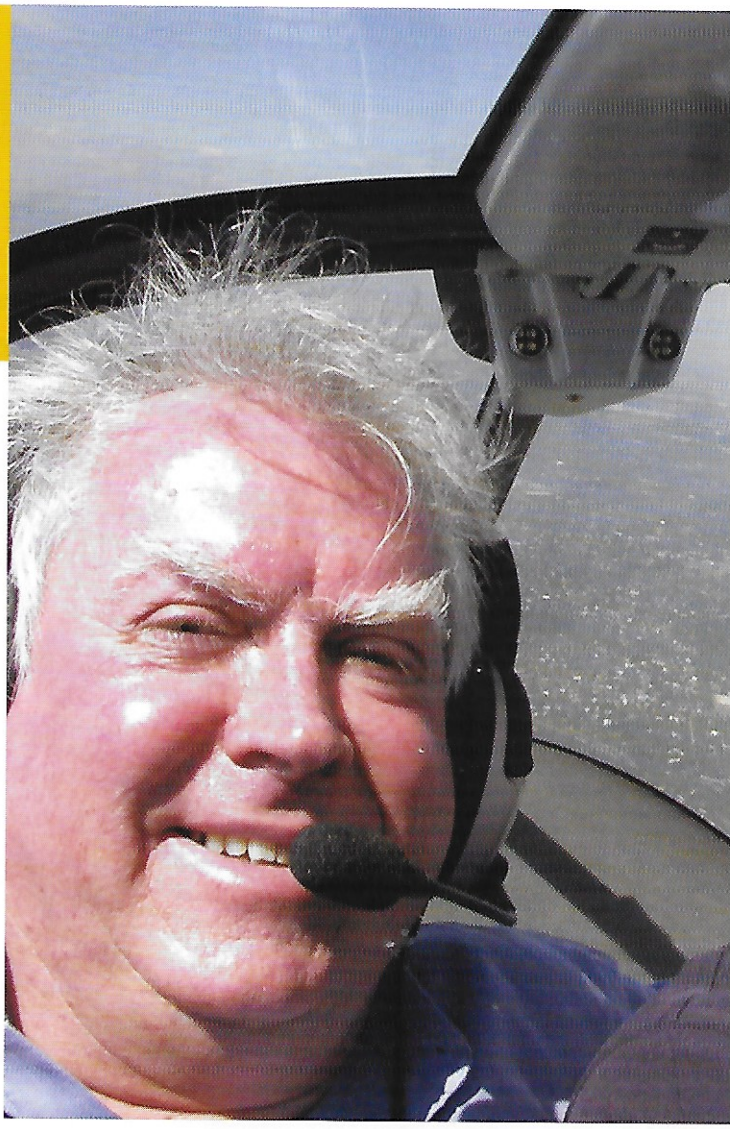
Reach for the Sky

WINGOVERS & LOOPS PG 64
AILERON ROLLS PG 66

The Basic Aerobatics endorsement

Victorian pilot **Michael Ralph** *offers this account of his trials, tribulations and adventures in gaining his basic aerobatic endorsement.*



The red Pitts S-2A two-seater flown by my friend, Ross McLean, out of Camden Aerodrome on Australia Day 2001 rolled slowly inverted. I felt myself lift out of my seat despite the five-point safety harness and an independent belt strapped across my thighs. As Ross continued the roll and we righted ourselves I asked nervously, "Will this harness hold me in?".

It was a valid question because Ross, in the rear cockpit, had a perspex canopy as a last resort against gravity, whereas I was in an open cockpit! "We'll see," he replied, rolling the Pitts inverted and holding her there. At 4000ft I lifted off the seat again in an earthbound direction. Ross had stood on my thighs as he tightened the strap before the flight, yet I dug my fingers into the lip of the dashboard, trying to hold myself into the aeroplane that I was convinced was going to eject me. After 10 seconds he rolled upright again. "Yeah, she'll be right," he chuckled.

For the next 45 minutes Ross performed manoeuvres that I had only ever performed with radio-controlled models. Loops, rolls, barrel-rolls, Cuban-8s, spins... . Every once in a while I'd ask for a reprieve and he'd get me to take the controls and fly straight and level until my stomach stopped threatening to add a colourful stripe down the side of the plane. But man, what a ride!

Inevitably I decided to follow this experience up by getting a basic aerobatic rating. I asked an instructor friend of mine, Bill Holmes, to be my mentor and we soon began lessons at my home airport, Moorabbin, in a Cessna 152 Aerobat (VH-RYI).

Wingovers, chandelles, loops

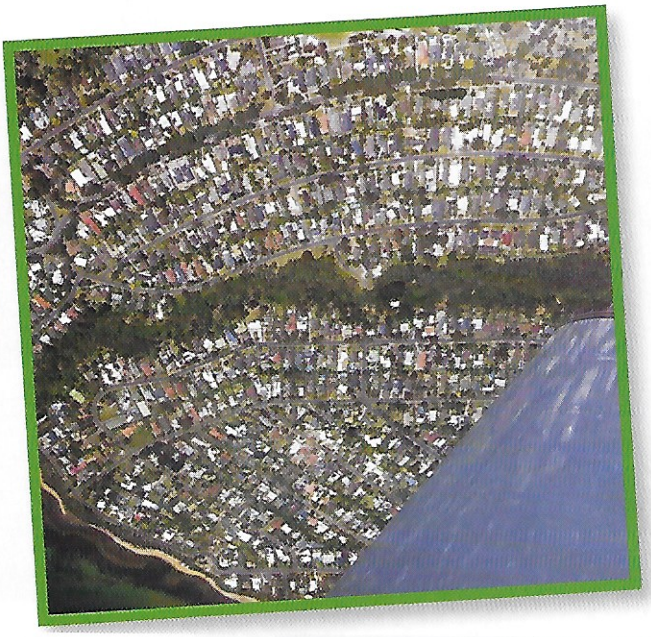
My aerobatic training took place in the aerobatics box near Pakenham in the Moorabbin training area. Bill had carefully explained how both the pilot and aeroplane must be approved for aerobatics. Many of the manoeuvres would pull the wings or tail off an ordinary GA aeroplane. Bill gave me an American manual covering aerobatics in the Aerobat. I noted that the pilots in the book wore parachutes, yet we weren't. "That's because Yanks think they're worth more than us," was his laconic reply. He added that the decision to use a parachute is the pilot's responsibility and most deem that a parachute is not required.

> « I dug my fingers into the lip of the dashboard, trying to hold myself into the aeroplane. »

In January 2006, five years less four days after my flight with Ross, Bill took me up in the little Aerobat. And I do mean little. Bill and I were both heavy blokes, so on a hot summer's day it took ages to climb to 4000ft; the basic aerobatic endorsement only allows manoeuvres above 3000ft AGL. In the aerobatics box, we gave a call to Melbourne Radar to advise them that we'd be performing aeros between 3000 and 4500ft for the next 30 minutes, then performed a clearing turn and the HASELL checks.

Bill pointed out the edges of the box and emphasised that he wanted me to remain within its boundaries. There was a 20 knot northerly wind blowing so he asked me to select an east-west road as my flight line. Each manoeuvre shou begin and end along that line so I wo have to allow for the crosswind. Bill reminded me that the aerobatic trai box is inside the Moorabbin training area, so I should keep an extra sharp lookout for other traffic.

The first manoeuvre was the wingover. This was actually taugh to me earlier by another instructor in a Piper Warrior because it is no strictly an aerobatic manoeuvre. A an initial dive to gain extra speed, pulls up into a steep climb and the rolls the ailerons to one side, then the other to straighten up. It produ a climbing then descending turn,



MAIN: Michael, right, with instructor Bill Holmes in the cockpit.

RIGHT: A different perspective – just some of the far out views of earth you'll experience once you get your aerobatic endorsement.

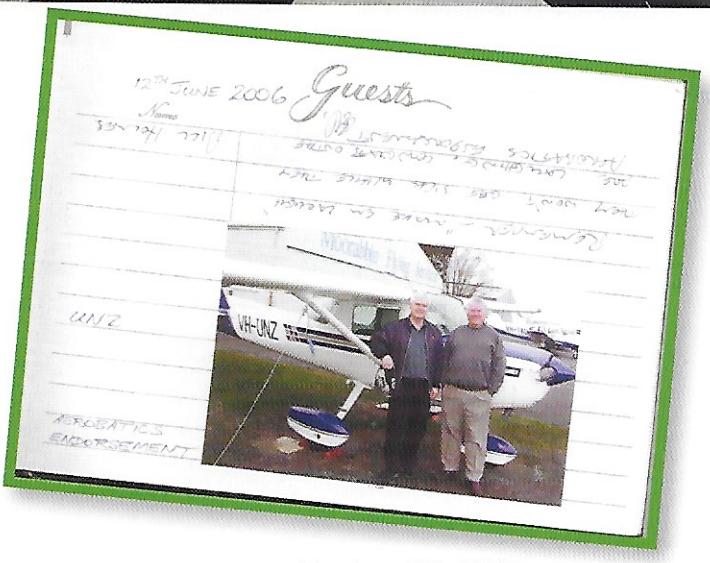
BELOW: Michael in the Pitts S-2A, bracing himself for his first aerobatic flight at Camden in 2001

FAR BELOW: Instructor Bill Holmes left this in Michael's flying diary upon completion of his aerobatic endorsement. Note the 'inverted' handwriting.

rather like a high-banked turn at a car racing track. It is safe to perform in a non-aerobatic aeroplane, but do get an instructor to teach it to you. If you come out of it in too steep a dive you might panic and pull back too hard. Bill demonstrated the manoeuvre then had me repeat it a number of times to the left and right.

The second manoeuvre was the chandelle, so-named because the flight path once reminded a Frenchman of the flame of a candle curling upward. It is basically the first half of a wingover. At the highest point and lowest speed of the wingover we rolled level before the descent phase. So far, so not-really-exciting.... I had to walk before I could run but Bill introduced the loop to ensure that the first lesson wasn't a non-event. He demonstrated one and then allowed me to try a couple.

After diving to increase the airspeed from 100 knots to 130 knots, reducing the throttle slightly to avoid over-speeding the engine and checking that the balance-ball was centred, I pulled up at 4G (4G up minus 1G down equals 3G). Ugh! I'd experienced 2G during steep (60°) turns when I was learning to fly; this was a bit stronger! As we went vertical I relaxed my pull on the control column to 3G, checking



TOP: Michael in the Royal Victorian Aero Club's Alpha 160A – the aircraft he uses for aerobatic flights these days.

LEFT: The facial expression says it all – Michael takes a mate for an aerobatic flight for his 60th birthday.

OPPOSITE PAGE: Seeing things from a different point of view during an aerobatic manoeuvre.

my left wingtip to ensure it was at right-angles to the horizon. Passing the vertical, I was looking up and craning my neck backwards to get that first view of the horizon of an upside-down world, relaxing to a 2G pull (2G + Gravity = 3G) as we went over the top of the loop. As the nose passed below the horizon I closed the throttle and began pulling 3G again. As the dive became vertical I increased the pull to 4G, bringing the nose of the Aerobat back through the horizontal plane and then to a zoom, throttling up again, to regain some of the lost altitude. Wow! That's more exciting!

What I didn't know at the time was that my loops were egg-shaped – at the top of the loop the airspeed had decayed so the arc at that point didn't cover the same horizontal distance as the arc at the bottom. Later I would learn to ease the pull over the top even more, and even push so I had zero G (weightlessness) to round out the loop.

Bill decided that was enough. One's tolerance to G builds with practice, and deteriorates without, so we headed back to Moorabbin after 1.3 hours in the air. However, the lesson wasn't quite over; in the debriefing Bill explained that aerobatics wasn't about simply throwing the aeroplane about the sky. It was about understanding and exploring the flight envelope of the aircraft and extending one's piloting skills to fly precisely, improve spatial awareness, assimilate information from inside and outside the aircraft and respond appropriately to operate the aircraft safely near and beyond the stall and in unusual attitudes.

Loops, aileron rolls and spins

Six weeks later Bill and I took off for our second lesson in VH-RYI in Moorabbin's aerobatic area. Bill had me perform a couple of loops, getting me to check that the balance ball was centred before pulling up and checking the left wingtip's position in relation to the horizon as we went vertical to avoid the loop leaning off to one side.

Once satisfied that I could loop safely, Bill demonstrated an aileron roll, then had me try a couple. Not so much altitude is lost in this manoeuvre, so we didn't have to climb as high to commence it. I pushed the nose forward to increase the airspeed to 110 knots then pulled back on the yoke. When the nose was about 35° above the horizon I neutralised the pull on the control and rolled the ailerons to full left deflection. The aeroplane rolled around its longitudinal axis. The Aerobat doesn't roll as quickly as more advanced aerobatic types so the upward flight path at the beginning of the manoeuvre is required because the aeroplane will be descending at the end of it. When the horizon was the right way up, I centralised the ailerons and pulled out of the shallow dive.

After I mastered the left aileron roll Bill had me try a couple to the right. A little more right rudder was required to help overcome the engine/propeller torque that makes rolls to the left easier. Now came the manoeuvre I'd been dreading: the spin. A spin is an aggravated stall resulting in autorotation around the vertical axis and a high rate of descent in a corkscrew flight path. A pilot might instinctively pull back on the controls in a desperate attempt to go up, which only makes the spin worse. In the early days of aviation, recovery techniques were unknown and many pilots were killed by spins, leading to its reputation as an unpredictable killer.

In 1912, Royal Navy pilot Lt Wilfred Parke entered an accidental spin to the left in the circuit at 700ft. He increased the throttle and pulled back, turning into the spin with left rudder, to no effect. His aircraft descended 450' and in an attempt to reduce the centrifugal forces pinning him to the right side of the cockpit he relaxed his pull on the elevator and applied full right rudder. His Avro biplane levelled out 50 feet from the ground, making him the first person to recover from an accidental spin. In 1914 Harry Hawker became the first person to recover from an intentional spin – on his *second* attempt! In his first attempt he entered a power-off loop in a Sopwith Tabloid, stalling off the top and entering a spin. He froze on the controls and the aeroplane spun to the ground. A few days later he tried again, this time centralising the controls then applying rudder

opposite to the direction of the spin. The aeroplane recovered.

Now that the recovery technique was known, the spin became an evasive manoeuvre during WWI because a spinning aircraft could lose height rapidly and enemy fighters pursuing in a dive risked structural failure.

So, 92 years later, with great trepidation, I switched on the fuel pump and carby heat and reduced the throttle to idle, progressively pulling on the elevator to hold my height at 4500' as the Aerobat slowed. Just above the stall the warning horn sounded. I pulled hard on the yoke and kicked full left rudder. The stall horn's screech became a yelp, then a scream as the Aerobat appeared to flick over my left shoulder. Now we were nose down, corkscrewing, with the earth spinning madly around the propeller. Like a spinning ice-skater, I tried to fix my eyes upon a feature to my left and watch it as long as I could, then fixate on another, to avoid getting dizzy. After two turns or so, I centralised the elevator and applied full right rudder. The Aerobat recovered from the spin in a dive and I cautiously fed in elevator to recover from the dive, throttling up once the nose was above the horizon. We had lost over 1000'.

Phew! I was grateful for the long minutes required to climb back to 4500'. Bill asked me to do another one, and then one to the right. Again, the torque made the spin to the right harder to initiate and easier to recover from, though the Aerobat would actually recover from a spin if I just let go of the controls. Like most fears, the spin lost some of its terror once confronted. Pleased with my survival, we returned to the airport after 1.2 hours in the air.

Double-loops, aileron rolls, spins and the Immelmann

I only allowed a fortnight to pass before my next lesson. This time we flew another C152 Aerobat, VH-HEZ. Bill asked me to perform two loops in succession. Instead of pulling all the way past the horizon on the recovery, at the end of the first loop I checked the ASI to ensure that we had 130 knots before pulling up into the second loop, trying also to keep the second loop straight. We practised aileron rolls to the left and right and then Bill requested a loop followed immediately by an aileron roll. The roll only needed 110 knots at the entry point, so there wasn't the need to extend the dive out of the loop for additional speed.

This all sounds a bit hectic but remember that between each sequence we had minutes to review the previous manoeuvre and settle my stomach as the little C152 laboured to claw back the lost altitude. My tolerance to the G-forces was increasing. Bill had me practice a couple of spins and I thought we'd call it a day but he had a new manoeuvre up his sleeve – the roll off the top. This manoeuvre is also known as the Immelmann Turn.

Legend has it that during WWI when Max Immelmann was pursued by a pusher type, such as the D.H.2 or the F.E.2b, he could pull into a loop and roll upright at the top of the loop, check the tactical situation and choose to either fly off in the other direction or roll inverted again and complete the loop to get onto his enemy's tail. It's doubtful that his Fokker Eindecker E.III monoplane could complete such a manoeuvre, but more probable that he executed a stall turn – a zoom climb to the point of stalling then a sharp kick on the rudder to dive back down.

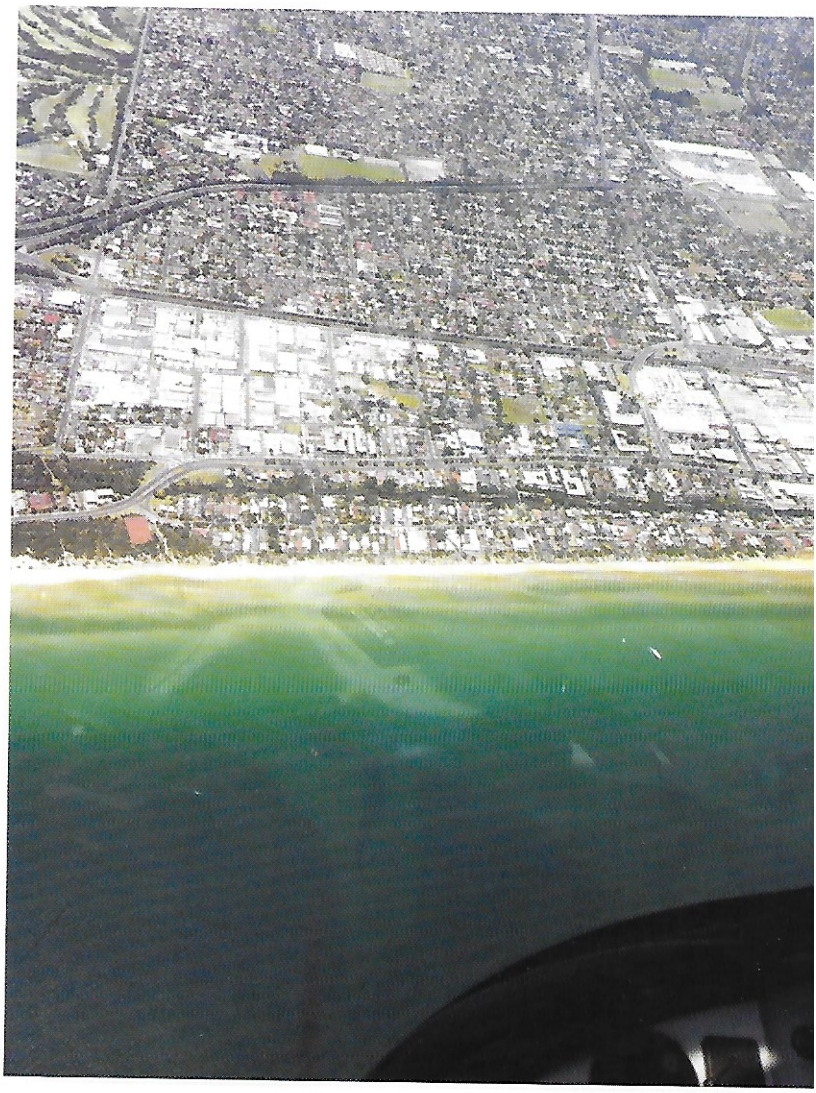
So, my turn. I pushed the yoke forward, easing the throttle to keep the RPMs below the red line. At 130 knots I pulled back, pushing the throttle fully in, checked I was straight then pulled harder into the loop. Craning my neck backwards, I watched for the horizon to appear and then eased the yoke forward and rolled the ailerons to the left. With the drag created by the pull-up, the C152 had just enough energy to roll upright, helped in the left roll by the engine and propeller's torque. We returned to Moorabbin after 1.2 hours.

Cuban-eights and snap rolls

Less than a month later we were at it again and I could see that Bill was leading me into more complex manoeuvres. The first new one was the Cuban Eight. Pushing the yoke forward we dived from 4500' to trade the altitude for the 135 knots we were going to need. I pulled back on the yoke into the start of a loop, straining against the 4G. Up and over the top, relaxing the pull, craning backwards to see theinverted horizon come into view.

Five eighths the way round the loop, having passed the top, I rolled the Aerobat through 180° so that we were upright again. Instead of completing the first loop, we dived for speed again and pulled into a second loop, facing in the opposite direction to the first. Again, past the top of the loop and inverted, I rolled the Aerobat upright then levelled out of the dive.

Next was a manoeuvre I'd been dreading almost as much as I'd feared the spin; the stunt that I'd declined at the end of my first aerobatic flight with Ross five years before – the snap roll. I followed Bill through his demonstration, noting the reduction in airspeed to 80 knots, then hauling back upon the yoke and kicking in full left rudder. After that, everything happened too quickly to take in! Bill was quite content to let me try another one, but it was still too sudden and violent to absorb the details. I've done a few since then, but I don't enjoy them. When the Aerobat is stalled at 80 knots, by suddenly exceeding the 16° angle of attack, the stall warning blares and then the C152 throws itself around all three dimensions at once. It's like being inside a washing machine on spin cycle while it's tumbling end over end



Michael, left, and instructor Bill, right, with VH-UNZ, one of three C152 Aerobats used in getting his basic aerobatic endorsement.

down a hill! After one revolution around the three axes, I pushed forward to break the stall and kicked the right rudder and we were flying instead of tumbling once more. I felt nauseous and Bill recommended forcing a belly laugh, pushing down with my abdomen muscles at the same time. It did the trick.

Barrel rolls

For our next lesson we cross-hired another C152 Aerobat, VH-UNZ, and this one seemed to have a bit more vigour. I was looking forward to our first manoeuvre, the barrell roll. The aeroplane makes a complete rotation on its longitudinal axis whilst following a helical path. In other words, it is a simultaneous combination of a loop and a roll, where the aeroplane seems to be flying down the inside of an invisible barrel. After following through with Bill's control inputs for the first one, I then had a go. I pushed the yoke forward to dive for 135 knots. As the speed was attained I rolled the Aerobat into a 45° bank to the right, centralised the controls and pulled back at 3.5G. As the nose rose through the horizon I began to ease the back pressure a little and began rolling to the left. A quarter of the way through the barrel roll the nose was high and the wings were vertical. At the halfway mark we were inverted, wings level and pointing almost 90° to the original direction of travel. The pull on the yoke was lessened, but with the decaying airspeed I was using full left aileron. The nose began to fall and I began pulling harder on the yoke and easing the aileron roll. At the three-quarter mark the nose was 45° below the horizon and rising again and the wings were vertical and levelling out once more. Finally we were wings level, upright and pointing in the original direction of travel.

I found the barrel roll to be delightful, a real pleasure to fly and not at all violent like the snap roll. We tried a few more. On one of them I pushed too far forward when we were inverted halfway through the manoeuvre, creating negative one G. The dirt and filth in the carpet was released and floated up into my eyes and nostrils! It was disgusting and hilarious at the same time.

Now for the stall turn. This manoeuvre begins as a loop but the pilot stops pulling on the yoke when the aeroplane is in a vertical climb, perhaps even pushing forward a little to keep vertical. The speed decays rapidly, even though the throttle is wide open. Just before the aeroplane stalls, full rudder is kicked in, the prop wash assisting in tipping the aeroplane over sideways so that it dives vertically. The pilot cuts the throttle and then pulls on the yoke to pull out of the dive. The trick is to not tip over forward or back and definitely to not tail-slide. The aeroplane is designed to fly forwards, so sliding backwards creates a reverse airflow that could slam the rudder or elevator against the stops, perhaps even fatally jamming it there.

Bill demonstrated one and then let me have a go. I found that the turn to the left was easier than a turn to the right, again because of the engine/prop torque. In the pre-flight briefing Bill had warned me not to let the airspeed get below 40 knots before kicking the rudder or else a tail-slide could develop. Once the turn was complete, a little dance on the rudder pedals prevented a pendulum swing from side to side during the dive. We tried a couple of stall turns. In one of them I cut the throttle before the rudder turn at the top, depriving the rudder of prop wash. The turn was ugly, but we didn't tail-slide. Surmising that my concentration was slipping due to overload, we ended with a spin for revision and called it a day after 1.2 hours.

Recovery from unusual attitudes

Getting close to achieving the endorsement, I booked another lesson for only a week later. Once more in VH-UNZ, we revisited spins, snap rolls and barrel rolls. I was reaching the conclusion that I enjoy smooth aerobatics but can leave the snap roll for the enthusiasts. It's too violent for my liking. Finally Bill wanted to cover the next part of the curriculum that I'd been nervously anticipating – recovery from unusual attitudes. Bil took control of the aeroplane and asked me to close my eyes and cover them with my hands. I did so and he pitched the nose up and down, yawed the plane left and right and then rolled us nearly upside down. "Recover!" he commanded.

I opened my eyes and grasped the controls. I'd already felt the aeroplan roll inverted but the requirement at this time was to note "the nearest horizon". We were inverted but the wings were not level. The left wingtip was above the horizon and the right one was below. This meant that the roll upright would be faster if made to the left, aided by the torque of the engine and propeller. I quickly input full left aileron deflection and we rolled upright. "Good," complimente

Bill. "The worst response would have been to pull through as though in the second half of a loop. You might not have the altitude to recover. Let's try another one. Close and cover your eyes again." I did so and Bill pitched, yawed and waggled the wings to disorient me. I listened to the engine note die away and the wind noise reduce. I guessed what was about to happen: a spin. Sure enough, the stall warning shrieked and we pitched up and over one shoulder, then started rotating. "Recover," grunted Bill.

I opened my eyes and seized the yoke. We were in a right-hand spin, which I considered a poor choice by Bill if he was trying to be harsh with me because the Aerobat will recover from a spin if the pilot simply releases the controls and the torque will assist a recovery from a right-hand spin. A left-hand spin would have been something for me to recover from, but the Aerobat was righting itself before I had a chance to contribute much. I eased her out of the dive, shut off the carby heat and increased the throttle. "Well done," said Bill.

Bill suggested that we end the lesson with two more spins, one in each direction. As I pulled out of the dive following the second one and opened the throttle, Bill pulled on the carby heat and closed the throttle. "Oh dear," he sympathised. "The engine's failed." Fortunately we were above 3000' AGL, so there was plenty of gliding altitude to select a suitable field in which to land. I went through my rusty CFM/CFM and FMOST engine-failure checks, pretending to broadcast a Mayday message. As I turned onto final for a simulated engine-out landing Bill restored the power and we climbed back to 1500' to report inbound at Carrum, landing after the 1.1 hour flight.

Sequences, revision & endorsed

Bill assured me that I'd earn the endorsement after one more lesson, so I booked VH-UNZ for the following day. The last topic to cover was revision and sequences, which just meant flying two or more manoeuvres in a sequence. The key points were to ensure the recovery from the preceding manoeuvre maintained sufficient airspeed to enter the next one and that the last manoeuvre was completed above the "floor" of 3000' AGL.

« I eased her out of the dive, shut off the carby heat and increased the throttle. »

First, Bill asked me to try a triple-loop; we'd done a double loop, but this time Bill wanted me to focus on the airspeed and altitude. From 4500' I pushed the nose forward and eased the throttle back to keep the RPM needle short of the red-line as we dived for speed. Keeping the balance-ball centred with the rudder at 130 knots, I pulled back on the yoke.

As the nose rose through the horizon I pushed the throttle all the way in and watched the left wingtip as we went vertical. Now craning my neck backwards, I looked through the little windows in the wing, watching for the horizon, easing the pull on the yoke as it appeared. Revelling in the joy, I closed the throttle as we commenced the dive down the back of the loop, pulling harder when we were diving vertically. With the first loop almost completed, I opened the throttle and held the aeroplane's nose 40° below the horizon until the speed reached 130 knots again then repeated the process to perform a second loop and then a third, this last time bringing the nose above the horizon on completion and zooming to regain some of the lost altitude.

Satisfied with that, Bill requested a loop followed by an aileron-roll and a spin. On completion of the loop I checked that the ASI was reading 110 knots before raising the nose into a zoom above the horizon, centring the yoke and then applying full left aileron deflection. We rolled inverted and upright again, ending with the nose below the horizon as I centred the ailerons and resumed level flight. I retarded the throttle and pulled on the carby heat, holding the nose up until the stall warning complained. I hauled back on the yoke and kicked left full rudder. The stall warning yelped as we flipped over my left shoulder and shrieked as the Aerobat began spinning. Push forward, right rudder, centre rudder, ease back, power on, carby off. Phew! "Well done," Bill complimented me.

We finished the lesson off with a barrel-roll, a stall turn and a spin. Bill pronounced himself happy with my performance and said he'd endorse me for Basic Aerobatics. The 3000' AGL restriction stays unless I decide to train for a low-level aerobatics endorsement. Bill signed off the endorsement in my logbook and it was official.

Epilogue

Since earning the endorsement, I haven't entered any competitions. I've just used my new-found skill to entertain friends and provide unusual birthday presents – to 16, 21 and 60 year olds alike. I have been checked out in the Royal Victorian Aero Club's Alpha 160A, which is a bit more capable than the humble Aerobat, although its electric stall warning doesn't have the drama of the C152's air-powered shriek! I've even had the privilege of taking a RAAF Wing Commander up for a few stunts.

I've only ever had one person throw up, mostly upon himself with a bit on my trousers. That unfortunate was a 12-year-old boy whose Dad had assured me that he loved roller-coasters. We only performed a loop, an aileron roll and a barrel-roll; after each the boy said he was fine, but then he vomited without warning on downwind in the circuit! Thank goodness the Aerobat's window opens right up to let in lots of fresh air!

So, if flying upright and not banking past 60° is becoming a bit dull and boring, get down to your local flying school and go for an aerobatic rating. It's the most fun you're going to have with your pants on!