The Fine Art of *Desert Flying*

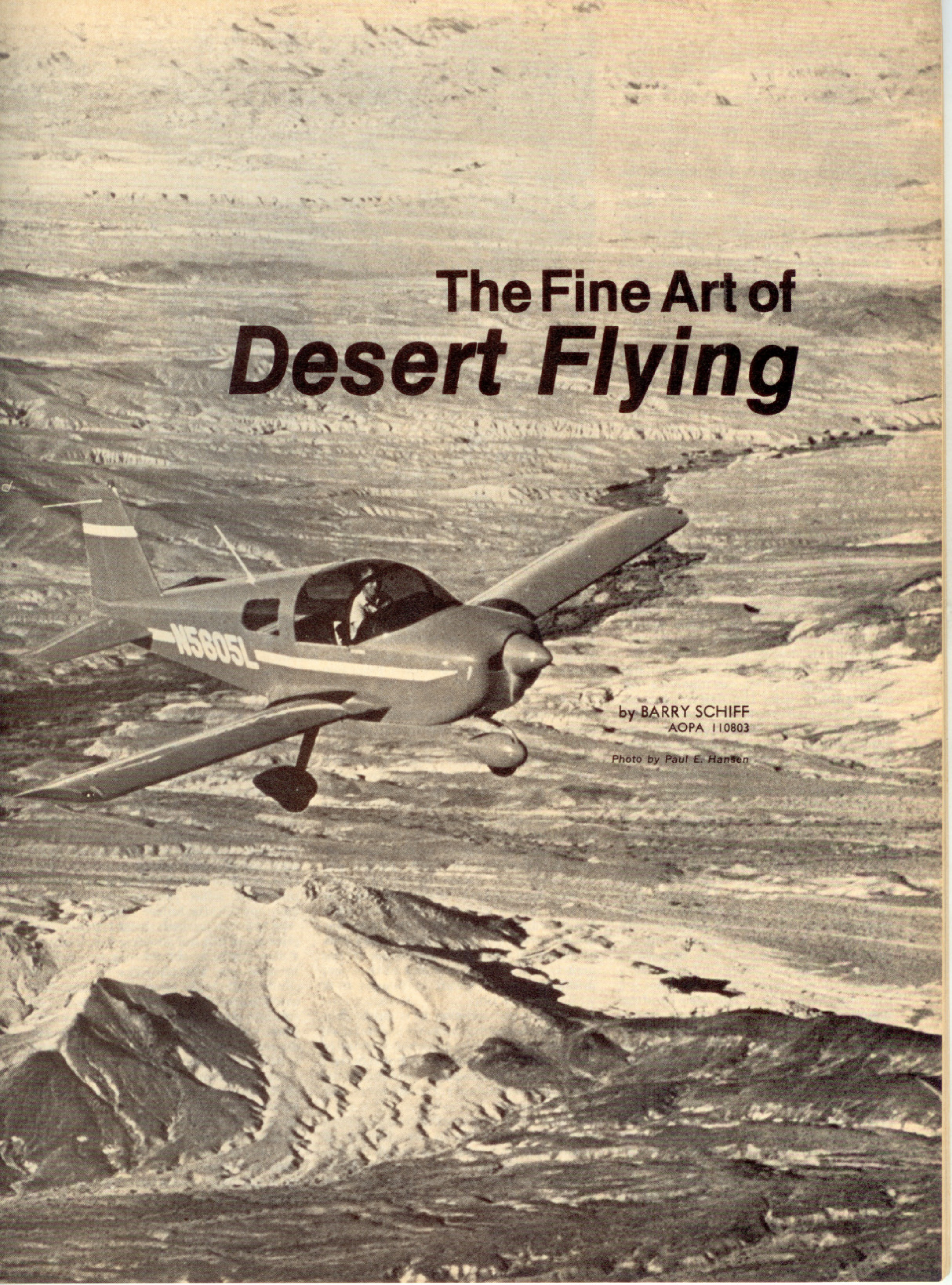

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Photo by Paul E. Hansen

■■ Historically, man has avoided the desert, a sun-seared, windswept, forbidding wasteland. There have been exceptions, of course, such as bedouins, aborigines, and a few other desert dwellers who long ago adapted to the perils and discomfort of desert life. But those from moister climates have chosen to stay away—until recent times.

Airways and highways have made accessible the desert and its breathtaking geological formations, spectacular sunsets, and countless other displays of Nature's splendor. Resorts such as Palm Springs and Las Vegas thrive in areas that not long ago were considered uninhabitable. Recreational areas and national parks beckon visitors in ever-growing numbers. Even that stretch of scorched isolation known as Death Valley in California has become alluring to pilots wanting to escape the beaten path.

Those planning to fly the desert, however, should be aware of unique problems. Even when the destination is elsewhere, it's difficult to fly in the Southwestern U.S. without crossing a part of the North American Desert. Of the world's 13 major deserts, it is the fifth largest and occupies more than a half-million square miles.

The word "desert" comes from Latin, means "abandoned," and is not a totally inaccurate description of much of the Southwestern U.S. The desert contains numerous pockets of population, but these are fairly widespread, as are desert airports. Because of this and the hostility of the desert toward careless pilots, flight planning should be conducted with exceptional care.

Victor Airways, for example, are often established without regard to the landscape. Blindly obeying VOR deflections can lead you over some of America's most rugged and inhospitable terrain. It is often wiser to follow major highways and railroads. This adds distance to a flight, but is navigationally more reliable. Also, a long and lonely highway is a welcome sight when an emergency landing becomes necessary.

Additionally, desert VORTACs often are few and far between. Because of this and the nature of the desert's often mountainous terrain, there are many areas where VOR signals cannot be received. To place all navigational eggs in this basket is risky. Stick to the well-traveled ground routes.

While cowboy movies have led us to believe that the West consists of wide-open spaces, such is not the case for general aviation pilots. The military has absconded with large chunks of desert airspace, leaving behind a proliferation of restricted areas. These areas must be respected because within them lurk all

Navigating by highway or railroad may add some distance to your desert flight, but may often be preferable to reliance on VOR signals. Photo by Don Downie.

manner of undetectable health hazards such as ground-to-air artillery, missile activity, etc.

One restricted area, R-2502, is only 7 miles from the centerline of the popular Los Angeles–Las Vegas airway (V8N) and is uniquely dangerous. The area overlies Fort Irwin, Calif., from which such potent radiation is transmitted that flying too closely to the antennas can be harmful to both pilots and avionics.

The fact that a restricted area is printed on the chart doesn't mean that a pilot can't fly through it. If detouring is undesirable, check with a nearby FSS or military facility to determine if the area is "hot." When it is not in use, permission may be given to penetrate it without restriction.

During the summer, it is preferable to fly the desert in the early morning or late afternoon, when thermal activity is nil or at a minimum. On a hot day, the desert floor can spawn teeth-rattling convective turbulence rising to 15,000 feet or more.

There are some useful techniques to employ when you're in the clutches of moderate or greater convective turbulence. Most pilots react improperly to vertical currents and only aggravate the problem.

First, airspeed should be reduced to the aircraft's maneuvering speed to minimize the possibility of structural damage.

When you're in a strong updraft, do not lower the nose to maintain altitude: This could result in dangerously excessive penetration speeds. An updraft is beneficial; it gives something for nothing—altitude. So take advantage of the updraft and accept the gift graciously. This extra altitude may soon be needed because, just as night follows day, downdrafts follow updrafts.

When the updraft weakens and the pilot finds himself sinking helplessly in a downdraft, he should—again—not try to maintain altitude. The result of a climb attitude is an airspeed loss that could place the aircraft in jeopardy of stalling. Also, the application of climb power when flying slowly in the hot desert air can result in excessive oil and cylinder-head temperatures.

Trying to outclimb a strong downdraft is usually an exercise in futility because these downdrafts frequently have sink rates considerably in excess of an airplane's ability to climb. Also, the airspeed loss resulting from an attempted climb only delays passage through the downdraft and prolongs the agony.

When you're caught in a strong "sinker," resist habit. Accept the altitude loss and either maintain airspeed or lower the nose slightly to increase airspeed. This prevents engine overheating and enables passage through the downdraft in minimal time.

During the summer it is wise to fly reasonably high, not only to escape low-level turbulence, but also to keep the cabin cool and comfortable. Since it is not uncommon for desert surface temperatures to exceed 120°F (in the shade), it might be necessary for you to fly at least 14,000 feet agl to maintain a cabin temperature at 70°F—which is another argument for avoiding a midday flight. Parenthetically, the highest temperature ever recorded in the United States was 134°F (Death Valley, 1913).

Since there is so little moisture in the desert air to retain heat, surface temperatures can drop 60 degrees between midday and midnight. But don't allow this to lure you into the night-clad desert without an IFR ticket in your hip pocket. After sunset, the desert floor can be the blackest black you'll ever experience, with ground lights few and far between. Combine this with a high overcast and it can be impossible to tell where the ground ends and the sky begins. Even experienced pilots avoid flying the night desert unless the moon is available to illuminate the way and ease the strain of a VFR flight.

During their first desert flights, Easterners are often confused when trying to correlate terrain features with symbols on a sectional. Rivers and lakes never seem to appear as advertised. This is because newcomers incongruously expect to see water. Since a desert—by definition—receives less than 10 inches of rain annually, most desert lakes and rivers are dry 9 to 10 months of the year; others are perennially arid.

Otherwise, a topographical chart is a pilot's most reliable navaid, especially if he can translate contour lines on the map to those below, an essential skill when airways and highways are unavailable. Striking out across the desert without having something to follow requires either the instincts of a camel or some skillful dead-reckoning and an abundance of fuel.

A side note about dry lakes. Some can be used as emergency landing sites, but others may be too soft, too rough, or occasionally too wet. If the surface has a dark or brown complexion, the lake is probably wet. The safest place to land is near the edge of the lake. It's drier there, and adjacent terrain features (sagebrush, cacti, etc.) provide peripheral reference for judging height above the ground.

Rogers Dry Lake in Southern California may qualify as the world's longest runway. Adjacent to Edwards AFB, it is 12 miles long and is used regularly by NASA's experimental aircraft.

Desert weather is generally severe clear, but when a relatively moist, unstable air mass visits the summer desert, the result is a widespread forest of mushrooming, violent thunderstorms. Although summer storms can reach massive proportions, they are generally widespread and circumnavigable. Extreme caution, however, is required when threading through the desert under these conditions.

Early morning flying precludes the pilot's having to do battle with the cu-nims because they usually don't develop fully until shortly before noon. Once full-grown, desert thunderstorms can remain quite vigorous until well after midnight.

Fortunately, tornadoes are a rare desert occurrence, but the desert does have "twisters." Although dust devils are considerably smaller and less violent than tornadoes, they must be regarded with caution.

A tornado is born in the belly of a thunderstorm and grows downward. Dust devils, on the other hand, are not related to thunderstorm activity. They are caused by intense surface heating and grow from the ground upward.

Dust devils have the appearance of small tornadoes but are usually only 50 to 100 feet tall. It is not unusual to see a half dozen or more dancing across the desert, and during the summer they are so common as to seem a part of the landscape. On rare occasions, a desert twister matures into a full blown "sand pillar" that can extend up to 1,000 feet agl (or higher) and must be avoided.

Since dust devils are usually small and hug the ground, they are a problem primarily during arrivals and departures. Flight through a desert twister can place an airplane instantly out of control, but the difficulty usually is over before a pilot realizes what has happened—unless the encounter occurs during takeoff or landing. This can be disastrous and explains why some desert fliers prefer to land on unpaved runways where twisters can be more easily noticed. When dust devils play tag on the runway, delay takeoff or landing until their frivolity takes them elsewhere.

Dust devils should be avoided while taxiing, too. Should one head your way, taxi in another direction, *pronto!* If an encounter is unavoidable, head the aircraft directly toward the twister and take it head on. Never allow one to overtake you from behind, since this can lift the tail of the aircraft and flip it on its back. This is rare, but it happens.

Another desert phenomenon is the sandstorm, a widespread affair that occurs when blusterous surface winds lift enough sand to darken the skies. A sandstorm can extend for hundreds of miles and generate dense clouds of sand to heights of 10,000 feet or more. This type of storm obviously should be avoided because of turbulence, less-than-VFR visibility, and the damage that sandblasting can do to an airplane and its engine.

Desert flying requires an intimate familiarity with the erosion of aircraft performance that results from increasing density altitude. Mountain fliers are aware of this problem because of the elevations at which they operate, but desert visitors frequently overlook the need to compute and compensate for density altitude because of the comparatively low elevations usually involved. But this oversight can be dangerous in the simmering heat of the summer desert.

Consider departing Las Vegas, Nev., for example. The elevation of McCarran International Airport is only 2,200 feet msl, but when the mercury hits 120°F, the density altitude exceeds 6,400 feet, doubling takeoff roll and decreasing rate of climb by almost 50%.

Some desert airports are above 5,000 feet. Combine this with 120° of sizzling Fahrenheit and density altitude shoots up to 11,000 feet.

The chart on page 48 shows the relationship between density altitude, pressure altitude, and ambient temperature. But for those who prefer rules of thumb, there is a mental exercise that can be used to determine density altitude without computers or charts.

It is first necessary to determine the standard temperature for the elevation under consideration. As an example, consider an airport with a pressure altitude of 4,000 feet msl and an OAT of 105°F. The standard temperature at sea level is 59°F, and since the standard temperature decreases 3½°F per 1,000 feet, the standard temperature at 4,000 feet must be 50°F − (4 × 3½°), or 59°F − 14°F, or 45°F.

Now compare the standard temperature at 4,000 feet (45°F) with the actual temperature (105°F). The difference between them is 60°F.

Now the rule. For each 10°F that actual temperature exceeds standard temperature, add 600 feet to the elevation. In this case, actual temperature exceeds standard temperature by 60°F, which means that 3,600 feet (6 × 600) must be added to the field elevation (4,000 feet) to arrive at a density altitude of 7,600 feet.

This rule of thumb is reasonably accurate and produces a result rarely more than 200 feet in error. But once density altitude is determined, it is absolutely meaningless unless used to derive realistic performance data from the aircraft flight manual.

If a novice desert flier were to consult a grizzled veteran about desert operations, he would most likely be given the following tips about landing in the desert:

- Be careful about sloped runways. The desert is chock-full of them. A runway with an uphill gradient gives a pilot on approach the illusion of being too high, and the result is a tendency to undershoot. Conversely, a downhill gradient gives the pilot the illusion of being too low, and there's a resultant tendency to overshoot.
- On a hot day, strong thermals encountered during the approach can lead to an overshoot.
- But, on the other hand, an airplane tends to settle more rapidly in hot, thin air.
- As density altitude increases, true airspeed increases for any given indicated airspeed. So be careful about faster touchdown speeds.
- Crystal-clear desert air makes objects seem closer than they really are and can lead to premature descents.
- On windy days, be careful about sudden wind shifts, a desert trademark.
- When the air is hot and dry, resist the urge to use carburetor heat, especially during touchdown and rollout. It is unnecessary and allows damaging, sand-filled air to enter the engine without being filtered.
- Don't refuel after landing; wait until you're ready to leave and know what the temperature will be and how it will affect performance. Then refuel and load accordingly.
- Secure the aircraft firmly, even during very short visits; the desert is notorious for sudden increases in surface wind.
- If you are using a portable tiedown kit, beware of screw-in devices that are incapable of getting a firm grip in the soft desert soil (sand).
- When surface temperatures exceed 100°F, the temperature in the cockpit of an aircraft exposed to the sun can exceed 180°F. Park in the shade whenever possible.
- If parking in the shade is not possible, hide plastic computers and plotters from the direct rays of the sun; otherwise, these items may warp permanently.

DETERMINING DENSITY ALTITUDE

Standard Temp.	Temp. / Elevat.	80° F	90° F	100° F	110° F	120° F	130° F
59° F	Sea Level	1,200'	1,900'	2,500'	3,200'	3,800'	4,400'
52° F	2,000'	3,800'	4,400'	5,000'	5,600'	6,200'	6,800'
45° F	4,000'	6,300'	6,900'	7,500'	8,100'	8,700'	9,400'
38° F	6,000'	8,600'	9,200'	9,800'	10,400'	11,000'	11,600'
31° F	8,000'	11,100'	11,700'	12,300'	12,800'	13,300'	13,800'

Regarding departures, the desert pro might offer this advice:

- Prior to boarding, open all cockpit doors and windows and allow the cockpit to cool; otherwise, controls, switches, and seatbelt buckles may be so hot that operating them without gloves may be impossible.
- When you're departing from an airport that does not have paved surfaces, avoid extending the flaps of a low-wing airplane until immediately before takeoff; extended flaps are easily damaged by pebbles picked up by the prop while the aircraft is taxiing and during engine runup.
- If the runup cannot be made on a clean, paved surface, perform it while in motion to prevent prop damage. (Use the brakes to keep the aircraft in check, however.)
- Unless conditions require it, avoid performing a functional check of the carburetor heat. This is to prevent ingestion of unfiltered air into the engine.
- Avoid prolonged runups that can overheat an engine.
- Be skillful at soft- and short-field takeoffs; these are frequent desert requirements.
- On hot days, it may be necessary to climb at faster-than-normal airspeeds to keep cylinder-head and oil temperatures within reason.
- If thermals are available, take advantage of them to gain altitude.
- If avionics fail to operate properly, the problem may be caused by transistors that have become too hot while parked in the sun; give them a chance to cool off.

Two of the most frequently neglected desert necessities are a survival kit and an adequate supply of supplemental water. This point cannot be overemphasized, and sometimes it is necessary to resort to shock to drive home the point.

A most gruesome and painful death is caused by dehydration. Without water, a man stranded in the summer desert has a life expectancy of two days. But before being relieved of his misery, he resorts to drinking anything available—no matter how nauseating—including engine oil, fuel, and urine. Those with the intelligence to acknowledge the possibility—however slight—of a desert emergency can survive if prepared. A supplemental water supply and a filed flight plan are a desert pilot's best insurance.

The survival kit should contain at least a solar still, chapstick, a signal mirror, emergency rations, a first-aid kit, whistles, hats, sunglasses, sunburn lotion, salt tablets, clothing to protect against cold nights, matches, a knife, nylon rope, a flashlight, a survival manual, water, water, and more water.

Although this article emphasizes the problems unique to summer flying, pilots should realize that the desert tames considerably during the rest of the year. Spring and autumn are delightful seasons in which to enjoy and explore the magnificent desert. It is Nature's kaleidoscope of wonders to see and things to do. □