DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 2

VFR CRUISING ALTITUDES

Assume that you plan to make a VFR cross-country flight over terrain which has a constant elevation of 2,900 feet. After charting the course you determine that the true course is 188° and the magnetic variation is 12° E. According to the latest aviation weather reports, there is a broken layer of clouds at 7,000 feet all along the route, and the visibility is unlimited along your intended route. The winds aloft forecast indicates that the higher the altitude the more favorable the wind direction and speed. If you intend to take advantage of the most favorable wind and still comply with Federal Aviation Regulations, you should decide upon a cruising altitude of:

a. 5,500 feet MSL
b. 6,500 feet MSL
c. 7,500 feet MSL
d. 9,500 feet MSL

Analysis

1- You wish to fly as high as legally possible to take advantage of the most favorable wind.

2- The base of the broken clouds is reported in height above the surface. Therefore, the base of the clouds is approximately 2,900 feet plus 7,000 feet, or 9,900 feet above sea level.

3- Cruising altitude is a level above mean sea level (MSL), but the rules pertaining to the selection of a cruising altitude appropriate to the flight's magnetic course are applicable only when flying more than 3,000 feet above the ground.

4- This flight will be made at an altitude of more than 3,000 feet above the surface in order to take advantage of the more favorable winds at higher altitudes. Since you will be flying more than 3,000 feet above the surface, you must, according to Federal Aviation Regulations, fly at a cruising altitude appropriate to the magnetic course. In this instance the magnetic course is 176° (true course 188° - 12°E magnetic variation = 176°.)

5- A magnetic course of 176° in this case requires that you fly at an altitude (above sea level) of an odd thousand plus 500 feet.

6- In this example, you must maintain a vertical distance under the base of any cloud formation of at least 500 feet. This rules out a cruising altitude of 9,500 feet. You do not choose 5,500 feet since you want to take advantage of better tail winds at higher altitudes. You eliminate 6,500 feet because you must be at an odd thousand altitude plus 500 feet. Therefore, you select a cruising altitude of 7,500 feet, which meets legal requirements and gives you the advantage of more favorable winds.

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 10/71

Department of Transportation
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 4

PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT
(Series 1)

1. WHAT IS REQUIRED OF THE PILOT PRIOR TO THE FLIGHT? FAR, Part 91.5, states in part: "Each pilot in command shall, before beginning a flight, familiarize himself with all available information concerning that flight. This information must include, for . . . . a flight not in the vicinity of an airport, weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed, and any known traffic delays of which he has been advised by ATC . . . . . "

2. WHY IS THIS REQUIRED? Careful preflight planning, in addition to satisfying FAR, enables the pilot to make his flight with greater confidence, ease, and safety. A review of fatal accident statistics for one year shows that as a "cause factor", <u>inadequate flight planning</u> was second only to "failure to maintain airspeed resulting in a stall."

3. WHAT ARE SOME SUGGESTED STEPS TO BE USED IN FLIGHT PLANNING?

   a. Assemble materials which will be needed on the flight such as current sectional charts, and other charts, for the route to be flown; the latest <u>Airman's Information Manual</u> (AIM), and plotter, computer, etc. Take along charts which adjoin those for the route of flight. Thus you are prepared in case it becomes necessary to circumnavigate bad weather, or in case you inadvertently fly off the chart on which your course is drawn.

   b. On the sectional chart, draw course to be flown; study terrain; select appropriate check points; consider alert, warning, restricted, and prohibited areas and Air Defense Identification Zones; study airport information, including enroute airports that can be used in case of emergency; choose refueling stops; list frequencies of towers and navigational aids to be used and also Flight Service Stations reporting the weather.

   c. Review weather maps and forecasts, current weather reports, winds aloft forecasts, pilot weather reports, SIGMETS, AIRMETS, Notices to Airmen (NOTAMS), and other information. Although you can get weather information by telephone, it is strongly recommended that a personal visit be made to the nearest Weather Service Office, Flight Service Station, or other flight service facility.

A chapter on Flight Planning is contained in the FAA publication, Pilot's Handbook of Aeronautical Knowledge, including a summary of flight assistance services available.

4. WHAT FURTHER ACTION IS DICTATED BY GOOD OPERATING PRACTICES? <u>File a Flight Plan</u>! This is <u>not required</u> by FAR but <u>is dictated by good operating practice.</u> It is extremely unlikely that air traffic rules can ever be written so as to eliminate the need for GOOD JUDGMENT in the planning and conduct of every flight. The pilot must make the final decision as to whether or not to make a flight. Use reasonable restraint in exercising this prerogative when preflight planning indicates the existence of marginal conditions of any kind.

BE SAFER -- FILE A FLIGHT PLAN

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch,
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Exam-O-Grams available free of charge in limited quantities from this office.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 1/74

DISTRIBUTION: ZC-307

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 5

PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT
(Series 2)

1. HOW MAY YOU OBTAIN WEATHER INFORMATION FOR PREFLIGHT PLANNING? Visit your local Weather Service Office (WSO) or your nearest FAA Flight Service Station (FSS), or other flight service facility for a thorough weather briefing. The latest weather maps, area forecasts, terminal forecasts, winds-aloft reports, winds-aloft forecasts, advisories, hourly sequence reports, and pilot reports will be available. If a visit is impractical, telephone calls are welcomed. When telephoning, identify yourself as a pilot; state your intended route, destination, intended time of takeoff, and approximate time en route; and, advise if you intend to fly only VFR.

   "FSS and Weather Service Telephone Numbers" section of the Airman's Information Manual (AIM) contains the location and telephone numbers of Weather Service Offices and FSS along with other pertinent information. Note the "restricted" telephone number listed for some Weather Service Offices on which only aviation weather information is given. Some Weather Service Offices have the Pilots' Automatic Telephone Weather Answering Service (PATWAS) which is a transcribed weather information service. For availability of weather information at various airports, check the Airport Directory, Airport/Facility Directory, or "FSS and Weather Service Telephone Numbers" section of AIM.

2. WHAT IMPROVEMENTS HAVE BEEN MADE TO PROVIDE MORE AND BETTER WEATHER INFORMATION FOR PILOTS? Equipment is provided at selected Flight Service Stations by which weather and Notice to Airman data will be recorded on tapes and broadcast continuously over the low-frequency (200-400 KHz) navigational aid facility, or VORs and VORTACs.

3. WHAT FURTHER PREFLIGHT WEATHER PLANNING SHOULD BE DONE TO OBTAIN IN-FLIGHT WEATHER INFORMATION? From your charts and the appropriate section of the Airman's Information Manual (FSS and Weather Service Telephone Numbers), make a list of the Flight Service Stations along your route that broadcast the weather information. In addition to the scheduled broadcast, you may also contact them at any time for further information.

4. WHAT IS RECOMMENDED BY GOOD OPERATING PRACTICES? If the preflight weather briefing reveals questionable or marginal weather, use reasonable restraint in flying VFR. File a flight plan. Maintain a close check on the weather through your Flight Service Stations. Be sure to close your flight plan upon arrival.

BE SAFER WITH A FLIGHT PLAN

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Exam-O-Grams available free of charge-single copy only per request. Permission is hereby granted to reproduce this material.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 10/71

Department of Transportation
FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 6

PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT (Series 3)

The statement "NO FLIGHT PLAN FILED," which appears in many accident reports and accounts of extensive search operations for missing aircraft, indicates a degree of thoughtlessness on the part of the pilot for the safety of his flight.

> "Businessman-pilot flying daughter home from college crash lands in sparsely populated area resulting in injury to father and daughter. Rescue effected within three hours of ETA near flight plan course filed with FAA.
>
> ○ ○ ○
>
> "Family of five forced down by snow storm while on flight to winter resort. No flight plan filed with FAA and 5 days later family reported missing by relatives. Search parties after covering extensive area, find bodies with no injuries-- expiration attributed to exposure."

HOW, WHEN, AND WHERE SHOULD A VFR FLIGHT PLAN BE FILED? Pilots are urged to file in person or by telephone to the nearest FSS prior to departure. Radio should be used for filing plans only if other means are not available. When filing by telephone or radio, have all the necessary information written down in the order it appears on a flight plan so that you will utilize the least amount of the controller's time and release the telephone circuit or radio frequency for someone else.

DO FEDERAL AVIATION REGULATIONS (FAR) REQUIRE THAT FLIGHT PLANS BE FILED? Regulations do not require the filing of flight plans for VFR flights unless the flight is to penetrate an ADIZ (Air Defense Identification Zone) or for flights between Mexico and the U. S. Filing at other times is entirely at the pilot's discretion, but is recommended as good operating practice.

WHY SHOULD A FLIGHT PLAN BE FILED? A flight plan not only assures prompt search and rescue in the event you become overdue or missing, but it also permits en route stations and the destination station to render better service by having prior knowledge of your flight. It costs nothing except a few minutes of time to file a flight plan and may be the best "insurance" investment you ever made. On the other hand, failure to file could contribute to unpleasant moments during flight, or long periods of waiting for help when an emergency arises.

WHAT DISPOSITION IS MADE OF FLIGHT PLANS? When the flight plan is filed before takeoff, the FSS takes no action on it until informed of your actual departure time. The following procedures are in effect: when a VFR flight plan is filed, it will be held until one hour after the proposed departure time and then canceled unless:

1. The actual departure time is received.
2. A revised proposed departure time is received.
3. At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications.

WHAT MUST BE DONE AT THE COMPLETION OF THE FLIGHT? If a flight plan has been filed FAR requires that an arrival notice be filed at the completion of the flight or when the flight terminates at other than the planned destination. This may be done (even if no tower or FSS is located at the destination) by contacting the nearest FSS by radio prior to landing, or by telephone after landing. Contrary to popular belief, the control tower at the airport of landing does not automatically close a VFR flight plan when the landing is completed. The tower is not always aware of which aircraft were on a flight plan. It is the pilot's responsibility to file the arrival notice with the tower or FSS (simply asking by radio, telephone, or personal visit that the flight plan be closed).

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

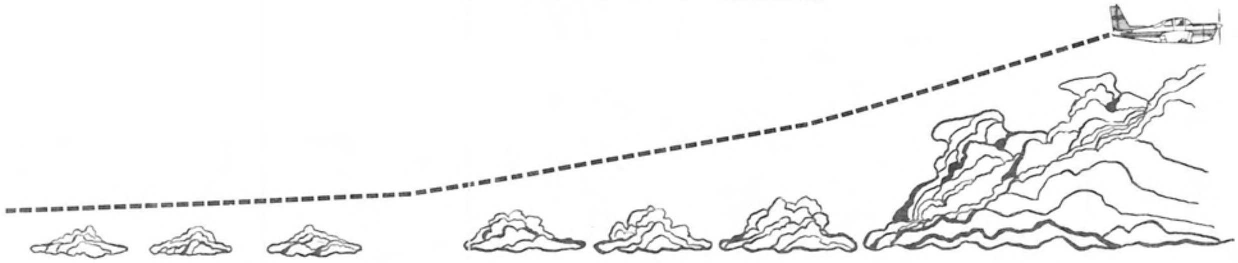
Rev. 3/71

FAA Aeronautical Center
Flight Standards Technical Division, Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 7

TRAPPED ON TOP OF AN OVERCAST!



DO YOU HAVE ALL OF THE FOLLOWING REQUISITES FOR INSTRUMENT FLIGHT? (1) An Instrument Rating, (2) an aircraft fully equipped for instrument flight, and (3) recent instrument experience. If not, you should heed the following bit of advice concerning flight over an extensive overcast cloud condition -- DON'T!

SHOULD YOU AVOID FLYING VFR OVER CLOUDS ENTIRELY? No. Many times it is both practical and desirable to select a cross-country cruising altitude above a scattered cloud condition to take advantage of smoother air, improved visibility, more favorable winds, or provide for more terrain and obstacle clearance, provided (1) you have legal cloud separation for climb, cruise, and destination descent, (2) weather conditions are stable or improving, and (3) you stay alert and take immediate action if the clouds beneath you increase and the "sucker holes" start to shrink. Don't wait too long to descend or make a 180° turn (one of aviation's oldest safety devices) if the situation warrants.

WHAT OTHER PRECAUTIONS SHOULD YOU TAKE TO AVOID BEING TRAPPED ON TOP OF AN OVERCAST? (1) Prior to your cross-country flight, visit or telephone the local Weather Service Office or the nearest FAA Flight Service Station for a thorough weather briefing (see VFR Exam-O-Gram No. 5). (2) Select an altitude that will be compatible with terrain and cloud separation requirements. (3) Don't attempt VFR flight when conditions are close to VFR minimums. Remember that, with the right conditions, an overcast can form beneath you in a matter of minutes. Consider the weather, the terrain you are flying over, and allow yourself a margin of safety commensurate with your experience level. (4) While enroute, monitor appropriate frequencies for weather broadcasts, and In-Flight Weather Advisories (AIRMETS, SIGMETS, and PIREPS), or call Flight Watch. Transcribed Weather Broadcasts are also available on certain navigational aids.

WHAT SHOULD YOU DO IF YOU FIND YOURSELF IN DIFFICULTY ABOVE AN OVERCAST? You are admittedly "in distress -- in a jam." Loss of ground references, probably followed by a loss of orientation, will further complicate your problem. However, you can improve your chances of avoiding disaster by following a few logical procedures. (See Airman's Information Manual, Part I, "Emergency Procedures.") For example, you should (1) Establish communications with an FSS or other ground stations and state your predicament. The personnel in these stations are well trained in assisting airmen in distress; give them a chance to help you before its too late. If necessary, they can alert available VHF/UHF Direction Finding and Radar Stations (including military stations) to stand by for possible assistance. (2) Give as much information as possible on initial contact with ATC -- nature of difficulty, position (in relation to a navaid if possible), altitude, radar beacon code (if transponder equipped), weather conditions, if instrument rated or not, destination, service requested. (3) If you have trouble establishing contact with a ground station, climbing will increase the range of your VHF radio equipment and improve the chances of ground radar detection. (4) Conserve your fuel by using an economical or maximum endurance power setting. (5) Adhere to ATC instructions or information, or if not possible, advise ATC immediately that you cannot comply.

Prevention is a much better approach to this problem than the cure. If you are a VFR pilot, AVOID FLYING ON TOP OF AN OVERCAST.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 9

ALTIMETRY

Your altimeter is a vitally important instrument. You will agree that flight without this instrument would indeed be a haphazard undertaking -- yet, HOW WELL DO YOU KNOW YOUR ALTIMETER? Take this short quiz on altimetry; then check the answers and explanations provided.

1. Check your ability to quickly interpret the altitude by jotting down the readings of the following 6 altimeters. Allow yourself 1 minute.


(1)


(2)


(3)


(4)


(5)


(6)

2. Federal Aviation Regulations require that you maintain specific cruising altitudes (VFR as well as IFR) by reference to an altimeter. What do regulations require concerning the setting (or adjustment) of an altimeter?

3. If flying in very cold air (colder than standard temperatures), you should expect the altimeter to read which of the following?

    (a) higher than your actual altitude above sea level.
    (b) lower than your actual altitude above sea level.
    (c) the same as your actual altitude above sea level.

4. Here are 4 altitudes with which you should be familiar. Briefly give the meaning of each. (1) Indicated altitude. (2) Pressure altitude. (3) Density altitude. (4) True altitude.

5. Assume that your proposed route crosses mountains with peaks extending to 10,900 feet above sea level. Prior to crossing this range, you adjust the altimeter setting window of the altimeter to the current altimeter setting reported by a Flight Service Station located in a valley near the base of this mountain range. If you maintain an indicated altitude of 11,500 feet, can you be assured of at least 500 feet clearance above these mountain peaks?

*****

NOTE: Answers and explanations to the above questions are on the reverse side of this page.

Rev. 1/77

ANSWERS TO QUESTIONS ON ALTIMETRY

1. (1) 7,500 ft. (2) 7,880 ft. (3) 1,380 ft. (4) 8,800 ft. (5) 12,420 ft. (6) 880 ft.

   If your altimeter is the three-pointer-type sensitive altimeter such as those pictured on the reverse side of this sheet, an orderly approach to reading the altitude is to first note the position of the smallest hand (10,000-ft. hand) to see if it is more or less than 10,000 ft.; next read the middle hand (1,000-ft. hand); and then, read the large hand (100-ft. hand). For the two-pointer altimeter, simply read the small hand first and the large hand next.

2. The altimeter should be set to the current reported altimeter setting of a station along the route of flight (Flight Service Stations, Control Towers, etc.). If your aircraft is not equipped with a radio, you should obtain an altimeter setting prior to departure if one is available, or you should adjust the altimeter to the elevation of the departure airport.

3. If flying in cold air, you should expect the altimeter to indicate HIGHER than you actually are. There is an old saying -- one well worth remembering -- "WHEN FLYING FROM A HIGH TO A LOW OR HOT TO COLD, LOOK OUT BELOW!" In other words, if flying from a high pressure area to a low pressure area or into colder air, be careful because you probably aren't as high as you think -- assuming, of course, that no compensations are made for these atmospheric conditions.

4. (1) INDICATED ALTITUDE--That altitude shown on the altimeter (uncorrected for temperature).
   (2) PRESSURE ALTITUDE--The altitude indicated after the altimeter setting window is adjusted to 29.92. This altitude is used in computing density altitude, true altitude, true airspeed, etc.
   (3) DENSITY ALTITUDE--This altitude is pressure altitude corrected for nonstandard temperature variations. It is important because this altitude is directly related to the aircraft's takeoff and climb performance.
   (4) TRUE ALTITUDE--The true height of the aircraft above sea level - the actual altitude. Often you will see a true altitude expressed as: "10,900 ft. MSL"--the MSL standing for MEAN SEA LEVEL. Remember that airport, terrain, and obstacle elevations found on charts and maps are true altitudes.

5. NO, you are not assured of 500 feet clearance above these mountains. As a matter of fact, with certain atmospheric conditions, you might very well be 500 feet BELOW the peaks with this indicated altitude. To begin with, 500 feet is hardly an adequate separation margin to allow on flights over mountainous terrain -- 1,500 to 2,000 feet is recommended to allow for possible altitude errors and downdrafts.

   A majority of pilots confidently expect that the current altimeter setting will compensate for irregularities in atmospheric pressure. Unfortunately, this is not always true. Remember that the altimeter setting broadcast by ground stations is the station pressure corrected to Mean Sea Level. It does not compensate for the effect of nonstandard temperature or pressure variations.

   When flying over mountainous country, allow yourself a generous margin for terrain and obstacle clearances.

KNOW YOUR ALTIMETER

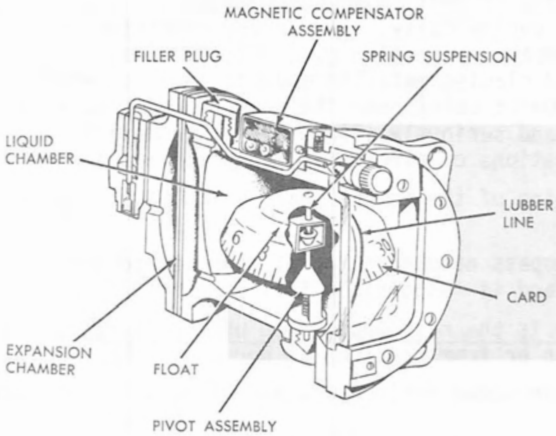
VFR - No. 9
1/77

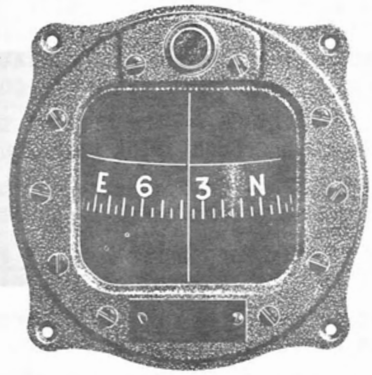
Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Exam-O-Grams available free of charge--single copy only per request. Permission is hereby granted to reproduce this material.

U.S. Department of Transportation
Federal Aviation Administration
VFR PILOT EXAM-O-GRAM NO. 12

THE MAGNETIC COMPASS





The magnetic compass, in terms of its errors, limitations, and in-flight characteristics, is one of those aeronautical subjects in which consistently large numbers of pilots do not do very well on FAA written tests. There is evidence that this veteran instrument -- it was one of the first to be installed in an aircraft -- is one of the least understood instruments in the cockpit of today's modern aircraft. Many pilots seem to operate on the premise that it is easier to ignore this instrument's characteristics rather than learn them. However, it should be remembered that (1) this is the only direction seeking instrument in most general aviation aircraft, and (2) it is mechanically a simple, self-contained unit (independent of external suction or electrical power for its operation) that is likely to remain reliable. Reliable, that is, if the pilot understands its characteristics and inherent errors.

MAGNETIC COMPASS CONSTRUCTION

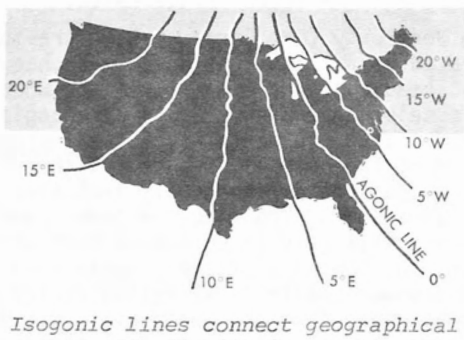
The magnetic compass is simple in construction. It contains two steel magnetized needles mounted on a float. The needles are parallel with the north-seeking ends pointed in identical directions. The compass card, attached to the float, has letters to show cardinal headings (N,E,S,W) and numbers to show each 30 degrees of direction between the cardinal headings. The first and last zero of each heading number is omitted; i.e., a heading of 030° is shown as 3. Between these numbers the card is graduated for each 5°.

The float assembly, consisting of the magnetized needles and compass card, is mounted on a pivot supported on a pedestal and sealed in a chamber filled with acid-free white kerosene, or naphtha compass fluid. This fluid serves several purposes. It provides buoyancy to support part of the card's weight. It also decreases the oscillation of the card resulting from turns or turbulence. In addition, it provides lubrication at the pivot point.

WHAT ARE SOME OF THE COMPASS CHARACTERISTICS THAT THE PILOT SHOULD UNDERSTAND?

I. VARIATION — In navigation, courses drawn on aeronautical charts are based upon a relation of that course to the true geographical north pole. The magnetic compass is oriented to magnetic north, which is at a different location from true north. This angular difference between true and magnetic north is known as variation.

Lines of equal magnetic variation are called isogonic lines, and are plotted in degrees of east and west variation on aeronuatical charts. A line connecting zero degree points of variation is called the agonic line. These lines are replotted periodically on aeronautical charts to correct any change which may occur as a result of the shifting of the poles, or any changes caused by local magnetic disturbances. The pilot should understand perfectly <u>which to add and which to</u>



Isogonic lines connect geographical points with identical magnetic variation.

Rev. 4/77

subtract when converting from true headings or courses to magnetic headings or courses and vice versa. Many pilots find such memory aids as "east is least and west is best" helpful in remembering that east is subtracted and west is added when converting from true to magnetic.

II. DEVIATION -- The deflection of the compass needles from a position of magnetic north as a result of local magnetic disturbances in the aircraft. To reduce this deviation, the compass has a compensating device consisting of small adjustable magnets. The compass deviation should be checked and compensated periodically. The errors remaining after compensating the compass should be recorded on a compass correction card which is installed in the cockpit within view of the pilot. NOTE: Avoid placing metallic objects such as metal computers, flashlights, etc., on top of the instrument panel near the magnetic compass as this practice may induce large amounts of deviation and seriously affect the instrument's accuracy. Deviation may change when different combinations of electrical equipment are turned on.

III. OSCILLATION ERROR — The erratic swinging of the compass card which may be the result of turbulence or rough pilot technique.

IV. MAGNETIC DIP — The tendency of the compass needles to point down toward the magnetic north pole because of the earth's curvature and is responsible for:

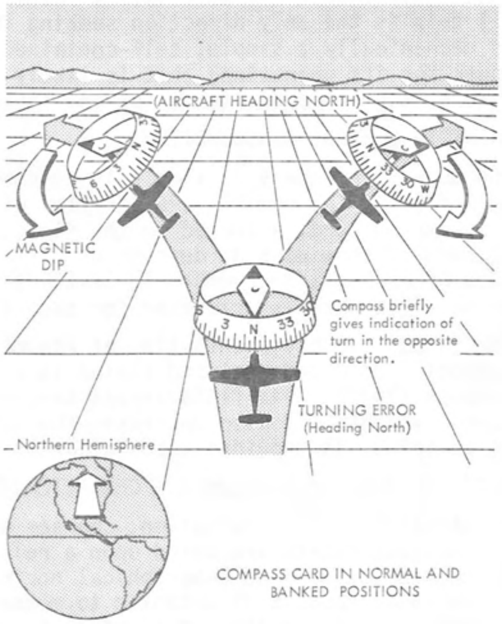
A. Northerly Turn Error — This error is the most pronounced of the in-flight compass errors. It is most apparent when turning to or from headings of north or south.

B. Acceleration Error — This error can occur during airspeed changes. It is most apparent on headings of east and west.

As a quick review of the dip error of the compass, we invite you to accompany us on a hypothetical demonstration flight around the compass rose. Unless otherwise noted, we will limit our bank during turns to a gentle bank (15°). Also, we will assume that we are in the northern hemisphere because the characteristics which we will observe would not exist at the equator, and would be reversed in the southern hemisphere.

DEMONSTRATION NO. 1 (HEADING — NORTH; ERROR — NORTHERLY TURN ERROR)

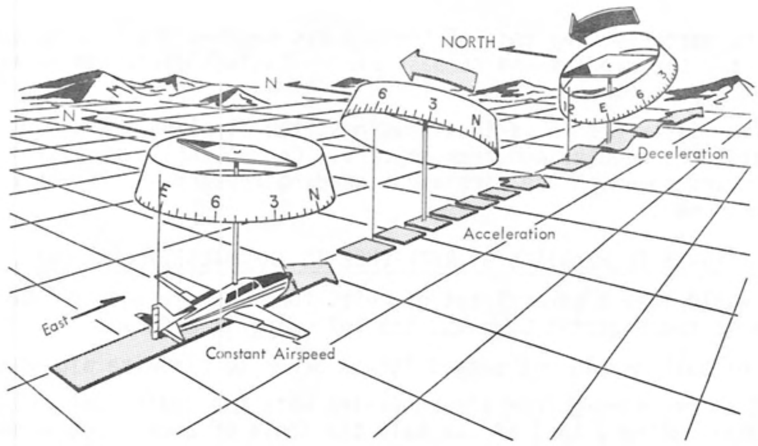
As we start a turn in either direction from a heading of north, we notice that momentarily the compass card gives an indication of a turn opposite the direction of the actual turn. While the compass card is in a banked attitude, the vertical component of the earth's magnetic field causes the north-seeking end of the compass to dip to the low side of the turn, rotating the card and giving the pilot an erroneous turn indication. As we continue the turn toward east or west, the compass card will begin to indicate a turn in the correct direction, but will lag behind the actual turn -- at a diminishing rate -- until we are within a few degrees of east or west. An additional demonstration on a heading of north is the Slow Turn Error. With a compass indication of north, we enter a very gradual shallow banked turn (3 or 4 degrees of bank) and find it is possible to change the actual heading of the aircraft by 20° or more while still maintaining a compass indication of north.



COMPASS CARD IN NORMAL AND BANKED POSITIONS

DEMONSTRATION NO. 2 (HEADING — EAST; ERROR — ACCELERATION/DECELERATION ERROR)

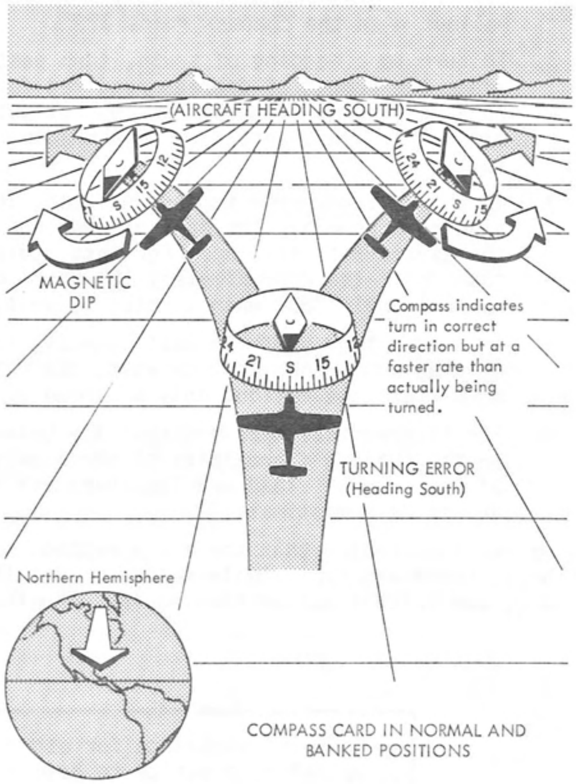
The Northerly Turn Error that we previously demonstrated is not apparent on an east heading (or on a west heading). However, let's see what happens when we accelerate and decelerate by changing the airspeed. With the wings level, we increase the airspeed by increasing the power setting or by lowering the nose — or both. Although we are holding the nose of the aircraft straight ahead, our compass card erroneously indicates a turn toward north. On the other hand, as we decrease the airspeed by reducing the power setting or raising the nose of the aircraft — or both, the compass will give an erroneous indication of a turn toward south. Because of the pendulous-type mounting, the side of the compass card which the pilot sees is tilted upward while accelerating, and downward while decelerating during changes of airspeed. This momentary deflection of the compass card from the horizontal, results in an error that is most apparent on headings of east and west. (See illustration at the top of the next page.)



EFFECTS OF ACCELERATION/DECELERATION ERROR

DEMONSTRATION NO. 3 (HEADING — SOUTH; ERROR — NORTHERLY TURN ERROR)

In this demonstration, we again have the Northerly Turn Error problem that we encountered in Demonstration No. 1. Although the same forces that caused the erroneous indication when we banked the aircraft while on a north heading will be working against us on a heading of south, the compass indications will appear quite different. For example, as we roll into a turn in either direction from south, the compass gives us an indication of a turn in the correct direction but at a much faster rate than is actually being turned. As we continue our turn toward west or east, the compass indications will continue to precede the actual turn — but at a diminishing rate — until we are within a few degrees of west or east. It should be noted that the Acceleration/Deceleration Error is not apparent on a south heading or on a north heading.



COMPASS CARD IN NORMAL AND BANKED POSITIONS

DEMONSTRATION NO. 4 (HEADING — WEST; ERROR — ACCELERATION/DECELERATION ERROR)

On a heading of west we encounter exactly the same errors that we previously covered on a heading of east in Demonstration No. 2. As we increase the airspeed, we note an erroneous indication of a turn toward north. As we decrease the airspeed, we will get an erroneous indication of a turn toward south. A memory aid that might assist you in recalling this relationship between airspeed change and direction of the error is the word "ANDS" — Accelerate-North, Decelerate-South.

WHAT ARE THE MAIN POINTS THAT SHOULD BE REMEMBERED CONCERNING THESE DEMONSTRATIONS?

The points we are trying to emphasize are: (1) WHEN READING THE MAGNETIC COMPASS WHILE ON A NORTHERLY OR SOUTHERLY HEADING (for establishing a course, setting the gyro-driven heading indicator, etc.), REMEMBER THAT IT IS ESSENTIAL TO HAVE THE WINGS PERFECTLY LEVEL FOR SEVERAL SECONDS PRIOR TO READING THE COMPASS. (2) WHEN ON AN EASTERLY OR WESTERLY HEADING, IT IS IMPORTANT THAT THE AIRSPEED IS CONSTANT IN ORDER TO GET AN ACCURATE READING. (3) WHEN ON AN INTERMEDIATE HEADING, BOTH OF THE ABOVE CONDITIONS SHOULD BE MET. (4) THERE ARE NO ACCELERATION/DECELERATION ERRORS WHILE CHANGING AIRSPEED ON NORTH OR SOUTH HEADINGS. (5) WHEN AN AIRCRAFT IS ON AN EAST OR WEST HEADING AND A GENTLE BANKED (15°) TURN IS ENTERED THE COMPASS WILL INDICATE A TURN IN THE PROPER DIRECTION TOWARD NORTH OR SOUTH. Note: If your aircraft is equipped with a gyro-driven heading indicator, check it frequently with the magnetic compass.

NOTE: Since the north-seeking ends of the compass needles are continuously being attracted to magnetic north, the needles and compass card — unless disturbed — may be considered stationary.

When the airplane is turned to various headings, the airplane, in effect, is revolving around the stationary needles and compass card. Consequently, the pilot views that portion of the compass card on which the airplane's heading appears — through a small window in the case of the instrument.

TURNS TO HEADINGS BY REFERENCE TO THE MAGNETIC COMPASS

For the pilot who would like a general set of rules for determining the lead points for making turns by reference to the Magnetic Compass, the following is offered:

Note: The angle of bank should not exceed 15° in order to minimize dip error.

The amount of lead in recovering from a turn varies with the individual pilot's rate of rollout. As a guide, we suggest using a lead of one-half the angle of bank. For example: with a 15° angle of bank, start the rollout 7 1/2° (7° for whole numbers) before reaching the desired heading.

1. When you turn to a heading of north, the number of degrees of lead necessary is equal to the latitude plus the number of degrees required for the rollout. Example: During a left turn to a heading of north, using a 15° angle of bank, at a TAS of less than 220 knots, in a locality where the latitude is 30°N, you should start the rollout when the magnetic compass reads 037° (30° plus one-half of 15°). In a right turn to a heading of north you should start the rollout when the compass reads 323°.
2. To turn to a heading of south, turn past south the number of degrees equal to the latitude, minus the number of degrees required for the rollout. Example: When you turn to the right to a heading of south, start the rollout when the magnetic compass reads 203° (180° plus 30° minus 7°). In a left turn to a heading of south start the rollout when the compass reads 157°.
3. In a turn from north to east or west, the magnetic compass initially shows a lag. As the heading approaches the east or west heading, the magnetic compass starts to turn faster than the aircraft is turning. For this reason, you must start the rollout when the magnetic compass indicates approximately 10° ahead of 090° or 270°. Example: Start the rollout at approximately 080° when turning to east; start at 280° when turning to west.
4. In a turn from south to east or west, the magnetic compass initially shows a lead. As the heading approaches east or west, the rate of rotation of the compass card decreases and you must start the rollout only 5° ahead of 090° or 270°.
5. For intermediate headings that lie between the cardinal headings, use an approximation based on the heading's proximity to north or south, the direction of the turn, and your knowledge of the compass' lead and lag characteristics in these areas. In other words, use an "educated guesstimate."

We won't guarantee that the above methods will roll you out on the exact heading every time. At best, these are approximate methods. But it will get you reasonably close to the desired heading, and this is better than having no method at all.

Constant vigilance for other aircraft is a must, and it is a good operating practice to have a safety pilot on board while practicing turns to magnetic compass headings. Know your magnetic compass--it will show you the way!

Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 13

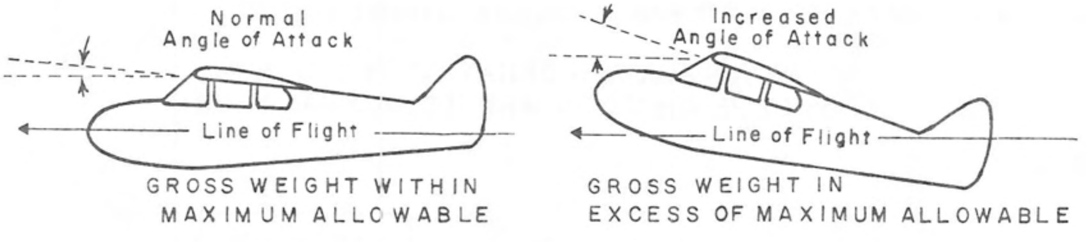
WEIGHT AND BALANCE

Loading the family automobile for a trip requires little serious planning. You can C-R-A-M as much luggage into the trunk as you have space, squeeze as many persons into the seats as you have room, and top off the gas tank with no thought given to Gross Weight or Center of Gravity. A similar approach to loading your "flying machine" could result in a serious accident.

WHAT IS EXCESSIVE WEIGHT? Assume that your airplane is a 4-place airplane with a baggage allowance of 120 pounds, a usable fuel capacity of 39 gallons, and an oil supply of 8 quarts. On a hypothetical flight you take on full fuel and oil servicing, toss the suitcases in the baggage compartment, and you and your three passengers eagerly climb aboard. This seems like a reasonable load, but if you had placed each of them on the scales you might have found that you and the passengers average 180 lbs. each (720 lbs.), and the four suitcases, 30 lbs. each (120 lbs.). The usable fuel load weighs 234 lbs. and the oil 15 lbs. Assume, also, that the Weight and Balance Data for the airplane shows an empty weight of 1, 325 lbs. and a maximum allowable gross weight of 2, 200 lbs. NOW, add the weight of the useful load to the empty weight and compare the total to the allowable gross weight. (1, 089 lbs. + 1, 325 lbs. = 2, 414 lbs.) . . . 214 lbs. excess!

WHAT RESTRICTIONS ARE THERE ON WEIGHT AND BALANCE? In many civilian airplanes it is not possible to fill all seats, baggage compartment, and tanks, and still remain within the approved weight and balance limits. If you do not wish to leave a passenger behind (a normal reaction) you must reduce your fuel load and plan on shorter legs enroute or cut down on the baggage carried, or both. Frequently, restrictions are placed on rear seat occupancy with maximum baggage allowance aboard. By all means follow your airplane's Weight and Balance restrictions. The loading conditions and the empty weight of your particular airplane may differ from those shown in the Owner's Manual, especially if modifications have been made or equipment has been added to the original basic airplane.

IS CRUISE PERFORMANCE AFFECTED BY AN EXCESS LOAD? At normal weight, the airplane requires a certain angle of attack to maintain straight-and-level flight at a given airspeed. To sustain a heavier load at that same airspeed, the angle of attack must be greater to provide the increased lift that is necessary. More power must be added to overcome the increased drag which results from the increased angle of attack. Additional power burns more fuel, thereby reducing the range of the aircraft.



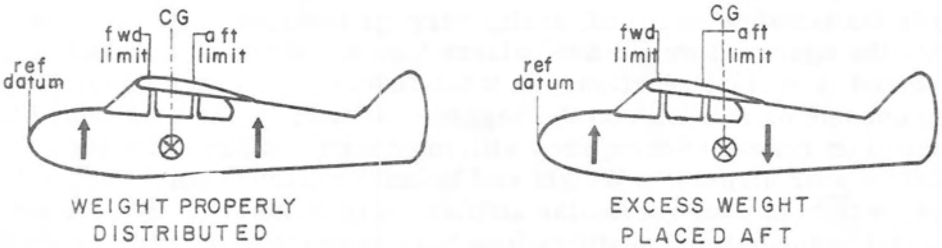
* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 1/77

IS CLIMB PERFORMANCE AFFECTED BY AN EXCESS LOAD? Time to climb to a given altitude is lengthened, because the angle of attack is greater and the extra thrust required to carry the additional weight limits the rate of climb and may limit the climbing speed, since this depends on the surplus power available. The additional time in climbing at the higher power setting also increases the fuel consumption.

IS "G" FORCE TOLERANCE AFFECTED? Assume that your airplane has a limit-load factor of 3.8 "G's". If the allowable gross weight is not exceeded, this means the wings can safely support 3.8 times the weight of the airplane and its contents. In accelerated flight (pull-ups, turns, turbulent air) the actual load on the wings would be much greater than the normal load, which of course results in much greater stresses in the wing structure. Overloading, therefore, has the effect of decreasing the "G" load capability of the aircraft and thus could result in the wing being stressed to the point of popped rivets, permanent distortion, or structural failure.

HOW IS AN AIRPLANE BALANCED? An airplane, like a steelyard scale, is in perfect balance when the weight is distributed in such a manner that it remains level when freely suspended. In an airplane, however, as long as the Center of Gravity lies anywhere within specified limits, balance can be maintained in flight. Flight with the CG outside of this range results in unsatisfactory or dangerous flight characteristics. Loading an airplane then, is simply a matter of distributing the load so that the CG falls within the allowable range. This can be accomplished by arranging the load in accordance with the Center of Gravity Envelope provided for each airplane.



DOES IMPROPER LOAD DISTRIBUTION AFFECT SAFETY? YES! When loading conditions cause the Center of Gravity to fall outside allowable limits, stability is adversely affected and erratic control forces may develop. Stalling speed, takeoff distance, and landing speed may be increased to the point of actual danger.

Due to the size of many baggage compartments there might be a tendency to fill them to capacity, ignoring the placarded baggage weight limitations. This could produce a Center of Gravity aft of allowable limits creating a highly dangerous flight condition. The result would be a nose high attitude which could lead to a stall from which recovery might not be effected due to inadequate elevator control.

AN AIRPLANE'S BEHAVIOR IN THE AIR
IS DEPENDENT ON WEIGHT AND BALANCE!

Federal Aviation Administration
Flight Standards National Field Office, Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation
FEDERAL AVIATION ADMINISTRATION

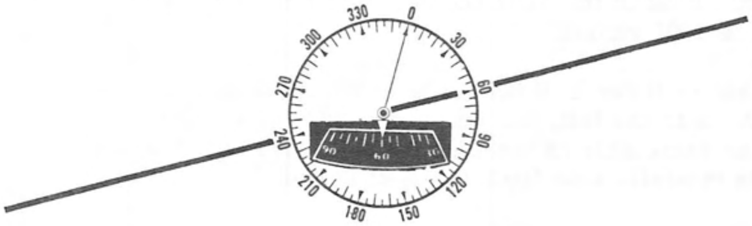
VFR PILOT EXAM-O-GRAM* NO. 15

HOW TO USE VOR
(Series 1)

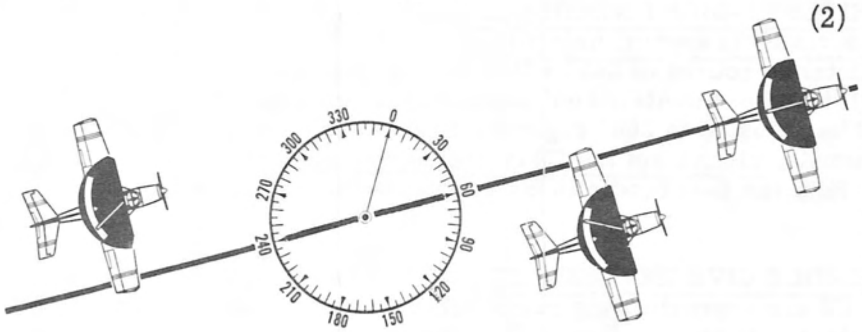
The VHF omnirange, commonly referred to as VOR, has largely replaced the low frequency, four-course radio range as an aid to navigation. VOR offers many advantages over the low frequency range -- (1) it is less susceptible to static; (2) an unlimited number of courses are available; and (3) navigational information is visual rather than aural. Since most modern aircraft are equipped with VOR receiving equipment, it behooves each pilot to know and understand how to use this equipment properly. The VFR pilot should use radio navigation along with other methods of navigation to maintain his desired course. Always double-check your position by aeronautical chart.

WHAT ARE THE VOR RECEIVER COMPONENTS USED BY THE PILOT? (1) COURSE (or omnibearing) SELECTOR; (2) LEFT-RIGHT (or vertical) needle; and (3) TO-FROM indicator.

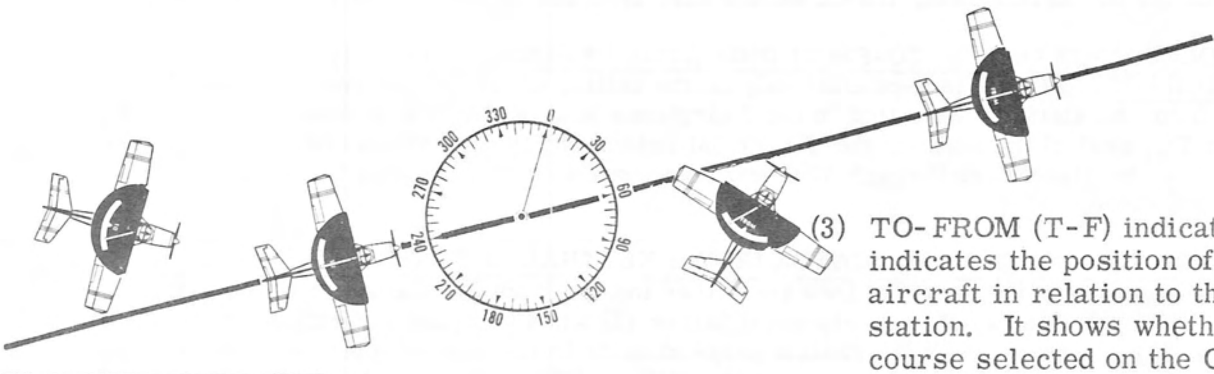
WHAT IS THE FUNCTION OF EACH OF THESE COMPONENTS?



(1) COURSE SELECTOR (CS) -- permits the selection of any course.



(2) LEFT-RIGHT (L-R) needle -- shows the position of the aircraft in relation to the course selected. If the course line is drawn on the chart, passing through the VOR station to which tuned, the L-R needle indicates on which side of the aircraft the desired course lies.

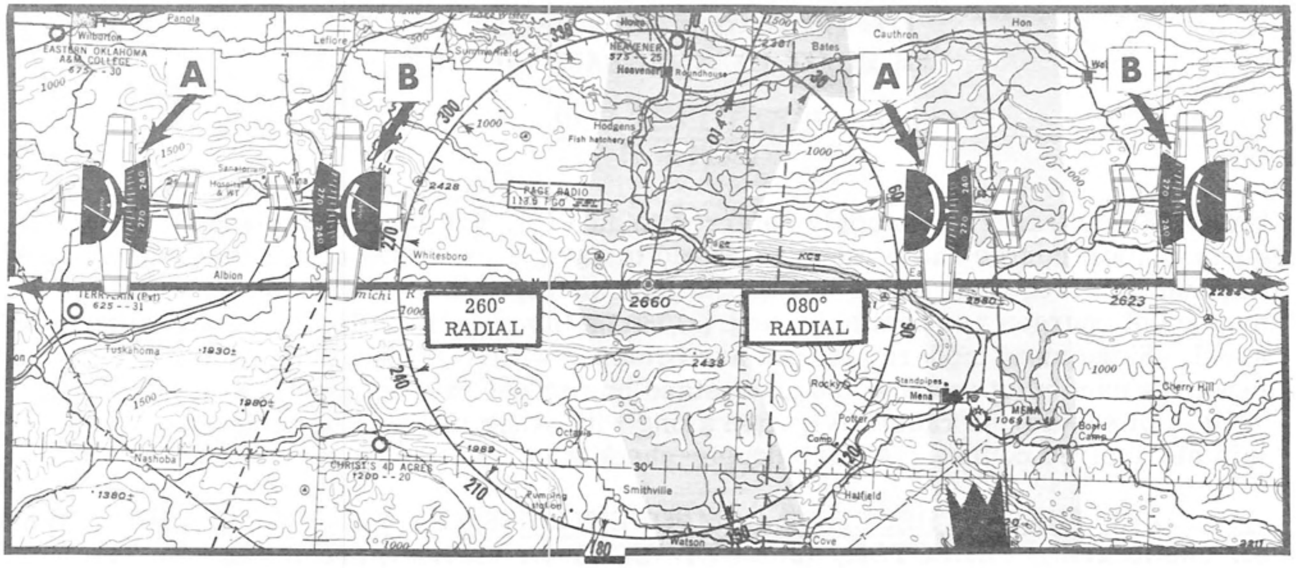


(3) TO-FROM (T-F) indicator -- indicates the position of the aircraft in relation to the VOR station. It shows whether the course selected on the CS, if intercepted and flown, will take you to or from the station.

A Aeronautical Center
;ht Standards Technical Division,
rations Branch,
O. Box 25082
Oklahoma City, Oklahoma 73125

*Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 8/64



WHAT IS A RADIAL? It is a line of magnetic bearing extending from the station. Note the easterly-westerly line in the illustration. East of the VOR station, this line is the 080° radial; west of the station, this line is the 260° radial.

WHAT IS PROPER SENSING? Simply this -- if the L-R needle is to the right, the desired course is to your right; if the L-R needle is to the left, the desired course is to your left. In other words, the desired course is on the same side as the L-R needle. (NOTE: With reverse or opposite sensing, the course is on the opposite side from the L-R needle.)

HOW CAN YOU BE SURE THAT THE LEFT-RIGHT NEEDLE IS GIVING PROPER SENSING? By ensuring that the heading of the aircraft is approximately the same as the course selected on the CS. Assume you wish to maintain a course of 260° which passes over PAGE VOR station. Your heading naturally will be approximately 260° depending on wind direction and speed. In this case your CS should be adjusted to 260° regardless of whether you are east or west of the VOR station. In other words, always set the CS on the course you are flying -- not the reciprocal of your course. Note the L-R needle in both airplanes above labeled A. They give proper sensing.

WHEN DOES THE LEFT-RIGHT NEEDLE GIVE REVERSE SENSING? When the aircraft heading and course selected on the CS are approximately reciprocals (actually, anytime the angle between heading and radial selected is greater than 90°). For example, both airplanes labeled B above are trying to maintain an easterly course of 080°; however, the CS is set on 260° (the reciprocal of 080°). Note that the L-R needle gives reverse sensing in both airplanes labeled B. In this case, the CS should have been set on 080° to get proper sensing.

IS THE INDICATION ON THE TO-FROM INDICATOR DEPENDENT ON THE HEADING OF THE AIRCRAFT? NO! It is dependent only on the setting of the CS and the direction of the aircraft from the station. Note that in the 2 airplanes east of the VOR station the TO-FROM indicates TO; west of the station, the TO-FROM indicates FROM. You could pivot any of the 4 aircraft in the illustration through 360° and there would be no change in the indication on the T-F indicator.

WHEN DOES THE TO-FROM INDICATOR GIVE A NEUTRAL INDICATION? (1) When an unreliable signal is being received (you are either too far from the station or at too low an altitude, or the station is not properly tuned in); or (2) when you pass directly over the station; or (3) when you cross the radials perpendicular to the course selected on the CS. For example, as the airplanes above cross the 350° or 170° radials (and a short distance on either side), the TO-FROM would have a neutral indication.

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 16

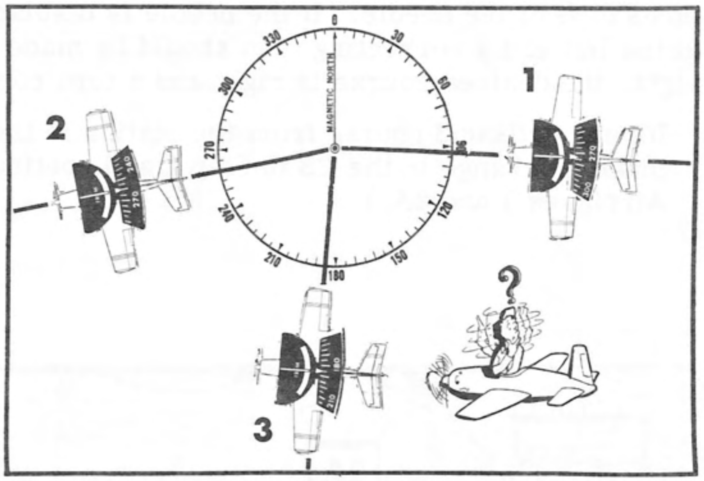
HOW TO USE VOR
(Series 2)

IN WHAT THREE GENERAL WAYS MAY A VOR STATION BE USED AS A NAVIGATIONAL AID?

1- To fly a course directly to a station (Airplane 1).

2- To fly a course directly away from a station (Airplane 2).

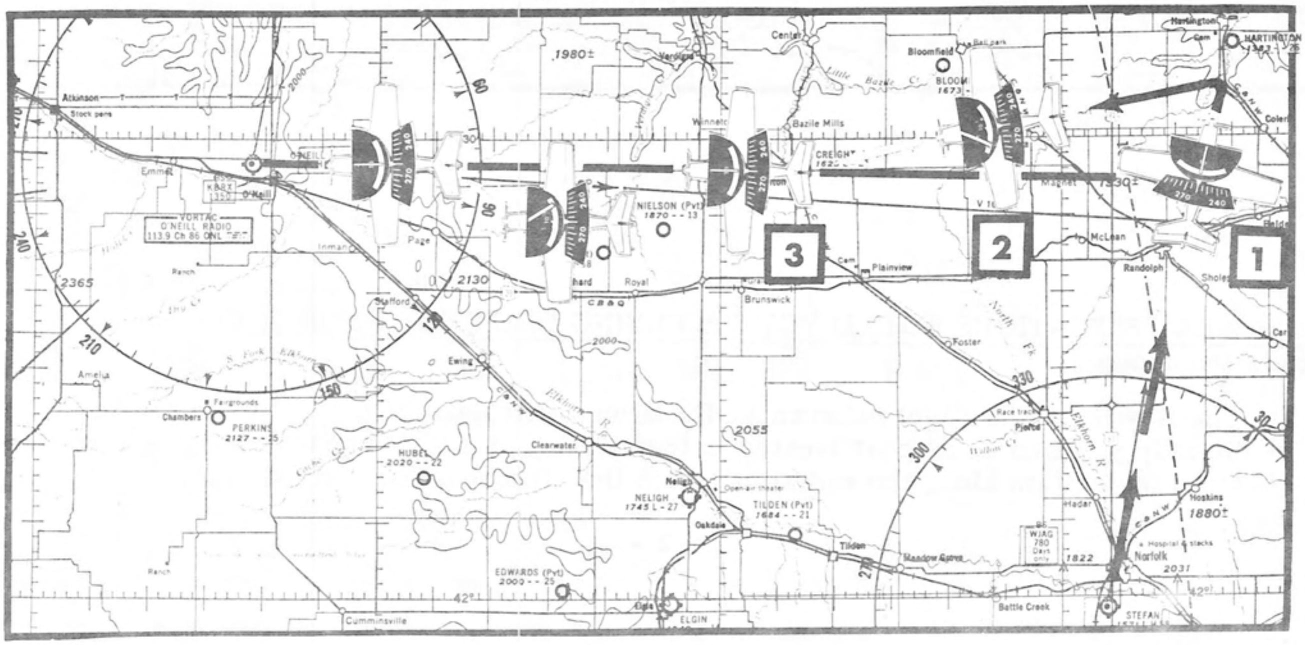
3- To determine the direction or bearing of your aircraft from a particular station or stations (Airplane 3).



WHAT PROCEDURE SHOULD YOU FOLLOW TO FLY DIRECTLY TO A STATION WHEN YOU ALREADY KNOW YOUR APPROXIMATE DIRECTION FROM THE STATION? (Assume you are flying from Stephan Airport to Hartington Airport; en route you decide to fly to O'Neill Airport. Visualizing your position, you know you are east of the O'Neill VORTAC.)

1- Tune in and aurally identify the station (O'Neill VORTAC).
2- Turn CS (Course Selector) until the L-R (Left-Right) Needle is centered and TO-FROM indicates TO (Airplane 1).
3- Turn to a heading approximately the same as the setting on the CS (Airplane 2).
4- The L-R Needle now has "proper sensing" (i. e. it is displaced in the direction of the desired course). Keep it centered by making turn corrections toward the needle.

(NOTE: After completing Step 3, you could re-center the L-R needle by readjusting the CS, then follow this new course inbound.)



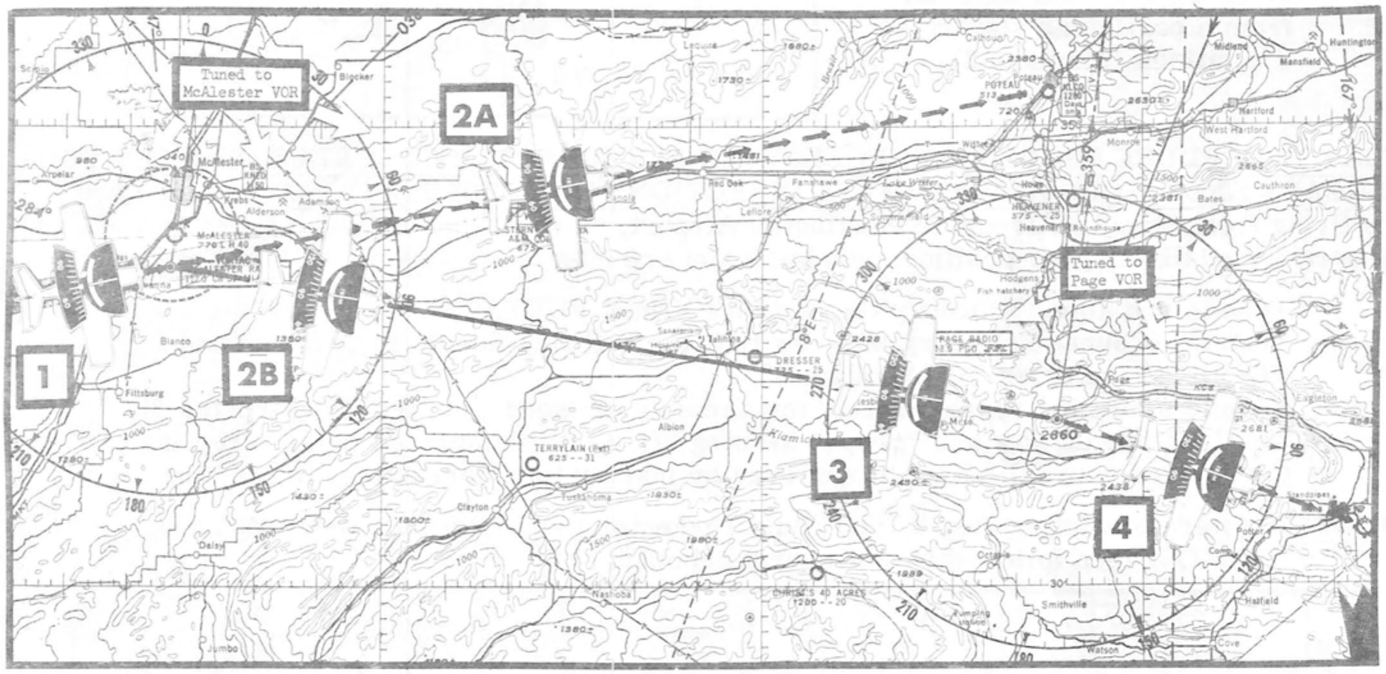
Rev. 8/64

*Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

AFTER ARRIVING OVER A STATION, WHAT PROCEDURE SHOULD YOU FOLLOW TO FLY DIRECTLY FROM THE STATION? (Illustration below).

1- As you pass over the station TO will change to FROM. (Airplanes 1, 2A and 2B).
2- At this time turn the CS to the radial which you wish to follow outbound (Airplane 2B).
3- Turn the aircraft to a heading which approximates the new setting of the CS.
4- The L-R Needle now has "proper sensing". Keep it centered by making correcting turns toward the needle. If the needle is displaced to the left, the desired course is to the left and a correcting turn should be made to the left; if the needle is displaced right, the desired course is right and a turn correction should be made to the right.

(NOTE: If your outbound course from the station is the same as the inbound course, then make no change in the CS in Step 2 and continue on your same general heading -- Airplanes 1 and 2A.)

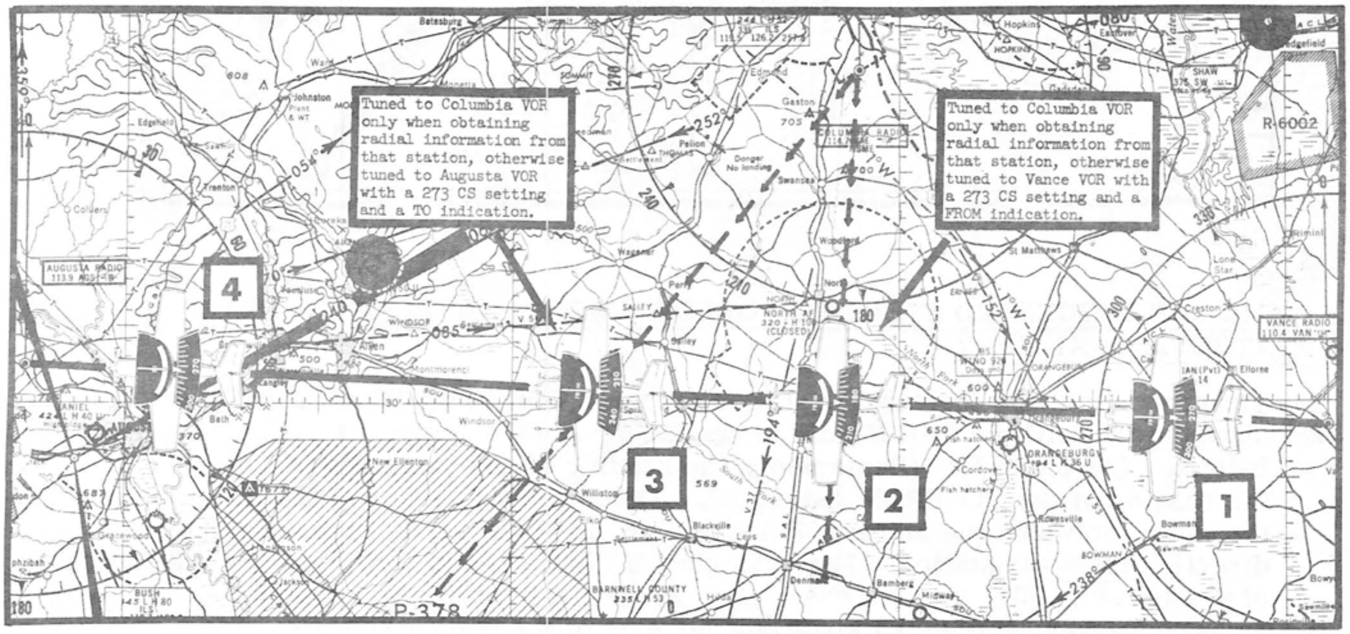


UNDER WHAT SITUATIONS WOULD YOU BE FLYING DIRECTLY FROM A VOR STATION? (Illustration above).

1- The first half of a flight between VOR stations (Airplane 2B).
2- To help you find an airport located in the vicinity of a VOR station by flying outbound from the station along the radial on which the airport is located (Airplane 2A or 4).

WHAT PROCEDURE SHOULD YOU FOLLOW TO DETERMINE YOUR DIRECTION OR BEARING FROM A STATION? (Illustration below).

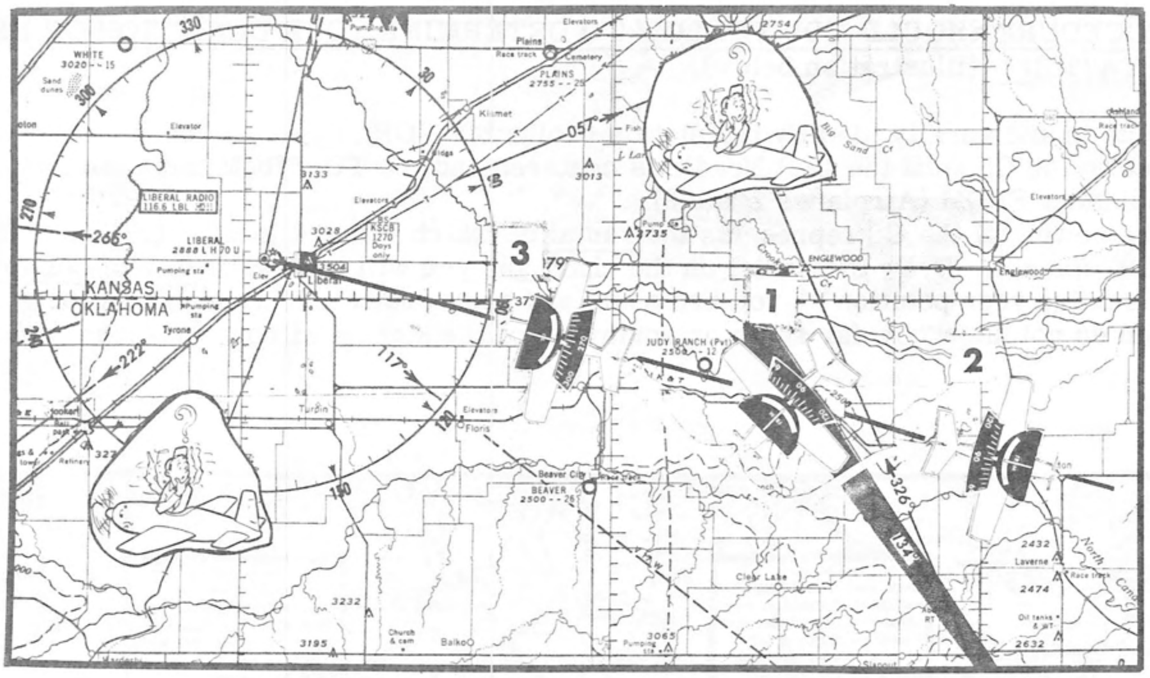
1- Tune in and aurally identify the station (Columbia VOR).
2- Rotate the CS until the L-R Needle is centered and the TO-FROM indicator indicates FROM (Airplanes 2 and 3).
3- The setting of the CS represents the radial on which you are located (185° for #2 and 220° for #3). Draw the radial on the chart and you will have your line of position.
4- Visualize your position -- you are south and southwest respectively from the station. You do not know how far south or southwest of the station without additional information.



IN WHAT WAY WILL IT BE HELPFUL TO YOU TO KNOW YOUR BEARING FROM A VOR STATION? (Illustration above).

1- If you are flying a course from Vance VOR to the Augusta VOR station (Airplanes 1, 2, 3, 4), you can determine your position along this route by finding your bearing from a VOR station on either side of your route (Airplanes 2 and 3).
2- If you are uncertain of your position, you may determine your bearing from two or more VOR stations. Draw these radials on the chart and your position will be where they intersect. Actually, you are doing this in the illustration above -- you are maintaining a specific radial FROM Vance VOR and TO Augusta VOR. You determine your radial from the Columbia VOR. The intersection of the two radials is your position. You would keep your radio tuned to Vance during the first half of the flight and to Augusta during the second half except when determining your radial from the Columbia VOR.

(NOTE: Knowledge of your exact position during the second half of this flight becomes very important so that you may be sure of avoiding the Prohibited Area, P-378, southwest of Airplane 3).



WHAT ARE THE SUGGESTED STEPS TO FOLLOW WHEN YOUR POSITION RELATIVE TO A VOR STATION IS UNKNOWN?

1- Tune in and aurally identify the station (Liberal VOR in the illustration above).
2- Turn the CS until the L-R Needle is centered and FROM appears on the TO-FROM Indicator (Airplane 1). (Remember, the heading of your aircraft will not affect the reading of the TO-FROM Indicator). The resulting setting of the CS tells you the radial on which the aircraft is located or, in other words, your bearing or direction from the station. For example: If the CS reads 225°, you are southwest of the station; 090°, you are east, etc. In the illustration, you are on the 093° radial; however, you do not know how far east of the station you are.
3- Visualize your position relative to the station -- always do this! After determining your bearing and visualizing your position, if you wish to fly directly away from the station along the radial on which you are located, you merely turn to a heading approximately the same as the setting on the CS (Airplane 2). The L-R Needle will have "proper sensing" and you should make corrections (toward the needle) to keep the L-R Needle centered.
4- After determining your bearing and visualizing your position, if you wish to fly directly to the station from your present position, you rotate the CS (approximately 180°) until the L-R Needle is centered and the TO-FROM indicates TO. Turn the aircraft to a heading approximately the same as the setting on the CS and make corrections (toward the needle) to keep the L-R Needle centered (Airplane 3). Since the heading of the aircraft and the setting on the CS are approximately the same, the L-R Needle will have "proper sensing".

IT MAKES GOOD SENSE TO HAVE PROPER SENSING
GET SHARP ON VOR - IT CAN TAKE THE HEADACHE OUT OF NAVIGATION

FAA Aeronautical Center
Flight Standards Technical Division,
Operations Branch,
P. O. Box 25082
Oklahoma City, Oklahoma 73125

U.S. DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

VFR PILOT EXAM-O-GRAM° NO. 17

POOR GUY . . .

COMMON MISCONCEPTIONS (Series #1)

The following remarks are actual excerpts from a pilot's written report of an accident in which he was involved.

> "I was climbing at an airspeed of 60 mph. I started a climbing turn to the right. The wind now became a cross wind instead of a head wind. This (lack of head wind) caused the airplane to stall -- to recover from the stall I turned the airplane back into the wind . . . (Later) I was in a quartering tailwind from the right. . . Went into a second stall. . . This is all I remember."

This pilot had over 100 hours, yet stalled and crashed due to an apparent misuse of controls at a slow airspeed (high angle of attack). The inspector who took this pilot's statement decided to pursue this theory with a group of student pilots. He posed this question to them.

> "If the aircraft's stalling speed was 60 mph and you were flying at an airspeed of 70 mph into a 30 mph wind, what would happen if you maintained this airspeed of 70 mph but turned downwind?" Five of the six students said the airplane would stall.

IS THIS ANSWER CORRECT? No.

DOES THE STALLING SPEED OF AN AIRPLANE DEPEND UPON THE AIRSPEED OR THE GROUNDSPEED? The airspeed.

DOES THE DIRECTION OF THE WIND HAVE ANY EFFECT ON THE AIRSPEED OF AN AIRCRAFT IN FLIGHT? No.

Now to summarize our point, airspeed is the only speed which holds any significance for an airplane. Once it is off the ground, an airplane feels nothing but its own speed through the air. It makes absolutely no difference what its speed happens to be in relation to the ground. The aircraft in flight feels no wind. It simply proceeds, operating with the same mechanical efficiency, upwind, downwind, crosswind, or in no wind at all. (NOTE: We are referring here to a steady wind. Turbulence, gusts, or wind shears can lead to stalls even though airspeed is being maintained above the normal stalling speed. In such conditions it is wise to add a safe margin to normal climbout or approach speeds.)

Rev. 1/77

Based on the performance of many applicants on the Private Pilot Written Test, here are some of the other more common misconceptions.

IF IT IS NECESSARY TO CLEAR OBSTRUCTIONS IMMEDIATELY AFTER TAKEOFF, SHOULD YOU USE BEST ANGLE-OF-CLIMB SPEED OR BEST RATE-OF-CLIMB SPEED? Best angle-of-climb speed. Simply stated, the difference is this. The best angle-of-climb speed produces the greatest climb in a given distance; the best rate-of-climb speed produces the greatest climb in a given time. Distance, of course, is the determining factor for takeoff obstruction clearance.

DO ALL WIND REPORTS INDICATE A TRUE DIRECTION? No. The wind direction, as reported by a control tower in pilot instructions, is magnetic. All other wind directions (Sequence Reports, Terminal Forecasts, Winds Aloft Forecasts, etc.) are true.

WHAT IS THE HEIGHT OF A CLOUD CEILING BASED ON? The height of the clouds above the ground, not the height above sea level (MSL). For example, let's examine the following weather report: ABQ M3Ø OVC. The station is Albuquerque, N.M., which has an elevation of 5,352 feet above sea level. The ceiling is reported as a 3,000-foot overcast. Using the current Albuquerque altimeter setting, your altimeter would indicate approximately 8,352 feet at the base of the clouds when over the airport, but your height above the ground would be 3,000 feet. As a word of caution, the 10,000-foot-plus mountains a few miles east of the city would probably extend up into the clouds since this ceiling report is based on an observation taken over the airport.

WHICH IS THE MORE DENSE -- MOIST AIR OR DRY AIR? Dry air. It is generally understood that high temperatures and high elevations result in a higher density altitude, but there seems to be a general impression that moist air has the reverse effect. The common misconception is that moist air is heavier than dry air. This is not true! Water vapor weighs less than an equal amount of dry air. A dry parcel is therefore denser and heavier than a moist parcel. Since both engine and aircraft performance decrease with an increase in density altitude, you should remember that high relative humidities (small spreads between temperature and dew point), especially on hot summer days, will result in longer takeoff runs.

IS AN AIRCRAFT CRUISING VFR AT 5,500 FEET MSL ALWAYS GOVERNED BY THE VFR CRUISING ALTITUDES REQUIREMENTS? Not necessarily. The rule pertains to aircraft operated in level cruising flight at more than 3,000 feet above the surface. The aircraft in this case (5,500 feet MSL) might be operating above a surface elevation of 3,500 feet and this rule would not apply.

* * * * *

These are, by no means, all of the common misconceptions that prevail among student pilots, but as we stated earlier, a trend has become apparent in the Private Pilot Written Examination results which highlights these that are discussed. Additional misconceptions are discussed in Exam-O-Gram No. 26.

Federal Aviation Administration
Flight Standards National Field Office, Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 18

LOST PROCEDURE - PILOTAGE

It seems that all who fly cross-country are destined to lose their way or become "temporarily misplaced" at one time or another. Therefore, we should give some forethought to procedures and practices that may be used to lead wandering birdmen out of the wilderness. Confining our problems to the typical VFR dilemma, we can start with the general and proceed to more specific rules.

1. GENERAL:

Don't fight the problem -- try to solve it! Stay loose -- don't hit the panic button, thus virtually assuring that all the thinking gears will grind to a halt.

Analyze and evaluate as to: Fuel available and consumption rate. In other words, how much longer can you fly insofar as fuel is concerned? Be conservative -- not hopelessly optimistic.

Weather -- is it good, bad, indifferent, improving, or deteriorating?

Equipment -- is everything functioning? Do you have lights (cockpit, landing, navigation, etc.) or survival gear of any description?

Terrain -- is it open, flat country, mountains, marshes, semi-desert, sparsely or thickly populated?

Daylight -- hour remaining (if any). Have you had night or instrument flying?

Once you have a reasoned assessment of the situation, you are better prepared to make vital decisions. One of the first is to decide if help is available, or are you all by your lonesome?

KNOW and ABIDE BY YOUR LIMITATIONS AND THOSE OF YOUR EQUIPMENT

*Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

URONUROWN
(with no radio)

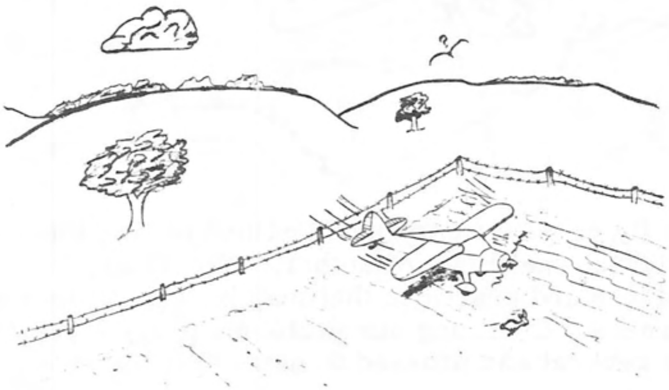
2. SPECIFIC:

Condition One:

(a) Low on fuel
(b) Weather deteriorating
(c) Inadequate experience and darkness imminent
(d) Engine or equipment malfunctioning

While (d) is not necessarily associated with being lost, the solution which follows would certainly apply if the situation were serious enough.

SOLUTION:



GET IT ON THE GROUND! Most accidents are the product of mistakes which have multiplied over a period of time. Getting lost is no exception. Don't push your luck. It may well be that in doing so you have added the final mistake which will add another figure to the statistics on accidents. How much better to be on the ground than in it. If terrain or other conditions make it impossible at the moment, don't waste time, for it is of the essence. Don't search for a field comparable to Idlewild. Anything usable will do. Remember, most people on the ground know where they are. You know you do not. This state of ignorance may well become permanent because the triple "whammy" of getting caught while "dangling, dark, and dreary" will rob you of virtually all control of the situation. If there is any alternative whatsoever . . .

NEVER fly until the petrol peters out. There are few things so nerve shattering as the rustle of the wind when an engine has coughed its last.

NEVER fly until the sun slowly sinks in the golden west. It may be a beautiful sight but the goblins will get you if you don't watch out.

NEVER fly until the biggest, meanest goblin of them all, Ole Bad Weather, falls flat on his face. He will do his best to take you with him.

Remember the NEVERs, lest in the blink of an eye, they become FOREVERs.

KNOW and ABIDE BY YOUR LIMITATIONS AND THOSE OF YOUR EQUIPMENT

Condition Two:

(a) Plenty of fuel (b) Plenty of daylight
(c) Plenty of good weather

SOLUTION:

Establish an "Error Semi-Circle".

1. Straighten up and fly right -- straight, that is. Establishing a course by hunch or because you "got a feeling" is for the birds. Don't wander aimlessly.

2. Use knowledge of last known position, elapsed time, approximate wind and ground speed, (airspeed is better than nothing), to establish how far you may have traveled since your last check point.

3. Use this distance as a radius and draw a semi-circle ahead of last known position on the chart. For example, you estimate your ground speed at 120 mph. If you have been flying 20 minutes since your last check point, then the no-wind radius of your semi-circle is 40 miles projected along the direction of your estimated track. If you believe your wind is from the right, then you are most probably in the left quadrant of your semi-circle. Of course, unless you were sure about the wind, you could not ignore the right quadrant. The use of a simple computer can materially reduce the effort required in solving problems of speed, time, distance, and fuel consumption.

4. If you have been flying a steady compass heading and keeping a reasonably accurate navigation log, it's not likely you will have too much difficulty. If you've been operating "fat, dumb, and happy" too long, your search is going to be more difficult.

5. In either case, loosen up the eyeballs and start some first-class pilotage. DON'T OVERLOOK THE POSSIBILITY OF BEING LOST, YET RIGHT ON COURSE OR VERY NEARLY SO. First, look for something big. Don't concern yourself with the minute or trivial at this point unless nothing better is available. Often there will be linear features such as rivers, mountain ranges, or prominent highways and railroads easy to spot and identify. By turning either to the right or the left, you CAN'T miss them. If preferable, you can use them simply as references for orientation purposes. In other words, you can use them as landfalls or backstops, and thus find them of great value in fixing your approximate position.

KNOW and ABIDE BY YOUR LIMITATIONS AND THOSE OF YOUR EQUIPMENT

Once you have utilized such features to the fullest extent possible, or if there are none available, you can use anything that might help -- don't pass up a thing. Double check all landmarks. Compare and analyze -- analyze and compare railroads and highways, topographical features (man-made and natural). Check for available air markers with names on 'em. But don't go down on the deck and stay there. As a general rule, it is both safer and easier at higher altitudes.

Remember this point. Be sure you have up-to-date charts, including those adjacent to the one in use. Everything which appears on the chart will usually be on the ground, but no standard chart is so detailed that everything you can see on the ground can also be found on the chart. If you either habitually or occasionally fly without suitable pilotage charts, you deserve to incur the full wrath of every goblin that ever hounded airmen. Every VFR flight is involved with pilotage!

One final word -- an ounce of preflight planning is worth far more than a pound of in-flight desperation. Sound, adequate preflight work will always pay off. It can prevent getting lost in the first place or at least simplify the task of fixing a position if you are "temporarily misplaced".

It can mean the difference between an enjoyable, satisfying experience and a palm-sweating ordeal.

KNOW AND ABIDE BY YOUR LIMITATIONS AND THOSE OF YOUR EQUIPMENT

FAA Aeronautical Center
Flight Standards Technical Division,
Operations Branch,
P. O. Box 25082
Oklahoma City, Oklahoma 73125

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 19

EMERGENCY OR LOST PROCEDURES (RADIO)

Let's face it, intrepid airman, you may some day find yourself behind an airborne "eight-ball". Now, verily, this is unfortunate, but for the informed, assistance may be at hand. Though many may suffer from rude exposure to the rigors of navigation up "Trouble Creek", few need labor without a paddle. The "paddles", or aids, available are many and varied, especially for those with radio capability and knowledge of all the facilities available, to summon the willing, able help that is ready. Before we examine the "aids" available to the pilot in any emergency phase, let's define the latter term. Emergency phase simply means a situation involving distress, the need to resolve uncertainty, or to alert those able to help with a pressing problem.

RADIO AIDS FOR PILOTS IN TROUBLE

- FAA Controllers and Flight Service Specialists
- Air/Ground Communication Channels
- VORs and VORTACs
- Flight Service Stations
- Towers
- Approach Control Facilities
- Military VHF/DF Stations
- FAA VHF/DF Stations
- FCC HF/DF Stations
- Airport Surveillance Radars
- Long Range Radars
- Precision Approach Radars
- Air Route Traffic Control Centers

NOTE: These radio aids should first be used to keep you out of trouble. The individuals at these aids are ready and willing to help!!

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 8/77

THE MANY AIDS AVAILABLE TO YOU AS A PILOT

I. THE "U" AID. This is Old Faithful. If you panic or have not mastered this one, you are likely to find the other aids both difficult to apply and limited in utility. With this, you develop good habits of planning and performance. It is the only thing reliable if you find yourself in some of the situations outlined in this and the previous Exam-O-Gram. Only through the use of this aid will you become acquainted with those that follow.

II. THE RADIO COMMUNICATION AID. This will vary from the most sophisticated and expensive equipment to that which is barely adequate. Therefore, its utility will also vary. Regardless of this, a pilot should know the

A. MEANS OF DECLARING AN EMERGENCY.

1. Transmission of a Radio-Telephone Message.
~~2. Flying an Appropriate Triangular Pattern.~~

B. THREE ELECTRONIC MEANS OF OBTAINING ASSISTANCE.

1. Receipt of Radio-Telephone Message.
2. Direction Finding (D/F) Bearings.
3. Radar Detection ~~of Triangular Patterns.~~

Radio Communication will generally prove to be the most useful aid. You may contact many FAA, military, or FCC Stations or facilities on the emergency frequency (121.5 MHz), or other assigned frequencies within the frequency and range capability of your equipment. When you do, utilize

The Four "C" Procedure

CONFESS -- The doctors aren't likely to treat your troubles if U won't admit you've got 'em! DON'T WAIT TOO LONG!

COMMUNICATE -- if in doubt, shout"! But be prepared to do more than simply "holler" for help. You may need to give any or all of the following: identification, type of aircraft, estimated position, heading, estimated speed, altitude, fuel, nature of problem, and assistance desired. Clearly understand that the facility with which you have established contact may not be able to supply the type of assistance you need or seek, but if you communicate pertinent information, facility personnel should be able to alert those who can. Personnel at FSS stations are trained to do so, and by voice directions alone, can get you back on course or to an airport. Often they can tell you how to use your equipment in order to get the assistance you need.

Even if a forced landing is imminent, try to communicate with somebody. The reasons for doing so should be obvious. If you cannot establish contact with a specific facility, you may communicate IN THE BLIND. Precede your message (3 times) with the word MAYDAY (distress), and simply transmit on your emergency frequency or available air-to-ground frequencies for reception by any facility or even other aircraft.

CLIMB if you can. Altitude improves the chance of establishing radio contact and increases likelihood of Radar and D/F detection.

COMPLY with the advice and instructions received, if you really want help. The trained specialist is anxious to help. If you cooperate, the ground station can help you.

III. THE DIRECTION FINDING (D/F) AID.

Types include both HF and VHF fixes and/or steers. In other words, they locate your position and give magnetic direction to fly to reach a desired destination.

Use is limited by: Radio equipment, your position in relation to facilities able to provide help, and the extent you are able to follow the four C's.

D/F stations and network include not only FAA, but FCC and military facilities. Those civilian airports capable of providing such aids are listed in the Airport/Facility Directory of the Airman's Information Manual, but when necessary, you may make the request of any station or tower you are capable of contacting. If possible, they will relay the request to the appropriate facility or station in the D/F net system. Check the Airman's Information Manual for information on stations, frequencies, and procedures.

IV. THE RADAR AID.

Types of radar are classified as to function, e.g., Air Route Surveillance Radar, Airport Surveillance Radar, Precision Approach Radar, and Radar Beacons. There are FAA-operated units plus many military installations.

Recommended emergency procedures are covered in Part 1 (ATC Services Available to Pilots) of the Airman's Information Manual. The following information was excerpted from this publication:

EMERGENCY OPERATION

a. When an emergency occurs, the pilot of an aircraft equipped with a coded radar beacon transponder, who desires to alert a ground radar facility to an emergency condition and who cannot establish communications without delay with an air traffic control facility may adjust the transponder to reply on Mode A/3, Code 7700.

b. Pilots should understand that they may not be within a radar coverage area and that, even if they are, certain radar facilities are not yet equipped to automatically recognize Code 7700 as an emergency signal. Therefore, they should establish radio communications with an air traffic control facility as soon as possible.

RADIO FAILURE

a. Should the pilot of an aircraft equipped with a coded radar beacon transponder experience a loss of two-way radio capability the pilot should:

(1) Adjust his transponder to reply on Mode A/3, Code 7700 for a period of 1 minute,

(2) then change to Code 7600 and remain on 7600 for a period of 15 minutes or the remainder of the flight, whichever occurs first.

(3) Repeat steps 1 and 2, as practicable.

b. Pilots should understand that they may not be in an area of radar coverage. Also many radar facilities are not presently equipped to automatically display Code 7600 and will interrogate 7600 only when the aircraft is under direct radar control at the time of radio failure. However, replying on Code 7700 first increases the probability of early detection of a radio failure condition.

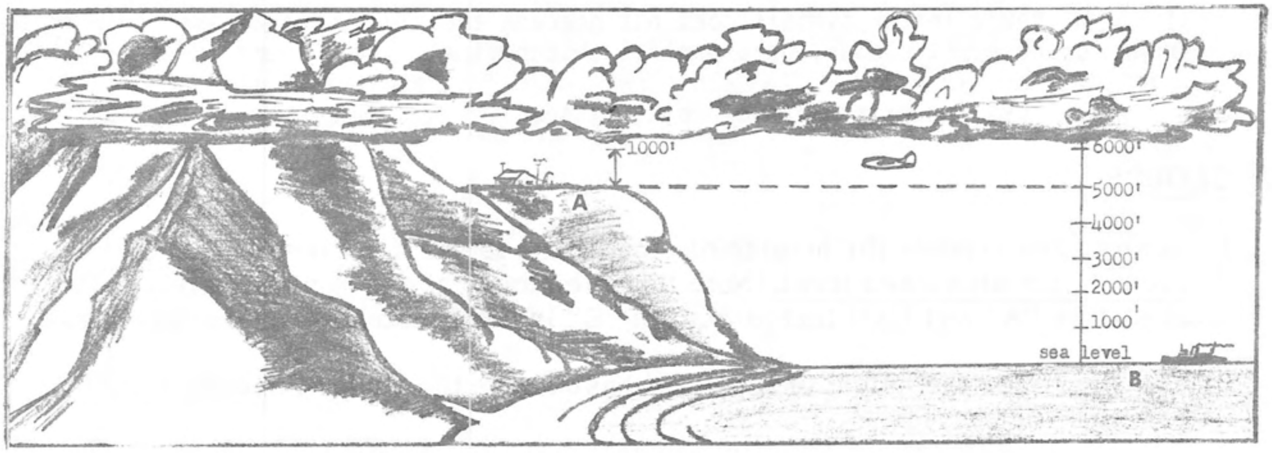
Federal Aviation Administration
Flight Standards National Field Office, Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 20

CEILING & VISIBILITY



An analysis of common mistakes on written examinations indicates that many applicants are improperly interpreting the ceilings and visibilities reported on hourly weather reports (sequence reports).

How about you? Do you really know what a ceiling is - what visibility is - and how both are reported??

A. CEILING:

1. Is defined as the "lowest layer of clouds or obscuring phenomena aloft that is reported as 'broken' (.6 to .9 coverage), or 'overcast' (more than .9 coverage) and not classified as 'thin'; or the height ascribed to surface-based obscuring phenomena not classified as 'partial'." This simply means that -

   a. The lowest cloud coverage reported as broken or overcast constitutes a ceiling except when a minus sign precedes the cloud layer contraction (-BKN, -OVC). When this occurs, that particular layer does not constitute a ceiling.

   b. If the sky is reported as completely obscured (X) by a phenomena extending to the surface (e.g., fog, dust, heavy precipitation), the ceiling is the vertical visibility into the obscuration.

   c. If the sky is partially obscured (-X) it does not constitute a ceiling and no height will be given for this partial obscuration.
   Example: OKC -X 18 SCT M35 OVC, etc.

   d. Scattered clouds (SCT) do not constitute a ceiling.

2. For practical purposes, ceiling is the lowest height above the surface at which the total cloudiness between that level and the surface (as seen by a ground observer) covers more than half the sky.

NOTE: The contractions CLR, SCT, BKN, and OVC have replaced the symbols ○, ⦶, ⦶, and ⊕.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 6/76

3. Ceiling may be classified in several ways. This classification is shown by a letter which precedes the ceiling height. Some of the more important of these letters are:

M = measured E = estimated W = indefinite

If one of these letter symbols does not precede the cloud contraction or if thin broken or overcast clouds, or a partial obscuration exists, there is no ceiling. Example: CBI -X 1Ø SCT 14 -BKN 14Ø -OVC 5H, etc. means that no official ceiling exists at Columbia, Missouri.

B. CLOUDS:

1. In sequence reports the heights of cloud-base levels are given in feet above the ground, not above sea level. Note that the clouds are at approximately 1000 feet at station "A" and 6000 feet at station "B" in the illustration on the first page.

2. The figure for the height of the cloud base above the surface precedes each sky coverage contraction.

3. The last two digits of the cloud height are omitted; i.e., 1 means 100 feet, 14 means 1400 feet, and 140 means 14,000 feet.

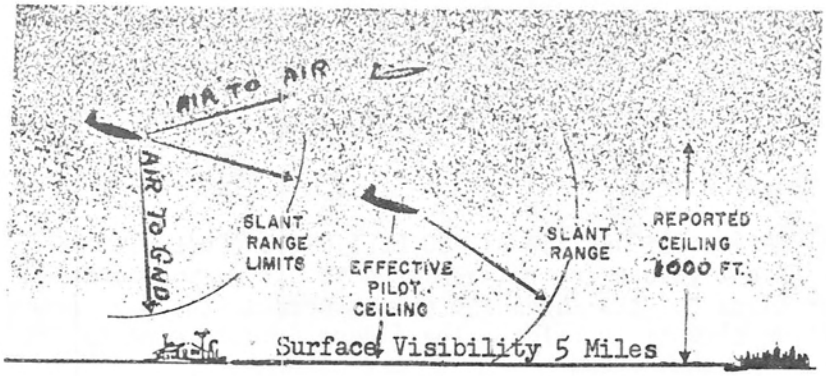
4. Clouds are reported in ascending order of height whether or not they constitute a ceiling.

5. Surface-based total obscurations (phenomena other than clouds such as fog, precipitation, dust, smoke, or haze) are not reported as clouds since this would be misleading but they are reported with a height value.

Example: BUF W15 X 3/4S-F, etc., means that at Buffalo there is a vertical visibility of 1500 feet into a total obscuration. A definite cloud base cannot be seen from the ground.

C. VISIBILITY:

1. Visibility is the greatest distance on the earth's surface at which prominent objects can be seen and identified. This distance is not always the same in all directions. Therefore, the value for prevailing visibility (which is a ground visibility only) is based on surface observations and is stated in the hourly sequence reports. Prevailing visibility is always reported in statute miles and is the greatest surface visibility attained or surpassed throughout at least one-half of the horizon circle, but not necessarily continuous or for all of the horizon circle.



Types of Visibility in Aviation

All pilots should clearly understand that sequence report visibility may be much greater than either air to air, or slant range visibility, particularly when low ceilings and/or obscurations prevail.

2. Fractional values for visibility such as $1\frac{1}{4}$, $1\frac{1}{2}$, $2\frac{1}{2}$, etc., appear as 1 1/4, 1 1/2, 2 1/2, on the hourly sequence report because the teletype machines do not have fractions.
   Example: CLE M12 BKN 2Ø OVC 2 1/2R-F Ø71/39/37/ØØØØ/974

3. It is not always possible to look at the visibility as reported in the main body of the teletype report and obtain complete information concerning surface visibility at the station because:

   a. If, in some direction from the station, there is a significant variation from the prevailing visibility, this variation will be found only in the remarks section.
      Example: PIT E18 OVC 4S-K Ø31/32/3Ø/ØØØØ/962/VSBY N 1 means that the reported visibility is reduced to 1 mile to the north.

4. Weather occurring at the time of observation is also reported through use of letter symbols. These symbols follow the visibility as reported in statute miles. Some of the more common of these symbols are:

   R=Rain; S=Snow; T=Thunderstorm; RW=Rain showers; A=Hail; IP=Ice pellets

5. Except for thunderstorms, hail, and ice crystals, the intensity of weather is shown by:

   a. A plus sign (+) following the symbol to indicate "heavy".
   b. A minus sign (-) following the symbol to indicate "light".
   c. A double minus sign (--) following the symbol to indicate "very light".
   d. The absence of any sign indicates the intensity is "moderate".

Example: STL 5 SCT E1Ø OVC 2R--S-K etc., which indicates that St. Louis has very light rain, light snow, and smoke. Note that these signs apply only to the weather and not to the obstructions to vision.

QUESTIONS AND ANSWERS

LAX -4 -SCT 14 -BKN 25Ø -OVC 4HK 196/66/63/ØØØØ/Ø11/VSBY N 2

A. Based on the above report --

1. IS THERE A PARTIAL OBSCURATION AT 400 FEET OR SCATTERED CLOUDS AT 400 FEET? Ans. No. Height values are not assigned to partial obscurations, and the figures for cloud heights above the ground precede the sky coverage contraction for those clouds; therefore, the figure 4 must refer to the scattered clouds.

2. WHAT IS THE CEILING? Ans. There is no official ceiling. No letter precedes the cloud contractions and all cloud coverage is reported as thin (-).

3. WHAT IS THE VISIBILITY? Ans. Prevailing surface visibility is 4 statute miles with haze and smoke, but to the north visibility is only 2 statute miles.

4. SHOULD A PILOT EXPECT HIS SLANT RANGE AIR TO GROUND VISIBILITY TO BE 4 MILES AT LOS ANGELES? Ans. No. Under the circumstances of obscuration, partial haze and smoke, it is probably less.

DEN 1Ø SCT M3Ø BKN 8Ø OVC 2VFK Ø31/75/65/11Ø5/962/VSBY 1V3

B. Based on the above report --

1. WHAT IS THE CEILING? Ans. Measured 3000 feet above the surface.

2. AT 7500 FEET MEAN SEA LEVEL OVER DENVER, COLORADO, WOULD THE PILOT BE ABOVE OR BELOW THE CLOUDS REPORTED AT 3000 FEET? Ans. Below the clouds. At 7500 feet MSL he is approximately 2200 feet above the ground at Denver.

3. SHOULD A PILOT INTERPRET THIS REPORT TO MEAN THAT HE WILL FIND .9 OR MORE CLOUD COVER AT 8000 FEET ABOVE THE SURFACE? Ans. No. While it is possible that this situation actually exists, it is also true that such may not be the case at all. If there actually exists, visible from the ground, .5 coverage at 1000 feet, .4 coverage at 3000 feet, and .1 coverage at 8000 feet, it would be reported as 1Ø SCT M3Ø BKN 8Ø OVC. The combination of clouds at various levels may make it impossible for the ground observer to determine the actual percentage of cloud cover for all except the lowest level.

C. WHY SHOULD A PILOT BE EXTREMELY CAREFUL IN INTERPRETING CEILING VALUES, PARTICULARLY IN MOUNTAINOUS AREAS? Ans. If he does not he may "booby trap" himself into expecting an adequate ceiling when it does not exist! He must always relate surface elevation at the reporting station to terrain elevation along his flight route. The diagram on Page 1 illustrates what can happen to a 6000-foot ceiling when the surface elevation changes. He must also be aware that there are wide enroute variations from the reported ceilings (and visibility) even if there is no significant change in terrain elevation.

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

VFR-No. 20
6/76

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 21

FLYING INTO UNFAVORABLE WEATHER

How many times have you overheard or perhaps made similar statements yourself - "Let's go, we don't need weather, we'll make it okay." All too often a departing pilot merely glances at or completely ignores weather reports and forecasts because of a biased opinion that "weathermen never hit it right anyway". True, ceiling and visibility reports are sometimes estimated and a forecast is for conditions likely to occur; but if you don't utilize this information, your flight may be full of unhappy surprises. Accident investigation statistics continue to reveal "flight into unfavorable weather" as the chief cause of VFR fatal accidents. Results of FAA written examinations confirm that many pilots lack an adequate understanding of weather information.

WHY DO PILOTS FLY INTO UNFAVORABLE WEATHER?

1. GO-ITUS -- "I gotta get there . . ."; "I don't have time to wait." This is a condition that usually converts HOT PILOTS into COLD BODIES, and is a most difficult "disease" to cure. This attitude can be controlled only through sound reasoning and judgment by the individual.
2. MISINTERPRETATION OF FORECASTS AND REPORTS -- "It looks like VFR . . ."; "aw, it's good enough." Applicant performance on FAA written examinations indicate that the problem lies not in reading the data, but in knowing just what it means in terms of expected weather conditions.
3. FAILURE TO KEEP ABREAST OF WEATHER CHANGES -- Weather conditions do change, and the best way to keep informed en route is to listen to in-flight advisories and scheduled broadcasts.
4. IGNORING IN-FLIGHT WEATHER SIGNS -- "It's just a little shower . . ."; "just a few puffs of clouds." Rarely does weather suddenly go bad with no warning. Signs of deteriorating weather should be learned and observed by the VFR pilot.

ARE YOU "WEATHER WISE" OR OTHERWISE?

DOES A STATION REPORT OF VFR CEILING MEAN EN ROUTE VFR? NO, the ceiling reported is the height above the reporting point only. It must also be related to the surrounding and en route terrain to determine if adequate VFR separation can be maintained between stations. (See Exam-O-Gram 20.) Additionally, unreported conditions between stations may be lower than those reported at the stations.

IS REPORTED VISIBILITY THE SAME AS VISIBILITY ALOFT? NO, the reported visibility is the visibility at the surface only. Conditions aloft may restrict flight visibility more or less than that reported. (See Exam-O-Gram 20.) Cockpit visibility in precipitation is further reduced by rain, drizzle, or snow spreading over the windshield. Forward visibility in a light snowfall may be zero due to the relative horizontal movement of the snow. Sunlight reflecting off haze or dust aloft reduces the visibility considerably.

WHAT CAN BE LEARNED FROM TEMPERATURE REPORTS? High temperatures reduce takeoff and landing performance. Low temperatures reflect the approximate freezing level and the areas of possible icing in precipitation. Sudden temperature changes reveal the relative position of a front and its associated weather.

WHAT IS THE SIGNIFICANCE OF DEW POINT? Specifically, a dew point value relatively close (2° - 5°) to the air temperature is indicative of the probability of fog, low clouds, or precipitation.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

WHY SHOULD THE REPORTED WIND DATA BE NOTED? The velocity and direction of the surface wind should be related to the runway at the point of intended landing to determine the degree of cross wind. Wind data also reflects the degree of turbulence to expect. A sudden shift in direction often reveals the position of frontal weather relative to a station.

OF WHAT VALUE IS THE ALTIMETER SETTING? Correct cruising altitudes and adequate vertical clearance are dependent on the application of altimeter settings. A rapid and continual drop in pressure (altimeter setting) forewarns of approaching inclement weather.

WHAT IS A PIREP AND WHERE IS IT FOUND? A PIREP is a report of weather conditions at flight altitude, particularly between stations, seen by the pilot instead of the ground observer. Reports are often broadcast, and a pilot report summary is disseminated hourly to stations by teletype. Cloud base and top reports are found in the Remarks section of sequence reports.

ARE YOU GETTING THE REAL PICTURE FROM FORECASTS AND REPORTS? Only when the above are considered in analyzing forecasts and reports will you have the full story.

WHAT ARE SOME OF THE WEATHER SIGNPOSTS AND THEIR WARNINGS?

Blowing Dust -- turbulence, poor visibility at low levels, particularly into the sun.

Low Layer of Haze -- possible fog or stratus cloud in early morning or late evening; poor visibility, particularly into the sun.

Light Puffs of Clouds at Low Levels -- probable fog or stratus cloud, particularly in early morning or late evening.

Ragged Cloud Base -- turbulence, erratic visibility, possible precipitation.

Bulbous Cloud Base -- turbulence, possible precipitation, conducive to TORNADOES.

Roll-Type Clouds -- DANGEROUS turbulence, dust and poor visibility, hazardous landing conditions, subsequent precipitation.

Line of Heavy Dark Clouds -- SEVERE turbulence, dust and poor visibility, hazardous landing conditions, precipitation, hail.

Opening in Wall of Dark Clouds (SUCKER HOLE) -- DANGEROUS turbulence, possible precipitation and poor visibility as the hole is entered.

Gradual Lowering and Thickening of the Ceiling -- inadequate terrain clearance, possible widespread precipitation, and fog.

Near Freezing Temperature -- poor visibility in precipitation with ice forming on the windshield as well as the aircraft structure.

THE 180° TURN IS AVIATION'S BEST SAFETY DEVICE -- IF USED PRIOR TO BEING ENVELOPED BY ADVERSE WEATHER. DON'T BE A "PUSHER" IN THE hope THAT THE WEATHER WILL GET BETTER!

FAA Aeronautical Center
Flight Standards Technical Division,
Operations Branch,
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation

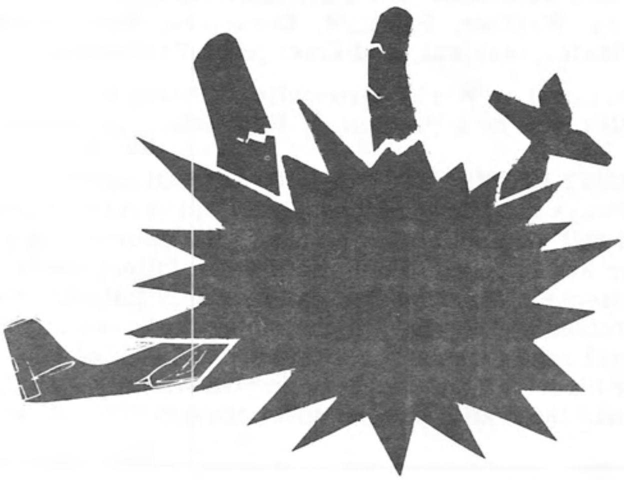
FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 22

POTENTIAL MID-AIR COLLISIONS

Analyses of answers to Pilot and Ground Instructor Written Tests indicate that many applicants do not fully understand several areas in Regulations and procedures that were devised as safety measures for VFR flying. Two of the areas will be covered in this Exam-O-Gram that seem to give applicants the most difficulty. They concern VFR Altitudes/Flight Levels in controlled and uncontrolled airspace and Airport Advisory Service at uncontrolled airports.

A pilot who does not keep abreast of and comply with the latest Regulations and procedures could be a source of danger to himself and to others in his vicinity. A Federal Aviation Administration report indicated that 549 "near mid-air" collisions were reported within the United States during one calendar year. This compared with 516 reports for the previous year. The Near Mid-Air Collision Report of 1968 listed 1,128 hazardous incidents. It would be reasonable to assume that other "near mid-air" collisions occurred that were not reported.



Failure to comply with Regulations and Procedures increases the degree of potential mid-air collision hazards!

Could any pilot with considerable flying experience truthfully say that he has never been involved in a "near miss" with other aircraft - or - that he is not seriously concerned about mid-air collisions? It is often so easy to fly for a long period of time with our head in the cockpit while we study charts or change radio frequencies. Finally, something tells us that we should start looking around, and then we suddenly realize how foolish we were to expose ourselves to the potential hazards of a mid-air collision while we were preoccupied.

Most pilots know very well the danger of not properly guarding the airplane from other aircraft while their attention is divided between things inside and outside the cockpit -- yet is there a pilot flying today who will not some day break this rule of common sense?

★★★

Rev. 8/77

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

TO AVOID OR REDUCE THE HAZARD OF TOO MUCH "EYES-INSIDE-THE-COCKPIT" FLYING, WHAT ACTION SHOULD A PILOT TAKE IN VFR CROSS-COUNTRY PREFLIGHT PLANNING?

(a) He should obtain from proper charts all the information pertinent to his route of flight. Information such as: headings, distances, checkpoints, altitudes, etc., should be placed in a flight log format. On the reverse side of the FLIGHT PLAN (FAA Form 7233) a flight log is provided for pilots.

(b) All necessary charts should be folded in proper sequence and conveniently located in the cockpit.

(c) The current issue of Airman's Information Manual (AIM) should be referred to with particular attention to NOTAMS and Airport/Facility Directory sections. All radio frequencies to be used on the flight should be written on the flight log for ready reference during the flight.

(d) The AIM Airport Directory or Airport/Facility Directory sections should be consulted to obtain airport data and to review VFR procedures for approaches to busy air terminals. For example: The Airport/Facility Directory section for Roanoke Municipal Airport under Radar Services states: "Stage II - Contact Approach Control within 20 NM radius".

(e) The Airman's Information Manual should be reviewed for additional information under such headings as: Good Operating Practices, Air Navigation Radio Aids, Airport-Air Navigation Lighting and Marking Aids, Weather, Preflight, Departure, Radar Assistance to VFR Aircraft, VFR Cruising Altitudes, Arrival, and Emergency Procedures.

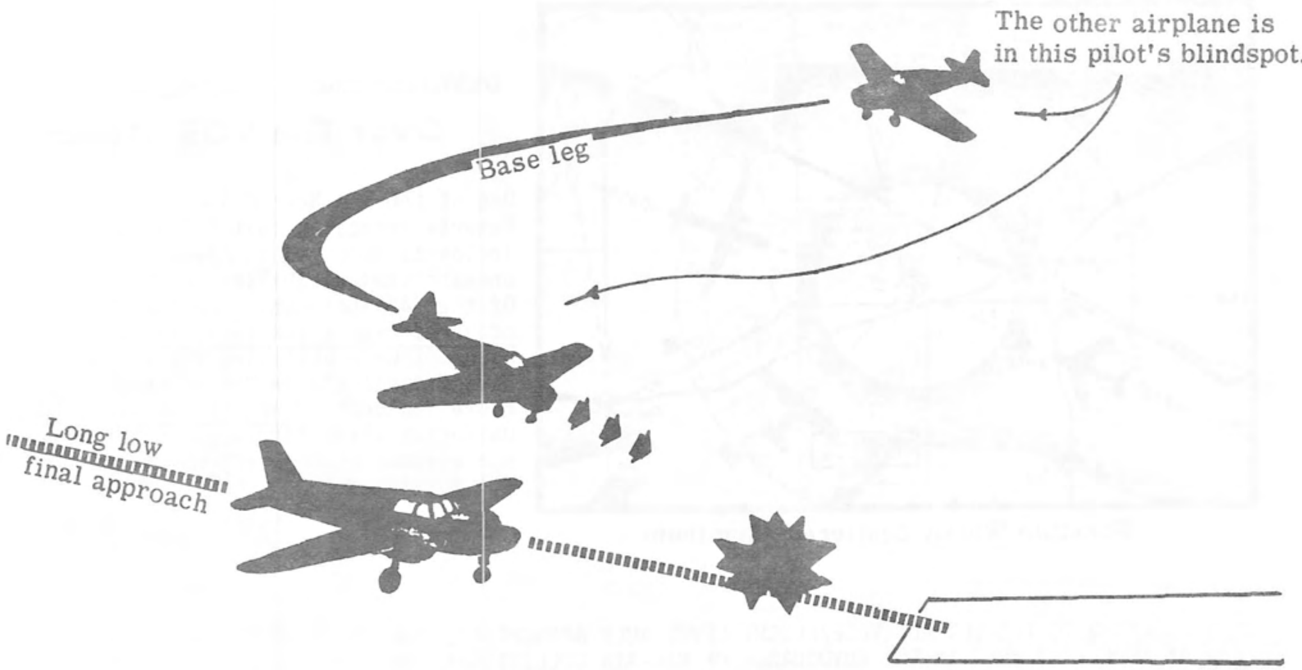
(f) A careful study of the Sectional or World Aeronautical Charts should be made to determine if your route of flight will traverse a Prohibited, Restricted, or Warning Area.

HOW DOES THE TOWER ASSIST IN PREVENTING MID-AIR COLLISIONS AT A CONTROLLED AIRPORT? Although it is always the direct responsibility of the pilot, when flying in VFR weather conditions, to avoid collision with other aircraft, the information and clearances issued by the controller in the tower are intended to aid pilots to the fullest extent in avoiding collisions. The controller in the tower issues clearances that can be safely followed without collision hazard if reasonable caution is exercised by the pilot. By advising the tower of your position well in advance of entering the control zone (normally a minimum of 15 miles out), you will be able to receive information on other aircraft which might be in your vicinity as well as being assured of a safe and orderly entry into the traffic pattern under the direction of the control tower.

> Note to Student Pilots: To receive additional assistance while operating in areas of concentrated air traffic, a student pilot should identify himself as a student pilot during his initial call to an FAA radio facility (Control Tower, FSS, Approach Control, etc.). For example: "Dayton Tower, this is Fleetwing 1234, Student Pilot, over."

At some busy airports (examples are: Memphis, El Paso, and Seattle) an expansion of the normal tower service is made possible through the use of radar. Here the tower will probably request that you listen on the approach control frequency which they give you. You will then receive essentially the same information and direction as though the tower had you in visual contact, but at a much greater range. The number of such airports with this service is increasing rapidly and is another step toward reducing the possibility of mid-air collisions.

WHY SHOULD A PILOT CHECK THE GRAPHIC NOTICES AND SUPPLEMENTAL DATA SECTION OF THE AIRMAN'S INFORMATION MANUAL? Before departing on an extensive cross-country flight in unfamiliar country, the pilot should check the Special Operations, such as notices for "Terminal Radar Service Areas" and "Terminal Area Notices." For example: Special Air Traffic Rules apply to VFR flights in the Valparaiso, Florida, Terminal Area Graphic Notice because of the high speed special activities conducted in the vicinity of Eglin AFB.



The collision that is about to happen as illustrated above can happen at any airport. A number of such accidents have already occurred - LOOK AROUND - DO NOT LET IT HAPPEN TO YOU.

IS TRAFFIC INFORMATION AVAILABLE AT CERTAIN NONCONTROLLED AIRPORTS? Yes, at certain noncontrolled airports (no control tower) where FAA Flight Service Stations are operating, there is available to you Airport Advisory Service. Use of this radio service will aid you in avoiding mid-air collisions.

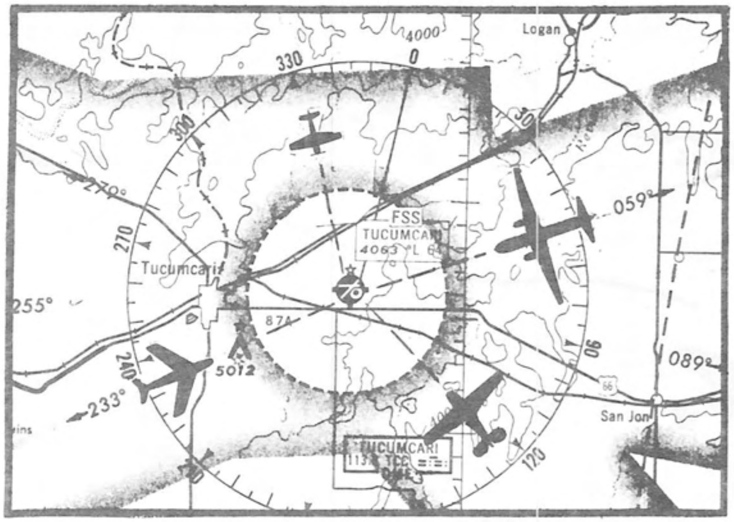
WHAT SERVICE DOES THE AIRPORT ADVISORY SERVICE PROVIDE? The Flight Service Station (FSS) at uncontrolled airports provides airport advisory service to aircraft operating to or from the airport on which the station is located. The airport advisory service provides the following information to aircraft which are in communication with the station: Wind Direction and Velocity; Favored Runway; Altimeter Setting; Pertinent Known Traffic; Pertinent Known Field Conditions; Airport Taxi Routes and Traffic Patterns, etc.

NOTICE! There may be other aircraft in the vicinity of the airport not in communication with and thus not known by the FSS.

HOW DOES THE PILOT KNOW WHERE TO FIND AIRPORT ADVISORY SERVICE LOCATIONS? The locations are appropriately depicted on the Sectional Charts in this manner:

* * * * *

WHAT IS A SAFE WAY TO CLIMB OR DESCEND ON VICTOR AIRWAYS? The AIM Good Operating Practices section states: "During climb or descent, pilots are encouraged to fly to the right side of the center line of the radial forming the airway in order to avoid IFR and VFR cruising traffic operating along the center line of the airway."



Possible Widely Scattered Aluminum

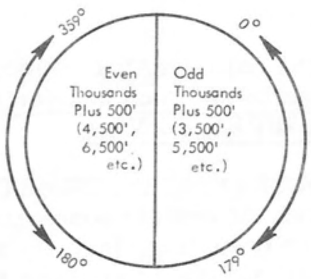
DESTINATION:
Over The VOR Station!

One of the FAA Near Mid-Air Collision Reports indicates that 81% of the incidents occurred in clear skies and unrestricted visibility conditions. Of the 549 incidents reported 255 (46%) occurred over a VOR facility, and the aircraft were utilizing VOR as the navigational aid in 89% of the en-route incidents. BE ALERT AT ALL TIMES: Unlimited visibility appears to encourage a sense of security which is not at all justified.

ooo

DOES ADHERING TO THE VFR ALTITUDE/FLIGHT LEVEL RULE APPROPRIATE FOR THE DIRECTION OF FLIGHT PLAY AN IMPORTANT ROLE IN THE ADVOIDANCE OF MID-AIR COLLISIONS? Yes, the rule is specifically designed to provide altitude separation, and applies to local as well as cross-country flights.

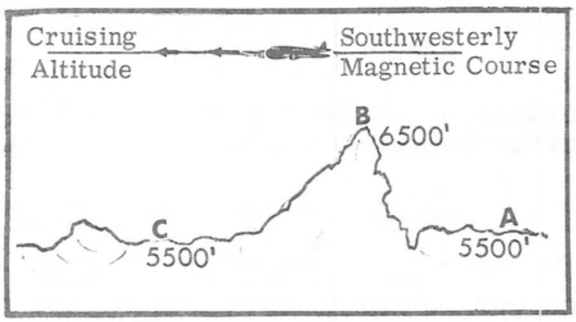
Many Airman Written Test applicants are incorrectly answering questions pertaining to the VFR Altitudes/Flight Levels rule for VFR cruising altitudes. When an aircraft is operated in VFR level cruising flight at more than 3,000 feet above the surface up to Flight Level 290 inclusive, the cruising altitudes (shown in the illustration to the right) shall be observed in accordance with the *magnetic course being flown. (Note: See Airman's Information Manual for more complete coverage of this subject.)



UNDER VFR-More than 3,000' ABOVE THE SURFACE

DO THE VFR CRUISING ALTITUDES APPLY BELOW 3000 FEET? No, only when you are flying at more than 3,000 feet above the surface.

Assume that in the diagram below your flight traverses terrain with the approximate elevations as depicted. You desire to select a constant cruising altitude which will conform to VFR cruising altitude requirements and also have sufficient altitude above mountain peaks to avoid downdrafts or extreme turbulence. Altitudes above the surface in mountainous areas should be based on the lowest general terrain (excluding deep crevices or canyons).



For example:
5500' general terrain elev.
+ 3000' above terrain
8500' effective altitude

10,500' correct (even +500') at points A, B, C.
10,000' incorrect at points A, B, C.
9,500' incorrect at points A, B, C.
9,000' correct at point B-incorrect at points A, C.
8,500' correct (even +500') at points A, B, C.
8,000' correct at A, B, C. }
7,500' correct at A, B, C. } less than 3000' above surface but inadequate safety above peaks.
7,000' correct at A, B, C. }

*NOTE - Magnetic course is true course corrected for variation. Do not confuse with: true course, compass course, magnetic heading, true heading or compass heading.

FAA Aeronautical Center
Flight Standards Technical Division, Operations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Exam-O-Grams available free of charge--single copy only per request. Permission is hereby granted to reproduce this material.

U.S. DEPARTMENT OF TRANSPORTATION

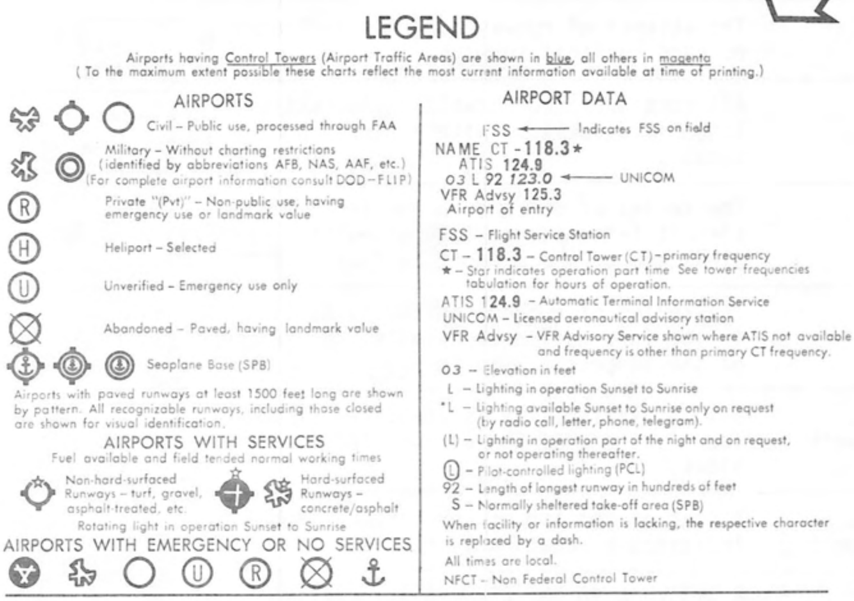
Federal Aviation Administration

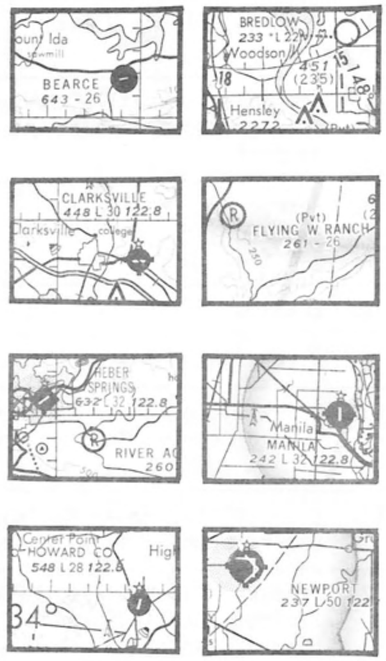
VFR PILOT EXAM-O-GRAM* NO. 23

INTERPRETING SECTIONAL AERONAUTICAL CHARTS (SERIES 1)

This Exam-O-Gram concerns only the symbols associated with: (1) airports that are not served by a Control Tower or Flight Service Station, (2) obstruction and terrain elevation, and (3) appropriate checkpoints for VFR navigation.

The 1977 editions of Sectional Aeronautical Charts present a revised format which includes numerous changes in the use of symbols. Note the chart legend excerpt below.

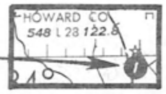




Refer to the airport symbols and the legend excerpts above to check your knowledge and understanding of these chart symbols. It is suggested that you answer each of the following questions to the best of your ability, then turn to page 2 to verify your answers.

1. Which airports have services for aircraft?
2. Which airports have emergency facilities only or no services at all?
3. Which airports have hard surfaced runways?
4. Which airports have no hard surfaced runways?
5. Which airports have hard surfaced runways at least 1,500 feet long?
6. Which airport is located at the highest elevation?
7. What is the elevation of this airport?
8. Which airport has the shortest landing area available?
9. What is the length of this landing area?
10. Which airports have UNICOM available?
11. Which airports have a rotating light?
12. Which airports have lighting facilities?
13. Which airport has lighting facilities available only upon prior request?
14. What is the length of the longest hard surfaced runway at the Newport Airport and which one is it?
15. Which airports would be the easiest to find at night?
16. Which airports have hard surfaced runways but have no facilities, or at best, have only emergency facilities?
17. Which airport is restricted from public use? How is an abandoned airport symbolized?

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Q.	Answer	Explanation
1.	Heber Springs, Manila, Newport	Airport symbols with the projections indicate airports with services. 
2.	Bearce, Bredlow, Clarksville, Flying W Ranch, Howard County	Those airport symbols without the projections indicate airports with emergency or no services. 
3.	Bearce, Clarksville, Heber Springs, Howard County, Newport, Manila	Hard surfaced runways are outlined in the airport symbol. 
4.	Bredlow, Flying W Ranch	The absence of runway outlines indicates no hard surfaced runways. 
5.	Bearce, Clarksville, Heber Springs, Howard County, Newport	All hard surfaced runways 1,500 feet or longer are outlined within the airport symbol. 
6.	Bearce	The series of numbers on the left of the airport information block gives the elevation of the airport in feet. 
7.	643 feet	
8.	Bredlow	The series of numbers on the right side in the information block gives the length of the longest runway in <u>hundreds</u> of feet. 
9.	2,200 feet	
10.	Clarksville, Heber Springs, Howard County, Manila, Newport	UNICOM availability is indicated at the far right end of the airport information block. 
11.	Clarksville, Heber Springs, Howard County, Manila, Newport	A star at the top of the airport symbol indicates a rotating light. 
12.	Bredlow, Clarksville, Heber Springs, Manila, Newport, Howard County	A letter L in the airport information line following the elevation indicates airport landing area lights available.
13.	Bredlow	An asterisk preceding the letter L indicates airport lighting only on prior request. Enclosing the letter L in parentheses indicates lights available part of the night and on request. 
14.	5,000 feet	For those airports that have hard surfaced runways, the length given in the airport information line is that of the longest hard surfaced runway. However there is no symbol to indicate which one runway is the longest unless this can be determined by the relative lengths of the runway outlines. 
15.	Clarksville, Heber Springs, Manila, Howard County, Newport	The rotating light would point them out. 
16.	Bearce, Flying W Ranch, Howard County	See answers and explanations to Q1 and Q3.
17.	Flying W Ranch	A letter R in the center of the airport symbol indicates the airport is restricted. Pvt in the airport information block indicates a private airport. An X indicates an abandoned airport.  

Another area of difficulty in reading and interpreting sectional charts is determining obstruction and terrain elevation. It must be understood that the elevation of obstructions is referenced to both ground and sea level, while terrain and contour elevations are referenced to sea level. With reference to the two chart segments, how many of the following questions can you answer? Answers and explanations are given below.

1. What is the height, above sea level, of the group obstruction which is classed as higher than 1,000 feet above the ground (Fig. 1)?

2. What is the height, above ground level, of the single obstruction which is classed as an obstruction below 1,000 feet above ground level (Fig. 1)?

3. What is the meaning of the large numbers 29 in Figure 2?

4. At what elevation intervals are contour lines shown on sectional charts?

5. What is the highest value in feet printed on a contour line (Fig. 2)?

6. What is the significance of the contour lines being close together? Far apart?

7. What is the highest critical terrain elevation (Fig. 2)?

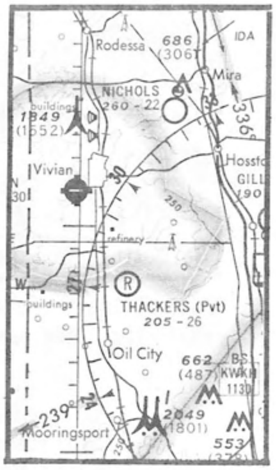


FIG. 1

FIG. 2

ANSWERS AND EXPLANATIONS TO QUESTIONS 1 THROUGH 7.

1. The tower shaped symbol indicates the top of the obstruction is 1,000 feet or higher Above Ground Level. A double symbol indicates a group obstruction. The height (top) above sea level of this obstruction in Fig 1 is 2,049 feet as shown in bold print and without parenthesis.

2. The inverted "V" shaped symbol denotes a single obstruction with the top less than 1,000 feet above ground level. The top of this obstruction is 306 feet AGL shown by the number in parenthesis below the bold faced number 686 representing the height MSL. A double symbol indicates a group obstruction.

3. The large numbers 29 are called Maximum Elevation Figures (MEF). The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.).

   Example: 2,900 feet ------------------------29

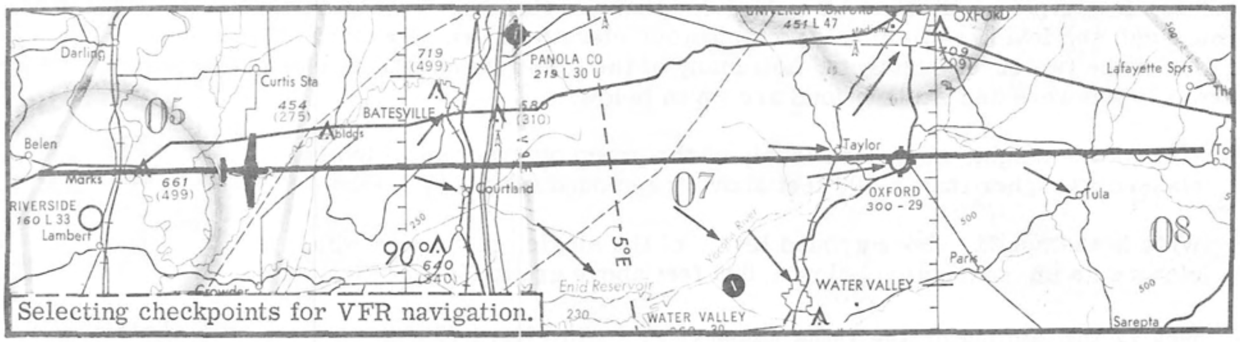
   ☆ NOTE: This is an important change in the meaning of the large numbers on sectional charts issued after June 1977.

4. There are two intervals used; the basic contour interval which is 500 feet, and the intermediate contour interval which is 250 feet. Contour lines may extend for some distance before the elevation is indicated. Sometimes no elevation indication is found on the contour lines, but generally the elevation can be determined by comparing nearby contours.

5. The highest value printed is 2,000 feet. This is not the highest terrain in the area or on the chart. The highest terrain is determined by applying the appropriate interval to a labeled line. The colored coding for the particular chart which is found on the front of the chart must also be used to determine terrain elevation.

6. The closer the contour lines are together the steeper the slope of the terrain; the farther apart they are the more gradual the slope of the terrain.

7. The highest critical terrain elevation is 2,230 feet MSL. The specific point is indicated by a small black dot located near the number denoting the elevation.



Selecting checkpoints for VFR navigation.

When flying the course shown above, which checkpoints indicated by arrows would be most appropriate for VFR navigation? (Assuming a visibility greater than 10 miles.)

I	II	III
Batesville	Batesville	Courtland
Enid Reservoir	Courtland	Enid Reservoir
Water Valley (Town)	Taylor	Oxford Airport
Oxford (Town)	Yocona River	Tula

Group I represents the best checkpoints since it includes only the prominent landmarks, i. e., larger towns and bodies of water. Although the larger towns are not exactly on course, they are close enough to be easily identified. Small towns and villages usually are poor checkpoints even though they lie right on course because they are difficult to identify. Small towns may be important as checkpoints in sparsely populated areas, but care must be exercised or their use may be misleading. Bodies of water reflect light and usually can be seen even with reduced visibility. Rivers are also excellent checkpoints, especially if they have prominent loops or bends, or are used in combination with other checkpoints. In fact, using a combination of checkpoints is always an effective and desirable practice in pilotage. Also, it should be noted that the highway to the left (north) of course provides an excellent reference for VFR navigation.

FAA Aeronautical Center
Flight Standards Technical Division, Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation
FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 26

COMMON MISCONCEPTIONS (Series 2)

Each question in FAA Airman Written Examinations offers the examinee a group of four answers from which to select the answer he believes to be correct. Applicants' comments and analyses of the answer sheets indicate that particular incorrect answers are frequently being chosen because of a misconception regarding certain items of required aeronautical knowledge. This Exam-O-Gram, as well as Exam-O-Gram No. 17, attempts to correct a few of these preconceived ideas.

WHAT INDICATED AIRSPEED SHOULD BE USED FOR LANDING APPROACHES TO FIELDS OF HIGHER ELEVATIONS? For all practical purposes, use the SAME indication as you use at fields of lower elevations.

WILL THE SAME INDICATED APPROACH SPEED BE SAFE AT HIGH ELEVATIONS? YES, in relatively smooth air. We all know that as altitude increases, the air becomes less dense, and consequently with decreased drag the airplane travels faster through the air. However, this faster speed creates no increase in impact pressure on the airspeed pitot system because of the lesser air density. In other words, we get a higher True Airspeed with the same Indicated Airspeed. Although the True Airspeed (TAS) at which an airplane stalls in thinner air is higher, the margin of safety is unaffected since the airplane is actually flying at a higher True Airspeed. Nevertheless, for the purpose of maintaining positive control in unstable air, the use of a higher than normal indicated speed is recommended for approaches during the turbulent or gusty conditions prevalent in mountainous areas, just as is used at fields of lower elevations in these conditions.

WHAT EFFECT DOES THINNER AIR HAVE ON APPROACH AND LANDING? Even though using the same indicated airspeed that is appropriate for sea level operations, the True Airspeed is faster, resulting in a faster groundspeed (with a given wind condition). This increase in groundspeed naturally makes the landing distance longer and should be carefully considered when landing at high elevation fields, particularly if the field is short.

WHAT INDICATED AIRSPEED SHOULD BE USED ON TAKEOFF AT HIGH ELEVATIONS? Just as in landing, the groundspeed as well as the takeoff distance, will be greater at high elevation fields. However, don't let this mislead you into P-U-L-L-I-N-G the airplane off the ground. If you do, the airplane will mush and settle back to the ground in a stalled condition. Use the SAME indicated airspeed as you use for takeoff at fields with lower elevations.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

WHAT WOULD YOU THINK IF YOU OVERHEARD THIS AIRPLANE "DISCREPANCY" REPORT? "Hey, Chief, - fix this goofed-up airspeed indicator! I was practicing power-off stalls with the gear and flaps down, but the airplane didn't stall until the pointer was 10 mph less than the white arc painted on the dial."

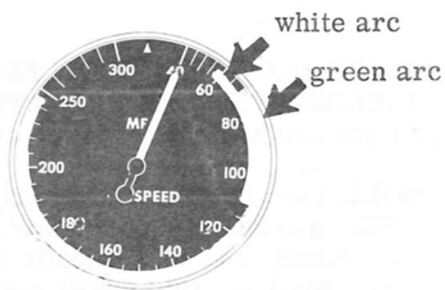
IS THE AIRSPEED INDICATOR FAULTY OR IS THE WHITE ARC MISPLACED? Not necessarily either one! Remember, the colored arcs on the airspeed dial mark the Calibrated Airspeed (CAS) and not merely the observed Indicated Airspeed (IAS) limitations.

WHAT IS CALIBRATED AIRSPEED (CAS), is Indicated Airspeed corrected for installation and instrument error. A wide difference between these speeds may exist, particularly at low airspeeds or under landing conditions. Installation error is caused when static atmosphere in certain flight attitudes enters the static system with a different pressure than it does in normal cruise conditions, creating a variance in pitot-static differential. Check the airspeed correction data for each airplane. You may find (as in the typical table below) that an IAS of 60 MPH is actually a CAS of 69 MPH.

AIRSPEED CORRECTION TABLE

FLAPS 0°								
IAS - MPH	60	80	100	120	140	160	180	200
CAS - MPH	69	82	100	119	139	160	181	202
***FLAPS 20°**								
IAS - MPH	40	50	60	70	80	90	100	110
CAS - MPH	57	62	68	75	84	93	102	112
***FLAPS 40°**								
IAS - MPH	40	50	60	70	80	90	100	110
CAS - MPH	57	62	68	75	83	92	102	111

*Maximum flap speed 110 MPH-CAS



WHAT IS THE RELATIONSHIP BETWEEN AIRSPEED INDICATOR COLORED ARCS AND STALLING SPEEDS? In the above illustrations, the white arc shows a stalling speed of 57 MPH (CAS), but because of installation error (reflected in the table), this airplane may not stall with power-off and gear and flaps down until the pointer is on 40 MPH (IAS). Similarly a variation is noted for the green arc and stalling speed with gear and flaps UP. Since an airplane in flight is operated most of the time within the upper speed range, installation error is normally adjusted so as to be at a minimum in that range. This results in the greatest error at the lower speed range, but provides a corresponding increase in the margin of safety at the critical lower airspeeds.

* *

CAN NORMAL IN-FLIGHT ASSISTANCE BE RECEIVED FROM ALL VOR STATIONS? NO, many VOR stations can be used only for navigation purposes. These stations without voice capability have the navigation transmitting frequency underlined on the newer aeronautical charts. Stations of this type cannot be used for weather information, position reporting, flight plans, or emergency assistance.

IN TERMINAL FORECASTS DOES THE LETTER "C" MEAN CLEAR SKIES? NO, -- when used in the cloud group of the forecast, it indicates the cloud layer that constitutes the CEILING.

IS THE WIND ALWAYS SHOWN IN TERMINAL FORECASTS? NO, -- if the wind is forecast to be less than 10 knots, it is omitted.

IS THE VISIBILITY ALWAYS SHOWN IN TERMINAL FORECASTS? NO, -- if the visibility is forecast to be more than 6 miles, it is omitted.

IS THE HEIGHT OF CLOUD TOPS PREDICTED IN TERMINAL FORECASTS? NO, -- only the base of the clouds above the surface is predicted. Cloud tops are usually found in Pilot Reports (PIREPS), and often in Area Forecasts.

ARE TURBULENT CONDITIONS PREDICTED IN TERMINAL FORECASTS? NO, -- however, a prediction of gusty surface conditions may be included in the wind group of Terminal Forecasts.

* *

IN TELETYPE FORECASTS AND REPORTS, IS THE WIND INFORMATION RELATIVE TO TRUE NORTH OR MAGNETIC NORTH? All printed weather information, such as Area Forecasts, Terminal Forecasts, Aviation Weather Sequence Reports, Winds Aloft Forecasts, etc., presents the wind direction as measured from TRUE NORTH. To use this wind direction for the computations of problems in which magnetic values are required, magnetic variation should be applied. That is, add or subtract variation as appropriate to the area involved, when magnetic headings are desired.

IN RADIO BROADCASTS, IS THE WIND DIRECTION RELATIVE TO TRUE NORTH OR MAGNETIC NORTH? Surface wind direction given in traffic instructions by the tower, or in airport advisories by an FSS, is always given as MAGNETIC direction, so as to be readily related to the runway number which is also a magnetic direction. In scheduled weather broadcasts the wind is given in True direction for all reported stations except that of the station making the broadcast, in which case the wind is reported in Magnetic direction.

* *

CAN THE DATE AN ANNUAL INSPECTION IS DUE BE DETERMINED FROM AIRWORTHINESS CERTIFICATES? NO, -- with regard to the due date of an Annual Inspection, the Airworthiness Certificate is of no value unless it was issued within the preceding 12 calendar months. This certificate is issued only when the aircraft is certificated as being airworthy at the time of original manufacture (or after being substantially altered or repaired), and in most cases is issued only once in the lifetime of the aircraft.

FROM WHICH DOCUMENTS CAN THE DUE DATE OF AN ANNUAL INSPECTION BE DETERMINED? By checking the entries in the aircraft and engine maintenance records (in most cases aircraft and engine logbooks) certifying the latest Annual Inspection. If the records show the preceding inspection was performed on April 5, 1973, then the next inspection is due at the end of the 12th month subsequent to that date; that is, by the end of April 30, 1974.

IS THERE A DIFFERENCE BETWEEN AN AIRPORT TRAFFIC AREA AND A CONTROL ZONE? YES, definitely; although in some cases they may coincide laterally, in which case rules applicable to each are in effect.

WHAT IS AN AIRPORT TRAFFIC AREA? An Airport Traffic Area is the airspace surrounding an airport at which there is an operating control tower. It extends from the surface upward to 3,000 feet, and although not marked on the chart (except by the presence of control tower CT frequencies), it includes the area within a 5-mile radius from that airport (see Fig. 1). When operating within the Airport Traffic Area, a pilot is required, unless otherwise authorized, to maintain two-way radio communications with the tower. This does not apply when operating for the purpose of taking off or landing at airports without a control tower that happen to be within the Airport Traffic Area of another airport. This rule is also not applicable when the tower is not in operation nor at airports without control towers outside of an Airport Traffic Area. (See Fig. 2.) The airport traffic pattern of an airport is not to be confused with an Airport Traffic Area.

Airport Traffic Area

(Tower Frequency)

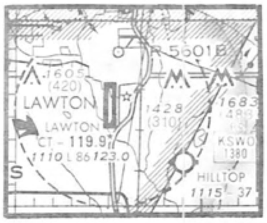


Fig. 1

No Airport Traffic Area →

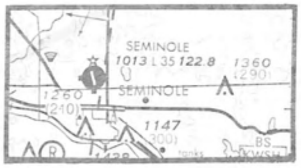


Fig. 2

WHAT IS A CONTROL ZONE? A Control Zone is an airspace surrounding one or more airports, within which, rules additional to those governing flight in control areas and "airport traffic areas," apply for the protection of air traffic. Normally, an aircraft shall not be operated under Visual Flight Rules within a Control Zone beneath a ceiling of less than 1,000 feet or with a visibility of less than 3 miles. To do so requires a special VFR clearance from Air Traffic Control. If the airport lies within a Control Zone as well as an Airport Traffic Area (see Fig. 3), this clearance is obtained through the control tower. However, all Control Zones do not have a control tower or lie within an Airport Traffic Area (see Fig. 4). In this case arriving and departing traffic is controlled by ATC either by direct communication between the control center and the pilot, or through an appropriate radio facility. Frequently, clearances are conveyed to an aircraft by a nearby Flight Service Station (FSS). All Control Zones are marked on charts by a circular broken line, normally a 5-mile radius with extensions as necessary for IFR approaches, extending from the surface upward to the Continental Control Area, and may encompass more than one airport. These special rules are also applicable to the other airports within the Control Zone boundaries.

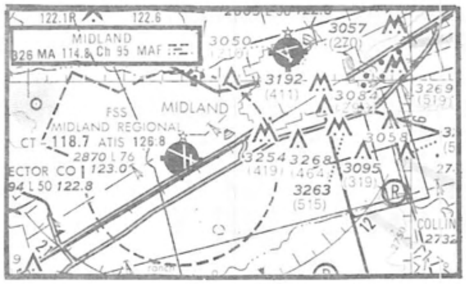


Fig. 3

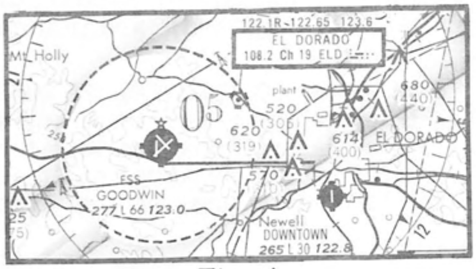


Fig. 4

Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

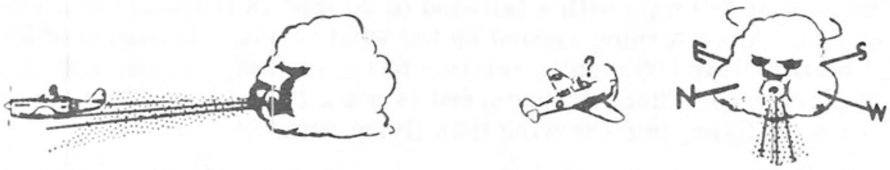
Exam-O-Grams available free of charge--single copy only per request. Permission is hereby granted to reproduce this material.

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 27

THE EFFECT OF WIND ON AN AIRPLANE



While acquiring aeronautical knowledge, we sometimes neglect, or do not thoroughly understand some of the fundamental principles involved in flying an airplane. One of the basic facts of flight which is involved in the safety of almost every flight, and yet in FAA Airman Written Examinations seems to be one of the least understood is THE RELATIONSHIP BETWEEN THE AIRPLANE AND THE AIR SURROUNDING IT.

DOES WIND AFFECT THE AIRPLANE'S AIRSPEED? With the possible exception of wind shear, severe gusts, sudden lulls, etc., NO. Remember, the airspeed is the speed at which the airplane is traveling through the air. Even though the air mass might also be moving (wind), the relationship of the airplane's movement to the mass of air remains unchanged. This may be explained by assuming a person is walking forward at 5 mph inside a railroad train which is traveling 60 mph. Regardless of the train's speed, the person is walking 5 mph in relation to the train. If the person turns around and walks toward the rear of the train, or if the train slows to a stop, he is still walking 5 mph in relation to the train. Similarly, the direction and speed of the movement of the air mass (wind) through which the airplane flies, has no effect on its speed through the air (airspeed). It follows then that stalling speed is also unaffected by a steady normal wind (Exam-O-Gram #17).

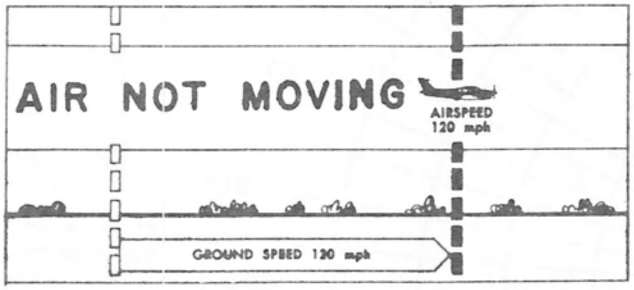


Figure 1

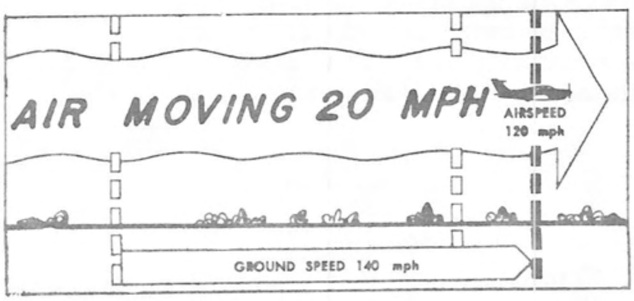


Figure 2

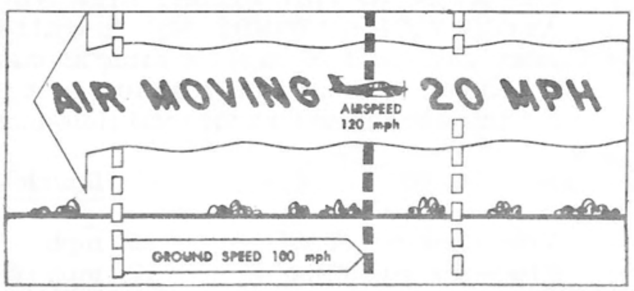


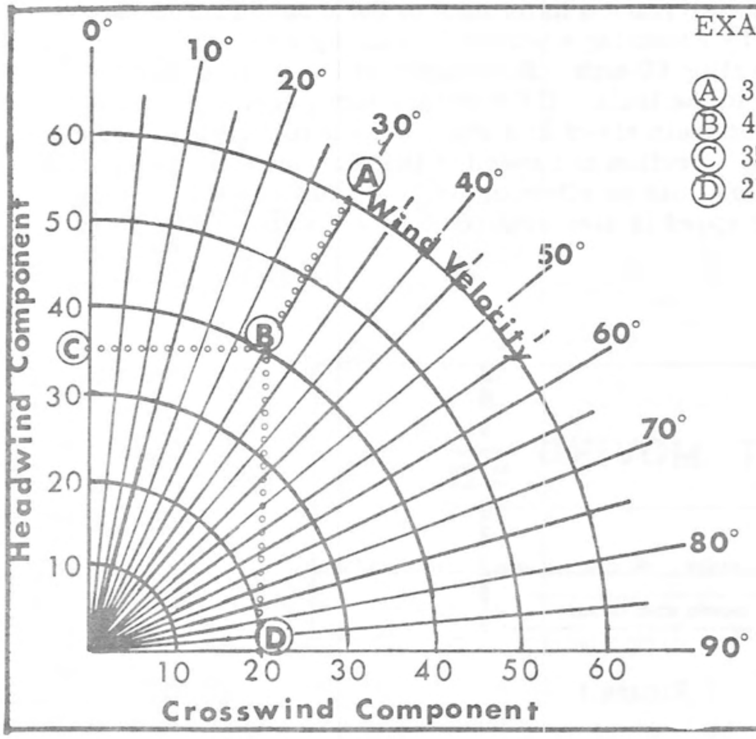
Figure 3

*Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 1/74

DOES WIND AFFECT THE AIRPLANE'S GROUNDSPEED? Definitely yes! Again consider the case of a person walking inside a railroad train. Since the train is moving 60 mph in relation to the ground and the person is walking forward 5 mph in relation to the train, he is actually traveling 65 mph in relation to the ground (groundspeed). Conversely, if he walks toward the rear of the train at a rate of 5 mph and the train is moving 60 mph, he is actually traveling at a rate of 55 mph in relation to the ground. Similarly, an airplane flying at an airspeed of 120 mph with a tailwind of 20 mph is traveling at a groundspeed of 140 mph (Figure 2). After turning around so the wind is now a headwind of 20 mph, the airplane would be traveling 100 mph in relation to the ground, or with a 40 mph reduction in groundspeed (Figure 3). Since groundspeed is not a factor in stalling speed, the airplane is no closer to a stall flying into the wind than flying with the wind.

IS THE GROUNDSPEED CHANGED BY AN AMOUNT EQUAL TO THE WINDSPEED? Not always! The groundspeed is increased or decreased by the full amount of the windspeed only when a direct headwind or direct tailwind exists. As the angle between the nose of the airplane and the wind direction increases (up to approximately 90° on either side) the headwind component decreases, resulting in a gradual reduction in the effect of wind on the airplane's groundspeed (see Figure 4). As the angle increases from approximately a 90° crosswind to 180°, the tailwind component increases with a corresponding increase in groundspeed.



EXAMPLE: 40 knot wind at 30° angle.

Ⓐ 30° angle between wind and nose.
Ⓑ 40 knots total wind velocity.
Ⓒ 35 knot headwind component.
Ⓓ 20 knot crosswind component.

Figure 4

(Not to be used for navigational purposes)

CAN A ROUND-TRIP FLIGHT WITH WIND CONDITIONS BE MADE IN THE SAME TIME AS ONE WITH NO WIND? No! It would seem that a headwind one way and a tailwind the other way would average the same as making the round-trip under no wind conditions, but it will not. The airplane flies longer in the headwind condition than it does in the tailwind condition and therefore the total time increases.

	20 mph Wind	No Wind
True Airspeed (TAS)	100 mph	100 mph
Flight Out 200 Miles	120 mph GS = 1 hr. 40 min.	100 mph GS = 2 hrs.
Flight Back 200 Miles	80 mph GS = 2 hr. 30 min.	100 mph GS = 2 hrs.
Total Time	4 hr. 10 min.	4 hrs.
Average GS	96 mph	100 mph

DOES AN AIRPLANE IN FLIGHT TRAVEL IN THE DIRECTION IT IS HEADED? Not always! The airplane moves forward because of engine thrust pulling in the direction it is headed. However, if the mass of air surrounding the airplane is also moving (wind) the airplane, in addition to its forward movement, is carried in the same direction and at the same speed as the air mass. Thus, we have two directional forces acting on the airplane--the thrust component and the wind component. If the thrust is moving the airplane forward toward the east and the wind is moving it sideward toward the south, then the resultant path over the ground will be east-southeasterly. (See Figure 5.) This sideward movement of the airplane caused by the wind is called "drift."

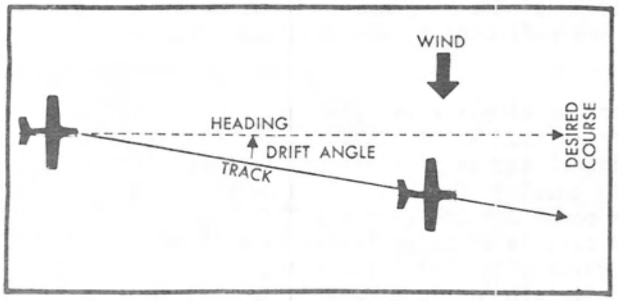


Figure 5

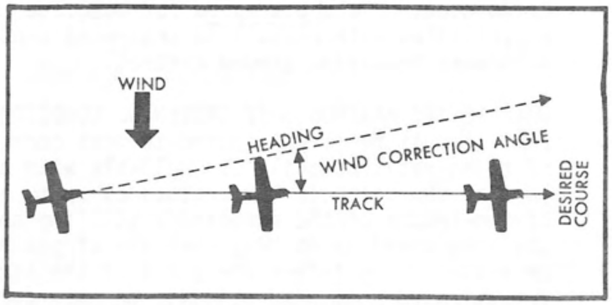
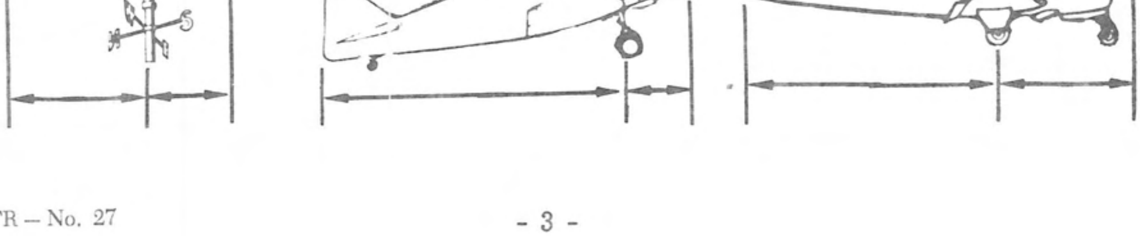


Figure 6

HOW CAN WE COMPENSATE FOR DRIFT IN ORDER TO MAKE GOOD A DESIRED COURSE OVER THE GROUND? We must head the airplane into the wind at an angle at which the direction of the thrust component will compensate for the wind component. This correction angle or "crab" should be sufficient to make the resultant path over the ground (ground track) coincide with the desired course over the ground. (See Figure 6.) The necessary heading can be determined by trial and error, or by wind triangle computations based on true airspeed, true course, and wind direction and speed.

DOES WIND AFFECT AN AIRPLANE ON THE GROUND THE SAME AS IN THE AIR? In certain respects, no! In addition to being moved forward through the air by its own power, an airplane in flight is carried in the same direction and at the same speed as the movement of the air mass surrounding it. Since it is free to move with the air mass, the airplane in flight does not "feel" this movement of the mass of air (except when wind-shear, or sudden lulls or gusts are encountered). Therefore, after the proper correction for drift is established, control pressure need not be maintained for directional control. However, during ground operation, the friction of the airplane's wheels in contact with the ground resists drifting, creating a pivot point at the main wheels. Since a greater portion of the airplane's surface is presented to the crosswind aft of the wheels than is presented forward of the wheels, the airplane tends to "weathervane" or turn into any crosswind. In this case corrective control pressures must be applied and maintained for directional control on the ground. This weathervaning occurs even in tricycle (nose wheel) gear airplanes, unless the wheels are located well aft in relation to the side surface of the airplane.

Figure 7



WHAT EFFECT DO CROSSWINDS HAVE ON TAKEOFF AND LANDING? While the airplane is free of the ground, the wind has the same effect as explained in preceding paragraphs for an airplane in flight. However, on takeoff and landings, an airplane should never be allowed to contact the ground while drifting or while headed in a direction other than that in which it is moving over the ground. Unless proper action is taken to prevent this from occurring, severe side stresses will be imposed on the landing gear, and a sudden swerve or ground loop may occur. When this develops, we have an almost uncontrollable situation and consequently, a serious accident potential.

CAN TAKEOFFS AND LANDINGS BE SAFELY MADE IN ALL CROSSWIND CONDITIONS? Not always! Takeoffs and landings in certain crosswind conditions are inadvisable or even dangerous. If the crosswind is great enough to warrant an extreme drift correction, a hazardous landing condition may result. Therefore, always consider the takeoff or landing capabilities with respect to the reported surface wind conditions and the available landing directions. The absence of proper crosswind techniques, or the disregard for adequate consideration of the airplane's characteristics and capabilities with respect to crosswind conditions, are reflected by the continual rise in accidents involving ground control.

WHAT IS THE MAXIMUM SAFE CROSSWIND CONDITION? Before an airplane is type certificated by the FAA, it must be flight tested to meet certain requirements. Among these is the demonstration of being satisfactorily controllable with no exceptional degree of skill or alertness on the part of the pilot in 90° crosswinds up to a velocity equal to 0.2 V_{SO}. This means a windspeed of two-tenths of the airplane's stalling speed with power off and gear and flaps down. (If the stalling speed is 60 MPH, then the airplane must be capable of being landed in a 12 MPH 90° crosswind.) To inform the pilot of the airplane's capability, Regulations require that the demonstrated crosswind velocity be made available. Certain Airplane Owner's Manuals provide a chart for determining the maximum safe wind velocities for various degrees of crosswind for that particular airplane.

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Department of Transportation
FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM* NO. 28

FACTORS AFFECTING STALL SPEED

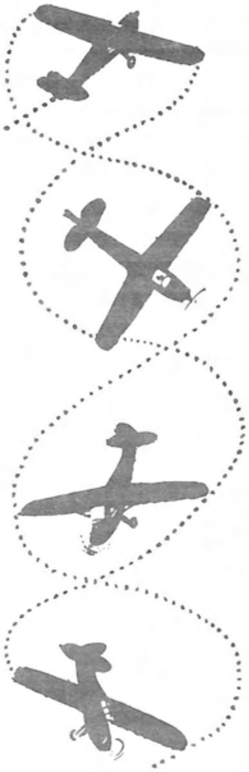


FIG. 1

A recent report indicates that approximately 80% of all accidents are pilot caused. The major cause of fatal accidents is listed as "failed to maintain airspeed (or flying speed) resulting in a stall." Although many of these stalls may have occurred under the stress and duress of other problems such as disorientation during limited visibility or at night, improper division of attention, etc., a review of statistical analyses of written examinations indicates a lack of knowledge and understanding of the various factors that can cause or contribute to a stall. This Exam-O-Gram discusses some of the more important, ever-present factors of which the pilot must have an understanding so that he will instinctively avoid or compensate for situations, conditions, and attitudes which may lead to a stall--even under the stress and duress of additional problems he may encounter in flight.

WHAT CAUSES AN AIRPLANE TO STALL? All stalls are caused by exceeding the critical angle of attack. Knowing this particular fact does not necessarily help the pilot. What is more important to the pilot is to know what factors are likely to contribute to or cause this angle of attack to be exceeded.

IS IT NECESSARY FOR THE AIRPLANE TO HAVE A RELATIVELY LOW AIRSPEED IN ORDER FOR IT TO STALL? No! An airplane can be stalled at any airspeed. All that is necessary is to exceed the critical angle of attack. This can be done at any airspeed if the pilot applies abrupt or excessive back pressure on the elevator control. A stall that occurs at a relatively high speed is referred to as an accelerated or high speed stall.

IS IT NECESSARY FOR THE AIRPLANE TO HAVE A RELATIVELY HIGH PITCH ATTITUDE IN ORDER FOR IT TO STALL? No! An airplane can be stalled in any attitude. Repeating again the statement made above - all that is necessary is to exceed the critical angle of attack. This can occur in any attitude by application of abrupt or excessive back pressure on the elevator control.

DOES WEIGHT AFFECT THE STALLING SPEED? Yes! As the weight of the airplane is increased, the stall speed increases. Due to the greater weight, a higher angle of attack must be maintained to produce the additional lift to support the additional weight in flight. Therefore, the critical angle of attack will be reached at a higher airspeed when loaded to maximum gross weight than when flying solo with no baggage.

DOES THE CENTER-OF-GRAVITY LOCATION (WEIGHT DISTRIBUTION) AFFECT STALL SPEED? Yes! The farther forward the center of gravity, the higher the stalling speed. The farther aft the center of gravity, the lower the stalling speed.

DOES THIS MEAN THAT THE WEIGHT SHOULD BE DISTRIBUTED IN THE AIRPLANE SO THAT THE CG IS AS FAR TO THE REAR AS POSSIBLE? No! This may present problems with stability that will far outweigh any advantages obtained by the decrease in stall speed.

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 9/65

DO FLAPS AFFECT STALLING SPEED? Yes! The use of flaps reduces stalling speed. The Stall Speed Chart (Figure 2) excerpted from an airplane flight manual illustrates this fact. This also can be readily verified by checking the color coding on any airspeed indicator. The lower airspeed limit of the white arc (power-off stalling speed with gear and flaps in the landing configuration) is less than the lower airspeed limit of the green arc (power-off stalling speed in the clean configuration).

This fact is important to the pilot in that when making no-flap landings, a higher indicated airspeed should be maintained than when landing with flaps. The manufacturers' recommendations should be adhered to as to approach speeds with various configurations.

STALL SPEED, POWER OFF

Gross Weight 3000 *lbs.*	ANGLE OF BANK			
CONFIGURATION	0°	20°	40°	60°
GEAR & FLAPS UP	65	67	74	92
GEAR DOWN, FLAPS 20°	61	63	70	86
GEAR DOWN, FLAPS 40°	60	62	69	85

SPEEDS ARE MPH, TIAS

FIG. 2. (Note: TIAS identical with CAS)

DOES AN ACCUMULATION OF FROST, SNOW, OR ICE ON THE WINGS AFFECT STALLING SPEED? Yes! Even a light accumulation of frost, snow, or ice on the wings can cause a significant increase in stalling speed. It can increase it so much that the airplane is unable to take off. The accumulation disrupts the smooth flow of air over the wing thus decreasing the lift it produces. To make up for the lost lift, a higher angle of attack must be used or a higher speed must be attained on the takeoff roll. The runway may not be long enough to attain the necessary speed and even though the airplane may become airborne, it could be so close to the stall speed that it would not be possible to maintain flight once the airplane climbs above the comparatively shallow zone where ground effect prevails. DO NOT TAKE OFF UNTIL ALL FROST, SNOW, OR ICE HAS MELTED OR BEEN REMOVED FROM THE AIRPLANE.

FIG. 3

DOES AN INCREASE IN ALTITUDE AFFECT THE INDICATED AIRSPEED AT WHICH AN AIRPLANE STALLS? An increase in altitude has no effect on the indicated airspeed at which an airplane stalls at altitudes normally used by general aviation aircraft. That is, for all practical purposes, the indicated stalling speed remains the same regardless of altitude in this range. This fact is important to the pilot in that the same indicated airspeed should be maintained during the landing approach regardless of the elevation or the density altitude at the airport of landing. (Follow the manufacturer's recommendations in this regard.) If higher than normal approach airspeed is used, a longer landing distance will be required.

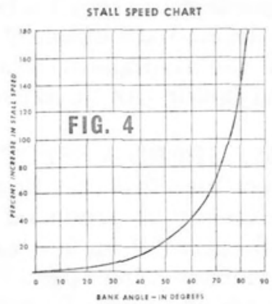
DOES AN INCREASE IN ALTITUDE AFFECT THE TRUE AIRSPEED AT WHICH AN AIRPLANE STALLS? Since true airspeed normally increases as altitude increases (for a given indicated airspeed), then true airspeed at which an airplane stalls generally increases with an increase in altitude. Under non-standard conditions (temperature warmer than standard) there is an additional increase in true airspeed above the indicated airspeed.

OF WHAT SIGNIFICANCE IS THIS TO THE PILOT? It is significant in that when landing at higher elevations or under higher density altitudes, he is operating at higher true airspeeds (and therefore higher groundspeeds) throughout the approach, touchdown, and landing roll. This results in a greater distance to clear obstacles during the approach, a longer ground roll, and consequently, the need for a longer runway. If, in addition, the pilot is operating under the misconception that a higher than normal indicated airspeed should be used under these conditions, the situation is further compounded due to the additional increase in groundspeed. (See EXAM-O-GRAM No. 26.)

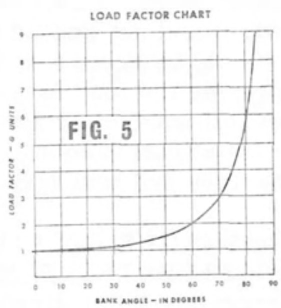
DOES TURBULENCE AFFECT STALLING SPEED? Yes! Turbulence can cause a large increase in stalling speed. Encountering an upward vertical gust causes an abrupt change in relative wind. This results in an equally abrupt increase in angle of attack which could result in a stall. This fact is important to the pilot in that when making an approach under turbulent conditions, a higher than normal approach speed should be maintained. Also, in moderate or greater turbulence, an airplane should not be flown above maneuvering speed.

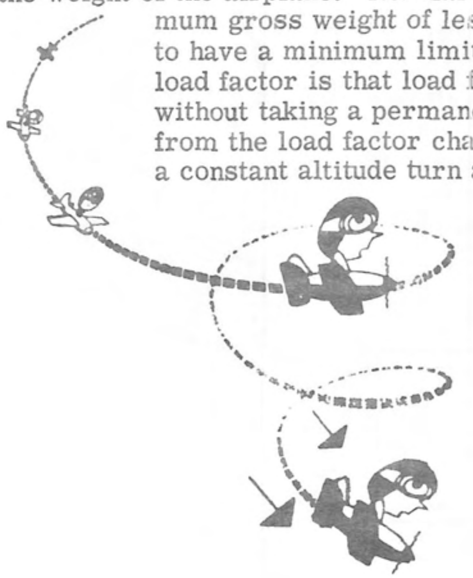
At the same time, it should not be flown too far below maneuvering speed since a sudden severe vertical gust may cause an inadvertent stall due to the higher angle of attack at which it will already be flying.

DOES ANGLE OF BANK AFFECT STALLING SPEED? Yes! As the angle of bank increases in a constant altitude turn, the stalling speed increases. This is easily seen from the STALL SPEED CHARTS (Figs. 2 and 4) which show the increase in stall speed as the angle of bank increases--Fig. 4 in terms of percent, Fig. 2 the actual values for one airplane. At a 60° bank stalling speed is 40% greater than in straight-and-level flight (25-27 mph for the specific example.) At angles of bank above 60°, stall speed increases very rapidly, and at approximately 75° it is doubled with respect to straight-and-level stall speed (Fig. 4).



DOES LOAD FACTOR AFFECT STALLING SPEED? Yes! As the load factor increases, stalling speed increases. When the load factor is high, stalling speed is high. A comparison of the two charts (Figs. 4 and 5) should easily show this relationship. Load factor is the ratio of the load supported by the wings to the actual weight of the airplane and its contents. At a load factor of 2, the wings support twice the weight of the airplane; at a load factor of 4, they support four times the weight of the airplane. Normal category airplanes with a maximum gross weight of less than 4,000 pounds are required to have a minimum limit load factor of 3.8. (The limit load factor is that load factor an airplane can sustain without taking a permanent set in the structure.) Note from the load factor chart (Fig. 5) that this minimum limit load factor is attained in a constant altitude turn at a bank of approximately 75°. Also note from the stall speed chart (Fig. 4) that at this angle of bank, the stall speed is twice as great as in straight-and-level flight. There are two reasons then why excessively steep banks should be avoided--an airplane will stall at a much higher airspeed and the limit load factor can be exceeded. The danger can be compounded when the nose gets down in a steep turn if the pilot attempts to raise it to the level flight attitude without shallowing the bank since the load factor may be increased even more. This is the situation as it generally exists when, due to disorientation, the pilot enters a diving spiral (often referred to as the "graveyard spiral") and attempts to recover with elevator pressure alone.





WHAT FACTORS CAUSE AN INCREASE IN LOAD FACTOR? Any maneuvering of the airplane that produces an increase in centrifugal force will cause an increase in load factor. Turning the airplane or pulling out of a dive are examples of maneuvering that will increase the centrifugal force and thus produce an increase in load factor. When you have a combination of turning and pulling out of a dive, such as recovering from a diving spiral, you are, in effect, placing yourself in double jeopardy. This is why you must avoid highspeed diving spirals or if you accidentally get into one--be careful how you recover. Turbulence can also produce large load factors. This is why an airplane should be slowed to maneuvering speed or below when encountering moderate or greater turbulence.

CAN THE PILOT RECOGNIZE WHEN THERE IS AN INCREASE IN LOAD FACTOR? Yes! He can recognize it by the feeling of increased body weight or the feeling that he is being forced down into the seat--the greater the load factor the greater this feeling of increased weight or of being forced down in the seat (Figs. 6 and 7). It is the same feeling one has when riding the roller coaster at the bottom of a dip or going around a banked curve. This feeling of increased body weight is important to the pilot because it should, if it becomes excessive, have the immediate effect of a red flag being waved in his face to warn him that the airplane will now stall at a higher airspeed or that the limit load factor can be exceeded, resulting in structural failure.

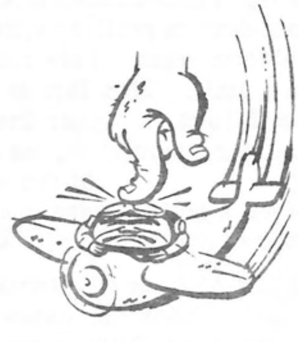


FIG. 6

DOES SPEED AFFECT LOAD FACTOR? Speed does not, in itself, affect load factor. However, it has a pronounced effect on how much of an increase in load factor can be produced by strong vertical gusts, or by the pilot through abrupt or excessive application of back pressure on the elevator control. This is why airspeed should be reduced to maneuvering speed or below if moderate or greater turbulence is encountered. At maneuvering speed or below, the airplane is stressed to handle any vertical gust that normally will be encountered. Also, below this speed, the pilot can make abrupt full deflection of the elevator control and not exceed the maximum load factor for which the airplane is stressed. However, it should be noted that the reason this is possible is because the airplane will stall, thus relieving the load factor. At airspeeds above maneuvering speed, abrupt full deflection of the elevator control or strong vertical gusts can cause the limit load factor to be exceeded. As airspeed continues to increase above maneuvering speed, the limit load factor can be exceeded with less and less turbulence or abrupt use or deflection of the controls.

WHAT IS THE RELATIONSHIP BETWEEN A HIGH SPEED (ACCELERATED) STALL AND LOAD FACTOR? The higher the airspeed when an airplane is stalled, the greater the load factor. When an airplane stalls at a slow airspeed, the load factor will be very little more than one. When stalled at an airspeed twice as great as the normal stall speed, the limit load factor for normal category airplanes probably will be exceeded. This fact can be determined from the stall speed (Fig. 4) and load factor (Fig. 5) charts. See also discussion of "Does Load Factor Affect Stalling Speed" (page 3).

FIG. 7

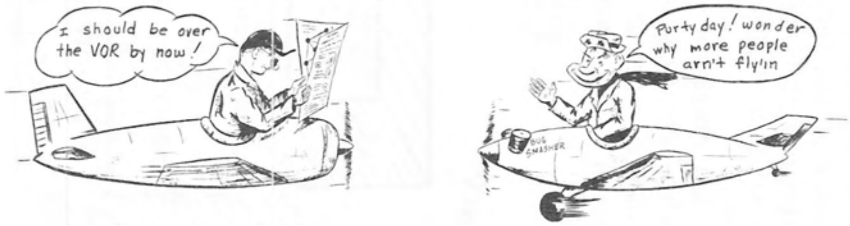
FAA Aeronautical Center
Flight Standards Technical Division,
Operations Branch,
P. O. Box 25082
Oklahoma City, Oklahoma 73125

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 29

POTENTIAL MID-AIR COLLISIONS (Series 2)



Due to an increasing number of "near mid-air" collision incidents being reported and the seriousness of mid-air collisions, most general aviation written tests contain one or more test items that deal with FAA "right-of-way" rules. (NOTE: See VFR Exam-O-Gram No. 22 which also deals with Potential Mid-Air Collisions.)

This Exam-O-Gram will be concerned primarily with the right-of-way rule for "converging" aircraft. The "approaching head-on" rule is one that is simple and easily understood, a rule that has been in existence for many years and one that has an added safety factor in that each pilot of each aircraft shall alter course to the right.

CAN YOU ANSWER THE FOLLOWING SAMPLE TEST ITEM?

Assume that during a flight in a 4-place single-engine airplane you observe a light twin-engine airplane at your altitude. The light twin is approaching from your right on an apparent collision course. Although each pilot must do his best to avert a collision, which airplane, according to regulations, should give way and why should it give way?

1- You should give way since you are flying a small single-engine airplane.
2- You should give way since the light twin is on your right.
3- Both airplanes should alter their courses to the right since each pilot must do his best to avert a collision.
4- The light twin should give way since your airplane is to the light twin's left.

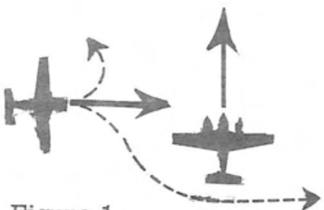


Figure 1.

The regulation concerning "converging" aircraft states in part: "When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way." Therefore, response number 2 is correct since the other aircraft is on your right and both aircraft are of the same category - both are airplanes. See Figures 1 and 2.

☆☆☆☆☆

On the back page of this Exam-O-Gram, you will find an excerpt from a U. S. Naval Aviation Safety Bulletin. It is an excellent portrayal of the rapid rate of closure in a head-on view of a T-33 Jet, with a wing span of 42' 5", which closely approximates the span of several present day light twin-engine aircraft.

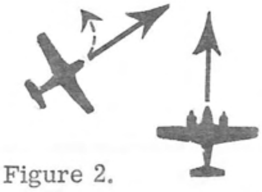


Figure 2.

Collision avoidance requires the necessity for constant vigilance of all pilots at all times under all circumstances. When another aircraft appears to be getting too close -- GIVE WAY! There is no equivalent to "fender bending" in aviation.

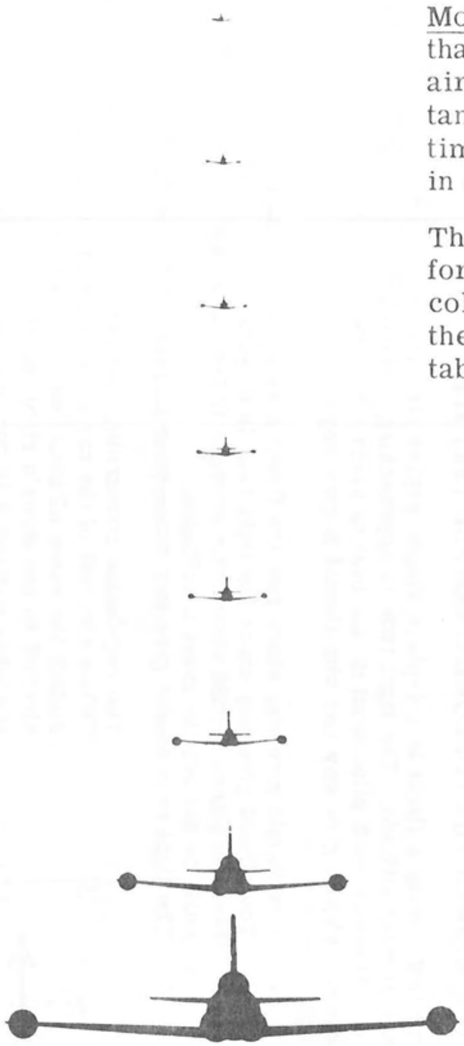
* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Rev. 1/74

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125

DISTANCE - SPEED - TIME

MPH	600	360
	SECONDS	
10 miles	60	100
6 miles	36	60
5 miles	30	50
4 miles	24	40
3 miles	18	30
2 miles	12	20
1 mile	6	10
½ mile	3	5



CRITICAL SECONDS

Move back 12 feet from this illustration. From that position the silhouettes represent a T-33 aircraft as it would appear to you from the distances indicated in the table on the left. The time required to cover these distances is given in seconds for combined speeds of 360 and 600 mph.

The blocks on the lower left mark the danger area, for the speeds quoted, when aircraft are on a collision course. This danger area is based on the recognition and reaction times shown in the table on the lower right.

RECOGNITION and REACTION TIMES (from U.S. Naval Aviation Safety Bulletin) Excerpt

	Seconds
see object	0.1
recognize a/c	1.0
become aware of collision course	5.0
decision to turn left or right	4.0
muscular reaction	0.4
aircraft lag time	2.0
TOTAL	12.5

U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 33

USE OF PERFORMANCE CHARTS

A report of an accident was stated in the following words: "Takeoff was attempted on a 1,600-foot strip; the airplane cleared the fences but sank back and struck a ditch." The pilot stated that he failed to consider the effects of the grassy, rough field, the 90° temperature, heavy load of fuel and passengers, and the calm wind. COULD THE USE OF THE TAKEOFF PERFORMANCE CHART FOR HIS AIRCRAFT HAVE PREDICTED THE SAD ENDING TO THIS FLIGHT?

WHAT ARE PERFORMANCE CHARTS? They are charts that describe or predict the performance of an aircraft under a given set of conditions or ground rules. They may be in tabular or graph form. (Because of their importance to safety, all applicants are being tested, and will continue to be tested, on use of performance charts in the written examinations.)

WHERE DO YOU FIND PERFORMANCE CHARTS? You can find them in the FAA-approved Airplane Flight Manual and the Owner's Manual or Handbook prepared by the manufacturer. In many cases, the FAA-approved Flight Manual must be carried in the aircraft at all times.

ARE THE CONDITIONS OR GROUND RULES UNDER WHICH YOU USE A PARTICULAR TYPE PERFORMANCE CHART ALWAYS THE SAME? No. The particular set of conditions or ground rules, as well as format, will vary with the manufacturer. Although ground rules for their use may be different, the information obtainable is essentially the same--takeoff and landing distance (ground run or roll and to clear a 50-foot obstacle), fuel consumption, rate of climb, true airspeed, etc.

HOW ACCURATE SHOULD YOU CONSIDER THE PREDICTIONS OF PERFORMANCE CHARTS? You will be headed in the safe direction if you always consider the performance of the airplane you fly to be less than predicted by the performance charts. The following statement is contained in one airplane flight manual: "Flight tests from which the performance data was obtained were flown with a new, clean airplane, correctly rigged and loaded, and with an engine capable of delivering its full rated power." You can expect to do as well only if your airplane, too, is kept in the peak of condition.

IS IT NECESSARY THAT YOU ALWAYS CONSULT PERFORMANCE CHARTS PRIOR TO TAKEOFF OR LANDING? No. Obviously, if you are taking off or landing on a 10,000-foot runway in a light airplane, you need not check the takeoff or landing data charts. But where is the dividing line--6,000? 4,000? 2,000? This depends on a lot of factors which include the equipment you are flying; pilot skill, proficiency, and familiarity with equipment; and the relative values of the 3 major factors affecting aircraft performance (density altitude, gross weight, and wind) plus the type and condition of the runway.

WHEN SHOULD YOU CHECK YOUR PERFORMANCE CHARTS? Any time there is doubt in your own mind, whether it be due to the length and/or condition of the runway, the high density altitude, a recognition of your own limitations or a lack of familiarity with the equipment you are flying--which will be alleviated through the use of performance charts. You should begin an operation with complete confidence in its success. Use everything at your disposal to establish this confidence. Charts do not cover all conditions that might have an effect on performance; but by making adequate allowances to the information obtained, you can ensure a greater margin of safety.

WHAT CAN YOU OBTAIN FROM TAKEOFF PERFORMANCE CHARTS? You can find the predicted length of the takeoff ground run and/or the predicted distance necessary to clear a 50-foot obstacle (which includes the ground roll). For example:

Chart 1: At an elevation of 4,000 feet, zero mph wind, 75° F, 15° of flaps, and maximum gross weight (2,300 lbs. for this airplane) the predicted ground run is 1,380 feet and the predicted distance necessary to clear a 50-foot obstacle is 2,065 feet. If the airplane weighed 200 lbs. less than maximum gross weight, these distances would be reduced by 30% and become 966 feet and 1,445 feet, respectively. (See NOTE at bottom of chart.)

OBSTACLE TAKE-OFF DATA — 15° FLAPS

Wind Vel. mph	Sea Level Temp. °F	Sea Level Ground Run Ft.	Sea Level To Clear 50' Obst. Ft.	2000 Ft. Temp. °F	2000 Ft. Ground Run Ft.	2000 Ft. To Clear 50' Obst. Ft.	4000 Ft. Temp. °F	4000 Ft. Ground Run Ft.	4000 Ft. To Clear 50' Obst. Ft.	6000 Ft. Temp. °F	6000 Ft. Ground Run Ft.	6000 Ft. To Clear 50' Obst. Ft.	8000 Ft. Temp. °F	8000 Ft. Ground Run Ft.	8000 Ft. To Clear 50' Obst. Ft.
0	30	785	1175	20	900	1340	15	1060	1580	10	1260	1895	0	1475	2305
	59	890	1320	52	1035	1535	45	1215	1810	38	1430	2170	30	1695	2735
	90	1005	1490	80	1160	1720	75	1380	2065	70	1640	2560	60	1890	3275
10	30	620	955	20	715	1095	15	850	1300	10	1015	1570	0	1195	1920
	59	705	1080	52	830	1260	45	975	1495	38	1160	1810	30	1380	2290
	90	805	1220	80	935	1425	75	1110	1715	70	1335	2135	60	1575	2780

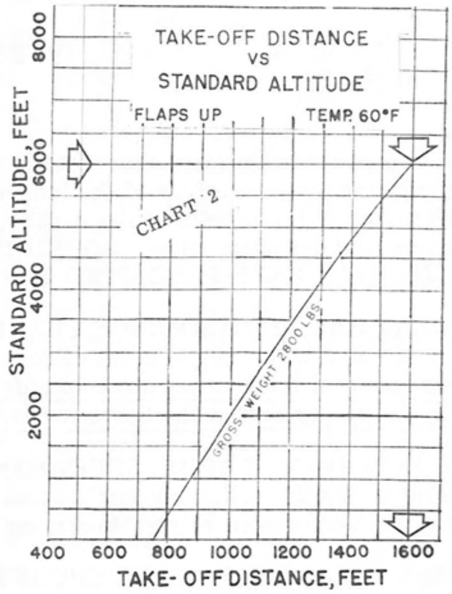
CHART 1

NOTE: Decrease distance approximately 15% for 100 pounds decrease in gross weight.

Rev. 1/77

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

Chart 2: At an elevation of 4,000 ft., 75° F, flaps up, and gross weight of 2,800 lbs., the takeoff distance is 1,600 ft. If you get 1,275 ft., it is because you used the same set of ground rules that you used in Chart 1. Since Chart 2 is based on standard altitude (standard temperature and pressure), you must first convert the elevation (to be completely accurate, the pressure altitude at that elevation) and temperature to a density altitude. A temperature of 75° F at an elevation (pressure altitude) of 4,000 ft. results in a density altitude of approximately 6,000 ft. (see Density Altitude Chart, page 4). Using an altitude of 6,000 ft. in Chart 2, you obtain the predicted takeoff distance of 1,600 ft. (75° F = 24° C)



WHAT CAN YOU OBTAIN FROM CLIMB PERFORMANCE CHARTS? Primarily, the rate of climb under various conditions. The information from these charts becomes exceedingly important when you have to cross high mountain ranges relatively soon after takeoff. Some charts also give the best climb airspeed and fuel consumed during the climb. For example:

CLIMB DATA

GROSS WEIGHT LBS.	AT SEA LEVEL & 59° F.			AT 5000 FT. & 41° F.			AT 10000 FT. & 23° F.		
	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	From SL FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	From SL FUEL USED
2100	87	1470	1.5	82	1200	2.8	78	925	4.3
2400	88	1210	1.5	84	960	3.1	80	710	5.0
2650	90	1030	1.5	86	795	3.5	83	560	5.9

Note: Flaps up, full throttle and 2600 RPM. Mixture leaned for smooth operation above 5000 ft. Fuel used includes warm-up and take-off allowance.

Chart 3

Chart 3: At 5,000 ft., 41° F, and 2,100 lbs. gross weight, the rate of climb is 1,200 ft./min.; best climb speed is 82 mph; and fuel used to climb from sea level to 5,000 ft. is 2.8 gal. At a gross weight of 2,650 lbs. under the same conditions, the rate of climb is 795 ft./min.

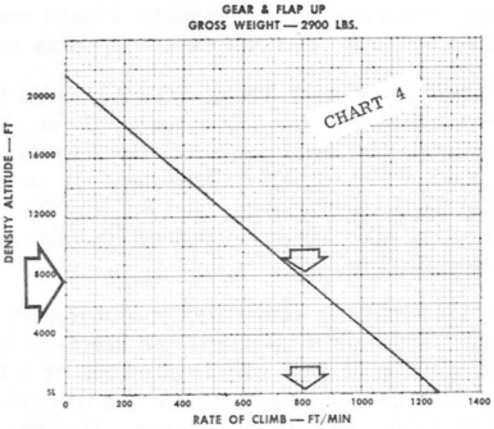


Chart 4: At 5,000 ft., 86° F, and 2,900 lbs. gross weight, the rate of climb is approximately 810 ft. -- not 970 ft. Note that you must first convert the altitude and temperature to a density altitude using the Density Altitude Chart, page 4. The density altitude at this altitude and temperature is approximately 7,750 ft. (86° F = 30° C)

WHAT CAN YOU OBTAIN FROM CRUISE PERFORMANCE CHARTS? Some of the items you can obtain include recommended power settings at various altitudes, along with percent of brake horsepower at these settings, rate of fuel consumption (gal/hr), true airspeed, hours of endurance with full tanks, and range in miles under standard conditions and zero wind. Not all of these values are obtainable from all charts. For example:

CRUISE AND RANGE PERFORMANCE

Altitude	RPM	M.P.	BHP	%BHP	TAS MPH	Gal/Hr.	End. Hours	Mi/Gal.	Range Miles
5000	2450	23	179	78	163	14.5	3.8	11.2	615
		22	169	73	159	13.6	4.0	11.7	640
		21	161	70	156	13.0	4.2	12.0	660
		20	150	65	151	12.2	4.5	12.5	685
	2300	23	167	73	158	13.4	4.1	11.8	650
		22	158	69	155	12.6	4.4	12.2	675
		21	148	64	151	11.9	4.6	12.7	700
		20	139	60	146	11.2	4.9	13.1	720
	2200	23	157	68	155	12.4	4.4	12.5	685
		22	148	64	151	11.7	4.7	12.9	710
		21	138	60	146	11.0	5.0	13.3	730
		20	131	57	143	10.5	5.2	13.6	750

Cruise performance shown is based on standard conditions, zero wind, lean mixture, 55 gallons of fuel, no fuel reserve, and 2650 pounds gross weight.

Chart 5

Chart 5: At 5,000 ft., 2,300 RPM, and 21 inches of manifold pressure, you should get 64% rated power, approximately 151 mph true airspeed, and consume approximately 11.9 gal./hr. of fuel which will give you an endurance of 4.6 hrs. and a range of 700 miles under standard conditions, zero wind, and full fuel tanks.

Chart 6: At 8,000 ft. you can obtain 55% rated power and 10.3 gal./hr. fuel consumption with 2,200 RPM and 19 inches of manifold pressure.

Power Setting Table –

Press. Alt. 1000 Feet	Std. Alt. Temp. °F	138 HP — 55% Rated Approx. Fuel 10.3 Gal./Hr. RPM AND MAN. PRESS.				163 HP — 65% Rated Approx. Fuel 12.3 Gal./Hr. RPM AND MAN. PRESS.			
		2100	2200	2300	2400	2100	2200	2300	2400
SL	59	21.6	20.8	20.2	19.6	24.2	23.3	22.6	22.0
1	55	21.4	20.6	20.0	19.3	23.9	23.0	22.4	21.8
2	52	21.1	20.4	19.7	19.1	23.7	22.8	22.2	21.5
3	48	20.9	20.1	19.5	18.9	23.4	22.5	21.9	21.3
4	45	20.6	19.9	19.3	18.7	23.1	22.3	21.7	21.0
5	41	20.4	19.7	19.1	18.5	22.9	22.0	21.4	20.8
6	38	20.1	19.5	18.9	18.3	22.6	21.8	21.2	20.6
7	34	19.9	19.2	18.6	18.0	22.3	21.5	21.0	20.4
9	27	19.4	18.8	18.2	17.6	—	21.3	20.7	20.1
8	31	19.6	19.0	18.4	17.8	—	—	20.5	19.9
10	23	19.1	18.6	18.0	17.4	—	—	—	19.6

CHART 6

CRUISE PERFORMANCE

ALT.	RPM	% BHP	TAS MPH	58.8 Gal Endurance Hours	58.8 Gal Range Miles
2500	2500	75	130	6.0	773
	2350	63	118	7.1	832
	2200	53	107	8.4	894
3500	2525	75	131	6.0	775
	2400	65	121	6.9	827
	2250	55	110	8.0	874
4500	2550	75	132	6.0	780
	2400	63	120	7.0	841
	2250	53	109	8.3	905
5500	2600	77	135	5.8	775
	2450	65	123	6.8	837
	2300	55	112	8.0	887

CHART 7

Chart 7: At 5,500 ft. and 2,450 RPM, you have 65% rated power, should obtain approximately 123 mph true airspeed, have an endurance of 6.8 hrs., and a range of 837 miles.

Use cruise performance charts to plan refueling stops. If you learn that your airplane performs differently than predicted by the chart, use this information; especially when performance is worse than predicted by the chart.

WHAT CAN YOU LEARN FROM STALL SPEED CHARTS? Chart 8 is a typical example of a Stall Speed Chart taken from an airplane flight manual. Note and continually be aware of the wide variation in stall speed between straight-and-level flight and various angles of bank. Note that the stall speed in a 60° bank with flaps up and power off (102 mph) is almost double the stall speed in straight-and-level flight with flaps down and power on (55 mph). Even with power on in the 60° bank, the stall speed is reduced only 4 mph to 98 mph. Study this chart and be aware of its significance, especially during traffic patterns and landings. You will find similar charts in any airplane flight manual.

STALL SPEEDS IAS

CONFIGURATION	ANGLE OF BANK 0°	20°	40°	60°
Flaps Up — Power Off	72 mph	74 mph	82 mph	102 mph
Flaps Up — Power On	69 mph	71 mph	79 mph	98 mph
Flaps Down (30°) — Power Off	64 mph	66 mph	73 mph	91 mph
Flaps Down (30°) — Power On	55 mph	57 mph	63 mph	78 mph

CHART 8

WHAT CAN YOU OBTAIN FROM LANDING PERFORMANCE CHARTS? The same type of information that you get from Takeoff Performance Charts--distance required to clear a 50-foot obstacle, length of the ground run, and in some cases, the recommended approach speed on which these figures are based. Landing Performance Charts will generally be used in the same way as Takeoff Charts for any given airplane, since each manufacturer usually follows the same format in these two charts. If you can read Takeoff Charts, you should have no difficulty reading Landing Charts.

HOW CAN YOU OBTAIN VALUES FROM PERFORMANCE CHARTS FOR CONDITIONS INTERMEDIATE TO THOSE GIVEN? By interpolation. For example, in Chart 1 (page 1) find the ground run required at an elevation of 5,000 ft., 72.5°F, zero wind, and maximum gross weight:

Ground run at 4,000 ft., 75°F, zero wind = 1,380 ft.	1,640 - 1,380 = 260
Ground run at 5,000 ft., 72.5°F, zero wind = ?	1/2 x 260 = 130
Ground run at 6,000 ft., 70°F, zero wind = 1,640 ft.	1,380 + 130 = 1,510

Since 5,000 ft. is halfway between 4,000 and 6,000 and the temperature is halfway between 75° and 70°, the ground run should be halfway between 1,380 and 1,640, which is 1,510.

Find the distance to clear a 50-foot obstacle at 4,000 ft., 65°F, zero wind, and maximum gross weight:

Distance at 4,000 ft., 45°F, zero wind = 1,810 ft.	2,065 - 1,810 = 255
Distance at 4,000 ft., 65°F, zero wind = ? ft.	2/3 x 255 = 170
Distance at 4,000 ft., 75°F, zero wind = 2,065 ft.	1,810 + 170 = 1,980

Since 65° is two-thirds of the way between 45° and 75°, the distance should be two-thirds of the way between 1,810 and 2,065 which is 1,980 ft.

IF INTERPOLATION IS DIFFICULT OR YOU ARE IN DOUBT ABOUT YOUR COMPUTATION, HOW CAN YOU ENSURE BEING ON THE SAFE SIDE? Use a condition more adverse than the one that actually exists--one that you can read directly from the chart without interpolating. Suppose, for example, you were taking off from an airport at an elevation of 5,200 ft. with a 5 mph headwind, a temperature of 65° F, and maximum gross weight. By using an elevation of 6,000 ft., a zero mph wind, and 70° F, you can read the takeoff distance directly from Chart 1. The conditions you are using are more adverse than the actual conditions. If the results indicate that takeoff is feasible, then you should have no difficulty taking off under the actual conditions.

(NOTE: Charts 1, 3, 5, 6, and 7 are excerpts from charts. Charts 2, 4, 8, and 9 are complete. Charts 1, 2, and 4 have been reduced.)

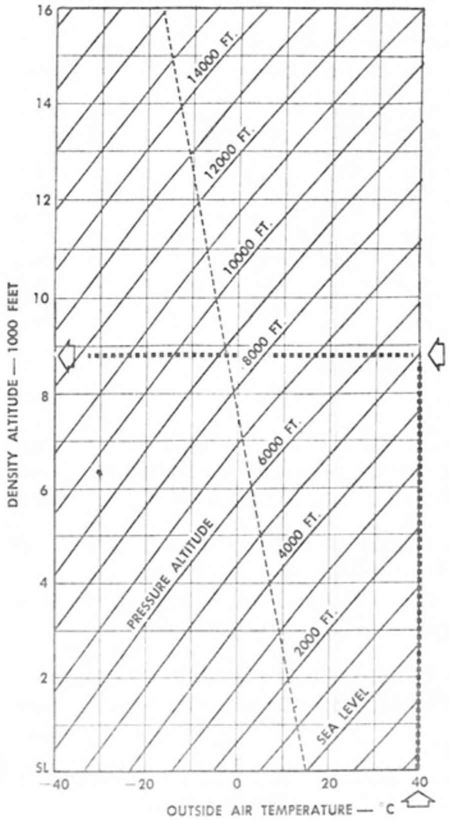


Chart 9

Chart 9: Density Altitude Chart. At an elevation of 5,000 ft. (assuming pressure altitude and elevation are identical) and a temperature of 40° C (104° F) the density altitude is approximately 8,750 ft.

Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

DEPARTMENT OF TRANSPORTATION

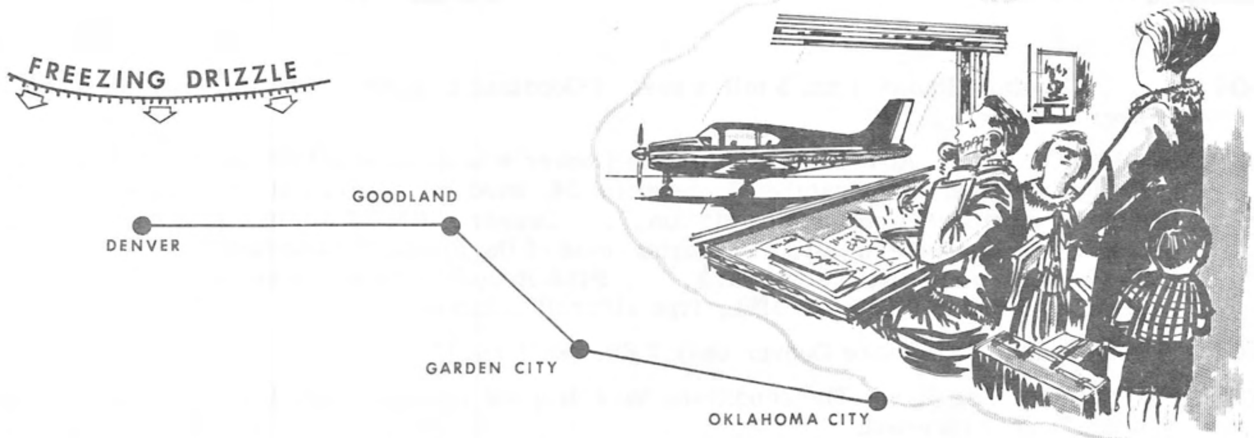
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 34

HOW TO OBTAIN PROPER WEATHER BRIEFING

A National Transportation Safety Board Statistical Review of General Aviation Accidents indicates that about one in every four fatal accidents in general aviation is the result of pilots continuing flight in adverse weather. This report lists weather as a causal factor in 1,039 accidents of which 296 were classed as fatal accidents and 743 were non-fatal.

Most FAA General Aviation Written Tests contain test items which deal with proper "Preflight Action" as required by Federal Aviation Regulations. Obtaining sufficient information concerning enroute and destination weather before beginning a flight is one of the most important parts of preflight action. The illustration and telephone conversation below is an example of an individual who "thinks" he has checked the weather.



PILOT: "This is Tom Jones. Will you give me the latest Garden City, Goodland and Denver sequence reports and the winds at eighty-five hundred feet?"

WEATHER BRIEFER: "Yes sir, at 1100 Central time, Garden City was reporting clear skies, visibility more than 15, surface wind 140 degrees at 20 knots. At Goodland the visibility is still good and they report scattered cirriform clouds. . . their wind is 150 degrees at 20 knots. At 1000 Mountain time, Denver is clear, visibility 50 miles, surface wind is from 040 degrees at 10 knots. Winds at eight thousand five hundred feet will average 220 degrees at 30 knots. Sir, would you like a weather briefing for your flight? A front lies. . ." (the pilot interrupts at this point.)

PILOT: "No, that's all right, thank you. I'm in a hurry. I'll check the weather along the way."

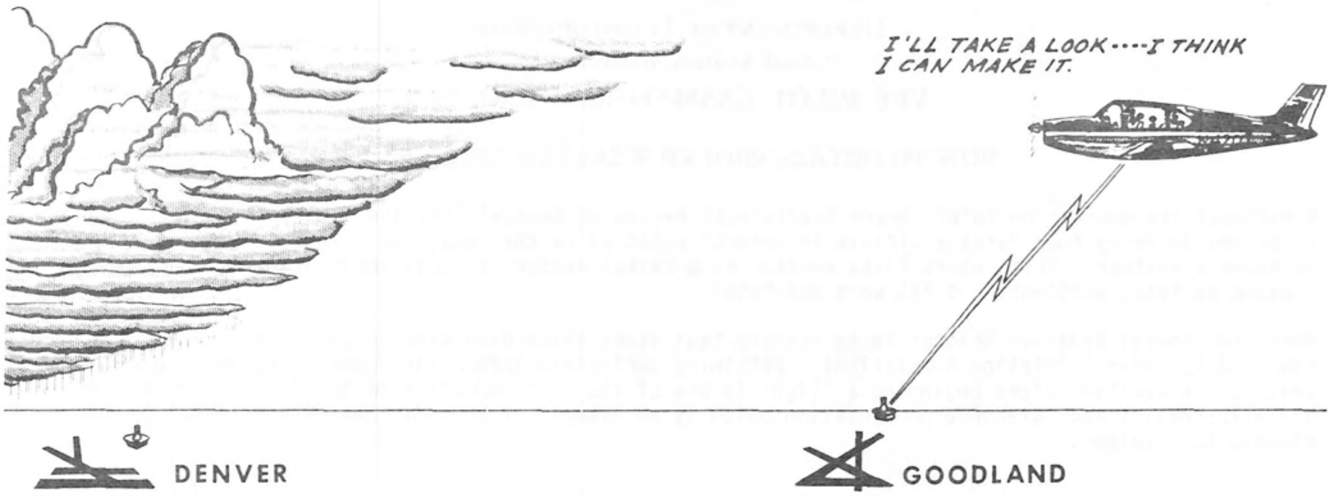
★★★★★

The above illustration portrays a pilot who is in a hurry to fly his family on an extended cross-country flight of approximately 463 miles. The weather looks good at his departure point and the hourly sequence reports indicate that present weather conditions are favorable along the route. However, this pilot is too anxious to get into the air -- too anxious to be on his way. He probably doesn't realize how rapidly the weather can deteriorate in the 3 hours that will be required to reach his destination--or--he is a careless or inexperienced pilot whose flying is characterized by poor judgment. If Mr. Jones had stayed on the phone for perhaps another minute, the briefer would have given him information (Terminal and Area Forecasts, AIRMETS, etc.) which should have changed his mind about attempting the flight. He would have learned that the proposed flight would take him into rapidly deteriorating ceilings and visibilities as well as freezing drizzle. The briefer offered the pilot more information and it may have appeared to him that the briefer was questioning his competence. Nevertheless, the pilot should have listened to what the briefer had to offer. Sometimes it may be superfluous--often it is vitally important.

★★★★★

* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

ENROUTE WEATHER BRIEFING . . .



PILOT: ". . . Goodland Radio, I am 5 miles east of Goodland at 6,500. Will you give me the latest Denver weather . . .?"

GOODLAND RADIO: ". . . At 1200 Mountain time Denver was measured 1500 overcast, visibility 10, very light drizzle, temperature 38, dewpoint 34, wind 040 degrees at 15, altimeter 29.98, low clouds northeast approaching station. . . Denver AIRMET ALPHA 2, moderate icing in precipitation in northern third of Colorado east of the Rockies, conditions continuing beyond 1500 Mountain and moving southward. . . Pilot Report at 50 northeast of Denver, moderate rime icing 6,000 to 9,000 feet MSL, type aircraft unknown. . ."

PILOT: "I believe that I can make Denver okay VFR, don't you?"

GOODLAND RADIO: "Negative. The conditions have dropped rapidly during the past hour. I'll give you the Denver forecast."

PILOT: "That's okay, I'll take a look and I'll turn around if it gets too bad. It's 1500 and 10 at Denver--I think I can make it."

ooo

(Epilogue - Unfortunately, he didn't make it!
The pilot encountered freezing drizzle, crashed,
and all occupants aboard were killed.)

So often pilots are given SIGMETS, AIRMETS, or Pilot Reports, but they do not realize the significance of the information--nor have they gained a lasting respect for the forces of weather. Even though this pilot was made aware of the potential weather hazards on the flight from Goodland to Denver, he did not heed the warning received. It is not unusual for a pilot to be motivated to continue flight into deteriorating weather in order to: Keep a speaking engagement, attend a party with friends, get home to the family, or a multiplicity of other seemingly important reasons. Those oft spoken words "I think I can make it," are too frequently the pilot's last transmission.

*****

WAS THE "PREFLIGHT ACTION" BY THE PILOT IN ACCORDANCE WITH REGULATIONS? No! FAR Part 91 states in part: "Each pilot in command shall, before beginning a flight, familiarize himself with all available information concerning that flight. This information must include, for a flight under IFR or a flight not in the vicinity of an airport, available weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed . . . ."

*****

This Exam-O-Gram covers several of the most common methods by which a pilot can obtain weather briefings. In certain localities, there are other ways that a pilot can receive weather information.

WHAT IS THE PROPER WAY TO REQUEST A WEATHER BRIEFING BY TELEPHONE? You get faster service and greatly assist the weather briefer by telling him:

1. That you are a pilot. (If you are a student, private, or commercial pilot--say so. The weather briefer needs to know that you are a pilot, not someone who calls just to find out the general weather picture.
2. The type of airplane you are planning to fly. (light single engine, high performance multi-engine, and jets all present different briefing problems.)
3. Your route and destination. (If you plan to stop somewhere enroute or deviate from the normal course, you should tell the briefer your intentions.)
4. Your estimated departure time and the estimated time enroute.
5. Whether or not you can go IFR. (Instrument rated? . . . Aircraft equipped?)

WHAT PERTINENT INFORMATION SHOULD A WEATHER BRIEFING INCLUDE? A preflight weather briefing will be incomplete unless it includes:

1. Weather synopsis (position of lows, fronts, ridges, etc.).
2. Current weather conditions.
3. Forecast weather conditions.
4. Alternate routes (if necessary).
5. Hazardous weather.
6. Forecast winds aloft.

NOTE: All of these items are on the weather briefer's checklist!

★★★★★

WHERE CAN YOU OBTAIN A WEATHER BRIEFING? Flight Service Stations (FSS) provide aviation weather briefing service, and at major strategically located cities weather briefings are also available through both the FSS and Weather Service Office (WSO). At many locations, the Weather Service furnishes Pilot's Automatic Telephone Weather Answering Service (PATWAS), which means that the weatherman records a briefing that is available to the pilot over his local telephone. Pilots may receive continuous broadcasts of weather information over certain VORs, VORTACs, and many of the low and medium frequency navigational aids - known as Transcribed Weather Briefings (TWEB). TWEB and PATWAS are similar in that they provide weather information for a radius of 250 miles.

WHERE CAN YOU FIND A LISTING OF FSS AND WEATHER SERVICE TELEPHONE NUMBERS? The Weather Service and Flight Service Stations provide weather briefings through both listed and unlisted telephone numbers. The unlisted numbers for all Weather Service Offices and FSS's providing this service are published in the Airman's Information Manual. See excerpt.

AIRMAN'S INFORMATION MANUAL Excerpt

FSS–CS/T AND NATIONAL WEATHER SERVICE TELEPHONE NUMBERS

Location and Identifier		Area Code	Telephone
OKLAHOMA			
Gage GAG	FSS	(405)	923-2601
Hobart HBR	FSS	(405)	726-5234
McAlester MLC	FSS	(918)	GA 3-4091
Oklahoma City OKC (Wiley Post)	FSS	(405)	787-9323▬
	FSS	(405)	787-9060★
	FSS	(405)	787-9061★
Ponca City PNC	FSS	(405)	RO 5-5485
Tulsa TUL	FSS	(918)	TE 6-3505▬
	FSS	(918)	835-2364★

★ Indicates Pilot's Automatic Telephone Weather Answering Service (PATWAS) or telephone connected to the Transcribed Weather Broadcast (TWEB) providing transcribed aviation weather information.

◆ Indicates a restricted number, use for aviation weather information

▬ Call FSS for "one call" FSS/WSO briefing service.

* Automatic Aviation Weather Service (AAWS).

For long cross-country flights or flights in marginal weather, the pilot may choose a face-to-face briefing by FSS or Weather Service personnel. If a planned flight is short (250 miles or less) a visit with a weather briefer may be unnecessary except in marginal or poor weather situations. Often, a briefing by telephone or the information contained in recorded weather briefings (PATWAS or TWEB) will fill a pilot's needs. NOTE: At the conclusion of a PATWAS recording, you may get additional information by holding the phone and waiting for the weather briefer to answer.

HOW CAN YOU DETERMINE WHERE RECORDED WEATHER BRIEFINGS (TWEB) ARE AVAILABLE? By referring to the Airport/Facility Directory section of Airman's Information Manual (AIM). Note in the excerpts to the right that additional information for Radio Aids are listed in a separate NAVAID entry. A pilot on the ground at a small airport 50 miles from Wiley Post Airport might utilize this service by tuning his ADF (or low frequency) receiver to 350 kHz, and thereby receive continuous transcribed weather briefings of the area around Oklahoma City within a 250 mile radius.

WHAT IS THE MEANING OF FOREIGN EXCHANGE TELEPHONE SERVICE AS PROVIDED BY FAA? Pilots departing from many of those airports having neither a Weather Service Office nor a FSS may call a nearby FSS on foreign exchange telephone service provided by FAA at no cost to the pilot. For example: In the Oklahoma City area there are 3 surrounding towns that have been provided this service. These towns are Norman, Stillwater, and Enid, and the distances from Oklahoma City are 22, 62, and 65 miles respectively. Calls can be placed to Oklahoma City FSS from any telephone located in these towns by dialing the local number listed in Airport Directory section of AIM. See excerpt for Enid, which lists the local call number 237-6737.

NOTE: When an Interphone line exists between the field and the FSS, it is indicated by "(DL)" (direct line) below the FSS name.

☆ ☆ ☆ ☆ ☆

PROPER AND COMPLETE WEATHER INFORMATION IS A PILOT'S BEST LIFE INSURANCE - IT PAYS OFF IN LIFE INSTEAD OF DEATH.

OKLAHOMA—CONTINUED

AIRPORT/FACILITY DIRECTORY Excerpt

§ **OKLAHOMA CITY,** WILEY POST (PWA) — **FSS:** OKLAHOMA CITY(OKC) ON FLD
35°31'57" 97°38'48" 8NW 1299' IFR
RWY 03/21: H3409. (S-12.5)
RWY 03: TREES. VASI **RWY 21:** TREES. VASI. RGT TFC
RWY 12/30: H4212. MI RWY LGTS. (S-35,D-50,DT-90)
RWY 12: POLE LINES. VASI. RGT TFC **RWY 30:** POLE LINES. VASI
RWY 17L/35R: H7198. MI RWY LGTS. (S-35,D-50,DT-90)
RWY 17L: TREES. MALSR. VASI. RGT TFC **RWY 35R:** POLE LINES. VASI
RWY 17R/35L: H3232. (S-12.5)
RWY 17R: TREES. VASI. RGT TFC **RWY 35L:** TREES. VASI
FUEL: 100, JET A. **REPAIRS:** MAJOR A & E
ROTG BCN: DUSK-DAWN. **UNICOM:** 123.0
OXYGEN: HI AND LOW PRESSURE SVC AND REPLACE ...
REMARKS: RWY LGTS OPER DUSK-DAWN. ... CTL OF MALSR WHEN ATCT IS CLSD. VASI RWY 30 TCH ... DEG. VASI RWY 17R TCH 31' GLIDE ANGLE 3.5 DEG. ... OVER 54000 LBS GWT. RWY 12-30 CLSD TO JETS ... TKOF & RWY 30 CLSD TO LNDG FOR ACFT OVER 12500 BS ... 12-30 CLSD DAILY FROM 2200-0600. TOUCH & GO OR STOP & GO LNL ... AUTHORIZED RWY 12/30.
WILEY POST TOWER: 119.7 **GND CTL:** 121.7
ATIS: 113.4
RADAR SERVICES:
OKE CITY APCH CTL: 124.6(170-350, 6000-11000) 121.05(351-169, 6000-11000) 119.3(170-350,5000 & BLO) 124.2(351-169,5000 & BLO)
OKE CITY DEP CTL: 121.05(351-169) 124.6(170-350)
STAGE I CTC APCH CTL
TWR HRS OF OPN: 0600-2200
REMARKS: FSS PROVIDES AAS ON 119.7 WHEN ATCT IS CLOSED.
ILS RWY: 17L
WILEY POST VOR ON ARPT
TULAKES NDB 319° 4.3 NM TO ARPT
OKLAHOMA CITY VORTAC 41° 8.1 NM TO ARPT

OKLAHOMA CITY NDB SABH 350(OKC) — **FSS:** OKLAHOMA CITY(OKC)
REMARKS: TWEB AVBL GENERAL OUTLOOK ONLY 2200-0500.

○ ○ ○ ○ ○

AIRPORT DIRECTORY

OKLAHOMA—CONTINUED Excerpt

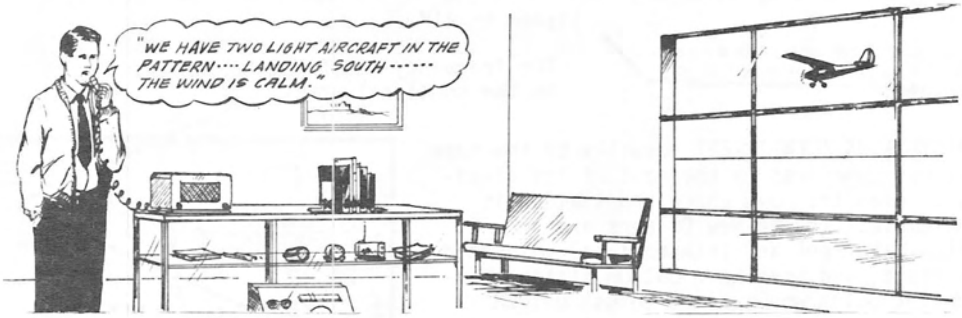
§ **ENID** WOODRING MUNI (WDG) — **FSS:** OKLAHOMA CITY(OKC) LC 237-6737
36°22'45" 97°47'28" 5SE 1167' IFR
RWY 02/20: H5044. (S-16)
RWY 02: TREE. RGT TFC **RWY 20:** RAILROAD
RWY 12/30: H5009. (S-16)
RWY 12: POLE LINES **RWY 30:** POLE LINES. RGT TFC

Federal Aviation Administration
Flight Standards National Field Office, Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125

U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

VFR PILOT EXAM-O-GRAM* NO. 35

UNICOM FREQUENCIES AND USES



WHAT IS UNICOM? UNICOM is a private aeronautical radio station. It provides a communication channel for many airports without a control tower or FSS (122.8 MHz) and a channel for airports with a control tower or an FSS (123.0 MHz). Both the ground station and aircraft transmit and receive on the same frequency. Many of the FAA Written Tests contain test items concerning this subject.

WHAT USES MAY BE MADE OF UNICOM AT THOSE AIRPORTS NOT SERVED BY A CONTROL TOWER?

1- It may be used for communications with private aircraft concerning runway and wind conditions, types of fuel available, weather, dispatching, availability of ground transportation, food, and lodging.

2- It may be very useful in an emergency. To illustrate this point, here is a sample transmission which might be used at a non-controlled airport: "Great Bend UNICOM, this is . . . . I am unable to receive a green light 'gear down' indication. Will you have your mechanic check my landing gear as I make a low pass over Runway 17?" In addition to observing the position of the landing gear during a fly by, the mechanic might also review the emergency gear lowering procedures with the pilot.

3- At certain airports, a pilot can turn on the runway lights by tuning his transmitter to the airport UNICOM frequency and then "pressing the microphone button" a predetermined number of times within a predetermined time interval. This is true at these locations as long as the UNICOM station receiver is turned on, even though it is unattended. Note the Airman's Information Manual (AIM) excerpt, above.

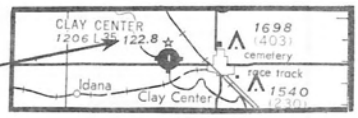
OHIO

§ LIMA 4 NW
827 H35 (1) BL4 S3 F4 **UNICOM:** 122.8 FSS: FINDLAY
Remarks: P-line N, S. For rnwy lgts press mike button 4 times within 5 seconds on UNICOM freq; lgts will remain on for 15 min.

4- It may be useful in a wide variety of other ways, such as: (a) A student calls to advise his instructor that he is experiencing a rough engine and seeks advice, (b) A private pilot calls in and asks if a mechanic is available to work on his inoperative aircraft tachometer, (c) A doctor requests that an ambulance meet his airplane upon landing to pick up a hospital patient.

○○○

HOW CAN A PILOT DETERMINE IF UNICOM IS AVAILABLE AT AN AIRPORT WITHOUT A CONTROL TOWER OR FSS? The airport information lists the UNICOM frequency 122.8 MHz.



CLAY CENTER MUNI (1K2) 2W 39°23'00'' 97°10'00'' **FSS:** MANHATTAN
@ 1206 H35/17-35 (1) BL4 S5 F12,18 **UNICOM:** 122.8
REMARKS: ARPT ATTENDED DAYLIGHT OTHER HRS CALL 632-3217. ROAD IN RWY 35 APCH. ASSOC FSS OPERS 0600-2200 LCL, OTHER HRS CTC SALINA FSS.

The availability of UNICOM can also be determined by referring to the Airport Directory Section of AIM. Note that UNICOM is followed by the frequency.

CAN COMMUNICATIONS ALWAYS BE ESTABLISHED ON UNICOM? No. Most pilots who land regularly at UNICOM equipped airports, have on occasion been unable to get a reply from UNICOM stations. This situation is usually caused by a shortage of personnel at small airports. Sometimes this results in the UNICOM being "on" but unattended. In some instances, the volume control on the station receiver may have been turned down and then forgotten. Although these situations are unfortunate, pilots should realize they may occur.

○○○○○

DISTRIBUTION: ZC-307 Rev. 4/77

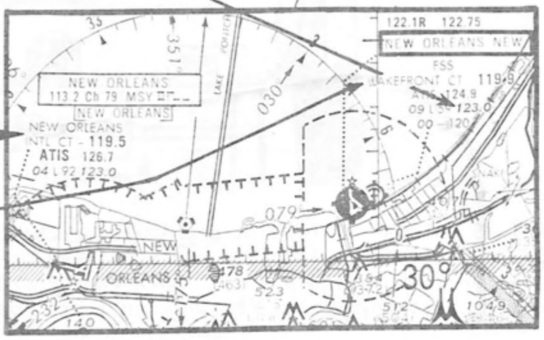
* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

HOW IS UNICOM USED AT AIRPORTS SERVED BY A CONTROL TOWER? Communications on 123.0 MHz are identical to those permitted on 122.8 MHz with the exception of information such as runway and wind conditions, weather, etc., which should be furnished by the tower.

HOW DOES A PILOT DETERMINE IF UNICOM IS AVAILABLE AT AN AIRPORT WITH A CONTROL TOWER? The Airport/Facility Directory excerpt to the left below shows how the UNICOM frequency is listed in AIM.

NEW ORLEANS
§ LAKEFRONT (NEW) IFR 5NE FSS: NEW ORLEANS on Fld
9 H59/17-35(3) (S-60, D-70, DT-110) BL5,7A,10,11,13 S5 F12,
18,30 Ox1,3 UNICOM: 123.0

The frequency 123.0 MHz appears in the airport data on the sectional chart.



HOW ARE UNICOM STATIONS IDENTIFIED? Usually by the name of the airport, but sometimes by the name of the fixed-base operator, or even the town where the station is located. For example: In the New Orleans area there are two airports--Lakefront and International-- located about 13 miles apart, and both have UNICOM stations on 123.0. A transient pilot who desires to use UNICOM and doesn't know the name of the operators in the area would normally address his call to "Lakefront UNICOM" or "New Orleans International UNICOM," rather than "New Orleans UNICOM."

HOW DO PILOTS ABUSE OR MISUSE UNICOM? Perhaps one of the most common abuses is the situation where several aircraft are flying at high altitudes and using one of the UNICOM frequencies for lengthy aircraft-to-aircraft radio chatter. At high altitudes their transmissions reach out in all directions and tend to block out many local airport UNICOM transmissions. Remember, use UNICOM like a party line telephone--be brief, transmit only essential messages.

○○○

UNICOM stations are crystal controlled to transmit and receive only on one frequency.

UNICOM is never used for Air Traffic Control purposes.

NOTE: For several years, the Airman's Information Manual and the Sectional Aeronautical Charts listed UNICOM by the symbols U-1 and U-2, etc. This format is no longer being used. The following excerpts from a 1977 edition of a Sectional Chart Legend and AIM Airport Directory (1977 Spring-Summer edition) show the revised format.

SECTIONAL CHART EXCERPTS

LEGEND

AIRPORT DATA

FSS ← Indicates FSS on field
NAME CT - 118.3*
ATIS 124.9
03 L 92 123.0 ← UNICOM
VFR Advsy 125.3
Airport of entry

FSS – Flight Service Station
CT – 118.3 – Control Tower (CT) – primary frequency
* – Star indicates operation part time. See tower frequencies tabulation for hours of operation.
ATIS 124.9 – Automatic Terminal Information Service
UNICOM – Licensed aeronautical advisory station
VFR Advsy – VFR Advisory Service shown where ATIS not available and frequency is other than primary CT frequency.
03 – Elevation in feet
L – Lighting in operation Sunset to Sunrise
*L – Lighting available Sunset to Sunrise only on request (by radio call, letter, phone, telegram).
(L) – Lighting in operation part of the night and on request, or not operating thereafter.
Ⓛ – Pilot-controlled lighting (PCL)
92 – Length of longest runway in hundreds of feet
S – Normally sheltered take-off area (SPB)
When facility or information is lacking, the respective character is replaced by a dash.
All times are local.
NFCT – Non Federal Control Tower

ADVISORY SERVICE AIRPORT
Non-Tower Airports
FSS
MARTIN
556 L 70 123.0

SOMERSET
1540 L 37 122.8

AIM EXCERPTS

UNICOM

The frequency available is indicated.

122.8 MHz for Landing Areas (except heliports) without an ATC Tower or FSS;

123.0 MHz for Landing Areas (except heliports with an ATC Tower or FSS;

123.05 MHz for heliports with or without ATC Tower or FSS;

122.85 MHz for landing areas not open to the public;

122.95 MHz for landing areas not open to the public.

§ FRANKFORT, CAPITAL CITY (FFT) FSS: LOUISVILLE(LOU)
38°10'55" 84°54'16" 1SW 804' IFR LC 875-2888
RWY 06/24: H5005. MI RWY LGTS. (S-44,D-51,DT-82)
RWY 06: TREES. REIL RWY 24: TREES. REIL
FUEL: 80, 100, JET A10. REPAIRS: MAJOR A & E
ROTG BCN: DUSK-DAWN. UNICOM: 122.8
REMARKS: RWY LGTS OPER DUSK-DAWN.

Federal Aviation Administration
Flight Standards National Field Office
Examinations Branch
P.O. Box 25082
Oklahoma City, Oklahoma 73125.