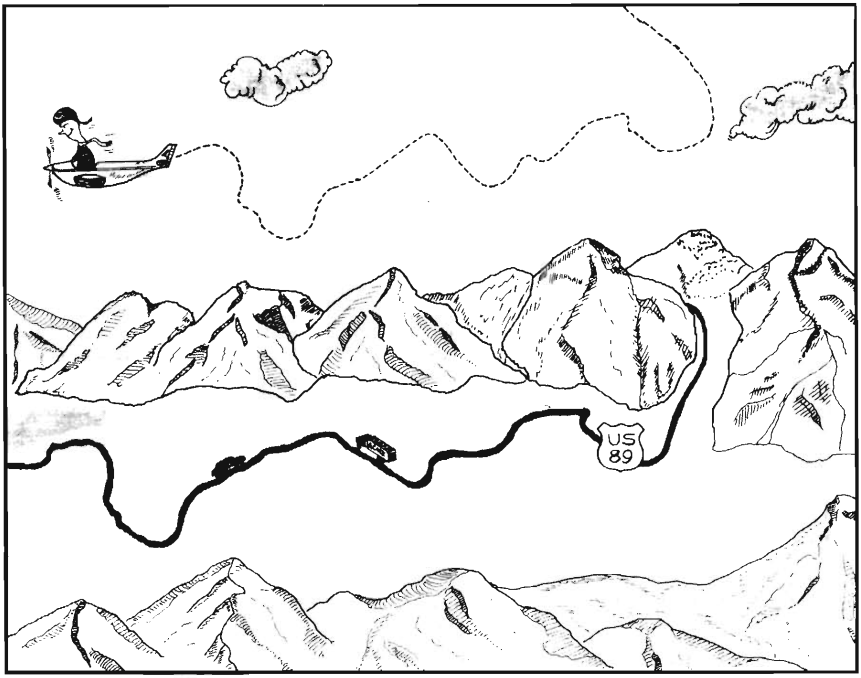
tained in current charts will enhance the pilot's ability to complete the flight with greater confidence, ease and safety.




## ROUTES

It can be proven the shortest distance between two points is a straight line; therefore, a majority of pilots desire direct routes for most flights. Quite often there are factors that should be considered that may make a direct flight in the mountains undesirable. And, in fact, most mountain flights are not along a direct route. A good general suggestion as to the best route to follow through mountainous regions is to choose a main highway that runs along or near the desired course and stay with it even though it means meandering somewhat. This is sound advice for almost any kind of difficult, isolated or unfamiliar terrain.

Many pilots prefer to "dog-leg" it rather than fly direct. Properly planned, the comparatively few additional miles of dog-legging shortens the distance of mountain flying considerably and skirts the higher terrain.

Sectional charts contain diamond-shaped "foot-prints" to aid you in picking a route through the mountains. This route has been carefully chosen to provide you with the maximum margin of safety, not only from the flying comfort standpoint, but from an emergency standpoint as well, by providing the best terrain clearance, the best radio reception and the better forced landing places.

Route selection must also allow for the possibility of mountain waves. Fly the windward side rather than the leeward side of the mountains if the winds aloft are greater than 20 knots. This will place you in the predominant updraft area rather than the downdraft area; then turbulence, if any, should be minimized.

Don't be too proud to ask "local senior pilots" or others knowledgeable about the area concerning the best route to take.

## NAVIGATION LOG

Precise flight planning of log items such as pre-computed courses, time and distance, navigational aids, and frequencies to be used will make enroute errors in these items less likely to occur. Special attention should be given to fuel requirements, keeping in mind the need for ample reserve as well as the location of refueling points available as the flight progresses.

## VFR FLIGHT PLAN

This is NOT REQUIRED by FAR's, but is DICTATED BY GOOD OPERATING PRACTICE. A flight plan not only assures prompt search and rescue in the event the aircraft becomes overdue or missing, but it also permits enroute stations and the destination station to render better service by having prior knowledge of your flight. It costs only a few minutes of time to file a flight plan and may be the best investment the pilot ever makes. It is darn cheap insurance.

## AIRPLANE FAMILIARITY

Aircraft manuals contain operating limitations, performance, normal and emergency procedures and a variety of other operational information for the respective aircraft. Traditionally aircraft manufacturers have done considerable testing to gather and substantiate the information in the aircraft manual. The pilot should become familiar with the manual and be able to extract information relative to the proposed flight operation.

Determine the takeoff and landing distances for various density altitudes and weights at which you may be required to operate to determine if the airplane will place any limitations on your proposed flight.

Speaking of density altitude, what is it? When we set our altimeter to 29.92 inches of mercury, we read the pressure altitude, then compensate for non-standard temperatures, and we obtain a textbook value known as density altitude. I prefer to think of it as THE ALTITUDE AT WHICH THE AIRPLANE THINKS IT IS FLYING. It is important to the pilot because aircraft performance is determined from this value. And the mixture

SHOULD BE LEANED in accordance with the manufacturer's recommendations based on the DENSITY ALTITUDE, not the physical altitude.

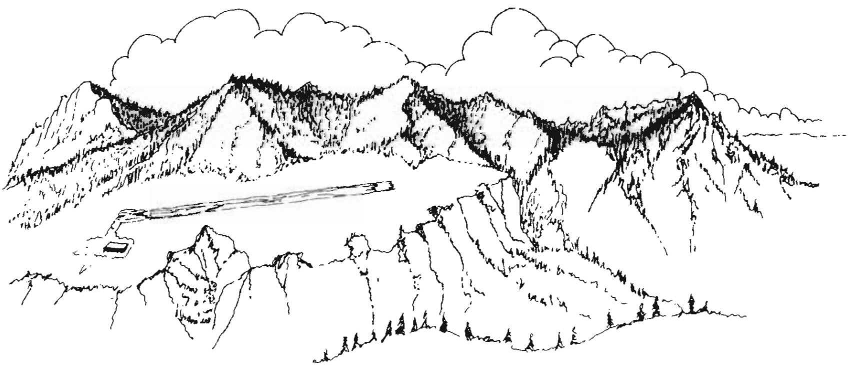
And, while density altitude is a good gauge of the performance you may expect, don't forget to consider:

- **RUNWAY SURFACE – grass, soft dirt, gravel, moist. The surface may require up to 10 per cent more runway for takeoff.**

- **RUNWAY GRADIENT – A one per cent downslope is generally equivalent to ten per cent more runway.**

- **LOCAL TERRAIN – Terrain configuration that lends to the presence of strong downdrafts and windshear once the aircraft becomes airborne on takeoff is especially critical.**

Many times if the runway is sloped, it is best to take off downhill, even with a slight tailwind. How much tailwind would be too much? This is mostly a matter of determination based on experience; however, a 1% downslope is generally equivalent to 10% more runway. A tailwind that is 10% of the takeoff airspeed will increase the no-wind takeoff distance by about 21%. By using the aircraft manual, a fairly accurate estimate of takeoff distance may be determined. Add to this an adequate safety margin until experience will help you make the takeoff determination.



**PLAN YOUR FLIGHT TO ENCOMPASS FAVORABLE WINDS ALLOWING UPSLOPE LANDING AND DOWNSLOPE TAKEOFF. WITH A STABLE AIR MASS, THE WIND FLOW WOULD GENERALLY BE UPSLOPE. WITH AN UNSTABLE AIR MASS WIND FLOW IS RADICALLY AFFECTED BY LOCAL TERRAIN CREATING SERIOUS CONTROL PROBLEMS.**

## PLAN EARLY-MORNING FLIGHTS

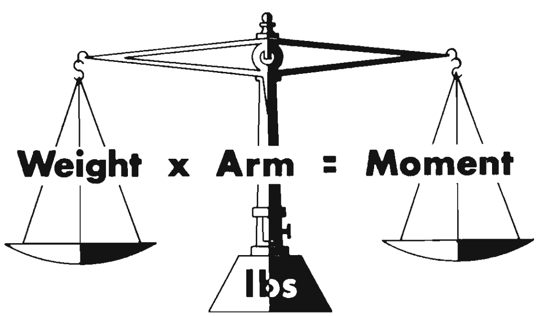
Plan early-morning flights to take advantage of the air, which is cooler and smoother. As a general rule, the air tends to get "bad" around 10:00 a.m., grows progressively worse until 4:00 p.m., then gradually improves (see FLYING BLIND). It is not necessarily dangerous to fly between 10:00 a.m. and 4:00 p.m., but the density altitude will increase, the wind will increase and there will be additional turbulence due to convection and increased wind flow during these hours. Also, early-morning and late-evening flights can generally be made closer to the ridgeline of mountains than during the heat of the day.

## WIND

As a general rule the inexperienced pilot should stay out of the mountains when the surface wind is greater than 20 knots. This indicates there will be very strong winds aloft.

Over relatively flat ground the wind will assume approximately a constant speed and direction throughout a horizontal plane. In this condition it is not necessarily dangerous to fly even in moderately strong winds; however, in the mountains you may expect the wind direction and velocity to be constantly changing due to modification from the shape of the mountains. This may constitute hazardous conditions.

Do not rely totally on the movement of cloud shadows to determine the wind direction in mountainous terrain unless you are flying at or near the cloud base. The steady state wind flow may be determined, but the wind movement over the mountains will break up and form various circulation patterns much as the water in a river. Strong winds aloft splash against the mountains on the updraft side creating updrafts for the most part, then tumble and spill down the lee side. Practice visualization of the effect of terrain on the wind. As you fly see if your visualization is showing you the updrafts and downdrafts.



## AIRCRAFT LOADING

Keep the aircraft as light as possible without skimping on fuel. Always carry an adequate fuel supply. Many situations dictate you carry more than the standard 30-minute day/45-minute night reserve for safety.

There is always the pilot who regards weight and balance data as information of interest only to engineers or airline personnel. He reasons the airplane was weighed during the licensing process and this data is valid indefinitely providing no modifications are made on the airplane. He reduces this information to a workable routine or rule of thumb such as, "If I have three passengers, I can load 100 gallons of fuel; four passengers, 70 gallons." Admittedly, this rule of thumb is adequate in most cases, but as the title "weight and balance" suggests, we are concerned not only with the weight of the airplane, but also the location of the center of gravity. The importance of the location of the CG will become apparent as you study stability, control and performance.

All airplanes are designed for certain limit loads and balance conditions. The weight primarily affects the structural capabilities and performance of the aircraft while the balance affects the aircraft's stability. An unbalanced airplane may reach a point where it is completely uncontrollable once it leaves the ground, resulting in a pitch oscillation that generally becomes worse with control input trying to stabilize the plane. The Federal Aviation Regulations stipulate that the responsibility for making sure the weight and balance limitations are met before takeoff rests with the pilot in command. Any pilot who takes off in an airplane that is not within the designated limits is not only violating the FAR, but also inviting disaster.

Since maximum allowable gross weight is established for an aircraft as an operating limitation for both safety and performance considerations, let's examine what happens when the gross weight increases. The gross weight is important as a basis for determining the takeoff distance. As the gross weight increases, the takeoff speed must be greater to produce the greater lift required for takeoff. The takeoff distance varies with the square of the gross weight. As an example, for an airplane with a relatively high thrust-to-weight ratio, a 10 per cent increase in takeoff gross weight will cause:

* a 5 per cent increase in the speed necessary for takeoff;
* at least a 9 per cent decrease in acceleration; and,
* at least a 21 per cent increase in takeoff distance.

For aircraft with relatively low thrust-to-weight ratios, the figures are slightly higher.

## ICE AND FROST

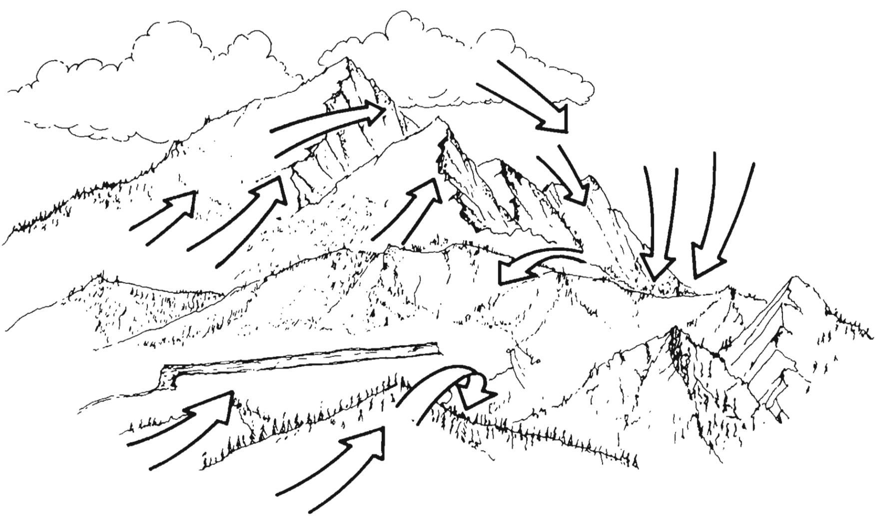
Ice or frost can significantly affect the takeoff performance of an airplane.

Pilots should never take off or attempt to take off with any accumulation of ice or frost on the aircraft. Most pilots are aware of the hazards of ice on the wings of an airplane, but the effects of hard frost are much more subtle. This is due to an increased roughness of the surface texture of the upper wing that may cause up to 10 per cent increase in the aircraft stall speed and may also require additional speed to produce the lift necessary to become airborne and stay airborne.

Once airborne the aircraft could have an insufficient margin of airspeed above the stall, such that gusts or even turning the airplane could result in a stall.

Frost is also very unpredictable. One student didn't believe me when I mentioned its effects prior to a training flight. Since we had plenty of runway available to take off and land again straight ahead, I decided to prove the consequences of the frost. Wouldn't you know it, the darn airplane took off and performed perfectly, even during stall maneuvers. However, the next day with the same student, same loading, and apparently the same frost accumulation, the airplane would not climb out of ground effect!

If a heated hangar is not available, remove all ice and at least polish the frost smooth on the top and bottom surface of the wings, giving particular attention to the first third of the wing. While it doesn't have to be completely removed, it must be smooth.



CRITICAL TERRAIN FEATURES CREATE RADICAL WINDFLOW PATTERNS. EACH MOUNTAIN STRIP POSES ITS OWN PARTICULAR PROBLEMS WITH SURROUNDING TERRAIN INFLUENCING THE LOCAL WIND CIRCULATION PATTERNS.