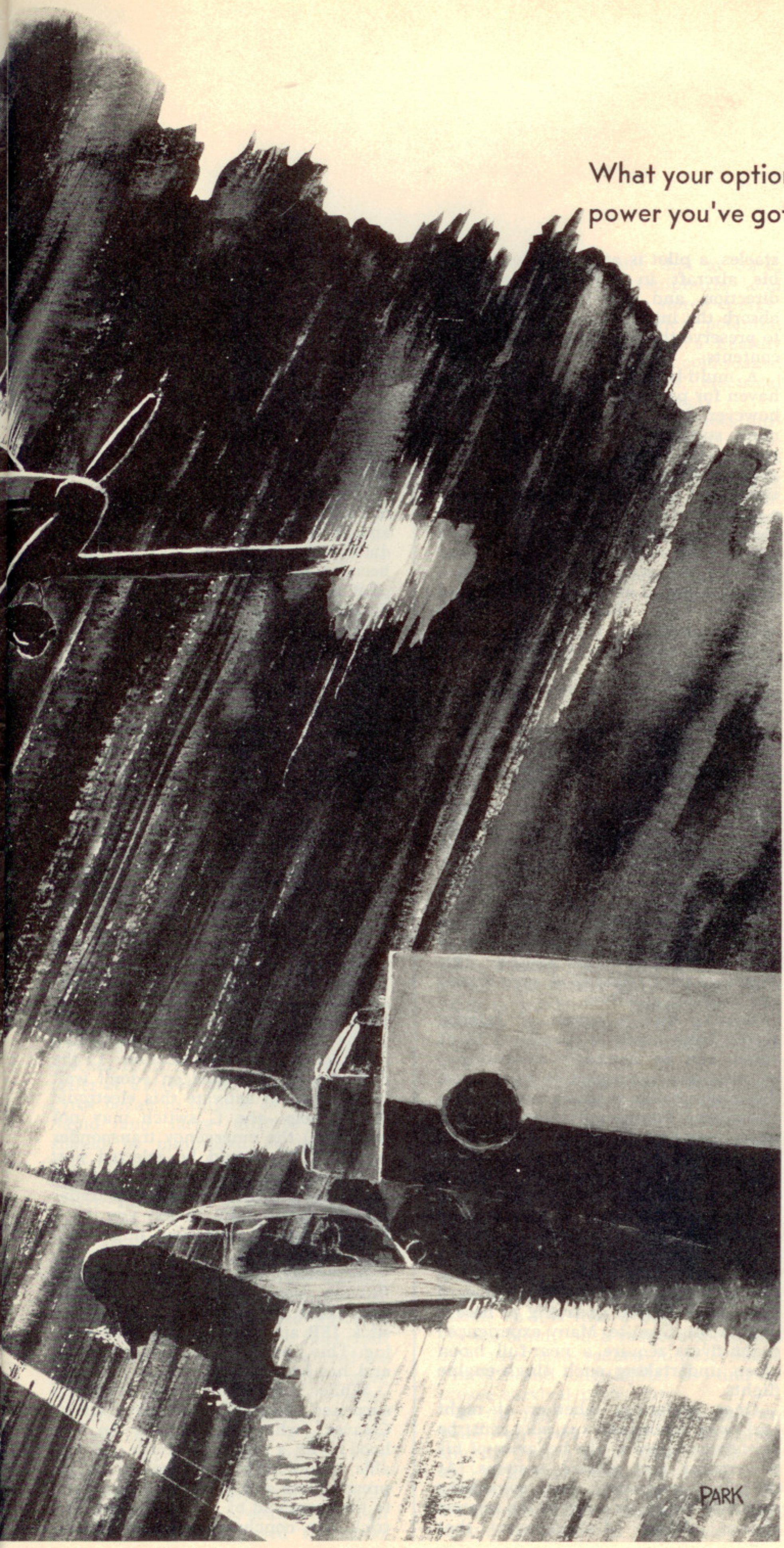
Engine Failure at Night or IFR



What your options are when you lose all the power you've got under the worst circumstances

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■■ Is there a prospect more chilling than an engine failure while flying at night and/or IFR in a single-engine airplane? A daytime failure is serious enough but is generally survivable. At night or when above a low ceiling, the same emergency can be catastrophic.

Pilots are trained to cope with engine difficulties during daylight VFR conditions. Who hasn't had an instructor pull the throttle to simulate engine failure? It catches us by surprise but is not alarming because the engine really isn't dead. And isn't every multi-engine pilot taught to manage a twin on one engine?

These exercises are reminders that although the modern piston engine is superbly reliable, it can fail and we need to be prepared for such a crisis. Paradoxically, however, we are taught nothing about handling a similar emergency at night or when IFR. The subject is virtually ignored.

The military, however, has this advice for its single-engine pilots: "If the engine fails at night or when above a low ceiling, bail out."

One fatalistic instructor offers this suggestion about an off-airport, dead-stick landing at night: "When you get to within a few hundred feet of the ground, turn on the landing lights. If you don't like what you see, turn 'em off."

Fortunately, engine failures are remarkably rare, but they do occur, however infrequently. When taking off into an ebony sky and/or a low ceiling, the possibility must be considered.

A pilot who flies single-engine at night or over an extensive area of low cloudiness does so because of his faith in the engine. Every hour, every day and every year of uneventful flight reinforces this belief. Experience tends to isolate a pilot from the concept of engine failure.

But should this occur while enshrouded in darkness or cloud, his brain may have considerable difficulty overcoming the shock of such cruel reality. He has had no preparation for the cataclysmic, terrifying silence. Plane and pilot simply descend helplessly toward an uncertain fate.

This is not intended to frighten night pilots or those who fly extensively in single-engine airplanes. Rather, the purpose is to focus attention on this axiom: "An engine can fail at *any* time, which dictates the need for preparation at *all* times."

Preparation begins with conservative planning. Unless a pilot is willing to bet his life (and those of his passengers) that his engine will not fail, flights should be avoided over areas of very low ceiling and visibility. There should be enough maneuvering room beneath the clouds for a pilot to locate a landing site of his choice. Descending blindly and powerless into zero-zero conditions puts lives totally in the hands of fate.

This is true because an emergency landing is generally survivable only when the pilot is able to control the aircraft and select the softest point of impact; crash landings in-the-blind are usually fatal.

If a flight over fog cannot be avoided by selecting an alternate route, consideration should be given to postponement until conditions improve.

Remember that while enroute stations may be reporting a 1,000-foot overcast, for example, hilly or mountainous terrain *between* those stations might rise to the base of the overcast or higher. Flying above a 1,000-foot ceiling might be safe when over the Great Plains, but not necessarily when over the Alleghenies or the Rockies. The character of enroute terrain should be considered.

Night flying also requires planning that enables a pilot—in case of engine failure—to *see* the projected landing area.

This, however, is not a universal opinion. Many pilots, professionals included, prefer gliding into a "black hole" instead of landing in an illuminated area. Their theory is that a dark spot is probably undeveloped and, therefore, reasonably flat. Landing "in the lights," they claim, offers a greater risk because of automobiles, structures, and other man-made obstacles.

Others (myself included) disagree because of our reluctance to plunge blindly and unexpectedly into a boulder, ravine or unlit structure. When he can "see" impending obstacles, a pilot is at least able to point his aircraft in the least damaging direction and direct the wings to absorb the initial shock in an attempt to preserve the fuselage and its fragile contents.

A multi-lane highway is a popular haven for powerless pilots. Admittedly, however, these lengthy "runways" were more suitable when the speed limit was faster. The best technique suggests landing into the wind (if possible) and *with* the traffic. Descend to a point between two cars and begin a speed reduction (flare) before settling between them. Hopefully, the aft car will see the aircraft and decelerate. As groundspeed decreases, the forward car should pull ahead of the airplane leaving sufficient room for a safe landing (power lines and bridges notwithstanding).

If highway traffic is heavy and slow, land elsewhere.

Another good alternative on a dark night is a body of water located by the lights reflecting from its surface. Ditching on inland water offers a high probability of survival, even to nonswimmers. The idea is to escape the crash; worry about subsequent problems later. (When ditching in a river, land with the current, not against it, unless strong winds dictate otherwise.)

If a landing must be executed on totally dark terrain, select a spot as near to civilization as possible. This increases the likelihood of early rescue and medical attention.

Soaring over a carpet of kaleidoscopic lights under a mantle of black velvet can be intensely rewarding—an aesthetic, introspective experience. But night flying requires unique considerations. Paramount among these is route selection. To maximize safety, courses should be altered so as to follow major highways, fly over as many enroute airports as possible and avoid extensive areas of totally dark terrain. This latter point is particularly important when over mountainous terrain. An engine failure here could find a pilot gliding unwittingly toward the Grand Canyon or trying to bore a hole in Mt. Granite. Many experienced night flyers require a near-full moon when undertaking such single-engine flights.

Once underway whether at night and/or on instruments, a pilot must be acutely sensitive to the behavior of his powerplant and related systems. At the first indication that something might be amiss, proceed to the nearest airport. Minor discrepancies that might be acceptable on a daytime, VFR flight may be totally intolerable at other times.

Fortunately, most power losses are only partial engine failures. With the exception of fuel starvation or exhaustion, it is unusual for an engine to quit without warning.

Should a partial loss occur, proceed to the nearest suitable landing area (which may or may not be an airport) and land as soon as possible.

The most horrendous situation is, of course, total power failure at night and/or when IFR. Your most immediate and pressing adversary is panic because of its detrimental effect on pilot performance. Contrary to immediate reaction, you will not be helpless. There will be many factors to consider and act upon. These require as unencumbered a mind and body as is possible to organize. Difficult as it may be, calm down.

The first step is to determine if you've really had an engine failure. Sound silly? It's not. A massive power loss might *feel* like total *failure*, but the engine could be producing sufficient power with which to either maintain altitude or hobble toward a nearby airport in a gradual descent. Juggle the engine controls in an attempt to find a combination that maximizes available power.

If the engine has failed totally and attempts to restart it are fruitless, *then* you are faced with a full-scale emergency and have precious few moments to consider many variables.

The first step involves establishing three forms of communication: 1) the ELT should be turned on (don't wait for a crash to activate this electronic plea-for-help—the G switch may not work); 2) the emergency transponder code (7700) should be selected *post haste;* and 3) attempt to establish voice communications with a radar facility that could vector you to a nearby airport that you might not know about.

Incredibly, an IFR pilot gliding through cloud can (either alone or with radar assistance) execute a dead-stick, IFR approach to an airport landing. This procedure takes a cool mind and has been done.

While researching this article, I surprised test pilot/attorney Robert Cleaves (who was wearing an IFR hood) with a retarded throttle. He was able to orient himself, select an approach plate and guide his Cessna 185 to the threshold of a local airport. The trick, we concluded, was to remain substantially above the minimum crossing altitudes shown on the approach plate until reasonably close to the airport. Curiously, and using a technique described later, such a feat is easier when the engine is *really* dead—not idling.

A dead-stick, IFR approach may not be successful, but there's not much to lose by trying. When "blinded" by cloud, where else have you got to go?

Communicate initially on the most recently used frequency. If no one answers, broadcast a Mayday on 121.5. If a non-radar facility answers, immediately request a local ARTCC or RAPCON frequency.

With respect to 121.5 mHz, does your radio operate on this frequency? Don't be so sure. When is the last time you used 121.5? Many pilots have never communicated using that crystal (or combination of crystals). Two points: 1) make a test broadcast on 121.5 at least every six months, and 2) monitor 121.5 on cross-country flights when a transceiver isn't required for other duties. Make sure 121.5 is operative and available.

Another major consideration (at night and/or when IFR) is the vacuum instruments (the artificial horizon and directional gyro). Without engine power, the vacuum pump produces considerably less than the minimum airflow required to maintain proper gyro operation. As an unpowered descent continues, be on guard for erroneous attitude information by cross-checking the usually-electric turn coordinator or indicator. (During a descent from 10,000 feet with the propeller of Cleaves' 185 windmilling, the gyros began to tumble at 4,500 feet.) Rapid and large attitude changes should be minimized because these add precessional forces that adversely affect gyro stabilization and reliability.

Gyro failure is a serious problem not only when IFR, but also perhaps when VFR at night. Although the horizon may be visible at altitude, it might disappear from view during descent because of terrain irregularities.

The electrical system also warrants attention. When the engine fails, rpm decreases to less than that required for generator operation. Windmilling rpm, however, usually allows an *alternator* to carry the load. Therefore, if the aircraft is equipped with a generator and not an alternator, only battery power will be available.

Batteries, however, are severely weakened when cold-soaked at high altitude or when exposed to winter temperatures. Consider that at 32°F, a fully-charged, lead-sulphuric acid battery loses 35% of its stored energy; at 0°F, 60% of its electrical potential is lost. And this assumes a healthy battery. If the battery is cold-soaked and weak to begin with, electrical power may be in short supply.

To prevent total electrical loss during an engine-out descent, it is important to reduce electrical load as much as possible. Turn off everything that isn't essential such as navigation lights, anti-collision lights, unneeded avionics, etc. When transmissions are made, keep them brief and to the point. Avoid using landing lights until close enough to the ground for them to be useful.

If your aircraft utilizes an engine-driven hydraulic pump to extend the landing gear and flaps, consider that when the prop is windmilling, there may or may not be sufficient hydraulic pressure available to extend the landing gear prior to landing. Plan on saving enough time for manual extension.

If you are on instruments and there may be conflicting traffic on the airway below, consider turning off course (terrain permitting) to reduce the possibility of a near-miss or worse.

Pilots have been trained since Year One to glide at the best-angle-of-glide speed. This is fine if trying to reach some distant point. But if there are no airports within gliding range or a pilot is unable to visually select a landing site (because he is still in cloud), then he has a wiser alternative.

By reducing airspeed to about stall speed plus 10 mph, sink rate decreases dramatically. This slower airspeed is familiar to all glider pilots as the "minimum sink speed." True, the airplane does not glide as far (horizontally), but it substantially postpones ground contact. This allows more time to communicate, more time to calm down and more time to select a landing site.

If the terrain is so dark or the clouds so low that a pilot must land "in the blind," such reduced speed and sink rate also reduce impact forces (vertical and longitudinal Gs) and increase survival probability.

If the pilot can see his touchdown point, airspeed should be increased slightly (when more than 1,000 feet agl) to increase maneuverability.

If structural icing is expected or encountered during descent, sink rate should be increased until below the icing level to minimize exposure to this added risk.

A powerless pilot has yet another life-saving technique available. If there is absolutely no hope of rekindling the engine, shut off the mags, adjust the mixture to idle cutoff and reduce airspeed until the propeller slows down and comes to a halt. (This usually occurs near the stalling speed in most lightplanes.)

Stopping the prop is almost as effective on a single as feathering the propeller on a twin; total airframe drag is reduced substantially.

If it is desirable to reach a distant airport, stopping the prop might make the difference, because this alone increases glide range by a whopping 20% (in most cases) over that attainable when the best-angle-of-glide speed is used.

Or, if descending at the minimum sink speed, such drag reduction decreases sink rate by 20%. With a stilled prop, Cleaves' 185 floated earthward (and *very* quietly) at a modest 300 fpm; sink rate in that airplane during a normal glide with engine idling is 900 fpm.

Short of stopping the prop, glide performance can be increased slightly by positioning the prop in maximum pitch (low rpm).

One subject of controversy is how to position retractable landing gear during an off-airport, emergency landing. Generally, and unless specific conditions warrant otherwise, touch down on land with gear extended and allow the legs to absorb some of the initial shock. Ditch in water with wheels up.

Flap position is also a controversial subject. Generally, and shortly before touchdown, they should be extended at least partially. Remember, flaps hinder glide performance, but reduce touchdown speed.

To minimize fire potential, fuel pumps, selector valves and the master switch (if practical) should be turned off prior to touchdown.

It is interesting that many countries prohibit night and/or IFR flight in single-engine airplanes. Fortunately, FAA imposes no such ban on U.S. pilots because night and/or IFR flying is a safe, rational activity—but only when tempered by conservative planning.

There can be risks, however. It is for each pilot to weigh the purpose of a specific flight against the risks to determine if and when the end justifies the means. ☐