Scanner
Familiarization and Preparatory Training
Course Part 2

Aircraft Operations and Limitations

Basic aircraft structure

The basic aircraft control surfaces can be seen in Figure 21, along with a general aircraft design. The effects of aileron, elevator, and rudder movements are discussed below.

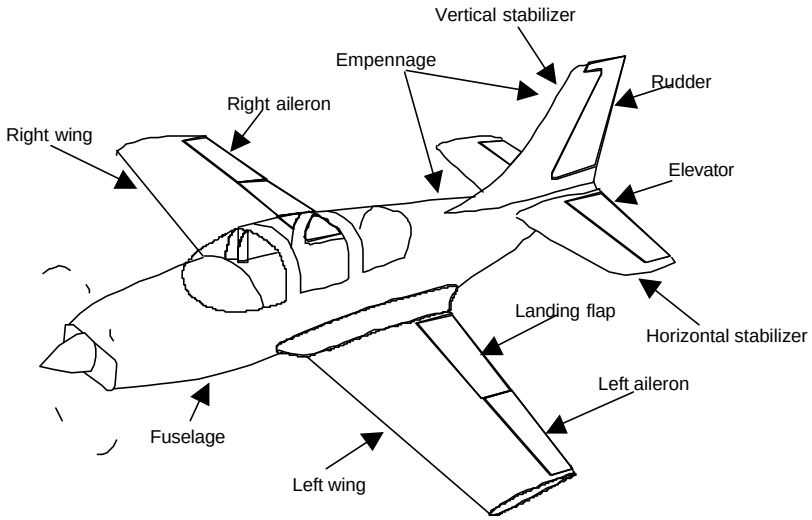


Figure 21

Ailerons

Ailerons are movable surfaces attached to the trailing edge of the wing, toward the wing tip from the flaps. They control roll or movement around the longitudinal axis.

Elevator

An elevator is a control airfoil attached to the trailing edge of the tail's horizontal stabilizer. It controls pitch, or movement of the nose up or down.

Rudder

The rudder is an airfoil attached at the trailing edge of the tail's vertical fin. It is designed to control the yawing, or side-to-side action around the vertical axis of the aircraft.

Safety

Safe activity in the vicinity of aircraft depends on everyone knowing certain “do’s” and “don'ts.” Knowing certain basics are a beginning only; from this point on the person must be observant and think! Distraction and hurrying are part of a sure formula for mistakes.

In addition to thinking, it is good practice to demonstrate courtesy. The Civil Air Patrol and individual aircraft owners who lend their craft to missions have a lot of money invested. Remember, aircraft and the equipment on them are fragile. Because of high investment and the fragility of the craft, owners are very protective of their property. Your demonstration of respect for their property will cause them to accept you more quickly as one of the team.

No smoking

You will see "No smoking within 50 feet" signs at aviation gasoline pumps. This distance is stated because of the possibility of igniting gasoline fumes when any closer to the pumps. Such signs will not be displayed on aircraft. Yet, the same rule applies.

The best or safest precaution is to forget about smoking when you are anywhere near aircraft or gasoline pumps or better yet, the flight line. There may be specially designated smoking areas at your mission headquarters. If so, use them.

Keep clear

You should always remember that an aircraft that is moving on the ground (taxiing) is a dangerous vehicle. You could be injured if struck by any part of the airplane, but the propeller is a real killer. The propeller spins so rapidly it is invisible most of the time, and this may be part of the explanation of why so many people have been killed by propellers. **NEVER RUN AFTER ANYTHING BEING BLOWN ALONG THE FLIGHT LINE!!**

Aircraft ignition systems are designed differently from those in cars. Even slight propeller movement, especially when the engine is still warm, can sometimes cause the engine to "fire" momentarily, hurting anyone in the propeller's path. Therefore, never touch or even get close to a stopped propeller.

The trailing edges of the wings, flaps, and ailerons may be very sharp and are often right at head level. You should take extra care when moving around the aircraft and looking at some other item of detail.

Ground Operations

Aircraft, unlike automobiles and other vehicles, seem very flimsy to us. Actually, they are extremely strong, but only when the loads and forces acting on them are applied in the amounts and directions for which their designers intended. Other forces and loads can easily cause minor or major damage to the aircraft. Due to the complexity of their structure, even minor damage can be very expensive to repair.

When ground handling and pushing an airplane, never push or pull on the propeller. Also, don't rotate, hold, or stand near the propeller. ALWAYS ask the pilot where he wants you to push or pull.

When loading the aircraft, ensure all loose items are stowed or secured. If the aircraft is equipped with cargo nets or cargo straps, use them. Also, make sure that you do not overload the baggage compartments, as this could affect the aircraft's center of gravity. Check with the pilot before loading any gear.

Be very careful where you step when boarding or exiting the aircraft. Most aluminum wing skin will *not* support the weight of even a small adult without dimpling or distorting. On low-wing aircraft, the portion of the wing that ***will*** support such weight is usually covered with black or gray nonskid material and is known as the wing walk. On high-wing aircraft, never step on the pod or "pant" that covers each main wheel and tire assembly. You may also see parts of the aircraft labeled "No Step" and "No Handhold." It is very important to follow the warnings given by these placards.

Normally, the scanner(s) enter the aircraft first, followed by the observer. Always approach airplanes from the rear for entry and depart toward the rear.

Entering or exiting an airplane while the engine is running is highly discouraged. If you must board while the engine is running, make sure the pilot has you in sight and approach the airplane from behind the wing and always remain in the pilot's sight.

Always wear seat belts in the aircraft. FAA and CAP regulations require all occupants to wear seat belts and shoulder harnesses anytime the aircraft is moving on the airport surface, landing, or taking off. Once airborne, you may remove the shoulder harness, but it makes good sense to leave it loosely fastened in case unexpected turbulence is encountered. Also, don't touch knobs and switches in the aircraft unless you are familiar with its purpose and use, and told to do so.

While taxiing the aircraft, all crewmembers should watch in all directions for any obstacles that might contact and damage the airplane.

Fire on the ground

As a general rule, the action to take in case of fire on the ground is to get away from the airplane. Whether you should run is a matter of judgment. After all, the fire may be a very small one that is confined to the engine compartment. If this is the case, the fire could be extinguished if action is taken quickly. You will be shown how to

perform an emergency egress from the aircraft you are to fly in before your first flight as a scanner. This also should be part of the pilot's briefing before each flight!

Flight Line Ground Signals

Because it is virtually impossible to communicate with the ground crew once the engine has been started, hand signals were developed to permit safe ground operations. The pilot is the person who reacts to the signals but you should observe them to anticipate the pilot's reaction. The most common are illustrated with their meanings on the Wing web page. This file should be downloaded and kept with your scanner material.

Questions

1. Within how many feet of an aircraft is smoking prohibited?
2. From what direction do you approach and enter an aircraft?
3. The propeller is the most dangerous part of the aircraft because of what two reasons?
4. When should you wear your seat and shoulder belts?
5. All loose items in the cockpit should be _____ or _____.
6. When will you be shown the ground emergency egress from an aircraft?

Survival

This section introduces the fundamentals of aircrew survival, and is not meant to make you a survival expert, nor is it meant to frighten you. After all, most pilots fly their entire life time without even a hint of a problem, let alone having a problem that leads to an off airport landing. Although safety is always our prime consideration, there is an element of risk involved in the type of flying that we do, particularly when we must fly low and slow in the mountains. Therefore, it is EXTREMELEY IMPORTANT that you carry survival gear with you on every flight and that you know how to use that equipment if ever the need should ever arise.

The most important survival tool is your attitude -- having a positive mental attitude is often the difference between life and death in a survival situation.

Communications

Before you leave the ground, ask the pilot to show you how to tune the aircraft radio to the emergency frequency, which is **121.5 MHz.** Help is always available by calling on this frequency. The FAA, Flight Service, many other agencies and pilots monitor this frequency and will respond to your call for help. Also, have the pilot show you were the aircrafts Emergency Locator Transmitter (ELT) is located and know how to activate it manually. Finally, take advantage of modern technology and carry a cell phone with fresh batteries. You may not get a signal in remote areas, but most accidents occur near civilization so the odds are with you.

Before Ground contact

In the extremely rare event of a off airport landing, the time to prepare for the landing is during the descent. In the CAP we are usually on a flight plan or in contact with our mission base. While the aircraft is still airborne, we should try to contact any one in order to communicate our distress and notify them of our location. The international emergency frequency is 121.5 and the transponder setting is 7700. Unlatch all doors and prop them open, if possible. Coats and any other materials should be passed to the people in front to be used as padding against the instrument panel. The aircraft survival kit should be moved to where it can easily be thrown out of the aircraft after the aircraft has stopped moving.

Post-crash Actions

First of all, get clear of the aircraft if there is any danger of fire or a chance that the aircraft may fall on you. Check everyone for injuries and apply first aid. As a precaution, treat yourself for shock by sipping water. Once the immediate danger has passed, you need to **STOP.** **STOP** is an acronym for:

- S --- Stop and assess the situation
- T --- Think and don't panic

- O --- Organize your survival equipment
- P --- Plan how you will survive until rescued

If you don't panic, you should survive. Remember that ***your will to survive is your greatest asset*.**

Try the aircraft radios and your cell phone. Make certain the ELT is activated by manually turning it on. Don't get impatient and leave the site, ***your best chance of discovery is to stay with the aircraft*.** Finally, if rescue is not immediately expected, consider what you are going to do about clothing, water, shelter, and food (in that order).

Clothing

California is a land of many contrasts with its deserts, mountains, and beaches. The weather varies widely from place to place and can change drastically within a few hours in any one place, even the hottest desert becomes cold at night. You must be dressed for the worse conditions you fly over. Additionally, your survival clothing must be designed to protect you from THE DEADLY TRIANGLE: WIND, WATER, and COLD. You should carry with you extra clothing such as a jacket, knit cap, gloves, thermal underwear, waterproof poncho or rain suit. Victims rarely freeze to death, but they can die from hypothermia, which is loss of body heat from exposure to the elements.

Survival Kits

Water is your most important survival resource. If you fly over regions where water is plentiful, have some means to purify water such as a filter, purification tablets or carry a metal cup for boiling water. Carry as much water in the aircraft as you can.

Aircraft

Large survival kits in the aircraft's baggage compartment, or rear seat, are good to have and should contain as a minimum; water and purification tablets or a filter, signal mirror, space blankets (one for each crewmember), rations like “Meal Ready to Eat” (MRE’s), first aid kit and manual, survival manual (written for your region), matches, and a compass. The survival kit should never be located out of the reach of the person who has been assigned the responsibility of removing it from the aircraft in case of emergency

Personal

YOU MUST HAVE SURVIVAL EQUIPMENT READILY AVAILABLE TO GO WITH YOU IF YOU MUST EXIT FROM THE AIRCRAFT IN A HURRY. Ideally, your survival gear should be carried in a survival vest or on a webbed belt you are wearing. Some items can be placed in your flight suit pockets. A pack that can readily be thrown over your shoulder might also be used.

There are many wonderful survival devices available, but you must remember to keep your survival kit small and lightweight. It will be largely your decision on what items to put in your survival kit. You may wish to buy one of the very compact kits available from the CAP Supply Depot or most sporting goods stores, or you may wish to assemble your own kit. WATER IS AN ABSOLUTELY ESSENTIAL ITEM! !

A list of items that you may want in your survival bag can be found on the CAWG web page.

Remember that the first order of business after a crash is to STOP AND THINK. You must manage panic and administer first aid to yourself and others. Then assemble your survival gear, use parts from the crashed aircraft and things that nature has provided in the area to help you survive.

Survival Signaling Methods and Devices

Waiting to be rescued does not mean sitting around doing nothing. In fact, the busier you can be, the better off you will be. A crashed aircraft is actually a small object to see from the air but it is a lot bigger then an individual! That is why you should stay with the aircraft. However there are signals that can be used to increase the chances of being seen.

The following are signaling techniques that you might use:

A fire. *A* fire may be the first attempt at signaling. The smoke and/or flame of a fire are easy to see from the air, day or night. Also the fire may be needed for other survival reasons.

A group of three fires. Three fires forming a triangle is an international distress signal.

Red, white, or orange smoke. Colored smoke may discharge from smoke flares or a fire. Other types of flares are rocket types that send up a magnesium flare that may or may not be attached to a small parachute.

Signal Mirrors. If the sun is shining, this type signal may be used. This special signal mirror includes Instructions to the survivor on how to aim the signal at the search aircraft. However, any shiny object could be

used as a mirror. Mirrors should be used even if no aircraft is visible as the reflection can be seen beyond the horizon.

Panels on the ground. This type signal can be formed with white and/or colored panels. Of course, survivors may be able to arrange aircraft parts as a signal. If the victims of an accident are fortunate enough to have Paulin material, they may be able to aid the rescuers greatly by sending signals with it. “Paulin” is a short form of tarpaulin, which means waterproof canvas. A quick reference guide of these signals is located on the wing web page for you to download and keep in your flight bag.

Messages. There are a number of methods and materials that can use to construct messages. In snow, sand, and grassy areas, survivors may use their feet to stamp out simple messages, such as HELP or SOS. More than likely such messages will be formed with rocks, tree branches, or any other similar materials. Such materials may also be used to construct standard ground-to-air signals. These international signals are familiar to military and professional pilots, and all CAP crewmembers. Figure 22 displays the signals you should also copy and have with you.

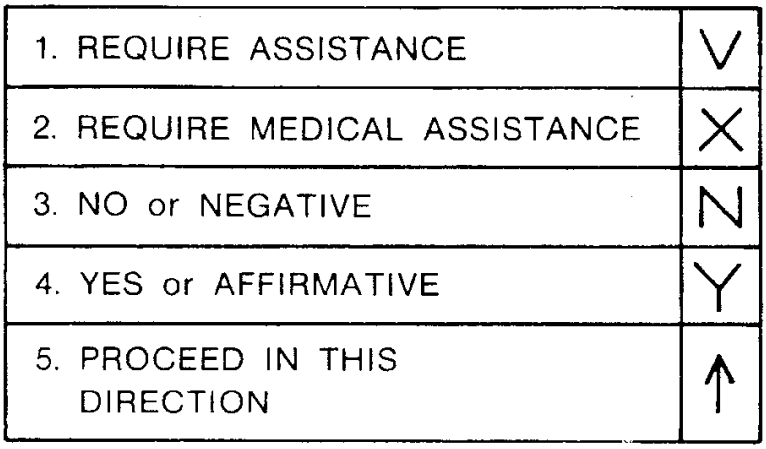


Figure 22

Messages should be constructed of contrasting colored materials from the background they are resting on. If that is not possible, use the material to create shadows. Dig a trench and mound the excavated material on one side to increase the height of the shadow created. The parts of the signals should be at least 2 to 3 feet wide and 8 to 12 feet long.

Ground to Air and Air to Ground Signals

Ground-To-Air

Body Signals can be used to communicate more information to the aircraft when you are found. Although body signals are not easily interpreted from an aircraft, they can be used to transmit messages to the pilot of an aircraft as he circles overhead. Be sure the background, as seen from the air, is not the same coloring as your clothing. Go through the motions slowly and repeat each signal until you are positive that the aircrew understands you. A quick reference guide of these signals is located on the wing web page for you to download and keep in your flight bag.

Air-to-ground signals

Communicating by radio is the basic air-to-ground communication method. If this isn’t possible for any reason, the pilot has a limited number of signals that can be given using the aircraft itself, as illustrated in Figure 23. These signals serve as a standard means to acknowledge receiving and understanding signals from the ground. An "affirmative, I understand" response to a survivor’s signal can often be a morale booster, and renew hope for imminent rescue.

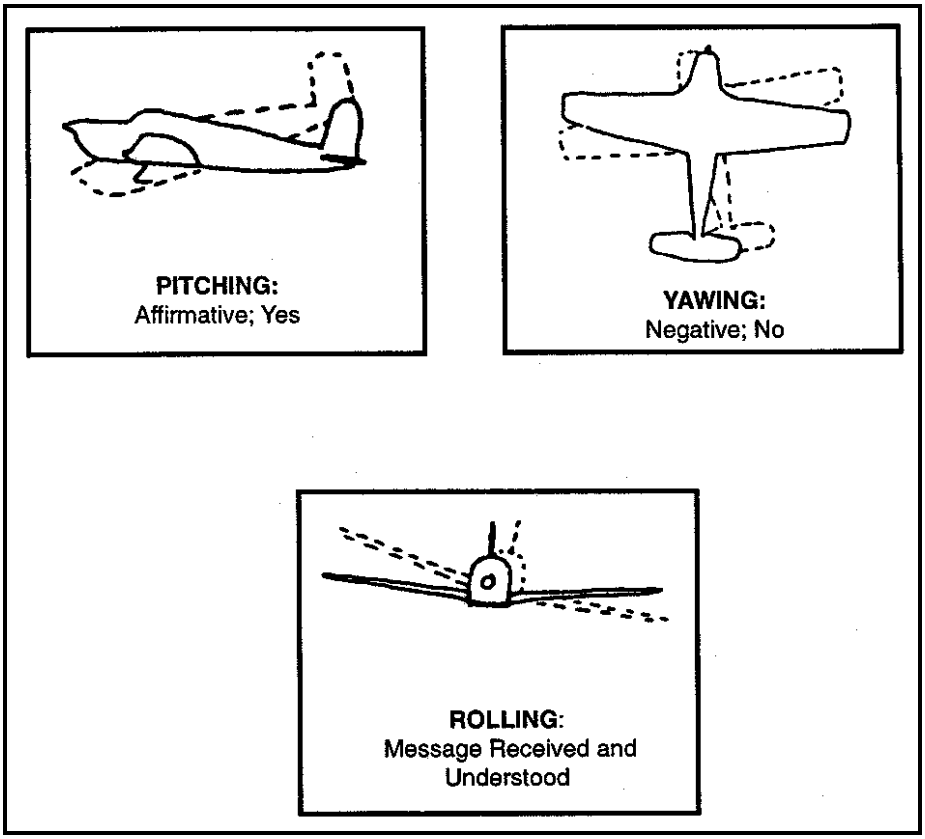


Figure 23

A fourth signal is to make a complete **RIGHT HAND CIRCLE** when the "Message is Received But Not Understood".

Questions

1. What emergency message signal would you make to indicate that you needed medical assistance?
2. What is the absolutely essential item you should have in your personal survival kit?
3. What is the emergency radio frequency for the aircrafts radios?
4. How would the pilot indicate to a person on the ground that he received their message and understood it?
5. What does three fires in a triangle signify?
6. The acronym "STOP" stands for what?
7. How should you dress for the flight?

First Aid

The scanner responsibility does not normally require first aid knowledge. At the mission base ground team members who have first aid training may be available and emergency civilian aid is usually available through 911. However, injuries may result from an emergency landing of your aircraft during a search mission. You may need to help an injured pilot if there were only two of you in the aircraft and you are far from help. In the extreme case, you may have to give any first aid you know to save the pilots life. Knowledge of CPR and first aid from certified courses, while not required for scanner qualification, is suggested but any first aid learned is a plus.

Here are the most important measures to take in the event of an accident, assuming you have the proper training:

- Do not move the person unless it is absolutely necessary to save a life (e.g., fire, smoke or noxious fumes, falling items, or flooding).
- Ensure the victim has an open airway and give mouth-to-mouth artificial respiration if necessary.

- ? Check for a pulse and give CPR if necessary.
- ? Locate and control severe bleeding.

The following procedures provide additional directions once emergency measures have been taken to ensure victim's safety:

- ? Do not let the victim get up and walk around.
- ? Protect the victim from unnecessary manipulation and disturbance
- ? Avoid or overcome chilling by using blankets, covers or clothing.
- ? Determine injuries and administer required first aid.
- ? Plan actions according to the nature of injury, the needs of situation and the availability of human and material resources.
- ? Remain in charge until the victim can be turned over to qualified persons.
- ? Do not discuss the victim's condition with bystanders or reporters.

Know the limits of your capabilities and make every effort to avoid further injury to the victim in your attempt to provide the best possible emergency care.

Questions

1. When is the only time you would move an injured person?
2. Before you locate and control severe bleeding, you should check what two things?

Aviation Weather

Basic weather

Since weather plays such an important part on any CAP operation, the mission scanner must become familiar with some basic weather conditions. Weather can have a pronounced effect on how the search is conducted, and is one of the most important variables that influences search effectiveness. Almost all search missions will require decent visibility in the search area. Also, the weather at the mission base must be good enough for the aircraft to take-off and land. This weather decision to fly or not will be made by the Air Operations Officer and Incident Commander who have checked all aspects of the weather conditions. .

A scanner also needs to be aware of some basic aviation weather effects. If you know what to expect, you will be better prepared. The effects of visibility limitations and aircraft turbulence are two areas that directly affect your ability to find the search object and your physical well being.

Reduced Visibility

According to FAA regulations, under almost all circumstances, flight using visual flight rules can only be conducted with at least three miles of visibility and a ceiling of at least 1000feet.

Visibility may be reduced by many conditions including clouds, rain, snow, fog, haze, smoke, blowing dust, sand, and snow. A similar condition called "white out" can occur where there has been snowfall..

The aircrew must also have adequate visibility in the search area in order to establish the proper scanning range (see the section on Scanning Techniques and Sighting Characteristics). Search visibility may be different than expected and your search pattern may have to be adjusted accordingly.

Turbulence

Turbulence is irregular atmospheric motion or disturbed wind flow that can be attributed to a number of causes. Under almost all circumstances, small amounts of normal atmospheric turbulence can be expected and it usually poses few problems. Convective activity, wind flow and aircraft wakes can be causes of turbulence.

Turbulence can be inconsequential, mildly distracting, nauseating, or destructive depending on its intensity. Turbulence can often be avoided by changing altitudes. Aircraft manufacturers publish *maneuvering speeds* in the operating handbooks. If the maneuvering airspeed of an aircraft is exceeded in turbulent air, structural damage could occur.

Turbulence can become a major factor in search effectiveness. Any scanner who is uncomfortable or nauseous cannot perform his duties at a very high level of effectiveness. If you experience these sensations, inform the pilot immediately before you become airsick. The pilot will change the aircraft motion or altitude to minimize the turbulence and reduce the chance of airsickness. The search mission may be aborted and the aircraft returned to mission base if your airsickness or nauseous does not go away. A sick scanner is not up to scanning the search area effectively for the search objective.

Questions

1. How may a scanner be affected by turbulence?
2. What should you do when you start feeling nauseous?
3. What are the FAA minimum standards for visual flight reported above?

High Altitude and Terrain Affects

Flying at high altitudes has a significant effect on both your performance and that of the aircraft. In a CAP light aircraft, anything from about 5,000' above sea level may be considered high altitude under the right conditions. The reason you would be flying at higher altitudes on a search mission is because your search area is in the mountains with their unique problems. You as a scanner must be prepared for the effects of altitude an our performance.

Effects on crewmember performance

Dehydration

The higher altitude with the changes in temperature and humidity can have a degrading effect on the ability of each crewmember to perform his or her job.

When operation in high temperatures and higher altitudes where the humidity is frequently lower, crewmembers should make every effort to drink plenty of water, juice or caffeine-free drinks prior to, during and after each sortie to help prevent dehydration.

Typical dehydration conditions are: dryness of the tissues and resulting irritation of the eyes, nose, and throat, and fatigue relating to the state of acidosis (reduced alkalinity of the blood and body tissues).

Ear block

As the aircraft cabin pressure decreases during ascent, the expanding air in the middle ear pushes the eustachian tube open and escapes through the nasal passages. Thus the air pressure in the ear is equalized with the cabin pressure. But during descent, you must periodically open or clear the eustachian tube to equalize pressure. This can be accomplished by swallowing, yawning, tensing muscles in the throat or, if these do not work, by the combination of closing the mouth, pinching the nose closed and attempting to blow through the nostrils (valsalva maneuver).

An upper respiratory infection such as a cold, sore throat, or a nasal allergic condition can produce enough congestion around the eustachian tube located in the throat to make equalization difficult. Consequently, the difference in pressure between the middle ear and aircraft cabin can build up to a level that will hold the eustachian tube closed, making equalization difficult if not impossible. This problem is commonly referred to as an "ear block." Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the eustachian tube. If fuel permits, climbing back to altitude and descending very slowly may relieve the ear block.

An ear block can produce severe ear pain and loss of hearing that can last from several hours to several days. Rupture of the eardrum can occur in flight or after landing. Alternately, fluids can accumulate in the middle ear and become infected. If an ear block does not clear shortly after landing, a physician should be consulted.

An ear block is prevented by not flying with an upper respiratory infection or nasal allergic condition. If you can't easily clear your ears on the ground; don't fly!

Sinus block

During ascent and descent, air pressure in the sinuses equalizes with the aircraft cabin pressure through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around the opening to slow equalization. As the difference in pressure between the sinus and cabin mounts, it will eventually plug the opening. This "sinus block" occurs most frequently during descent and causes **excruciating pain.** If fuel permits, climbing back to altitude and descending very slowly may obtain relief of the sinus block.

A sinus block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Do not fly with these conditions!

Hypoxia

Hypoxia is a state of oxygen deficiency in the body that can be sufficient to impair functions of the brain and other organs. Hypoxia from exposure to altitude is due to the reduced barometric pressures encountered at altitude and the resulting decrease in available oxygen. Although deterioration in night vision occurs at a cabin pressure altitude as low as 5,000 feet, other significant effects of altitude hypoxia usually do not occur in the normal healthy crewmember quite so low. Each person reacts differently to hypoxia and each of us has our own unique intolerance to oxygen starvation. The reported symptoms of hypoxia are headaches, drowsiness, dizziness and general mental impairment but they are frequently masked by a general feeling of euphoria, the happy drunk, which makes the condition even more insidious.

Some people can fly at 12,000 without showing any hypoxic symptoms, others start displaying symptoms at a much lower altitude.

To prevent hypoxia; heed the factors that reduce tolerance to altitude, use supplemental oxygen from an appropriate oxygen system and maintain a comfortable, safe cabin pressure altitude.

Aircraft performance limitations

The aircraft also suffers some impairment as the altitude increases. The air becomes less dense so the engine has a harder time developing power and the wings don't develop as much lift. The propeller, which is also a small wing with its own airfoil, doesn't produce as much thrust. The net result is that as the aircraft climbs, it becomes less efficient. The negative effects on the aircraft as it increases in altitude are, of course, due to the less dense atmosphere. The same decrease in density occurs with an increase in temperature or an increase in humidity. Each of these affect the density of the atmosphere and have an affect on the performance of the aircraft. You don't want to be heavily loaded on a hot, humid day and try to take off at Big Bear!

Mountainous terrain

Flying in high altitude mountainous terrain, such as the Sierras requires special training that is beyond the scope of this course.

Questions

1. Generally speaking, as the altitude and temperature increase the aircraft performance _____.
2. During a descent your ear become blocked. Swallowing or yawing does not unblock it. What maneuver should you attempt?
3. You are flying on a hot day and feel that you are becoming dehydrated. You should drink plenty of fluids but avoid those with _____.
4. Your nasal allergies are acting up. You take an oral decongestant and are carrying a decongestant spray as a back up. Should you fly a search mission?

Navigation and Position Determination

Navigation is the process of continuously determining your position so you can get from one place to a desired location. Navigation and position determination is critical to the CAP mission. It doesn't do much good to find your search objective if you don't know where you are when you do. The pilot and/or observer are responsible to know where the aircraft is. Your duty as a scanner is to find the search objective, not keeping track of where you are. However, you will have to help locate the search object on a chart or map.

Latitude and longitude

Navigation begins with is a common reference system or imaginary grid "drawn" on the earth's surface by ***parallels of latitude* and *meridians of longitude.*** The numbers representing a position in terms of latitude and longitude are known as the coordinates of that position. Each is measured in degrees, and each degree is divided into 60 smaller increments called minutes. Each minute may be further divided into 60 seconds but more usually it is divided into tenths and hundredths of a minute.

Latitude

The equator is a great circle midway between the poles, Figure 24. Parallel with the equator are lines of latitude. Each of these parallel lines is a small circle, and each has a definitive location. The location of the latitude is determined by figuring the angle at the center of the earth between the latitude and the equator.

The equator is latitude 0º, and the poles are located at 90º latitude. Since there are two latitudes with the same number (two 45º latitudes, two 30º, etc.) the letter designators N and S are used to show which latitude is meant. The North Pole is 90º north of the equator and the South Pole is 90º South. Thus the areas between the poles and the equator are known as the northern and southern hemispheres. A written example of latitude is, "36º 5.5'N".

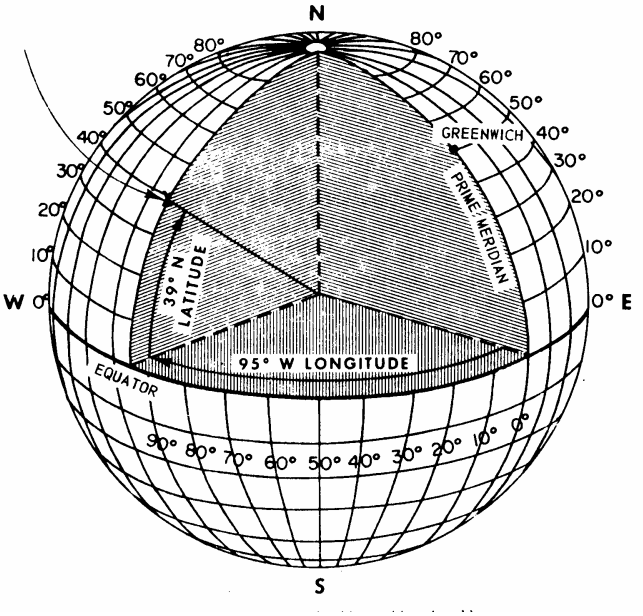


Figure 24

Longitude

There is no natural starting point for numbering longitude. Therefore the solution was to select an arbitrary starting point. It is the meridian through the observatory in Greenwich, England. The meridian through Greenwich is sometimes called the first, zero, or prime meridian.

Longitude is counted east and west from this meridian through 180º. Thus the Greenwich Meridian is the zero degrees longitude on one side of the earth. After crossing the poles, it becomes the 180th meridian (180º east or west of the 0-degree meridian). Therefore we have all longitudes designated either west or east, for example, 140º E or 90º W. The E and W designations define the eastern and western hemispheres. A written example of longitude is, "119º 32.0'W".

Position location

This system is used to precisely locate any point on the earth's surface. When identifying a location by its position within this latitude-longitude matrix, you identify the position's ***coordinates***, always indicating latitude first, and then longitude. When a search object is found, it has to be located on the chart by other means before the coordinates can be determined.

Map reading or other electronic aids will be used to locate it on a chart or map. The Ground Positioning System (GPS) simplifies the location process by reading out the latitude and longitude of the aircrafts location.

Plotting a Position

The United States is located in the North and West hemispheres. Therefore, in the United States, the latitude will always be north direction and the longitude will always be west direction. Referring to Figure 25, the parallels of latitude are horizontal on the chart and the lines of longitude are vertical. The entire square covers an area of 1 degree north and west as indicated by the black degree numbers in the four corners. This area would be described as 36º N and 123º W. Each vertical line of longitude is divided and marked in 1 minute units that measure the distance between the lines of latitude. For ease in counting each 5 units are indicated by a wider mark, 10 units by a mark going through the longitude line, and 30 units with a line through the entire area. There are 60 units from 36º to 37º N or 60 minutes in 1 degree.

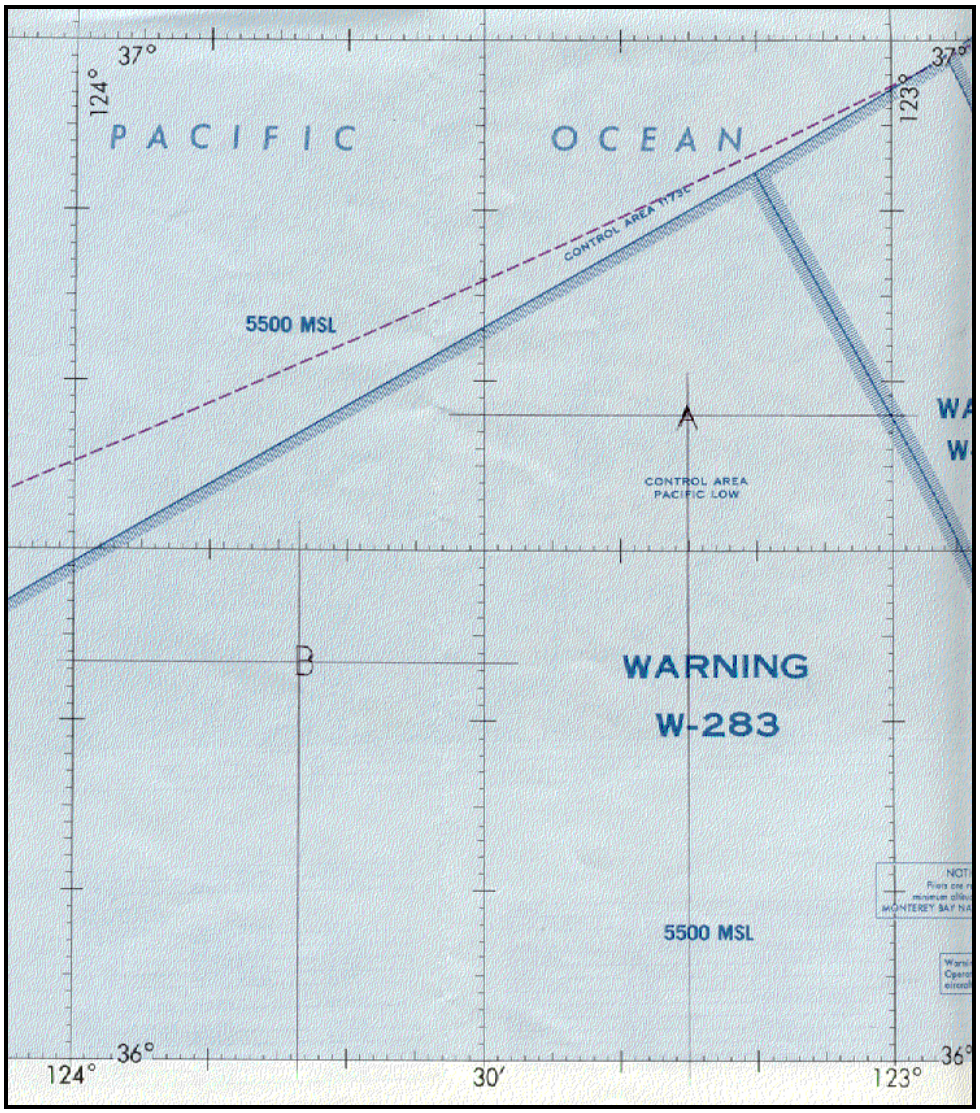


Figure 25

This all sounds a bit complicated but follow the directions below to see how it is done.

Plot three points from the given sets of coordinates.

A. 36º 38.0' N
123º 15.0' W

B. 36° 23.25' N
123º 43.5' W

C. 36º 48.0' N
123º 22.5' W

1. Start counting at the intersect1on of 36° 00.0' N and 123° 00.0' W.

2. For point A, count up 38’ on the closest longitude line (123° 00.0' W) towards 37° 00.0' N. This indicates an increasing or more northerly coordinate from your starting point. Make a line from the 38’ mark to the 38’ mark on the next higher (westerly) longitude line. (123° 30.0' W)
3. Next count left on the latitude line (36° 00.0' N) towards 124° 00.0’ N for your 15’. This indicates an increasing or more westerly coordinate from your starting point. Make a line from the 15’ mark to the 15’ mark on the next higher (northerly) latitude line. (36° 30.0'N)
4. The intersection of your two lines is the location of the coordinate set.
5. Follow the same steps to arrive at point B.
6. Plot point C. Your intersection should plot out on the letter "'N" in “CONTROL AREA 1173”.

A coordinate practice sheet is at the end of the section for your practice.

Sectional Charts

The most important tool you will use in both mission planning and execution is a Sectional Aeronautical Chart (Used by all pilots), sometimes simply referred to as the ***"sectional".*** Visual air navigation charts must have certain basic features including; navigational reference system superimposed over the terrain depiction, identifiable, measurable scale to measure distances, and detailed graphic depiction of terrain and culture or man-made features. Highway road maps are usually not acceptable for air navigation, since most don't have detailed terrain depiction and also lack the superimposed reference system.

A most important part of the sectional or any other chart is the chart legend. This is a written explanation of symbols, projections, and other features used on the chart. The title panel identifies the region of the country shown by the chart, indicates the scale used in drawing the chart, explains elevations and contour shading, and shows the expiration date of the chart and effective date of the next issue of that chart. Other important areas of the sectional chart are its title page or "panel", and the margins around the chart edges. The margins contain supplemental radio frequency information, details about military or ***special use airspace,*** other applicable regulations and rulers to measure distances in kilometers, and statute or nautical miles.

You will need a sectional chart covering your local area. Ask a pilot in your squadron for an old sectional chart. It does not have to be current because it will be used to locate search grids, and not for navigation. Study the chart to learn what the symbols are used for. Especially compare how the chart represents the area you live in and the things you are familiar with. Locate your house or place of work. Find the coordinates of your house.

Shading is added to sectional charts to help highlight and give contrast to the contour lines. Gradient tints, the "background" colors on charts, indicate general areas of elevation. The height range assigned to each gradient color is indicated on the title panel of each sectional chart.

The sectional chart contains a maximum elevation figure (MEF). The MEF, shown in each quadrangle bounded by ticked lines of latitude and longitude, is represented in thousands and hundreds of feet above mean sea level. The figure is printed in dark blue normally near the center of the quadrangle. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.). in Figure 26, the “68” represents 6,800 Ft as the highest know feature in the quadrangle. Figure 26 also shows the elevation gradient tints and spot elevations. A spot elevation is the height of a specific point. On the sectional charts, this height is indicated by a number next to a black dot, the number indicating the height of the terrain above sea level.

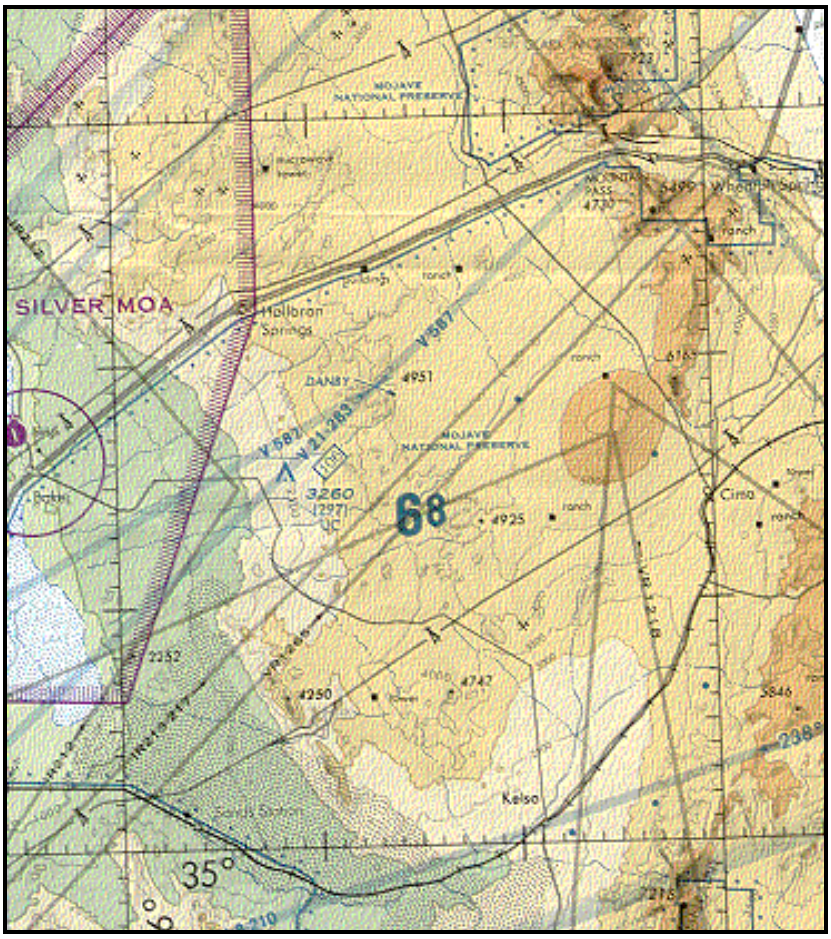


Figure 26

Experience is the best teacher for learning chart interpretation. Every time you go flying take along sectional chart. Compare what the chart symbols are to what you are really seeing on the ground.

Standardized Grid Systems

A grid is a network of regularly spaced horizontal and vertical lines used to help quickly locate points on a map. Most city street maps have grid systems that help motorists locate streets or other points of interest. The Civil Air Patrol has adopted a standard grid system built upon the matrix of lines of latitude and longitude and the sectional aeronautical chart.

The sectional grid system used by Civil Air Patrol divides each sectional chart into a number of squares. This process begins by dividing the whole area into **30 *minute*** grids, using the 30-minute latitude and longitude lines as shown in Figure 11-4. Finally, each of the 30-minute grids is divided into four ***15 minute*** grids, using the 15 and 45 minute latitude and longitude lines as shown in Figure 27.

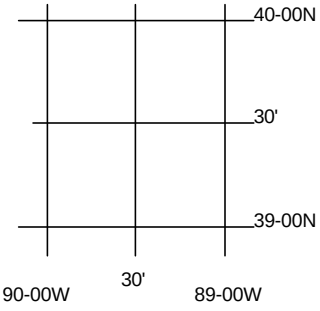


Figure 27

Next, the grid squares are numbered 1 through the number of grids shown on the Standard Grid Charts at the end of this section. The numbering begins with the most northwest square on the entire sectional, and continues left to right. Example, The numbering for the San Francisco Sectional begins at 1 and goes through 28 on the first row. The second row resumes with number 29 placed beneath number 1, 30 beneath 2, and so on through 56. Numbering continues through successive rows until all 448 squares have a number.

In Figure 28, each 15-minute grid square has the number it would have received if this demonstration had started with the entire St. Louis sectional chart.

In some areas, two sectionals overlap by one full degree of longitude. Where charts overlap, the CAP always uses the numbers from the western most chart in the area of overlap.

A 15-minute grid can be divided into 4 more quadrants using 7 1/2 degree increments of latitude and longitude, creating 4 equal size grids that are approximately 7 1/2 miles square. This is the level that you will most likely be assigned when searching grids. The quadrants are then identified alphabetically - A through D – as shown in Figure 29. A search area assignment in the southeast quadrant may then be made as, "Search STL 5D", where “STL” is the sectional abbreviation, “5” is the grid number and “D” is the quadrant within the grid.

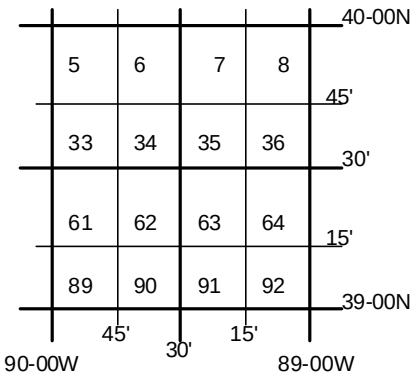


Figure 28

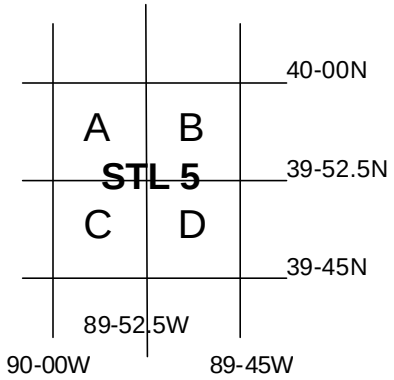


Figure 29

Gridding Your Chart(s)

You must have a gridded chart(s), more then one sectional may be needed, for your local search area. Before you start to grid your chart, ask a mission pilot, observer or qualified scanner if you can see theirs. This will give you have an idea of what the gridded chart will look like, which sectional charts you will need, and what the grid numbers are. An out-of-date chart(s) may be used for gridding. **DO NOT USE GRIDDED CHARTS FOR NAVIGATION!!!**

Pre-gridded charts may be bought. For information contact the web sites at, www.nhs.mnwg.cap.gov/html or www2.bitstream.net/-storius/gridded/html. Gridding a Chart can take 2-3 hours so this might be something to consider.

Draw your grid lines with a water-based magic marker. Choose a color that will contrast with the dominant colors on the chart and will not obscure any symbols and lettering. A fine point marker is also recommended. Some people avoid red because it will not show up at night with red cockpit lights. Fluorescent colors seem to work well. If you make a mistake in your gridding or numbering, dip a cotton swab into bleach, erase your mistake, and allow the chart to dry before making corrections. This will not harm the chart itself if you use only a drop or two of bleach. Your charts will last much longer if you laminate them or cover them with clear contact paper after they have been gridded.

Begin gridding by following the lines of latitude and longitude on your chart with your magic marker, both the degree and thirty-minute lines. Notice that these lines are somewhat curved because of the curvature of the earth. A long straight edge may help to draw the lines especially the vertical meridian lines of longitude. However, the long straight edge does not work as well on the more curved parallel lines of latitude. When you have completed this task on both sides of your chart, you will need to draw an additional line at the halfway point between each of the lines you have drawn, both horizontally and vertically. These are on the fifteen-minute markers. Then you can number the grids you have drawn, being certain that your first number is in the first FULL grid at the northwest corner of your chart. Refer to the gridding instruction charts at the end of this section. Continue gridding according to the instruction chart, stopping at the end of each row to make sure you are numbering properly. Note that, because sectional charts overlap, you must follow the specific instruction chart for the sectional chart you are gridding.

Because a 15-minute square grid covers a large area of more than 200 square miles, we often subdivide the grids into four 7.5-minute squares. We generally do not draw these subdivisions on our gridded charts because the charts become too cluttered and difficult to read.

While you are gridding your sectional chart, take time to become familiar with the symbols used on it. You must possess at least a basic knowledge of map skills in order to be an effective aircrew member.

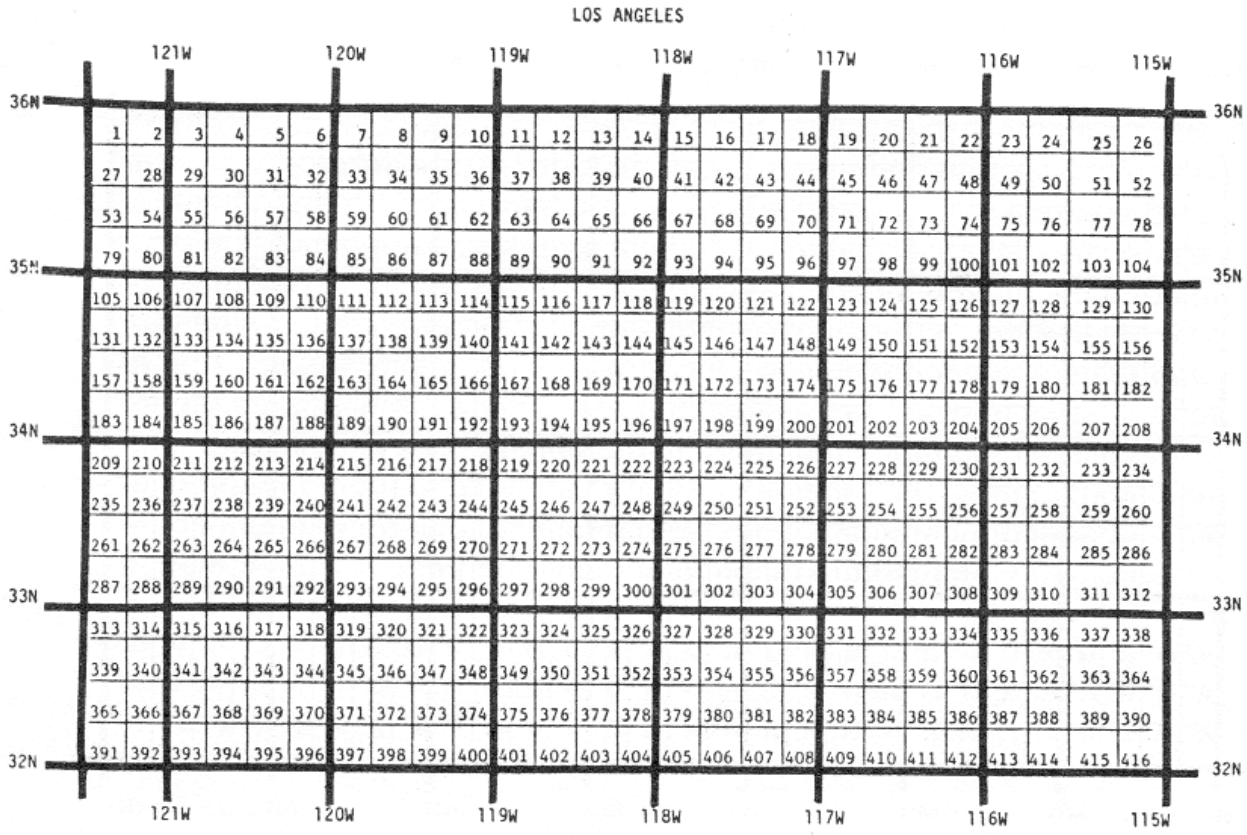
It is also important for you to carry a road map of the area you are searching. Maps available from AAA have

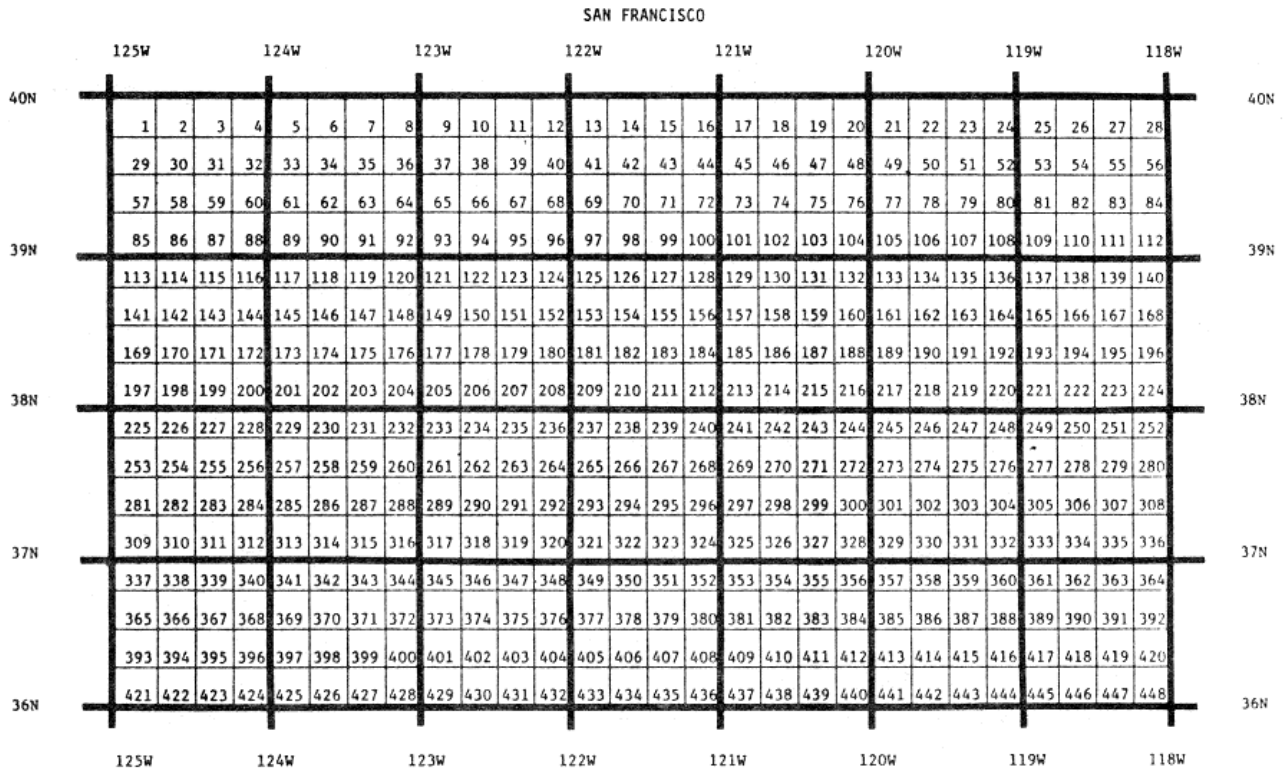
latitude and longitude marks that make them easier to grid or locate coordinates on. Road maps used in conjunction with aeronautical charts make identification of landmarks easier and enable you to be more efficient in leading ground teams to a crash site.

Questions

1. The sectional chart's grid numbering system is based on a grid defined by _____ minutes of latitude and longitude.
2. Contour lines, shading, color gradient tints, and spot elevations are used on a sectional chart to depict what?
3. All United State's _____ is North and all _____ is West?
4. The four quadrangles in a sectional chart grid are labeled A, B, C and D in what order?
5. If two sectional charts overlap, which chart's numbering system is used?
6. When plotting or determining the coordinates of a point in the United States, latitude is always measured _____ and longitude always measured to the _____ from the starting point.
7. The dark blue Maximum Elevation Figure (MEF) in each quadrangle indicates _____?

Standard Grids





You can find Phoenix and Klamath Falls on the website

Coordinate Practice Sheet

The coordinate sets on this sheet are from the San Francisco and Los Angeles Sectional charts. They are presented for your practice in plotting coordinates. An object description of what is located at the set of coordinates is included below the coordinate sets. A correctly plotted set of coordinates may not find the describe object because the information on the sectional charts changes over a period of time. If your plot does not fall on the describe object, replot the coordinates to check for a mistake. Go on to the next set of coordinates if your plot is correct.

Los Angeles Sectional Coordinates

1. 34° 37.0'N 117º 34.0'W	2. 34° 55.5'N 117° 22.5'W	3. 35° 40.0'N 117° 21.0'W	4. 35° 22.0'N 120° 02.0'W	5. 36° 01.0'N 120° 03.0'W	6. 35º 31.0'N 119° 03.5'W
7. 35º 11.0'N 120° 05.0'W	8. 34° 34.5'N 118° 23.0'W	9. 34° 22.5'N 117º 18.5'W	10. 35° 44.0'N 118° 38.0'W	11. 35° 31.5'N 116° 26.0'W	12. 35° 08.5'N 116° 06.5'W

1. Glider symbol indicating glider activity.
2. An abandoned airfield.
3. Salt evaporators.
4. Solar collectors.
5. Oil Tank (A small round circle also indicates a small community.)
6. A group of towers with tops 453 feet above the ground (AGL).
7. A fire lookout tower.
8. A dam.
9. Hesperia airport, which is designated as a Visual Check Point for aircraft traffic control.
10. A power transmission line. They may be a hazard if they are hanging across the valley.

11. Avawatz Pass through the hills.
12. The community of Zzyzx.

San Francisco Sectional Coordinates

1. 38° 34.0'N 118° 37.0'W	2. 39° 07.0'N 121° 53.0'W	3. 38° 40.0'N 123° 17.0'W	4. 39° 44.0'N 122° 10.5'W	5. 38° 35.0'N 121° 53.0'W	6. 36° 58.0'N 119° 13.5'W
7. 36° 20.0'N 118° 00.0'W	8. 36° 02.0'N 120º 04.0'W	9. 36° 43.0'N 120º 47.0'W	10. 36° 57.5'N 122° 01.0'W	11. 37° 40.0'N 121° 32.0'W	12. 36° 23.0'N 121° 40.0'W

1. Hawthorne munitions storage area with all its rail lines.
2. Sanborn airfield.
3. A sawmill.
4. A racetrack that may at a school.
5. A parachuting jump site.
6. A power transmission line. They may be a hazard if they are hanging across the valley.
7. A dry lake. How it looks can change in wet weather.
8. An oil well. Note that a small open circle also represents a small community.
9. Panoche VOR.
10. A pier in the ocean.
11. A restricted area. The top section of the chart identifies it as the Tracey Restricted Area with altitude and times of activity.
12. Los Padres dam which is designated as a Visual Check Point for air traffic control.

Aircrew Coordination and CRM

Assignment and Coordination of Duties

Assignment of aircrew duties is based on CAPR 60-3. All flight-related duties are conducted under the supervision of the pilot or aircraft commander.

It is very important for each crewmember to know what they are supposed to be doing at all times and under all conditions. Aircraft safety duties vary with the start up, taxi, takeoff, departure, transit, approach and landing phases of flight. Mission duties are related to the mission objective, primarily to fly the aircraft safely and precisely (the pilot) and to scan effectively (scanners and observers).

The same general principles of crew coordination and resource management apply to all the members of the aircrew team. External resources can be people, equipment, or simply information. Incident commanders, planning section chiefs, operations section chiefs, SAR/DR pilots, mission observers, scanners, air traffic controllers, and flight service station personnel should all be considered sources for appropriate information by the aircrew team. Internal resources are primarily training and experience. Each crewmember must be able to identify the resources available to him or her, determine where the resources can be located when needed, and effectively incorporate those resources into the mission.

In order for any information to be used, it must be effectively communicated. The effective communication process that leads to good crew coordination actually starts well before a flight begins. Each member must pay close attention during the briefing to every detail presented. Clear understanding of the "big picture," search objective, altitudes, area assignments, and search patterns to be used ***prior*** to departure will preclude questions and debate in flight, when other tasks should take higher priority. Crewmembers having questions are encouraged to ask them at this time. The incident commander or air operations officer will normally establish certain safety-related rules for conducting that particular mission.

Workload management and task distribution are very important in developing the actual mission operational plan. An over-tasked crewmember may not develop a complete grasp of mission aspects that later may affect his or her performance. Remain alert for over-tasking in other crewmembers, and offer help if possible. If you find yourself over-

tasked, do not hesitate to ask another qualified member for help. Each team member must continually think "teamwork."

Close attention should be paid during the pilot's briefing. The pilot will establish flight-specific safety "bottom lines" at this time, such as emergency duties and division of responsibilities. Each individual must again clearly understand his specific assigned duties and responsibilities before proceeding to the aircraft.

Recent air transport industry statistics show that 67% of airline accidents during a particular survey period happened during only 17% of the flight time, the taxi, takeoff, departure, approach and landing phases. The FAA has designated these phases of flight as critical, and has ruled that the cockpit environment ***must*** be free of extraneous activity and distractions during these phases to the maximum extent possible (the ***sterile cockpit***). The sterile cockpit concept should be adhered to during the search phase of the mission also. Anything that disrupts the scanners concentration can result in a missed search objective.

In assigning scanning responsibilities to the scanners, pilots or mission observers must be receptive to questions and suggestions from the scanners. Carefully consider suggestions and understand that suggestions are almost always offered constructively, and are not intended to be critical. Answer questions thoroughly and openly, and don't become defensive. All doubts or questions that you can't answer should be resolved as soon as possible.

Crew Resource Management (CRM)

Crew Resource Management (CRM) was developed by the airlines and later adopted by the U.S. Air Force. Over the years it has gone through several different names and stages. The Air Force, and CAP, has recognized this safety concept and over the past several years, aggressively started building programs to protect crewmembers and aircraft.

CRM focuses on the attitudes and behaviors of the crew in order to increase effective team coordination. Although we focus on the CAP aircrew remember that your A&P, the mission staff, and air traffic control are also part of your team.

It is essential that everyone in the aircraft feel free to speak up and provide input and ideas. Even the crewmember that has only flown once may have the critical idea that could save an entire plane or mission.

Statistics

CAP	**1996**	**1997**	**1998**	**1999**	**2000**
Aircraft accidents	9	5	6	3	1
Per 100,000 hours	7.79	4.16	4.76	2.34	0.94
Aircraft flight incidents	28	27	19	12	16
Aircraft ground incidents	7	8	3	6	8
Fatalities	7	2	3	2	0

Figure 30

While the overall CAP aircraft accidents (as defined by dollar and injury loss) have decreased, Figure 30, the number of flight and ground incidents are up over last year.

We use statistics to show us where we are having problems, which will hopefully help us, correct those problems. Where do we need to focus our attention? Lets look at some other statistics in Figure 31.

MISHAP	**1998**	**1999**	**2000**
Taxi	9	4	9
Ground	4	6	3
Landing	8	8	10
Other	4	3	2

Figure 31

Taxi mishaps are mishaps where a crewmember was in the aircraft and moving it under aircraft power. All of these are a result of colliding with something, or going off the paved surface into a ditch in many cases these mishaps occurred with more than one pilot onboard.

Ground mishaps were due to moving the aircraft with human power, such as pushing or pulling the aircraft in and out of a hanger. Five of these totals were a result of opening or closing a hanger door and hitting the aircraft.

Landing mishaps (constantly high numbers) have a potential for great damages to aircraft and injury to personnel due to the phase of flight.

A critical concept that needs to be enhanced is that, if any crewmember sees a problem or doesn't like the landing situation, they need to call "GO-AROUND." The pilot should then immediately perform a go-around (unless a higher emergency exists). **Every crewmember, pilot or not, has the right and the responsibility to keep themselves alive**. Maybe the scanner in back notices that the main tire is flat, tell the pilot! Everyone MUST speak out, and the pilot MUST act on it.

Other mishaps occurred when two separate crews flew the aircraft out of fuel and crashed. The other mishaps were caused in flight by stalling the aircraft for some reason, or reasons that have not been determined by the NTSB.

Situational Awareness

Simply put, situational awareness (SA) is "knowing what is going on around you at all times." SA is not restricted to just pilots -- everyone must exhibit SA at all times. Each crewmember must have their SA at peak levels while flying because it takes everyone's awareness to keep the plane safe in flight. Scanners and observers have their own unique positions and functions that require full attention, so their SA is essential to the safe operation of any CAP flight.

Examples of good SA attitudes are; good mental health with good physical health no fatigue, sickness, hydration, and stress factors, attentiveness to the task at hand, and inquisitiveness by asking questions, challenging ideas, and asking for input.

Common reasons for loss of SA are:

- ***Strength of an idea.*** Someone has an idea so strong and ingrained that they won't listen to anything else. The antidote to this is to ask questions or revert to training.
- ***Hidden agenda.*** Someone has a personal agenda, but keeps it hidden. The antidote is to be honest, and to express ideas and intentions.
- ***Complacency.*** Someone has done a certain task so often that they forget about the risk. The antidote is to revert to training, and realize that even if you've done it a hundred times before, the one hundred and first can still hurt you.
- ***Accommodation.*** Repeated exposure to threats or stress situations will decrease alertness or awareness, which leads to a form of complacency.
- ***Sudden Loss of Judgment.*** Something quickly distracts a person and gets their full attention. Whatever they were doing or should be doing is now gone.

Symptoms of loss of SA vary, but a few are; fixation, ambiguity, complacency, euphoria, confusion, distraction, overload, and improper performance of tasks or procedures. Also, look for ***hazardous attitudes*:**

- Anti-authority (Don't tell me!). The antidote is to follow the rules.
- Impulsiveness (Do something NOW!). The antidote is to slow down and think first.
- Invulnerability (It won't happen to me!). The antidote is to realize that, yes, it can happen to me.
- Macho (I can do it!). The antidote is to realize that this attitude can hurt others beside yourself.
- Resignation (What's the use?). The antidote is to realize that you can make a difference, and to ask for help.
- Get home-i-tus (I've got to be home by 5!). Its better to be late than to be dead.

Regaining Situational Awareness

Once we have lost situational awareness, or recognized the loss in another crewmember, how do we get it back? A few methods are to:

- ***Listen to your gut feelings***. If it acts like an idiot and talks like an idiot, then it is probably is an idiot.

- ***Use terms like "Time Out" or "Abort" or "This is Stupid."*** Once terms like these are called, the pilot should terminate the task or maneuver, climb away from the ground, establish straight-and-level flight and then discuss the problem. [The term you use should be agreed upon before the flight.]
- ***Keep the cockpit sterile*****.** keep talk to the minimum necessary for safety and mission accomplishment.

Barriers to Communication

Rank, gender, experience level, age, personality, and general attitudes can all cause barriers to communication. You may occasionally be hesitant to offer an idea for fear of looking foolish or inexperienced. You may also be tempted to disregard ideas that come from individuals that have a lower experience level. If you are committed to teamwork and good crew coordination, you must look through such emotions and try to constructively and sensitively adapt to each personality involved.

You can deal best with personalities by continually showing personal and professional respect and courtesy to your teammates. Criticism will only serve to build yet another barrier to good communication. Always offer opinions or ideas tactfully, respectfully and constructively. Instead of telling the pilot, "You're wrong," tell him what you ***think*** is wrong, such as "I think that new frequency was 127.5, not 127.9."

Personal factors, including individual proficiency and stress, may also create barriers to good communication. Skills and knowledge retention decrease over time, and that is why regular training is necessary. If you don't practice regularly, you very likely will spend a disproportionate amount of time on normal tasks, at the expense of communication and other tasks.

Stress can have a very significant, negative effect on cockpit communication. An individual's preoccupation with personal, family, or job-related problems distracts him or her from paying complete attention to mission tasks and communication, depending upon the level and source of stress. Many fliers and medical specialists advocate refraining from flying or other complex tasks until the stress is removed.

In an emergency, there will likely be much more stress with which each crewmember must cope. Since very few emergencies result in immediate or rapid loss of an airplane, most experienced aviators recommend making a conscious effort to remain calm, taking the amount of time necessary to properly assess the situation, and only then taking the appropriate corrective action.

Part of your job is to recognize when others are not communicating and not contributing to the collective decision-making process. Occasionally, other crewmembers may need to be actively brought back into the communication process. This can often be done with a simple "What do you think about that?" In a non-threatening way, this invites the teammate back into the communication circle, and, in most cases, he or she will rejoin the information loop.

Questions

1. Keeping talk in the cockpit to a minimum for safety and mission accomplishment is known as a _____.
2. What CAP Regulation covers aircrew duties?
3. CRM focuses on _____ in order to increase the effective crew coordination.
4. What may be one way of breaking down a barrier to communication?
5. A "hidden agenda' is an example of how what may be lost?
6. What is the pilot's duty?
7. Get home-i-tus is a _____ of a hazardous attitude that could result in a loss of situational awareness.

AT THIS POINT, TAKE THE SCANNER TEST WHICH CAN BE FOUND AT THE CAWG WEBSITE.

Question Answers

Aircraft Operations and Limitations Section Answers

1. 50 feet.
2. From the rear.
3. It cannot be seen while spinning and moving the propeller could “fire“ the engine because of the engines ignition system.
4. At all times in the aircraft.
5. Stowed or secured.
6. It will be part of the pilot’s briefing before each CAP flight.

Survival Section Answers

1. An “X”.
2. Water.
3. 121.5 MHz.
4. By rolling or rocking the aircraft.
5. A distress signal.
6. Stop and assess the situation, think and don’t panic, organize your survival equipment, and plan how you will survive until rescued.
7. For the worse conditions you fly over.

First Aid Section Answers

1. To save their life.
2. There is breathing and a pulse.

Aviation Weather Section Answers

1. It could make you airsick and not capable of scanning effectively.
2. Tell the pilot.
3. Three miles and 1000ft.

High Altitude and Terrain Affects Section Answers

1. Decreases
2. Close your mouth; pinch your nose closed and attempt to blow through your nostrils (valsalva maneuver). Or have the pilot climb and descend more slowly.
3. Caffeine, because it adds to the dehydration.
4. No

Navigation and Position Determination Section Answers

1. 15
2. Relief features
3. Latitude, longitude
4. A – upper left, B – upper right, C – lower left and D – lower right
5. The western most chart
6. Up, left
7. The highest known obstruction

Aircrew Coordination and CRM Section Answers

1. Sterile cockpit.
2. CAPR 60-3.
3. Attitudes and behaviors of the crew.
4. Asking, “What do you think about that?”
5. Situational awareness.
6. To fly the aircraft safely and precisely.
7. Symptom.