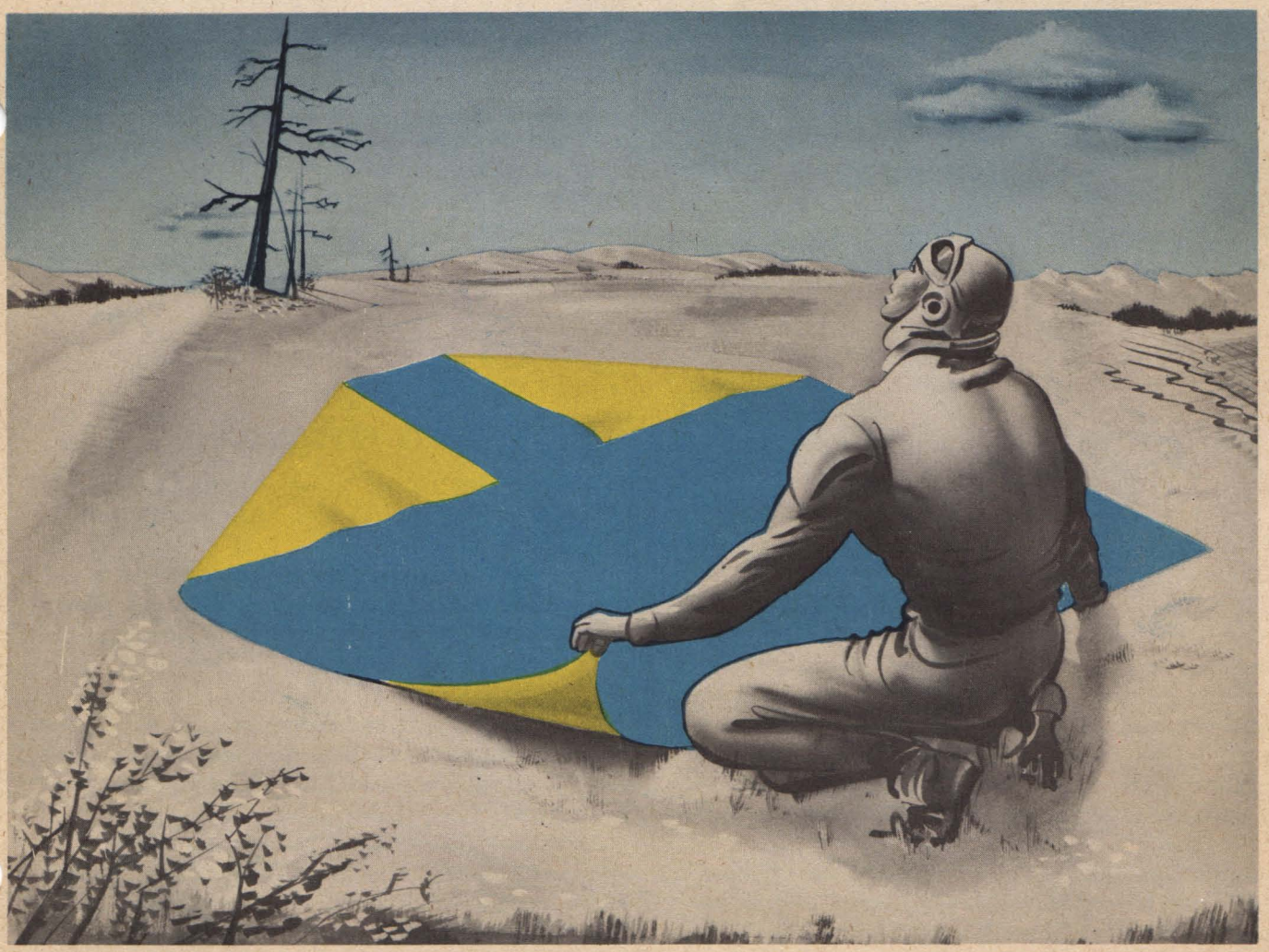
Need Food and Water



Need Warm Clothing



Have Abandoned Plane, Walking in This Direction



# SMOKE GRENADES

Airplanes to be flown over sparsely settled regions on cross-country, patrol, or ferry missions will be equipped with either an M8 or an M3 smoke grenade. In the event of a forced landing, use the grenade as a marker to aid searching parties in locating the airplane which otherwise might be difficult to find.

Radio Operators observing smoke of the type produced by M8 or M3 smoke grenades will immediately attempt to locate the source.

The M8 smoke grenade burns about 3½ minutes, giving off a dense gray smoke, and is intended to be used primarily in heavily forested regions. It is easily distinguished from wood fires which give off a blue-gray or black smoke.

The M3 smoke grenade is designed to be used in snow-covered regions. It gives off a dense red smoke for 2 minutes which can be distinguished against a white snow background for about 4 miles by a person in an airplane.

## METHOD OF FIRING M8 SMOKE GRENADE

**1**—Grasp the grenade with lever held firmly against grenade body.

**2**—Withdraw safety pin, keeping a firm grip around the grenade and lever.

**3**—Either throw the grenade with a full swing of the arm, or place on the ground and release.

**4**—As the grenade is released from the hand the lever drops away, allowing the striker to fire the primer.

## METHOD OF FIRING M3 SMOKE GRENADE

**1**—Pull the 3 vanes on the side of the grenade up and away from grenade body.

**2**—Place grenade in snow so that it is supported by the vanes in an upright position.

**3**—Keep lever held firmly against grenade and withdraw safety pin.

**4**—Release lever.

## SAFETY PRECAUTIONS

To avoid a fire, do not throw or place the grenade within 5 feet of dry grass or other readily inflammable material.

After the grenade is ignited, stay at least 5 feet away from the burning grenade, as heavy smoke develops and there is a tendency to throw off hot particles of residue.

Keep these smoke grenades dry. If the chemical contents of a grenade become wet it will ignite. Future procurement of these grenades for the Army Air Forces will be packed in individual waterproof containers.

All smoke grenades will be shipped and handled in accordance with Interstate Commerce requlations. These regulations prohibit the shipment of these smoke grenades in personal baggage.

NOV. 1944 8-4-1

# GIBSON GIRL

# DINGHY SCR 578

## *Emergency Sea Rescue Transmitter*

## DESCRIPTION

Radio set SCR-578 is a pretuned, automatically keyed distress transmitter operating on the international distress frequency of 500 kc. It is designed primarily for operation from a rubber life raft.

It is also possible to use the set for a hand-powered signal light.

## COMPONENTS

### TRANSMITTER BC-778

**1—WATERPROOF** cover is sealed by rubber gaskets.

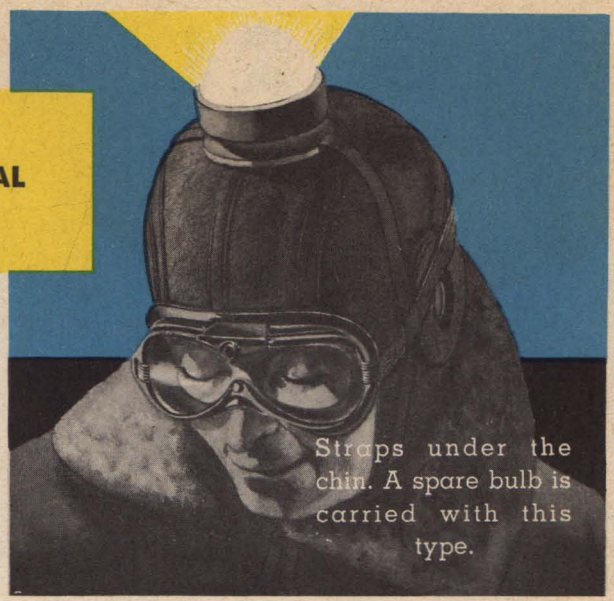
**2—HAND-CRANKED** gear assembly drives a self-contained generator and automatic keying assembly.

# SIGNAL LAMP

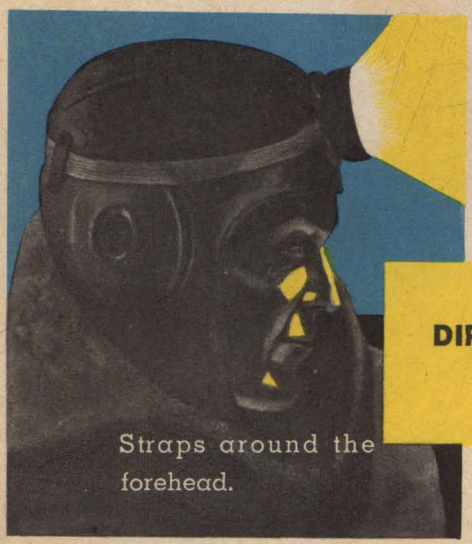
*for visual signaling*

One of two types of lamps will be furnished.

**NON-DIRECTIONAL TYPE**



Straps under the chin. A spare bulb is carried with this type.



Straps around the forehead.

**DIRECTIONAL TYPE**

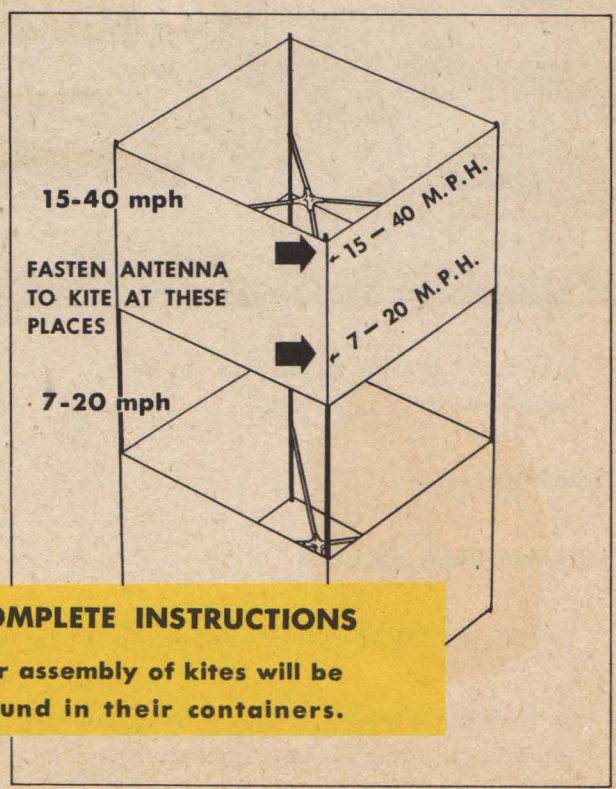
The signal lamp should be used at night if an airplane or surface vessel is heard. ***Do not waste energy by using light if they cannot be heard.***

## WHEN TRANSMITTING RADIO SIGNALS 175 TO 300 FEET OF ANTENNA ARE NECESSARY

The following methods are used to fly the antenna:

## 1—BOX KITE

Collapsible type designed to fly in wind velocities from 7 to 40 mph. The cloth covering is water repellent providing it does not soak continually. There are two types of kites. They differ only in construction. The newer types are hinged so that they will fit into a smaller stowage bag.




**COMPLETE INSTRUCTIONS**

**for assembly of kites will be found in their containers.**

**Drag the kite out of water as soon as possible. It may require hours to dry if it becomes wet.**

# 2—HYDROGEN BALLOON

### Used When Wind Is Too Calm To Fly the Box Kite

There are usually two balloons packed in sealed cans stowed away with each unit.

The balloons are inflated with hydrogen, which is produced by immersion of a chemical generator into water.

Hydrogen is supplied from the generator to the balloon through a special inflating tube.

### OPERATING INSTRUCTIONS

Remove the balloon from its sealed container. Care must be taken to avoid tearing it.

Immerse the balloon in water for about 1 minute to insure flexibility. Then gently unfold it.

Remove the top and bottom plugs of the hydrogen generator. Screw the inflating tube into top of the generator. The bottom hole is a water inlet.

Wet the other end of the tube and insert it into the balloon-valve hole. Hold on to the wooden handle of the tube. The chemical contained in the generator will burn the skin or clothing. Wash it off immediately if any splashes on you.

Immerse the generator until its top is level with the water. Wait until the balloon reaches its full diameter of 4 feet.

When the balloon is fully inflated, remove inflating tube and insert the rubber plug tightly in the valve.

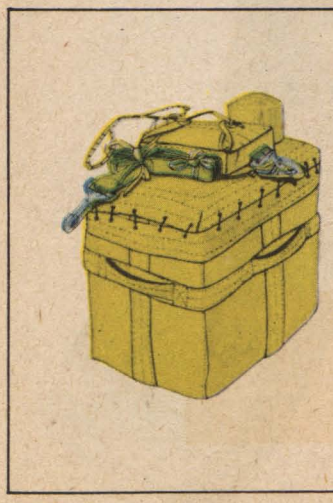

If red lines are painted around the generator, immerse it to first red line and wait 10 minutes. Then slowly immerse it until the top of the generator is level with the water.

**NO SMOKING!!!!**

Do not smoke while inflating the balloon. Hydrogen is highly inflammable.

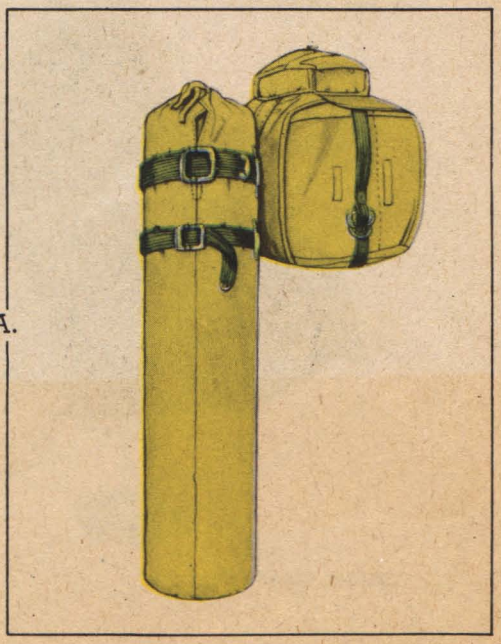
### CARRYING BAGS

The SCR-578 will be found stowed in one of two types of bags.

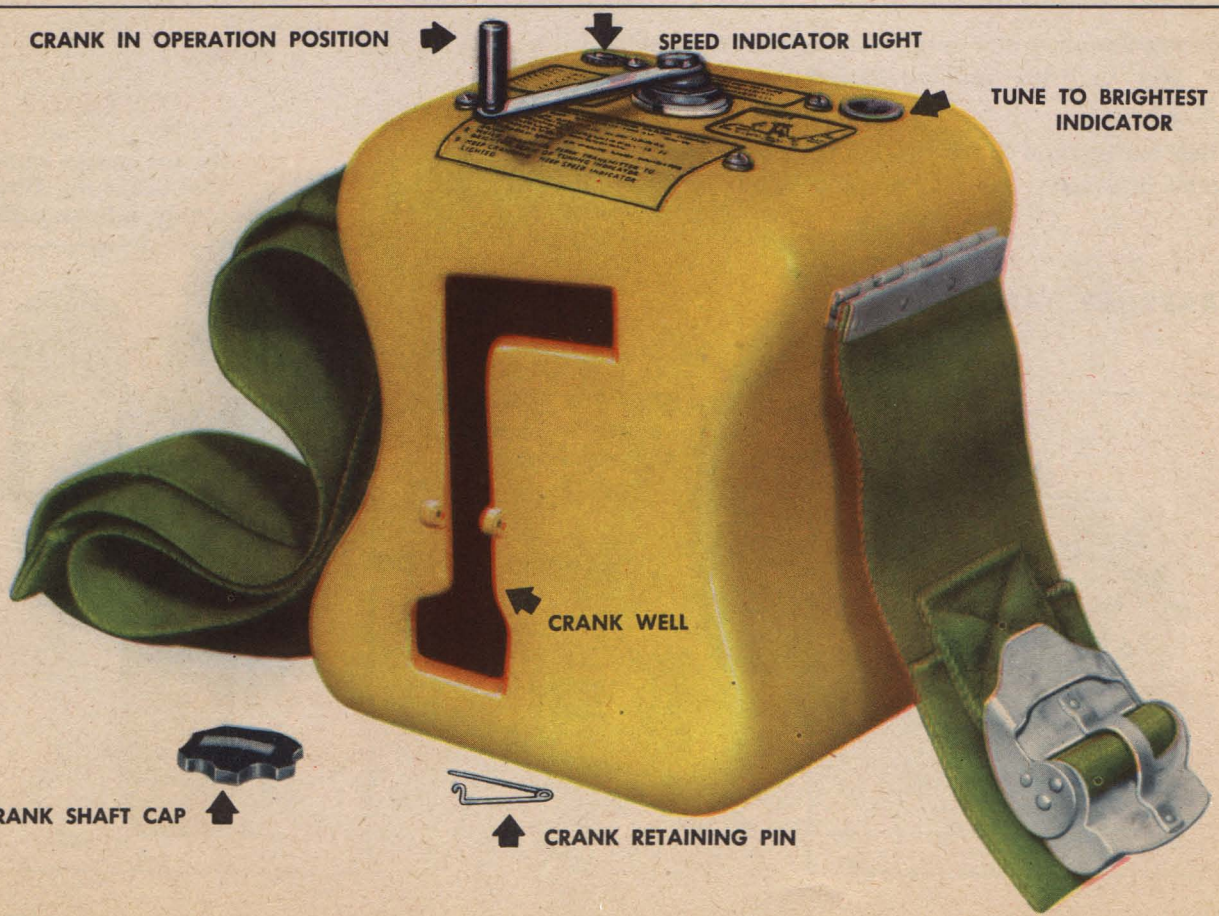


Used with SCR-578-B and later models.

Used with SCR-578-A.




JACK FOR SIGNAL LAMP M-308-B
ANTENNA TUNING CONTROL
DOOR CATCH
ANTENNA LEAD-IN
RADIO LIGHT SWITCH
KEY
ANTENNA BRAKE
MANUAL
AUTO. 2
TUNE
OFF
KEY


CRANK IN OPERATION POSITION
SPEED INDICATOR LIGHT
TUNE TO BRIGHTEST INDICATOR
CRANK WELL
CRANK SHAFT CAP
CRANK RETAINING PIN

# TRANSMITTER OPERATION

### Distress

International law requires all surface vessels to maintain a watch on 500 kc for 3 minutes after the first and third quarters of the hour. Therefore, distress signals are most likely to be picked up if you send them from 15 to 18, and from 45 to 48, minutes after each hour.

Remember to continue your transmissions long enough to allow the stations receiving them to take your bearing.

### Radio Transmission

First of all, be sure that you are using the greatest possible antenna length. A length of less than 300 feet will lower the set's operating efficiency.

Unscrew the ground plug and put the wire in the water or earth. Be sure you uncoil and use **all** of the ground wire.

Put crank in the socket on top of the transmitter. **Make sure it is tight.** There are no spare cranks with the set.

Fasten the strap securely around your legs.

Set the RADIO end of the selector switch to the kind of transmission you want (AUTO 1, 2, or MANUAL). To determine type of transmission, consult the chart on the front panel.

Rotate the crank until the speed indicator on top of the unit glows. It will glow at approximately 80 rpm.

Allow 20 seconds for the tubes to heat, then adjust the TUNE control until you obtain maximum brilliancy in the TUNE TO BRIGHTEST indicator.

**Conserve energy.** Change hands every few minutes, to ease fatigue.

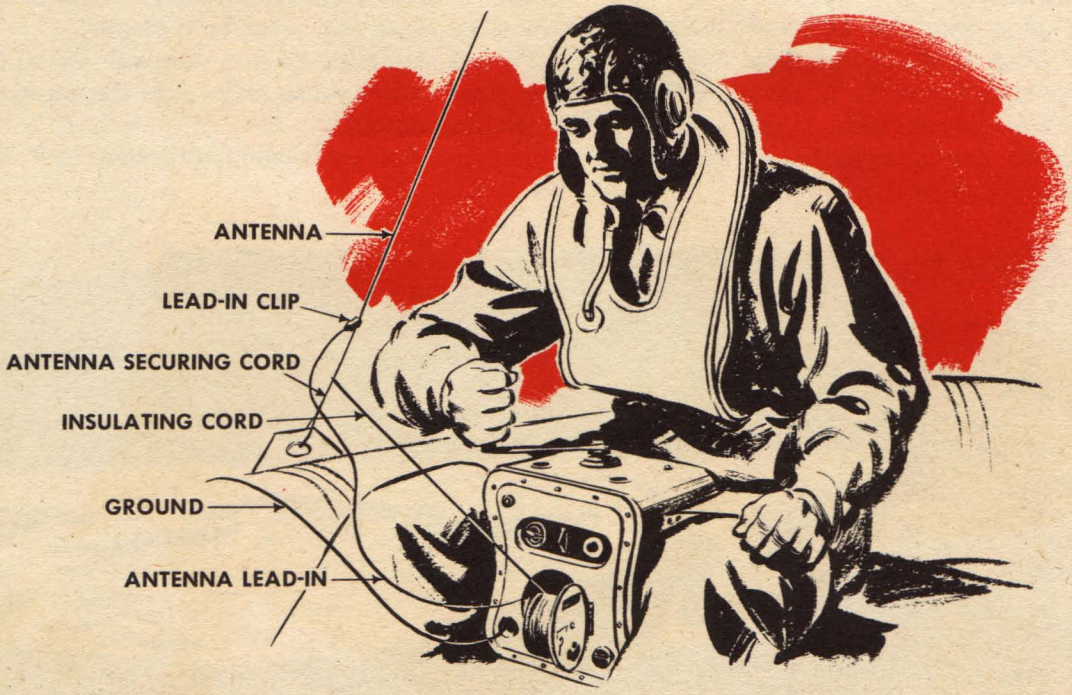
### Ranges

Here are the probable ranges of the transmitter. The transmitting ranges vary with the different methods of grounding.

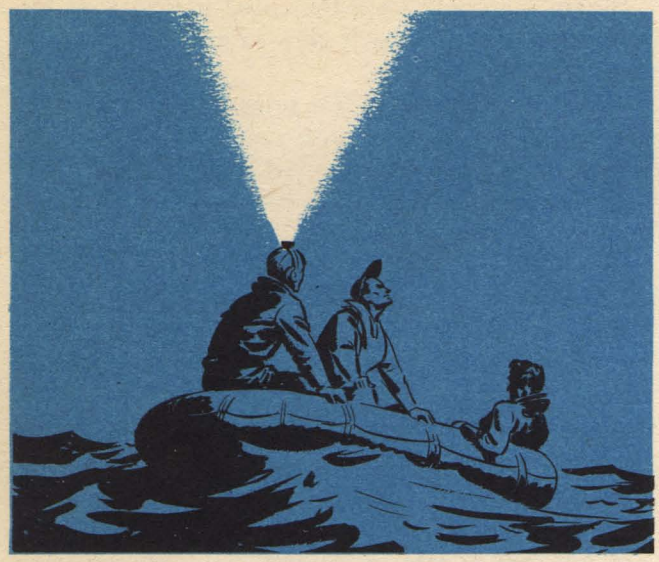
**Be sure your set is grounded properly. This is important.**

1. At sea ..... 250-500 miles
2. Inland lake ..... 50-150 miles
3. On edge of lake or stream ..... 30- 50 miles
4. On land (grounded in moist earth) ..... 5- 10 miles

**WARNING: Do not fly the antenna during an electrical storm.**



# SIGNAL LAMP OPERATION



Strap the lamp to your head. If you have the non-directional type, fix it so that it shines straight up. Fix the directional type so that it shines along the water, where reflections increase the chances of its being seen from the air.

Put the lamp plug into the SIGNAL LAMP SOCKET on the front of the transmitter. Set the LIGHT end of the selector switch to either AUTO 1 or AUTO 2, for a continuous light. If you want to key the light, turn the switch to MANUAL and use the hand key on the front panel.

**Remember:** When the selector switch is on LIGHT position, **no radio signals can be heard.**

## MAINTENANCE AND INSPECTIONS

### Monthly

The transmitter should be inspected once a month in this way:

1. Remove the set from its stowage bag, and insert the crank.
2. Connect the dummy antenna to the antenna lead-in and ground wires. This antenna (A-98) is in your squadron communications kit.
3. Set the selector switch to RADIO position, and turn the crank at 80 rpm. Allow 20 seconds for the tubes to heat.
4. Adjust the TUNE control until you have maximum brilliancy in the TUNE TO BRIGHTEST indicator.
5. Check the keying mechanism. There should be a flickering in the TUNE TO BRIGHTEST indicator when the key is pressed.

**Be sure the crank is rotated monthly. Otherwise grease may pack or freeze in the bearings.**

### General

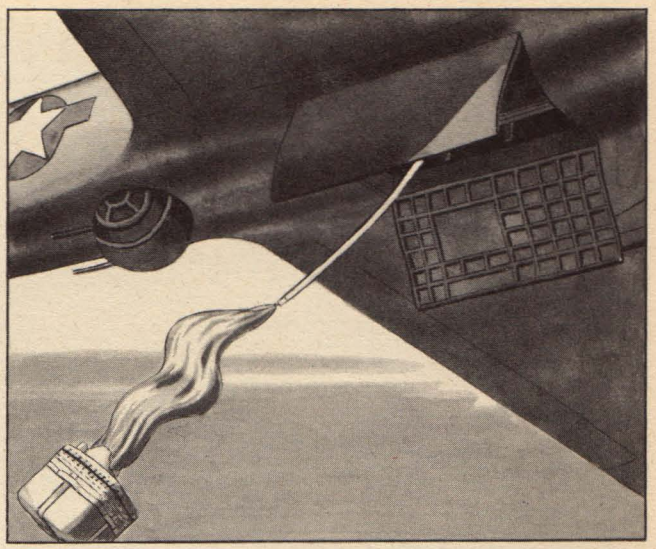
The parachute should be repacked every 60 days. Packing must be done only by properly authorized persons.

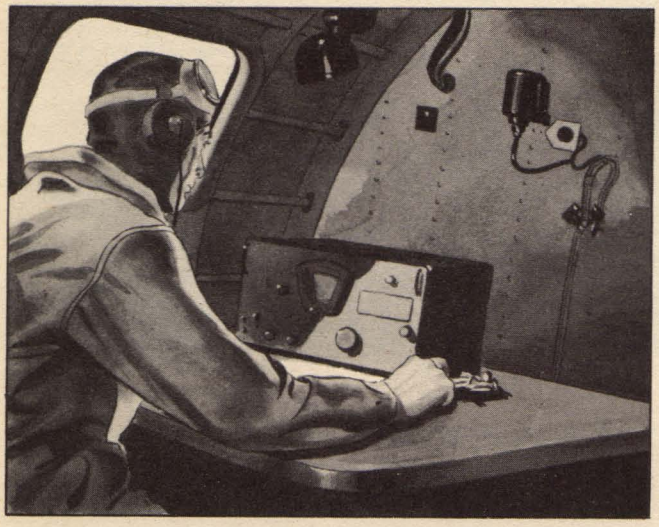
After continued humid weather, the dessicator unit may have to be replaced. Its content is normally bluish. If it has absorbed too much moisture it turns a pinkish white and must be replaced.

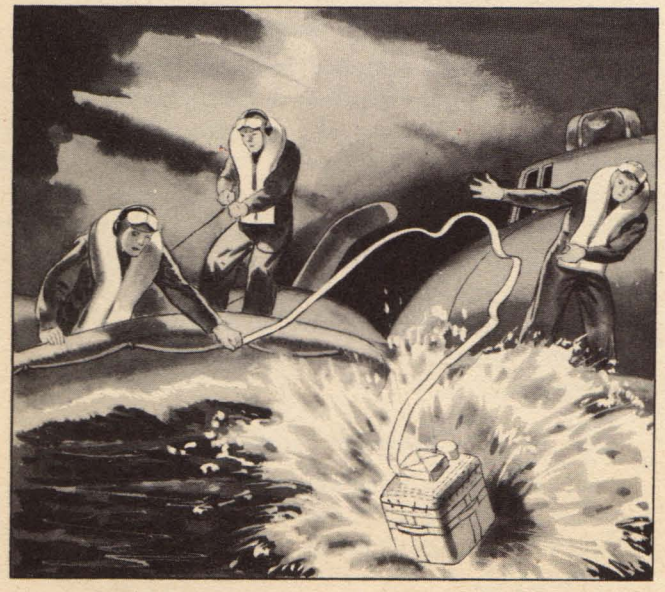
The set should be given a thorough visual inspection after each flight to make sure the equipment is in good condition.

You will find additional instructions in T. O. AN-08-10-94.

# REMOVAL FROM THE AIRPLANE







In case of a crash landing or normal ditching, never drop the Gibson Girl by parachute. In either event it would be far behind you before you could recover it.

You will have to drop it, however, if the pilot has ordered a bailout. It must also be dropped if your airplane is expected to sink too soon after ditching to allow you to remove the set in the normal way. In this case, throw the Gibson Girl out when you are approximately 200 feet above the water. If you drop it sooner, it may drift out of sight.

If you must drop the Gibson Girl by parachute:

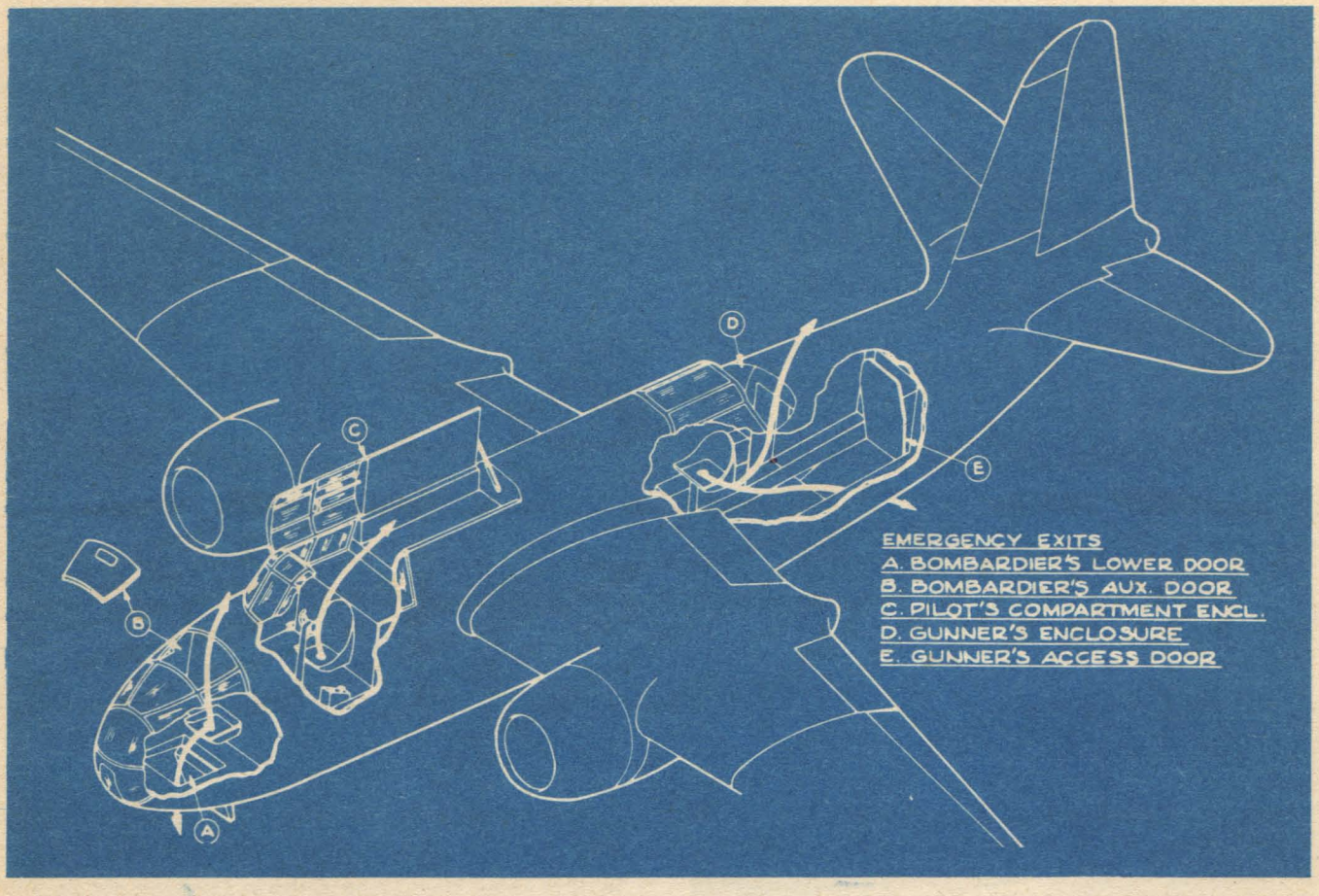
1. Fasten the loose end of the static line to the metal structure of the airplane.
2. Be sure the static line is clear and will not become fouled in other equipment.
3. Throw the set out of the airplane. The static line will open the parachute.

**WARNING: Never attach the static line to any part of your body.**

When your airplane is to be ditched:

1. Turn the IFF EMERGENCY switch ON.
2. Get the airplane's position from the navigator.
3. Send out the proper distress signals (See ROIF, page 8-1-1.)
4. Screw down the key before you leave your post.

The Gibson Girl will float, and if it is impossible to carry it to the life raft, you can throw it into the water. If you do this, be sure to keep hold of the static line. Attach it to the life raft so that the set will not drift away. Haul it in and begin transmission as soon as you can.




# Emergency Exits

All Army Air Forces airplanes contain means for quick exit, in the air, on the ground, or water.

Before you fly, be sure you know:

1. What exit to use.
2. How to use it.
3. When to use it.

**All crews must hold frequent practice drills.** Teamwork and speed mean a lot in an emergency.

### What Exit?

In flight, upper exits are dangerous because of the possibility of being caught by a propeller or of striking the tail. Use lower or side exits whenever possible. Study Handbook of Flight Operating Instructions to learn how to bail out of your particular airplane.

On the ground or water, fasten all lower hatches before landing. Dump all upper ones. They may jam upon impact and delay is dangerous. In an emergency, you can knock a hole in the skin of the airplane. If a handaxe is provided on the airplane, know where it is and how to remove it.

### How to Escape

Emergency exits are provided with quick release red handles. Usually the door or hatch will be blown away by the windstream, if you pull the release and give the exit panel a light push.

**For a crash landing on land or water, don't dump lower hatches.** Dump the upper hatches, but remember that they may damage the tail assembly.

**Learn all you can from practice drills.** Be sure you know your exact duties and the meaning of emergency signals by interphone, call light, or warning bell.

### When to Escape

Any emergency is unexpected and unusual, so keep your wits about you. Be deliberate, even though hurried. Consider the situation; make a decision; then act.


Any crash landing that you can walk away from is a good one. Forced landings in which there is a minimum of damage to the airplane or injury to the crew are the result of forethought, calm execution, and adherence to a few fundamental principles by all crew members. The following suggestions will help you. Think them over. Plan in advance for the day when you are confronted with a forced landing.

1. Stay calm. This is the primary rule for any emergency.

2. Jettison cargo and unnecessary equipment. Throw out all loose objects to prevent injury to crew on impact.

3. Open emergency escape hatches, or they may jam on impact and delay exit. Do not open windows that may slam shut and jam at the time of the impact.

4. Take the position assigned to you in advance for crash landings. It is the one in which you will sustain the least personal injury. It is the pilot's duty to warn you of the impending crash in plenty of time.

5. Take the brunt of the crash through the thickness of your body rather than the length. In general, positions of all crew members for a crash landing are the same as those for ditching. (See ROIF, page 8-7-2.) Brace yourself with a crash, not against it. Never brace yourself with legs or arms rigidly extended. The bones are strong and you may be speared by your own skeleton.

6. After the airplane has stopped, grab first aid kits and any other necessary equipment and get out fast. Get at least 50 feet away. There may be danger of fire and explosion.

# Ditching

## BEFORE TAKEOFF

Some day you may be forced down at sea. You won't have time to look up the answers then, so now's the time to start preparing for such an emergency.

Ditching and dinghy drills will familiarize you with the duties you must perform when the order "Prepare for ditching" is given. If you master these


drills well enough to carry them out in a darkened plane under unfavorable circumstances, your education is at least well begun. However, before you take off on a long over-water mission, there are several other important points you must consider.

1. Be sure all emergency equipment functions properly and that it is properly stowed.
2. Make sure that the nearest escape hatch operates properly.
3. Check your life vest adjustment. Blow the vest up by mouth and check the adjustment of waist and leg straps. Inspect $CO_2$ cartridges and see that the mouth-tube valves are closed.

## BEFORE DITCHING

At the first indication of trouble, it is the duty of the navigator to notify you of the airplane's exact position.

Start emergency radio procedure immediately. Your best chance of being rescued lies in early and correct emergency radio procedure. Specific procedure differs in various theaters of operations. Learn the instructions for your theater.

If you have transmitted ditching signals and then find the pilot can make land, notify the Air/Sea Rescue Unit as soon as possible so as to prevent useless search.

For standard emergency radio procedure, see ROIF, page 8-1-1.

### Jettisoning

Lighten the plane by jettisoning guns, ammunition, and anything not essential to the operation of the airplane. Throw out any objects lying loose or likely to be torn loose by the impact. Hold, or firmly secure, emergency equipment that you are going to take with you.

### Emergency Exits

Close all lower hatches to keep the water out. Keep open top or upper side emergency exits through which you will escape. If they are closed, they may jam on impact. Close all bulkhead doors to stop the flow of water through the plane.

### General Preparations

Remove your oxygen mask as soon as you are below 12,000 feet. Take off your necktie and open your collar. Remove heavy boots, but keep on your flying clothing and helmet for protection. Remove your parachute.


Do not take off your life vest. Keep it on at all times. **Do not inflate it until you are out of the airplane.**

If you inflate your life vest while you are still in the airplane, you will find it difficult, if not impossible, to get out through the hatches.

### Ditching Positions

All crew members must take the standard ditching positions recommended for various planes in the AAF ditching posters and pilot training manuals. If there is no poster in your airplane, or you can't use the positions recommended because of differences of stowage or structural variations, remember the following:

### General Rules

1. The best ditching position is to sit facing the tail of the plane, knees drawn up, back and head braced against a solid structure. If your head extends above the support, clasp your fingers tightly behind it to keep it from being snapped back.

2. The second position is to lie on the floor of the plane, head to the rear and feet firmly braced against a solid structure. Bend the knees slightly. The best position for an injured man depends on his injuries. If the best position is not the injured man's regular one, someone can trade places with him. If there is not enough bulkhead room for all to brace against, if there are extra people in a compartment, it will be necessary for some to sit facing aft, back braced against forward man's shins, feet and knees drawn up, hands clasped behind head.

3. Another position, in airplanes which are equipped with ditching belts, is to brace against the belts.

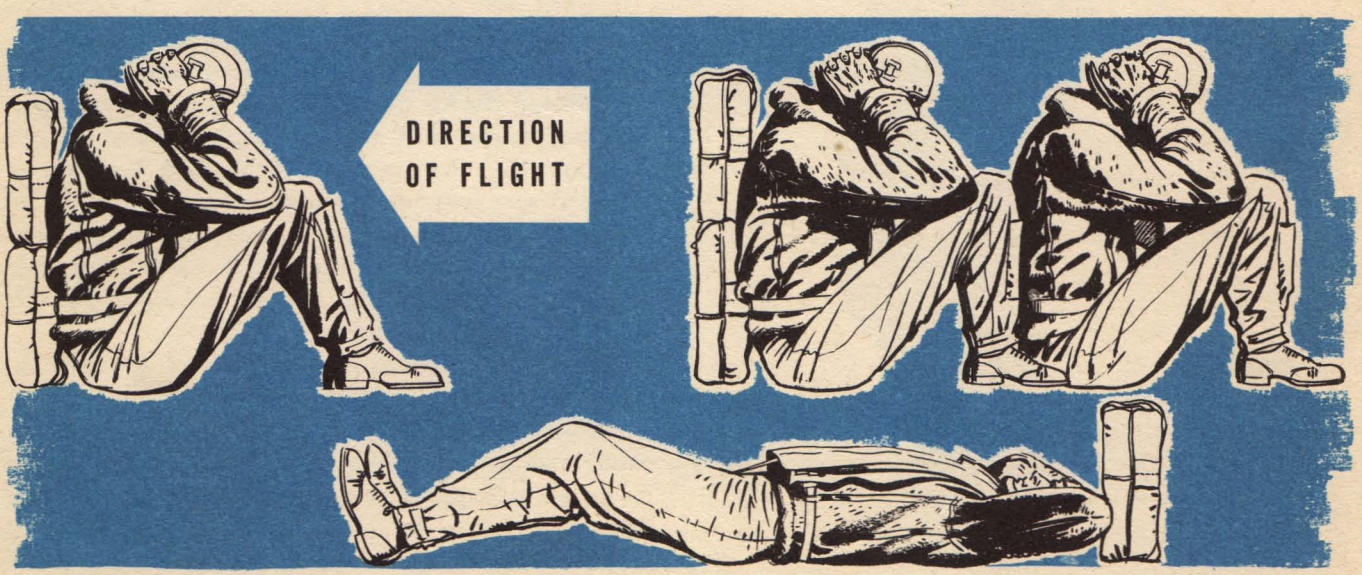
4. It is the pilot's responsibility to warn you five seconds before the impact, so that you can brace for the shock. Hold your position until the airplane comes to a stop; casualties result when men relax immediately after the initial impact.

### Boarding the Life Raft

Launch and board rafts from the wing tips if possible, to avoid damage from jagged edges.

Don't jump into the raft; you'll go through the fabric. Don't get onto an inverted raft; you'll expel the air underneath and make the raft hard to turn over. Right it from the wing of the plane if you can.

Paddle away from the plane and tie all rafts together. Stay near the plane as long as it stays afloat. It will be easier for rescuers to spot you.



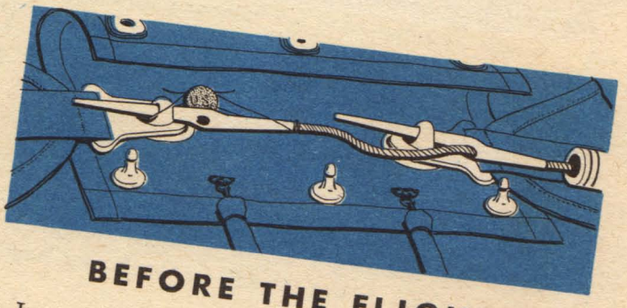
ROIF 8-8-1
REVISED MARCH 1945



# Parachutes

**All persons aboard Army airplanes will be equipped with standard-type parachutes. Wear your parachute whenever possible. The pilot will see that all persons aboard have parachutes, are instructed in their use, and know the bail-out plan. It is an excellent precaution to carry an extra parachute in multiplace airplanes.**

**CORRECT LANDING POSITION**

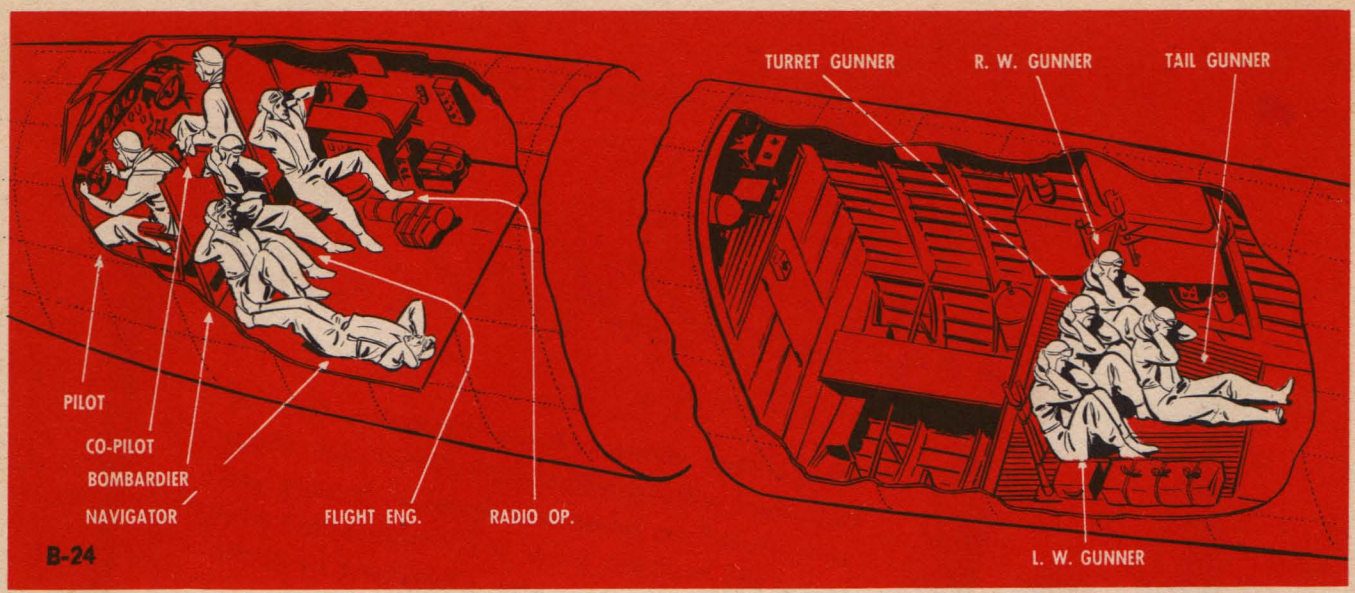


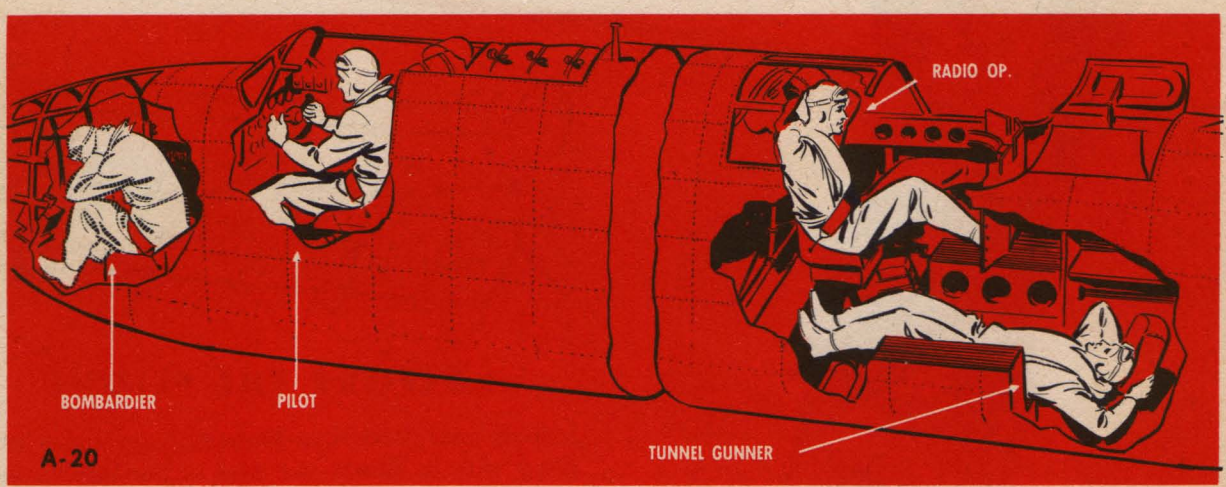
## BEFORE THE FLIGHT

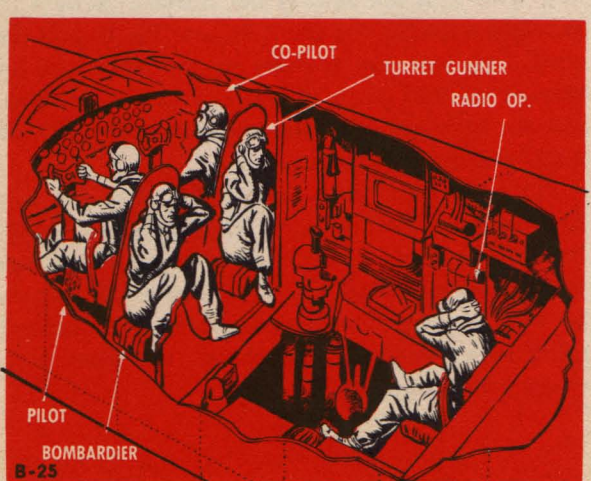
Inspect your parachute. Remember, you may have to jump with it! Check the date of the last inspection. The packing interval should not exceed 60 days in the United States or 30 days in the tropics. Open the flap; make sure that the ripcord pins are not bent and that the seal is not broken. A bent pin or jammed wire may make it impossible to pull the ripcord. See that the corners of the pack are neatly stowed so that none of the silk is visible. See that the six or eight opening elastics are tight. Inspect each parachute you draw.

Put your parachute on and be sure the harness fits properly. The shoulder and chest straps should be snug without play; the chest buckle should be twelve inches below the chin. The leg straps should be snug. In fact, the harness should be comfortably snug when you are seated and disagreeably tight when you stand up.

# DITCHING POSITIONS




**B-24**—Ditching belt in the aft compartment is attached to gun mounts. Men brace against it as shown. Flight engineer, on cockpit step, also should use a ditching belt. Otherwise he should lie on floor, feet against step, knees bent slightly. Fasten down all loose equipment. Hold positions until plane stops. If help is near, crew should use one-man raft parachute and bail out.

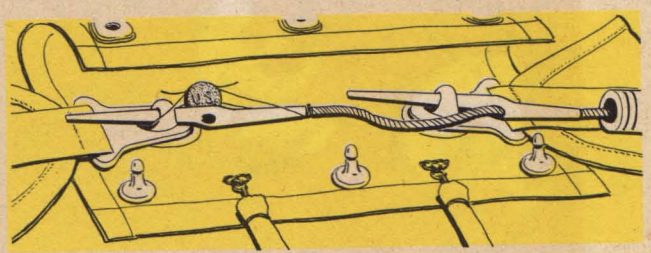
**A-20**—Bombardier should wear one-man dinghy parachute pack and bail-out of bottom nose hatch if rescue appears possible. Other crew members take positions shown and maintain them until plane comes to rest.

**B-25**—If there is sufficient time and altitude, crew members in the rear should crawl through the bomb bay to ditching positions in forward part of plane. Otherwise they should remain in the aft compartment. Positions shown should be maintained until plane comes to rest.

# Parachutes

**All persons aboard Army airplanes will be equipped with standard-type parachutes. Wear your parachute whenever possible. Be sure you know the bail-out plan. It is an excellent precaution to carry an extra parachute in multi-place airplanes.**

**CORRECT LANDING POSITION**



## BEFORE THE FLIGHT

Inspect your parachute. Remember, you may have to jump with it! Check the date of the last inspection. The packing interval should not exceed 60 days in the United States or 30 days in the tropics. Open the flap; make sure that the ripcord pins are not bent and that the seal is not broken. A bent pin or jammed wire may make it impossible to pull the ripcord. See that the corners of the pack are neatly stowed so that none of the silk is visible. See that the six or eight opening elastics are tight. Inspect each parachute you draw.

Put your parachute on and be sure the harness fits properly. The shoulder and chest straps should be snug without play; the chest buckle should be twelve inches below the chin. The leg straps should be snug. In fact, the harness should be comfortably snug when you are seated and disagreeably tight when you stand up.

## IN FLIGHT

If you find yourself in serious trouble, prepare to put your bail-out plan in operation.

**CONSIDER THESE POINTS:**

**1**—Note your altimeter reading.
**2**—Check the altitude of the terrain below.
**3**—Decide on a minimum altitude at which you can safely bail out. Take into consideration the flight characteristics of the plane and the kind of trouble you are having. Notify the pilot.
**4**—If you are still in trouble when you reach that minimum altitude—bail out.
**5**—Remember that in general it is safer to jump than to attempt a forced landing on hazardous terrain with a fully loaded plane.
**6**—If you have to bail out, help the pilot pick the best available spot.

## THE BAIL-OUT

Know the emergency exits provided for the airplane and understand how and when to use them. Bail-out posters are supplied for most bombardment types of aircraft.

Practice making exits while wearing full equipment when the airplane is on the ground. Drill yourself in a standard bail-out procedure, including warning signals and exit signals.

**JUMPING FROM TWIN-ENGINE TRAINERS, BOMBERS, AND TRANSPORTS**

You will normally use an escape hatch, the bomb bay, or a door, depending upon circumstances. Slide yourself to the edge of the opening and go out head first and straight down.

**DRILL IS ESSENTIAL**

**You Must Know When, Where, and How to Leave the Airplane**

## CLEARING THE AIRPLANE

Probably the most important single act, in any parachute jump, is opening the parachute only after you are clear of the plane. Wait until you are well away from the airplane before you pull the ripcord. Keep your eyes open. Look around. If you have enough altitude, wait at least five to ten seconds before pulling the ripcord.

# PULLING THE RIPCORD


There is nothing complicated or difficult about getting your parachute safely open. Just:

**1**—Straighten your legs and put your feet together to reduce the opening shock, and to avoid tangling your harness.

**2**—Use both hands to grasp the ripcord pocket.

**3**—Grab the ripcord handle with the right hand, and yank! Keep your eyes open and look at the ripcord as you pull it.

## THE DESCENT

About two seconds after you have pulled the ripcord, you will feel a sharp, strong tug as the canopy opens and bites the air.

Look up to see that the chute is fully open. If a suspension line traverses the top, or the lines are twisted, manipulate the lines to remedy the fault.

Do not worry about oscillations. They will almost certainly occur on your way down, but are of minor consequence. Do not attempt to check them or to slip the parachute, as such maneuvers are useful only to experts, and are dangerous below 200 feet.

Make a quick estimate of your altitude by looking first at the ground below and then at the horizon.

You will descend approximately 1000 feet per minute.

Observe your drift by craning your neck forward and sighting the ground between your feet, keeping your feet parallel and using them as a driftmeter.

Face in the direction of your drift.

While you cannot steer your chute, you can turn your body in any desired direction. **The body turn is the most useful maneuver you can learn because with it you can make certain that you land facing in the direction of your drift. It is simple and easy. Note carefully exactly how it is done.**

**STUDY THE PICTURES. Practice the body turn in a suspended harness if you get the chance. This description may sound backward to you. Note with special care how these turns are executed and simply say to yourself:**

**"To turn right, right hand behind my head."**

**"To turn left, left hand behind my head."**

# HOW TO MAKE BODY TURNS

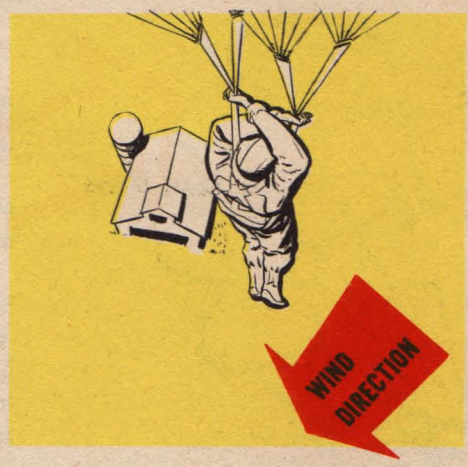
## TO TURN YOUR BODY TO THE RIGHT:

**1**

**Reach up behind your head with your right hand and grasp the left risers.**


**2**

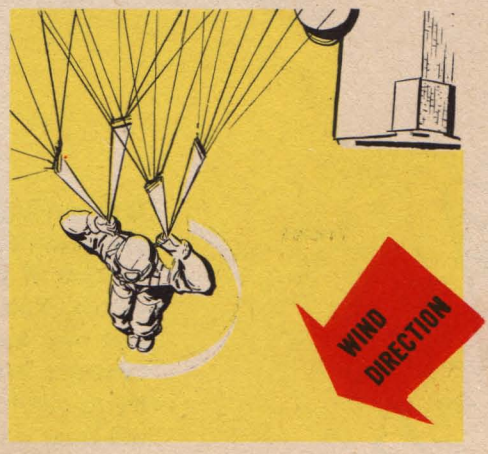
**Reach across in front of your head with your left hand and grasp the other risers. Your hands are now crossed, the right hand behind, and in each you have two risers.**




**3**

**Pull simultaneously with both hands; this will cross the risers above your head and turn your body to the right. You can readily turn 45°, 90°, or 180° by varying the pull.**

**To turn to the left, reverse this procedure**




In the descent, start your body turn high enough to allow you to master it. Once you have made the turn, you will find that you can control your direction of drift perfectly. Hold the turn, or slowly ease up if necessary, to bring you in facing downwind. Continue to hold the risers, whether you have had to twist them to make a body turn or not, and ride right on into the ground this way.

# THE LANDING

## NORMAL LANDINGS

Whether you have made a body turn or not, keep your hands above your head, grasping the risers.

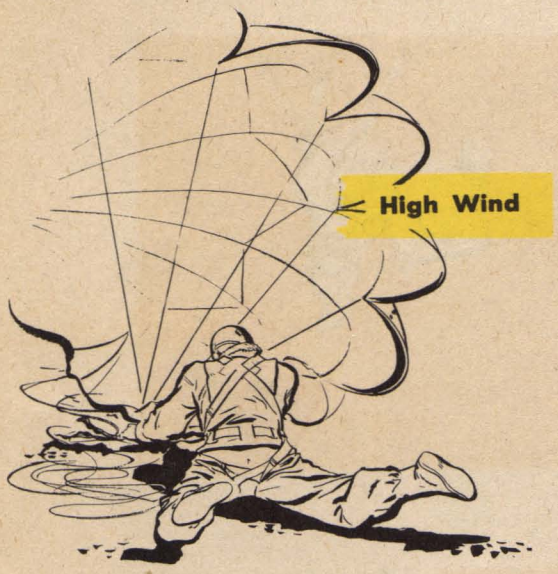
Look at the ground at a 45-degree angle, not straight down.

**Set yourself for the landing by placing your feet together and slightly bending your knees,** so that you will land on the balls of your feet.

**Don't be limp; don't be rigid.**

Relax, and keep your feet firmly together with your knees slightly bent, and your hands grasping the risers above. Now hold everything and ride on into the ground, drifting face forward.

**At the moment of impact, fall forward or sideways in a tumbling roll to take up the shock.**



**High Wind**

## ABNORMAL LANDINGS

If there is a strong wind blowing across the ground when you land, do two things.

First, make certain that you carry out the procedures described above for a normal landing, **including the body turn to face you exactly in your direction of drift.**

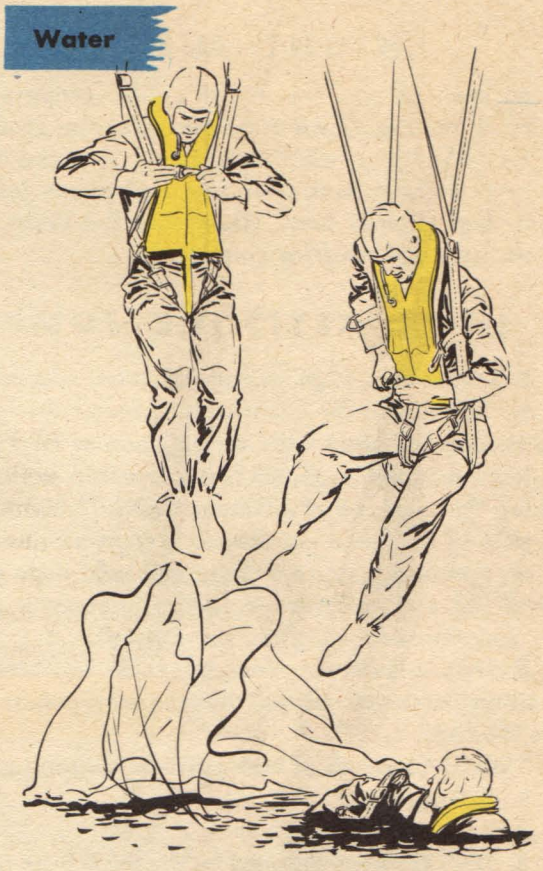
Second, once you are down, roll over on your abdomen and haul in hand over hand on the suspension lines nearest the ground. Keep right on pulling them in until you grab silk. Then, drag in the skirt of the canopy to spill the air and collapse the chute. If you can't manage this maneuver on your face, go over onto your back, but haul in the suspension lines until you reach the bottom edge of the canopy, then spill the chute.

**Trees**

Tree landings are usually the easiest of all. If you see that you are going to come into a tree, drop the risers, cross your arms in front of your head, and bury your face in the crook of an elbow. You can see under your folded forearm. Keep your feet and knees together. If you get hung up high in a tree, consider first the possibility of immediate rescue before you try to climb down. Failing that, get out of the harness and cut the lines and risers to make a rope for climbing down.

Water landings are safe if you know what to do. The ability to swim is an advantage but not a prerequisite if you are properly equipped and trained. Follow the procedure outlined here for all types of parachutes except the QAC AN6513-1A (which has no risers on pack or harness) and the single point quick release, instructions for which are given separately. Prepare for the water landing as soon as the parachute is open.

1. Throw away what you won't need.
2. Pull yourself well back in the sling by hooking your thumbs in the webbing and forcing the sling downward along your thighs.
3. Undo your chest strap by hooking a thumb beneath one of the vertical lift webs, pushing firmly across your chest to loosen the cross webbing so that you can undo the snap. **This must be done before you inflate the Mae West, as the chest strap cannot be released over an inflated life vest.**
4. When chest strap is undone and you are well back in the sling, unsnap the leg straps by doubling up first one leg and then the other. Then keep your arms folded, or hang onto the risers, so you won't fall out of the harness. If you are unable to unfasten leg straps in the air, remove them in the water by unsnapping them or by working them down over your feet.
5. As soon as you are in the water, inflate your Mae West, one half at a time (either half will support you) and shrug out of the harness. **Remember, never inflate your life vest until you have unfastened your chest strap.**
6. Get clear of the parachute promptly, and stay clear.




**Procedure for Single Point Quick Release Harness**

Modify the standard procedure as follows:

1. Before reaching the water, turn the locking cap 90° to set the release mechanism for immediate operation.
2. As soon as you are in the water, but not before, pull the safety clip, and press hard on the cap to release the lock. The harness will then slide off.
3. Inflate the Mae West, one half at a time, but never until the harness has been released.
4. Stay clear of the parachute.

See Life Vest, ROIF 8-9-1, Life Rafts, ROIF 8-11-1.

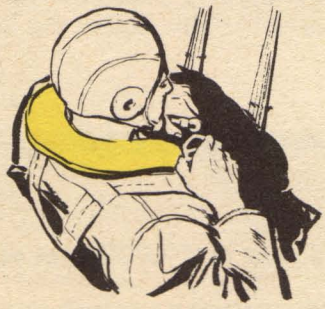
**WARNING:** The canopy and shroud lines, **not the harness,** may dangerously tangle you after landing in water. When equipped with any quick attachable chest pack, first unsnap the entire pack from the harness, then get away from the canopy and lines before you stop to take off the harness. **Think it through now and you'll be safe later.**

On over-water flights, **always** carry a sharp, serviceable knife where it is easily accessible. If you experience difficulty releasing yourself from the harness after landing in water, stay calm and cut yourself free.

**Procedure for QAC AN6513-1A (no risers on pack or harness)**

Modify the standard procedure as follows:

1. Reach under the pack cover and unfasten the chest strap.



2. Pull yourself well back in the sling and undo the leg straps, if you have time.
3. As soon as you are in the water, release both sides of chest pack from harness and immediately swim **upwind**, away from the canopy and lines.
4. Inflate the Mae West, one half at a time, but never until the chest strap is unfastened.
5. When clear of the canopy and shroud lines, you can slip out of your harness at leisure.

## NIGHT JUMPS

As soon as you are in the chute, prepare for a normal landing. Since you cannot see the ground on a dark night, you want to be ready to make contact at any moment. **Get your feet and knees together, your legs slightly bent. Hang onto the risers above your head and wait for contact.**

## HIGH ALTITUDE JUMPS

Bail-outs from high altitudes present special problems. The higher the altitude, the greater the dangers in bailing out. Stay with the airplane as long as you safely can; down to 15,000 feet if possible. If you must leave the airplane at altitudes above 15,000 feet and if you do not have bail-out oxygen equipment, take a deep breath of pure oxygen and hold your breath. Dive out and continue to hold your breath as long as you can before pulling the ripcord.

**Except in extreme emergency, do not attempt a bail-out without bail-out oxygen equipment above 30,000 feet.**

**The chief hazards of high altitude jumping are:**

1. Intense cold.
2. Lack of oxygen.
3. High G forces induced by the parachute opening at high altitudes.

If it is necessary to bail out at high altitude, you can reduce the hazard by making a long free fall to about 10,000 feet before pulling your ripcord. A free fall enables you to reach warmer regions more rapidly; it reduces the hazard of anoxia, and insures less shock when the parachute opens.

At high altitudes the opening shock of the parachute develops excessive G forces. The higher the altitude, the greater the shock.

### Judging Altitude in Free Falls

Do not depend upon counting or timing to judge distance above the ground. In the excitement it is difficult if not impossible to judge time.

Look at the ground and judge your altitude. For instance, at 5,000 feet the earth begins to look green, you can distinguish details, the horizon spreads, and the ground rushes up at you.

### Changing Your Falling Attitude

If your falling attitude is such that you can't see the ground, you can alter your position by extending an arm and the resulting turn will give you a look at the ground. Then pull in your arm and legs and straighten out your knees to stop tumbling before you pull the ripcord.

### Terminal Speed

Remember that in many emergency jumps you may leave the airplane at speeds so high that an immediate parachute opening would be dangerous. Hence, if you have sufficient altitude, you should wait 5 to 15 seconds to slow down before pulling the ripcord. This will avoid injury to yourself or damage to your parachute. You actually slow down during the first 10 to 15 seconds in a free fall until you reach terminal velocity. The lower the altitude, the lower the terminal velocity. So in making a free fall you do not tend to fall faster the longer you fall. You actually fall slower and slower the lower you get because the air becomes denser. With your parachute open, the rate of descent is also slower the lower you get.

*Notice*

**In all jumps from above 10,000 feet, fall free to 10,000 feet or less before pulling the ripcord if you can. This will reduce your exposure to cold, anoxia, enemy action, and lessen the opening shock of the parachute. If you do not have bail-out oxygen equipment, just hold your breath and dive out. Then continue to hold your breath as long as possible before pulling the ripcord.**

# Parachute Types

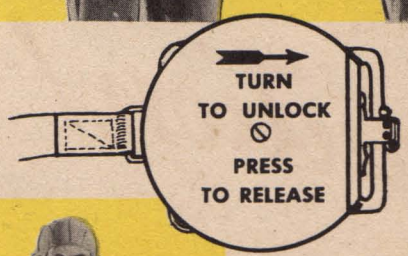


## BACK-TYPE PARACHUTES

**Type B-7** (AN6512)—The chest straps and leg straps have bayonet type or snap fasteners. Note that parachute belt is worn outside harness to hold webbing snug.

**Type B-8**—Flexible back pack with bayonet type fasteners on chest and leg straps. Older type B-8 parachutes have snap fasteners.

**Type B-9**—Flexible back pack on single point Quick Release harness. To get out of Quick Release harness turn the cap clockwise 90°, pull safety clip, and strike the cap a sharp blow with the hand.


Cap is shown in safetied position.



## SEAT-TYPE PARACHUTES

**Type S-1, S-2,** AN6510, and AN6511 — Harness has back and seat pad. Chest and leg straps have snap or bayonet fasteners.

**Type S-5**—Same chute as S-1 with single point Quick Release harness.

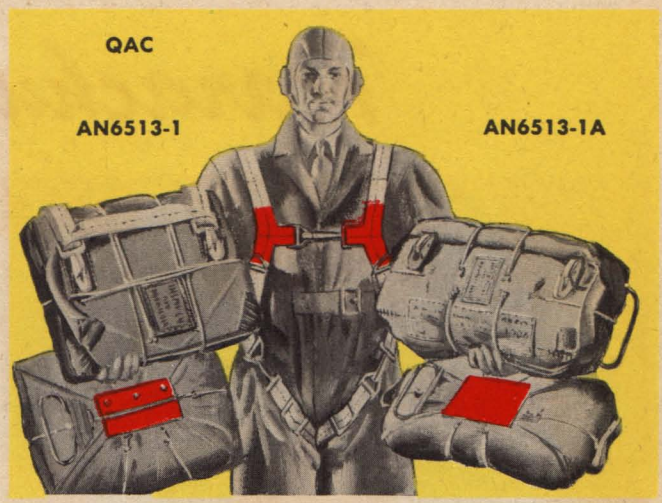
## ATTACHABLE CHEST-TYPE PARACHUTES

### Group 1 Assemblies

**Type QAC (AN6513-1)**—Quick attachable chest-type parachute with square pack. Harness has snap fasteners on chest and leg straps. It has D-rings for attachment of pack.

**Type QAC (AN6513-1A)**—Quick attachable chest-type parachute with barrel-type pack. Harness has snap fasteners on chest and leg straps. It has D-rings for attachment of pack.

**NOTE: On both AN6513-1 and AN6513-1A parachute assemblies the snaps are on the pack and the D-rings are on the harness.** Either of these packs can be used with the harness shown.

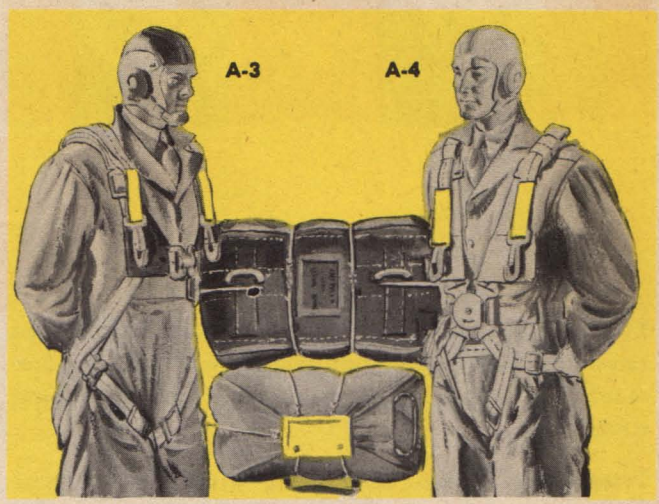



### Group 2 Assemblies

**Type A-3**—Quick attachable chest-type parachute with barrel-type pack. Harness has bayonet-type fasteners.

**Type A-4**—Quick attachable chest-type parachute with barrel-type pack and single point Quick Release harness.

**NOTE: On the A-3 and A-4 parachute assemblies the rings are on the pack and the snaps are on the harness.** This pack can be used with either of the harnesses shown.




# Caution!

**Parachutes of Group 1 are not interchangeable with parachutes of Group 2.**

The pilot is responsible for prevention of mismatching quick attachable chutes in his airplane.

Before the airplane moves for take-off, inspect all attachable parachutes to see that the pack fits the harness. Snap each pack to its harness to make certain it matches.

If you find any pack which does not fit the harness, change either pack or harness to get the correct assembly.

Each group is to be identified by a color. The same color must be on both pack and harness.

Red identifies Group 1.
Yellow identifies Group 2.

**Be sure all packs and harnesses in your plane match.**

REFERENCE: Technical Order 13-5-39

# LIFE PRESERVER VEST


Wear your life vest whenever you fly over water.

When the vest is issued to you, put it on, inflate it by the mouth tubes. Adjust the straps. **With the vest inflated the waist strap should be tight, the crotch strap snug.**

Deflate the vest by opening the valves at the base of the mouth tubes. Roll the vest up to deflate completely. Be sure to close the valves tightly to prevent leak on automatic inflation.

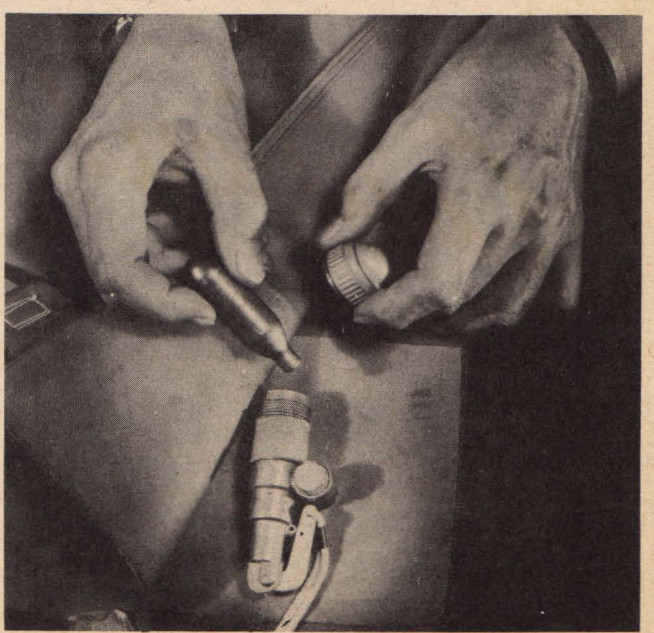
Wear the vest over the clothing and **under the parachute harness.** Tuck the vest under the collar of your flight jacket.

To inflate, pull one cord at a time so that if the mouth valves have been left open you will discover the error before you have discharged both $CO_2$ cartridges. One compartment will support you and will interfere less with swimming.

If the vest leaks, or fails to inflate completely from the $CO_2$ cartridge, fill by blowing into the mouth tubes. Open the valves while filling the vest by mouth, then reclose the valves tightly.

**Note: cutting off or bending the mouth tubes flush with the retaining loop will prevent possible injury to your eyes at the time your parachute opens.**

Before each flight remove the cap from the inflator cylinder and inspect the $CO_2$ cartridge. If the seal at the top is punctured replace the cartridge. With the lever which actuates the puncturing pin in the up position, parallel to the container, insert the new cartridge, seal end down. Always check the container cap to be sure it is screwed down tightly.



**Inserting $CO_2$ inflator. Screw cap down tight.**

## SEA MARKER PACKET

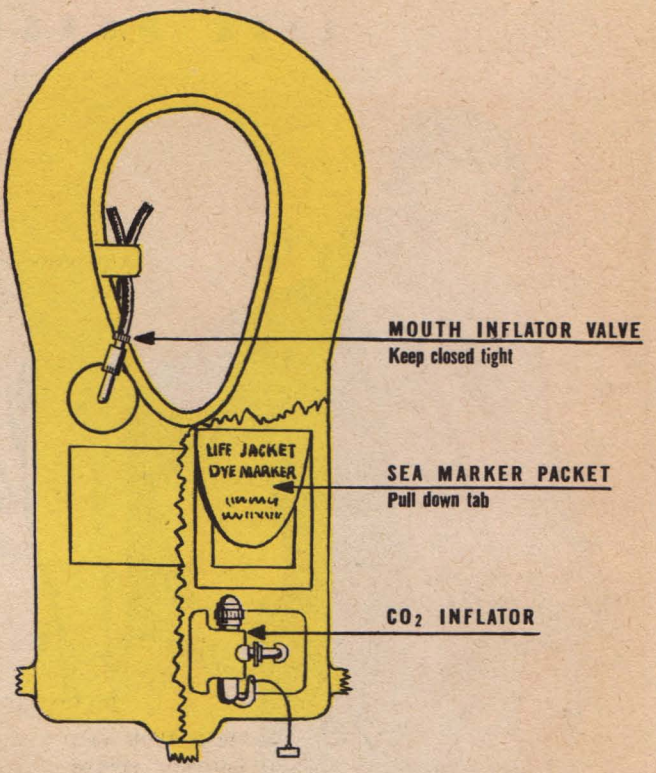
A sea marker packet is cemented to the life vest. When friendly airplanes approach, release the packet by pulling down on the tab. The dye will form a large green area lasting three to four hours. This will help airplanes to find you.

### CAUTION

Before take-off be sure your life vest cartridge containers are loaded with live $CO_2$ cartridges, **and that the container caps are screwed down tightly.** (See illustration.)

Always make certain that the mouth inflator valves are tightly closed before pulling the inflating cords.

Turn in your life vest for inspection every six months.




## WARNING: STAY AWAY FROM YOUR CHUTE IN THE WATER

After parachuting into water you will have a tendency to drift downwind into the fallen parachute as soon as you inflate your life vest. To avoid entanglement with harness and shroud lines, work upwind, away from the chute, and stay clear. If you have a raft, salvage your parachute for sail, cover, and extra lines. If not, get away from the chute and stay away.

ROIF 8-10-1
REVISED MARCH 1945

# Swimming Through Fire

When an airplane is ditched at sea there is always the possibility that a smashed wing tank and engine will spread flaming oil and gasoline on the water. By using the following procedure, however, you can swim to safety through such a fire, even when you wear a life vest.

1. Jump feet first upwind of your airplane. Cover your eyes, nose and mouth with both hands. Take a deep breath. Hold breath until you rise to the surface.

2. Just before you reach the surface, make a breathing hole in the flames. Swing your arms overhead to splash flames away from head, face, and arms.

3. Swim into the wind. Use the breast stroke. Before taking each stroke splash water ahead and to the sides. Keep mouth and nose close to the water. Duck your head every third or fourth stroke to keep it cool. If there are several men, swim single file. Let the strongest swimmer splash a path so the rest can follow safely in his wake.

## Swimming Under Water

If the heat is too intense or flames tco high, swim underwater —out of the danger area. To do this:

1. Splash flames away from body.
2. Hold head near water level.
3. Deflate life vest by releasing valves.
4. Take a deep breath but do not inhale fumes.
5. Sink beneath the surface, feet first.
6. Swim upwind as far as possible.
7. Splash away the flames as you come to the surface. Take a deep breath and submerge again. Repeat procedure until you are beyond the fire.
8. Re-inflate life vest by mouth.

# EMERGENCY KITS

Vest, Emergency Sustenance, Type C-1, was developed for the use of aircraft crews forced down in isolated regions. It consists of an adjustable vest-like garment, fitted with pockets into which the items of the kit are conveniently stowed. The vest is to be worn under the life preserver vest and parachute.

**PROTECT YOURSELF.** Before taking off on a flight over inaccessible or mountainous country, the arctic, jungle, desert, or ocean, check your vest and be sure it contains all the necessary equipment. If it does not, check with your Personal Equipment Officer.

The following items of equipment are carried in the pockets of the vest:

- 1 hat (yellow on one side, OD on the other)
- 1 pair Polaroid sun goggles
- 1 signal mirror, with lanyard
- 1 sharpening stone
- 1 fishing-sewing kit, in plastic container
- 1 collapsible spit and gaff
- 1 plastic water canteen (3-pint capacity)
- 1 Boy Scout knife
- 1 large knife (with 5-inch saw and blade)
- 1 package toilet tissue
- 10 yds. bandage (with sulfa powder)
- 1 waterproof match-box with compass
- 20 matches
- 14 fire starting tabs
- 1 burning glass
- 1 signal whistle
- 1 oil container
- 1 waterproof cover for .45 cal. pistol
- 20 .45 cal. shot cartridges
- 1 First Aid Kit
- 1 Survival manual
- 2 vest-kit rations in tin containers
- 2 five-minute signal flares
- 1 mosquito headnet
- 1 collapsible container for boiling water
- 1 pair woolen insert gloves
- 1 pair leather outer gloves

## LIFE RAFT KIT

Accessories for multiplace life rafts are carried in a kit and include the following items:

Signal kit (Pyrotechnic projector and 6 flares).

Emergency drinking water, 7 cans. Don't open before flight or water will spoil. Save cans for storing rain water.

Sea marker, 3 cans. When you see a plane, pour a can of marker on the water and stir it with an oar so it will spread. Do this quickly.

Life raft rations, 7 cans.

Flashlight, hand energized.

Knife, floating, attached to raft.

Police whistle, to attract attention.

First Aid Kit (Medical Supply Catalog, #9776900).

Fishing kit. Don't let hooks puncture raft.

Paulin for use as a sail.

Paulin for signal, shade, camouflage, and catching rain water.

Sun protective ointment, 4 tubes.

Emergency signalling mirror.

Wrist compass.

Religious booklets.

Water containers, 4.

Cellulose sponge.

Aluminum oars, 3.

Hand pump and hose.

Repair kit.

Bailing bucket. Use it also for urinating. Don't stand in raft.

Repair plugs, 4.

Ocean charts.

Gatty's Raft Book.

Survival booklet.

Twine, 40 feet. Tie loose equipment to raft.

Sea anchor.

# Life Raft Discipline

## EQUIPMENT

Familiarize yourself now with the use of the equipment provided with the various life rafts. Ask your Personal Equipment Officer for demonstrations and instruction in its use.

If there are two or more rafts, connect them with the line provided to keep from becoming separated. Remain in the vicinity of the plane if it stays afloat, but not so close that the raft might be damaged by tossing against a sharp projection. Securely fasten the kit and all loose gear to the raft, with tight but easily untied knots.

Get the emergency radio into operation as soon as weather permits. Instructions are on the set. Keep all signaling equipment where you can get at it quickly. Keep flares and Pyrotechnic Pistol and cartridges as dry as possible. Use the flares only when a ship or plane is near. Fire the pistol almost vertically for maximum height, ahead of the plane so that the shot will be within the visibility range of the pilot.

Use the tarpaulin yellow side up for a signal, blue side up for camouflage from enemy.

Keep the sea anchor out. It will head you into the wind or check your drift.

## WATER AND FOOD

Your pilot is in charge of food and water rationing. Abide by his rulings. Take no food at all for the first 24 hours. In general, take no food if you have no water.

Drink all the water you can hold before any overwater flight. Your body will store it.

You can collect rain water in the tarpaulin or sail. Drink as much as you can and store the remainder in empty water cans and other containers.

**Never drink sea water or urine.**

Take good care of your fishing kit.

## PROTECTION

**In the tropics protection from the sun is vital.** Rig the oars and tarpaulin as a canopy and stay in the shade. Keep arms, legs, and head covered. Wet yourself, clothes and all, with bucket, sponge, or by immersion, but be careful to keep salt water out of your mouth.

Don't overexert. Perspiration will result and you will require more water.

**Continued exposure to cold sea water plus loss of circulation** may bring about a condition known as Immersion Foot. To guard against it, keep your feet as dry as possible. Move your feet around and wriggle your toes to encourage circulation. If feet become swollen and sore, don't rub them. Rubbing will make the condition worse. Sprinkle open sores with sulfanilamide powder.

Large salt water burns or boils should be covered with sulfanilamide ointment and a light bandage. Don't prick or squeeze boils.

Don't worry about the absence of bowel movement or urination. It is a natural situation. Never take a salt water enema or a laxative.

If there is more than one man aboard, establish a watch routine. Keep a man on alert at all times. **Tie the man to the raft with at least ten feet of slack.**

# Fire Fighting

## IN FLIGHT

Use all extinguishers applicable and always aim at the base of the fire.

Keep your parachute away from the fire. Put it on as soon as possible.

Give the pilot any assistance possible. Inform him of any terrain obstructions in the path of the airplane.

Get your exact location from the navigator. Transmit your position and the ETA to the field toward which you are heading. Make every attempt possible to get the message through.

Stay at your position until a crash seems imminent, then move to your proper bailout station.

### Engine Fires

At the first sign of a fire, if conditions permit, the pilot will take all necessary action to control it from the cockpit. His actions will depend upon the type of equipment he has.

In any engine fire your only duty is to stand by and give all necessary information to the pilot.

### Fuel Tank and Amphibian Hull Fires

1—Try to locate the source of the fire.

2—Inform the pilot.

3—If fire is accessible, use hand and built-in equipment if possible.

4—Transmit your position and ETA to the field toward which you are heading.

5—Continue your duties.

### Cabin Fires

1—Give pilot the necessary information.

2—Close windows and all openings.

3—Locate source of fire.

4—Use all extinguishers available. (Open windows as soon as the flames are extinguished.)

5—Continue your duties.

### Flare Fires

If flares in the racks ignite, release the flares at once. Pry them loose if they stick in the racks.

### Other Fires

The pilot will attempt to extinguish wing fires or drop tank fires by slipping the airplane away from the fire or dropping the tanks.

Your only duty is to give the pilot or navigator any necessary information and continue your duties.

**In case of fire, don't open emergency hatches or bomb-bay doors in the air, except for bailout. External fires may be drawn into the cabin. Drafts will cause cabin fires to flare up.**

**Open emergency hatches just before landing if fire makes a crash landing necessary, to permit escape or rescue.**

## ON THE GROUND

Always have a member of the ground or air crew stand by with adequate, portable fire extinguishing equipment while the engines are being started.

**Starting an engine is a critical fire moment. Backfiring sometimes ignites excess priming fuel in the induction system. Fires spread rapidly.**

**In case of fire while starting engines:**

1—Help crew use portable fire-fighting equipment.

2—**Notify tower to rush crash equipment.**

3—See that all crew members clear the airplane.

4—If there is time, remove classified equipment.

# Fire Fighting Equipment in Airplanes

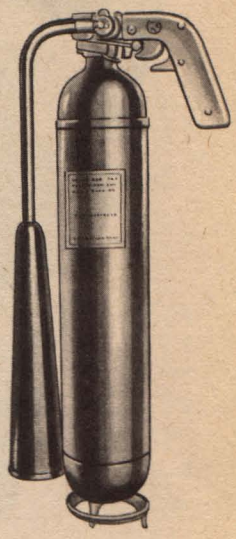
## LEARN THE LOCATION AND PROPER USE OF FIRE EXTINGUISHING EQUIPMENT INSTALLED IN YOUR AIRPLANE


FYR FYTER, hand-type fire extinguishers, having a carbon tetrachloride base, are found in most airplanes. Use this extinguisher primarily for fighting fires in the cockpit or cabin. It is unsuitable for extinguishing fires outside the fuselage during flight.

Aim at the base of the fire, remembering that your supply is limited and must be used effectively. The FYR FYTER extinguisher in your plane has enough fluid to last for about one minute of continuous use. Its effective range is approximately 20 feet.

$CO_2$, hand-type fire extinguishers, using carbon dioxide, also are found in large airplanes. Use this extinguisher for fighting fires inside the airplane.

The $CO_2$ extinguisher has an effective range of only 3 feet. The charge will last only 15 to 30 seconds, according to size of the unit. So aim at the base of the fire and move in close, on the upwind side. **Then pull the trigger release, directing the $CO_2$ straight at the base of the fire.** Move the discharge nozzle slowly across the flame area.



***AIM AT BASE OF FIRE***

**Know the location of all extinguishers, their limitations, and how to use them.**

***AIM BEFORE PULLING TRIGGER***

Both of these extinguishers are effective in combating fuel, electrical, and wood or fabric fires. $CO_2$ is rapid, clean, and easy to use. However, because of the small quantity in the cartridge, it might not be final in action.

Built-in $CO_2$ (carbon dioxide) systems are installed in some types of airplanes, so that engines, hulls of amphibians, gasoline tank compartments, or even cargo sections may be flooded with carbon dioxide gas in case of fire. First, set the extinguisher selector valve to direct the $CO_2$ charge to the desired location. Then pull the release handle. The operating controls are marked clearly to indicate their method of use.

### Precautions

Stand back, but within effective range, when using the FYR FYTER carbon tetrachloride extinguisher. Open windows and ventilators after fire is extinguished. **The fumes generated are poisonous.** See a doctor as soon as you land if you have inhaled excessive amounts of the gas or have swallowed even a small quantity of the liquid.

Don't touch any portion of the discharge nozzle of the $CO_2$ extinguisher. The extremely cold temperature of the carbon dioxide may cause severe burns.

### CREW FIRE DISCIPLINE

**Be sure that you know fire fighting procedures and methods of fire prevention.**

## RELEASE DROP TANKS BEFORE A WHEELS-UP LANDING


SEAL: Not to be broken except in case of an actual wound or injury.

EXTERNAL POCKET: Contains iodine and adhesive compresses for minor injuries.

# KIT, FIRST-AID, AERONAUTIC

## Installed in Military Aircraft

*Medical Supply Catalog No. 97765*

## CONTENTS

1—Tourniquet, (1)

2—Morphine syrette, (2)

3—Wound dressing, small, (3)

4—Scissors, (1 pair)

5—Sulfanilamide crystals, envelope, (1)

6—Sulfadiazine tablets, (1 box of 12 tablets)

7—Burn ointment, (1 tube) (Boric or 5% Sulfadiazine)

8—Eye dressing set

9—Halazone tablets

10—1" Adhesive compresses (1 box) (Contents of small outer pocket)

11—Iodine swabs (10) (Contents of small outer pocket)

**1**—In the case of a wound, first stop the flow of blood. The clothing should be cut away and a compress or wound dressing applied after the sulfanilamide powder has been sprinkled into the wound. If a firmly applied dressing will not cause the bleeding to stop, or if there is actual spurting of blood from an artery, the tourniquet should be applied. A tourniquet must be released every twenty minutes and removed as soon as hemorrhage stops.

**2**—To relieve severe pain, open the small cardboard container and follow directions given there in the use of the hypodermic syrettes of morphine. Do not hesitate to use the hypodermic to relieve suffering.

**3**—In case of head injury have the man lie quietly with head slightly elevated.

**4**—In the event of marked blood loss with shock and/or unconsciousness, have the man lie horizontally or lie with the head down, if possible.

**5**—An adequate supply of oxygen is doubly important in case of serious injury. Use it generously.

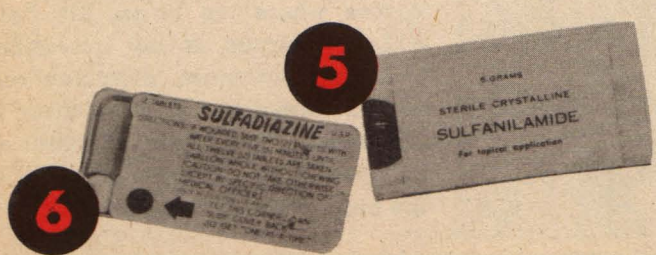
# NOTICE: Drugs Contained in This Kit are Potent and Must Be Used Correctly. Follow Directions!


**TOURNIQUET:** To be used to stop flow of blood but use only if blood flow cannot be stopped with a wound dressing. *Caution:* Release tourniquet every 15-20 minutes and remove as soon as hemorrhage is controlled. (See PIF 8-14.)


**MORPHINE SYRETTE:** To be used to relieve pain and should be employed without hesitation to prevent suffering. *Directions for use:* Remove transparent hood, grasp wire loop and push wire in to pierce inner seal, turning if necessary. Pull out and discard wire, thrust needle through skin at least half its length and inject solution by slowly squeezing the syrette from the sealed end. In extreme cold, warm syrette by holding under clothing next to skin.


**WOUND DRESSINGS:** Apply dressing with firm pressure into the wound and tie securely.

**SCISSORS:** Do not hesitate to cut away clothing and flying garments from the wound so that the dressing may be applied without hindrance.




**SULFANILAMIDE POWDER:** Sprinkle on the wound to prevent infection.

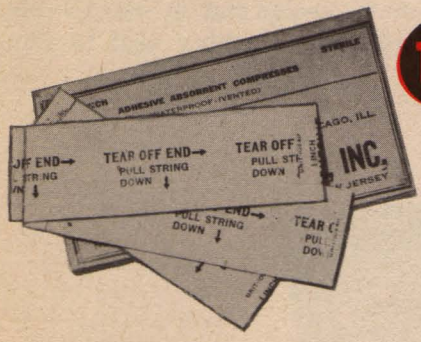
**SULFADIAZINE TABLETS:** To be taken internally if wounded. *Directions for use:* Take two tablets with water every five minutes until all twelve tablets are taken. Swallow whole without chewing.

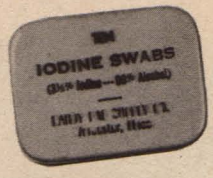

**BURN OINTMENT:** To be used on skin surfaces for all burns from any cause. *Directions:* Apply ointment liberally and without friction to all burned surfaces.



**EYE DRESSING SET:** Use for burns of the eye. Apply Metaphen ophthalmic ointment directly to the eyeball. Then apply the boric acid ointment to the inner surface of the eyelid. Cover the eye with a dressing and secure in place with adhesive strips.

**HALAZONE TABLETS:** For the disinfection of water. *Directions:* Add one tablet to a canteen full or a pint of water. After tablet dissolves wait 30 minutes before drinking. If water is greatly polluted use two tablets.




**EXTERNAL KIT POCKET:** Contains iodine swabs and adhesive dressings for minor injuries. Do not use iodine in serious wounds. (Use sulfanilamide powder.)

**KIT, FIRST-AID, FOR PNEUMATIC LIFE RAFT**

*Medical Supply Catalogue No. 97769*

This is a part of the life raft kit. (See PIF No. 8-11.) Contains morphine syrettes, bandage compresses, sulfanilamide powder, sulfadiazine tablets and burn ointment as illustrated in photos Nos. 2, 3, 5, 6, and 7.


**PACKET, FIRST-AID, PARACHUTE**

*Medical Supply Catalogue No. 97785*

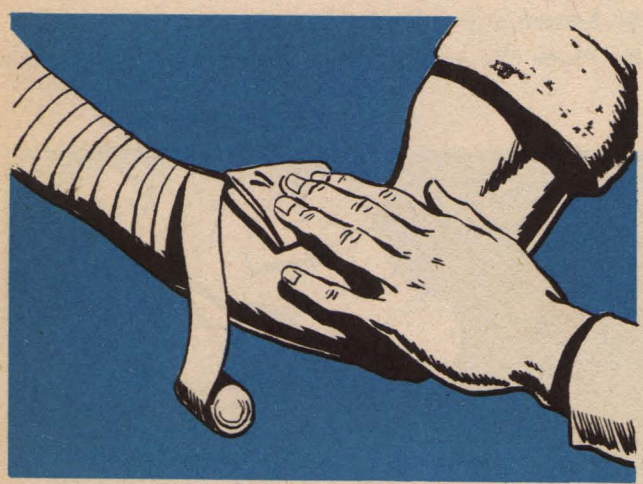
To be attached to the parachute harness or Mae West life vest for constant availability. Should be carried in Gun Turrets and other cramped spaces where the larger Kit, First-Aid, Aeronautic, is not accessible. Contains tourniquet, morphine and wound dressing as illustrated in photos Nos. 1, 2, and 3. Packet can be opened by tearing either end of the outer container at the notch.


Your airplane is a good first-aid station. You have the Kit, First-Aid, Aeronautic, and the Packet, First-Aid, Parachute. Oxygen is frequently available. Splints, or splint materials, are at hand. Hot drinks are often carried in thermos jugs. In certain bombers you will be provided with blood plasma. Familiarize yourself thoroughly with the first-aid supplies which you carry, and get clearly in mind just what you can do with them.

## WOUNDS AND INJURIES

Wounds and injuries involve one or more of these problems: **pain, cuts, bleeding, broken bones, burns, frostbite, shock, and unconsciousness.** Generally you will have to deal with combinations of these, such as cuts which are bleeding, burns that cause pain, broken bones associated with cuts or burns, and so on. Shock usually comes on after a good deal of blood has been lost either inside the body (where you may not be able to see it), or on the outside. Shock also accompanies deep or extensive burns. Unconsciousness may be produced by a head injury, may follow shock, or may occur as a result of failure to get enough oxygen.

In giving first-aid, try to size up the general situation accurately. Then attend to the most serious problems first. Above all, use common sense.



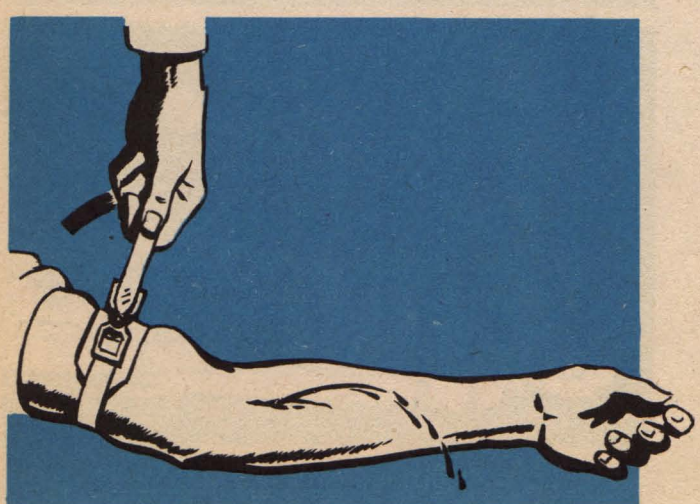
## CUTS AND BLEEDING

**1**—Expose wound by cutting nearby clothing with scissors.

**2**—Cover cuts with sterile dressings and apply firm pressure.

**3**—If this does not stop the bleeding, elevate the bleeding part.

**4**—If these measures fail to stop bleeding in arms or legs, apply a tourniquet in the middle of the upper arm or middle of the thigh. The tourniquet must be released every 15 minutes for at least a few seconds, depending upon the amount of bleeding.



## TOURNIQUET (WARNING)

A tourniquet must be removed, or temporarily released, every 15 minutes. **Failure to release the tourniquet often enough or long enough to provide an adequate circulation to the blocked portion of the arm or leg may necessitate amputation later.**

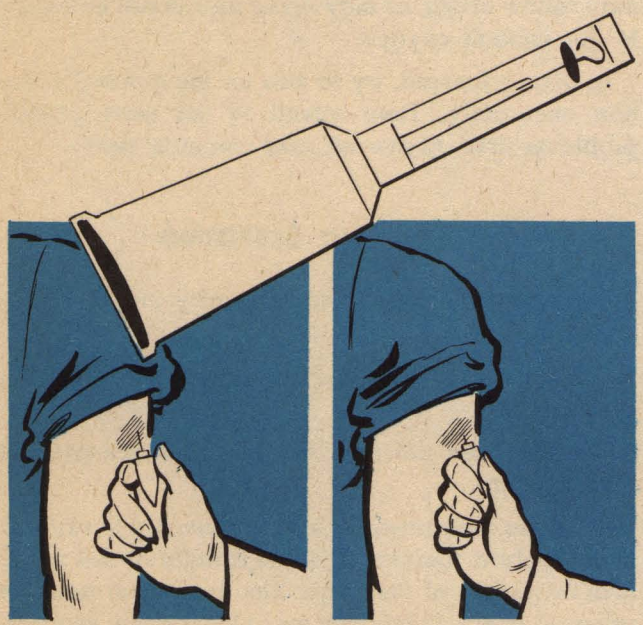
## PAIN

Use morphine at once for severe pain. This makes it possible for the patient to lie quietly, preventing aggravation of the injuries. Do not use more than one tube (½ grain) of morphine at any one time.

When giving morphine, mark down the time and dose on the patient's forehead or clothing with a pencil. Remember that an excess of morphine can be fatal. Do not give morphine to a person who is unconscious, who has a head injury, or who is breathing less than 12 times per minute.

## TO GIVE MORPHINE

**1**—Paint any small area of skin with iodine.
**2**—Remove the transparent cover from the morphine syrette.
**3**—**Push in the wire loop to puncture the inner seal;** then pull the wire out.
**4**—Thrust the needle through the skin, using care not to press morphine out of the tube while doing so.
**5**—Squeeze the tube slowly to inject the morphine.



## GIVE MORPHINE:

**1**—To stop pain.
**2**—To decrease shock.
**3**—To facilitate moving the patient.

## DON'T GIVE MORPHINE:

**1**—To an unconscious person.
**2**—To a person with a head injury.
**3**—To a person who is breathing less than 12 times per minute.

## SHOCK

You can tell when a patient is in shock by the total picture he presents rather than by any single sign. Usually he will have:

**1**—Lost considerable blood, or
**2**—Suffered severe burns, or
**3**—Been subjected to intense pain, or
**4**—Received a head injury.

**His skin is pale,** cold, clammy, or moist.

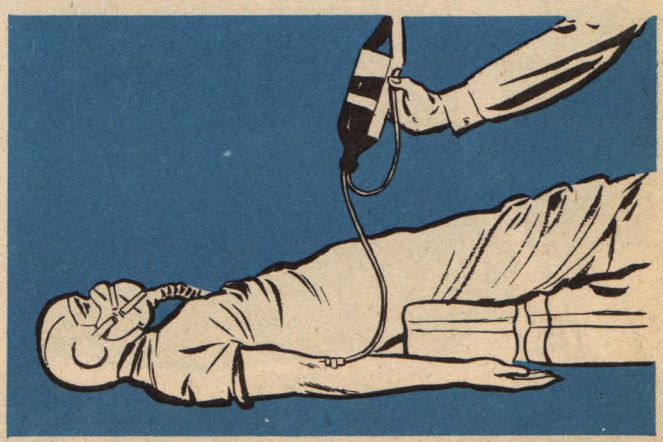
**His breathing is shallow,** and may be irregular.

**His pulse is weak,** rapid, thready, and often difficult to find.

Sometimes there is nausea and vomiting.

**Treat shock by doing the following things as promptly as possible:**

**1**—Stop any obvious bleeding.
**2**—Give pure oxygen to breathe. (Automix "OFF.")
**3**—Give morphine. (Exception: Head injury.)
**4**—Keep the patient warm with blankets, extra clothing, or a sleeping bag, but avoid excessive heat.
**5**—Loosen any tight clothing.
**6**—Place the patient with his head slightly lower



than his feet, to promote better circulation to the brain.

**7**—Inject plasma, when it is available, in accordance with the directions on the plasma package.

## FRACTURES

**1**—If a broken bone is associated with a cut, sprinkle with sulfa powder and cover with a sterile dressing. If the dressing is firmly bound in place it will almost always stop the bleeding.

**2**—Give morphine.

**3**—Apply a temporary splint to the part, using wood, strips of metal, heavy cardboard, or any convenient pieces of equipment such as a machine-gun barrel or fire axe.

**4—Do not attempt to set the bone. Manipulation causes shock.**

## BURNS

**For minor burns:**

Squeeze burn ointment onto a sterile dressing. Then cover the burn gently with the dressing.

**For severe burns:**

**1**—Give morphine.

**2**—Treat shock. (Oxygen; plasma, if available.)

**3**—Apply burn ointment on sterile dressings, **and bind the dressings gently but firmly in place.**

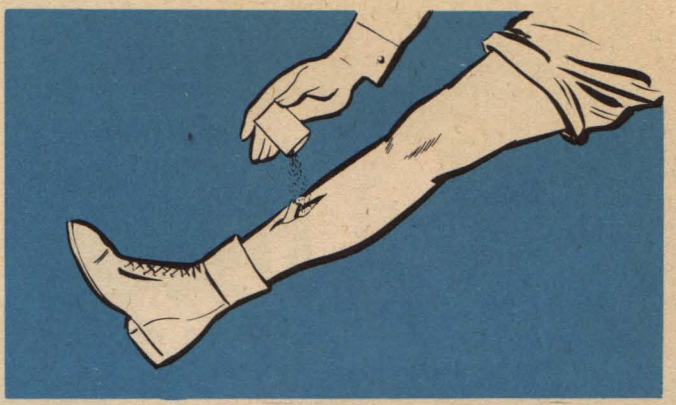
**4**—Never open blisters resulting from burns.

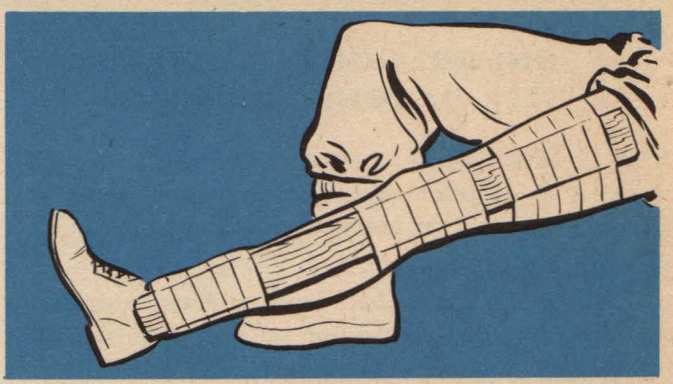
## FOR EYE BURNS

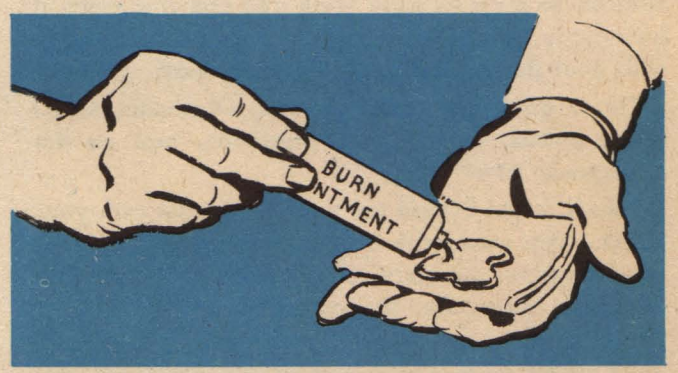
Apply Metaphen ophthalmic ointment directly to the eyeball. Then apply the boric acid ointment to the inner surface of the eyelid. Cover the eye with a dressing and secure in place with adhesive strips, provided the skin around the eye is not burned. Do not touch the eye with your fingers, and do not rub it—either before or after the ointment has been applied.

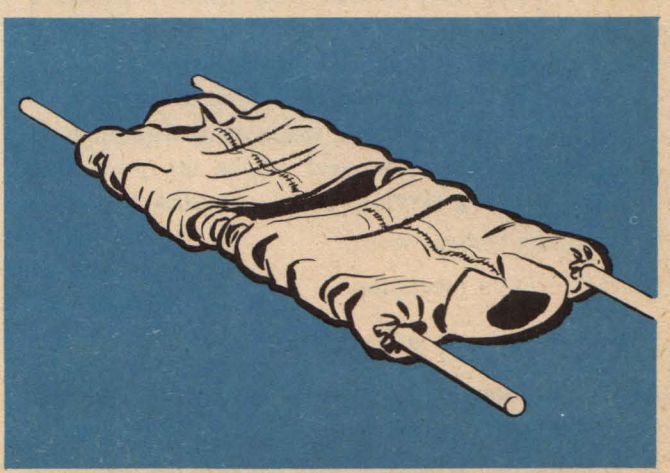
## TRANSPORTATION OF WOUNDED

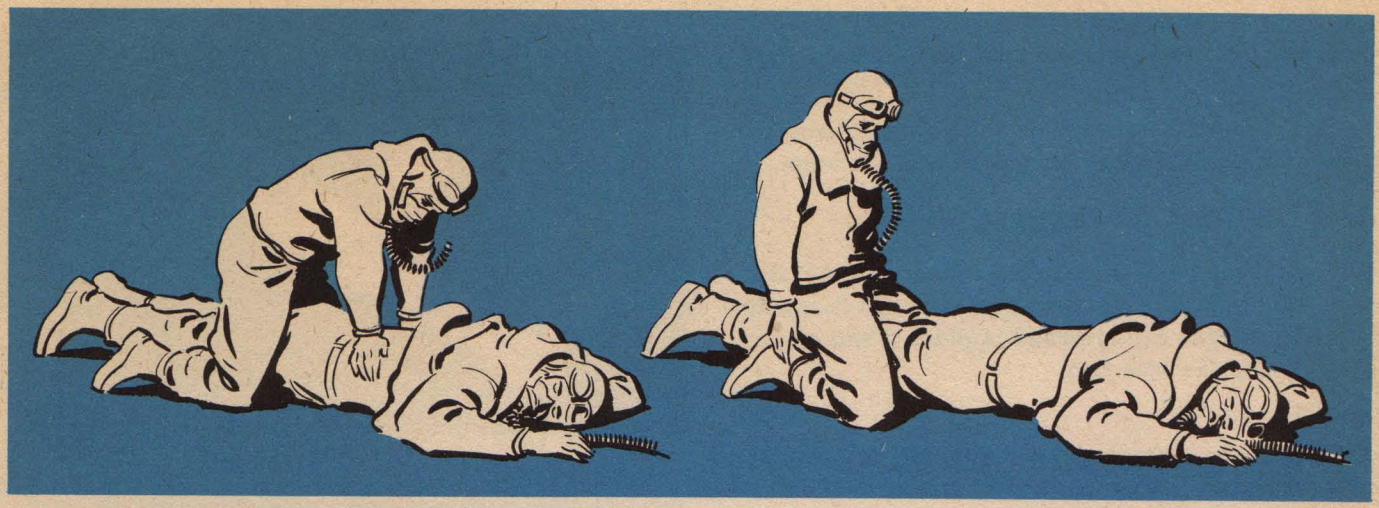
If it becomes necessary to move an injured crew member improvise a litter with 2 poles and a pair of flying jackets. Turn the sleeves inside out and insert the poles through them. Then close the jacket over the outside of the poles. Additional support can be obtained by using boards or cardboard splints inside the jackets. Litters can also be improvised with poles and blankets. Take great care to be as gentle as possible in moving an injured person onto a litter. Keep his body as flat as possible at all times. Have 3 or more persons move and support him by placing their arms under his legs, buttocks, back, shoulders, and head.









## UNCONSCIOUSNESS AND NEAR-UNCONSCIOUSNESS

Oxygen lack, carbon monoxide poisoning, and head injury are important causes. Immediate treatment is vital, especially if breathing has stopped.

**1**—Give artificial respiration:

**First,** lay the patient face down with one arm bent at the elbow, his face resting on his hand, and his other arm extended beyond his head.

**Second,** open his mouth and remove all foreign substances such as false teeth and chewing gum. If his tongue has fallen back into his mouth, grasp it with your fingers and pull it well forward.

**Third,** give him pure oxygen. (Auto-mix OFF.) **If the patient has stopped breathing, turn on the emergency flow.**

**Fourth,** kneel astride the patient's thighs with your knees about even with his. Place the palms of your hands against the small of the patient's back, with your little finger over the lowest rib.

**Fifth,** with your arms stiff, swing your body forward slowly so that your weight is applied over the patient's back. This should take about 3 seconds.

**Sixth,** release your hands with a sudden snap and swing backward to remove all pressure from the patient. After about 2 seconds repeat the cycle.

**Continue giving artificial respiration without stopping for 2 hours or longer, unless the person to whom it is being given begins to breathe normally.**

**2**—Keep the patient warm.

**3**—Do not give morphine.

## FROSTBITE

**1**—Fingers, toes, ears, cheeks, chin, and nose are the parts most frequently affected.

**2**—Numbness, stiffness, and whitish discoloration are the first symptoms.

**3**—Wrinkle your face to find out if it is numb; watch for blanched faces of your crew mates.

**4**—If frostbite occurs, warm the affected part gradually. Never rub or attempt to thaw it rapidly.

**5**—If blisters develop, do not open them. (See HEAT AND COLD, PIF 4-7-3.)

## FAILURE OF OXYGEN SUPPLY

If a crew member's oxygen supply fails above 10,000 feet, make every effort to replace his equipment or give him an emergency supply. If this is not practicable, descend to 10,000 feet as fast as safe operation permits. Loss of oxygen above 20,000 feet is critical, but there is no need for panic. **Get oxygen, or get down.**


## WOUND DISINFECTANTS

**1**—Sprinkle Sulfa powder in open wounds.

**2**—Use iodine only for small cuts and scratches, which should not be covered by a dressing.

**3**—Never put iodine on or into large or deep wounds.

# RADIO OPERATORS

# *Information File*

# INDEX

NEW ERA LITHO - 50M - 12-44