RESTRICTED

NAVY PILOTS'

INFORMATION FILE

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NavAer 00-80-T-33

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INFORMATION FILE

ISSUED BY CHIEF OF NAVAL OPERATIONS,
AVIATION TRAINING BRANCH, JUNE, 1949

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REVISION PAGES

Date Issued	Date Inserted	No.	Inserted by (Signature)

INTRODUCTION

Today, flying is not just a matter of moving a stick or pushing a foot pedal. It is a complex, highly technical art which demands the services of a highly skilled artisan. The things which a pilot, particularly a Naval Aviator, must know and remain constantly abreast of are enough to fill a complete library.

Few, if any, pilots have such a library. Therefore, the *Navy Pilot's Information* File is issued to Naval Aviators in order that they may have, in one volume, most of the information which a pilot must know. This does not mean that you should consider your knowledge complete once you learn the contents of this book. It is not the last word on nor does it contain a complete coverage of any one subject. For this reason, references for clarification and further study on any subject in the NPIF may be found at the conclusion of the respective subject subsection. Neither is the NPIF a static organ; every 3 months or as conditions change and new and better information comes to light, revisions to the NPIF will be issued. It will be each pilot's responsibility to see that these revisions are inserted in his NPIF.

The NPIF tries to digest the pertinent, general information of importance to the pilot. If you feel that there are other topics of general interest which might prove of value to Naval Aviators and which should be included in the NPIF, submit such recommendations to the Chief of Naval Operations, Aviation Training Branch Section (OP542).

Each pilot should read the NPIF thoroughly upon receipt and as often thereafter as it is necessary for him to remember the information it contains. On the next page is a table of contents and at the back of the NPIF is an index which will enable you to quickly find the particular information you want.

This handbook is classified *restricted* and should be handled in accordance with security regulations governing the use of *restricted* matter.

CONTENTS

Section I. GENERAL

FLYING REGULATIONS

FLIGHT TIME

All Naval Aviators detailed to flying duty must obtain a minimum of 100 hours in the air each year as pilot or copilot. When facilities are available and it is possible to do so, pilots should meet the following requirements each year:

12 hours instrument, actual or simulated
10 hours at night
Qualify for standard instrument pilot certificate
Qualify in Ground Controlled Approach

REFERENCE: ACL 27-48

Flight log. Each pilot is responsible for maintaining a complete record of his flight time in an aviator's flight log. Time is logged in hours and tenths of hours. Although at some stations the log is maintained by operations office personnel, this does not relieve you of full responsibility.

At the end of each quarter and upon detachment, verify the entries in your log immediately after the last entry and get your commanding officer or the officer having that authority to approve the entries. Commanders and above must fill out a report of such time and forward it, in compliance with instructions in ACL 50-47, to the Chief of Naval Operations (Attn: Op-531D) not later than 10 days after the end of each quarter.

REFERENCE: ACL 50-47, 97-47

Crediting flight time. Pilot time for any specific flight is credited to only one person except where dual-control aircraft are assigned to training missions or where the nature of the flight requires the services of two pilots at the controls.

REFERENCE: ACL 97-47

PUBLICATIONS REGARDING FLIGHTS IN NAVAL AIRCRAFT

Naval aviation has become a highly technical, complex field. To cover the multiple items within the scope of Naval aviation activities, it is necessary that much information be available to the pilot. Thus, a large number of publications are required reading for the Naval Aviator. Although the publications are numerous and sometimes lengthy, no pilot can rightly call himself a Naval Aviator without familiarizing himself with all those publications which govern flights in Naval aircraft. Those which, in whole or in part, are devoted to this task are:

Aviation Circular Letters

Civil Aeronautics Administration rules, regulations, and instructions for aircraft flying civil airways

Flight Safety Bulletins

Fleet Tactical Doctrines

Navy Department Bulletins

Pilots' Handbooks

Squadron or station flight doctrine and flying regulations

Technical Notes

Technical Orders

AIRSPACE RESERVATIONS AND RESTRICTED AREAS

Air space reservations. No pilot is allowed to fly over an airspace reservation without obtaining permission prior to flight. Four airspace reservations exist in the United States:

Washington, DC

Clinton Engineering Works, Oak Ridge, Tenn

Los Alamos, Santa Fe, NM

Hanford Engineering Works, Richland, Wash

Restricted Areas. Two types of restricted areas are established by the Administrator, Civil Aeronautics Authority:

(1) *Danger area:* That area in which invisible hazards to aircraft exist and through which no aircraft will fly unless granted permission.

(2) *Caution area:* That area in which visible hazards to aircraft exist and which should be avoided if practicable.

REFERENCE: ACL 97-47; Memo for Aviators No. 8 of June 7, 1948

WARNING

Restricted areas are constantly changing. To make certain that you will not fly over *new* restricted areas, always check the *Airman's Guide,* published biweekly by the CAA, and the *Notices to Airmen* before embarking on a flight.

Flight over foreign territory. Never fly over or enter the airspace of a foreign country without proper authority. When you do enter or fly over a foreign country, abide by the laws and regulations of that nation.

REFERENCE: ACL 97-47

PILOT COMPLEMENT IN TRANSPORT AIRCRAFT

Except for training flights under Visual Flight Rules (VFR), the following type transport aircraft require the specified number and type of aviators on flights.

Medium and heavy transports: A first pilot holding a valid Standard or Special Instrument Rating Certificate and a copilot, both of whom must be qualified in the type aircraft.

Light transports: Under VFR conditions, one pilot qualified in type aircraft assigned. Under Instrument Flight Rules (IFR), the same as for medium and heavy transports.

REFERENCE: ACL 13-46

ALL WEATHER AIR STATIONS

All Weather Air Stations are those stations, designated by the Chief of Naval Operations, to which single pilot type aircraft may be cleared under Instrument Flight Rules. These stations are selected because of their location, electronics equipment, and the nature of their mission. By clearing to an All Weather Air Station, the pilot of a single pilot type aircraft can descend safely through the guidance of Navy electronics equipment and thus probably avoid the complicated holding and approach procedures encountered on civil airways. All Weather Air Stations are published in the Naval Airways Pilot, HO 510, and the Air Forces-Navy Radio Facility Charts.

NOTE: CHECK "NOTICES TO AIRMEN" BEFORE EACH FLIGHT TO MAKE SURE THAT THE ALL WEATHER AIR STATIONS WHICH ARE YOUR DESTINATION AND ALTERNATE HAVE NOT BEEN CLOSED DUE TO OPERATING FAILURES.

REFERENCE: ACL 49-49

AIRPLANE MINIMUMS

Weather minimums for Navy and Marine Corps Air Stations published in Naval Airways Pilot (HO 510) and other aeronautical publications are to be considered as **recommended** minimums. The mandatory weather restrictions for operating into or from a specific field will be determined by the pilot's instrument rating and the instrument classification of his aircraft (see Instrument Flight Rules). However, the commanding officer of any Air Station has the authority to close the field at any time. When you are operating into or from Air Force or civilian fields, bear in mind that the Navy has no jurisdiction over weather minimums which may be instituted at those fields and restrict your operations in addition to the instrument rating and aircraft classification mentioned above.

REFERENCE: ACL 48-49

VISUAL FLIGHT RULES

To clear on Visual Flight Rules (VFR), the following weather minimums must exist and be forecast by the clearing-authority-station aerologist:

(1) 1,000-foot ceiling at departure and arrival terminals and enroute.

(2) 3 miles visibility at departure and arrival points and 1 mile enroute.

When clearing on VFR, you must remain at least 500 feet below the cloud base and 500 feet above the ground at all times except when taking off or landing. When lowering cloud base prevents you from maintaining these minimums, you must request an instrument clearance by radio, or turn around and return to your base, or land at the nearest field. Never proceed on instruments without getting clearance from CAA or if you are not a qualified instrument pilot. Your responsibility to yourself, to your plane, and to other pilots who may be flying on instruments demands that you abide by the rules.

REFERENCE: CAR-60

INSTRUMENT FLIGHT RULES

When weather conditions are below VFR, you can obtain clearance only if you hold an instrument rating and provided you are flying an airplane to which you are qualified and which has a comparable instrument classification. (Instrument ratings for aircraft are listed in ACL 46-49.) When your instrument rating and that of your aircraft are didfferent, the lowest rating governs the type of clearance.

Restricted rating. With this rating, you may clear on IFR in planes of a Restricted or higher rating under the following conditions:

Takeoff: Not below 500 foot ceiling and one mile visibility, and in no case less than the authorized minimum altitude (radio range let down) for military aircraft. If none are published, non-schedule civil air carrier minimums apply.

Enroute: IFR condition (dependent upon NOTE next page).

Destination: Any field where VFR conditions are forecast for the ETA plus two hours, or All Weather Air-Stations if IFR conditions are forecast for the ETA. The approach shall not be below range minimums altitude nor in any case below 600 foot ceiling and one mile visibility.

Alternate: Must be VFR and forecast to remain so for ETA (to the alternate).

Standard rating. If you hold this rating, you may clear on IFR in planes of a Standard or higher rating under the following conditions and those of Single Piloted Type Clearance (see next page).

Takeoff: Not below 300 foot ceiling and one mile visibility.

Enroute: IFR conditions (dependent upon NOTE next page).

Destination: Any field, either VFR or IFR. For radio range approach same minimums apply as on Restricted ratings. For GCA approach, not below GCA minimums nor in any case below 300 foot ceiling and one mile visibility.

Alternate: Must conform with Civil Air Regulations Part 60.

Special rating. If you hold this rating, you may clear yourself. There are no set minimums. Only restrictions are those of CAR and of Single Piloted Type Clearance (see below).

Single Piloted Type Clearance. If you are flying a single pilot type aircraft, you must also conform to the following regulations in addition to those governing your individual instrument rating.

You may clear VFR from any field provided your destination and alternate are designated All Weather Air Stations or are VFR and are forecast to remain so for the respective ETA plus two hours. Your IFR flight plan must provide for the avoidance of known congested air traffic control areas, either by the utilization of high altitudes or by routing around such areas.

NOTE: NO FLIGHT SHALL BE MADE THROUGH KNOWN OR ANTICIPATED ICING CONDITIONS UNLESS THE AIRPLANE EQUIPMENT PROVIDES ADEQUATE PROTECTION AGAINST ICING, OR THE ALTITUDES ASSIGNED PERMIT CIRCUMVENTING THE ICE LEVEL.

INSTRUMENT RATINGS

Qualifications for the *Restricted, Standard,* and *Special* instrument ratings are contained in ACL 46-49. All types of ratings must be renewed every 12 months.

WARNING

No flight in Naval aircraft will be made below 500 feet except where the mission of the flight requires otherwise.

FLIGHT PLANNING

Flight planning calls for due consideration of all possible factors that might affect your flight. Plan your flight before takeoff. Think out in advance what you will do in case of an emergency and execute that plan without hesitation when the emergency arises. In planning a flight, ask yourself the following questions:

(1) What is the range of my aircraft?

(2) How long will it take to complete this flight?

(3) Can I arrive at my destination before sunset?

(4) Is the weather marginal anywhere enroute?

(5) Does the forecast of weather at my alternate destination predict weather marginal?

(6) Have I checked my weight and balance to insure the plane is correctly loaded?

(7) Have I checked NOTAMS and the latest *Airman's Guide* as well as the sectional maps to locate any danger or caution areas enroute and to check conditions of my destination and alternate fields?

(8) Have I all the necessary charts not only for my intended path but for the area surrounding it?

(9) Am I familiar with the necessary procedures and equipment in the plane in case of an emergency?

(10) What are my plane's operating limits?

(11) Have I consulted the Air Forces Radio Facilities Charts to find compulsory reporting points, radio facilities and frequencies enroute and at destination, and minimum altitudes enroute?

REFERENCE: FSB 17-45

FLIGHT CLEARANCE

OBTAINING CLEARANCE

Getting a clearance for flight and filing a flight plan are different things even though they are generally performed in the same act—filling out a clearance form. A clearance is permission to make a flight; filing a plan is merely an announcement of indication or plan of flight.

Table 1-2-1 shows by what authority and on what type of clearance you may clear different type fields.

REFERENCE: ACL 97-47, 46-49

TABLE 1-2-1 CLEARANCE DATA

CLEARING FROM	WITH INSTRUMENT RATING	WITHOUT INSTRUMENT RATING
Navy or AAF Field	From Navy clearance authority or base operations [3]	From Navy clearance authority or base operations
CAA field	Obtain IFR [1] clearance form, or file VFR flight plan with CAA [3]	File VFR flight plan and notify AFFS [2]
Field with no communications	Fly VFR only to nearest Navy or AF facility [3]	Fly VFR only to nearest Navy or AF facility

[1] In accordance with CAR and Navy directives.
[2] By telephone collect or by radio immediately after takeoff.
[3] Special instrument card holders can clear themselves.

NOTE: ALL SINGLE-PILOT TYPE AIRCRAFT MUST PROCEED IN ACCORDANCE WITH SINGLE-PILOTED TYPE CLEARANCE.

AIRCRAFT CLEARANCE
NAVAER-423 (REV. 9-46)

1

OPERATIONS OFFICE U.S.NAVAL AIR STATION Anacostia, D.C.

DATE

AIRCRAFT MODEL | SERIAL NO. | HOME STATION

FLIGHT PLAN ☐ AIRWAYS ☐ DIRECT

PILOT (Print name) (Rank) (Organization)

DESTINATION | ALTERNATE | CRUISING ALT. (MSL)

NAME, INITIALS, RANK AND HOME STATION OF OTHER OCCUPANTS (State whether crew or passengers. List additional passengers on separate sheet.)

ETD | TRUE AIRSPEED | ETE | HOURS OF FUEL

FLIGHT ROUTE AND FIXES TO BE REPORTED EN ROUTE

I have the necessary authority to make this particular flight and am physically qualified to make this flight in accordance with current BuAir, NCNO (air) and Station regulations and directives. I am familiar with the flight controls, gasoline system, and flying characteristics of this airplane, and am competent to pilot aircraft in accordance with Part III of the Air Station Regulations. I am familiar with the Washington 'Prohibited areas'. I understand that any plane assigned N.A.S., Anacostia shall not be left by me at any other field or location because of weather, mechanical condition or other reason, except in case of extreme emergency and then only with the express permission of the Commanding Officer. N.A.S., Anacostia, D.C.

TOWER FREQUENCY 396

TRANSMITTING FREQUENCIES KC. KC. MC.

☐ RADIO RECEIVER ONLY ☐ NO RADIO

ARRIVAL REPORT ☐ AIRWAYS COMMUNICATION SYSTEM (FX) ☐ OTHER

PILOT INSTRUMENT QUALIFICATIONS ☐ RESTRICTED ☐ STANDARD ☐ SPECIAL

TYPE OF CLEARANCE REQUESTED BY PILOT ☐ INSTRUMENT ☐ CFR

PLANE INSTRUMENT QUALIFICATIONS ☐ RESTRICTED ☐ STANDARD ☐ SPECIAL

WEATHER (*Altitudes are based on mean sea level. Ceilings express cloud height above terrain.*)

TYPE OF CLEARANCE REQUIRED BY EXISTING AND FORECAST WEATHER (ETE + 2 HOURS) ☐ CONTACT ☐ RESTRICTED N ☐ STANDARD N ☐ SPECIAL N

DESTINATION (EXISTING) TIME | ALTERNATE (EXISTING) TIME

ROUTE FORECAST

FORECAST FOR DESTINATION (ETE+2 HOURS)

FORECAST FOR ALTERNATE (ETE+2 HOURS)

WINDS ALOFT AT POINT OF DEPARTURE	AT PROPOSED CRUISING ALT.	WINDS ALOFT AT MID-ROUTE	AT PROPOSED CRUISING ALT.	WINDS ALOFT AT DESTINATION	AT PROPOSED CRUISING ALT.
	AT		AT		AT
	AT		AT		AT

BEST ALTITUDE CFR | AVERAGE WINDS BEST ALT. | IF INSTRUMENT AVERAGE WINDS AT ALT.

CLEARANCE VOID AFTER | FORECASTER (AEROLOGIST) (Rank or rating) SIGNED

Loading of this airplane for this flight is as indicated on submitted form. Thorough consideration has been given to the necessary maps, emergency equipment, notices to airmen and weather conditions affecting the flight. I am familiar with local flight rules and regulations and Civil Air Regulations.

PILOT SIGNED | CLEARANCE AUTHORITY SIGNED | APPROVED BY AIRWAY TRAFFIC CONTROL TIME INIT.

WEIGHT AND BALANCE | FORM | ACTIVITY WHERE FILED | DATE FILED | WT. & BAL. OFFICER | TRANSMITTED TO TOWER BY | ACTUAL TIME OF TAKE-OFF

DEPARTURE RECORD *Line Crewman will complete this stub and deliver to Operations Office.*

PILOT | NUMBER OF PERSONS ON BOARD

AIRCRAFT MODEL | SERIAL NO.

TIME AND DATE OF DEPARTURE | LINE CREWMAN SIGNED

Figure 1-1-1. NavAer Form 423.

CLEARANCE FORM

Use. Use NavAer Form 423 (Revised) in the clearance of all aircraft for flight except for:

(1) Local flights under VFR

(2) Operational flights

(3) Student training flights under VFR and in a specified training area

(4) Training flights of fleet air commands which do not cross civil airways

Procedure in using NavAer Form 423 (Revised).

(1) Before you get the weather, fill in all information required above the heavy black line separating weather from flight plan. (See fig 1-1-1.)

(2) Present form with weight-and-balance data to weight-and-balance representative for appropriate entries and initialing before getting clearance authority to sign form.

(3) Deposit departure record with line crewman prior to takeoff and present arrival record to line crewman on arrival at destination.

(4) Always present page two of the form to operations at point of arrival.

REFERENCE: ACL 97-47

FORM F

Before requesting clearance, you must present a Form F (fig 1-1-2) to the weight-and-balance officer or his representative. This form is obtained from the AN01-1B-40 *Handbook of Weight and Balance Data* which shows the actual loading of the aircraft or sufficient data for computation of the Form F. Weight-and-balance classifications for individual aircraft models are established in Technical Order 83-45.

Only class 2 aircraft assigned for and undergoing test and captured aircraft are exempt from this rule. When class 2 aircraft are being ferried and AN01-1B-40 handbooks are not valid or are missing from the aircraft, these aircraft are also exempt.

REFERENCE: ACL 97-47; TO 83-45

TRANSPORT AND CARGO
WEIGHT and BALANCE CLEARANCE

FORM F

DATE ______ AIRPLANE ______ FROM ______

FLIGHT ______ SERIAL NO. ______ TO ______

PRELIMINARY ESTIMATE	WEIGHT
ALLOWABLE GROSS WEIGHT	
TOTAL AIRPLANE & FUEL WT. *(Ref. 10)*	
ALLOWABLE LOAD *(Ref. 11)*	

LIMITS

Recommended Max. Take-off Gr. Wt. ______ LB.

Recommended Max. Landing Gr. Wt. ______ LB.

Permissible CG Limits ______ to ______ % M.A.C.

REF.	ITEM	WEIGHT	INDEX OR MOMENT
1	BASIC AIRPLANE *(from chart C)*		
2	OIL (*Gallons)*		
3	CREW *(No.)*		
4	CREW'S BAGGAGE		
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT		
7	EXTRA EQUIPMENT		
8	OPERATING WEIGHT		
9	TAKE-OFF FUEL (*Gallons)*		
10	TOTAL AIRPLANE & FUEL WEIGHT		
11	DISTRIBUTION OF ALLOWABLE LOAD		

• REMARKS •

COMPT.	PASSENGERS NO.	PASSENGERS WEIGHT	BAGGAGE	MAIL	CARGO	WEIGHT	INDEX OR MOMENT
A							
B							
C							
D							
E							
F							
G							
H							
I							
J							
K							
L							
M							
N							
O							
P							

COMPUTER PLATE NO. ______ *(If Used)*

CORRECTIONS *(Ref. 13)*

COMPT.	ITEM	CHANGES (+ or −) WEIGHT	CHANGES (+ or −) INDEX OR MOMENT/
TOTAL WEIGHT REMOVED		−	−
TOTAL WEIGHT ADDED		+	+
NET DIFFERENCE *(Ref. 13)*			

REF.	ITEM	WEIGHT	INDEX OR MOMENT
12	TAKE-OFF CONDITION *(Uncorrected)*		
13	CORRECTIONS *(If required)*		
14	TAKE-OFF CONDITION *(Corrected)*		
	TAKE-OFF CG IN % M.A.C.		

NOTE: Moment will be used only when the balance computer is not available.

COMPUTED BY ______

WEIGHT & BAL. OFFICER ______

PILOT ______

(FOR TACTICAL MISSIONS, USE OTHER SIDE)

Figure 1-1-2. Form F.

PLAN 62

Plan 62 is conceived to give you aid and advice, but not to give you orders. It offers to Naval pilots the services of the US Air Forces Military Flight Service Communications System. To receive the aid and advice of this service, adhere to the following procedures:

Filing flight plans. (1) *At Air Force or Navy fields:* Do this in the normal manner.

(2) *At nonmilitary fields.* Under IFR conditions, file IFR flight plans and get a clearance from the local CAA office. If no CAA communications are available, ask Flight Service to request clearance from CAA-ATC for you. Always file a flight plan (VFR or IFR) with the nearest Air Force Flight Service center. Do so by calling long distance telephone collect or by calling the nearest military airways air/ground station or tower by radio as soon as practicable after takeoff.

Merely file the flight plan with Flight Service when clearing from a nonmilitary field. Only a CAA-ATC clearance is necessary.

Closing flight plans. (1) *At Air Force or Navy fields.* Do this in the normal manner.

(2) *At nonmilitary fields.* File your flight plan and RON with Flight Service via long distance telephone collect, unless a military unit at the field has a communications tie-in with Flight Service.

Change of flight plan enroute. Get clearance for change of flight plan, VFR to IFR, from CAA-ATC. Merely notify CAA-ATC of a change from IFR to VFR. Advise Flight Service of the intended change through the most practicable medium, either military airways air/ground station or tower. If unable to contact CAA, ask Flight Service to request permission from CAA for your proposed change.

Aircraft position reports. Make IFR position reports to CAA compulsory reporting points.

Advisories. Weather and traffic information is available from any CAA radio station. For additional operational information with respect to your flight, contact any military airways air/ground station.

The frequencies and call signs of military airways air/ground stations may be found in Air Force Radio Facility Charts.

Remember that Plan 62 does not relieve you of any responsibility for normal clearance and position report procedures. It is merely an extra aid to help you as a pilot, not to give you orders or flight clearance.

REFERENCE: ACL 51-47

PILOT'S RESPONSIBILITIES

CLASSIFICATION OF PILOTS

Navy pilots are assigned to one of three categories:

Service group I: Pilots under 40 years of age; unlimited duty.

Service group II: Pilots of 40 to 50 years of age or younger pilots who, for other reasons, are not qualified for service group I but are qualified for unlimited flying in service group II; not assigned to VF or VA squadrons, but can, if physically qualified, fly aircraft on and off carriers.

Service group III: Pilots over 50 years of age; normally expected to perform flights of administrative and broad command status.

The Chief of the Bureau of Medicine and Surgery establishes physical standards for each of the three groups. Normally, pilots below the rank of captain will not be assigned to service group III. Exceptions will be pilots recovering from injury or those not physically qualified for other service groups whose flying experience and the needs of the Navy sufficiently justify their employment in a limited status.

REFERENCES: ACL 97-47; Navy Department Bulletin, 15 April 1948

RHIP . . . RHIR

Rank has its privilges. . . . Rank has its responsibilities. Your rank is the absolute command of the airplane you fly. Your *privilege* is to refuse the plane for flight at any time you have reason to believe the aircraft, any of its equipment, or any of its crew is not safe for flight. Having that privilege, you also have *responsibilities*. These responsibilities include:

To the Navy. (1) To conscientiously exert your energies and abilities to the safe and purposeful handling of your aircraft.

(2) For the security of your aircraft when left on a field, beach, body of water, or other area where naval or military personnel cannot take custody; or, in case of an accident, until you are relieved of the responsibility by proper authority.

To yourself. (1) To maintain your proficiency as a Naval Aviator.

(2) To avoid conduct which would in anyway reflect on your integrity as a Naval officer.

To your crew. (1) To instruct and drill your crew in abandoning and ditching procedure.

(2) To see that all emergency equipment, life rafts, life vests, and parachutes for each crew member or passenger are aboard the plane and that each individual knows how to use them.

(3) To insure that all crew members and passengers know how to use oxygen equipment, that all oxygen equipment is functioning, and that they use it any time you fly above 10,000 feet. Only in case of emergency should you fly above 10,000 feet when the aircraft lacks sufficient oxygen equipment and then for only as short a period as possible. (See section III, *Physiology of Flight.*)

To other pilots. (1) To follow your flight plan as filed or to notify a military airways air/ground station in case of a change of flight.

(2) To give other planes wide berth for clearance when passing in flight.

(3) To report to medical authorities when for any physical or mental reason you feel unfit to fly.

To those pilots who will fly the same aircraft. (1) To report any discrepancies or failures you may encounter while flying the plane.

(2) To report all instances in which you fly the plane in excess of operational limits.

SAFEGUARDING CLASSIFIED MATERIAL

Publications of the Navy Department and other defense agencies are classified according to the value which the information contained in them would have to enemy governments. Security regulations are more strict as that value and the classification increases.

Remember that other pilots, ships, and commands have the same publications as you. They depend on you, as you do upon them, to keep the information contained in the publications secret.

If secret or confidential publications are lost or compromised by theft, capture, salvage, inspection, or photography, immediately notify the Chief of Naval Operations by dispatch, making your operational commander an information addressee. Any attempt to conceal the loss of a publication by false reports is punishable by General Court Martial.

Certain registered, classified publications may be taken up in an aircraft at the discretion of the operational commanding officer when the mission of the flight warrants. Authority is contained in the publication itself or in current allowance tables.

You are responsible for all publications and classified matter in your airplane. All registered and classified publications must be carried in a weighted container when not in use. In event of a forced landing, if it is necessary to prevent any material from being compromised:

(1) Insure that all registered publications are destroyed or sunk in deep water.

(2) Destroy *restricted* equipment beyond repair.

(3) Destroy *confidential* and *secret* equipment beyond recognition.

AIRFIELD MARKING

DANGER AREAS

Yellow flags, strips of fabric, or pyramids by day and red lights by night are used:

(1) To mark small holes or soft spots in the usable part of a landing area.

(2) To outline relatively large areas that are unsafe for landing.

(3) In the center of an area to indicate that the entire area is unsafe for landing.

(4) In the form of a large cross to indicate that a well-defined runway is closed.

NOTE: WHEN PERSONNEL ARE ENGAGED IN REPAIRING CLOSED TARGETS, THEY DISPLAY PIECES OF YELLOW FABRIC IN A LARGE X ADJACENT TO GROUND TARGETS AND YELLOW DYE AROUND WATER TARGETS. IF YOU FAIL TO RECOGNIZE THE SIGNALS AFTER STARTING A RUN ON A TARGET, PERSONNEL REPAIRING THE TARGET WILL FIRE RED PARACHUTE FLARES THAT BURN FOR 30 SECONDS. WHEN YOU SEE ANY OF THESE SIGNALS, DO NOT MAKE A RUN ON THE TARGET.

REFERENCE: ACL 97-47

RUNWAYS

Runways are marked with numbers and letters at the end to indicate the direction of the runway as well as to distinguish one runway from another. Numbers are a division by 10 of the heading of the runway; for example, *35* for 350 degrees. Letters are used where two or more runways parallel each other and need to be distinguished, as *L*, left; *R*, right; *C*, center.

Symbols are located at the end to indicate the runway length in feet. Each 50-foot symbol indicates 1,000 feet of runway.

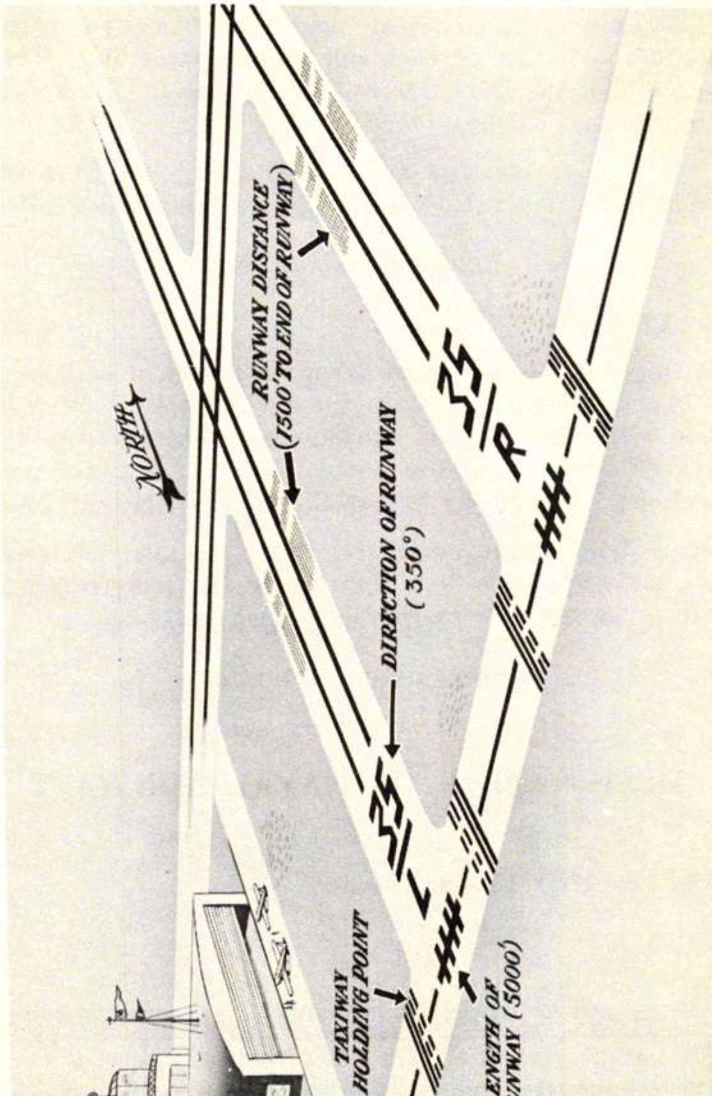


Figure 1-4-1. Airfield marking.

Longitudinal stripes are painted on the runway parallel to and 15 feet on each side of the center line. They begin and end 25 feet from the markers at each end of the runway.

Distance markers are located 1,500 feet from the ends of the runway to warn the pilot. (See fig 1-4-1.)

REFERENCE: ACL 35-48

TAXIWAYS

A single stripe is painted down the center of each taxiway. It stops 10 feet from runway symbols at intersection with the ends of runways and 10 feet from the nearest edge of the runway stripe at other runway intersections. At taxiway intersections, the stripes intersect.

A holding point marker to warn the pilot intersects the taxiway stripe at a right angle 100 feet from any runway or taxiway intersection. (See fig 1-4-1.)

REFERENCE: ACL 35-48

DESIGNATION OF NAVAL AIRCRAFT

TYPES AND CLASSES

TYPES

V	H	Z	K	M
Heavier-than-air (fixed wing)	Heavier-than-air (rotary wing)	Lighter-than-air	Pilotless A/C	Guided Missiles

CLASSES

VF	VA	VP	VR	VU	VT	VG
Fighter	Attack	Patrol	Transport	Utility	Training	Gliders

MODEL DESIGNATIONS

A sample of aircraft model designation is given below with explanations of the symbols used. Although different symbols are used for different types of aircraft, they always occupy the same position in the group.

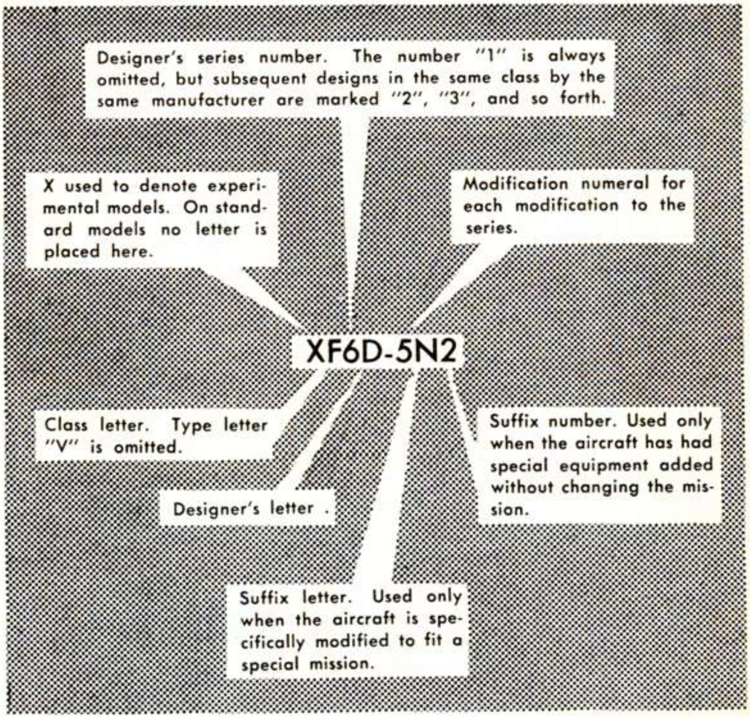


Figure 1-5-1. Sample aircraft model designation.

The pattern illustrated in figure 1-5-1 designates an experimental fighter, the sixth fighter designed by Douglas Aircraft for the Navy. This particular model has undergone five modifications and is to be used for night operations. Two pieces of equipment have been added to the original night fighter version.

Section II. FLIGHT SAFETY

2

GENERAL

THE OLD PILOT

In deciding to become a Naval Aviator you chose to join the ranks of a group of men who are fighting a battle for survival—a battle against cold statistics. The fight is not easy. The little black figures on the white page show that approximately one out of every hundred Naval Aviators on active duty will be killed this year. Your contemporaries in civilian life have, according to insurance companies (and they make money by being right), a life expectancy 12 years greater than you.

Flying Navy aircraft is not selling ties in a haberdashery. This can be a dangerous business. It all depends on how you approach it. Assume a bravado attitude, take unpredictable risks and you make it dangerous. Maybe this year the odds won't catch up with you. But next year—well, the odds will be just about the same. You can't win 'em all!

It was knowledge of the danger in taking unpredictable, unnecessary chances that prompted the expression, "*There are old pilots and there are bold pilots, but there are no old, bold pilots.*" The old pilot, for example, a four-striper, attained age and rank not only through luck and perseverance, but, mainly, through attention to what he was doing. One-third of his classmates are dead as a result of aircraft accidents.

There is a big difference, of course, between being a *bold* pilot and being a *safe* pilot. The bold pilot is willing to take all sorts of chances. He's the fellow who "can fly the box it came in." He's the guy who told the aerologist: "You put the weather on it, Bud, I'll fly it." He's the pilot who crashed into the side of a mountain in a rainstorm months after his instrument card expired.

The safe pilot knows that there are plenty of hazards in Naval aviation. He knows that he won't be worth a plugged nickel to his country or the Navy if he gets killed in a peacetime training accident. He's the fellow who was plenty good in combat when bravery really counted, but was smart enough to down a training plane when the mag check was not up to requirements. He's the chap who, when on a proficiency flight, made a 180-degree turn and went back to his home station upon encountering a severe front. Yes, he's the fellow who has learned to fly right past his house without buzzing it, and he's the guy who knew the ditching procedure so well that he hardly got wet when his engine quit during carrier qualifications. He's not a "Hot Rock." *He's just a guy that everyone wants to fly with.*

Only by playing it smart—and safe—does a pilot become old. To rate among those pilots whose lifetime expectancy is high, you must absorb knowledge about your airplane and all the things which affect it in flight and on the ground. You must use that knowledge to develop safe, correct habit patterns. Use these patterns as basic tools on which to rely with confidence, as the guides for action in the various conditions under which you must make decisions.

By having a thorough knowledge of flight safety, the smart pilot respects the limitations and dangers of flying enough to keep from being a show-off. By using that knowledge to perfect safe flying habits, he develops self-confidence that sees him safely through emergencies.

Your mother didn't give birth to you, the little red school house didn't educate you and the Navy didn't train you to be a statistic—and a dead one at that. **Be smart—be safe!**

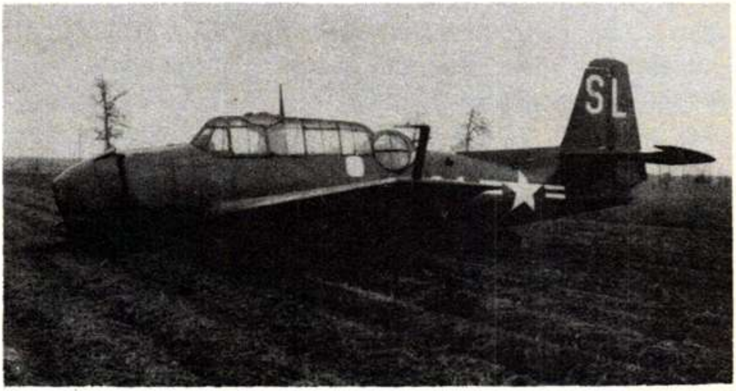
AIRCRAFT ACCIDENTS

By a large majority, pilot error is the chief cause of aircraft accidents. Mishaps which fall into that category can be further broken down into those which are a result of:

(1) "Doping-off", or

(2) Willful violation of orders

"Doping-off". A good example of the "doping-off" accident is found in the crashes which occur because a pilot has been inattentive to his fuel supply or fuel-selector valves. Constantly check your fuel gage in order to switch tanks when one indicates close to empty and be certain you are shifting to a full tank.

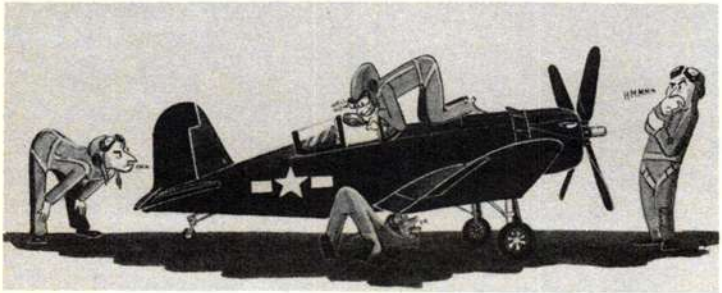


"He didn't watch his fuel gage. He doped off."

Willful violation of orders. Accidents resulting from the pilot being unfamiliar with the type of aircraft he is flying are typical of the ones attributable to willful violation of orders. Qualification in a particular type aircraft varies according to the type and the command to which you are attached. If you are not qualified in the particular type because of insufficient time or not having flown that particular type recently, you must receive a checkout from the operations officer. Disregard for this rule may result in your failure to remember some emergency procedures, the location of some pertinent controls, or some flight performance found only in that type aircraft, and, subsequently, to the mishandling and crash of the plane. *Never let your ego or your desire outweigh your reason.*

LIMITATIONS OF PILOT AND PLANE

The smart pilot knows and does not try to exceed his own limitations and those of his aircraft. To familiarize yourself with aircraft limitations, you should devote much study to the pilots' handbook of your aircraft, the pertinent Technical Orders and Technical Notes that affect your aircraft or the particular mission which you are assigned, and the Aviation Circular Letters that place restrictions on you or your aircraft. (A full list of the publications which the pilot should study is contained in section I, *General.*)



"Make sure you know your aircraft."

PROCEDURES PRIOR TO TAKEOFF

PERSONNEL HAZARDS

Reciprocating engine aircraft. Be alert for spinning propellers. Should you happen to get too close to one, you will be lucky to get away with only the loss of a limb. The blow from even an idling propeller may kill you.

Jet aircraft. The jet aircraft is like an alligator. It can do damage to you with its front or tail end. As you respect the snap of the alligator's mouth and the slap of its tail, so must you respect the suction of the jet's nose and the blast from its tail.

The suction of a jet intake is powerful enough to draw a man into the scoop. At 20 feet, the blast effect from the tail is extremely powerful. Even when the engine is not running, a jet airplane may be dangerous because the tail pipe or adapter remains hot for about ½ hour after the engine has stopped. Never touch a jet's tail pipe or adapter unless you are absolutely sure it is cool.

Secure all loose gear around jet aircraft. Never walk too close to the intake when you have loose articles such as rags, wrenches, watches, hats, and the like on your person. More important than destroying the article is the damage which will result to the engine.

REFERENCE: ACL 123-47, FSB 2-47

INSPECTION OF EMERGENCY EQUIPMENT

Before each flight, always check your personal and emergency equipment:

Life vests. (1) See that the metal valve stem of each oral inflation tube is provided with a lock nut to prevent accidental loss of the valve.

(2) See that CO_2 cylinders are properly placed and have not been accidently discharged.

Life rafts. Insure that the life raft has been inspected within the three months' time limit.

Emergency escape provisions. Insure that safety wiring is in place to prevent accidental release.

Parachutes (1) See that the ripcord pins are not bent and that the seal is unbroken.

(2) See that the corners of the pack are neatly packed and that none of the canopy is visible.

(3) See that the pack-flap elastic cords are drawn tight.

Oxygen equipment. If you contemplate making a flight using oxygen, as you must do on all flights above 10,000 feet, see that the equipment is in the plane and attached and that sufficient oxygen is available.

REFERENCES: BAM 13-601, 13-701; TO 106-43; ACL 97-47

INSPECTION OF AIRCRAFT

Climbing from the field or carrier after takeoff, midway through your flight at an altitude of 5,000 feet, or even 10 feet from the runway or deck on the return landing is no time to discover that there is something wrong with the controls, wings, or fuselage of your airplane. Before you leave the line is the only safe time to discover discrepancies in the aircraft. Don't get in the cockpit without inspecting your plane to see that the controls are free and that there are no loose articles such as rags, waste, tools, and the like, loose and capable of drifting into and fouling the controls in flight.

You can never tell when an emergency may occur. If you should be forced to make a crash landing or ditch with the airplane, you would find that loose, weighty material such as cargo or equipment shifting in the airplane will only increase the danger of your landing. Before taking off make sure that all cargo and equipment is properly secured. The primary responsibility for the proper security of cargo and equipment lies with you.

REFERENCE: ACL 97-47

YELLOW SHEET

It is the responsibility of the plane captain to check the aircraft each day before it is flown and to mark all discrepancies on an aircraft flight report form, commonly called the *yellow sheet*. The yellow sheet indicates not only the discrepancies of the aircraft, but also a report of whether it is ready for flight. When made out for single-engine aircraft the yellow sheet consists of a single sheet, NavAer 2430. When made out for multiengine aircraft, the form used is NavAer 2429 and consists of three duplicate sheets.

Pilot procedure with NavAer 2430. Check to see that the form is signed by the plane captain and then signify your acceptance by also signing. (See fig 2-2-1.) This form is retained at the station and must be completed when you return unless it involves the transfer of aircraft.

AIRCRAFT FLIGHT REPORT—VP and VR

NAVAER-2429 (8-46)

IMPORTANT—See instructions on front cover before filling in this form.

DATE	PLANE TYPE	BOMB LOAD	AMMO LOAD
SQUADRON	MAINTENANCE ACTIVITY	ROCKET LOAD	TORPEDO LOAD
LOCATION	SQUADRON PLANE No.	TOTAL OIL *(Gallons)*	TOTAL FUEL *(Gallons)*
BUREAU PLANE No.	BUREAU ENGINE No.(s)	TANK CAPS SECURE	

I certify that this aircraft has this day been inspected prior to this flight by me or under my supervision in accordance with existing instructions and that the aircraft is ready for flight.

SIGNED ____________ MAINTENANCE CREW LEADER OR PLANE CAPTAIN

I have examined discrepancy report of last flight. I accept this aircraft for flight. I have presented a valid Form F or NAVAER-2300, AUTHORIZED STANDARD LOADING form, to the Weight and Balance Officer as required.

SIGNED ____________ PILOT

The following information must be filled in by pilot:

TYPE OF FLIGHT

ENGINE TIME RECORD

	NO. 1	NO. 2	NO. 3	NO. 4
HOURS THIS FLIGHT				

AIRCRAFT TIME RECORD

TIME OUT	TIME IN
TOTAL FLIGHT TIME	NUMBER OF LANDINGS

AUXILIARY POWER UNIT TIME	BOMBSIGHT TIME	AUTO PILOT TIME

INSTRUMENT TIME

PILOT

PILOT

PILOT

NIGHT FLIGHT TIME

PILOT

PILOT

PILOT

PILOTS, AIRCREWMEN OR PASSENGERS *(Please print)*

NAME AND RANK, OR RATE	FLIGHT STATION	NAME AND RANK, OR RATE	FLIGHT STATION

Figure 2-2-1. Yellow-sheet

Pilot procedure with NavAer 2429. Check to see that the form is signed by the plane captain and then signify your acceptance by signing. Leave the top sheet (yellow) at the station and take the other two sheets with you. On return, complete the second sheet (white) and turn it in to maintenance. The third sheet (pink) is left in the book as a permanent record of the flight and also to inform the next pilot of action that has been taken on any reported discrepancies.

Following your flight, place in the remarks column of the form (either 2429 or 2430) any defects noted in flight, any undue stresses to which the aircraft was subjected while in your possession, or any discomfort experienced in flight from exhaust gases or condition of the aircraft. If you experienced no discrepancy, place the words "no defect" in the remarks column. If the airplane was subjected to abnormal stresses or a major defect was noticed, make a note of the defect on the yellow sheet and make an oral report of same according to squadron doctrine immediately after landing.

NOTE: SIGNIFYING THE YELLOW SHEET WITH YOUR SIGNATURE DOES NOT MAKE YOU RESPONSIBLE FOR PROPER INSPECTION OF THE AIRCRAFT. ON THE OTHER HAND, YOU SHOULD ALWAYS MAKE AN INSPECTION AND REPORT TO THE FLIGHT OFFICER WHAT CORRECTIVE MEASURES ARE REQUIRED BEFORE YOU WILL ACCEPT THE AIRCRAFT FOR FLIGHT.

REFERENCE: BAM 4-302, 4-303, ACL 153-46

REMOVING ICE

Remove carefully and completely all frost and ice on your airplane before taking off. A barely visible frost deposit on the wings doubles the drag and greatly reduces the lift.

REFERENCE: FSB 12-44

GETTING SQUARED-AWAY IN THE COCKPIT

Shoulder harness. Check to insure that the shoulder harness is firmly anchored behind the seat. Never pass the harness directly over the seat back. Instead, pass it over the reinforcing bar behind the seat. **Use the shoulder harness on every flight.**

Radio check. Always contact the tower by radio before leaving the line. If you are unable to do so, do not taxi out. Determine what the trouble is before leaving the line.

REFERENCE: TN 28-43

TAXIING

Taxi accidents seldom cause fatalities but usually result in considerable damage to the aircraft. You can help reduce accidents of this nature by abiding by the following rules:

(1) Taxi at a slow rate of speed to permit improved vision by S-turning and to retain positive control at all times.

(2) Never taxi into any area without first making sure that it is clear of obstacles and personnel.

(3) Maintain a sharp lookout in all directions while taxiing. Raise the seat to its maximum height and adjust rudder pedals to allow good brake action for positive control.

(4) Taxi far enough behind other planes to avoid nose-ups or collisions should the airplane in front of you suddenly stop.

(5) After landing, be certain that the area is safe for taxiing before adding throttle to clear the runway.

(6) Maintain radio contact with the tower while taxiing. (See section V, *Communications,* for information regarding request for taxi instructions.)

(7) Learn, understand, and respond properly to taxi signals.

(8) Never depend on automobile drivers to get out of the way of taxiing airplanes.

(9) If the engine fails while taxiing, notify the tower and keep a sharp lookout for other planes taxiing in the vicinity in order to warn them of your predicament.

(10) At night, taxi slower and with more caution than in the daytime. Check to insure that your running lights are operating before leaving the line. If they should fail while you are taxiing, notify the tower and return to the line immediately.

(11) Use brakes smoothly, applying pressure slowly. Check to insure that brakes are functioning before leaving the line and compensate for any weakness by taxiing slower than normal and by maintaining a greater interval between you and other aircraft.

REFERENCE: FSB 16-45

"Speed is for the air. Taxi slooowly."

TAKEOFF INSTRUCTIONS ON LAND

(1) Use your checkoff list. In all Naval aircraft there is a checkoff list which gives all the checks and operations a pilot must make for takeoffs and landings. The smart pilot, regardless of experience, will always use the checkoff list for either takeoff or landing. Be smart—don't try to rely entirely on your memory.

(2) Line up straight with the runway.

(3) Never takeoff in the same path and close astern to the preceding plane. This precaution will enable you to avoid the effect of slipstream. When this is not possible, allow sufficient time for the slipstream of the preceding plane to disperse.

(4) Lock the tail wheel.

(5) When flying from fields above sea level, make the following allowances for additional length of take-off run.

Aircraft with supercharged engine. Allow 3.5 percent for each 1,000-foot increase in altitude up to rated altitude. Allow 15 percent for each 1,000-foot increase in altitude above the rated altitude.

Aircraft with unsupercharged engine. Allow 15 percent for each 1,000-foot increase in altitude.

(6) Set flaps for individual aircraft according to instructions in the pilots' handbook. Should specific instructions be lacking, do not exceed one-half flap setting. Do not raise the flaps until you have excess flying speed and safe altitude.

REFERENCE: FSB 12-44; TN 42-36

PROTECTION OF FLAPS

(1) Use caution when taxiing or taking off over rough ground. Pebbles or gravel might be thrown into and damage lowered flaps.

(2) Never lower flaps when flying at speeds in excess of the specified speeds listed in applicable technical orders and pilots' handbooks.

REFERENCE: TN 42-36

STALLS AND SPINS

RECOVERY

The following procedures are recommended for recovering from stalls and spins.

Stalls. If the plane stalls, push the elevator control forward with a brisk movement and increase power.

Normal spins. (1) If a spin develops, kick the rudder hard and with a positive motion full against the spin and hold. Simultaneously, retard the throttle.

(2) After about one-quarter to one-half turn, move the elevator controls full forward with a positive motion.

(3) Keep the ailerons in neutral unless otherwise required for a particular type aircraft.

(4) Hold controls in this position positively and long enough for them to take effect. Judge the time by the number of turns. If the spin is well developed, hold the controls for five full turns before attempting any other means of recovery.

(5) Unless stick forces are abnormally high and recovery very difficult, do not use elevator tab in recovery procedure.

(6) Use the throttle for attempted recovery from a spin only as a last resort.

(7) Neutralize rudder after rotation ceases.

(8) Level wings.

(9) Pull out at such a rate as to avoid placing excessive G on the aircraft, thereby avoiding another stall.

"Make pullouts from spins smooth and gradual."

Inverted spins. (1) Retard throttle.

(2) Determine the rotation of the spin. If, because of inverted flight, your head is thrown back, you will be able to see only the ground and the spin will probably

appear to be reversed. Get your vision in line with the nose of the plane. If you are unable to do this, check the turn indicator. It shows the true rotation of both normal and inverted spins.

(3) Kick rudder hard against the direction of rotation.

(4) Pull the stick all the way back, neutralizing the ailerons.

(5) As soon as autorotation ceases, complete the recovery from the inverted position by rolling out with the ailerons or finishing the loop, or by a combination of both.

(6) Ease the throttle on very gradually to prevent engine-bearing damage.

REFERENCE: TO 113-44

SUCCESSIVE SPINS

When recovering from a normal spin, the *g* is high and a sharp pullout greatly increases the stalling speed of the aircraft. Make smooth pullouts in recovery to avoid falling off into another, or progressive, spin. Remember that one progressive spin may lead to another because stalling speed increases with each successive spin.

REFERENCE: TO 113-44

COWL FLAPS

Open cowl flaps fully only for ground running or prolonged taxiing. Cowl flaps are to be fully closed when landing in order to prevent excess cooling. Only partial flap opening is necessary for takeoff and in flight. If, immediately after takeoff, you should have to land and are unable to close cowl flaps because of lack of time, add a few knots to your landing speed.

REFERENCE: TO 48-38

STALLS IN TURNS

Stalling speed increases in turns. In turns over 50 to 60 degrees, it increases sharply. Records show that a large majority of spin crashes result from stalls during steep nose-high turns at low altitude. To prevent such accidents, the following procedures are recommended:

(1) Learn to judge angles of bank correctly.

(2) Never make a steep turn at low altitude.

(3) Know exactly how much speed you must maintain for any particular angle of bank, then add a few knots for safety.

REFERENCE: FSB 21-44

SPIRAL RECOVERIES ON INSTRUMENTS

Almost every accident attributable to loss of control on instruments has been due to diving spirals, not spins. To recover from a diving spiral when on instruments:

(1) Retard throttle.

(2) Stop the turn.

(3) Pull out of the dive at a rate which will prevent a high-speed stall or structural damage.

REFERENCE: FSB 8-44

WARNING

Never try to pull out of the dive without stopping the turn.

STRUCTURAL FAILURE IN FLIGHT

FLUTTER

If your plane experiences flutter or any unusual vibration of the wings or tail while in flight, reduce your speed immediately. Always report such an incident and be sure that a check of the plane is made immediately upon landing.

AVOIDING COMPRESSIBILITY

Compressibility generally occurs when you are making high-speed dives from high altitudes. Some points to remember regarding high-speed dives are given below.

(1) Try to prevent your airplane from yawing when diving at high speed from high altitude.

(2) When practicable, try to dive to high speed at as shallow an attitude as possible in order to have better control of speed and acceleration if compressibility occurs.

(3) Avoid high-speed accelerated stalls at high altitude.

(4) Avoid exceeding three-fourths the speed of sound at high altitudes. (This does not necessarily apply to jet aircraft.)

(5) In high-speed dives, keep a firm grip on the stick and keep ailerons neutral.

(6) Return the elevator trim tab to its initial position if, in a high-speed dive, you find it to be ineffective in reducing control forces. This will probably occur when you exceed three-fourths the speed of sound at high altitude, and, unless corrected, will result in a very abrupt pullout when reaching lower altitudes where true airspeed becomes less than three-fourths the speed of sound.

(7) Use extra caution in attempting high-speed-dive recovery when the air is bumpy.

REFERENCE: TN 20-44, 72-44

CHANGES IN ANGLE OF ATTACK

When you make a sudden large change in the angle of attack ending in a stall, *g* forces (load factors) are multiplied by the square of the ratio of entry speed to stalling speed. Thus, in performing a snap roll which is entered at a speed three times the stalling speed, the *g* factor is nine at the time the aircraft stalls out. In training planes and other aircraft not equipped for taking high stress, structural failure, even loss of a wing may result. **Never enter snap rolls or similar maneuvers at excess speeds.**

Remember that even at high speeds a small sudden change in the angle of attack can result in high load factors (*g*). Learn to gage load factors (*g*) according to the amount you are pushed down in your seat during a maneuver. Also, as a general rule, the amount of stick force applied suddenly is an indication of the magnitude of the load factors (*g*) which will be reached. Check the pressure of the forces on your body and the pressure on the stick against the accelerometer readings.

In a steady banked turn, load factors (*g*) exist in the same manner as described in sudden changes of angle of attack. Be conscious of the load factor (*g*) which exists at various angles of bank. For example, in a steady bank of 60 degrees, the load factor (*g*) is two; in a steady bank of 76 degrees, the load factor (*g*) is four. As with sudden changes in angle of attack, you should come to "feel" the load factor (*g*) in banks through pressure forcing you down in the seat and pressure on the stick.

REFERENCE: TN 63-42

MID-AIR COLLISIONS

LOOKOUT

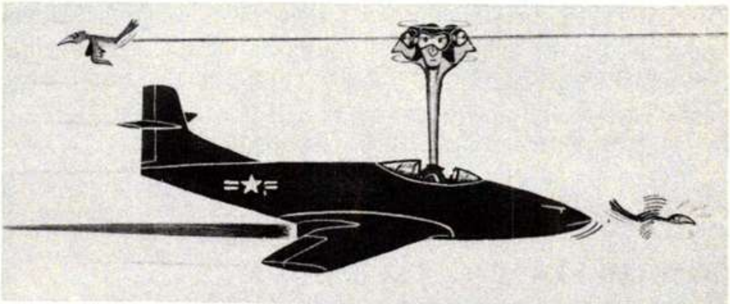
Always maintain a sharp lookout for other aircraft. Keep your head out of the cockpit as much as possible. Pilots who are accustomed to instrument flying tend to be "cockpit" flyers more than do others. Don't get into the habit of keeping your eyes constantly on the instruments during visual flight. Don't begin acrobatic maneuvers without first making sure that no other aircraft are in your vicinity.

REFERENCE: FSB 9-45

FORMATION COLLISIONS

The majority of formation collisions result from poor pilot technique during join-ups. To avoid such accidents, always remember this maxim: **Never lose sight of the plane you are joining.** Don't make steep inside turns which will blank out from your vision any of the planes in the formation. If you are going to overshoot, drop your wing and slide under before attempting a join-up.

When making cross-overs and cross-unders, never move up or down into position at the completion of the maneuver unless you have the near planes of the formation in sight. To aid each pilot in the formation, the lead pilot should, in flying close formation, hold throttle and course changes to a minimum.



"Look!"

DEFENSIVE WEAVE FORMATIONS

Section leader. When acting as a section leader, you can avoid the possibility of mid-air collisions by:

(1) Not making sharp turns which your wingman is unable to anticipate.

(2) Not flying too close, vertically or horizontally, to the other section.

(3) Not getting below the wingman and pulling up suddenly.

(4) Not leading the wingman in such a direction that the sun blinds him.

(5) Not making runs on the attacking planes simultaneously with the other section.

Wingman. To avoid the possibility of mid-air collisions when flying as a wingman:

(1) Don't fly too close and too flat on the leader.

(2) Don't lag behind on cross-overs, thereby passing too close to the opposite section.

(3) Keep your eyes on your own aircraft when near the crossing point of the weave.

REFERENCE: FSB 19-45

UNSCHEDULED COMBAT TACTICS

Combat tactics are forbidden unless prearranged. Never make a run on a transport aircraft. Civil Air Regulations forbid aircraft to fly closer than 500 feet to another plane except by pre-arrangement.

REFERENCE: FSB 16-44; ACL 97-47

VERTICAL DIVES

BOMB-RELEASING TECHNIQUE

The displacement gear on your airplane is designed to throw the bomb clear of the arc of the propeller when the bomb is released from dives ranging up to 90 degrees. In dives greater than 90 degrees, however, there is a possibility that the flight path of the airplane will intersect the trajectory of the bomb. Therefore, when making vertical bombing runs:

(1) Never exceed 90 degrees in a dive.

(2) Pull out immediately after releasing the bomb.

REFERENCE: FSB 1-46

PREVENTION OF ACCIDENTS

Strafing and dive or glide-bombing accidents are generally attributable to failure to begin recovery at a safe altitude. The number of these accidents can be greatly reduced if you:

(1) Find out the altitude of the terrain over which you are diving, be certain of correct altimeter setting, and allow for plenty of clearance over high obstacles.

(2) Find out how much altitude your plane will lose for any given loading, angle of dive, and type of pullout.

(3) Avoid snap pullouts. No training mission demands that you use maximum allowable acceleration to recover from a high-speed dive with bombs aboard.

(4) Beware of severe or abrupt use of ailerons in high-speed dives.

(5) Make constant reference to the altimeter during a dive until you become proficient at judging altitude through the bomb sight. Allow for altimeter lag of about 325 feet (as explained below).

REFERENCE: FSB 11-45

ALTIMETER ERROR

Anticipate lag in altimeter in attempting high-speed dive recovery. Remember the following facts:

(1) The altimeter reads higher than the actual altitude.

(2) The error increases as the diving speed increases.

(3) The average error in normal dives is 325 feet.

REFERENCE: TN 20-37

FLATHATTING

ACROBATIC RULES

You are encouraged to execute acrobatics, but only in conformity with the following rules:

(1) All acrobatic flying in Naval aircraft must be executed in designated acrobatic areas.

(2) You must not perform acrobatics in flight unless authorized by an approved flight schedule.

(3) If you desire to perform unscheduled acrobatics, always obtain permission from your commanding officer.

(4) Never perform acrobatics when you are carrying members of any of the armed services women's corps as passengers.

(5) Never perform acrobatic maneuvers when conditions are below the following minimums.

Altitude 1,500 feet above land or water
Visibility 3 miles
Cloud proximity ½ mile

(6) Never perform acrobatics above an overcast or when the ground or water is not visible for reference.

REFERENCE: ACL 24-49

"Finale for a Flathatter."

LANDINGS

ACCIDENTS IN LANDING

The majority of landing accidents result from stalling your aircraft during the approach. The stall may result from failure to maintain flying speed or from flying in the slipstream of another airplane. Remember the following factors concerning landings:

Maintaining flying speed. Keep intent on maintaining flying speed in each approach you make. Remember particularly to do this when making carrier or field carrier landings. Flying at such low speed as you must in making carrier approaches, you are more apt to experience trouble when your plane gets in a dangerous attitude. Sometimes the first signal you get from the landing signal officer will be a wave-off. The LSO has probably noticed that you are making a dangerous approach and that a good landing could hardly be executed. As you make your initial turn into the groove, you can determine when you are flying in a dangerous attitude by checking to see if:

(1) Your plane is too low and settling.

(2) You are in too steep a turn. (This often results from having been too close aboard in the downwind leg and/or too close to the ramp in the crosswind leg.)

(3) You are overshooting the groove.

When conditions such as these exist, you will, in taking a normal wave-off to the left, only steepen the bank and further increase the possibility of a stall and spin. Therefore, if you receive a wave-off as the *first* signal from the LSO when turning into the groove, remember that it is probably given to help you out of a dangerous attitude. The safest procedure for recovery from a near stall in a turn is to level the wings simultaneously with application of *full* throttle. This increases the lift and decreases the resultant g of the turn. To execute this procedure, you may have to fly across the wake and make your wave-off to the right. Take the wave-off to the right *only* when recovering from a dangerous attitude *while turning into the groove. After you are in the groove,* always make wave-offs to the left.

REFERENCE: FSB 1-47

Losing lift in slipstream. To avoid landing accidents which are the result of flying in the slipstream of another airplane and losing lift at low speeds:

(1) Always remember to keep a safe interval behind the preceding plane in the landing approach. Take a voluntary wave-off if you feel the interval is too short.

(2) Always maintain plenty of airspeed throughout the landing approach. If you encounter bad slipstream below 100 feet, do not try to fight the plane down to a landing. Go around again.

(3) When a crosswind exists, land on the side of the runway upwind of the preceding plane when possible.

(4) When making carrier landings, avoid stack wash by not overshooting the groove.

REFERENCE: FSB 20-45

USE OF FLAPS

(1) Anticipate a change in the plane's attitude when lowering flaps; the nose will either drop or rise, depending on the characteristics of a particular aircraft. Corrective action should be anticipated.

(2) With flaps down, maintain a speed at least 10 knots above stalling speed as a safety measure and to allow flaring out to brake the descent for a normal landing.

REFERENCE: TN 42-36

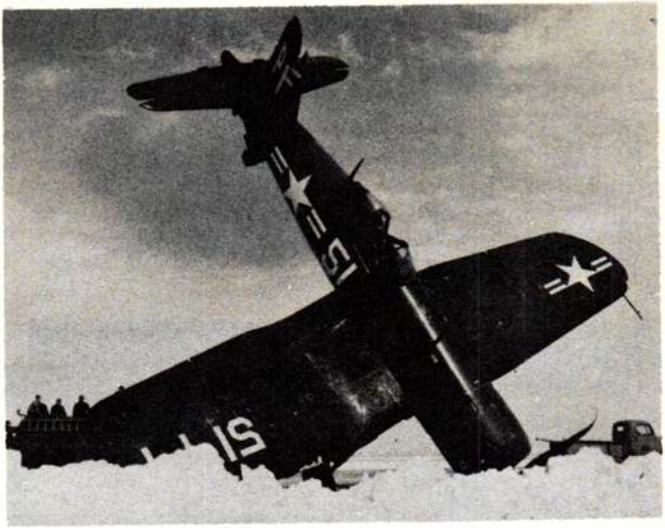
EXTENT OF LANDING

Never forget that a landing is not complete until the plane has come to a stop. Negligence resulting from over-relaxation of the pilot as soon as the plane's wheels touch the deck has been the cause of many an accident. Remember, the plane is "all yours" until it's at the chocks and the engine stopped.

REFERENCE: FSB 21-45

WARNING

When you make a hard landing which may have caused structural failure, be certain that the plane is given a thorough check before it is flown again. *Do not let your negligence kill a fellow pilot.*



"It's yours till you hit the chocks."

REPORTING AIRCRAFT ACCIDENTS

WHEN, WHERE, WHY, WHAT

If you experience an accident which results in personnel injuries or damage to your aircraft requiring assistance, notify the controlling unit or station by telephone or dispatch, whichever is available, as soon as possible. Doing so not only informs the necessary authority of the location and condition of your plane, crew, passengers, and yourself; but it will also help investigators to determine the cause of the accident and possibly help you or other pilots to keep from experiencing similar accidents.

Give as much of the following information as can be determined at the time of reporting.

(1) Bureau model and number of aircraft.

(2) Unit to which the aircraft is assigned.

(3) Time and date of accident, using local zone time.

(4) Location of accident.

(5) Purpose of flight.

(6) Type of clearance issued.

(7) Type and cause of accident. Brief description of accident including all known facts. If cause not known, probable cause should be given.

(8) Weather conditions, if involved.

(9) Full name, rank or rate, service branch, and duty status of pilot and passengers.

(10) Injuries, if any, to personnel. Include injury and identification of personnel not occupants of the aircraft.

(11) Damage to aircraft. Brief statement.

(12) Description of any material failure.

(13) A brief statement of search or salvage operations in cases where personnel have not recovered.

(14) Whether or not aircraft should be repaired on the spot.

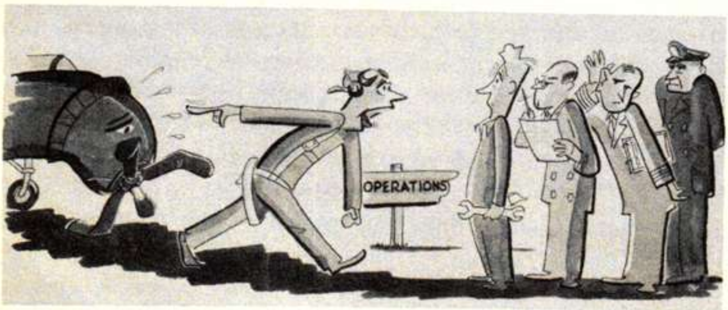
(15) Service needed, if any, or steps taken to repair damage.

(16) Spare parts needed to effect repairs.

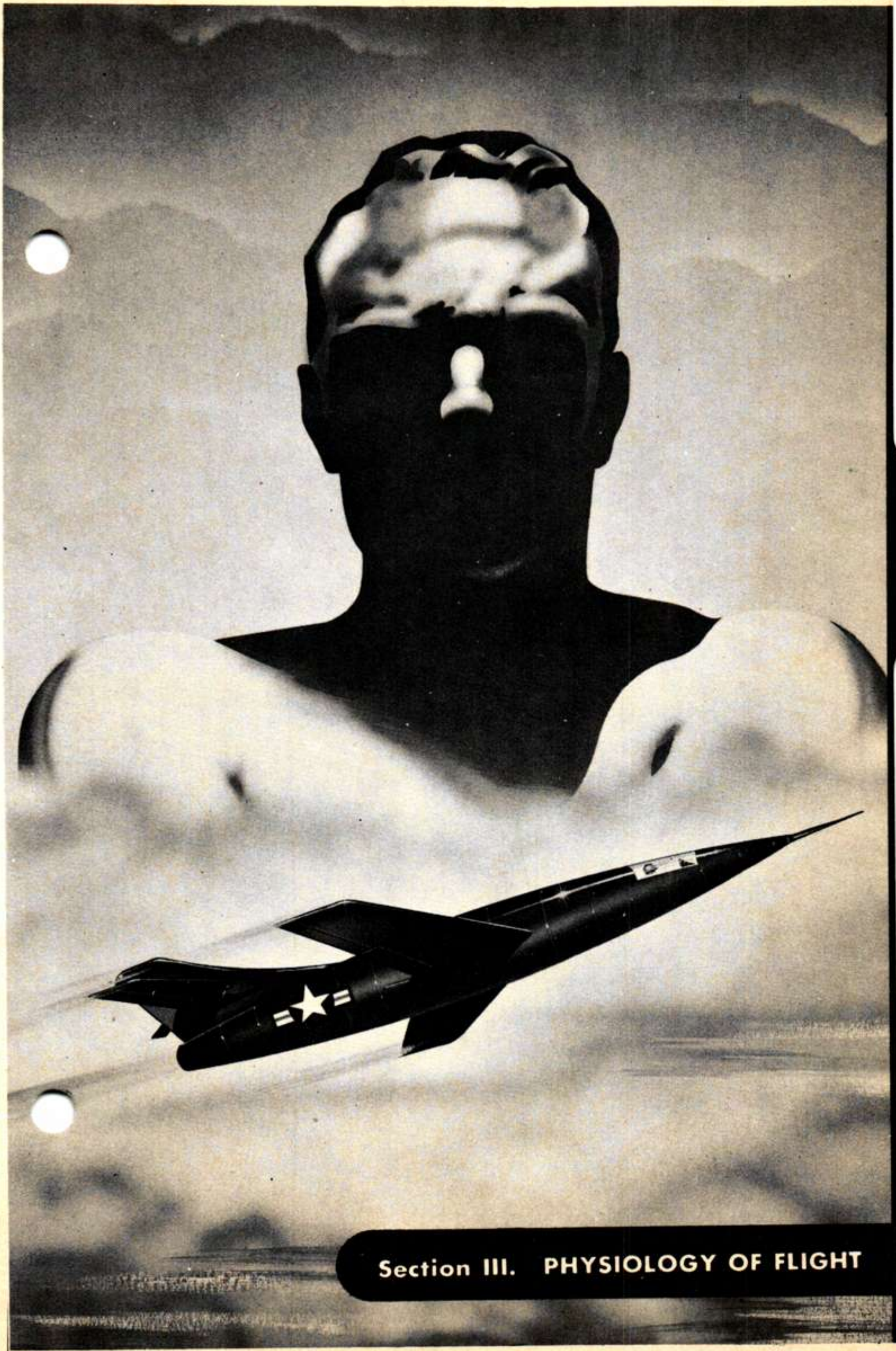
(17) Location of nearest airport, or safe landing area.

(18) Location and number of nearest telephone.

REFERENCE: ACL 81-48



"Report accidents as soon as possible."



Section III. PHYSIOLOGY OF FLIGHT

3

EFFECTS OF HIGH ALTITUDE

GENERAL

High altitude flight is any flight above 10,000 feet. Among the effects of this type of flight on the human body are:

(1) Lack of oxygen in the blood stream, known as *anoxia.*

(2) Expansion of gases in the body.

(3) Pressure changes in the middle ear and nasal sinuses.

(4) Decompression sickness, more commonly known as the *bends.*

(5) Increasing cold with increasing altitude.

All but the last of these effects are caused by the decrease of barometric pressure with increasing altitude. Of the first four, anoxia is probably more often encountered by the pilot and presents the greatest problem to him.

ANOXIA

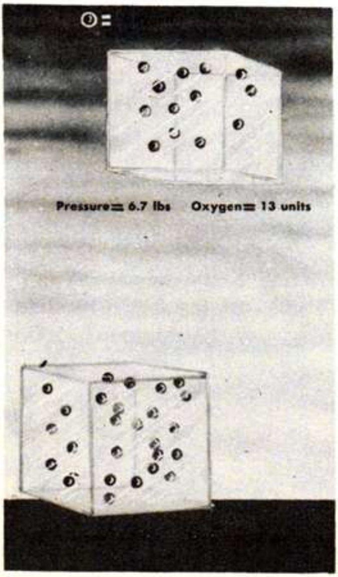


Figure 3-1-1. Two cubes of air. Top cube is at 20,000 feet; bottom cube, at sea level.

Causes. Anoxia or the lack of oxygen in the blood stream is caused by the reduction of pressure with altitude. This is easily understood if you compare the two cubes of air illustrated in figure 3-1-1. Both cubes are the same size and contain the same *proportion* of oxygen (one-fifth the volume); yet because of the difference in altitude and therefore pressure, the cube at 20,000 feet contains less oxygen.

Your body needs more oxygen than is contained in the 20,000-foot cube. Consequently, you suffer from anoxia.

To remedy this situation, one of two things is necessary.

(1) Place more oxygen in the volume of air you breathe at 20,000 feet by substituting it for the inert nitrogen.

(2) Increase the pressure of the air you breathe at 20,000 feet (pressure breathing).

As you go higher, however, both of these methods have limitations, explained below, necessitating a third method.

(3) Increase the pressure of the air you breathe and the air on the outside of your body (pressure cabin).

Substituting oxygen for inert nitrogen. At sea level, your lungs contain air at an atmospheric pressure of 14.7 pounds per square inch.* Figure 3-1-2 shows the relative amount of oxygen in your lungs at this pressure.

Figure 3-1-2. Oxygen and nitrogen in the lungs at sea level.

At 20,000 feet the atmospheric pressure is 6.8 pounds per square inch* as compared to the sea-level pressure of 14.7.* Thus, the air in your lungs contains less than half the amount of oxygen as it did at sea level (fig 3-1-3). In order for your body to function, it must receive more oxygen. This is accomplished by your diluter-

Figure 3-1-3. Oxygen and nitrogen in the lungs at 20,000 feet.

* Less 0.91 psi water-vapor pressure.

demand oxygen equipment which cuts out some of the atmospheric air and allows you to breathe a certain amount of pure oxygen. This places the same amount of oxygen in your lungs as is available at sea level.

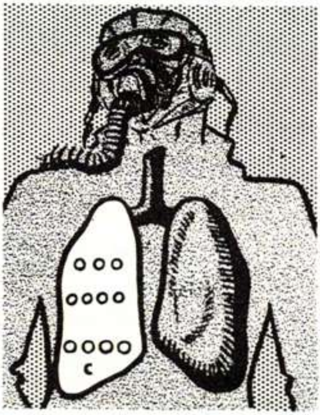


Figure 3-1-4. Amount of oxygen in the lungs at 30,000 feet, as delivered by diluter-demand equipment.

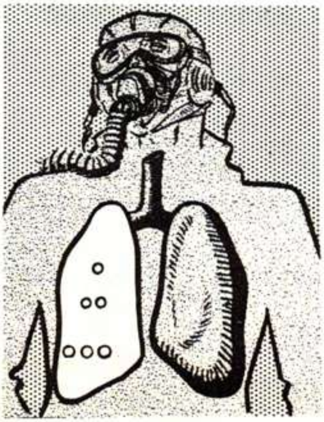


Figure 3-1-5. Amount of oxygen in the lungs at 40,000 feet, as delivered by diluter-demand equipment.

As you go higher, this equipment cuts out more and more atmospheric air and replaces it with oxygen. At 30,000 feet, the diluter is closed and you are breathing 100-percent pure oxygen (fig 3-1-4).

From 30,000 feet up, the diluter-demand equipment continues to deliver 100-percent oxygen, but the higher you go the less oxygen enters your lungs. The reason for this is that diluter - demand equipment was not designed to deliver oxygen at a pressure higher than outside pressure. Hence, at 40,000 feet this equipment is delivering 100-percent oxygen, but there is barely enough in your lungs (fig 3-1-5) because the outside pressure is so low, 2.72 pounds per square inch.* If you go any higher than 40,000 feet using diluter-demand equipment, you become anoxic.

Increasing pressure of air you breathe. For you to go higher than is safe with diluter-demand equipment, enough oxygen must be

* Less 0.91 psi water-vapor pressure.

forced into your lungs to meet your body's demands. This is what *pressure* diluter-demand equipment does, increasing your ceiling to 43,000 feet. You cannot go higher, not because of the equipment but because of your body. When you are breathing under pressure, the pressure inside your lungs is higher than that on the outside of your chest. Inhaling is easy, but exhaling becomes an effort for which your chest muscles and diaphragm were not designed. When the difference between outside pressure and pressure inside your lungs becomes great, as is the case of pressure breathing with excessive pressure, you become too tired to breathe, much less fly a plane. Therefore, pressure breathing is considered an emergency procedure. The only way you can go higher is to increase the pressure outside your body. This can be done if you are flying a plane which has a presurrized cockpit or cabin, or if you are wearing a pressurized suit.

Increasing pressure outside and inside the body. When flying a plane which has a pressurized cockpit or cabin, safe altitudes are increased, providing you use oxygen and set the cabin pressure regulator at maximum allowed pressure. If you set the cabin regulator at combat or safety pressure, fly no higher than the limits established for your plane at that setting.

Whenever the pressure in a pressurized cockpit or cabin is lost, the air under higher pressure in your lungs and other parts of your body tries to escape. If, at such a time, the difference between the pressure of air inside your body and that outside is very great, the air inside expands so rapidly that various body tissues are torn and ruptured. This is known as *explosive decompression*. If you stay within the ceiling limits established for your plane at combat or safety setting, you will not be subject to explosive decompression should the canopy be shattered or other holes made in the cockpit which cause loss of pressure. You must, however, descend immediately to a lower, safer altitude.

Danger of anoxia. The greatest danger of anoxia is that the first symptoms are not apparent to the pilot. You merely feel extremely self-confident and rather happy. When anoxia becomes greater, your vision is blurred, your judgment impaired, and you are usually incapable of controlling your muscular activity. Unconsciousness follows.

Avoiding anoxia. Follow these rules:

(1) Use oxygen on all flights above 10,000 feet.

(2) Do not fly above 40,000 feet unless you are using *pressure* diluter-demand equipment, a pressure suit, or are in a pressurized cockpit and are breathing oxygen.

(3) Use oxygen on night flights, on combat missions, and on training missions simulating combat.

(4) Keep yourself in good physical condition. Avoid excessive smoking. The carbon monoxide from your cigarette decreases the oxygen-carrying capacity of your blood. Moderately heavy smoking decreases your altitude tolerance as much as 2,000 feet.

(5) Know and take care of your oxygen equipment. Check it before taking off and frequently during flight.

EXPANSION OF BODY GASES

There is always some gas in your stomach and intestines. This gas expands with increasing altitude due to the reduction of pressure, making your abdomen swell; severe abdominal cramps may be experienced. Generally, however, expansion of body gases causes only minor discomfort.

When flying frequently at high altitudes, avoid such gas-producing foods as beans, cabbage, raw apples, soda pop, and beer. Remember what foods give you trouble and avoid them. Never chew gum before or during high-altitude flights because you are more likely to swallow air when you do.

PRESSURE IN SINUSES AND MIDDLE EAR

The nasal sinuses and middle ear are bony spaces in the head which contain air. When you are gaining altitude, air inside these structures expands because of decreasing outside pressure. Normally, this presents no problem since air in the middle ear, after expanding somewhat (fig 3-1-6), passes out the Eustachian tube; and air in the sinuses likewise equalizes pressure through sinuses openings. Each time the Eustachian tube opens during ascent, you hear a clicking sound. Then, pressure is equalized.

During descent, however, you must make an effort to clear your ears. Considerable pain and even rupture of the eardrum may result unless pressure in the middle ear equals that on the outside. To equalize pressure, swallow or yawn; both tend to open the Eustachian tube. If this does not work, hold your nose and blow gently with your mouth shut. The most important thing to remember is to clear your ears the moment you become aware of pressure. Never allow the difference between outside and inside pressure to become too great because this increases the difficulty in clearing the ears.

You will experience no difficulty with sinuses during descent unless you have a cold. Then, the linings of the sinuses *and* the middle ear are swollen and you will have difficulty equalizing pressures in both structures. You will suffer great pain in the ears and have a painful headache. There is the possibility that your eardrums may rupture. For this reason, do not fly if you have a cold. If it is absolutely necessary that you fly, see your flight surgeon first.

DECOMPRESSION SICKNESS

Decreasing pressure on the body not only affects the gases present in the stomach and intestines, but allows gases in the body fluids, especially nitrogen, to escape into and form bubbles in and around the joints (fig 3-1-7). This action may be compared to the reaction obtained by opening a bottle of soda. In the soda, gas bubbles do not form as long as pressure is high. When the cap is removed, pressure decreases and gas bubbles escape.

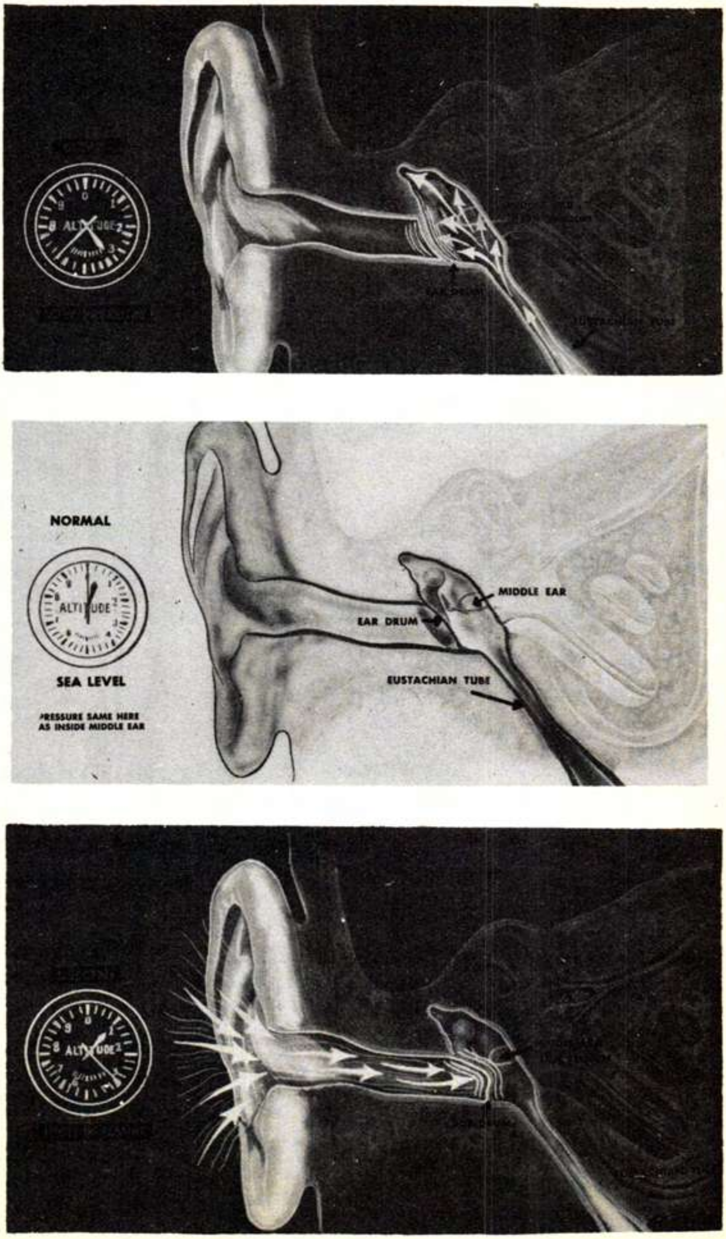


Figure 3-1-6. The middle ear.

Nitrogen bubbles in the joints cause great pain. However, this trouble, known as the *bends*, seldom develops below 30,000 feet. Above that altitude, pain may get so intense as to become incapacitating. In addition, you may get a burning sensation in the lungs (*chokes*). This may be followed by stabbing pains and a desire to cough. Coughing, however, does not relieve the pain.

Combating bends. When you have the bends and chokes, the only solution is to descend to a lower altitude. Do not wait. Go down immediately. That is the only way to combat decompression sickness after you have it.

Avoiding bends. To avoid decompression sickness, breathe pure oxygen for about 30 minutes before taking off and continue to do so from the ground up. This procedure tends to reduce the proportion of nitrogen in the body. Remember, however, that the supply of oxygen in your plane is limited, so climb to your altitude as rapidly as possible.

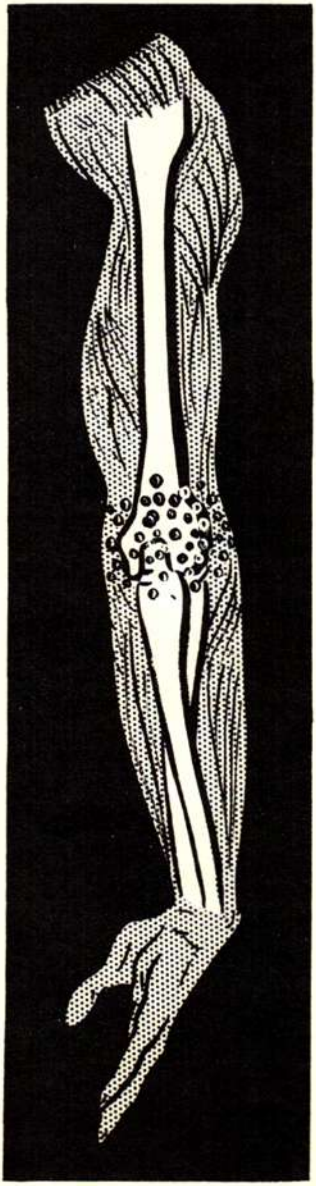


Figure 3-1-7. Nitrogen bubbles in and around an elbow joint.

NIGHT VISION

THE EYE

In the back of the eyes are light-sensitive nerve endings of two kinds: *cones* and *rods*. The cones are concentrated in the center of the *retina*, or inner lining of the eye, and the rods in a ring or circle around the cones. The cones see color and detail. The rods do not see detail and are color blind, seeing color only as shades of gray. In daylight, you see mostly with the cones. At night, however, you see with the rods. Since there are no rods in the center of the retina, you have a blind spot in the center of your field of vision. (See fig 3-2-1.)

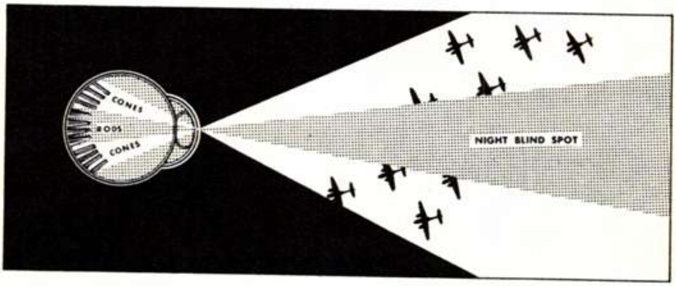


Figure 3-2-1. The eye at night.

Looking at objects at night. You see best at night when you look slightly off-center and to the side of the object you wish to see. When you direct your eyes straight toward an object, you will not see it because it is in the blind spot.

Never stare at a light while flying at night. If you stare at a stationary light in a dark room, you will soon think the light has begun to move. The same sensation occurs during night flying.

Searching at night. When you are searching at night, do not sweep the sky or sea at random. Keep your eyes on a small area for about a second, then move them quickly to another small area, and so on, systematically covering all quadrants, as illustrated in figure 3-2-2.

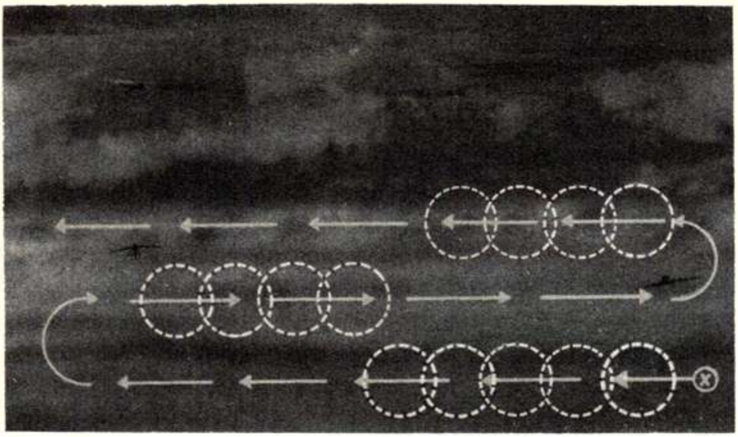


Figure 3-2-2. Night searching technique.

DARK ADAPTION

When you enter a dark room from a brightly lighted area, vision is poor until the eyes adjust themselves to the dim light. Gradually you began to see objects. In about 30 minutes, you can see light 10,000 times dimmer than any you could see in bright light. If the dark room were suddenly lighted for a few seconds, it would take your eyes another period of time to adjust themselves again.

This is the first principle of night vision. You must dark adapt your eyes and keep them adapted. Do this by wearing red-lens goggles at least 30 minutes before taking off on a night flight. Keep your eyes dark adapted by avoiding all but red light. In red light, you can see with the cones; the rods react to red light much as they do to darkness. This means that if you stay in a red-lighted room or wear red-lens goggles, the rods will adapt while you read or play cards.

AIDS TO NIGHT VISION

Oxygen. The retina is highly sensitive to lack of oxygen. Without oxygen, vision is impaired at 5,000 feet, and is about half efficient at 12,000 feet. It is advisable to use oxygen from the ground up on all night flights.

Vitamin A. Your ability to see at night depends largely on your body's content of vitamin A, which is obtained from such foods as eggs, butter, carrots, cod liver oil, and all types of greens. If you eat plenty of these foods, supplementary vitamin tablets are unnecessary.

Clean windshields. Make sure your goggles and windshield are clean and free of scratches. If they are scratched or dirty, they scatter light and produce glare, dangerously impairing night vision.

VERTIGO

DEFINITION

Vertigo is a term used in aviation to denote a sensation or feeling of one's position and movement in space that is not correct. You normally determine the position of your body by what you see, what you feel, and what your inner ear tells you. Of the three, the most used is vision. You accept what your eyes tell you regardless of what your senses say. When on a contact flight, you rely on your vision and automatically disregard these false impressions caused by centrifugal forces on your organs of equilibrium. When, however, your vision is not able to tell you the position of your body, as is the case in instrument flight, you will tend to heed these false impressions at certain times.

Figure 3-3-1. The inner ear.

THE INNER EAR

The inner ear (fig 3-3-1) is composed of two parts concerned with equilibrium, semicircular canals and the static organ. Pilots perceive turns with the aid of the semicircular canals, and the pull of gravity and other forces with the static organ. A simple illustration of this static organ in a case of vertigo is given below. The many hairs in this organ are represented in the accompanying pictures by one hair.

VERTIGO IN ACTION

In figure 3-3-2 a blindfolded man is sitting in the rear cockpit of an airplane on the ground. Gravity is acting on the axis of the hair illustrated so that it is not deflected. When the plane is tilted on one wing (fig 3-3-3), the hair is pulled to one side by a change in the direction of the force due to gravity, and the man receives the sensation of leaning. He also knows he is leaning because of the change in pressure on his seat; he feels more pressure on one side than on the other.

In figure 3-3-2*c*, the plane is flying in a bank to the right. The blindfolded man, however, does not realize he is in a bank because the hair is held upright due to the action of centrifugal force. Centrifugal force also holds him firmly in his seat; therefore, he does not feel the turn.

Since the hair and pressure on the seat are the same as in level flight, the blindfolded man is under the impression that he is flying straight and level. This impression is false—vertigo in its simplest form. Under turbulent instrument conditions, there will be a barrage of contradictory sensations of your position and movement. You must train yourself to disregard these sensations and fly solely by your instruments. They are reliable. Trust them. They are your only means of combating vertigo.

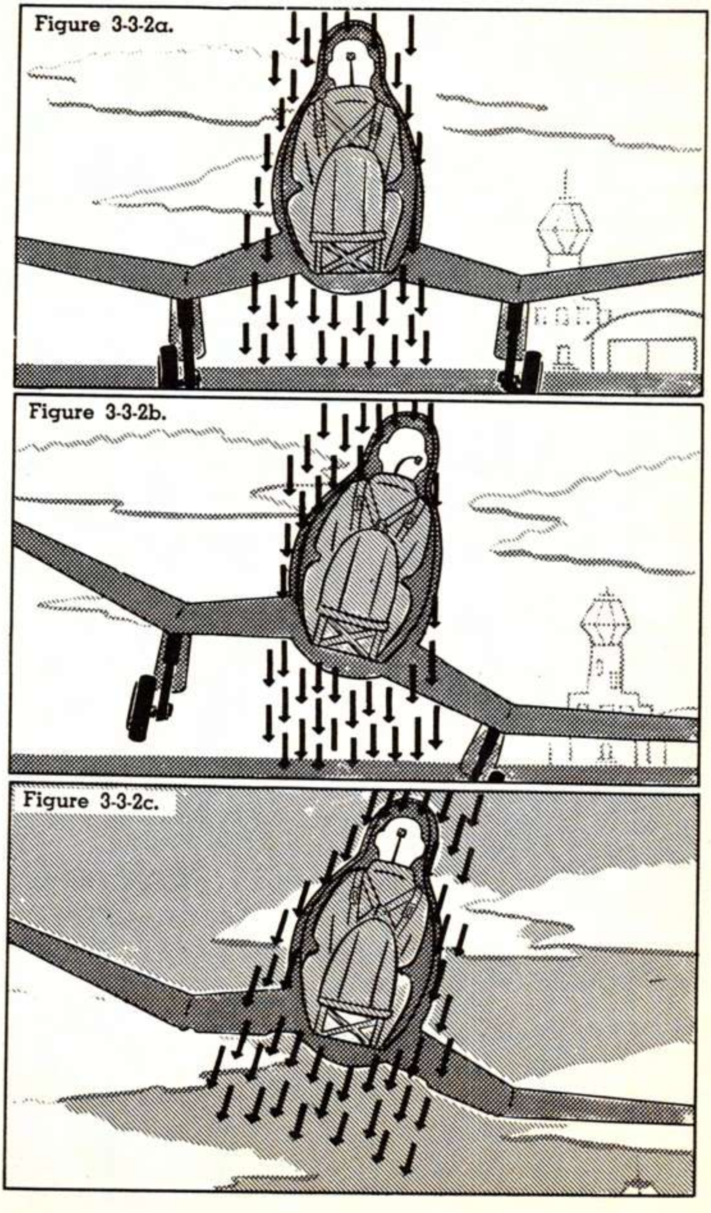


Figure 3-3-2. Vertigo.

g FORCES

TYPES

Whenever you change direction in flight, centrifugal force increases the normal force or weight of gravity ($1g$) on your body and your airplane. The amount of this force is governed by the speed of your plane and the radius of the turn. The greater the speed and the narrower the turn, the greater is this force. When it is several times the force of gravity ($3g$s, $5g$s, and so on), the effect on you and your plane may be serious.

Positive g (+g). When you do a normal loop, a normal turn, or a pullout from a dive, centrifugal force drives the blood from your brain towards your feet. This is known as *positive* ($+ g$). It increases your weight and the wing loading of your airplane.

Structurally, you and your airplane have limits beyond which there will be material failure. Fortunately, the structural support of your body (bones) is much better stressed than your plane. Your bones will take a very high g force before breaking. However, the fluid elements, such as the blood, are easily influenced by g, although it takes *seconds* for these fluid elements to respond to the forces. In other words, you can pull $10g$s and pull the wings off your plane *but not blackout*. However, if this g is sustained long enough the blood will be drawn away from your head, your vision will dim first, then you will blackout and finally as the g forces *and* time increase, unconsciousness will develop.

An excessive g force on your airplane regardless of the time factor, will cause the wings to break off. Remember, every type of airplane is designed to withstand a certain wing loading. If, for example, you get a $+7g$ force pulling out of a dive, the normal wing loading is multiplied by seven. On certain types of planes, this may be disastrous.

Negative g (—*g*). When you do an outside loop, an outside turn, or push the nose of your plane down abruptly, centrifugal force drives the blood from your feet to your brain. This is known as *negative g (—g)*. It causes your vision to go red. Your eyes bulge and your head throbs with pain. If the force is prolonged you may lose your sight temporarily.

You and your airplane can withstand more +*g* force than —*g* force, and you can recover from +*g* force much quicker. Remember, also, that many airplanes were not designed to withstand the stresses of inverted maneuvers.

COMBATING g FORCES

Your +g tolerance. Each pilot has individual +*g* tolerance. You may be able to withstand slightly more or less +*g* force than others. Find out how much you can stand and then avoid maneuvers which cause a +*g* force above your tolerance. If your airplane is equipped with an accelerometer, use it as a guide. If not, get to know when you are approaching your tolerance by experience. Remember, when your vision begins to dim, you are close to blackout and unconsciousness. Use this as your warning sign.

Maintaining your +g tolerance. Avoid the following conditions. They decrease your +*g* tolerance and make loss of consciousness more likely and more dangerous.

(1) Lack of sleep.

(2) Lack of oxygen.

(3) Excessive use of tobacco and alcohol.

(4) Poor physical condition.

Raising your +g tolerance. You can increase your resistance to +*g* force by:

(1) Tensing the muscles.

(2) Straining against the safety belt.

(3) Pulling your head and neck back and down into your chest.

(4) Yelling at the top of your voice.

Anti-blackout suits. An anti-blackout suit increases your resistance to +*g* force by 1.5 to 2*g*s, providing it fits properly. Remember, however, that your airplane has *g* limits also. Know them and stay within them.

Your —g tolerance. All pilots have a low —*g* tolerance, about —3*g*s being near the maximum safe limits. Because there is no way to raise this tolerance and because the results of excessive —*g* force are so dangerous, avoid excessive inverted maneuvers and abrupt pushovers.

- **Avoid snap maneuvers. You can take it, but your PLANE can't.**

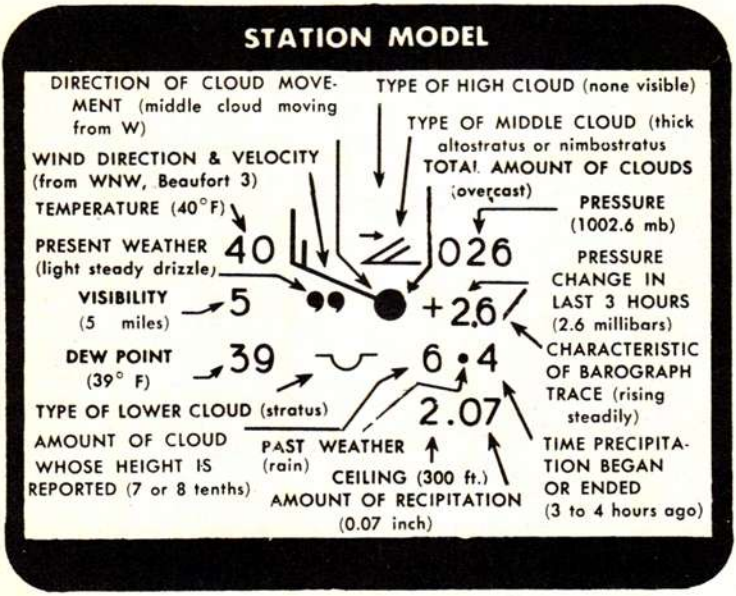
- **Avoid high sustained gs. YOU can't take it.**

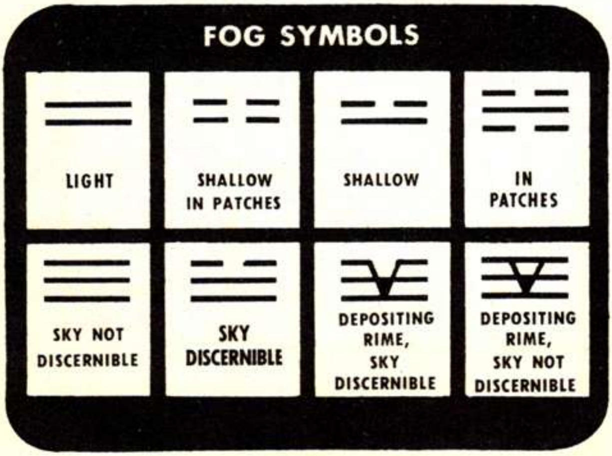
4

Section IV. AEROLOGY

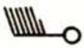
CLOUD POSTER

WEATHER SYMBOLS





BEAUFORT SCALE

BEAUFORT NUMBER	MAP SYMBOL	VELOCITY (KNOTS)
0		CALM
1		1-3
2		4-6
3		7-10
4		11-16
5		17-21
6		22-27
7		28-33
8		34-40
9		41-47
10		48-55
11		56-63
12		64-71
13		72-80
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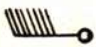
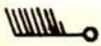
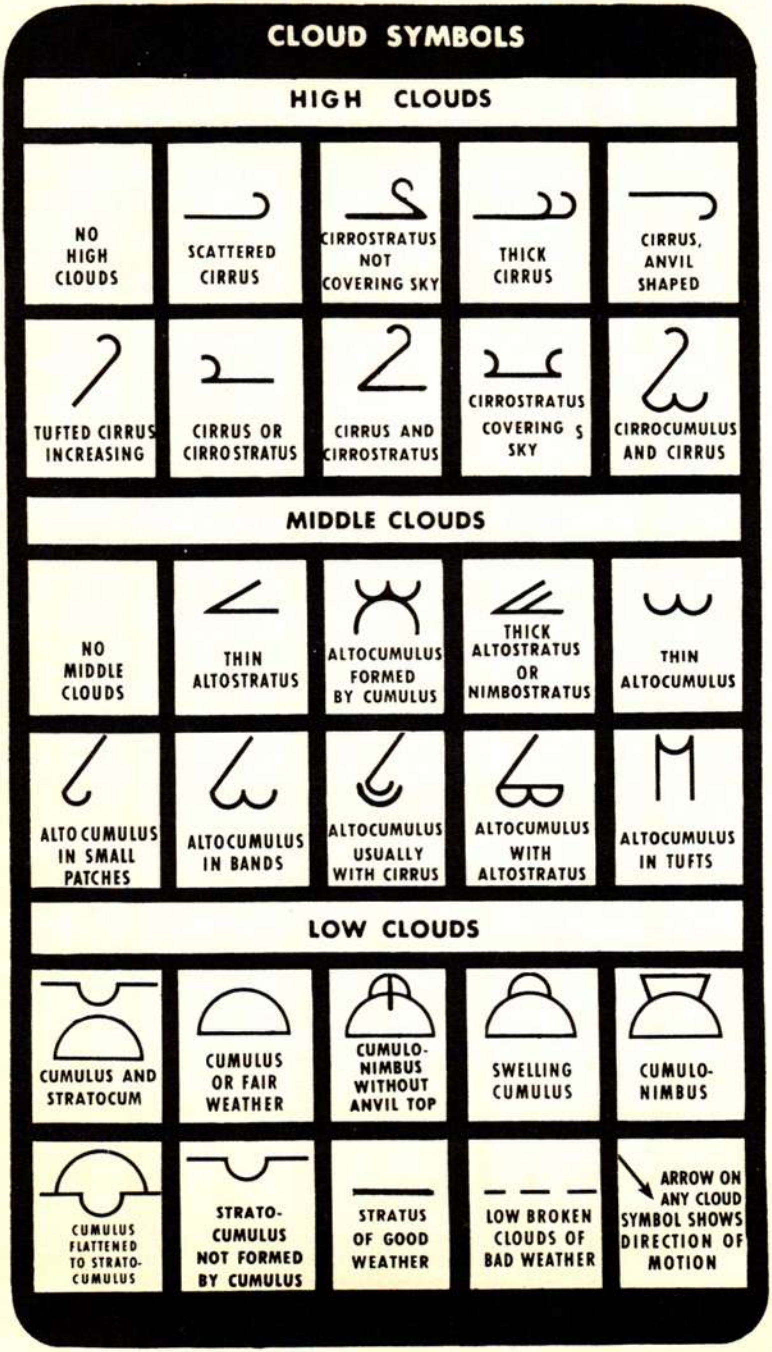
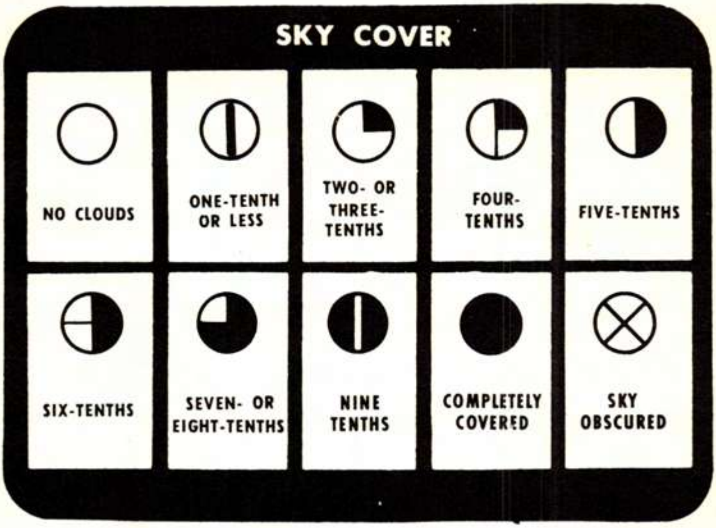
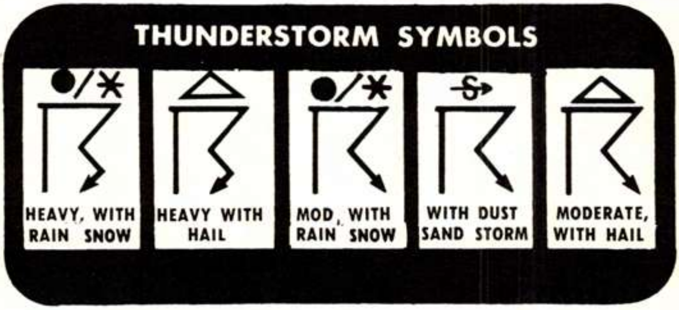
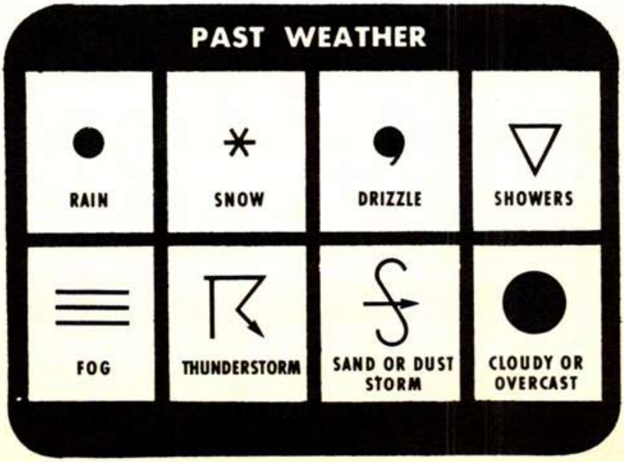
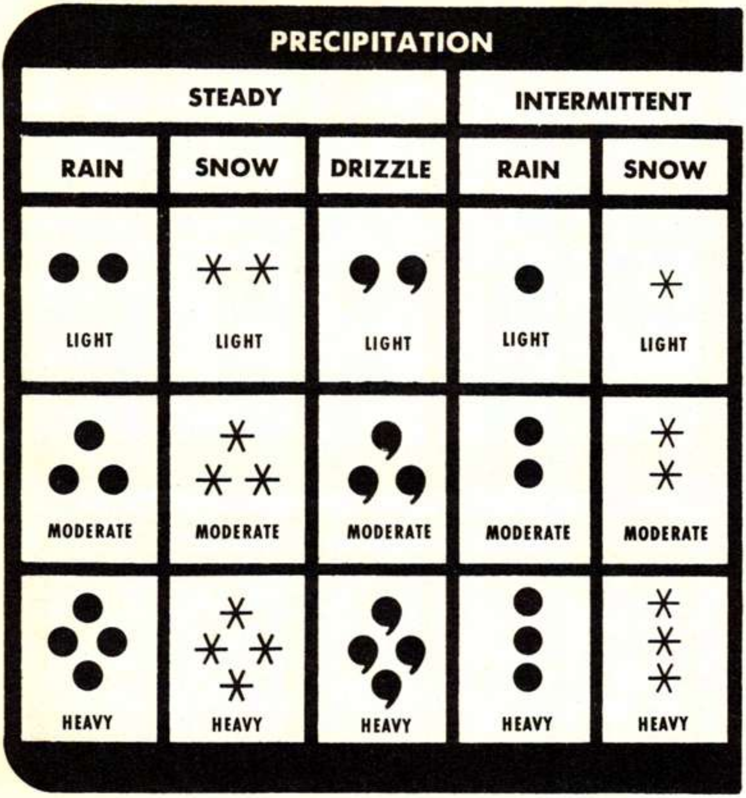
15		90-99
16		100-108
17		109-118


CLOUD SYMBOLS
HIGH CLOUDS
NO HIGH CLOUDS
SCATTERED CIRRUS
CIRROSTRATUS NOT COVERING SKY
THICK CIRRUS
CIRRUS, ANVIL SHAPED
TUFTED CIRRUS INCREASING
CIRRUS OR CIRRO STRATUS
CIRRUS AND CIRROSTRATUS
CIRROSTRATUS COVERING SKY
CIRROCUMULUS AND CIRRUS
MIDDLE CLOUDS
NO MIDDLE CLOUDS
THIN ALTOSTRATUS
ALTOCUMULUS FORMED BY CUMULUS
THICK ALTOSTRATUS OR NIMBOSTRATUS
THIN ALTOCUMULUS
ALTO CUMULUS IN SMALL PATCHES
ALTOCUMULUS IN BANDS
ALTOCUMULUS USUALLY WITH CIRRUS
ALTOCUMULUS WITH ALTOSTRATUS
ALTOCUMULUS IN TUFTS
LOW CLOUDS
CUMULUS AND STRATOCUM
CUMULUS OR FAIR WEATHER
CUMULO-NIMBUS WITHOUT ANVIL TOP
SWELLING CUMULUS
CUMULO-NIMBUS
CUMULUS FLATTENED TO STRATO-CUMULUS
STRATO-CUMULUS NOT FORMED BY CUMULUS
STRATUS OF GOOD WEATHER
LOW BROKEN CLOUDS OF BAD WEATHER
ARROW ON ANY CLOUD SYMBOL SHOWS DIRECTION OF MOTION


SKY COVER
NO CLOUDS
ONE-TENTH OR LESS
TWO- OR THREE-TENTHS
FOUR-TENTHS
FIVE-TENTHS
SIX-TENTHS
SEVEN- OR EIGHT-TENTHS
NINE TENTHS
COMPLETELY COVERED
SKY OBSCURED


THUNDERSTORM SYMBOLS
HEAVY, WITH RAIN SNOW
HEAVY WITH HAIL
MOD. WITH RAIN SNOW
WITH DUST SAND STORM
MODERATE, WITH HAIL


PAST WEATHER
RAIN
SNOW
DRIZZLE
SHOWERS
FOG
THUNDERSTORM
SAND OR DUST STORM
CLOUDY OR OVERCAST


PRECIPITATION
STEADY
INTERMITTENT
RAIN
SNOW
DRIZZLE
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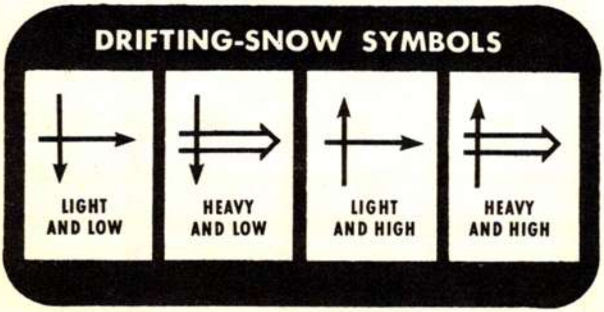
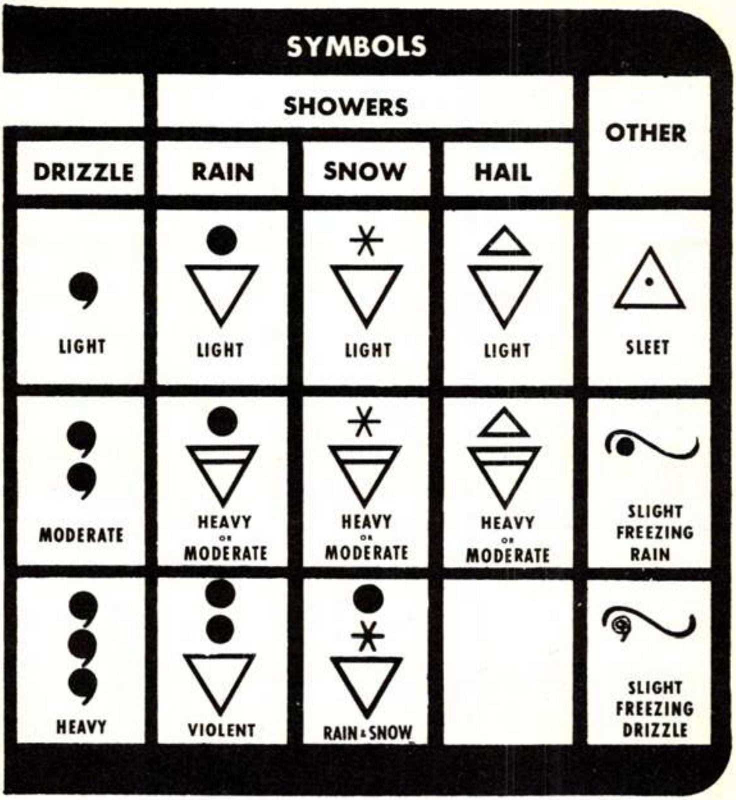

DRIFTING-SNOW SYMBOLS
LIGHT AND LOW
HEAVY AND LOW
LIGHT AND HIGH
HEAVY AND HIGH

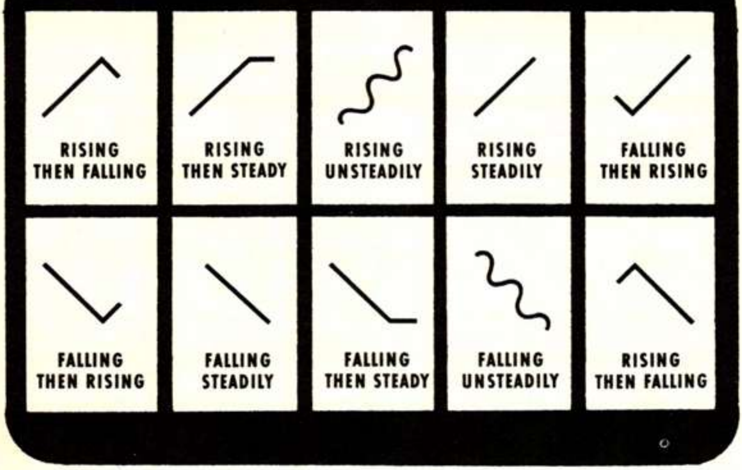


MODIFYING SYMBOLS

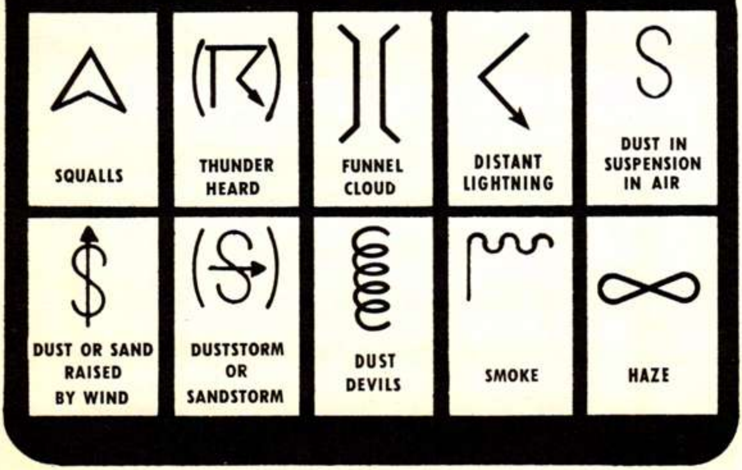
( ) AROUND SYMBOLS: *OCCURRED IN SIGHT OF STATION*

] TO RIGHT OF SYMBOLS: *OCCURRED DURING LAST HOUR*

BAROMETER CHARACTERISTICS



MISCELLANEOUS SYMBOLS



FRONTAL SYMBOLS

TYPE OF FRONT	ON PRINTED MAP	ON COLORED MAP
Warm		(red)
Cold		(blue)
Stationary		(red & blue dashes)
Occluded		(purple)

AIR MASSES & PRESSURE CENTERS

SYMBOL	MEANING	COLOR IN BLACK OR
A	Arctic air mass	Blue
P	Polar air mass	Blue
T	Tropical air mass	Red
E	Equatorial air mass	Red
H	High-pressure center	Blue
L	Low-pressure center	Red

ICING

EFFECTS ON AIRCRAFT

Ice may form on aircraft flying through precipitation and clouds when the temperature is near or below freezing. Figure 4-3-1 illustrates the critical places on an airplane where ice may form and the effects on the plane's flying characteristics. The most important of these effects is the reduction of lift, although all contribute to decrease the aerodynamic efficiency of the aircraft.

TYPES OF ICE

Ice forming on aircraft in flight is classified according to appearance and structure. In general there are two basic types, *clear* ice and *rime* ice. (Frost, which usually forms on grounded aircraft and occasionally on flights in Arctic regions, is sometimes classed as a third type.) You will usually encounter a combination of rime and clear ice, with the characteristics of one being dominant.

Clear ice. Clear ice (fig 4-3-2) is translucent and smooth in appearance. This type of ice tends to conform to the airfoil of the wing and tail surfaces. It forms more rapidly, is more difficult to detect, and is much stronger and harder than rime ice. It is easier to pick up and harder to get rid of, and is, therefore, a greater hazard.

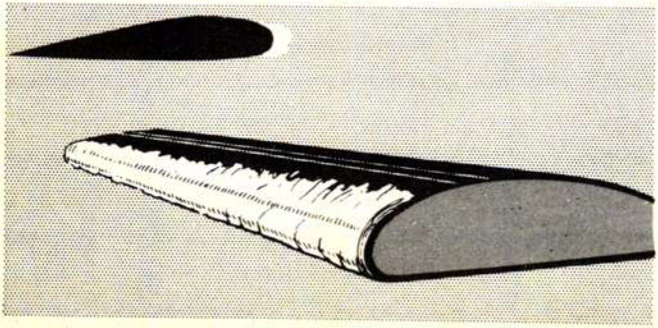


Figure 4-3-2. Clear ice on an airfoil.

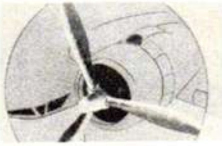
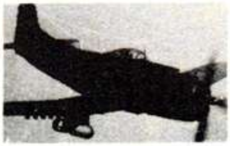
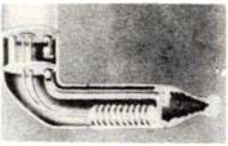
ICE FORMS . . .	CAUSING . . .
 on WINGS	*Lift to decrease and drag to increase*
 on PROPELLER BLADES	*Loss of efficiency: perhaps destroying it*
 on RADIO ANTENNA	*Antenna to break; or bridging insulators, thus grounding antenna to plane*
 on WINDSHIELD	*Loss of vision, necessary when landing*
 in PITOT TUBE	*Incorrect airspeed readings*
 in CARBURETOR	*Loss of power, or even stopping engine completely*

Figure 4-3-1. Icing and its effects.

Even when de-icer boots are removing clear ice effectively, there is the hazard of rough ridges of ice which are left along the rear of the boots. These ice ridges act as spoilers in addition to serving as anchor points for more and rougher ice to form.

Rime ice. Rime ice (fig 4-3-3) is opaque, rough, and white in appearance. It has a semicrystalline structure resembling crusted snow. The leading edges of the wings and tail surfaces are usually the only places affected by this ice. Rime ice is not as strong as clear ice and does not spread; hence, it is more easily removed.

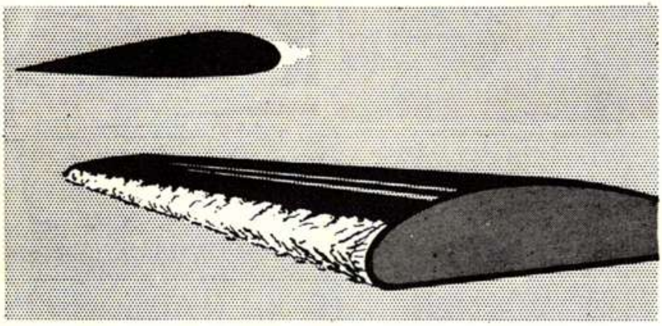


Figure 4-3-3. Rime ice on an airfoil.

ICING CONDITIONS

The two following conditions are necessary for ice to form:

(1) Air temperature near or below freezing

(2) Water present in a liquid state

Such conditions are met only in clouds or in precipitation areas directly below them. When they do exist, anticipate icing.

The severest and most dangerous icing conditions are encountered in clouds near 25°F and in freezing rain. Statistics show that approximately 85 percent of all icing occurs in frontal zones, with cold fronts producing the most icing. (See figs 4-3-4 to 4-3-6.)

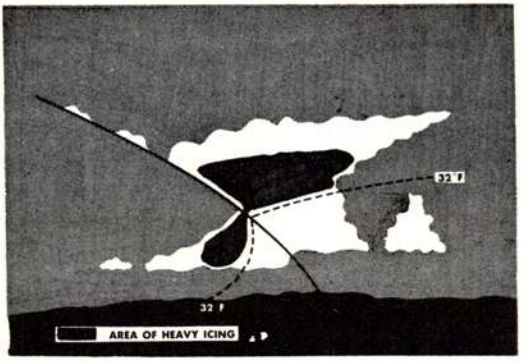


Figure 4-3-4. Icing in a cold front.

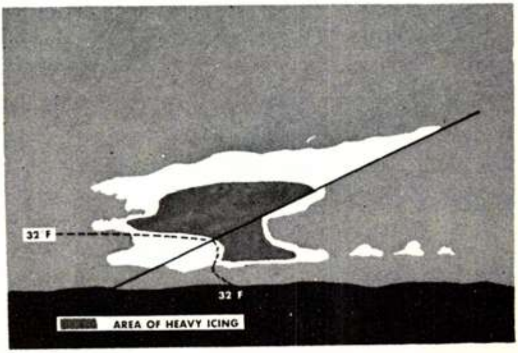


Figure 4-3-5. Icing in a warm front.

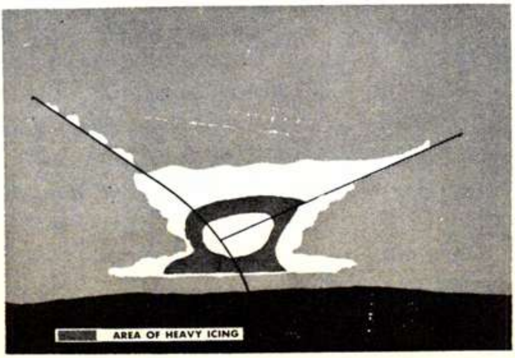


Figure 4-3-6. Icing in an occluded front.

COMBATING ICING

By using your head. The best way to combat icing is by employing the intellect. De-icer equipment can only help you combat icing. It was devised and placed on your airplane to enable you to *control* the effect of ice while you seek areas where icing is nonexistent or is not severe.

Before taking off, study the forecast and the weather map. Consult the aerologist and plan your flight to go around or bypass areas favorable to icing. Know and respect the flight characteristics of your airplane under all conditions. In flight, expect icing whenever there is visible moisture in the air at temperatures near or below freezing.

Since every icing condition presents a different problem, specific instructions cannot be given for combating ice. The success or failure of your flight depends on the action you take. You may, however, find the following generalizations helpful in making the proper decision and doing the right thing.

(1) When flying in freezing rain, *climb* into the clouds, but do not climb too high or you will encounter icing conditions. Rely on your outside-air temperature indicator.

(2) When flying in wet snow which sticks to your plane, *climb* to a higher, colder level.

(3) When flying in sleet, do not attempt to avoid it by climbing. Sleet is not dangerous and clouds above contain liquid moisture at freezing temperatures.

(4) If you encounter icing in turbulent clouds, *descend* if conditions of terrain clearance permit. If this is not possible, *climb rapidly* to get above the clouds.

(5) Beware severe icing conditions over mountains. Bypass the clouds or fly over them. *Never* descend or climb through clouds on the windward side of mountains.

(6) Do not make gradual letdowns through areas of intense icing. *Descend rapidly.*

(7) If you have wing ice, even a small amount, *keep your airspeed well above stalling.* Make no sharp

turns close to the ground. Come in under power.

(8) Know your own limitations.

By mechanical devices. Thoroughly acquaint yourself with the de-icing equipment on your airplane. Know when to use it and how to use it. When you can avoid icing zones, never fly into them simply because your airplane has this equipment. Remember, de-icing equipment only enables you to *control* the effect of icing while you seek safer conditions. Follow the general rules regarding the use of de-icing equipment given below.

(1) For best efficiency, do not turn on wing and tail de-icers until a thin coating covers the leading edge.

(2) Do not use de-icer boots continuously. When a thin coating builds up on the leading edge, turn the de-icers on; when the ice breaks loose, turn them off. Repeat this procedure every time a thin coating builds up.

(3) Do not wait until a thick, hard crust has formed before employing de-icer boots. If you delay too long, particularly when clear ice is forming, the ice formation may become so heavy that de-icers cannot break it loose, or can break only part of it loose.

(4) Keep your propeller clear of ice. Use your de-icer fluid and increase your rpm. Always use propeller de-icers when running up engines in a fog if the temperature is 32°F or below.

(5) Turn on the pitot heater whenever the free-air temperature is near freezing and there is visible moisture in the air.

(6) Elaborate on these rules as your experience and knowledge grows, and always know the limitations of the de-icing equipment with which your airplane is equipped.

CARBURETOR ICE

Carburetor ice, unlike other ice, will form when temperatures are well above freezing and when there is no visible moisture in the air. It can be expected at any time, particularly when other forms of icing are occurring. The first indication of carburetor ice is a gradual drop in manifold pressure. The engine will not run rough, for the action of the ice is like gradually closing the throttle.

Since various types of carburetors function differently, icing warnings are different for each type. Be familiar with the characteristics of the carburetor on your airplane. Know when to apply heat, just how much to apply, and what other methods you can use to combat carburetor icing on your airplane.

Alternate-air systems. On planes equipped with alternate-air systems, turn the alternate-air valve to FULL ALTERNATE whenever there is a possibility of icing. This system will prevent ice from forming in the carburetor, but will not, however, always melt ice once it has formed.

Tips on combating carburetor ice. (1) The critical outside temperature for carburetor ice is 65°F.

(2) Keep carburetor heat on until just before the takeoff run. Make sure carburetor temperature is above freezing prior to takeoff.

(3) Turn on carburetor heat before you begin your landing approach.

THUNDERSTORMS

CHARACTERISTICS

All thunderstorms, whether they are caused by air being heated from below, *air-mass* thunderstorms, or by air being forced up an inclined plane, *frontal* and *orographic* thunderstorms, have the same general structure and contain the same hazards. Figure 4-4-1 illustrates the structure of a typical thunderstorm and shows the hazards within and near the cloud. Examine this figure in connection with the text below.

Turbulence. There is great turbulence both within and without the thunderstorm cloud. The most violent activity occurs in the lower two-thirds of the cloud, the region of maximum turbulence being in and around the roll cloud.

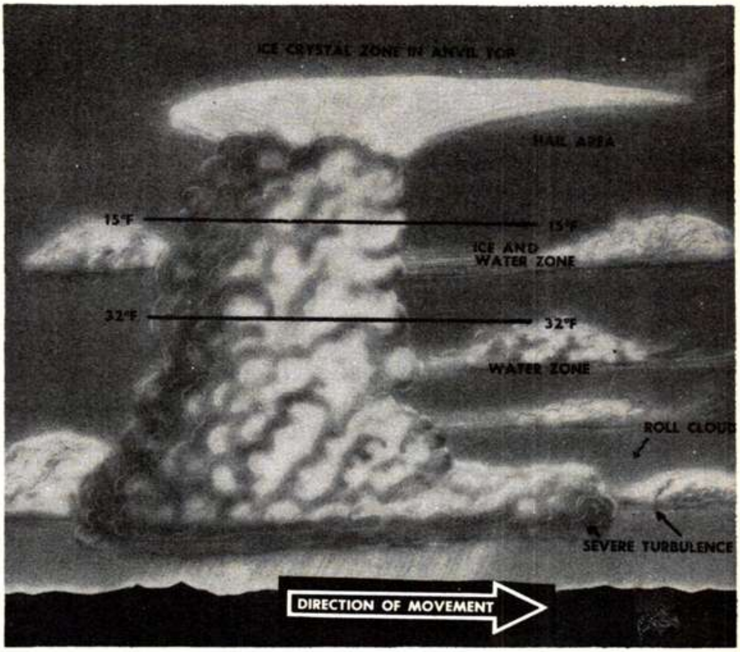


Figure 4-4-1. Typical thunderstorm.

Water. The *water zone* extends from the base of the storm up to the freezing level. Heavy precipitation occurs in this area, which is always in the lower two-thirds of the thunderstorm cloud. Hail is sometimes encountered in this region, although it is rarely large enough to cause structural damage.

Ice. In the area between the freezing level and a temperature level of about 15°F is the *ice-and-water zone* where icing possibilities are the greatest.

Ice crystals. The area of the storm between the 15°F temperature level and the top of the storm is the *ice-crystal zone.* Icing in this zone is less severe than in the ice-and-water zone. Since this area is generally in the upper third of the storm, turbulence is relatively mild or nonexistent.

Hail. Hail does not exist in all thunderstorms. When it does exist, it is usually encountered under the anvil top, outside and in front of the storm.

Lightning. Lightning may be encountered in any part of a thunderstorm, although it is usually found in the lower two-thirds of the cumulonimbus cloud. The primary danger of lightning is that it may temporarily blind the pilot.

FLIGHT THROUGH THUNDERSTORMS

The following are general rules for flying thunderstorms. They are not set down as an exact formula for successful flight through storms, but are to be used merely as a guide. Under actual conditions, you must exercise your own judgment.

(1) Before attempting to fly thunderstorms, study the situation thoroughly. Whenever possible, circumnavigate a storm. *Always* fly around isolated thunderstorms.

(2) If terrain conditions permit, flying underneath the storm is probably the easiest method. If you do this, fly at an altitude of about one-third the distance from the surface to the base of the storm.

(3) If you decide to fly over the top of the storm, consider such things as the service ceiling of your aircraft, fuel supply, oxygen equipment, and whether or not you will have to letdown through a thunderstorm to land.

(4) If you must fly through a line of thunderstorms and it is not possible to find a light spot (See Flying Cold Fronts, p 4-5-2.), remember to:

- Avoid flying through the roll cloud.
- Avoid the center of the storm or the area where the most violent turbulence is apparent from the boiling in the clouds.
- Avoid the ice-and-water zone. If turbulence is not too violent beneath this area (in the water zone), enter there. Otherwise, enter the area where the free-air temperature is 15°F or below.

(5) Before entering the storm line, determine the direction it is taking. Then enter the storm at a right angle.

(6) When entering the storm from the front, anticipate updrafts; when entering from the rear, expect downdrafts.

(7) Once you have entered the storm, do not turn around because of turbulence, rain, or hail. If you do, you will have to fly through the same conditions twice, and you may get lost. **Hold your original course.**

(8) Do not worry about lightning. Switch on the cockpit light and keep your eyes on the instrument panel so flashes of lightning will not blind you.

COLD FRONTS

CHARACTERISTICS

Dimensions. The cold front (fig 4-5-1) may be from a few hundred miles to 2000 miles in length. Its width usually does not exceed 50 miles, although cold fronts with shallow slopes are sometimes as much as 100 miles wide.

Slope. Cold fronts with shallow slopes generally do not have as violent weather as do those with steep slopes and are, therefore, less hazardous even though it takes more time to fly through them. The slope of the average cold front is 1 mile vertically for 40 miles horizontally.

Speed. The average speed of a cold front with a steep slope is 25 knots. This and the comparatively narrow width are advantageous factors for the pilot flying through them despite the fact that the weather in steep-sloped fronts is more violent.

Wind shift and temperature change. On each side of a cold front, winds blow in different directions. A pilot can tell when he has encountered a change in wind direction by observing the change in temperature which indicates that he has crossed the front.

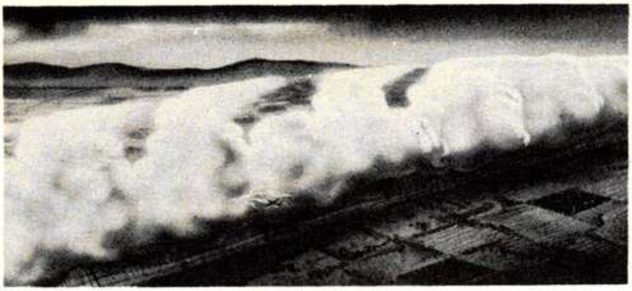


Figure 4-5-1. Cold front without prefrontal cloud formation.

Intense cold fronts. Cold fronts are most intense in late fall, winter, and spring. However, intense cold fronts have occasionally been encountered during the summer months.

HAZARDS

The most hazardous flying weather is encountered in cold fronts. Rain, sleet, hail, snow, intense icing conditions, violent turbulence, and lightning are to be expected. Methods of combating these hazards are described in this section under *Thunderstorms* and *Icing.*

FLYING COLD FRONTS

Flight over the top. High-level flight over the top or over the saddlebacks is preferable to any other method, providing it can be accomplished. However, you must consider many things before attempting it. Some of the more important of these are the height of the clouds or saddlebacks, the service ceiling of your aircraft, and the adequacy of your oxygen equipment and fuel supply.

Flight under the front. This method should be used only if you can maintain contact flight. Never fly underneath a cold front along mountain ranges unless the visibility is good enough for you to see the peaks and ridges clearly. Fly under the front at an altitude of about one-third the distance between the surface and the cloud base.

Flight through the front. This method is the least preferable of the three. If you must use it, get enough altitude before approaching the front so you are on top of the cloud shelf and can inspect the storm lines before selecting your flight path. Make sure you are above the lower two-thirds of the main frontal cloud formation. If the front is solid, search for a light spot. Avoid off-color greenish and other off-hued spots.

Whenever you fly through a cold front, remember these very important things:

(1) Fly through the front at a 90-degree angle to the line of the storm. (See fig 4-5-2.)

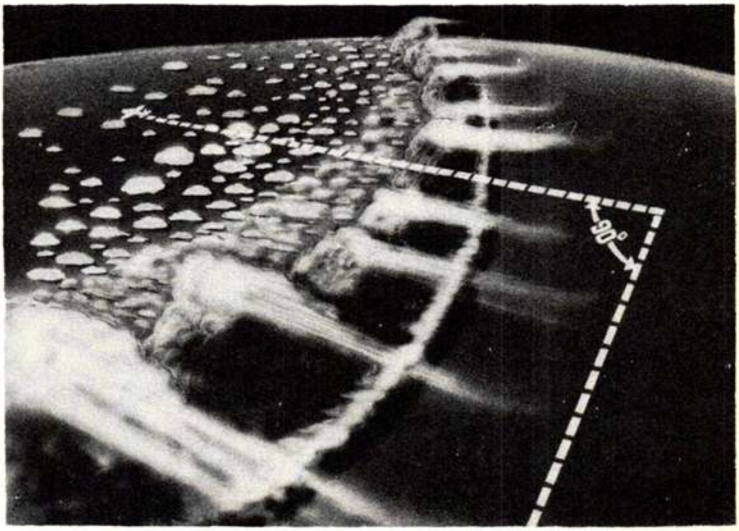


Figure 4-5-2. Correct flight path through a cold front.

(2) When your free-air temperature gage shows a rise or fall, you have crossed the front. Make a drift correction to the right. (See fig 4-5-3.)

(3) Once you have entered the cold front, do not turn around because of turbulence, rain, or hail. You will merely have to fly through the same conditions twice and you may become hopelessly lost.

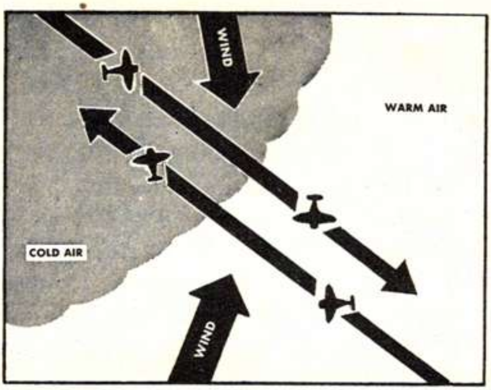


Figure 4-5-3. Make a drift correction to the right when crossing a front.

(4) When you enter the cold front from the rear, you will probably encounter downdrafts. When you enter from the front side, you will encounter violent updrafts. (See *Thunderstorms* for information on flight through cumulonimbus clouds.)

WARM FRONTS

CHARACTERISTICS

Dimensions. The warm front may be from a few hundred miles to 1,000 miles in length and is normally about 600 miles wide. The main cloud system may extend to an altitude of 30,000 feet. (See fig 4-6-1.)

Slope. The slope of a warm front is very gentle, being about 1 mile vertically for every 150 miles horizontally.

Speed. The warm front moves very slowly. Because of this and because the warm front is extensive, bad flying conditions persist over a given area for many hours.

Wind shift and temperature change. The wind shift encountered when flying through the warm front is mild compared to the wind shift which is typical of the cold front. In a warm front, the closer you are to the surface of the earth, the greater is the magnitude of the wind shift. This also applies to the temperature change. At 2,000 feet, the temperature change may be as much as 20°F, while at 10,000 feet it may not be more than 5°F.

Intense warm fronts. From the pilot's viewpoint, intense warm fronts are those in which the overrunning warm air is extremely unstable. Such fronts contain thunderstorms which are sometimes hidden by the main frontal coluds. These thunderstorms have higher bases and are usually less violent than air-mass and cold-front thunderstorms.

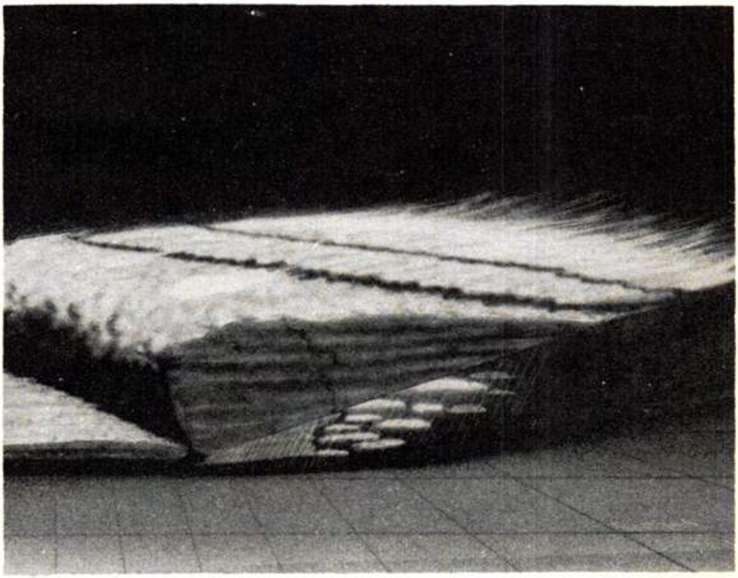


Figure 4-6-1. Typical warm front.

HAZARDS

The two principal hazards of a warm front are icing and the lack of surface visibility and ceiling. Although icing in a warm front is generally considered to be less severe than icing in a cold front, the pilot must not underestimate this danger. In the warm front, you are most likely to encounter freezing rain and wet snow, both of which cause clear ice. The precipitation area is very extensive, as is the dangerous icing area between 32° and 15° F. **Always avoid this icing area.**

The second principal danger, lack of surface visibility and ceiling, is encountered in the area 50 to 100 miles in advance of the front. Here, clouds generally lie on the earth's surface, causing zero visibility and zero ceiling.

There is a third hazard in warm fronts, thunderstorms, but it is more remote than the ever-present danger of icing and low visibility and ceiling.

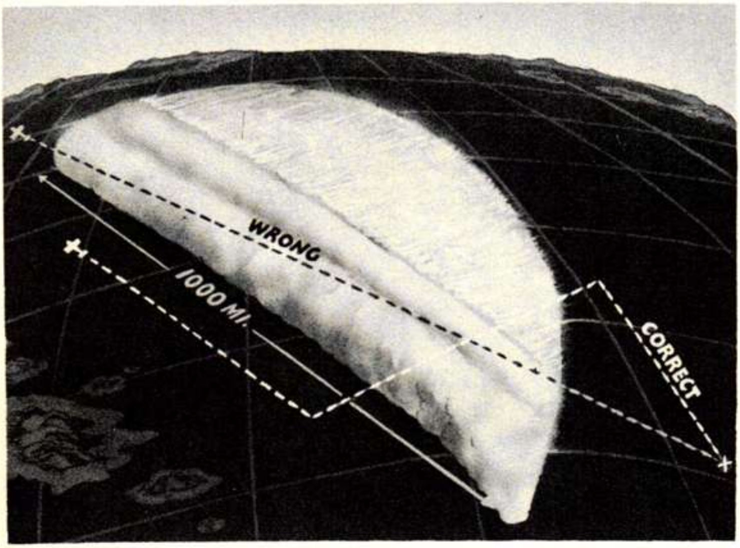


Figure 4-6-2. Correct and incorrect flight paths through a warm front.

FLYING WARM FRONTS

The best way to fly a warm front or any other type front is to fly on top of the clouds. If this is not possible, and you have to fly through the front, use one of the two procedures given below. Always remember:

- You must fly at right angles to the front (fig 4-6-2).
- You must avoid the dangerous icing area which lies between 32° and 15°F.

(1) **Flight below 6000 feet.** Using this method, you will probably avoid running into thunderstorms. You will, however, encounter the various types of precipitation and probably will have to change altitude at various times in order to avoid the dangerous icing area.

(2) **Flight above 18,000 feet.** When using this method, you will usually be able to see the tops of cumulonimbus clouds and thus avoid them. In addition, you will avoid dangerous icing and precipitation areas.

WARNING

Never fly through a warm front at intermediate levels.

OCCLUDED FRONTS

CHARACTERISTICS

Common to both types. Whether the occlusion is the warm-front type (fig 4-7-1) or the cold-front type (fig 4-7-2), the weather of the upper-front is nearly always typical of a cold front, and both types of occlusions are preceded by a widespread area of warm-front weather. Along the upper front of either type occlusion; the activity is particularly severe for a distance of 50 to 100 miles north of the peak of the warm sector (fig 4-7-3). This area must be avoided.

Primary difference. The primary difference between the warm-front and the cold-front occlusion is the location of the occluded front (the surface front) in relation to the upper front, as illustrated in figures 4-7-1 and 4-7-2. In the warm-front type, the weather band is wider.

Wind shift. In both types of occlusions, there is a distinct wind shift. Flying from east to west in the cold-front type, you encounter the wind shift shortly after you encounter the weather of the upper front. Flying in the same direction through a warm-front occlusion, you will encounter the upper-front weather as much as an hour before the wind shift.

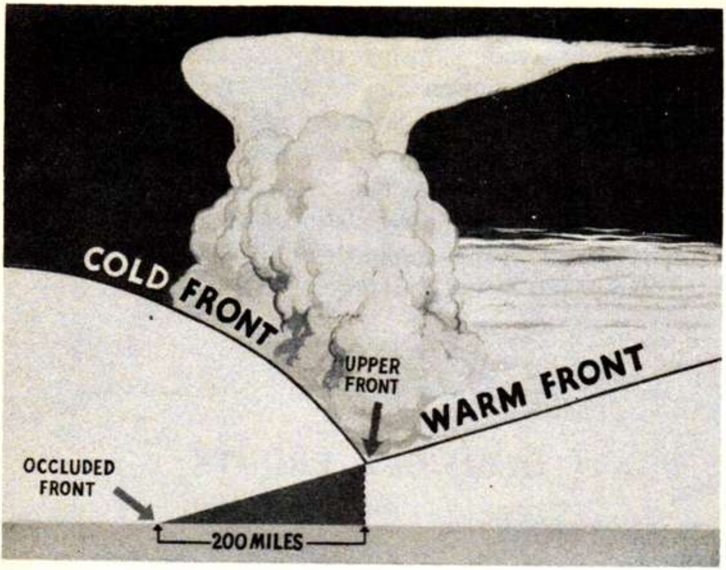


Figure 4-7-1. Warm-front type occlusion.

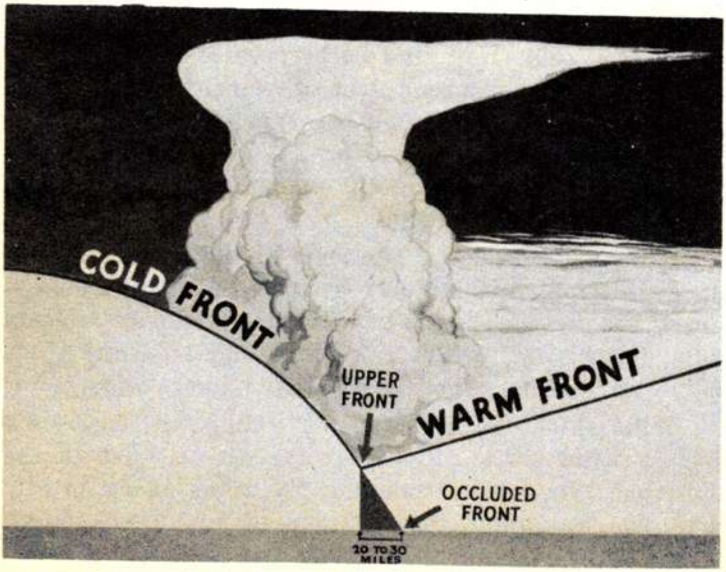


Figure 4-7-2. Cold-front type occlusion.

HAZARDS

Because the occluded front is a combination of a cold front and a warm front, you can expect to encounter the dangers associated with both types of fronts. The cold front's narrow band of violent weather and the warm front's widespread weather area occur in combination within the occluded front.

FLYING OCCLUDED FRONTS

If it is feasible, fly over the top of occluded fronts. If this is not possible, fly through the front at an altitude below 6,000 feet, providing the terrain permits. In this way you will probably avoid the activity of the upper front. Always fly through the front at a right angle.

Whenever you plan a flight through an area of weather brought about by an occluded front, avoid the dangerous zone which extends 50 to 100 miles north of the peak of the warm sector. Choose a flight path that will take you at least 100 miles away from this zone (fig 4-7-3). Because it is difficult for the aerologist to locate this peak accurately, never choose a flight path closer than 100 miles. Protect yourself by allowing a safe margin.

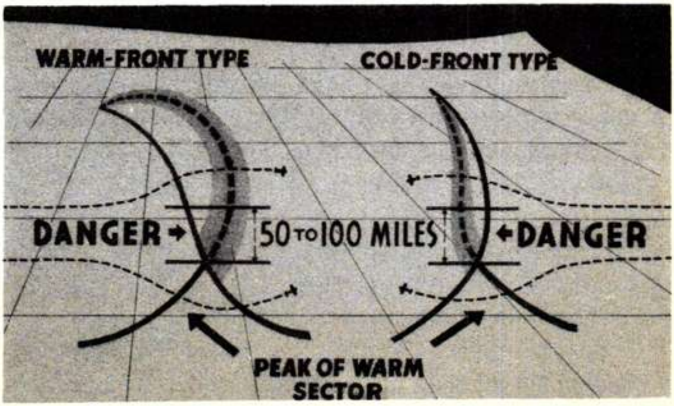


Figure 4-7-3. Dangerous areas in both types of occluded fronts. *Avoid them!*

EQUATORIAL FRONTS

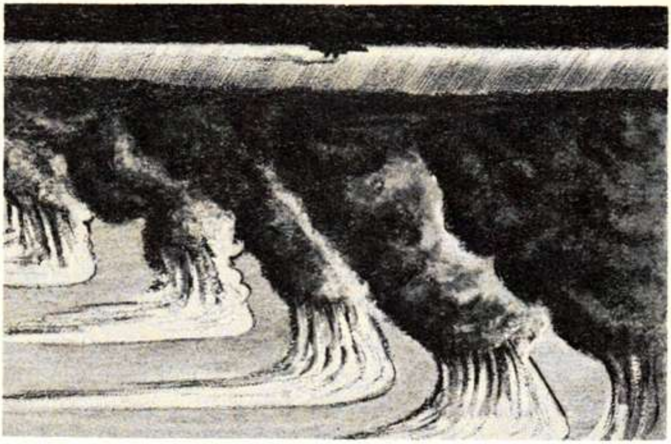


Figure 4-8-1. Cold-front type equatorial front.

CHARACTERISTICS

Movement. *Seasonal:* In the Atlantic, the equatorial front (fig 4-8-1) is always north of the equator. In the Pacific, the eastern position of the front is also north of the equator. This part of the front does not change appreciably during the year. The western part, however, is always inside the summer hemisphere, lying across northern Australia in February and across the Philippines in late August (fig 4-8-2). Figure 4-8-3 shows the extreme northern position of the equatorial front and the extreme southern position 6 months later.

Day-by-day. In addition to its large seasonal movements, the equatorial front changes position during the day, moving sometimes as much as 200 miles in 24 hours. These daily movements are caused by the varying intensity of the trade winds.

Over land. Occasionally, the equatorial front moves inland over the continental areas of the southern hemisphere. Then, widespread areas are littered with scattered thunderstorms. Well-defined line squalls do not form.

When summer cold fronts move towards the equator, they push these scattered storms into line and intensify them, forming serious flight hazards.

Dimensions. The width of the weather band of the equatorial front varies according to the intensity of the wind shift. When the front has the appearance of a warm front (caused by a distinct wind shift), the weather

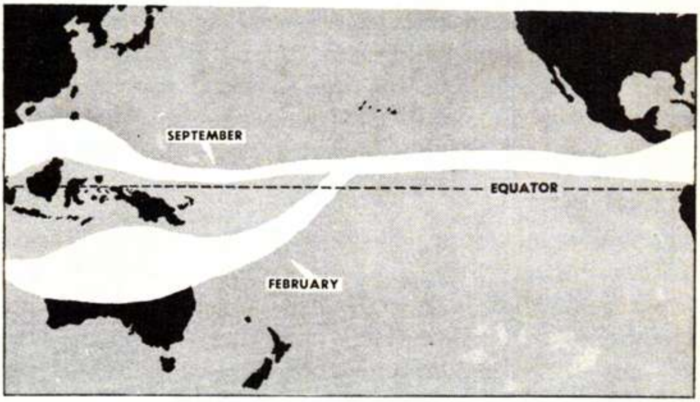


Figure 4-8-2. Seasonal changes of the equatorial front in the Pacific.

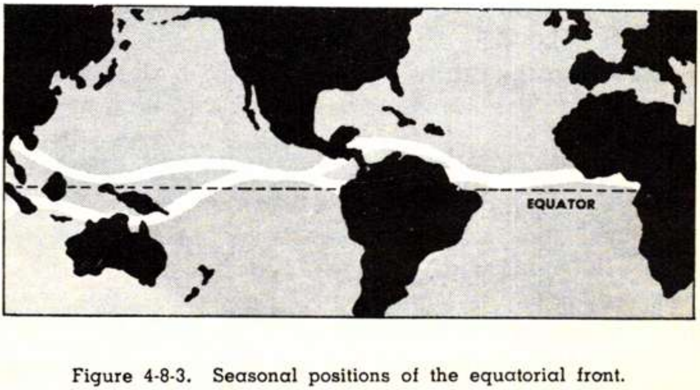


Figure 4-8-3. Seasonal positions of the equatorial front.

band may be 400 miles wide. When the equatorial front looks like a cold front (fig 4-8-1) (moderate wind shift), the weather band may be only 25 to 50 miles in width. Since the wind shift across the front varies widely from place to place, the frontal weather band also varies in width and intensity.

Clouds in the equatorial front extend to 25,000 feet or higher. Their bases are usually 1,500 feet above the water, dropping to 300 feet where it is raining heavily.

Intense equatorial fronts. Frontal activity varies with the time of day, reaching its maximum at sunrise. Minimum activity occurs in the afternoon. At that time, there is less rain, lightning, and turbulence.

HAZARDS

The equatorial front contains all the worse types of weather. Heavy rain, hail, lightning, severe icing, and strong turbulence are to be expected. The icing level extends from 14,000 to 18,000 feet, although in the lower latitudes it is seldom encountered below 13,000 feet. Turbulence is severe in the lower two-thirds of the clouds. Hazards encountered in the equatorial front and methods of combating them are discussed in *Thunderstorms* and *Icing* in this section of the NPIF.

FLYING EQUATORIAL FRONTS

Flight under the front. Since most of the equatorial front is over open sea, your best procedure is to fly under the clouds at an altitude of about one-third the distance from the cloud bases to the surface. This is the best method since it enables you to avoid turbulence and icing conditions. Also, it provides the advantage of contact flight. By flying over open sea, you can keep a constant check on your drift, something you must do ably and frequently, especially in a region of shifting winds.

Circumnavigation. If the cloud system of the equatorial front is similar to that of the cold front, it may be advantageous for you to fly through the front by circumnavigating the thunderstorms.

Over the top. High-level flight over the top or over the saddlebacks is not a recommended procedure since clouds extend to great heights which are often above the ceiling of existing service type aircraft. Even if you could attain the proper altitude, such a flight plan would not be economical in fuel consumption, an important item when flying over water.

NOTE: THE RULE REGARDING FLIGHT THROUGH COLD, WARM, AND OCCLUDED FRONTS AT A RIGHT ANGLE APPLIES ALSO TO THE EQUATORIAL FRONT. YOU DO NOT WANT TO BE IN THE WEATHER AREA ANY LONGER THAN NECESSARY, AND FLYING THROUGH THE FRONT AT A RIGHT ANGLE IS THE QUICKEST WAY FOR YOU TO GET OUT OF IT.

PRECIPITATION STATIC

COMBATING STATIC BEFORE IT IS ENCOUNTERED

When planning a flight, you should bear in mind that severe precipitation static is to be expected in clouds, particularly the cumuliform type, and in precipitation areas directly below them. Remember, also, that the most frequent temperature range for this static is from 22° to 32°F. Therefore, plan your flight to avoid these areas. If this is not possible, follow the procedure given below when you encounter precipitation static.

COMBATING STATIC AFTER IT IS ENCOUNTERED

If it is feasible, change altitude and fly out of the congested area. If, for various reasons, you cannot change altitude, the following is recommended.

(1) Reduce speed (fig 4-9-1). Do not, however, lower the undercarriage. In most types of aircraft, this produces an additional source of corona discharge.

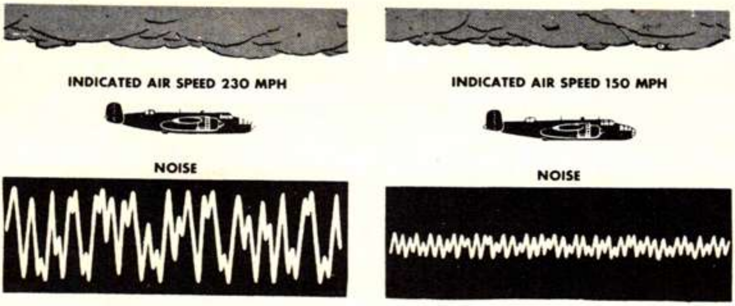


Figure 4-9-1. Speed-noise ratio. At lower speed there is less static.

(2) Tune in the desired station on radio compass and switch to LOOP position. Rotate the loop to get the maximum signal from the desired station.

(3) If your aircraft is equipped with a trailing-wire antenna, instruct the radio operator to let out about 100 feet and then ground the antenna to the aircraft frame. Extreme caution should be used with this device, particularly in or near thunderstorms areas, *because the trailing wire will act as a lightning rod and attract a strike.*

(4) If your aircraft has neither a radio compass nor a trailing-wire antenna, *key* the transmitter at intervals. This increases the voltage on the antenna, thereby causing the accumulated charge to discharge into the surrounding atmosphere. This leaves the airplane almost electrically neutral for a short time. Then, radio reception is possible until a sufficient charge again builds up to produce a corona discharge.

(5) When the flight is along airways, follow the procedure shown in figure 4-9-2. Be sure and switch the audio filter to RANGE position.

(6) When attempting to communicate with the ground and you are within sight of the station, use the VHF radio, if your airplane is so equipped. Precipitation static does not disturb VHF radios as much as HF radios.

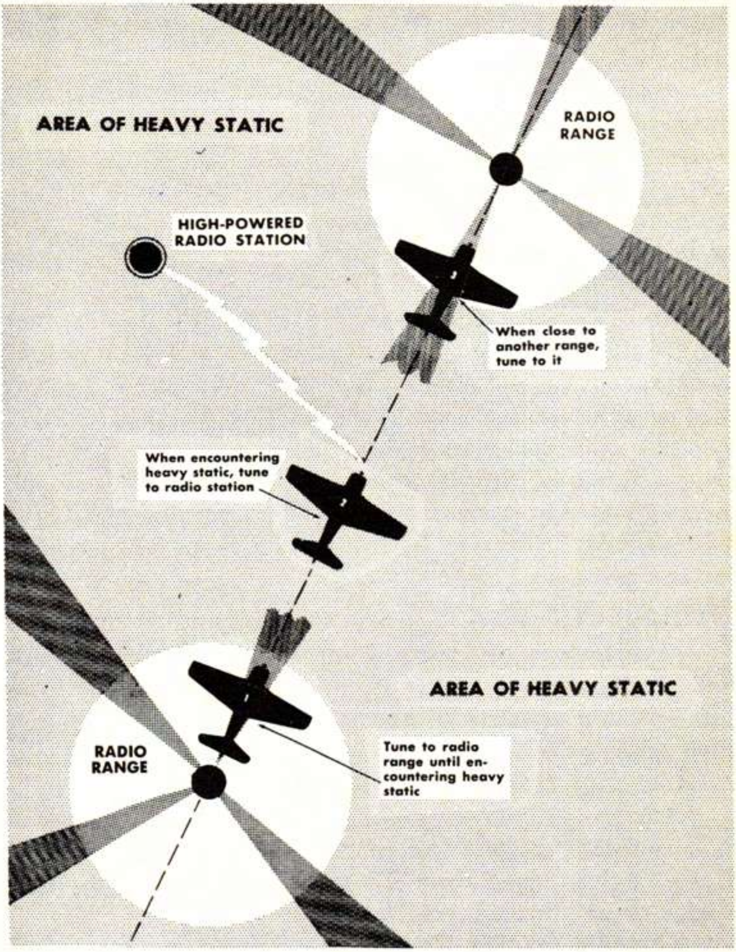


Figure 4-9-2. Procedure for combating precipitation static on flight along airways.

FOG

TYPES OF FOG

There are two major classifications of fog, *air-mass* fogs and *frontal* fogs.

Air-mass fogs. Air-mass fogs are divided into two types, *advection* fog and *radiation* fog. Advection fog is formed when warm air flowing over a cold land or water surface is cooled to the dewpoint. Radiation fog is formed by the cooling of a land surface on a clear night by radiation. Air-mass fogs occur more frequently than do frontal fogs.

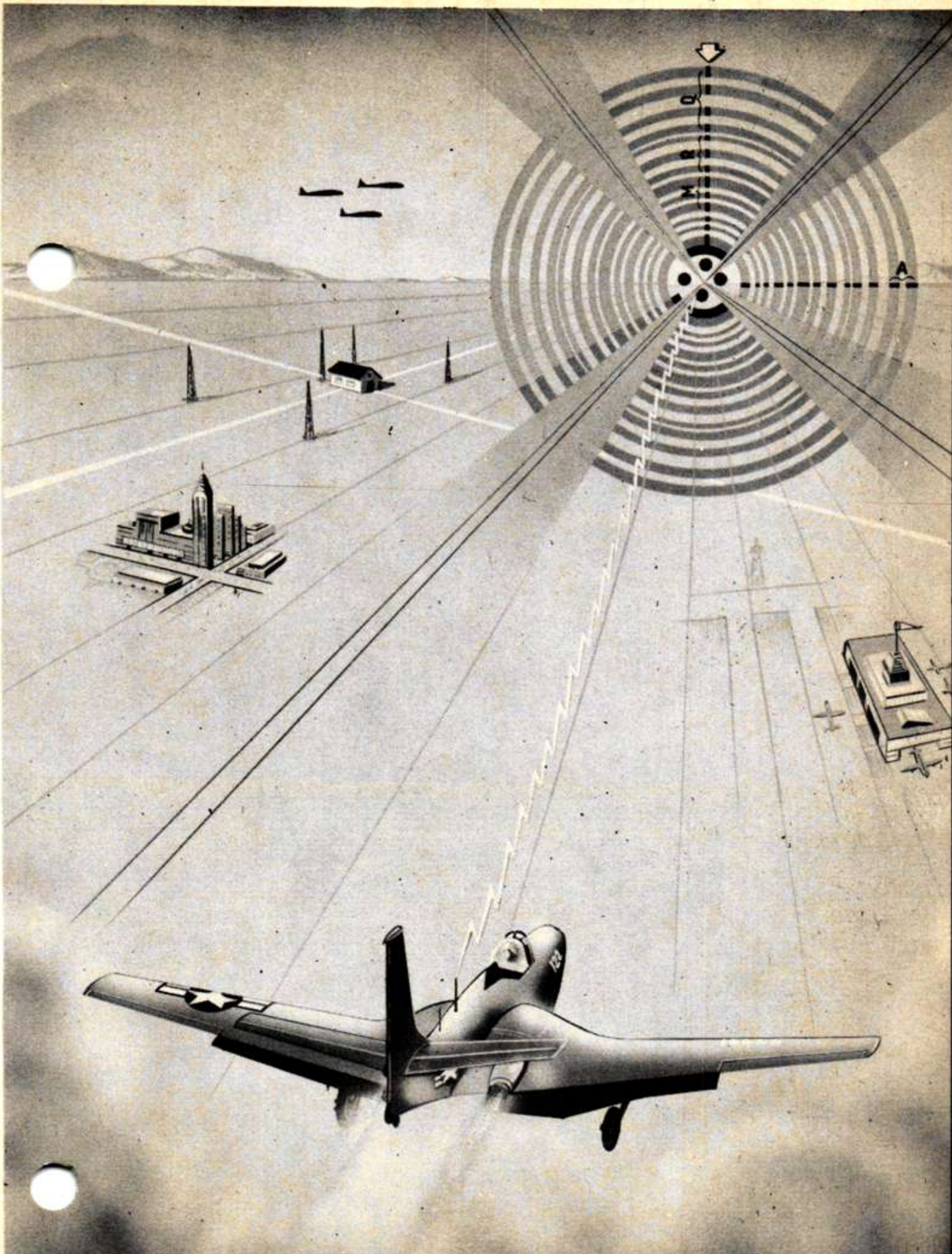
Frontal fogs. The second major classification of fog, the frontal type, is more limited in extent than the air-mass varieties. Cold-front fogs are not a great hazard because they are confined to the narrow weather band of the front and move rapidly. Warm-front fogs, however, are much more extensive and are a definite hazard. Since the band of the warm front is quite wide and the front moves slowly, this type of fog may cover a large region for a considerable time.

COMBATING FOG

At the present time, there is no method for combating fog. If the airport at your destination is fogged in, the only solution is to fly to an alternate airport where you have sufficient visibility to land safely. It rarely pays to circle an airport waiting for fog to lift.

Another reason why fog is such a flight hazard is that accurate forecasting of fog is extremely difficult. Many factors other than meteorological conditions may hinder or aid in its formation.

The only solution for the pilot is to be extremely *fog conscious*. Know the various types of fog, how and where they are likely to occur, and the probable extent of the area they cover. (This information is covered in detail in booklet No. 3 of the aerology series.) Carefully prepare your flight plan whenever there is the possibility of fog at your destination. Consult the aerologist in the selection of an alternate airport.



Section V. INSTRUMENT FLYING, NAVIGATION, AND COMMUNICATIONS

INSTRUMENTS AND INSTRUMENT FLIGHT

FLYING BLIND

To fly *blind* is to employ the imagination. You must be able to visualize the path of your plane, horizontally and vertically, without once seeing beyond your instrument panel. Mechanical forces are at your aid. For the attitude of your plane, you have instruments to give you readings; for the track of your flight, you have radio and electronic devices to give you signals, audio and visual. Your responsibility is to know what each instrument and receiver is, what it shows, how to make necessary flight adjustments, and what relation the information presented has to the information of the other instruments and receivers.

Your responsibility does not stop here. It is not enough that you alone know your attitude and location; yours is not the only plane in the sky. For your own protection as well as the protection of other pilots, it is necessary that you pass on that information. To do so, you must maintain radio contact with stations on the ground which, in turn, notify all other agencies that need to know where you are and where you are going. These agencies keep pilots of other aircraft in flight and yourself advised of air-traffic information needed to safely navigate from one point to another.

INSTRUMENTS

To control the attitude of your plane in relation to the ground, you are interested in flight instruments only. These instruments and all their components are contained within the aircraft and are independent of outside mechanisms. Principally three types of instruments are used: gyro, pressure, and magnetic.

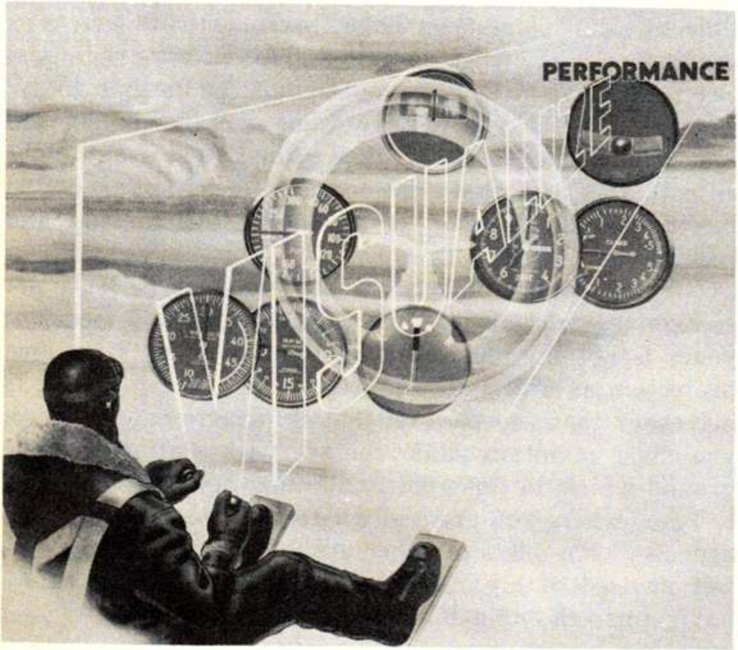
Flight instruments are classified as attitude, power, and performance indicators. For proper use of these instruments, you must know them thoroughly. This calls for knowledge of:

(1) Their function and construction.

(2) Their use and manual adjustment.

(3) Their limitations and errors.

(4) Necessary cockpit checks prior to takeoff.



An instrument is of little or no use to you unless you can visualize the function of your aircraft that it measures. Never fly the instruments; fly the plane. Look at your instrument panel as you would a movie screen—to give you a constantly changing picture of what is happening to your airplane.

ATTITUDE INSTRUMENTS

Strict attitude instruments are gyro-horizon indicators. Naval aircraft are equipped with one of two types.

The Pioneer I-1305 attitude gyro. This instrument indicates the degree of climb, dive, and bank during any aircraft maneuver throughout 360 degrees without any limitations. In an inverted position, the numerals on the meridian line are inverted.

Operation. To start the attitude gyro, turn on the power supply and allow ample time for the electrically operated motor to reach full speed. For this particular instrument, 20 minutes is considered the minimum time. Note the position of the attitude bar in relation to the zero reference line. For level flight, the attitude bar should be exactly on the zero reference line. Remember that in aircraft equipped with a tail wheel, the attitude bar will ride a little above the zero reference line when taxiing or when parked; in aircraft equipped with a nose wheel, the attitude bar will ride just as it would in normal flight.

With different loading or power setting, the nose of the airplane will be in a different position in regard to the horizon when in level flight. To set the attitude bar on the reference line, rotate the pitch-trim knob at the bottom of the instrument face.

Discrepancies. Correction for tumbling is not necessary because the erection system of the gyro will return it to normal should it go off its vertical position. However, should the power supply for the unit be cut off a short time after being turned on, the gyro may erect in an inverted position. When this occurs, turn off the power and allow sufficient time for the gyro to come to rest before turning on the power again.

NOTE: KEEP THE GYRO UNCAGED AT ALL TIMES.

The Sperry H-3 gyro horizon. This instrument (fig 5-1-1) indicates the pitch within 27 degrees of level flight and bank up to 90 degrees during an aircraft maneuver.

The H-3 gyro operates in inverted flight the same as in level flight, the one exception being that in inverted flight the bank index is hidden by the support of the trim indicator.

Operation. To start the gyro horizon, close the main power supply switch. With quick-erection models, you need allow no more than 1 minute for the gyro to settle, but with earlier models you should allow about 10 minutes for the gyro to settle. Never make an instrument takeoff until 10 minutes after closing the main-power-supply switch.

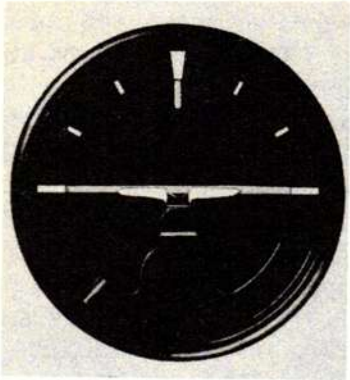


Figure 5-1-1.

As with the Pioneer I-1305, make allowances for difference of the horizon bar in relation to trim indicator according to the type landing gear and load and power setting.

Discrepancies. This instrument does not tumble. However, during turns, temporary displacement of the gyro from its normal position may occur. This depends on the rate of turn and the airspeed. At normal speeds and from one-half to standard rate of turn, this displacement will be negligible. As the airplane returns to level flight, the gyro will automatically return to its normal position.

RECIPROCATING-ENGINE POWER INSTRUMENTS

Tachometers. *Description.* . Tachometers in reciprocating engine aircraft indicate, by electrical or centrifugal force, the revolutions per minute of the engine's propeller. Errors in the instrument are nominal and may be disregarded. (See fig 5-1-2.)

Operation. While the engine is warming up, check the tachometer for excessive oscillations or unusually low readings. Either of these conditions indicate malfunctioning.

Figure 5-1-2.

The manifold pressure gage. *Description.* This instrument (fig 5-1-3) is an aneroid barometer which registers in inches of mercury the pressures at which the fuel mixture is delivered to the engine. When used in Naval aircraft equipped with constant-speed propellers, it becomes the reference for regulating the power output of the engine. Errors in the instrument are nominal and may be disregarded.

Operation. Check the instrument before starting your engine to see that it indicates approxmately the existing atmospheric pressure. After starting the engine, check for very low readings and excessive oscillations at various throttle settings. Inaccurate readings generally result from water in the lines. To drain the water, open the bleed valve while the engine is running. **Always close the bleed valve before taking off.**

Figure 5-1-3.

JET-ENGINE POWER INSTRUMENTS

Tachometers. Some tachometers in jet aircraft indicate the percentage of the maximum engine speed. The larger pointer indicates up to 100 percent of the engine speed and the smaller pointer indicates engine speed within each 10 percent of the larger pointer. Error in the instrument is nominal and may be disregarded. (Direct-reading tachometers of centrifugal or electrical principle are also used.)

The exhaust-temperature indicator. This instrument is a thermo-couple instrument which indicates the temperature of the tail pipe on a jet engine in calibrations from 0° to 1,000° C. Error in the instrument is nominal and may be disregarded.

WARNING

Never exceed the red line on the instrument or the temperature at which (in later models) the warning light flashes on.

PERFORMANCE INSTRUMENTS

The sensitive altimeter. This is a pressure-activated instrument normally set to indicate the airplane's altitude above sea-level (fig 5-1-4).

Figure 5-1-4.

Operation. To insure proper indications, be sure that the barometric pressure at the field or level from which you are taking off or landing coincides with that set in your sensitive altimeter. If the altitude indicated by your sensitive altimeter does not agree within 50 feet of the field altitude after being set to field-level pressure, the instrument is faulty and in need of repair.

WARNING

Turn on the pitot-tube heater whenever icing is anticipated.

Discrepancies. No appreciable lag is noticeable in the altimeter during level flight, but during dives and rapid climbs the instrument will lag considerably, depending upon the rate of ascent or descent.

All indications of the instrument must be computed with corrections for installation and mechanical errors and temperature variations to get the true altitude. A scale card in the plane will aid you in these computations.

The radio altimeter. The radio altimeter (fig 5-1-5) is an instrument which determines the absolute altitude of the aircraft above the ground.

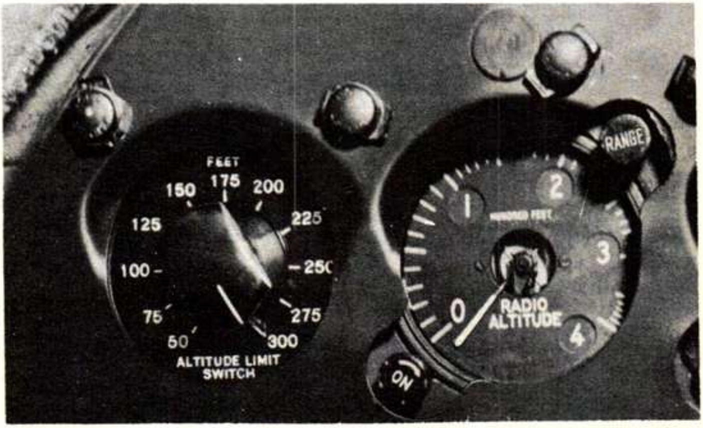


Figure 5-1-5.

Operation. To operate properly, use the low range for indications up to 400 feet and the high range for indications from 400 to 4,000 feet. When operating with automatic pilot, use the low range for indications from 50 to 300 feet and the high range for indications from 500 to 3,000 feet. When flying in conditions of poor visibility, always use the low range at altitudes below 600 feet. Never use the high range below 400 feet; incorrect readings will result.

The radio altimeter may be set in operation at any time. A zero reading is not normally obtained when the aircraft is on the ground and therefore does not indicate malfunctioning of the instrument.

Power failure. The radio altimeter may experience electrical failure. Inconsistent or interrupted indications, sometimes accompanied with an increased reading when the aircraft is in level flight, will warn you of power failures.

The vertical speed indicator. This instrument (fig 5-1-6), commonly referred to as rate-of-climb indicator, is pressure activated and indicates the rate of ascent or descent of the aircraft.

Operation. The pointer should point to zero in level flight. If it does not, set it by turning the small knob at the edge of the face-plate. Tap the face of the dial to be sure the pointer is free to move.

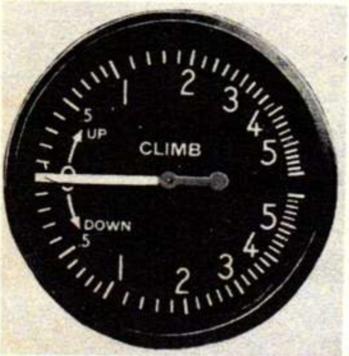


Figure 5-1-6.

Discrepancies. This instrument has a lag built into its pressure system; therefore, its indications lag behind the airplane's performance. Readings of the vertical speed indicator should be considered as a record of what has happened rather than what is happening.

The altimeter and vertical speed indicator should be used as a check against each other.

Readings of the vertical speed indicator are reliable only in smooth air and after the plane has maintained one particular attitude for a period of time.

Airspeed indicator. The airspeed indicator (fig 5-1-7) is a pressure-activated instrument which indicates the speed of your airplane through the surrounding air mass. Later models are equipped with a second pointer to indicate the maximum allowable airspeed and a moving dial which is seen through the face of the main dial to indicate the critical Mach number of the aircraft at various altitudes and temperatures. Earlier models have a red line marked on the face to indicate the maximum allowable airspeed of the aircraft at sea level.

Figure 5-1-7.

Operation. Check the pitot tube to be sure it is uncovered, clear of ice, and not damaged. If you anticipate icing conditions, turn on the pitot-tube heater.

Discrepancies. There is no lag in the airspeed indicator. However, you must compute the indicated airspeed with corrections for altitude to obtain true airspeed. A rough correction can be made by adding 2 percent for each 1,000 feet of altitude to the indicated airspeed to obtain true airspeed.

Turn indicator. The turn indicator is a gyro instrument which shows at what rate the plane is turning.

Operation. You can adjust the sensitivity or dampening of the instrument by turning the screws marked *S* and *D* on either side of case. Before taking off, check the suction gage to make sure it indicates at least 4 inches of mercury. In addition, make sure that the needle deflects momentarily when you press and release one side of the instrument panel. Taxiing out, check to see if the needle deflects during a turn and returns to normal when taxiing straightaway once more. When relying on the turn indicator as the sole directional reference immediately after takeoff, make only shallow turns as the gyro rotor does not usually gain full speed until 4 or 5 minutes after takeoff.

Discrepancies. As this instrument gets older, it gets less sensitive. With increase in altitude, it shows excess indications.

The magnetic compass. The magnetic compass (fig 5-1-8) is an instrument which indicates, within the limitations of error, the directional heading of your aircraft.

Operation. The magnetic compass should not be used as a directional reference during turns except when the gyro compass or directional gyro are not working. If, for any reason, you cannot use the directional gyro or gyro compass, make only shallow, timed (counted) turns to new headings and compensate for the *lag* or *overswing* of the instrument when turning to north or south headings.

Figure 5-1-8.

Before taking off, check the compass bowl to see if there is an adequate amount of fluid to keep the compass from oscillating too freely. Also, check the compass indication with a known direction. While taxiing, make sure the compass card swings freely.

Discrepancies. This instrument does not give accurate readings in rough air. If you navigate by it in rough air, "average out" the oscillations it makes. This will give you a rough directional indication. In extreme latitudes near the magnetic poles, the magnetic compass oscillates and swings unpredictably in turbulent air and during turns, making the instrument of no value. To get a true directional indication, all readings of the magnetic compass must be computed with corrections for mechanical and magnetic error in the plane and the variation between true and magnetic north in the earth's surface.

The directional gyro. This instrument (fig 5-1-9), when properly aligned with the magnetic compass, indicates the directional heading of your aircraft. Because it is more stable than the magnetic compass, it is used in maintaining a fixed course or heading. It functions within 55 degrees of pitch and 55 degrees of bank.

Operation. Before taking off, check the suction gage to make sure there is enough suction to operate the instrument (preferably 3.8 inches to 4.2 inches of mercury). When setting the directional gyro, you should feel a definite resistance as you turn the caging knob. This indicates that the instrument is operating properly.

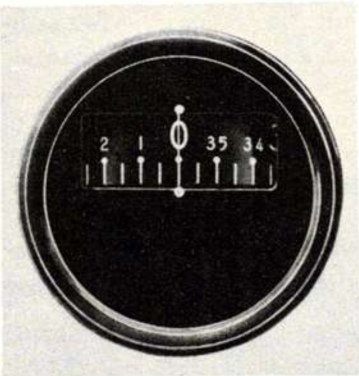


Figure 5-1-9.

In planes where a P-3 gyro flux gate compass is installed, the directional gyro should be used to supplement that instrument.

Discrepancies. If the bank and pitch limits are exceeded, the directional gyro will tumble. Reset it when you return to normal, level flight. Because this instrument precesses, continually check it against the magnetic compass and reset it when necessary.

The gyro flux gate compass. This is a combination gyro-magnetic instrument which indicates the directional heading of your aircraft. (See fig 5-1-10.)

Operation. To operate, turn on power and wait 5 minutes before caging the gyro. To erect the gyro using the CQ-2 caging switch box, just push the button; the cage-uncage cycle will automatically take place. When using the CQ-2 caging switch box, throw the switch to CAGE and UNCAGE in rapid succession. In tail-wheel type aircraft, allow 15 minutes and in nose-wheel type aircraft, allow 5 minutes after caging when you activate the instrument on the ground. Always be in a level attitude when activating the compass in flight. While taxiing out for takeoff, be sure the compass follows correctly each change in direction.

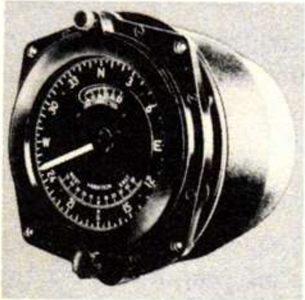


Figure 5-1-10.

Discrepancies. After performing maneuvers greater than 70 degrees in pitch and 100 degrees in bank, always reset the gyro.

THE INSTRUMENT PILOT

The real instrument pilot is the full panel pilot. Learn not one, but all flight instruments. Do not come to depend on one instrument as a primary indicator. Check each instrument against the others for complete knowledge and control.

THE AUTO-PILOT

Operation. The auto-pilot can be engaged for control in any attitude not exceeding 45 degrees of bank, 30 degrees of climb, and 50 degrees of dive. However, be sure that the gyro compass and gyro horizon units are erect and operating before engaging the auto-pilot.

Never adjust trim tabs while in automatic flight. When a sudden change in load necessitates retrimming, disengage the auto-pilot before you do so. When employing the automatic pilot for a long period, it is wise to return to manual flight and retrim the airplane every hour.

Emergency procedure. In an emergency, you can generally overpower the auto-pilot with twice normal exertion on the controls. During blackout or other incapacitation, you can return the plane to normal, level flight by pulling the ON-OFF valve out and turning it to the CENTRALIZED or FULL-IN position. To effect emergency disengagement of the system, pull the emergency mechanical release.

ELECTRONICS NAVIGATION

RADIO AIDS TO NAVIGATION

Radio range stations. Reception can be effected on the basic radio set's low frequency channels. Bad weather, particularly electrical thunderstorms, can rule out the reception of range due to the static produced. In mountainous areas, always check the beam headings listed on the map against the *on-course* signal you receive. *On-course* signals have been known to bend around or off mountains. To check the operational status of radio range facilities, consult the sectional aeronautical charts produced by the US Coast and Geodetic Survey and the *Naval Airways Pilot*, HO 510 series.

Ground-control approach stations. Reception can be effected on the basic radio set, either HF or VHF channels or for Navy GCA units LF. In using GCA, few acknowledgments for transmission are necessary. Radiotelephone phraseology for GCA is found in ACL 62-48. Navy GCA facilities are listed in *Naval Airways Pilot,* HO 510 series. Radio facility charts and the *Airmen's Guide* contain a more complete listing of all facilities.

YE and YG sector coded radio homing beacons. Reception can be effected on the basic radio set, 540-830 kc, but is good only on line of sight. If you are unable to pick up the YE or YG signal, climb to a higher altitude. Consult the most recent Hydrographic Office Publication No. 522 for the location, call letters, modulation frequency, and operating hours of shore-based homing beacons. If you are operating from a ship, always get the call letters, code, modulation frequency, and operating hours of the ship's homing device from the squadron ready-room blackboard before departing on a flight.

75 megacycle marker beacons. Marker beacons are used in connection with the radio range station to indicate definite location of the range station or definite positions along a range or course. Reception requires an additional receiver installed in the plane. This receiver works automatically in connection with the standard HF receiver. Consult the sectional aeronautical charts and the *Naval Airways Pilot,* HO 510 series, to check the operational status of marker beacon facilities.

Special airborne radio receivers are used in connection with the over-all instrument approach system of an airfield, or separately for homing or position finding. To effect homing or position finding, always turn function switch to COMP; to effect use of loop, always turn function switch to LOOP. During periods of bad precipitation static, always operate the equipment on LOOP position. Remember, no cone of silence is encountered with a loop type station; only a distinct build and fade.

Homing and position finding can be effected on any station, but special ground stations, YR beacons, and the like are available to aid you in getting precise homing and position finding information. YR beacons and other types of nondirectional homing beacons are listed in aeronautical charts as type H or MH facilities. H type beacons operate in excess of 50 watts; MH type beacons, under 50 watts.

RADAR NAVIGATION AIDS

Loran. The loran receiver is dependent upon transmission from ground stations to divulge distance readings which can be plotted on special charts into positions of the aircraft. Use of LORAN is dependent upon special navigation charts prepared by the Hydrographic Office for that purpose. The range of loran station transmissions is 600 to 800 miles in daytime and 1,200 to 1,400 miles at night. Loran system is dependable in all sorts of weather except when extreme precipitation static exists. Loran navigation charts are prepared and distributed by the Hydrographic Office and are catalogued in Hydrographic Office Publication No. 1-L.

Airborne Radar. Airborne radar equipment may be used for navigational purposes by two methods:

(1) Reference of the radar scope to maps of the area.

(2) Reception of radar beacons from ground stations. Radar beacons are located on AV, AVP, CV, CVE, CVL, and CVB type ships and at Army, Navy, and Coast Guard shore establishments. Location, identification code, operating-agency angular coverage, and operating hours of shore-based beacons are listed in Hydrographic Office Publications No 520 and No 521. Check the squadron ready-room blackboard for this information when operating from ships.

Radar beacons are line-of-sight transmissions. If you are unable to receive a particular beacon, climb to a higher altitude.

COORDINATED USE OF ELECTRONICS AIDS

Whenever possible, use the electronics aids in your aircraft in coordination by checking one against the other in order that the failure of one particular piece of equipment will not deprive you of proper navigational information.

GROUND EQUIPMENT FOR EMERGENCY USE

At each Navy tower there are, where equipment and personnel will allow, two radio devices to aid you in establishing your position if you become lost.

VHF/DF. This very high frequency direction finder equipment is operated at all times during normal operating hours and is available on 5-minute notice at all hours. If you are lost, you may request the nearest Navy tower to give you a bearing. Continued transmission on your part is necessary for the tower operator to take a bearing on you once the equipment is operating. Being VHF, this equipment operates on line of sight and, dependent on the altitude of your plane, has a range of 100 miles.

Long-range surveillance radar. This radar equipment is operated at all times during normal operating hours and is available on 30-minute notice at all hours. If you are lost, you may request the nearest Navy tower to give you your position. If there are other planes near you, you may be asked to vector out in certain directions in order that you can be identified on the tower radar scope. Follow the tower operator's directions carefully. This equipment has a range of 70 miles, dependent upon the altitude of your plane.

PECULIARITIES OF POLAR NAVIGATION

Navigators flying in polar regions have experienced difficulty navigating due to rapidly changing compass indications and narrowing lines of latitude. To effect proper navigation, the Navy is pursuing many different developments, none of which have yet been approved. When navigating in the polar region, navigate with your directional gyro. Before flying in the polar areas, calibrate the precession of the directional gyro. Then, when flying near the poles, be sure to add in the precession of the gyro instrument when figuring your heading.

COMMUNICATIONS

MESSAGE COMPONENTS

Components. Regardless of the nature or recipient of a transmission, all radio messages are divided into three components.

(1) *Call.* Example: PITCHFORK, THIS IS VICTOR ONE THREE.

(2) *Text.* Example: WHAT TIME SHALL WE ATTACK?

(3) *Ending.* Example: OVER (OUT may be used if no answer is expected).

Brevity. Brevity should be the guidepost for all radio communications. Remember, others must use the same radio frequency, and only one can be heard at a time. All messages must be official and the use of profanity in transmission is forbidden.

After communication with another station has been established and when no confusion will result, you may exclude the name of the station called.

Enunciation. Spell out all difficult words and encrypted groups. Use the standard phonetic alphabet for this purpose.

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

Recorded messages. Give the time of the origin of the message when you want the message to be recorded. Time is expressed in the following manner: TIME ONE THREE THREE ZERO. When requested, add the zone suffix letter. The time group follows the text of the message.

AIRCRAFT REPORTS

Position reports. A position report is made according to the order of the officer authorizing your flight. For action, it should be addressed to your next point of destination and last point of departure; for information, to your operating organization and all ships or stations guarding your flight. Use Greenwich Civil Time in your date-time group.

Weather reports. A weather report is made only by aircraft specifically authorized to do so. The *in-flight report* must be be completely encyphered in the code designated by the authorizing agency to whom the message is addressed.

AIRPORT TRAFFIC COMMUNICATIONS

Outbound traffic. Outbound traffic contacts the control tower for takeoff instructions before taxiing from the parking area. The tower operator will give you taxi instructions before you leave the line and takeoff instructions, wind direction, and any additional information that is pertinent to your flight before takeoff. Stay tuned to the tower frequency for at least 5 minutes after departure unless cleared to another frequency by the tower operator.

Inbound traffic. Inbound traffic contacts the field control tower when 10 miles from the field. Unless instructed by the tower to contact them at another time, report position to the tower operator a second time when 1 mile from the field. The tower will give you wind direction and velocity and landing instructions plus any pertinent information. On landing, the tower will furnish you with taxi instructions.

Identification. Identify yourself to Navy towers by the Bureau of Aeronautics number of the plane except when assigned a special call number for a particular mission; then use your mission call number. Acknowledge all transmissions by *Roger*, except those which contain an order or direction. *Wilco* for all orders and directions.

Wind direction and velocity. Wind is expressed with the direction first, then velocity; for example, *Southeast four, Northwest one five,* and so on.

Flight leader's procedure. When more than one plane constitute the flight, the flight leader requests takeoff and landing instructions for the group, notifying the tower of the number of planes in the group.

USING THE MICROPHONE

Hold the face of the microphone flat against the lips in a vertical position just slightly to one side of the center of your mouth (fig 5-3-1). Hold the contact button down firmly when talking.

You are not able to receive and transmit at the same time. *Do not press the contact button unless you wish to transmit.*

Do not shout. Talk in a normal tone. The radio set will increase or decrease your voice to the proper level automatically. Talk slowly, plainly, and in phrases. This tends to make your message have a rhythmic tone and aids in reception.

Figure 5-3-1. Correct and incorrect methods of using the hand microphone.

Section VI. EMERGENCIES AND EMERGENCY EQUIPMENT

6

RECIPROCATING-ENGINE FAILURE

ON MULTIENGINE AIRCRAFT

The loss of an engine on most multiengine aircraft is not serious if you go on single-engine operation immediately. Most of the accidents caused by the loss of one engine are due to poor pilot technique on single-engine operation. The following are mistakes most commonly made in such cases:

(1) Becoming panic stricken—freezing up.

(2) Failing to go on single-engine operation immediately. Not keeping your airplane under control.

(3) Failing to adjust trim or making wrong adjustments.

(4) Failing to use necessary power on good engine (or engines) to maintain flight.

(5) Failing to feather the propeller of the dead engine.

(6) Failing to jettison unnecessary weight.

(7) Failing to notify the crew of the situation so they will be prepared to ditch or bail out, should that become necessary.

The best way to become an expert at single-engine operation is to learn the exact procedure for single-engine operation for the type airplane you are flying. This is contained in the pilots' handbook for that plane. Then, practice the procedure at a safe altitude until you become so proficient that you will automatically take corrective action when an engine fails.

REFERENCE: FSB 31-44

ON SINGLE-ENGINE AIRCRAFT

When the engine of a single-engine aircraft, reciprocating-engine type, fails in flight, attempt to start it if you have enough altitude. Unless you know the cause of engine failure, check your fuel system first to ascertain that the engine is receiving fuel. Then, follow the procedure for starting in flight as set forth in the pilots' handbook for the type airplane you are flying. Attempt to restart the engine only after making sure of flight control and checking for such hazards as fire, excessive vibration, and the like.

FORCED LANDINGS

SELECTING A FIELD

When selecting a field for a forced landing, choose one which has the characteristics given below. Remember that a field which appears smooth and level when viewed from altitude frequently turns out to be rough and full of obstructions when seen close to the ground. When you discern this, it will usually be too late to change your mind, so give as much time and consideration as possible to the selection of the best available landing area. Pick an area that is:

(1) Large enough for you to get your plane into.

(2) Located to enable you to land into the wind or almost into the wind.

(3) Smooth and free of obstructions.

The terrain of the field you are obliged to land in governs whether you go in wheels up or wheels down. It is generally considered good policy to land wheels up on all types of terrain except that which is laden with boulders and tree stumps or filled with pot holes. Bail out if you think a reasonably safe landing cannot be effected.

REFERENCE: FSB 14-44

PROCEDURE IN MULTIENGINE AIRCRAFT

(1) Warn your crew in plenty of time. Order them to bail out if circumstances make landing exceptionally hazardous.

(2) Establish a glide well above stalling speed. Never attempt turns close to the ground.

(3) Lighten the plane by jettisoning fuel, cargo, all loose objects, and any unnecessary equipment.

(4) Open escape hatches.

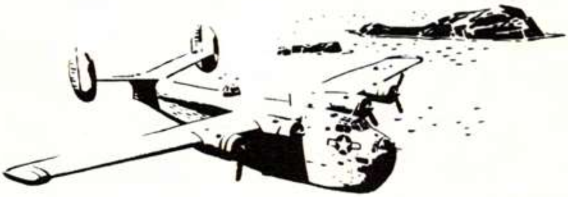
(5) Tighten safety belt and shoulder harness.

(6) Land with power if it is available. Always fly the plane right down to the ground with ample speed.

(7) Just prior to actual landing, shut off fuel and electrical switches.

(8) Lower flaps. Do not lower landing gear unless terrain is unusually rough or is smooth and hard.

(9) Warn crew a few seconds before landing.



PROCEDURE IN SINGLE-ENGINE AIRCRAFT

(1) Release drop tanks.

(2) Unbuckle parachute and tighten shoulder harness and safety belt.

(3) Jettison canopy.

(4) Lower flaps. Do not lower landing gear unless terrain is unusually rough or is smooth and hard.

(5) Turn off fuel and electrical switches.

(6) Make normal approach with speed 20 to 25 knots above stalling speed.

REFERENCE: FSB 14-44

FIRE IN FLIGHT

EXTINGUISHING ENGINE FIRES

Immediate steps. (1) Whenever fire breaks out in an engine, immediately warn every man on board to attach his parachute and to be prepared to abandon the plane when ordered to do so.

(2) Close cockpit and cabin windows immediately. **Never open the pilot's escape hatch unless you are going to bail out.** If cockpit windows and the pilot's escape hatch are opened, a draft is created and smoke and flames may be drawn into the cockpit, placing control of the airplane in jeopardy. These steps should be accomplished simultaneously with the procedure given below.

Procedure for extinguishing engine fires. The following procedure applies specifically to multiengine aircraft equipped with engine fire extinguishers. It also applies, as far as the equipment permits, to single-engine airplanes.

(1) Feather the propeller of the burning engine. If propeller cannot be feathered, place it in high pitch.

(2) Close throttle at the same time you feather propeller.

(3) Shut off fuel by turning selector valve or fuel shut-off valve to closed position.

(4) Shut off lubricating and hydraulic oil if shut-offs are available.

(5) Open cooling flaps.

(6) Move mixture control to IDLE CUT-OFF.

(7) Release extinguisher, but only after propeller is stopped or reduced to lowest rpm.

(8) Turn off ignition.

(9) Turn off electrical switches.

(10) Lower landing gear if aircraft is the type with tires in the flame path when gear is retracted, and no other hazards or undue loss of altitude are involved.

(11) **Do not restart engine.**

(12) If engine fire is not extinguished, give the order to abandon the plane.

NOTE: IF AIRPLANE HAS NO FIRE-EXTINGUISHER SYSTEM, FOLLOW PROCEDURE OUTLINED ABOVE EXCEPT FOR ITEM 7.

Remarks. Most fire-extinguisher systems emit but one spray which is of short duration (2 to 6 seconds). Therefore, it is important that the engine be fully stopped or at least reduced to its lowest rpm prior to release of the extinguisher. Otherwise, imflammable fluids or vapors may be pumped into the fire or onto hot metal parts, causing reignition to occur.

REFERENCE: TN 86-44, 4-49

EXTINGUISHING CABIN FIRES

(1) Warn crew members.

(2) Close all windows and ventilators. Hatches and bomb bays should not be opened for ventilation or to jettison material until after the fire has been extinguised. Open them only if it is necessary to abandon the plane or to jettison endangered explosives.

(3) Locate source of fire. If an electrical fire, cut power to affected part. If a fuel line is leaking, cut flow through line.

(4) Use all extinguishers available.

(5) When flames are extinguished, open windows and ventilators immediately.

FIRE HAZARDS IN DIVING AIRPLANES

Airplanes equipped with float type carburetors are subject to engine fire when placed in a dive, a steep spiral, or in a spiral with a closed throttle. This occurs shortly after the pushover, and is the result of an over-rich mixture which is caused mainly by faulty carburetor action. If the throttle is opened immediately, the flame will usually be drawn into the engine and no damage will result. If the throttle is kept closed, however, the fire may persist after pullout, and may cause engine stoppage and a serious fire. To avoid this hazard, maintain a partial throttle opening during dives and spirals.

REFERENCE: TN 23-40

BAIL OUT

FROM MULTIENGINE AIRCRAFT

Responsibility. Every pilot in command of an airplane must know the emergency exits provided for the plane he commands, and must see that his crew knows them and how to use them. It is the direct responsibility of the airplane commander to drill his crew in a standard bail-out procedure, including warning signals and exit signals. Practice making exits wearing full equipment when the airplane is on the ground. See that each crewmember's parachute fits him properly.

As airplane commander, the decision to bail out rests with you. Before giving the order to jump, be sure that you have enough altitude to allow all of your crew to escape safely. Always warn them in advance.

If you decide that jumping is necessary, put your airplane in level-flight position and slow it down as much as possible. When your crew has jumped, make your own exit.

Escaping. You and your crew will normally use an escape hatch, the bomb bay, or a door, depending on the circumstances. When possible, roll yourself to the edge of the opening facing the wing tip of the plane and go out head first and straight down. Wait until you are well away from the plane before pulling the ripcord (5 to 10 seconds if you have enough altitude).

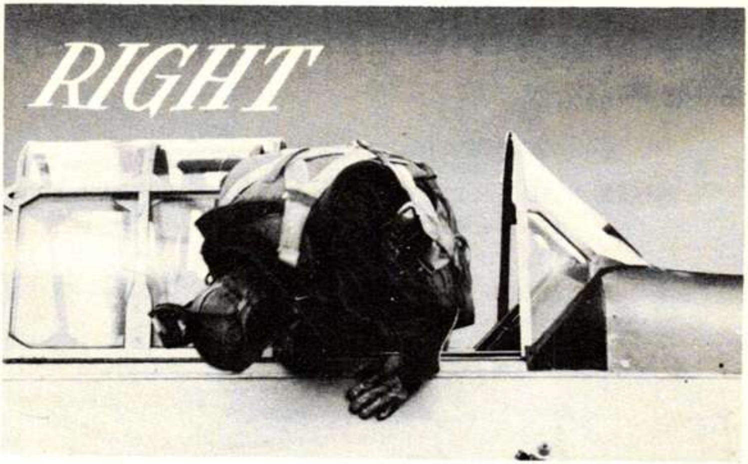
FROM SINGLE-ENGINE AIRCRAFT

(1) Slow plane down as much as possible.

(2) Jettison canopy or place it in EMERGENCY-OPEN position.

(3) Release composite disconnect. If your airplane is not equipped with this device, disconnect equipment if time permits.

(4) If bailing out from a normal altitude, turn towards the side of the aircraft you intend to exit from, and pull with your hands and push with your feet to get out. Try and keep your body low, below the level of the windshield (fig 6-4-1), to avoid action of the slipstream.



Pilot's body is *below* the level of the windshield.

Pilot's body is *above* the level of the windshield.

Figure 6-4-1. Correct and incorrect methods of bailing out.

(5) Dive straight out or slightly forward. As you do, place your arms in position to shield your face (fig 6-4-2). This affords protection in case you should hit parts of the plane.

(6) Pull ripcord when clear of plane.

NOTE: THE ABOVE INSTRUCTIONS ALSO APPLY TO TWIN-ENGINE FIGHTER PLANES. PILOTS OF MULTIPLACE SINGLE-ENGINE AIRCRAFT SHOULD WARN THEIR CREW AND ALLOW THEM TO BAIL OUT FIRST.

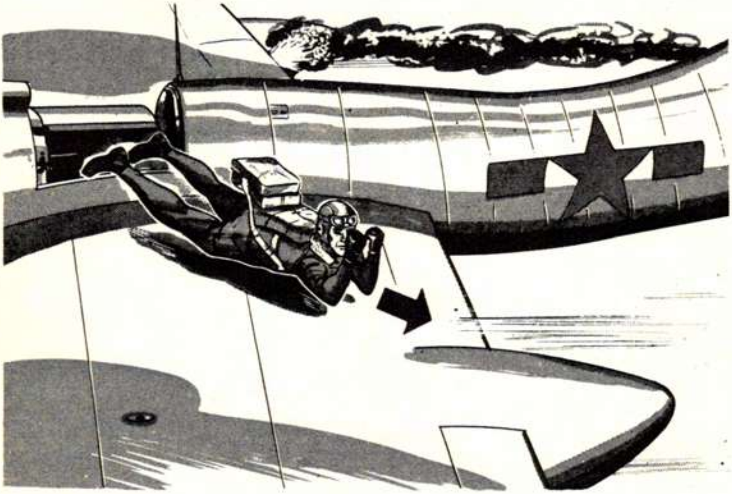


Figure 6-4-2. Pilot's arms are in position to shield his face.

USING THE EJECTION SEAT

Pilots of planes equipped with an ejection seat should be prepared to use this device when bailing out. It is the best way to assure escape from a plane traveling at a very high speed.

Description. The seat is designed to clear the tail of the plane by a safe margin. When it reaches the point of maximum trajectory, the stabilizing drogue chute is automatically opened and you begin a rapid descent.

Procedure for using seat. (1) If you are using oxygen, turn on bail-out bottle.

(2) Jettison canopy or place it in EMERGENCY-OPEN position.

(3) Take feet from rudder pedals and place them in stirrups attached to the ejection seat.

(4) Pull the curtain downward past your face, bracing your body against the seat as you do so. Force your head and body back against the seat as hard as possible.

(5) As you continue pulling the curtain downward, the release mechanism is actuated, catapulting you out of the plane.

(6) Ride the seat down until you reach a low altitude. Then, unfasten your safety belt and shoulder harness, and throw them away from you.

(7) Jump away from the seat as far as possible. Wait 5 seconds before pulling the ripcord.

NOTE: WHEN BAILING OUT AT A LOW ALTITUDE AND IT IS NECESSARY TO LEAVE THE SEAT AS QUICKLY AS POSSIBLE, TRY TO WAIT 5 SECONDS BEFORE PULLING THE RIP CORD.

DELAYED JUMPS

Reasons for delayed jumps. When it is necessary to jump from an aircraft flying at medium or high altitudes, a delayed opening of the parachute has the following advantages:

(1) A jumper is less likely to foul another jumper, the aircraft out of control, or falling parts.

(2) The jumper is less likely to be shot at by enemy aircraft.

(3) The jumper escapes the dangers of frostbite and anoxia.

(4) The jumper slows down, eliminating dangerous stresses on the chute when it opens, because the forward motion imparted by the plane has ceased and the rate of fall decreases with decreasing altitude due to increasing air density. A jumper who opens his parachute immedi-

ately after leaving a plane traveling at high speed is likely to be injured, and there is the possibility that the parachute will be ripped from his body.

Judging altitude. During a free fall, do not depend on counting or timing to judge distance above ground. Look at the ground and estimate your altitude. For example, at 6000 feet the earth begins to look green, you can distinguish details, and the ground rushes up at you.

Opening the chute. When making a delayed jump, pull the ripcord between 10,000 and 15,000 feet. It is safe to open your parachute in almost any position except when in a rapid tumble or a flat spin. Flat spins and rapid tumbling can be stopped by straightening the legs and by sticking an arm, leg, or both out from the side of the body. Holding out an arm or leg will also turn your body should your falling attitude be such that you cannot see the ground.

After you have stopped the tumble or flat spin, pull in your arms or legs and pull the ripcord.

REFERENCE: TN 42-44

DITCHING LANDPLANES

PROCEDURE PRIOR TO DITCHING

As soon as you decide you must ditch, order your crew to prepare for ditching. Give them adequate time to carry out their duties and assume ditching positions. Start emergency radio procedure immediately. Lighten the plane by jettisoning bombs, guns, extra fuel, and anything not essential for survival. Close bomb-bay doors after jettisoning, and make sure that all upper emergency exits are open; all lower hatches closed. Have all bulkhead doors closed to stop the flow of water through the plane. When your crew has assumed ditching positions, caution them to maintain these positions until the plane comes to a complete stop.

WIND AND SURFACE CONDITIONS

Except close inshore and in fast-running estuaries, waves move in the same direction as the wind. As the wind velocity increases, the waves become larger until the tops approach vertical and break. Swells do not necessarily move with the wind and generally have no breaking crest. To become adept at estimating wind and sea conditions, study table 6-5-1, and form the habit of studying wave and swell formations at every opportunity.

TABLE 6-5-1. WIND AND SEA CONDITIONS

WIND VELOCITY (KNOTS)	SURFACE CONDITIONS SEEN FROM AIR
Less than 1	Smooth, slick sea
1-3	Small ripples with calm areas
4-6	Ripples everywhere or well-defined waves which are smooth and do not break
7-10	Occasional whitecaps
11-16	Pronounced waves; frequent whitecaps
17-21	Long, well-defined wind streaks with waves and streaks coming from same direction
22-27	Large seas with waves forming on them; wind lifts occasional wave crests
28-33	Heavy seas; pronounced streaks; wind lifts most wave crests; breaking, rolling waves form
More than 33	Continual rolling waves; well-defined waves form on some of the heavy seas; wind lifts all wave crests along for a distance equal to at least one one-half wave length; scud or foam

JUDGING ALTITUDE

Estimating altitude is extremely difficult over a calm, glassy sea. One way to judge it is to have the radio operator reel out the trailing antenna a definite distance. When the "fish" hits the water, an approximate indication of altitude is given. If you are flying a carrier-based aircraft, you can estimate your proximity to the water by dropping your arresting hook and noting the slight vibration when it encounters the sea.

APPROACH

When ditching, approach with power if it is available. If power is not available, a greater than normal approach speed should be used. This insures good control and some margin of speed after flattening out to allow you to study the seas so you may choose the best point of impact. Don't commit the error of stalling in from too great a height.

REFERENCE: Naval Aviation News, 15 Feb 1945

LANDING CROSSWIND OR INTO THE WIND

The advantage of having lower ground speed when fully stalled by landing into the wind is offset by two serious disadvantages which accompany this procedure.

(1) You may fly straight into a wave face.

(2) The tail may bounce on a crest, causing the nose to be thrown violently downward.

When the wind velocity is less than 16 knots (wave height 5 feet or less, table 6-5-1) you may choose to land either crosswind or into the wind. When, however, wind velocity is more than 16 knots and wave height greater than 5 feet, *ditch only into the wind.*

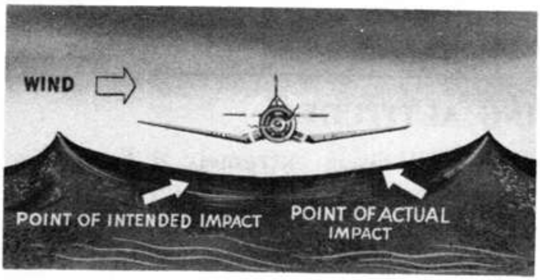


Figure 6-5-1. Ditching crosswind. Plane is on the downwind side of wave crest. Note computation necessary for drift.

Crosswind procedure. If, after you have noted the wind and sea condition, you decide to ditch crosswind or along the waves, follow this procedure:

(1) Obtain the lowest rate of descent and forward speed by use of flaps and power, if available. Use medium flaps on all airplanes excepting carrier-based fighters and the PB4Y.

(2) Maintain the most advantageous nose-up attitude possible.

(3) Compensate for drift by heading.

(4) Endeavor to land on the downwind side of the swell top or wave crest. (See fig 6-5-1.)

(5) In multiengined aircraft, that side of the aircraft which has maximum power available should be the upwind side if this does not involve a turn near the water.

Into the wind. If you decide to ditch into the wind, follow this procedure:

(1) Obtain the lowest possible rate of descent.

(2) Obtain the lowest possible forward speed.

(3) Maintain the most advantageous nose-up attitude, thereby avoiding as far as possible the nose striking a wave face.

(4) Endeavor to touch down just before striking a rising wave face.

(5) Endeavor to hold the nose up until all speed is lost.

DITCHING FIGHTERS

In many pilots' handbooks it is stated that pilots of high-speed fighter aircraft, particularly jet aircraft, should not ditch because they have all their survival equipment in the pararaft and they are flying the hardest type of plane to ditch successfully. Experience has shown, however, that such aircraft can be ditched successfully. When ditching, follow applicable procedures given above. Jettison wing tanks *only if they are not empty.* When empty, they should be retained as a flotation aid.

Figure 6-6-1. Mark 2 life vest.

EMERGENCY EQUIPMENT

MARK 2 LIFE VEST

The Mark 2 life vest, shown in figure 6-6-1, has three separate inflatable compartments, none of which are interconnected. The inside and outside compartments are inflated by means of CO_2 and the middle compartment orally through the oral-inflation valve. Inflation of the middle compartment is mandatory because CO_2 leaks out of the other compartments after a short while.

Inflation. To inflate, pull one lanyard at a time. When the two compartments are inflated, unscrew the mouthpiece of the oral-inflation connector, place it in your mouth, and blow, pressing down on the mouthpiece as you do so. Release of pressure on the mouthpiece allows the spring-loaded valve to close, preventing loss of air from the compartment. Secure the valve by means of the screw take-up.

WARNING

Inflate the middle compartment as soon as possible. If you wait, you may become too fatigued to do so.

Fit. When first issued the vest, put it on, secure the harness, and inflate. Then, adjust the adapters on the harness so a comfortable, snug fit is obtained.

Inspection prior to flight. (1) Check to see that there are no snags or tears in the vest or harness and that metal parts are not corroded.

(2) Check CO_2 cylinders to make sure they have not been discharged.

(3) Make sure all equipment items are attached to the vest.

(4) Make sure that mouthpiece of oral inflation valve is unlocked fully for immediate oral inflation in the water.

REFERENCE: TO 90-45

MODEL PK-2 PARARAFT KIT

The model PK-2 pararaft kit (fig 6-6-2) is attached to the parachutes worn by pilots of carrier type aircraft. The kit consists of two compartments, one containing the raft and the other containing the equipment listed in table 6-6-1. The cover of the raft compartment is secured by snap fasteners; the equipment compartment, by a slide fastener. Fastened to the kit is a retaining line which the pilot attaches to his life vest.

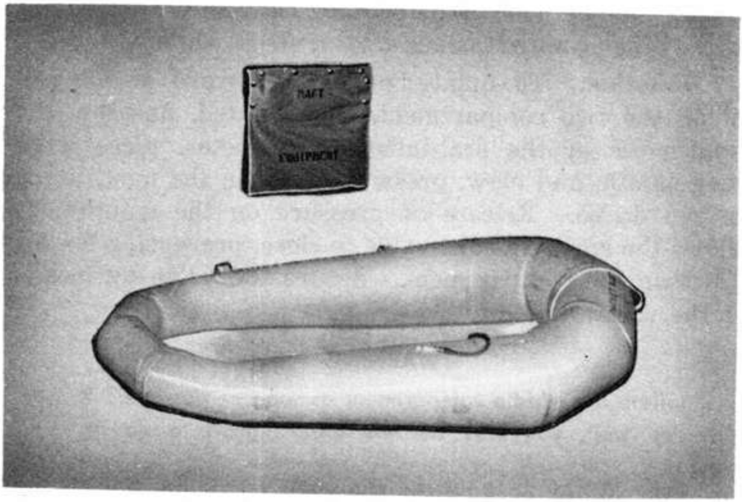


Figure 6-6-2. Model PK-2 pararaft kit.

Use. The kit is easily detached from the parachute and the raft can be inflated without difficulty. The equipment compartment remains attached to the inflated raft by a fastener. After the pilot has entered the raft, which he should do from the smaller (foot) end, he can unsnap the equipment compartment and secure it in a safer position aboard the raft.

Equipment. All personnel using the model PK-2 pararaft kit should familiarize themselves with the equipment contained in the kit.

REFERENCE: TO 22-47

TABLE 6-6-1 Equipment in PK-2 Pararaft Kit			
ITEM	QUANTITY	ITEM	QUANTITY
Anchor, sea	1	Pararaft	1
Bag, water-storage	1	Signal, distress (day or night)	2
Cord, nylon	50 ft	Poncho	1
Kit, desalting	1	Still, solar	1
Marker, dye-pack	2	Transceiver, model AN/CRC-7, or radar reflector	1
Mirror, signalling	1		

MULTIPLACE LIFE RAFTS

Multiplace life rafts (fig 6-6-3) are carried on all multiengine Naval aircraft when storage facilities permit. There are three types: Mark 2 (two-man), Mark 4 (four-man), and Mark 7 (seven-man). The emergency equipment carried with these rafts is listed in table 6-6-2. Some of these items are stowed in the raft and others in the life-raft emergency-equipment container. The equipment container is attached to the raft by a retaining line. All personnel assigned to multiengine airplanes should learn how to use this equipment and the raft. Plane commanders should hold frequent drills to insure that their crews are thoroughly familiar with the equipment and ditching procedures.

TABLE 6-6-2 Emergency Equipment in Multiplace Life Rafts

ITEM	QUANTITY In MK-2	QUANTITY In MK-4	QUANTITY In MK-7
Anchor, sea	1	1	1
Bag, water-storage*	2	4	7
Bed, hammock	1	1	2
Compass, card type	1	1	1
Cord, nylon	100 ft	100 ft	100 ft
Jacknife	1	1	1
Kit, desalting*	2	4	7
Kit, first-aid*	1	1	1
Marker, dye	6	6	6

TABLE 6-6-2 continued			
Mirror, signalling	1	1	1
Oars	3	3	3
Ointment, sunburn*	1	1	1
Paulin	1	1	1
Pump, hand	1	1	1
Rations*	2 cans	4 cans	7 cans
Signals, distress (day and night)	6	6	6
Sponge, bailing	1	2	2
Still, solar*	2	4	7
Transceiver, model AN/CRC-7, or radar reflector	1	1	1
Whistle	1	1	1

* Stowed in life raft emergency equipment container.

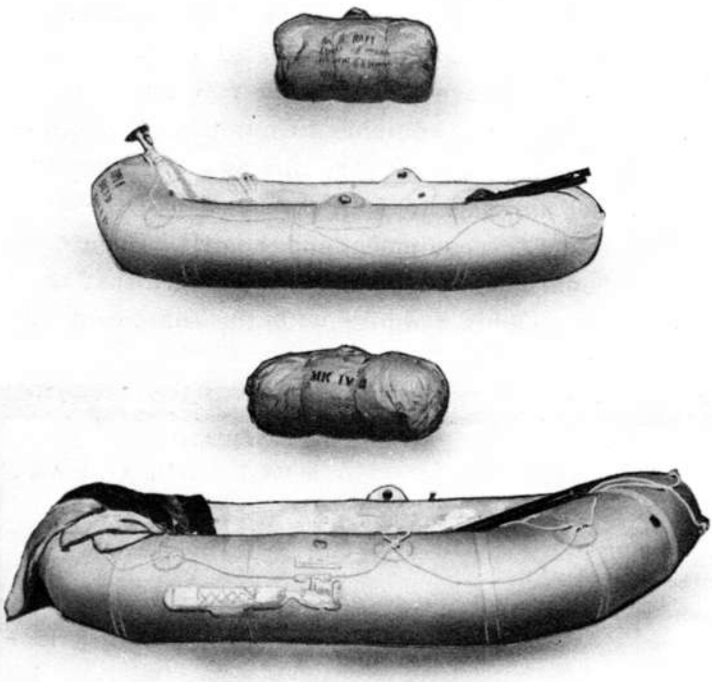


Figure 6-6-3. Multiplace life rafts.

EXPOSURE SUITS, MARK 1 AND 2

The exposure suit is made of lightweight waterproof material and is designed to provide protection from immersion in cold water and exposure to wind, rain, and spray when aboard a life raft. In addition, it has a high degree of bouyancy. The Mark 1 suit (fig 6-6-4) is designed for donning immediately before crash landings at sea. The Mark 2 (fig 6-6-4) is a continuous-wear suit worn by pilots and crewmen of attack and other carrier types of airplanes.

MARK-2 MARK-1

Figure 6-6-4. Exposure suits.

Before entry into the water. (1) Close all vents and tighten wrist and ankle straps.

(2) Tighten drawstring at neck. If you wear the Mark 1 suit, force air out of it before tightening drawstring. If the wearer should become wet before donning the Mark 1 suit, it will still afford protection if donned immediately after boarding the raft.

Entering the water. If possible, enter the water feet first, inflating your life vest before doing so.

REFERENCE: TN 7-45, 14-46

SURVIVAL

PREREQUISITES

Every pilot should be dressed to cope with the physical conditions of the area over which he is flying. You should have proper survival equipment aboard your plane or person before starting a flight, and you should have a knowledge of the hazards which you will have to combat if forced down. Fear of the unknown weakens you by reducing your ability to think and plan. If you have some knowledge of what to expect and what to do beforehand, you will not find a strange environment puzzling or frightening, and you will gradually learn to know it as you have learned to know your home or city.

To survive, you must learn what can be used for food, where to look for it, and how to prepare it. Also, you must know how to care for your body, how to conserve energy, where to sleep, how to take shelter, and how to tell where you are at all times. In addition, you must know what things in the environment will harm you. This information is covered in detail in *Survival on Land and Sea,* NavAer 13-1-501, and *How to Survive on Land and Sea.* **Study and survive.**

GENERAL SURVIVAL RULES

The following are general rules which you must adhere to regardless of what type of environment you encounter.

(1) When you are forced down on land, stick by your plane unless you are certain you can find your base, or, if in time of war, you are in enemy territory.

(2) Never eat if you lack water. Eating uses up the body's reserves. If you have water, if the body is not overexerted, and if the climate is warm, you can live without food for weeks.

(3) Ration your water if the supply is limited. You need about a pint a day to keep fit, but you can survive on 2 to 8 ounces. Water goes farther if you hold it in your mouth for a long time—rinse, gargle, and swallow.

(4) Pay particular attention to your feet. Keep them dry. If they or your legs become swollen, do not massage them. Remove your shoes if the swelling is at all severe.

(5) Avoid unknown plant foods with milky juices or bitter taste. In general, it is safe to *try* the foods that you observe being eaten by birds and mammals, although there are exceptions.

(6) Test strange food by eating only a little of it and waiting to see its effect. A small quantity of poisonous food is not likely to prove fatal or even dangerous.

(7) If you leave your plane, first salvage anything that can be of value, particularly maps and the compass. **Always take your parachute.** It can be used in many ways.

(8) Determine a course to follow and travel slowly, resting when you become tired.

(9) Start looking for food and water before you become too tired or exhausted to do so effectively.

(10) Don't lose your head.

HINTS ON SURVIVAL AT SEA

(1) Rinse your clothing in the sea at least once a day to prevent accumulation of salt. Dry it in the late afternoon.

(2) Systematically build up your resistance to sunshine by exposing your body 5 to 10 minutes each day until you have a good tan.

(3) Wear sun glasses or some type of eyeshade.

(4) Drink only rain water or the body fluids of animals. **Never** drink sea water unless your raft is equipped with a still or chemical apparatus for removing the salt from it.

(5) Preserve the water already in your body by avoiding excessive perspiration. Do this by avoiding unnecessary exertion, by rigging an awning for shade, and by keeping your clothing wet with sea water during the day.

(6) Generally, it is safe to eat all fish caught in the open sea; all sea birds are edible. What parts you do not eat, dry for future eating or for use as bait.

(7) At night, catch flying fish by using your flashlight. Shine your light on the side of the raft or any surface that will reflect it and flying fish will usually glide toward the light and in or against the raft.

(8) Never eat seaweed unless you have plenty of drinking water.

(9) Never swim or trail your hands in the water when sharks are present. To drive them away, use shark repellent or slap the water and shout. A shark's nose is the most sensitive spot; a blow there may drive it away.

HINTS ON SURVIVAL IN THE ARCTIC

(1) Wear sun glasses or an improvised eyeshade in overcast as well as clear weather.

(2) Never let metal objects touch your skin.

(3) Avoid overexertion. Perspiration can be as deadly as a ducking in ice water, and deep breathing causes frosting of the lungs.

(4) Dry wet clothes as soon as possible or you may be severely frostbitten.

(5) Gloves, shoes, and outer clothing should be loose. Tight clothing impairs circulation and increases the possibility of freezing.

(6) If you have a sleeping bag, get the warm, moist air out of it during the day by turning it inside out.

(7) Improvise a shelter that can be heated. Be sure and provide sufficient ventilation; carbon-monoxide fumes are deadly in an unventilated shelter.

(8) Eat at least two meals a day. Meat should be cooked rare and without removing the fat. To preserve unused meat, bury it in the snow.

(9) Never eat the liver of a polar bear.

(10) Do not eat snow without melting it first.

(11) If you become frostbitten, which you can detect by a grayish or whitish appearance of the skin, do not rub the area and do not put snow on it. Warm the area until circulation is restored.

SURVIVAL IN OTHER PARTS OF THE WORLD

Living on a raft in open sea or fending for yourself in the Arctic are certainly more difficult than surviving in other parts of the world, because the hazards are so severe. Yet, to survive in the tropics or on an island, you must know many more things. Food is usually plentiful as is water, but you must know what you can eat, how and where to obtain it, how much of certain items you can eat, and what to drink. You must take precautions against the various germ-carrying insects and poisonous fish and animals. You must know the animals which may be dangerous to man and how to deal with them. Also, you must be capable of dealing with natives. Knowing these hazards, yet not overemphasizing (as is the case many times) or underemphasizing them is the formula for survival.

EMERGENCY SIGNALS

GROUND/AIR EMERGENCY CODE

SYMBOL	MEANING
I	Require doctor; serious injuries
II	Require medical supplies
X	Unable to proceed
F	Require food and water
︾	Require firearms and ammunition
□	Require map and compass
¦	Require signal lamp with battery, and radio
K	Indicate direction to proceed
↑	Am proceeding in this direction

SYMBOL	MEANING
I>	Will attempt takeoff
L┐	Aircraft seriously damaged
△	Probably safe to land here
L	Require fuel and oil
LL	All well
N	No
Y	Yes
JL	Not understood
W	Require engineer

Instructions. (1) Layout these symbols by using strips of fabric or parachutes, pieces of wood, stones, or any other available material.

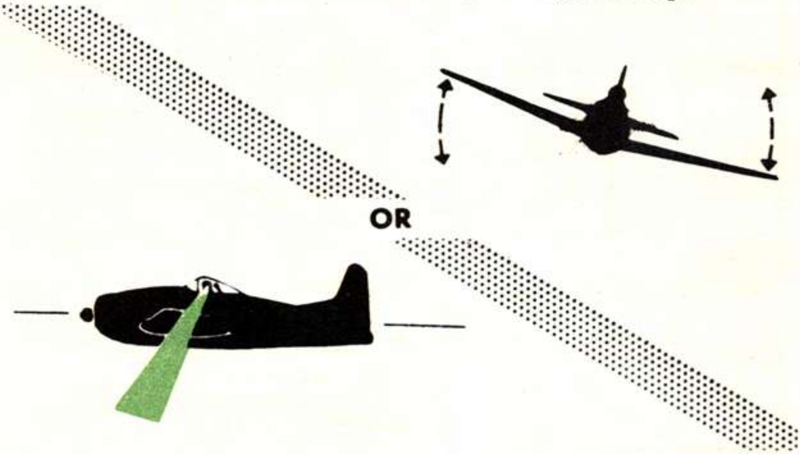
(2) Provide as much color contrast as possible between material used for symbols and background.

(3) Make symbols at least 8 feet in height; larger if possible.

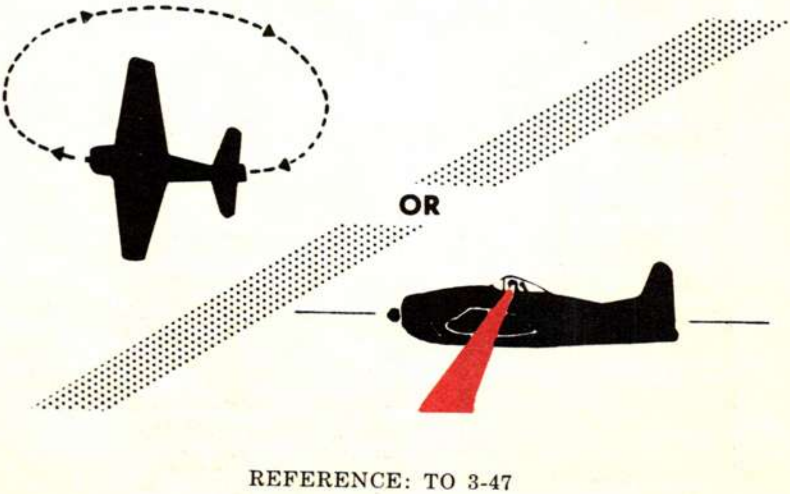
AIRCRAFT ACKNOWLEDGEMENTS

The pilot of the rescue plane answers messages given in the ground/air emergency code as described below.

Message understood. Rock your plane from side to side or make green flashes on your signal lamp.

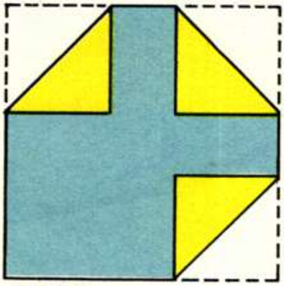


Message not understood. Make a complete right-hand circuit or make red flashes on your signal lamp.

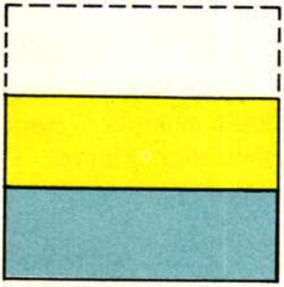


REFERENCE: TO 3-47

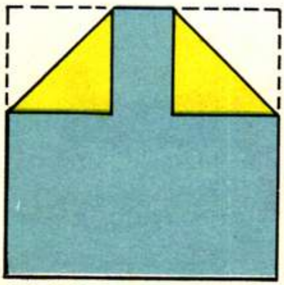
LIFE RAFT PAULIN SIGNALS



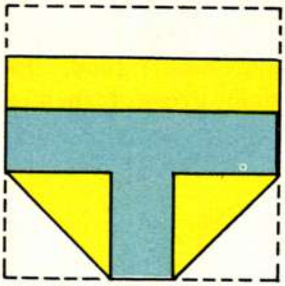
NEED
FIRST-AID SUPPLIES



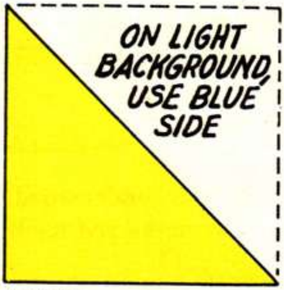
SHOULD WE WAIT
FOR RESCUE PLANE?



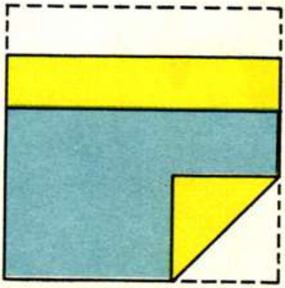
NEED
WARM CLOTHING



NEED QUININE
OR ATABRINE

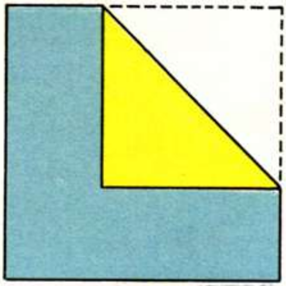


NEED
FOOD AND WATER

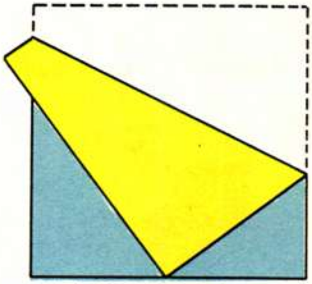


HAVE ABANDONED
PLANE — WALKING
THIS DIRECTION →

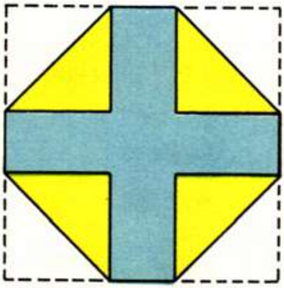
LIFE RAFT PAULIN SIGNALS



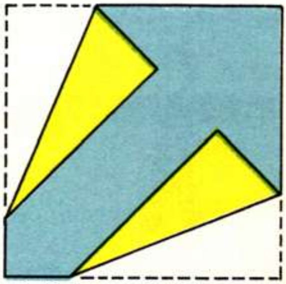
NEED GASOLINE AND OIL — PLANE IS FLYABLE



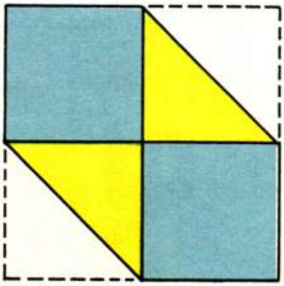
NEED TOOLS PLANE IS FLYABLE



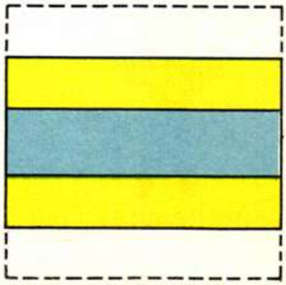
NEED MEDICAL ATTENTION



O.K. TO LAND — ARROW SHOWS DIRECTION



DO NOT ATTEMPT LANDING



INDICATE DIRECTION OF NEAREST CIVILIZATION

BODY SIGNALS

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.

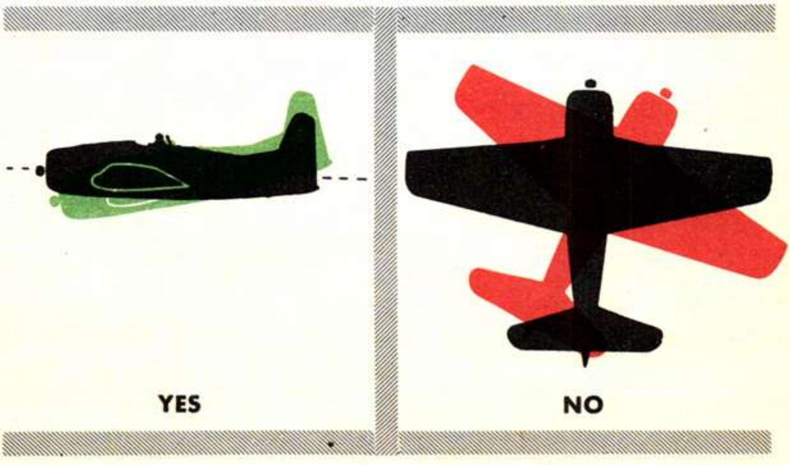
Use drop message

Affirmative (Yes)

Negative (No)

PLANE ANSWERING SIGNALS

The pilot of the rescue plane answers messages given by the signals illustrated above 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).



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