FOUR

FATAL FACTORS

POOR FLIGHT PLANNING, aircraft handling problems and fuel starvation and exhaustion are behind most fatal general aviation accidents in Australia, according to an analysis of 10 years of Australian Transport Safety Bureau data.

Preliminary results of the analysis show that these factors contributed to more than 60 per cent of fatal accidents between 1991 and 2000.

The results of the study, carried out by CASA statisticians as part of a larger joint CASA-ATSB project, have just been released. They will lay the foundations for a more targeted approach to regulatory reform and safety promotion. They also point to possible weaknesses in flying training that CASA, in cooperation with industry, should address.

However, further research will be needed to firm up the conclusions.

A preliminary analysis of 10 years of ATSB accident data shows that just a few factors are to blame for most general aviation deaths.

The research centred on fatal accidents involving Australian-registered aircraft. It excluded accidents in the sports aviation and regular public transport sectors.

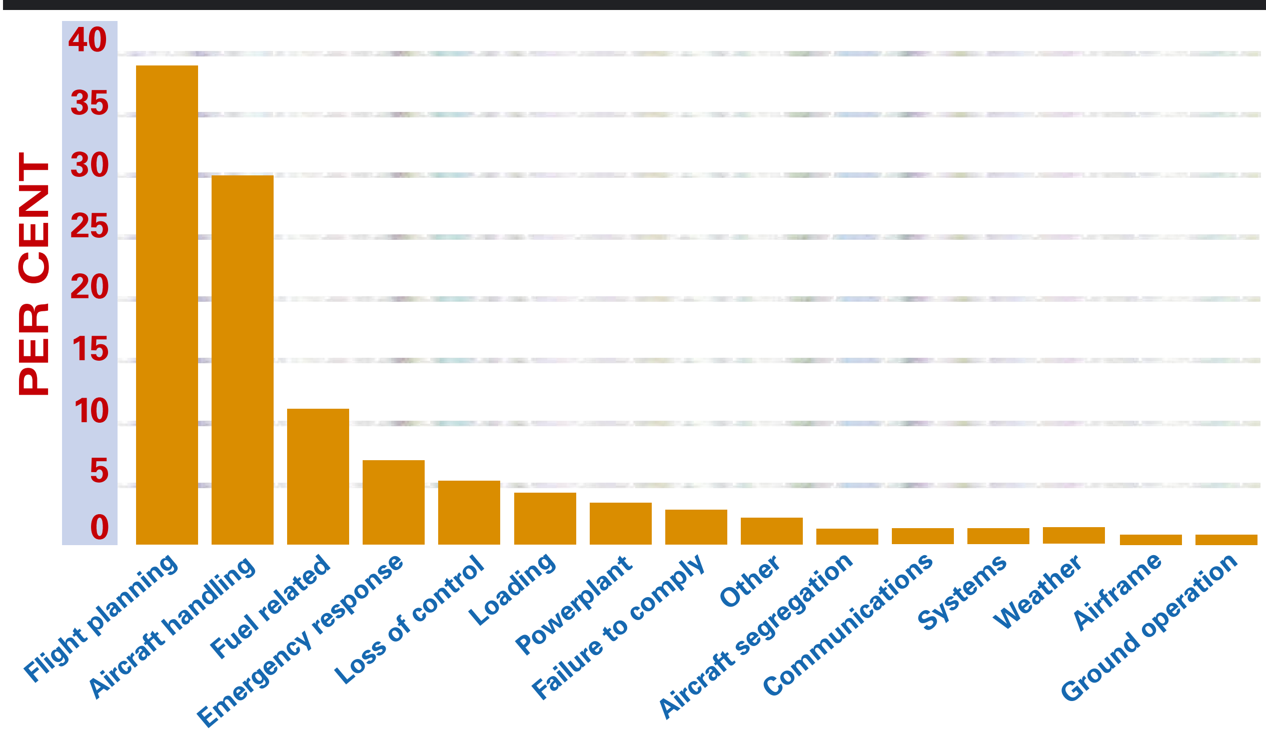
A total of 196 fatal accidents and 379 fatalities, divided about equally between pilots and passengers, occurred in the period. The ages of pilots ranged from 19 to 78 years, with an average age of forty-three.

About 53 per cent of fatal accidents and 59 per cent of fatalities were in the private, recreational and personal business sectors. Seventeen per cent of fatal accidents and 22 per cent of fatalities involved charter flights.

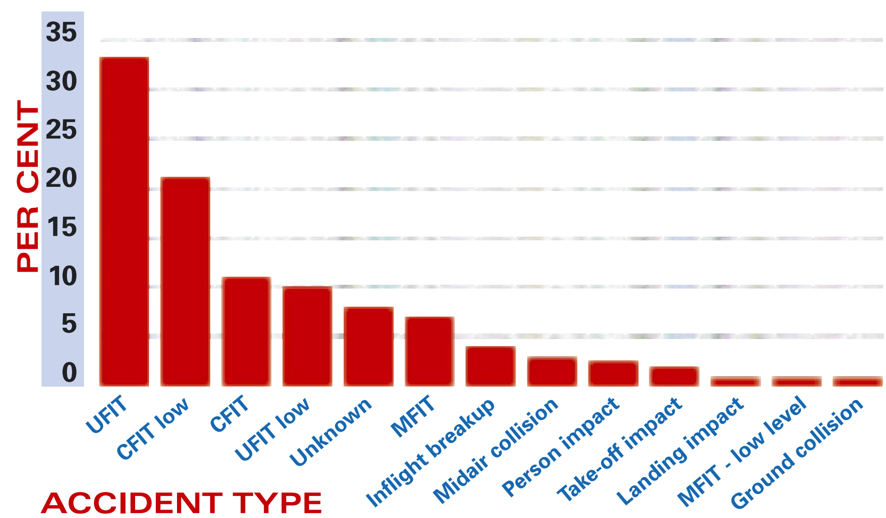
Contributing or causal factors The small number of primary contributing or causal factors figuring in most fatal accidents opens up big opportunities for prevention.

Deficiencies in flight planning were

RELATIVE FREQUENCY OF FACTORS CONTRIBUTING TO FATAL ACCIDENTS



TYPES OF ACCIDENTS INVOLVING FATAL INJURIES



implicated in about 38 per cent of cases. Of these, 25 per cent involved VFR pilots flying into instrument meteorological conditions. Unnecessary low-level flight accounted for 17 per cent of the cases, and scud running, 11 per cent. Poor decision making in emergencies was implicated in 9 per cent of fatal accidents.

Meanwhile, aircraft handling errors were noted in 30 per cent of cases. Of these, mishandling of control inputs accounted for 59 per cent of fatal accidents, while inadequate pilot response to emergencies was responsible for 19 per cent. Incorrect configuration of control surfaces, for example, was implicated in 13 per cent of cases, with unnecessary, risky manoeuvres playing a part in 9 per cent.

Fuel starvation and exhaustion were involved in 10 per cent of the accidents.

Experience levels of pilots in fatal accidents varied according to the sector of GA. Agricultural pilots were the most experienced, with 57 per cent having clocked up more than 4,600 hours against just 30 per wcent of those working in charter or other aerial work. About 7 per cent of private or recreational pilots involved in fatal accidents had more than 4,600 hours' experience.

Most business and private fatal accidents resulted in multiple fatalities.

CFIT or UFIT Forty-three per cent of fatal accidents were described as uncontrolled flights into terrain (UFIT), with 32 per cent involving controlled flight into terrain (CFIT), most of them resulting from low-level flying.

Most of the UFIT accidents ended in crashes into the ground rather than into wires, trees or other obstacles. Two thirds of the total led to multiple fatalities.

Pilots involved in UFIT crashes tended to be younger than the average.

And handling problems were associated with 90 per cent of UFIT accidents involving low-level flying.

Among CFIT accidents, impact with the ground or trees (or other obstacles) was equally likely. Of those involving low-level flying, almost 75 per cent involved wire strikes.

And errors in flight planning figured in 76 per cent of all CFIT cases.

A high number of the accidents were associated with agricultural work.

Meanwhile, fuel starvation or exhaustion were implicated in half of accidents involving flight into terrain under partial control.

Release of the preliminary results of the study will stimulate some discussion, ahead of confirmation of the analysis.

The ATSB will complete a comprehensive study of the data, with help from CASA specialists. The final report is due in a few months.

This will be invaluable for understanding the main risk areas of flight, and will enable both the regulator and industry to target risk areas more accurately.

- Bruce Byron, CASA CEO

"There is about one GA accident or incident a week in Australia directly related to fuel exhaustion or starvation."

FATAL FACTOR 1
OUT OF FUEL

Fuel starvation or exhaustion featured in 10 per cent of accidents.

WITNESSES HEARD THE CESSNA 210's engine splutter before seeing the aeroplane disappear as it descended into trees just west of Tindal in the Northern Territory.

The pilot and four passengers were killed in the crash, following a scenic flight from the Bungle Bungle Ranges.

Australian Transport Safety Bureau investigators attributed the crash to fuel exhaustion.

The pilot, inexperienced in ad hoc scenic flight, had underestimated by almost an hour and a half the flight time for a busy schedule of sightseeing. In fact, he had omitted one segment of the trip from his flight plan.

In their report, the investigators cited evidence that the pilot was "not in the habit of maintaining a running log of time, distance and fuel endurance". He navigated by GPS but, according to his boss, "always seemed to know where he was".

"When faced with the emergency, the pilot did not take advantage of available options that could have minimised the consequences," the report said.

"Once the engine power began to fail, it is likely that the pilot was concentrating on the reasons for the power loss and was attempting to restore power rather than considering suitable areas in which to make a forced landing." In fact, the aircraft was seen to fly over a perfectly acceptable emergency landing area just before the engine failed.

There is about one GA accident or incident a week in Australia directly related to fuel exhaustion or starvation.

You can avoid becoming one of these statistics by following a few simple rules and anticipating operational problems possible during flight.

Be confident you know how much fuel you need. Well before you plan a flight, check the availability of fuel en route, noting suppliers' operating hours and call-out fees. This will help you choose the appropriate aircraft for the job.

For example, a 300 nm trip in a light two-place training aircraft with two heavy people on board plus baggage will require at least one refuelling stop. However, a similar four-place aircraft might be capable of carrying the required load plus greater fuel reserves over the same distance without refuelling en route, and without introducing payload or all-up weight problems.

Make sure you are familiar with all systems in the aircraft well before the flight, paying particular attention to peculiarities in the fuel system. You should establish from the aircraft's flight manual the total fuel capacity and precisely what amount of fuel is useable.

Establish from the pilot's operating handbook the fuel consumption rates. Extract the correct information (for example, do not use the 55 per cent power chart if you intend to cruise at 65 per cent power) and double-check any conversions – US gallons to litres, for example. Be familiar with the correct method of selecting another fuel tank during normal operations and know what to do if a tank is inadvertently run dry.

Calculate the fuel needed based on the correct consumption rate and planned ground speed. This calculation does not allow for fuel that will be used during taxiing, for manoeuvring before departure and on arrival or for other delays.

To carry only flight fuel is unsafe. Always carry reserve fuel. If you are involved in commercial operations, your company operations manual will specify statutory fuel reserves. For other operations, fuel reserves might be entirely at your discretion.

FUEL PLANNING SCENARIO

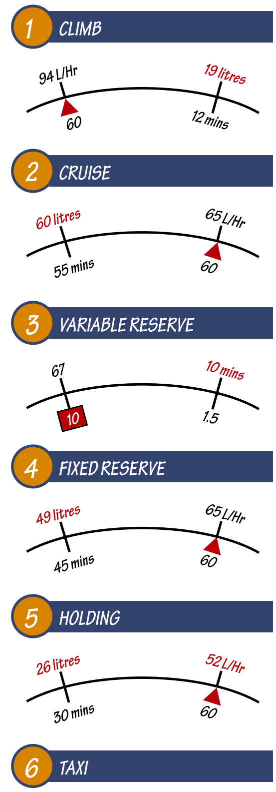
SCENARIO - PIPER LANCE

CATEGORY	Private	*WIND*	Nil
FROM	Mallacoota (YMCO)	*CLIMB*	110 KT
TO	Albury (YMAY) ETA 0500	*CRUISE*	150 KT
DISTANCE	160NM		

PIPER LANCE TYPICAL FUEL FLOW:

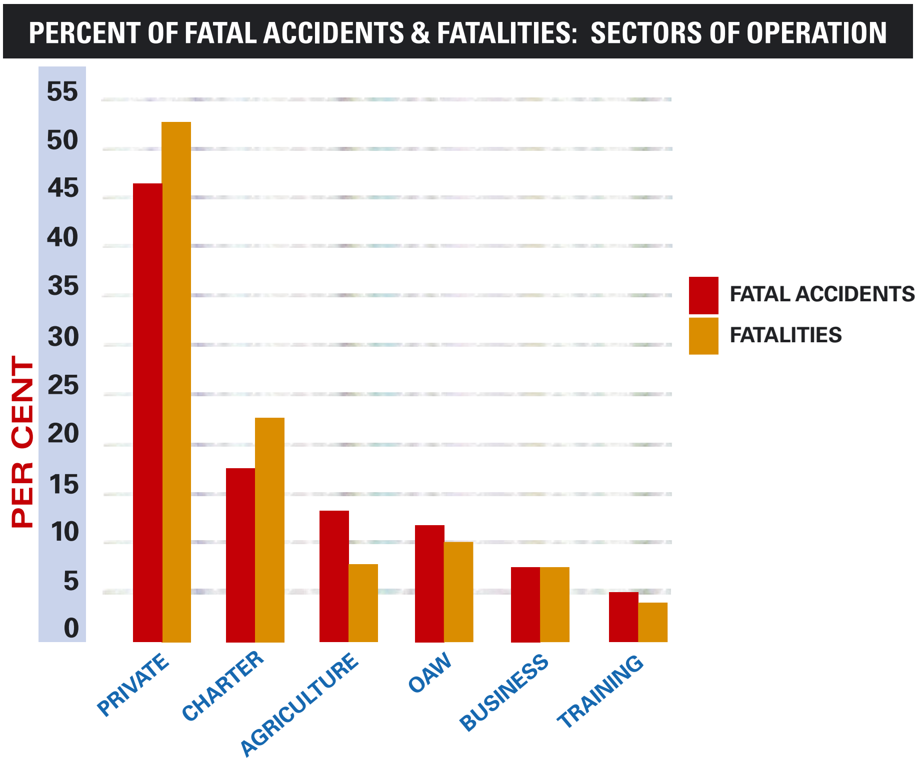
CLIMB 94 litres/hr *CRUISE* 65 litres/hr *HOLDING* 52 litres/hr

USE FIGURES FROM YOUR AEROPLANE'S PILOT OPERATING HANDBOOK



NB: Allow appropriate fuel for aircraft (time calculation not applicable).

FUEL CALC.	Min	L/Kg?...
1 Climb	12	19
2 Cruise	55	60
Alternate	-	-
SUB TOTAL	67	79
3 Variable Reserve	10	12
4 Fixed Reserve	45	49
5 Holding	30	26
6 Taxi	-	10
FUEL REQUIRED	152	176
Margin	22	24
ENDURANCE	174	200
FROM	YMCO	



The old rule of a 45-minute fixed reserve for VFR operations might be excessive for a two-minute flight from one ALA to another. However, a 45-minute reserve might not be enough for a long VFR flight. Aim to land with intact fixed fuel reserves, with en route delays being accommodated by dedicated reserves or the fuel margin.

Be confident you know how much fuel you have. When possible, visually check the amount of fuel in each tank with a dipstick, but beware of possible calibration inaccuracies on locally-produced dipsticks. When a tank cannot be dipped, fill at least one or two tanks – all up weight permitting – so there is a known fuel quantity in at least one of the tanks.

Civil Aviation Order Section 20.2 specifies fuel quantity measurement for large aircraft but also advises on how to check fuel content in smaller aircraft. If separate methods of determining the fuel on board vary by more than 3 per cent, use the lowest figure.

Refuel on level ground if you can to avoid inaccurate fuel measurements and unwanted fuel transfer. Check the fuel filler cap for security and sealing, unless you wish to empty a tank in record time! Ensure drains and vents are working properly. Also check for fuel stains around fuel caps and vents. If in doubt about the serviceability of the aircraft, get an engineer to investigate the problem.

Follow the aircraft manufacturer's recommendations when doing fuel drains. Rock the aircraft to remove trapped water over the drain point before carrying out a fuel drain. Satisfy yourself that the fuel in the aircraft is the required grade and quality, checking for water and other contaminants.

Be confident you know how much fuel you have left, and whether it will be enough. Keep an accurate fuel log, noting when you changed tanks. Fuel logs vary in style but the most usual type is referred to as a "Howgozit", in which predicted fuel remaining is checked against actual fuel remaining, usually at 30 minute intervals or coinciding with position reporting points or position checks. If you appear to be using significantly more fuel than planned, land as soon as possible and check out the problem.

The accuracy of fuel gauges in light aircraft is sometimes questionable, but these inaccuracies are consistent. This means that you should be able to trust the fuel calibration card that says how much fuel you really have when the tank reads half.

You now have two different, independent systems to tell you how much fuel you have, and they should agree. If they don't agree, then you can't know which one is wrong, and you should consider the worst case as your best option.

Ensure you use the correct power settings and mixture leaning technique. If you have to fly lower than expected or use carburettor heat, you will probably burn more fuel than planned.

If you look like consuming your fixed reserves, a precautionary search and landing is likelier to result in a safe outcome than a forced landing after fuel exhaustion.

What is appropriate in a car is not in an aeroplane.

– Steve Tizzard, CASA

FATAL FACTOR 2
VFR INTO IMC

Poor flight planning was behind 38 per cent of fatalities, with 25 per cent of these involving VFR pilots flying into instrument meteorological conditions.

WE HAVE ALL HAD TO CHANGE PLANS because of the weather. How often did you have a backup plan?

If you fly into cloud without being properly trained, your chances of survival are low.

In the 1960s, United Kingdom researchers performed a simple test exposing pilots without any instrument flying training to simulated instrument flight conditions. The pilots lost control within two minutes.

VFR pilots should always expect to make a "no-go" decision.

If you find yourself operating under VFR in marginal weather conditions, you need eyes in the back of your head to ensure you have at least one option other than entering cloud. Many pilots in this situation fly too high, making inadvertent cloud entry more likely. By flying a little lower, you may be able to get a clearer picture of the cloud base and make a decision before inadvertent entry into IMC is the only option open.

Slow the aeroplane down (use flap and drop the gear) so you can manoeuvre in a tighter area. This will improve your forward vision.

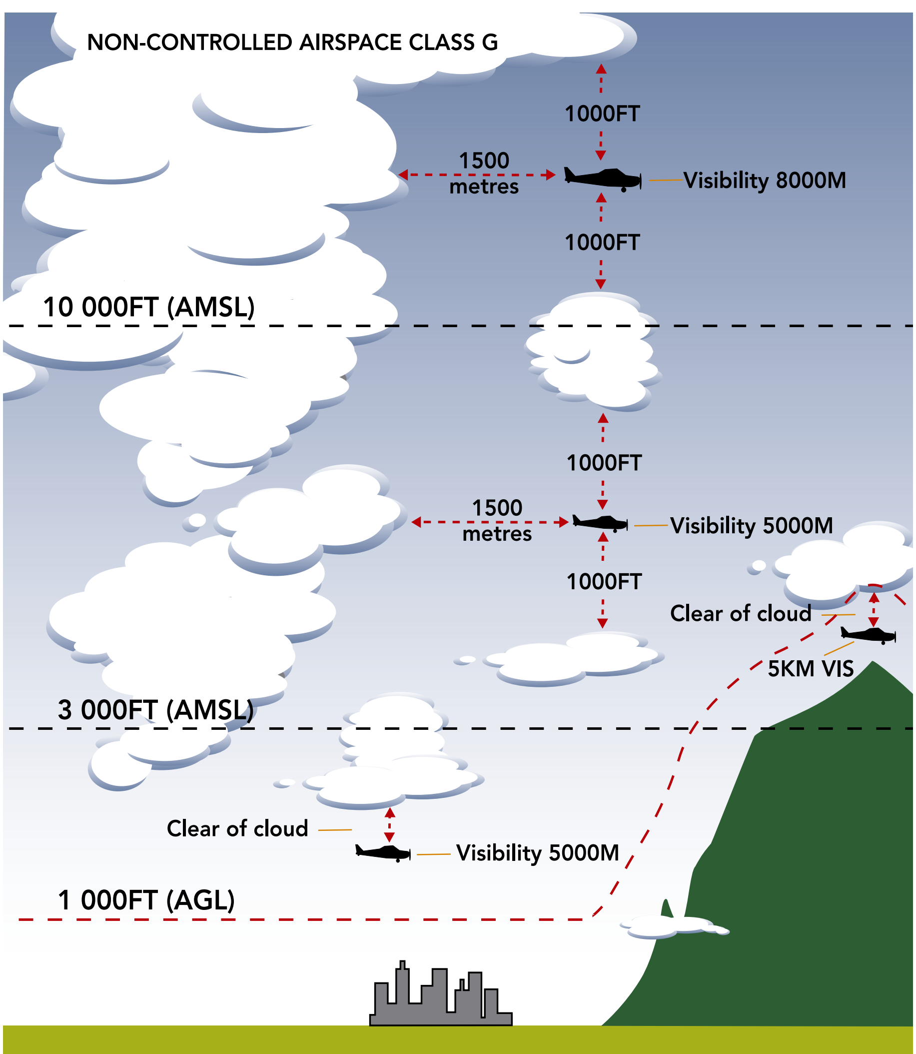
There is generally a higher probability of getting caught when operating above cloud or between layers. No matter how well you did in the instrument flying component of your training, there is a big difference between flying in cloud and "hood flying" (with the occasional sneaky look outside) where you have a flying instructor to take control if matters get out of hand. The sensory illusions of cloud flying can be powerful if you are not proficient and current.

Some pilots might want to take advantage of the private IFR rating that came into force in 2000. The rating makes a basic IFR capability accessible to private pilots for whom the command instrument rating (CIR) is difficult to obtain and maintain. But it aims to achieve at least the same standards of safety for the operations involved. In its basic form the PIFR allows flight under the IFR for en route navigation, but is limited to visual conditions for climb and descent below lowest safe altitude (LSALT). It was introduced to help cut the number of VFR into IMC incidents and accidents by providing a safer option for VFR pilots than scud running in bad weather.

– Steve Tizzard, CASA

"The new analysis of fatal GA accidents indicates that pilots who use their licences for private or personal business are most at risk."

MINIMUM REQUIREMENTS FOR VISUAL FLIGHT IN CLASS G AIRSPACE



FATAL FACTOR 3
MISHANDLING GO-AROUNDS

Aircraft handling errors were noted in 30 per cent of fatalities, with many related to unusual manoeuvres or emergencies. Some advice on one of the trickies, the go-around.

IT'S CALLED A GO-AROUND, A WAVE-OFF, AN aborted landing, a missed approach, a rejected landing, or a bugger. Whatever you choose to call it, coming back for a second try at the runway is a skill that everyone needs but many lack. And there is little room for handling error.

Most pilots don't go around very often, and there are at least two reasons for that: We like landings and hate to waste an approach, or we're loathe to admit that things weren't working out the first time and worry that it might be perceived as incompetence.

There are several excellent reasons to reject a landing. The first is being too far down the runway to stop safely. The rule of thumb says that if the aircraft isn't on the ground in the first third of the runway, go around. If the speed or the alignment isn't right, go for the gas. There is always a chance to play again.

One of the tricky things about go-arounds is that the aircraft is trimmed for landing – not going around. On very light airplanes this isn't much of an issue because the pilot can overpower the pitch-up tendency when full power is applied. Fly something with muscle, however, and the pilot will need super strength to keep the nose from getting too high.

The go-around sequence is much the same for all aircraft – power, pitch, flaps, and gear – but check your Pilot's Operating Handbook for the exact procedure for your aircraft. This will generally work on everything from trainers to twins. As the accident scenarios prove, however, many pilots don't know the drill, and the sequence is important.

Full power is the first thing needed to get the aircraft climbing, but how it's applied is just as important as when. I remember coaching a student on what turned out to be a memorable go-around when he jammed on full throttle. The engine made an ugly sound, stuttering, gasping, and finally emitting a great snarling "harrumph", as if to get even for being treated so shabbily. It then gave us exactly what we asked for – full power.

All the torque and left-turning tendencies kicked in with a vengeance, so directional control became the issue of the moment. My student, usually ham-fisted with the throttle, was equally ham-footed, or, rather, dead-footed, with the rudder. More rudder sooner is much better than less rudder later. The manoeuvre eventually worked out, but not without some amusement for the spectators.

Next, the pitch attitude must be adjusted from landing to climb, with a transition through level. If the go-around occurs before the flare, raising the nose to level should arrest the descent.

In many aircraft you'll need to hold the nose level with forward pressure to keep the aeroplane from attaining too high an angle of attack as power is added. That's another tricky thing about go-arounds – we want to go up but have to hold the nose down. A strong left arm is an essential part of a successful go-around.

The third item is to retract the flaps as recommended by the manufacturer. This usually means going to half or "approach" flaps.

Single-engine Cessnas, such as the 150 or 172 sometimes won't climb with 40 degrees of flap. On the later models, Cessna limited the travel to 30 degrees to give the pilot a little more performance, and that's usually what you get – a little more. The procedure is to retract the flaps immediately to 20 degrees and then go for climb airspeed.

The deck angle – or pitch attitude, if you prefer – will be much lower than the normal no-flaps climb attitude. Once the aircraft has cleared the obstacle and has adequate speed, then retract the rest of the flaps.

Piper and Mooney flaps aren't quite as effective, so there is a bit more room to fumble, but we all take pride in doing it correctly. If the pilot retracts the flaps too quickly, there is usually a sinking spell and sometimes a stall, so adding just enough back pressure to keep from sinking is something else to add to the skills list.

On the Beech V35 Bonanza, the stall speed increases by about 12 knots as the flaps come up. On the Cessna 172, it's around seven knots; on the Piper Arrow, it's about five knots.

As soon as the power, pitch attitude and flaps are set, retrim to take pressure off the control yoke. Want to see what it's like with full power, full flaps, and landing speed? Try a go-around at altitude. The control pressures may be surprisingly strong.

The last item is to raise the landing gear, if it's retractable. This is done only when the vertical speed indicator shows a positive climb so that if the aircraft should settle to the runway despite our best efforts, there's a only a minor delay in getting airborne again, which is preferable to experiencing a belly slide.

On some aircraft, the gear retraction sequence actually creates more drag as doors open to accept the wheels than if the gear were left down. In many aircraft the procedure is to wait until clear of the obstacle before starting the retraction cycle.

Go-around gone wrong Here's an accident that illustrates almost everything that could go wrong with a go-around. A Cessna 182RG approached a 6,000 foot runway with 40 degrees of flaps. The heavily loaded aircraft bounced twice during the landing; the pilot, deciding to go around, applied full power. The aircraft was reported to be "wallowing" in ground effect, so, to reduce drag, the pilot raised the landing gear, but the Cessna settled onto the runway. After the accident, the flaps were found to be fully retracted. The pilot believed that the flaps were accidentally retracted when the front passenger's knee came in contact with the flap switch during the first bounce. The six-foot-seven-inch passenger had trouble sitting in the aircraft comfortably and received a bruise on his left knee in a position that corresponded with flap switch.

The winds were less than 10 kt, but the pilot claimed wind shear. The accident investigator didn't buy that scenario. The probable cause was listed as an improper flare with improper gear and flap usage in a go-around. In the heat of the moment, it's tempting just to grab the nearest switch to start cleaning up the aeroplane. But as previously discussed, the sequence and timing are critical when operating so close to the ground.

You don't have to wait until the aircraft is sliding sideways off the runway or bouncing 10 feet into the air before deciding that a particular landing is not worth the aggravation. Good go-arounds start early in a bad landing sequence. If it's not looking good halfway down final approach, go against your basic instincts and start on the road to recovery right then. Ask yourself, "When was the last time I did a go-around?" If every pilot did just one go-around for practice every 90 days, we could eliminate this accident cause.

– Bruce Landsberg, US AOPA

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FATAL FACTOR 4
FAILING TO FLY THE PLAN

"Plan the flight and fly the plan." It's excellent advice, but too few pilots follow it.

FLIGHT PLANNING MANAGEMENT COVERS several issues, including the acquisition of information, the processing of the information and decision making before and during flight. It covers VFR flight into IMC, unnecessary low level flight and VFR after last light, as a few examples.

The new analysis of fatal GA accidents indicates that pilots who use their licences for private or personal business are most at risk.

Other research shows that pilots in training are generally at much lower risk. This makes sense. When I was training for the PPL, I spent hours preparing for a flight. I'd prepare maps and charts, note and memorise features and decode weather forecasts and NOTAMs, applying them to the flight plan. I calculated fuel consumption and prepared a fuel log, along with weight and balance and p-charts.

This was excellent grounding in planning and executing a flight. As my experience increased, the preparation time decreased.

Do you put as much effort into planning your flights as you did when you were a student? Following are some simple rules on flight planning management.

Plan for the expected Plan for the outcome you want to achieve.

Plan for the unexpected This is a little harder to do, but it is much easier to plan on the ground than to make decisions in the cockpit when things go awry. Consider the options, including different routes, different aerodromes and even different dates to fly.

Apply crew resource management principles Even single pilots have a "virtual crew". Use such resources as the Bureau of Meteorology aviation desk forecaster, people at your destination who can give you the low down on weather, and other pilots familiar with the route or area to which you are flying. Your virtual crew can include the men and women at the other end of the radio, be they Flight Watch or Centre. And, yes, even under the new NAS, they are there to help pilots.

Manage expectations – yours and your passengers' Set ground rules for yourself and your passengers before you plan your flight. Combat "get-there-itis" and "press-on-itis", potentially fatal maladies for pilots, particularly those flying for business purposes. Set clear rules on the "go/no go/return to base" decision before the flight.

Options Never get yourself into a situation in which you run out of options, especially in marginal weather. As you exercise one option, ensure you keep another couple of escape routes available.

Set your own minimum standards CASA has set a raft of regulation-based minimum standards. Smart pilots go one better and set minimum standards of their own that are more conservative than those published in the regs. As your experience grows, your limitations shrink, but assess your competency and capability levels honestly.

Practice good decision-making None of us is born with the ability to make good decisions and display proper judgement, but we can learn these skills. However, a good outcome does not necessarily mean that your decision was a good one.

"Never get yourself into a situation in which you run out of options, especially in marginal weather. As you exercise one option, ensure you keep another couple of escape routes available."

On a flight in marginal conditions a pilot decides to press on, and flies into better conditions. This outcome can reinforce a poor decision, emboldening the pilot to push the boundaries next time. The secret to good decision making habits is objective self criticism at the end of each flight.

Become your own instructor and debrief yourself at the end of every flight. This will set you up for a cycle of continuous quality improvement.

Use technology wisely Pilots can become so enamoured with their kit that they place complete faith in the data provided, to the detriment of their skills. Computer flight planning programs and GPS can be wrong, so check and double check. If you're using GPS use the flight plan function rather than the "GO TO" or "DIRECT TO" button, because this gives you the best chance of doing a check and double check as you enter your flight plan into the box. Carry your maps and charts and continuously confirm the data displayed with your map reading.

Aviate, navigate and communicate Fly the aircraft first. The CASA/ATSB study shows that uncontrolled flight into terrain (UFIT) is a significant cause of fatalities.

- Roger Weeks, CFI ,
Royal Aero Club of WA.

WANTED: YOUR IDEAS AND COMMENTS

SPECIAL LETTERS SECTION COMPETITION

IMPROVING GA SAFETY

Win $300

Flight Safety Australia will publish a special letters section in the next issue showcasing the best readers' ideas and comments on how safety in general aviation could be improved.

A prize of $300 will be awarded for the best letter.

Letters should be no longer than 300 words.

E-mail your comments and ideas to fsa@casa.gov.au by May 17.
Or send your letter to Flight Safety Australia, CASA, GPO Box 2005, ACT 2601.

The winning letter will be judged by a panel of CASA experts. CASA staff and their families may submit letters but are ineligible for prizes. The panel's decision is final and no further correspondence will be entered into.