Cessna 182 Skylane Safety Highlights

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Introduction

The Cessna 182 Skylane is a favorite for cross-country travelers as well as for transitioning pilots. Its excellent safety record attests to its reliability and structural integrity. First built in 1956, and still manufactured today, approximately 13,000 Skylanes currently are on the FAA Aircraft Registry. This Safety Highlight analyzes fixed-gear Skylane accidents that occurred between 1983 and 1999. Included are 1,314 Cessna 182 accidents and 3,022 accidents of a comparison group, comprised of the following aircraft: Cessna 177 Cardinal, Cessna 205, Cessna 206, Cessna 207, Gulfstream American AA-5, and Piper PA-28.

Almost three-quarters, or 72 percent, of Cessna 182 accidents were minor, resulting in little or no injury, while two-thirds, or 66 percent, of the comparison aircraft accidents were minor. (See Figure 1). Accidents resulting in serious injuries, as defined by NTSB Part 830, make up the smaller portion of the accident number. The Skylane had fewer serious accidents than the comparison group. This may be due to the Skylane being used for cross-country trips, while the majority of accidents in the comparison group involved PA-28s, which are used primarily as trainers. Trainers participate in more takeoffs and landings, which is when most accidents occur.

According to FAA estimates, Cessna 182 aircraft flew approximately 22.4 million hours during the years 1983-1999. Only 1,314 accidents occurred during that time, which averages out to 5.9 accidents per 100,000 hours. The comparison group had a similar accident rate with 6.0 accidents per 100,000 hours.

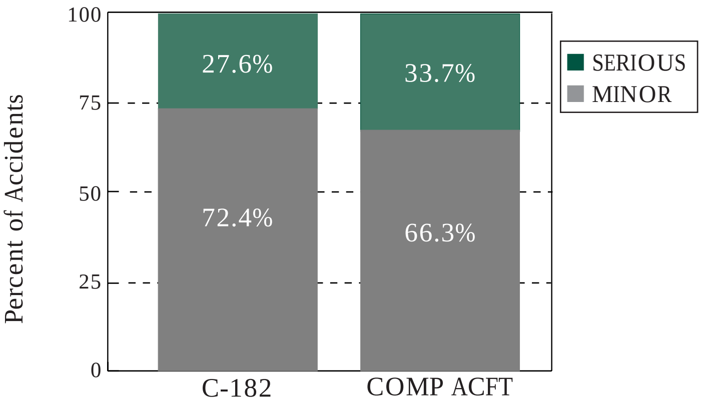
Pilot-Related Accidents

As expected, the majority (80 percent) of Cessna 182 accidents were due not to aircraft problems, but to pilot error. Mechanical/maintenance problems caused only 10 percent of the Skylane accidents, and the remaining 10 percent were attributed to other causes and unknown factors. (See Figure 2).

Regardless of the type of aircraft, the number of accidents is inversely proportional to the number of hours a pilot has accumulated. (See Figure 3). The majority of accidents for the Skylane and comparison aircraft involved pilots with less than 400 hours total time, and less than 100 hours time in type. Pilots generally gain skill and better judgment with experience.

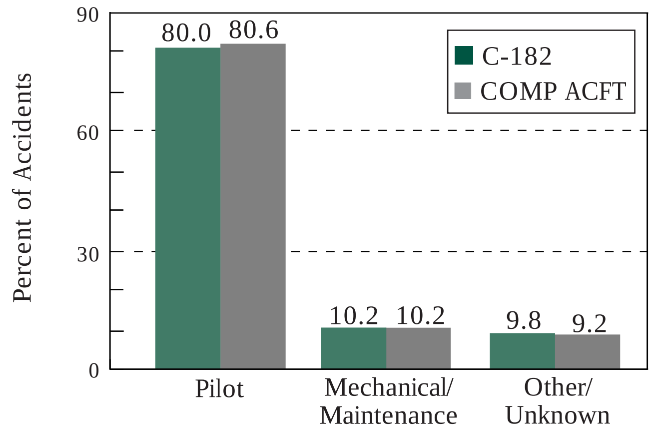
Weather caused the highest number of pilot-related serious accidents. (See Weather section on page 4). Twenty-one percent of Cessna 182 and comparison aircraft serious accidents were due to poor pilot decision making and judgment regarding the weather. Pilots frequently choose the Skylane as one of their first cross-country airplanes and thus learn, some of them the hard way, about flying through weather systems.

Figure 1. Accident Summary C-182



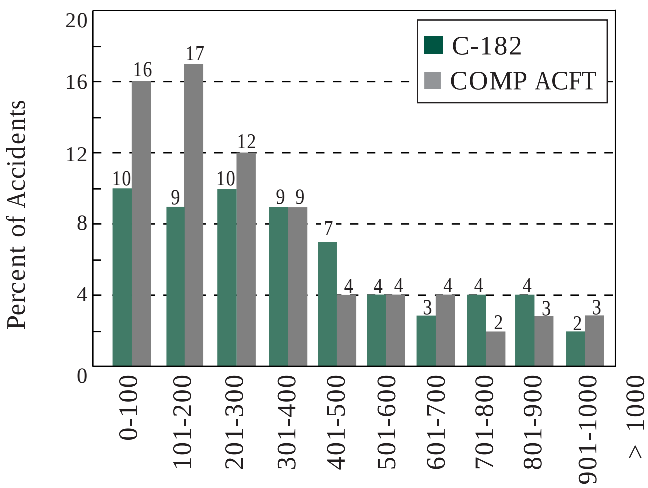
SERIOUS	363	1017
MINOR	951	2005

Figure 2. Major Cause C-182



C-182	1051	134	129
COMP ACFT	2436	308	278

Figure 3. Pilot Total Flight Time Serious Accidents C-182



	0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000	> 1000
C-182	36	34	35	33	25	13	10	14	16	7	137
COMP ACFT	167	176	120	88	44	40	37	24	30	26	258

Preflight

A thorough preflight consists of four components: pilot, weather, airplane, and flight. The flight should be conducted only after each component of the preflight has been checked and found to be satisfactory. Allow yourself plenty of time to thoroughly check each, without feeling pressured or rushed. Here are some specific items to include in your preflight:

Pilot: The first step in planning for a flight is to be sure you are ready, physically and emotionally. Here are some things to keep in mind:

- Remember IMSAFE:
  Illness
  Medication
  Stress
  Alcohol
  Fatigue
  Emotion
- Know your personal limitations. Every pilot is different, and your own minimums may even change from day to day. The FAA has published a personal minimums checklist, which is available online at www.faa.gov/avr/news/checklst.pdf.
- Currency and proficiency. Are you safe and legal for this flight?

Weather: Once you have prepared yourself for the flight, it's important to check the weather along your planned route. According to FAR 91.103, a weather briefing is required for all IFR flights and any flight not in the vicinity of an airport. Obtaining a weather briefing is a good idea for all flights. The following are some weather resources to use during the planning:

- Flight Service Stations (FSS) may be contacted for weather information, notams, and pireps.
- Online services such as AOPA (www.aopa.org/members/wx/), DUATS (www.duats.com), National Weather Service (NWS) (www.nws.noaa.gov/), and Aviation Digital Data Service (ADDS) (http://adds.awc-kc.noaa.gov/).
- AWOS, ASOS, or ATIS will provide you with the current local weather at your departure airport.

Note: For more weather information, see the Weather section on page 4.

Airplane: The airplane preflight consists of a thorough check of the aircraft itself and associated paperwork:

- Review the airplane's airworthiness status, including an inspection as described in the *Pilot's Operating Handbook* (POH).
- Paperwork associated with the airplane (ARROW):
  Airworthiness certificate
  Registration certificate
  Radio station license (for international flights only)
  Operating limitations (*Pilot's Operating Handbook*)
  Weight and Balance records
- Weight and center of gravity (CG) limits.
  Note: For weight and balance information specific to the C-182, including a loading example, see the Weight and Balance section on pages 3-4.
- Fuel requirements. ASF recommends landing with at least one hour of reserves on board. This means a Skylane with 88 gallons of usable fuel, in no-wind conditions, and a fuel burn of 13.0 gph can fly for approximately 6¾ hours total, or 5¾ hours with 1 hour reserves. Of course, any wind or nonstandard conditions will alter your calculations for distance. Note: For more information regarding fuel planning, see the Fuel section on page 6.
- Takeoff and landing distances. Note: Information regarding takeoff and landing in a Skylane can be found on pages 8 and 9.

Flight: There are many factors associated with any flight that must be checked before departing, especially if an unfamiliar route or airport will be encountered. Such information includes the following:

- Airport/runway conditions at the departure and arrival airports.
- Notams and Temporary Flight Restrictions, if any.
- Runway lengths and LAHSO distances at the departure and arrival airports.
- Obstructions en route and near the airports.
- Special use airspace along your route of flight, i.e., restricted areas, prohibited areas, MOAs, and MTRs.

Weight and Balance

The weight and balance of any aircraft affects it in all phases of flight, from takeoff to landing. An overloaded airplane may not be able to reach rotation speed from a short runway, and/or may not be able to clear obstacles at the end of the runway. An out-of-balance airplane may become uncontrollable in flight, require an excess amount of trim, or may not even be controllable during takeoff.

The weight and balance section of the C-182's POH includes a loading example for your convenience. Become familiar with it, and also consult the CG chart before each flight involving more baggage than usual or more than two occupants, to verify that you have loaded the aircraft within the CG "envelope," or limitation range. Below is an example of a weight and balance problem for a typical cross-country flight. Notice that the fuel had to be reduced to allow for the four people and baggage (the fuel tanks can actually carry 528 lb of usable fuel). The takeoff weight is 3,100 lb, but the landing weight for this model, a 1985 C-182R, is 2,950 lb. Know the numbers for the aircraft you fly.

Cessna 182R Sample Weight & Balance Problem

	Weight	X	Arm	=	Moment/1000
Airplane (BEW)	1800		35.2		63.3
Pilots (Front)	340		37.1		12.6
Passengers	340		74.1		25.2
Baggage Area A	100		97.0		9.7
Baggage Area B	20		116.0		2.3
Baggage Area C	60		129.0		7.7
Fuel	450		46.6		21.0
Fuel for start-up, taxi, runup	-10		46.6		-0.5
TOTAL	3100		45.6		141.3

The Skylane is known for its large capacity and ability to carry heavy loads, but the 1956 through 1961 models only had maximum gross weights of 2,550 lb or 2,650 lb. That was increased to 2,950 lb beginning in 1970 and again to 3,100 lb in 1981. Don't become overconfident with the newer, heavier models. If you carry passengers and baggage for a cross-country flight with full fuel tanks, you may be very near the airplane's capacity limit. You may even need to limit the amount you carry. Local flights with an instructor, a couple of flight bags, and full fuel tanks will not be a problem with this aircraft. The maximum useful load for a 1985 Skylane is 1,377 lb. Remember that this is a POH number, and will vary depending on the equipment installed in the aircraft. Most Skylanes will have a useful load of approximately 1100 lb. The maximum baggage weight for the C-182R is 200 lb (120 lb forward of baggage door latch and 80 lb aft of it).

During takeoff, the 435-hour private pilot lifted the Cessna 182 off the 3,200-foot runway at approximately midfield. The aircraft touched down, then became airborne again before it crashed. Four occupants, 40 gallons of fuel in the 60-gallon tanks, and 380 pounds of cargo had been loaded prior to initiating the flight. The aircraft was estimated to have been at least 210 pounds over its maximum allowable gross weight, and the center of gravity (CG) was estimated to be 1.1 inches beyond the aft limit.

Density Altitude

The 160-hour private pilot did not check the density altitude or lean the mixture prior to taking off. The Cessna 182, with four people aboard, departed from an intersection near the middle of the 5,289-foot runway. The pilot aborted the takeoff upon realizing that inadequate engine power was being produced to lift off. The airplane overran the end of the runway and collided with rough terrain. The calculated density altitude was approximately 7,100 feet.

Because the C-182 is a big, beefy aircraft, compared to some of its lighter siblings, some pilots mistakenly believe that it can be loaded with impunity. The accident history suggests otherwise, particularly at high density altitude. Two percent of the Skylane accidents were attributed to high density altitude. That does not include the close calls, where pilots were lucky and avoided triggering the NTSB's computer. Any normally aspirated aircraft with a large engine will be a strong sea-level performer. Take the same aircraft to a mountain airport surrounded by higher terrain and that strong performance magically dissipates into thin air.

For example, a short-field takeoff in a C-182 at sea level, standard temperature (15 degrees C), and zero wind requires 1,518 feet to clear a 50-foot obstacle. If the field's elevation is 3,750 feet with a temperature of 95 degrees, a common occurrence on a summer day, the density altitude equates to 7,000 feet. The 182's takeoff distance will more than double to 3,185 feet. The maximum rate of climb at sea level is 865 fpm and decreases to 505 fpm at 7,000 feet. Add in terrain or obstacles and the possibility of downdrafts to negate the already anemic climb, and it becomes obvious why states with high real estate have much higher accident rates than the flatlands.

Remember that POH performance numbers are based on new aircraft under standard weather conditions with a test pilot. Most of us will not achieve the published numbers on a normal basis. ASF recommends adding 50 percent to all published takeoff and landing numbers, to allow a safety margin. Therefore, the takeoff distance from the same 7,000-foot density altitude airport becomes 4,778 feet.

The landing distance over a 50-foot obstacle will increase from 1,350 feet at sea level to 1,640 feet at 7,000 feet (2,460 feet with the 50 percent safety margin). One aeronautical myth that some pilots have attempted to disprove is that if it flew in, it will fly out. **There are many airports where it is possible to land but it may be impossible to depart, either under ambient conditions, or at all.** The C-182 is a good short-field airplane but it can't do the impossible.

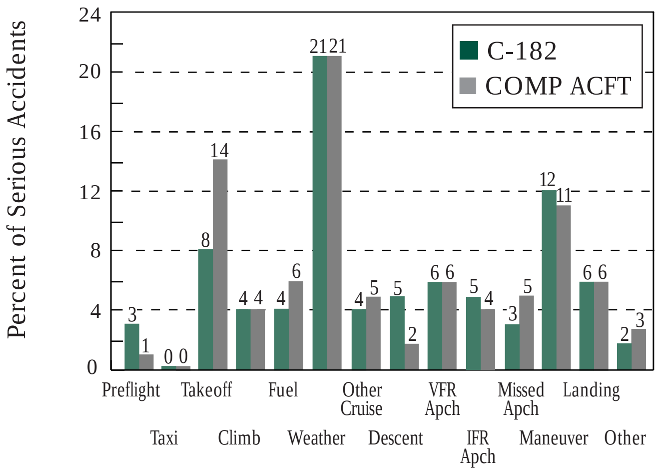
Weather

Weather was the leading cause of pilot-related serious accidents for the Cessna 182 as well as for the comparison aircraft group, causing 21 percent of the serious accidents for both. (See Figure 4). Poor judgment and decision-making in regards to weather caused the majority of these accidents. Weather is a crucial part of initial and recurrent training. Most new pilots will get only cursory exposure to it.

Preflight should include obtaining the local weather and, for all flights not in the vicinity of an airport, a full weather briefing. However, don't assume that the forecasted weather will be what is encountered en route. Weather changes rapidly, and forecasts don't always hold true. Be prepared for diversions around weather by carrying extra fuel. Use Flight Watch and Flight Service en route for a more precise picture of what you will encounter. Pireps are also a great source of weather information; use them, and supply them when able. ASF's *Weather Tactics* and *Weather Strategies* Safety Advisors may be viewed online at www.aopa.org/asf/publications/sa_index.html.

If your aircraft is so equipped, the autopilot may be used to get out of deteriorating weather. Use it to safely turn around and depart the

Figure 4. Pilot Related Causes Serious Accidents C-182



C-182	10	1	29	14	16	75	16	17	21	18	10	42	22	8
COMP ACFT	13	1	136	38	61	195	44	22	59	36	49	104	55	26

hazardous conditions. That will help ease your workload, but remember that the autopilot cannot be used in severe turbulence, because it may overstress the aircraft, or in icing conditions, because it may mask the signs of ice accumulation on the aircraft.

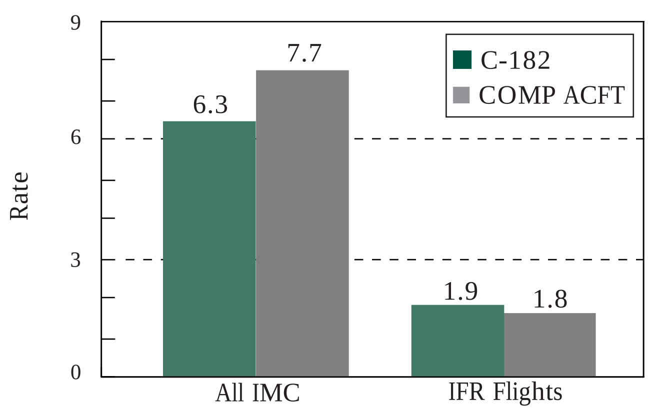
Instrument Meteorological Conditions (IMC)

Between the years 1983 and 1999, there were 6.3 Cessna 182 IMC accidents per 100,000 IMC hours, 1.9 of which involved instrument-rated pilots on IFR flight plans. (See Figure 5). That means 4.4 IMC accidents per 100,000 IMC hours involved pilots who were not appropriately rated, or were instrument-rated but not on an IFR flight plan. The comparison group had 7.7 IMC accidents per 100,000 IMC hours, of which 1.8 were on IFR flight plans.

Note: Although the accidents occurred in instrument conditions, weather may not have been the cause of each accident.

> The 100-hour noninstrument-rated private pilot was on the third leg of a trip between Tampa, FL and Sussex, NJ. (The previous two stops were made because of adverse weather conditions.) Before this flight, the pilot was advised by FSS that VFR flight was not recommended. A VFR flight plan was filed but not activated. Witnesses reported the aircraft was flying northeast below a low overcast and some said it was flying in the clouds. One witness said the clouds were at treetop level. The aircraft reversed course and soon afterwards it descended to the ground. One witness said that before the aircraft descended it pitched up and then spun during descent. The aircraft collided with the ground in a remote wooded area.

Figure 5. IMC Accidents Per 100,000 IMC Hours C-182



C-182	125	37
COMP ACFT	333	77

Autopilot

The autopilot is an invaluable piece of equipment that will reduce workload on long flights and under single-pilot IFR conditions. The FAA believes so much in autopilots that they are required for single-pilot IFR air taxi flights. At the very least, the autopilot will maintain a wings-level attitude while the pilot troubleshoots a problem or navigates out of hazardous weather. It should be a part of your aircraft familiarization training. Review its operation regularly.

Some autopilot tips:

- Know how to disengage the autopilot quickly by at least three methods.
- Know where the autopilot derives attitude information–some depend on the attitude indicator, which is usually vacuum powered, others on the turn coordinator. When the vacuum pump fails, the autopilot may be inoperative when needed the most.
- Use the autopilot when programming GPS equipment or consulting charts.
- Many pilots hand fly departures and arrivals to maintain proficiency and let the autopilot handle the long, boring en route portion of the flight.
- Practice using the autopilot in good weather and practice coupled approaches so on that dark, cloudy IMC night when you're tired, the autopilot will help bring you down safely.
- Be able to hand fly the aircraft at any point, if needed, and don't be reluctant to advise ATC to stand by if you're busy after an autopilot failure.

Fuel

The C-182 had 71 fuel exhaustion accidents compared to 188 for the comparison group. Exhaustion occurs when all tanks are depleted. Fuel starvation occurs when fuel is available but, for any number of reasons, doesn't reach the engine. There were 27 Cessna 182 starvation accidents and 75 in comparable aircraft. Only six of those Skylane accidents were due to improper fuel tank selection or failure to switch tanks, compared to 35 of the comparison group. That may be because Skylanes have a BOTH option on the fuel selector.

Keep track of fuel burn along your flight by using a fuel log. This will help establish the fuel usage of that aircraft. For a flight at 8,000 feet and 65% power in a 1985 C-182, the zero-wind range (88 gallons/one hour reserve) is 764 nm. (Note: The POH states a fuel burn of 11.1 gph. ASF recommends adding a safety margin. For this example, 13.0 gph was used.) With a 20-knot headwind, the range is reduced to 649 nm, a 115 nm difference. It is better to think of fuel in terms of time rather than distance.

Flush-type fuel caps leak water as the seals deteriorate. These caps, common on 182s manufactured prior to 1979, should be replaced by the umbrella-type caps. Also on the older models are the bladder-type fuel tanks, which can trap and hide water if there are "wrinkles" in the cell. Integral tanks will not pose such a problem.

ASF fuel recommendations:

- Land with at least one hour of fuel reserves on board.
- Learn to lean properly and do it on every flight–most engines, contrary to what is taught in many flight schools, *may be leaned at any altitude*, provided they are below the approved power setting.
- Add two gallons per hour to book consumption numbers until you have accumulated some experience with that particular aircraft to verify the fuel burn with your leaning techniques. Estimate the fuel consumption for each flight and check that against the actual amount of fuel added. (You really only know how much fuel is on board when the tanks are full unless you stick the tanks, have very accurate fuel logs, or use a fuel management device such as a totalizer.)
- Avoid planned fuel stops within 100 miles or one hour of your destination. There is great temptation to press on to the destination.
- For most operations, leaving the fuel selector on BOTH will eliminate the possibility of running one tank dry. However, if a significant load imbalance exists, switch tanks on an hourly basis and set a timer to remind you.

Prior to departing on the 600-mile flight, the 350-hour private pilot obtained a weather briefing but did not file a flight plan. The flight lasted for 5 hours and 28 minutes before the engine sputtered and quit four miles short of its destination airport. Endurance calculations based on 11.0 gph and a 600 nm distance, correcting for nonstandard temperature and pressure, revealed a usable fuel burn time of 5 hours and 25 minutes.

Note: Add a safety margin of approximately 2.0 gph to POH fuel burn numbers until you gain some experience with that particular airplane. The accident report above states that endurance calculations were based on 11.0 gph, which was likely the POH number.

Icing

Before takeoff, the 1,800-hour ATP received a complete weather briefing. The briefer warned the pilot of an extremely hazardous weather system in the area and advised him several times not to go. The briefing included numerous pilot reports that confirmed the forecast of icing and turbulence. The pilot filed an IFR flight plan and departed in an aircraft not certified for icing conditions. While the aircraft was descending to intercept the ILS, radar contact was lost. The aircraft crashed into a mountain.

Cessna 182 Icing Accidents

Description	Total
Attempted takeoff with snow/ice on wings/airframe.	4
Lost control, turbulence/ice encountered at high altitude.	1
Failed to use carburetor heat during IMC/icing conditions.	3
Power loss, lack of carburetor heat use.	7
Power loss on descent because of lack of carburetor heat use.	6
Power loss on approach, carburetor heat not used.	15
Stalled/lost control during continued approach in icing conditions.	5
Stall/mush due to ice-buildup on airframe	1

Cessna 182s are not approved for flight into icing conditions. Some hangar tales tell about the fat wing and how much of a load it will carry. Understand that the aircraft is operating outside of the approved envelope and you have become a test pilot.

Structural Ice: Structural ice disrupts the flow of air over the wing, tail, and prop, which increases drag, decreases lift, and may cause a significant increase in stall speed. Conditions conducive to severe in-flight icing are high moisture content in clouds, relatively warm temperatures, and freezing rain.

The first indication of ice will normally be a buildup on small protrusions, corners, or the base of the windshield. Airspeed will begin to drop shortly after the flight encounters icing conditions. Turn on the pitot heat if it's not already on and immediately work to get out of the clouds. A 10-knot speed reduction is a mandate to change altitude or divert immediately.

Carburetor and Induction Ice: Induction ice blocks the air intake and can cause the engine to stop. Skylanes built after 1997 have fuel-injected engines and thus do not suffer from carb ice, but a blocked intake may cause a problem. The alternate air source should resolve it. Older Skylanes are susceptible to carb icing, as are the aircraft of the comparison group. The use of heat applied at the first indication of carb icing is essential.

Carb ice is not restricted to cold, cloudy days but can occur in clear air, high humidity, and temperatures as warm as 70 degrees F or higher. The temperature drops as much as 70 degrees F within the carburetor's throat. Follow the checklist, use carb heat whenever operating at reduced power, and be suspicious of carb ice when flying in clouds and rain. Many owners have installed a carburetor temperature gauge or ice detector device to warn them of the onset of carburetor icing conditions.

The Air Safety Foundation's Safety Advisor, *Aircraft Icing*, www.aopa.org/asf/publications/sa11.html, discusses both structural and carburetor/induction icing and how to fly safely when icing conditions are forecast.

Night

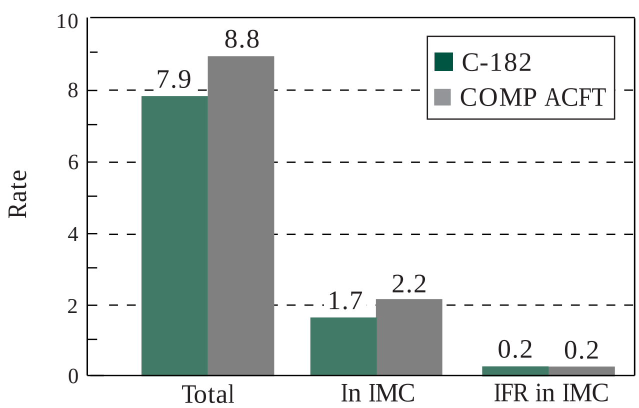
The noninstrument-rated private pilot departed on a night cross-country in VMC along the East Coast. The airplane was observed on radar to climb to 2,500 feet and level off. Shortly after leveling off, the airplane descended at 500 fpm. It dropped off radar at 1,000 feet, but witnesses observed the airplane flying 150 feet above the water. During a left turn on this dark, moonless night, the airplane descended and struck the water. The NTSB cited spatial disorientation and the pilot's lack of instrument experience as factors in this accident.

Most night accidents for both the Skylane and comparison group occurred in VMC. That is probably because the majority of Skylane hours are flown in VMC (20.5 million out of 22.4 million). Only 1.7 Cessna 182 accidents per 100,000 night hours occurred in IMC, compared to the total number of 7.9 per 100,000 hours. Of the 1.7 night IMC accidents, only 0.2 were IFR in IMC (See Figure 6). That means that 1.5 out of 1.7 night IMC accidents per 100,000 night hours involved either a noninstrument-rated pilot or a rated pilot who was not on an IFR flight plan.

Most general aviation flying is during daylight hours and, not surprisingly, night flying skills may become rusty. ASF recommends regular night instruction to review aircraft and airport lighting, vision, fatigue, weather, spatial disorientation, obstruction clearance, takeoffs/landings, and emergencies. An instrument rating is highly recommended for night cross-country flying.

Your personal minimums should be more conservative at night. The FARs raise the basic night VFR weather minimums in Class G airspace to 3 statute miles, compared to only 1 mile during the day. Below 1,200 feet AGL, the distance from clouds increases from day VFR requirements of clear of clouds, to 500 feet below, 1,000 feet above, and 2,000 feet horizontal. East of the Mississippi, the transition areas around airports at 700 feet AGL effectively preclude night VFR flight when ceilings are below 1,500 feet, except in the airport traffic pattern (1000 feet AGL and 500 feet below the clouds). ASF recommends at least 5 nm visibility for night cross-country flights and a 2,000-foot ceiling in flat terrain. Mountainous terrain minimums should be at least a 5,000-foot ceiling and 10 miles. Ceiling and visibility frequently deteriorate at night as the temperature and dewpoint spread closes. *The weather between reporting points may be much worse than what is observed*.

Figure 6. Night Accidents Per 100,000 Night Hours C-182



C-182	184	39	4
COMP ACFT	543	139	11

Note: Basic VFR weather minimums are listed in FAR 91.155.

FAR 61.57 requires three night takeoffs and landings to a full stop, within the preceding 90 days, to be legal to act as pilot in command of an aircraft carrying passengers at night.

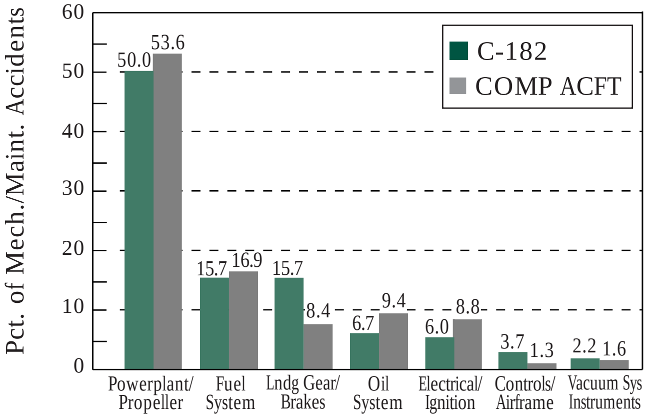
Here are some specific things to be aware of at night:

- Avoid bright lights at least 30 minutes before flying at night. If bright light is needed while flying, close one eye to preserve night vision in that eye.
- Don't descend to pattern altitude before you are in the pattern – descend over the airport. There may be obstructions in the area that cannot easily be seen at night. Instrument-rated pilots should use instrument approach procedures. Try to go to airports that have VASI or ILS and avoid unfamiliar short fields.
- Spatial disorientation. The horizon is less visible at night, and lights may create an artificial horizon. When a clear horizon is unavailable, trust your instruments. Your body may feel as if you're turning when you are actually in straight and level flight. Many pilots have gotten themselves in dangerous situations by ignoring the instruments.
- Weather and clouds are much harder to see at night. Get a full weather briefing, and update it while en route. Get and give pireps.
- Check the aircraft electrical system thoroughly. Does the aircraft have an annunciator to show when the alternator has failed? Typically, there will be only about one half hour from electrical system failure to battery depletion and darkness.
- Have more than one flashlight easily accessible in the cockpit.

Mechanical

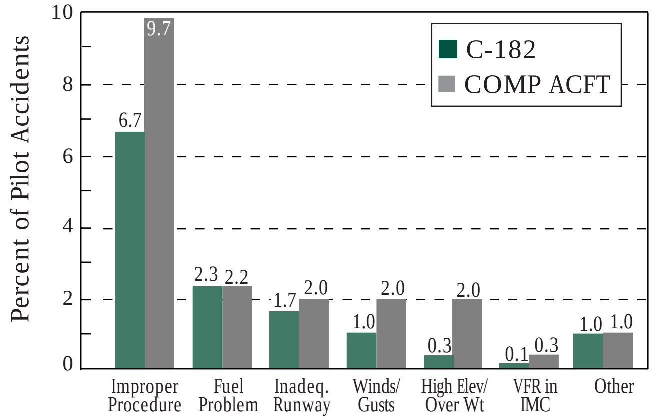
Of the 134 Cessna 182 and 308 comparable aircraft mechanical/maintenance accidents, approximately 50 percent of each were due to powerplant/propeller issues. (See Figure 7). The fuel system and the landing gear/brakes caused 15 percent of the mechanical Skylane accidents each. However, with only 10 percent of all studied accidents attributable to mechanical issues, the aircraft are extremely reliable.

Figure 7. System Involvement C-182



C-182	67	21	21	9	8	5	3
COMP ACFT	165	52	26	29	27	4	5

Figure 8. Critical Phase of Flight–Takeoff C-182



C-182	70	24	18	10	3	1	11
COMP ACFT	236	53	48	48	48	7	24

The newer Cessna 182s contain some major mechanical changes. The new Skylane model C-182S, manufactured beginning in 1997, is powered by a fuel-injected, 230 hp Textron-Lycoming IO-540 engine, instead of the 230 hp Continental O-470s used in the past. The new engines are therefore not susceptible to carburetor ice. Induction icing is a possibility, but rare.

Another large change with the new aircraft is the number of fuel drains. There are now five under each wing, and two in the belly, whereas the older models had one sump under each wing and a fuel strainer drain under the belly.

There are several modifications available for the Skylane, which currently has 577 STCs in the FAA registry. Possible modifications include increased gross weights for earlier models (pre-1972), speed mods, increased horsepower, replacement of flush-type fuel caps, installing solid fuel tanks to replace the bladder-type (pre-1979), and adding a backup vacuum system. More information can be found online at www.aopa.org/pilot/features/skylane0012.html.

Takeoff

Most takeoff accidents were due to improper takeoff procedures, such as failure to establish a positive climb rate, failure to attain takeoff/liftoff speed, improper trim setting, failure to maintain directional control, and premature rotation/liftoff. (See Figure 8). This includes 6.7 percent of the pilot-related Cessna 182 accidents and 9.7 percent of those for the comparison aircraft group. Other factors included inadequate runway, wind, gusts, high elevation, overweight, VFR in IMC, and fuel problems such as contaminated fuel, wrong fuel tank selected, and fuel exhaustion.

Factors affecting the safety of takeoff must be checked as part of your preflight procedure; for example, runway lengths, wind direction and speed, local weather, obstacles at each end of the runway(s), and condition of aircraft and pilot.

ASF recommends adding 50 percent to POH numbers, as a safety margin. For example, at 3,100 lb, sea level, and 20 degrees C, the distance to clear a 50-foot obstacle is 1,570 feet. With the safety margin included, that increases to 2,355 feet. Wind affects the takeoff distance by 10 percent for each nine knots of headwind and 10 percent for each two knots of tailwind. Use half the predicted headwind and double the predicted tailwind.

Abort the takeoff if an abnormal situation exists. It's always better to resolve problems on the ground rather than complicate a situation by becoming airborne.

> The private pilot was on takeoff roll when he observed the aircraft would not rotate. The takeoff was aborted, but the aircraft overran the runway and nosed over. The pilot had not removed the control wheel lock prior to takeoff.

Wind

> The private pilot flew a normal approach in the Cessna 182, 70 mph with full flaps. The airplane crossed the runway threshold at 60 mph. The winds, according to the pilot, were gusty at touchdown. According to the airport manager, the winds were 90 degrees to the landing runway with a speed of approximately 45 mph. On touchdown the airplane lifted off the 1,735-foot runway. The second touchdown occurred with 100 to 150 feet of the runway remaining. The pilot was not able to stop the airplane before traveling off the departure end of the runway where the airplane nosed over. The demonstrated crosswind component of this aircraft was 12 mph with no flaps and 11 mph with full flaps.

The maximum demonstrated crosswind component for most Cessna 182 aircraft is 15 knots. Aerodynamically, the aircraft may be able to handle greater winds but most pilots should consider that as limiting until they are highly proficient in crosswinds and have had the opportunity to explore the aircraft's behavior on a long wide runway.

Section 4 of the POH suggests procedures for taking off and landing in crosswinds. Both should be performed with the minimum flap setting necessary for the field length.

Approach

Almost 10 percent of pilot-related Skylane accidents occurred during approach, compared to approximately eight percent for the comparison group. (See Figure 9). Most of them occurred in VFR conditions, when most of the flying in these types of aircraft occurs. Transitioning pilots have to get used to thinking further ahead of the airplane when flying the Skylane. That may be the reason for it having more accidents during approach, a high workload phase of flight, than the comparison group. High performance aircraft like the 182 take a while to slow down, so pilots should reduce speed before entering the pattern.

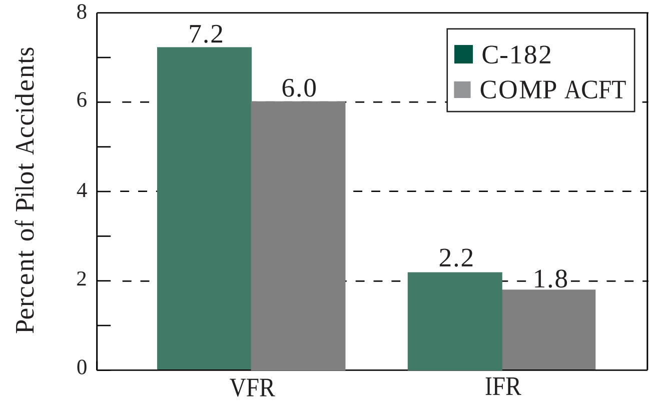
Below are some things to consider before beginning an approach:

- Obstructions in the area
- Runway lengths
- Wind direction and speed
- Radio frequencies
- Sectional, approach charts, taxi diagrams
- Instrument pilots must additionally be aware of landing minimums and missed approach procedures.

Scan constantly for other traffic and monitor the CTAF. Be situationally aware. With the mix of VFR and IFR traffic at most airports, be prepared for nonstandard patterns.

Understand IFR terminology, to help in your situational awareness. VFR pilots should review this with an instructor. Understanding what is being communicated over the radio drastically minimizes confusion. For more information about terminology, communication, and flying at nontowered airports, view ASF's Safety Advisor, *Operations at Nontowered Airports*, online at www.aopa.org/asf/publications/sa08.pdf.

Figure 9. Critical Phase of Flight–Approach C-182



C-182	76	23
COMP ACFT	146	44

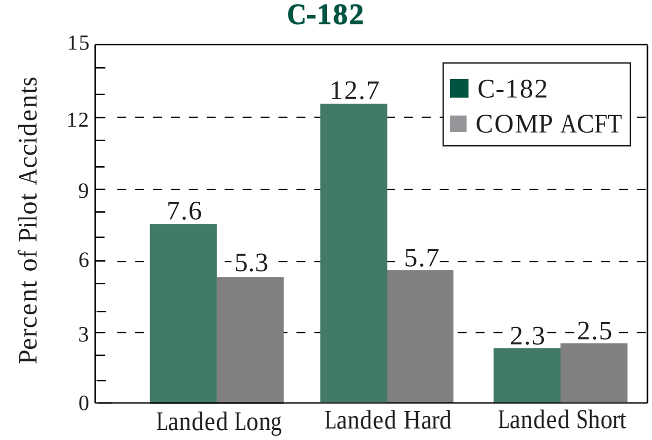
Landing

Landing is the most accident-prone phase of flight for Cessna 182s and comparison aircraft, with 39 percent and 29 percent, respectively. For the 182, landing hard was the leading transgression. The Skylane had considerably more accidents landing hard than did the comparison group (12.7 percent of pilot-related C-182 accidents, compared to 5.7 percent). (See Figure 10). This may be due to the heavy feel of the elevator control, especially for pilots transitioning to the Skylane from lighter airplanes. Substantial trim is required during landing, but don't trim so much that you will not be able to handle a go-around. Trimming for 75 knots will require you to hold back pressure during landing, but won't require so much forward pressure on the controls during a go-around.

Note: Improper speed control and a forward CG (full fuel and two occupants) results in bent firewalls being very common during 182 landings, especially for pilots transitioning from lighter airplanes. Hard landing forces are transmitted through the gear and engine support structure to the firewall. ASF recommends a full load checkout as part of your Skylane familiarization. Pre-purchase inspections should include a close look at the firewall.

Remember to compensate for winds during landing. A tailwind of only four knots will increase landing distance by 20 percent. Include landing distance calculations as part of your preflight and add 50 percent to the book numbers.

Figure 10. Critical Phase of Flight–Landing C-182



C-182	80	134	24
COMP ACFT	130	138	61

Cessna 182 Skylane Test Questions

The purpose of this open-book test is to familiarize the pilot with the Cessna 182 Skylane and its corresponding POH. **The 1985 Cessna Model 182R Skylane was chosen as the test airplane; answers given pertain to that aircraft. Refer to the POH for your aircraft as you complete the test.**

1. Total fuel capacity is ___________ gallons. Total usable fuel is ___________ gallons.

2. What is the recommended fuel grade?

3. How should the fuel selector be positioned to ensure the maximum fuel load?

4. What is the endurance with a 45-minute reserve at a cruise altitude of 10,000 feet at standard temperature? Include start-up, taxi, takeoff, and climb fuel.
   With full tanks at 65% power: ___________
   With 65 gallons at 65% power: ___________

5. Do not operate on less than ___________ quarts of oil. Fill to ___________ quarts for normal flights of less than 3 hours, and ___________ quarts for extended flights.

6. What is the recommended oil type and viscosity?

7. What is the maximum takeoff weight? ___________
   What is the maximum landing weight? ___________

8. How much payload will your airplane carry with maximum fuel? ___________ lb

9. How much fuel can you carry with the following payload? ___________
   Front seats: 400 lb
   Rear seats: 200 lb
   Baggage: 150 lb

10. What is the CG range? ___________

11. What is the distance required to clear a 50-foot obstacle during takeoff under the following conditions:
    3,100 lb, sea level, 85 degrees F _____________________
    3,100 lb, 7,000 feet, 80 degrees F _____________________

12. What are the rate of climb and airspeed at 3,100 lb, 8,000 feet, OAT 20 degrees C? ___________

13. What are the fuel consumption and TAS at standard temperature for
    2300 rpm, 65% power, at 7000 feet?
    Fuel consumption ___________ TAS ___________

14. What is the maximum demonstrated crosswind velocity? ___________ knots
    (This number is noted only in newer POHs. It is not considered limiting.)

15. What is the maneuvering speed (Va) at max gross weight? ___________

16. What limitation applies to the fuel selector valve during takeoffs and landings? ___________________________

17. What is the best glide speed at maximum gross weight? ___________ KIAS
    At 2,600 lb? ___________ KIAS

18. What are the indications of a vacuum system failure?

19. Which instruments/systems would be affected by a complete vacuum failure?

20. List the number of fuel drains and locations.

21. How is carburetor ice detected?

22. What is the procedure to remove carb ice?

23. What are the indications that the alternator has failed?
    How would you attempt to bring it back online?
    What is the procedure if unable to restore the alternator?

24. Which instruments will be inoperative with a dead battery?

25. The speeds and flaps settings for takeoffs and landings are:
    Normal takeoff ___________ Flaps ___________
    Normal landing ___________ Flaps ___________
    Short-field takeoff ___________ Flaps ___________
    Short-field landing ___________ Flaps ___________

26. What is the emergency descent procedure?

27. List the following indicated airspeeds:
    Rotation, Vr ___________
    Never exceed, Vne ___________
    Maximum flaps extended, Vfe ___________
    Stall, clean configuration, Vs ___________
    Stall, full flaps, Vso ___________
    Normal operating, Vno ___________
    Best angle of climb, Vx ___________
    Best rate of climb, Vy ___________

28. What is the normal full flaps approach speed? ___________

29. What is the procedure for a go-around?

30. What is the procedure following an inflight engine failure?

Cessna Skylane Training Course Outline

INTRODUCTION

This outline is a training guide for pilots and flight instructors. Because of variables involving pilot experience and proficiency, the training should be flexible. For example, a thorough discussion of IFR procedures and regulations is recommended for pilots who are not current. For more proficient pilots this much instruction may not be necessary and training should be adjusted accordingly.

Pilots should perform all tasks to practical test standards (PTS) and receive, at the satisfactory conclusion of training, a flight review endorsement and, if instrument-rated, an instrument proficiency check.

This training course outline is divided into four blocks of instruction. The first block, consisting of two hours ground orientation, concentrates on the C-182, its systems, and pilot procedures. The second block reviews normal and emergency VFR procedures and elementary IFR procedures. The third block reviews instrument flight operations, and the fourth block concentrates on cross-country flight. The time required to complete this training will vary with pilot proficiency and experience. Average time to complete each block is indicated below.

Block 1: Ground Orientation

The pilot will thoroughly review the *Pilot's Operating Handbook* and all documents covering modifications to the aircraft and electronic equipment installed. In-cockpit familiarization will be accomplished and C-182 accident history will be discussed. The pilot will review normal and emergency operations, calculate weight and balance, and calculate takeoff and landing performance data.

Ground: 2.0 hours

Pilot
- Certificates, ratings, and currency
- High performance endorsement, if needed

Airplane and Systems
- Flight controls
- Installed instruments, avionics, and autopilot
- Landing gear and hydraulic system
- Brakes
- Seats, seat belts, and doors
- Engine and engine instruments
- Propeller
- Fuel system
- Electrical system, ground service plug
- Lighting systems
- Environmental control system
- Pitot-static system and instruments
- Vacuum system and instruments
- Supplemental oxygen system, if installed

Aircraft Inspections and Handling
- Required inspections
- Ground handling
- Fueling
- Oil, hydraulic, oxygen replenishment

Performance
- Use of performance charts
- Takeoff distance, time, fuel, and distance to climb charts
- Cruise performance charts
- Range and endurance charts
- Landing distance charts

Weight and Balance
- Review of aircraft equipment list
- Determination of weight and balance from sample loading situations

Limitations
- Airspeeds
- Powerplant
- Fuel system
- Operating instrument indications

Normal Procedures
- Speeds for normal operation
- Preflight inspection
- Engine start and runup
- Taxiing
- Normal, short-field, soft-field, and crosswind takeoffs
- Normal and maximum performance climbs
- Cruising flight
- Descents
- Normal, short-field, soft-field, and crosswind landings
- Balked landings and go-arounds
- Flap retraction procedures
- After landing, securing the aircraft

Emergency Procedures
- Airspeeds for emergency operations
- Engine failure procedures
- Emergency and precautionary landings
- Fires
- Icing
- Vacuum, pitot, and static system failures
- Electrical system malfunctions
- Emergency descents
- Inadvertent door opening in flight

Troubleshooting
- Autopilot and electric trim malfunctions
- Relationship of vacuum failures to autopilot operation
- Electrical system and what to do if charging system fails
- Load shedding and estimated time of usable battery life
- Hung starter indications and remedies
- Emergency checklists
- Relationship between EGT, if so equipped, and fuel flow on climb and cruise

Block 2: General Flight Operations

The pilot will become acquainted with the Cessna 182 aircraft. Preflight, in-flight, and postflight operations will be discussed and practiced.

Ground: 1.0 hour
Weight and Balance Calculation
Review of Normal and Emergency Procedures
Determination of PIC and Transfer of Control

Flight: 2.5 hours
Preflight Operations
- Takeoff, climb, and landing performance calculations
- Preflight line check
- Starting:
  Normal
  Hot
  External power
- Pretakeoff runup and checks

Takeoff Operations
- Normal
- Rejected
- Crosswind
- Instrument
- Short-field
- Soft-field

Airwork
- Climbs
- Turns
- Slow flight
- Approaches to stalls/full stalls
- Steep turns
- Cruise configuration
- Approach/landing configuration

Instrument
- Turns, climbs, descents
- Slow flight
- Unusual attitude recovery
- Recovery from approaches to stalls

Emergency Procedures
- Engine failure
- Fire in flight
- Induction ice
- Alternator failure
- Vacuum pump failure

Landings
- Normal
- Crosswind
- No flap
- Short-field
- Soft-field
- Balked (go-around)
- Failed engine

Block 3: IFR Operations

The pilot will review the requirements, regulations, and procedures for IFR flight operations.

Ground: 1.5 hours
Requirements for Instrument Flight
- Pilot
  - Certificates, ratings, and currency
  - High performance endorsement, if needed
  - Six-month currency
  - 90-day currency
- Aircraft
  - Required equipment
  - Equipment certification
  - RNAV/Loran/GPS
  - Autopilot/Flight Director
  - Other
- Periodic Inspections
  - Transponder
  - Pilot-static system
  - ELT
  - Annual/100 Hour
  - ADs/Service Bulletins
  - Recommended service intervals
  - Preflight line inspection

FARs for Instrument Flight
- Flight plan/clearance required
- Compliance with ATC instructions
- Alternate criteria
- Lost communication procedures
- Required reporting points
- PIC authority and responsibility

Charts
- SIDs / STARs
- Low altitude en route
- Instrument approach procedures

Preflight Briefing
- Lesson content
- Instructor/pilot roles and responsibilities
- Transfer of control
- Collision avoidance procedures

Flight: 1.5 hours
Clearance Copy, Accurate Readback
- Accurate copy and readback
- Proper nav and com radio configuration
- SID, if appropriate

Note: If ATC clearance is not available, instructor will issue clearance containing all elements of a standard departure clearance.

Pretakeoff
- Checklist use
- Instruments
- Avionics
- Charts
- Departure procedure review

Departure
- Heading and altitude
- Route interception
- Amended clearance
- Climb and cruise checklists

Holding
- Holding clearance copy and readback
- Aircraft configuration prior to holding fix
- Entry procedure
- ATC reporting

NDB Approach
- Approach clearance
- Checklist, aircraft configuration
- Tracking, orientation, altitude, MDA
- Interception of bearings
- Timing, MAP
- ATC coordination

Missed Approach
- Climb, heading, altitude
- Course interception
- Climb checklist
- ATC and CTAF

DME Arc Approach, if available
- Arc interception
- Orientation
- Radial identification
- ATC and CTAF

VOR Approach
- Approach clearance
- Checklist, aircraft configuration
- Tracking, orientation, altitude, MDA
- Timing, MAP identification
- ATC and CTAF

GPS Approach
- Approach clearance
- Approach programming
- Approach arm
- Missed approach
- ATC and CTAF

Circling Approach
- Altitude
- Distance from airport
- Traffic avoidance
- Missed approach procedure
- ATC and CTAF

ILS Approach
- Approach clearance
- Aircraft configuration
- Tracking, orientation
- Altitudes, DH
- MAP procedure
- ATC and CTAF

Partial-Panel Approach
- Approach clearance
- Checklist, aircraft configuration
- Orientation
- Altitudes, MDA
- ATC and CTAF

Inoperative Equipment
- Lost communication
  - Route and altitude
  - Position reporting
- Lost Navigation Equipment
  - Revised minimums
  - ATC report
- Alternator Failure
  - Load shedding
  - Flight plan revision
  - ATC notification and coordination

Emergency Procedures
- Engine failure
- Airframe ice
- Vacuum pump/gyro failure
- Fire
- ATC notification and coordination

Block 4: Cross-Country IFR/VFR Operations

The pilot will gain understanding of the elements of cross-country flight and demonstrate proficiency in IFR and/or VFR cross-country operations.

Ground: 1.0 hours
The Flight Environment
- Airspace
- FAR Part 91

Weather
- The atmosphere
- Winds and clear air turbulence
- Clouds and thunderstorms
- Icing
- Weather products and services available for pilot use

Flight Planning and Navigation
- Fuel: wind and ATC routings
- Navigation
- Charts
- Navaids
- Planned descents

Physiological Training
- Respiration
- Hypoxia
- Vision

Emergency Operations
- In-flight fire
- Turbulence
- Thunderstorms
- Ice
- Use of autopilot to assist in some emergency situations

Flight: 1.5 hours

Preflight Briefing

- Line check
- Charts, documents
- Checklist use
- Clearance copy and readback

Departure

- Checklist
- SID, if appropriate

Climb

- Checklist

Cruise

- Checklist
- Power setting
- Mixture setting

Emergencies

- Emergency descent (discussion only)
- Alternator failure
- Load shedding
- Flight plan change
- ATC coordination
- In-flight fire
- Checklist use

Descent

- Planning
- Engine temperature monitoring
- Airspeed
- STAR, if appropriate

Approach and Landing

- Checklist use

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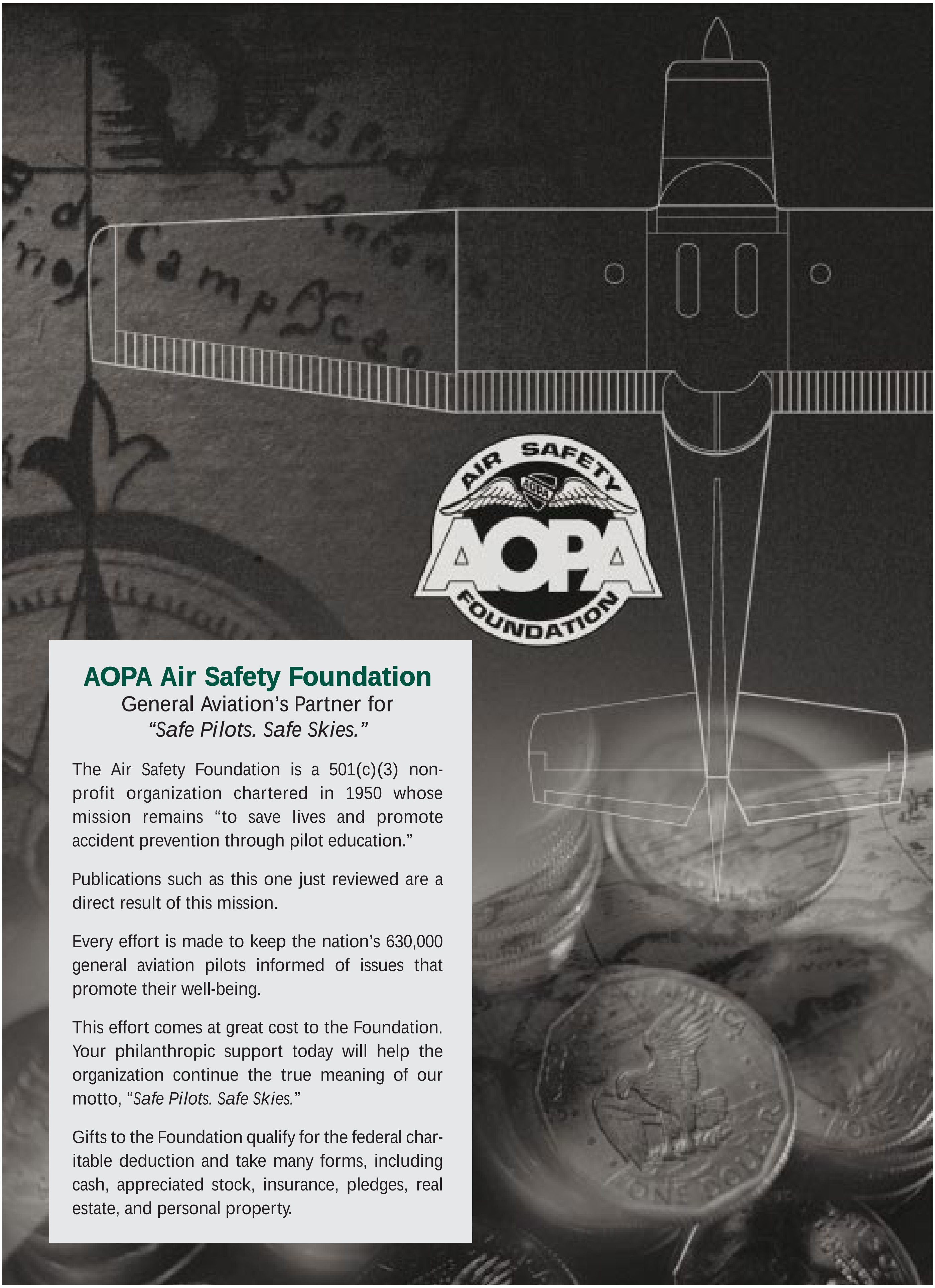

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