March / April 2005

VECTOR

Pointing to Safer Aviation

Maximum Performance

Ag Work and the R22

Grass Runways

More on TCAS II

CAA
CIVIL AVIATION AUTHORITY OF NEW ZEALAND

VECTOR CAA NEWS

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Manager Communications: Bill Sommer.

Editor: Peter Singleton.

Publishing Team: Gareth Clare, Pam Collings, Cliff Jenks, Peter MacDonald, Jim Rankin, Anna Walkington, Rose Wood.

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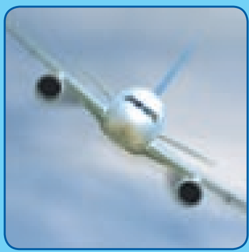
Rotor blade failure accidents have prompted us to have a closer look at the way Robinson R22 helicopters are operated in New Zealand.

There have been more than 15 reported incidents (since 2000) of aircraft landing on undesignated areas beside a grass runway, or landing on a closed grass runway. This article covers some methods of reducing the chances of this happening to you.

We take another look at TCAS II equipment and how it works to avoid collisions. Also, revised ACAS procedures and pilot training guidelines are reviewed.



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Maximum Performance

Article courtesy of ***Flight Safety Australia****, September-October 2004.*

Flying a Chieftain with nine passengers, multi-engine instructor Kevin McMurtrie found himself below minimum safe altitude (MSA) in cloud and unable to maintain height. That's when his experience – and adrenaline – kicked in.

Kevin is the chief pilot and chief flying instructor for Johnston Aviation Services, and a CASA approved testing officer.

The Pilot's Account of the Incident

The pre-flight preparations at Port Macquarie went well. Meteorological conditions would be solid IMC throughout the trip to Gunnedah. My only concern was the freezing level. However, my route's MSA was below this and even lower within 25 NM of Tamworth.

The PA-31-350 was loaded within the centre of gravity range and 55 kg below maximum takeoff weight.

I entered cloud about 1200 feet amsl and set a course of 269 degrees. I gave my departure report to Brisbane centre and reported that I would be levelling off at MSA 6200 feet.

For the cruise I had engine power settings of 31inches manifold pressure (MP), 2200 rpm, and a fuel flow of 20 gallons per hour for each engine. This gave an exhaust gas temperature (EGT) indication of 1400 degrees Fahrenheit. I had selected the outboard fuel tanks for the cruise.

About 75 NM from Tamworth, I noticed the right engine rpm fluctuating slightly. I readjusted the propeller lever for that engine and checked fuel flow, manifold pressure, fuel pressure, EGT, cylinder head temperature (CHT), oil pressure, and oil temperature. Everything was within normal operating limits.

The engine started to miss occasionally. I suspected some rime ice could have been building up in the induction-air intake, even though I was monitoring all external surfaces closely and periodically monitoring outside air temperature which, at 6200 feet, was around + 2 degrees Celsius. I did not see any ice on the airframe.

I elected to use alternate engine air and requested a climb to 10,000 feet, as I knew the cloud tops were forecast at 8000 feet.

The Brisbane centre controller cleared me for 10,000 feet and I started a climb at V_Y, using power settings of 38 inches MP, 2400 rpm and full rich fuel flow. I selected inboard fuel tanks for the climb.

The airframe picked up some light rime ice during the climb, and at this stage I was breaking out of the cloud tops at 8500 feet.

At 9000 feet, the right side engine started making popping and banging noises. The EGT was indicating above the red radial line and exceeding normal operating parameters. The fuel flow indication for the right engine was getting low.

I began the checks for engine failure during the cruise as the right-side engine surged, causing a large yawing moment. All indications were normal except for the elevated EGT and low fuel flow.

Fuel quantity and pressure indications were normal. I adjusted the fuel flow control lever and noticed that the slightest aft movement of this lever caused the engine to surge and backfire even more. I suspected a problem with the fuel flow control lever. I levelled off at 9000 feet and made a PAN-PAN call to Brisbane centre. I informed the controller that I was shutting down one engine, and I requested a meteorological report on Tamworth, to where I intended diverting.

I briefed my passengers on the situation.

After shutting down and securing the troublesome engine, I set the other to 38 inches MP, 2400 rpm and full rich fuel flow and closed the inoperative engine cowl flap. The aircraft would not maintain altitude.

The controller came back to me, reporting VMC at the airport. A pilot in another company aircraft in Tamworth airspace said it was clearer in the area. Meanwhile, I was in solid cloud, still descending, and getting closer to MSA.

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Instrument panel on a PA31-350 Chieftain.

I increased the manifold pressure and rpm to maximum and set up a climb speed of 104 KIAS (V_{XSE}), to try to maintain altitude. I had just reached the MSA of 6200 feet. Brisbane centre told me the radar MSA in my area was 6200 feet. I was now below this. The controller asked me if I was visual, and I told him I was in IMC and unable to maintain height. I was 34 NM from Tamworth. In another 9 NM, I would be within the 5600 feet minimum sector altitude of Tamworth. My altimeter indicated 5800 feet, and the aircraft was still descending.

I declared an emergency.

The controller asked me a lot of questions, but I asked him to standby while I focused on flying the aircraft.

I tried using the autopilot at times, but it wanted to command a pitch-down attitude, increasing my descent rate. Hand flying gave me better control.

Passengers Assume the Brace Position

I directed my passengers to assume the brace position, and I manually switched the emergency locator transmitter (ELT) on.

The controller said I was deviating to the south of my track, heading for higher terrain. The horizontal situation indicator showed I was on a southerly heading.

I started to turn back onto my heading for the initial approach fix waypoint BRAD for the Tamworth 30R ILS approach.

I was then confused by my instrument indications – the vertical speed indicator showed an increasing rate of descent, with altimeter readings decreasing and airspeed readings increasing! I instinctively made corrective action in pitch and roll on the attitude indicator and the situation became worse! I looked at the turn coordinator. This confused me even more – I had never seen such an ancient one before.

The co-pilot attitude indicator (AI) was indicating a 45 degree angle of bank descending turn. I quickly levelled off using the co-pilot AI, and everything seemed to be back to normal.

Brisbane centre told me they had learned from another pilot in the region, that it was much clearer at Walcha. The controller gave me a bearing and a distance to the Walcha airstrip. I decided to take this escape route, thereby avoiding the mountains on the way to Tamworth. I turned and set course for the airstrip. We were still drifting down and in IMC. The aircraft was becoming difficult to fly, and I had to try to maintain aircraft attitude from the co-pilot AI. Compounding this was turbulence.

The stall warning was activating intermittently. My next challenge was to maintain sufficient indicated airspeed to avoid stalling and spinning in, as the airspeed fluctuations, due to the turbulence in the cloud, would at times get close to minimum control speed (V_{MCA}). I asked one of my passengers, a student pilot, to monitor the co-pilot AI and tell me if I deviated from wings-level attitude.

The Brisbane centre controller was periodically giving me distance to run readouts to the Walcha airstrip and asking me if I was visual with the ground. The aircraft was beginning to hold altitude – we were maintaining 4800 feet, which I calculated was about 800 feet agl in the Walcha area.

At 6 NM from Walcha, we broke out of the cloud through a hole about the size of two football fields; I estimated we were about 400 feet agl. I told the Brisbane controller I was visual with the ground, remaining in this position and commencing an orbit and drift down to get under the cloud ceiling. I descended below the ceiling (at what indicated altitude I don't know, for I was now visual with the ground). I completed the orbit onto the heading in which I thought the airstrip would be. The controller informed me that Walcha airstrip was in my 10 o'clock at 4 NM by radar. I was established on the centre line of runway 05! I reported that I was visual with Walcha airstrip.

I configured the aircraft for a one-engine-inoperative landing, cautiously extending flaps first, to evaluate any further loss of performance. When I was certain we were going to make it to the runway threshold, I extended the undercarriage, and landed the aircraft.

Investigating the Problem

My company chief engineer found that a line which distributed fuel from the fuel control unit to the injectors had become loose! It had not been tightened properly during maintenance, and there was no fuel getting into the injectors.

Fuel was being sprayed throughout the aft section of the engine nacelle, and over the hot turbocharger. (The aircraft had not been maintained by our engineering company, but by another maintenance organisation that had ceased operations a month before the flight. The aircraft is not part of our company fleet and was cross-hired for this flight.)

The chief engineer also discovered the wing flaps were extended five degrees down. The flap selector was in the up position. The flaps had been in this position for the entire flight. I was bewildered – why didn't I detect this at the pre-flight inspection back at Port Macquarie? The drag on the flaps explained partly why the aircraft did not maintain height.

I pre-flighted the aircraft with the flaps fully down and retracted the flaps when the inspection was complete. When I am pilot-in-command, just before I am about to close the doors after passengers are loaded, I do a quick walk around of the aircraft. I did not do this amid heavy rain on the morning of the incident. The flap problem was not endorsed on the maintenance release.

I put the failure of the primary attitude indicator down to the failure of the left engine pneumatic pump to provide enough pressure to spin the instrument's gyroscope. Incidentally, the co-pilot's AI had been overhauled and re-installed the day before the flight.

Meanwhile, I believe I had the aircraft configured for maximum performance and minimum drag, except for the unknown flap problem.

I believe I made all the right in-flight decisions, but I should have been carrying a WAC chart to assess terrain. In my view, I dealt with the passengers efficiently.

Flap extended 5 degrees.

CASA Comment

The following comment is by Grahame Murray, a CASA flying operation inspector.

Management of the Situation

The pilot-in-command (PIC) did very well under intense pressure. He demonstrated what the term pilot-in-command really means.

Before going into what went right, a word about optimising performance. Pilots should always try to achieve the minimum weight possible at takeoff. Only take the fuel you need plus margin fuel needed or desired. Margin fuel means the pilot exercises his or her command judgement by weighing up the conditions on the day determining if additional fuel might be prudent. Consider taking only one-way fuel. Sometimes, this option is not as expensive as you may think.

It costs money to carry the return fuel. For example, a PA-31-350 on a 100-NM sector carrying an extra 225 kg (310 litres) will burn an extra 4.3 kg (6 litres) of fuel and take a minute longer to complete the sector. At 500 hours per year, this will cost the operator almost $5000 in extra fuel, plus approximately $3000 in extra maintenance. Remember, if you keep the takeoff weight to a minimum, you will save money and optimise performance.

Management of the Emergency

The PIC managed the situation and did not just fly the aircraft. It is this management of a problem that can determine the outcome. I have set out below, a management plan that I use and teach.

When a problem occurs:

1. Conduct the memory recall or bold-face items as specified by the manufacturer.
2. Manage the Problem. I use the following acronym (3 'W's and 2 'P's):

- **W**here are we? Take stock your current position and your location with respect to other airports, navaids, altitude, configuration and power setting.
- **W**here are we going? This is not the final destination decision, but where are we going to go to keep the aircraft in a safe position while we sort the mess out.
- **W**ho's flying? Unless the manufacturer prohibits the use of the autopilot during asymmetric operations, trim the aircraft and turn it on. Seventy percent of an average pilot's mental capacity is required to manually fly the aircraft. Turn the autopilot on and give the problem some more brain power.
- **P**AN-PAN (or MAYDAY if needed). Get some attention that all is not right. If the aircraft is in distress, turn the ELT to ON.
- **P**assengers. Keep the folks informed and briefed as appropriate. This aspect will either reflect poorly, or professionally, in the subsequent media interviews with passengers. As PIC, you also have a duty of care to your passengers to brief them as appropriate, eg, seat belts, brace positions, etc, and to keep them informed of the flight progress.

3. Confirm from the checklists that the recall items have all been completed correctly.
4. Action the reference items from the checklists. This generally involves securing inoperative systems.
5. Review the single-engine landing checklist if required.
6. Crew Resource Management (CRM). Obtain all the information that you can (and not just from inside the aircraft) and analyse that information. Decide on the best course of action and put it into play. Continue to evaluate the decision and amend it if required.
7. Conduct the descent and approach self briefing as required.

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Summary

The PIC has covered most of the above points during his management of the incident:

- He conducted the engine failure checks.
- He positioned the aircraft (initially) at a safe height.
- He continued to fly towards Tamworth into decreasing MSAs.
- He tried to get the autopilot to help.
- He declared a PAN-PAN. This made Brisbane centre give him undivided attention and assistance. It was the controller that alerted him to the problem attitude indicator, provided him with vectors and information on the Walcha airstrip. The centre controller provided valuable assistance.
- He informed the passengers and enlisted their assistance. Once the aircraft was below MSA, he had them assume the brace position.
- He used CRM techniques. He considered Met from Brisbane centre and actual reports. He considered the navaids at Tamworth and approaches.
- He re-evaluated the plan and obtained the necessary information and assistance to implement the decision to fly to Walcha airstrip.

The PIC prioritised his tasks into aviate, navigate, and communicate.

The failure of the attitude indicator was handled well. The pilot quickly went about determining the faulty indication by referring to the other aircraft instruments after the timely call from Brisbane centre. The instrument check that is performed prior to takeoff is conducted for good reasons. A wise LAME once told me that most mechanical problems encountered in-flight were obvious before departure. Follow aircraft flight manual procedures.

Self Analysis

The PIC also did an excellent job in his self-analysis of the incident. Pilots should practice this technique for all flights, not just flights like this one. As pilots, we strive for perfection. However, due to circumstances on the day, we can only get so close. If we evaluate each flight we undertake, what went right, what could have been better, we will continue to get closer to that perfect flight.

In essence, you become the person conducting your own check flight every time you fly. This constant monitoring and evaluating of your own performance will lead to continual improvement in your ability to command an aircraft.

In conclusion, the world is full of armchair experts and it is easy to be wise after the event and point to things that should have been done or what was missed.

In my view the pilot deserves a "well done" as the desired outcome occurred – passengers, pilot, and aircraft landing safely. ■

Ag Work

The Robinson R22 type has been operating in New Zealand since 1984 and is by far the most prolific helicopter type, with some 133 on the current register. Initially there were some instances of the helicopter being operated into a zero G condition, with consequential very alarming fatal accidents. The manufacturer, in conjunction with Airworthiness Authorities and the pilot trainers, quickly revamped the training programmes, and included placards, safety notices and cautions in the helicopter and Flight Manuals. The instances of zero G in-flight break-ups appear to have ceased. The R22 has gone on to gain an excellent reputation for its simplicity, reliability, and capabilities – especially given its small size and low power.

Kiwis soon had cargo hooks installed to enable the carriage of farming equipment, venison, and moss. Later, agricultural spray equipment was fitted. The helicopter entered work roles that the manufacturer was (and is still) not that comfortable with!

A Recent Accident

The recent and well publicised event, whereby a main rotor blade failed at the root on a Robinson R22 Beta II when the helicopter was only just airborne, is the first reported failure of this type in New Zealand. There have, however, been several instances of failures overseas. These failures are still subject to current investigations by Robinson, the FAA, and in the New Zealand case, CAA of New Zealand.

Circle shows the location of the blade after the accident.

Mandatory Service Bulletin

In December 2004, Robinson issued a Mandatory Service Bulletin (SB94) requiring staged removal of the A016-2 blades. These blades are to be replaced with the "new" A016-4 blade. The Dash 4 blade has design changes in the grip, but Robinson's stated major change was the stainless steel blade skin with improved resistance to corrosion and the increase of calendar finite life from 10 to 12 years. CAA New Zealand recommends that you follow this Service Bulletin; it is possible that an Airworthiness Directive will be issued.

and the R22

The Australian Experience

The first cases of rotor blade failure in the blade grip area occurred in Australia and were attributed to the mustering role of the helicopters. The CASA belief is that the large cyclic control inputs, the frequency of these inputs, and the strong likelihood of under-recording of time in service, were the principal reasons for the blade fatigue failures. CASA Airworthiness Directive AD/R22/31 Amendment II (available off the CASA web site, www.casa.gov.au) details the Australian compliance requirement. Robinson and CASA are investigating the specific Australian mustering role, and they will be considering changes to the inspections and fatigue life limits of blades working in this role.

So, is our New Zealand R22 role likely to have similar instances to the failures in Australia?

The Australian situation is likely to have the helicopter operating at lighter weights, and considerably more cyclic inputs. Our situation, however, is that, in our agricultural roles, especially spraying, the helicopter will be involved in a much greater number of rated power lift-offs at (and sometimes substantially over) maximum certificated takeoff weight (MCTOW). The New Zealand coastal environment would also be likely to be more corrosive in comparison to the mustering regions in Australia, and most certainly corrosion has the potential to significantly degrade fatigue life of any component.

Some Technical Stuff

The centrifugal/centripetal loads are the greatest loads on the blade grips and spindles, but it may not be so well understood that these loads increase, not steadily, but **more and more rapidly with rpm increase**.

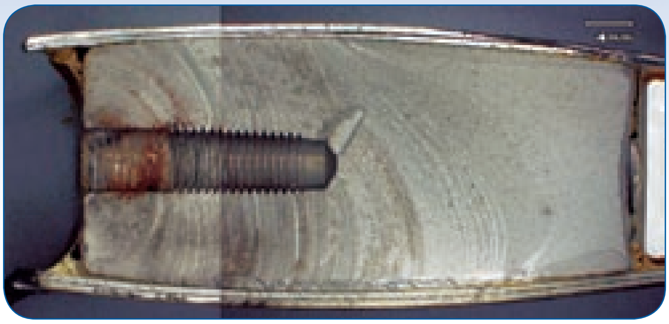
A feature of the Robinson R22 rotor head (which is not shared with other manufacturer's semi-rigid rotor head systems) is that it has individual blade coning hinges, as well as a teetering hub. The blades are, therefore, individually free to flap up and/or down, and during cyclic inputs the Coriolis effect of each individual blade mass effectively moving inboard, or outboard, of the hub has the resultant effect of the blades either wanting to lead or lag.

The R22 teetering hub, coupled with individual blade coning hinges and its relatively low inertia disc, means that the cyclic is very light and responsive. During rapid and large cyclic inputs, an upward moving blade will have the tendency to be trying to lead, while the opposite down-going blade will be trying to lag. The problem is, that the rotor head, in common with all two-blade rotor heads, does not allow for blades to lead and lag, so excessive cyclic inputs will result in the blade grip area taking excessive bending loads as well as the centrifugal loads. At 530 rotor rpm, for example, these Coriolis loads are occurring around nine times per second, and practices such as using excessive manifold pressure, or exceeding rotor rpm limits by overriding the governor with the "big twist and heave" will have the effect of seriously eating into the certificated safety margin. **And it could well precipitate the onset of fatigue cracking in regions not as yet able to be readily inspected.**

Even at the correct rpm, the use of full throttle at sea level would involve the drive train and rotor system in an excess of 22% above the manufacturer's published limits on a R22 Beta, and 37% on a R22 Beta II. There is **no** agricultural overload allowable for helicopters. The main reason for change of powerplant to the Lycoming 0-360-J2A in the Beta II was **not** to give the helicopter any **additional** sea level performance**.** It was to provide the rated 131 hp limitation to a greater altitude than that of the R22 Beta with the smaller Lycoming 0-320-B2C.

In point of fact, looking at the manufacturer's out of ground effect (OGE) hover ceiling versus gross weight, the regular Beta chart indicates that it would OGE hover to a pressure altitude of 4000 ft at 20 degrees C, and the Beta II chart indicates approximately the same. The Beta II advantage only becomes apparent at pressure altitudes above 4500 ft. **The Beta II will lift more than the Beta at sea level only when the manufacturer's limits are ignored.**

All these factors have an influence on fatigue lives and expected component overhaul TBOs.



Fracture surface of an R22 blade root, showing fatigue cracking in the root fitting. Note: Growth of fatigue is obscured by external skin and doubler.

R22 Safety Alert

Robinson added an R22 Safety Alert on 1 Dec 2004 with warnings 29310, 29311 and 29312 which say:

1. If the helicopter has occasionally operated above manifold pressure limits, replace the main rotor blades!
2. If the helicopter is normally parked outside in humid climates, particularly in tropical or coastal areas, replace the A016-2 blades within 5 years time in service, due to possible internal corrosion. **Note:** This has now been superseded by SB94

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3. If main rotor vibration increases during flight, make an immediate safe landing and determine the cause of vibration before further flight. If cause cannot be determined, replace the main rotor blades before further flight!

Finally, Robinson asks that operators re-read Safety Notices SN-37 and SN-39!

Robinson has a good web site, and all their important information is available at **www.robinsonheli.com**. More importantly, all this information is in the **Flight Manual.** It's worth a read, and **adhering to** if you want to keep your helicopter in one piece and stay alive**!**

Full throttle at sea level is automatic cause to reject R22 rotor blades. The regular Beta for instance has a maximum manifold pressure of 23.7 in Hg, and the Beta II only 23.5 in Hg at sea level on a 20 degree C day. Exceeding this limit is **cause for blade replacement**. These limits also **reduce** with either reductions in temperature, or increases in altitude.

Some New Zealand Scenarios

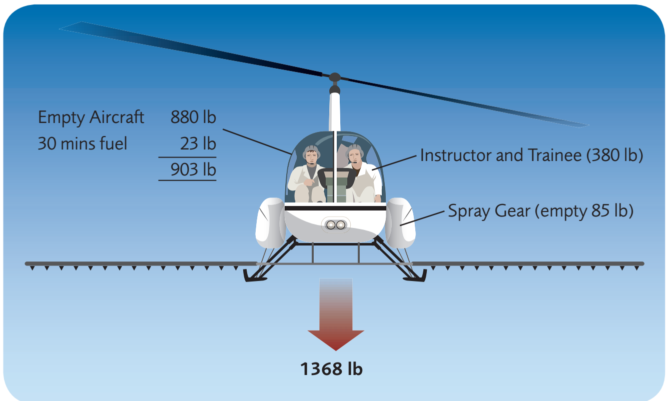
Does overloading, or use of excess manifold pressure occur in New Zealand?

R22 empty weight	880 lb
Pilot	170 lb
Spray gear	85 lb
Fuel (30 minutes)	23 lb
AUW =	**1158 lb**

R22 Beta (and Beta II) gross is 1370 lb. This leaves a useful product load of approximately 212 lb or 96 litres of water, (when operated with only 30 minutes of fuel, remember). Many machines have spray gear weighing more than the figure used, and there are a good many pilots of slightly greater stature than the 170 lb used as well.

If one looks at Agricultural training, where the R22 is occupied by both a pilot and an instructor, we have the following:

R22 empty weight	880 lb
Instructor and Trainee (solid)	380 lb
Spray gear (say)	85 lb
30 minutes fuel	23 lb
AUW =	**1368 lb** **(leaving 2 lb for product!)**



Robinson Safety Notice SN-37

Issued: Dec 01

Exceeding Approved Limitations Can Be Fatal

Many pilots do not understand metal fatigue. Each time a metal component is loaded to a stress level above its fatigue limit, hidden damage occurs within the metal. There is no inspection method which can detect this invisible fatigue damage. The first indication will be a tiny microscopic crack in the metal, often hidden from view. The crack will grow with each repetition of the critical stress until the part suddenly breaks. Crack growth will occur quite rapidly in drive system parts from the high frequency torsional loads. It will also occur rapidly in rotor system components due to the high centrifugal force on the blades and hub. Damaging fatigue cycles occur with every revolution of an overloaded drive shaft or rotor blade.

If a pilot exceeds the power or airspeed limits on a few occasions without failure, he or she may be misled into believing it is safe to operate at those high loads. Not true. Every second the limitations are exceeded, more stress cycles occur, and additional fatigue damage can accumulate within the metal. Eventually, a fatigue crack will begin and grow until a sudden failure occurs. If the pilot is lucky, the part will have reached its approved service life and be replaced before failure. If not, there will likely be a serious or fatal accident.

View of fractured blade root.

Warning

1. Always operate the aircraft well below its approved V_{NE} (never exceed speed), especially in turbulent wind conditions.
2. Do not operate the engine above its placarded manifold pressure limits.
3. Do not load the aircraft above its approved gross weight limit.
4. The most damaging conditions occur when flying or manoeuvring at high airspeeds combined with high power settings.

By the CAA's reckoning, any R22s being used for agricultural training conducted with two POB and spray product, would most likely already be in an overweight configuration! This is **unsafe, undesirable, and illegal.**

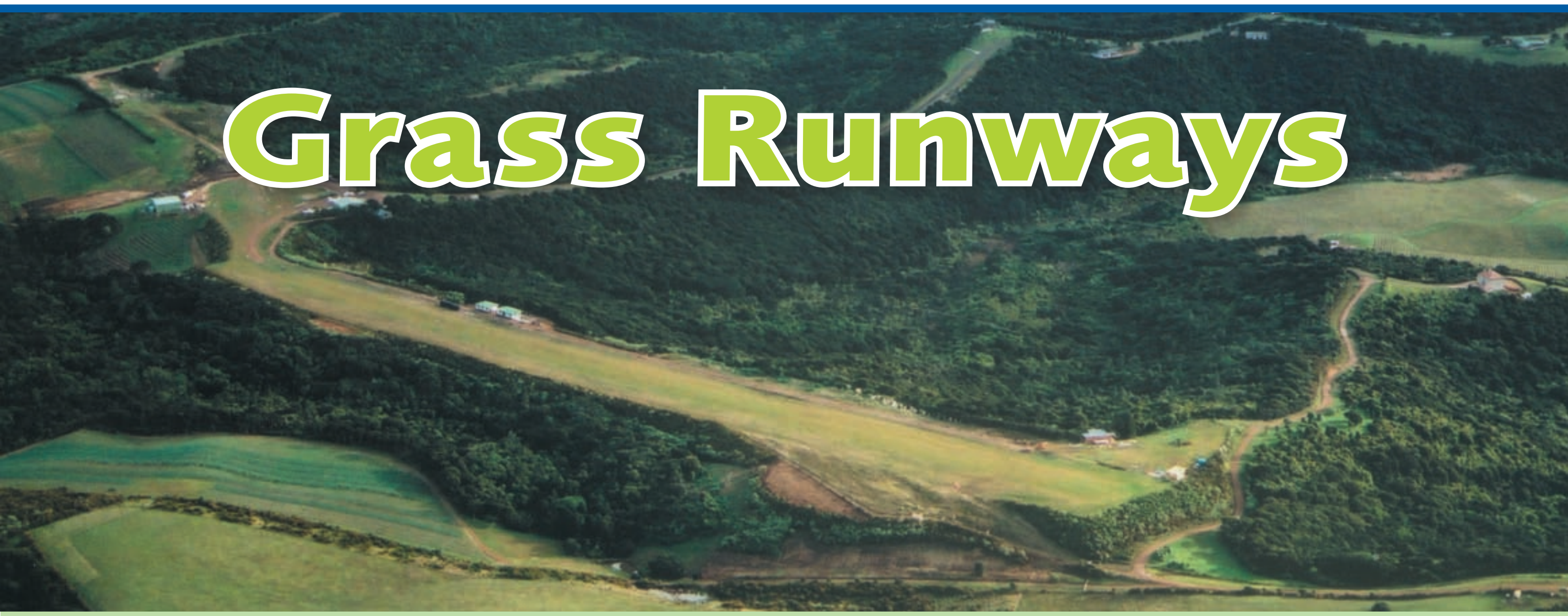
Conclusion

The Robinson R22 is a light helicopter which has been designed according to the task the manufacturer intended. To achieve simplicity and low cost, the rotor head design does not have the sophistication of larger helicopters. This makes it even more important to respect its limitations. In private operations, the R22 (if operated within its limitations) has proven to be a reliable and safe machine. Given a fair go, it will perform with safety and reliability!

The blade failures reported to date should be proof enough that operating outside the limits can be lethal.

The new A016-4 blades have been designed to increase corrosion resistance and inspectability. They are not designed for increased load carrying ability. These blades should not be considered as a cure-all for operations outside the detailed Flight Manual parameters, and the best advice must be to operate within these limits.

Operating outside the limitations of the Flight Manual will put the pilot in the role of a **test pilot.** Not only will this cause unnecessary personal risk to the pilot, but it may also leave the helicopter in an unsafe condition for the operator – or indeed any future operator! ■



Grass Runways

The aircraft was issued with a landing clearance from Hamilton Tower for grass Runway 08. The aircraft landed on the recently mown area adjacent to the runway. The pilot landed on the undesignated area because he mistakenly thought the freshly cut area was the grass runway.

This incident is not uncommon; there have been more than 15 reported incidents (since 2000) of aircraft landing on undesignated areas beside a grass runway, or landing on a closed grass runway. The majority of these incidents have occurred at Hamilton, Rotorua and Napier. At these locations, pilots have mistaken the undesignated areas for the grass runway – either because they were unfamiliar with the aerodrome layout, or were unable to distinguish the grass runway from the markers provided, ie, marker boards, painted tyres or cones. No doubt there have been many more unreported incidents at other airfields, particularly at those not serviced by ATC.

Pre-flight Planning

The risk of landing beside a grass runway, or on a closed runway, can be reduced by thorough pre-flight planning.

Examine the aerodrome chart in the *AIP New Zealand Vol 4* AD section.

Look at the dimensions and location of the grass runway:

- What is its position relative to other runways?
- Is it parallel to the sealed runway?
- Is it a cross runway?

Examine the comments:

- Can the grass become soft during winter, or after heavy rain?
- Is the ground rough and undulating?
- Do cattle or sheep have to be removed before use?

The answers to all of these questions will assist in the planning of the flight. For example, it may be unsuitable to land an aircraft with a low propeller clearance on an aerodrome that is rough and undulating; there is a greater chance of a propeller strike. Additionally, a grass runway may be closed after a prolonged period of rainfall. Or there may be significant work in progress at the aerodrome, information that should be published in NOTAMs and/or the *AIP Supplements*. Always check NOTAMs for possible information on the condition of the aerodrome that you intend to use.

If you are still unsure about the condition of the aerodrome, then telephone the aerodrome operator. This may assist in obtaining further information about the aerodrome layout and how the grass runways are marked. Talk to other pilots who are familiar with the aerodrome, about the possible hazards.

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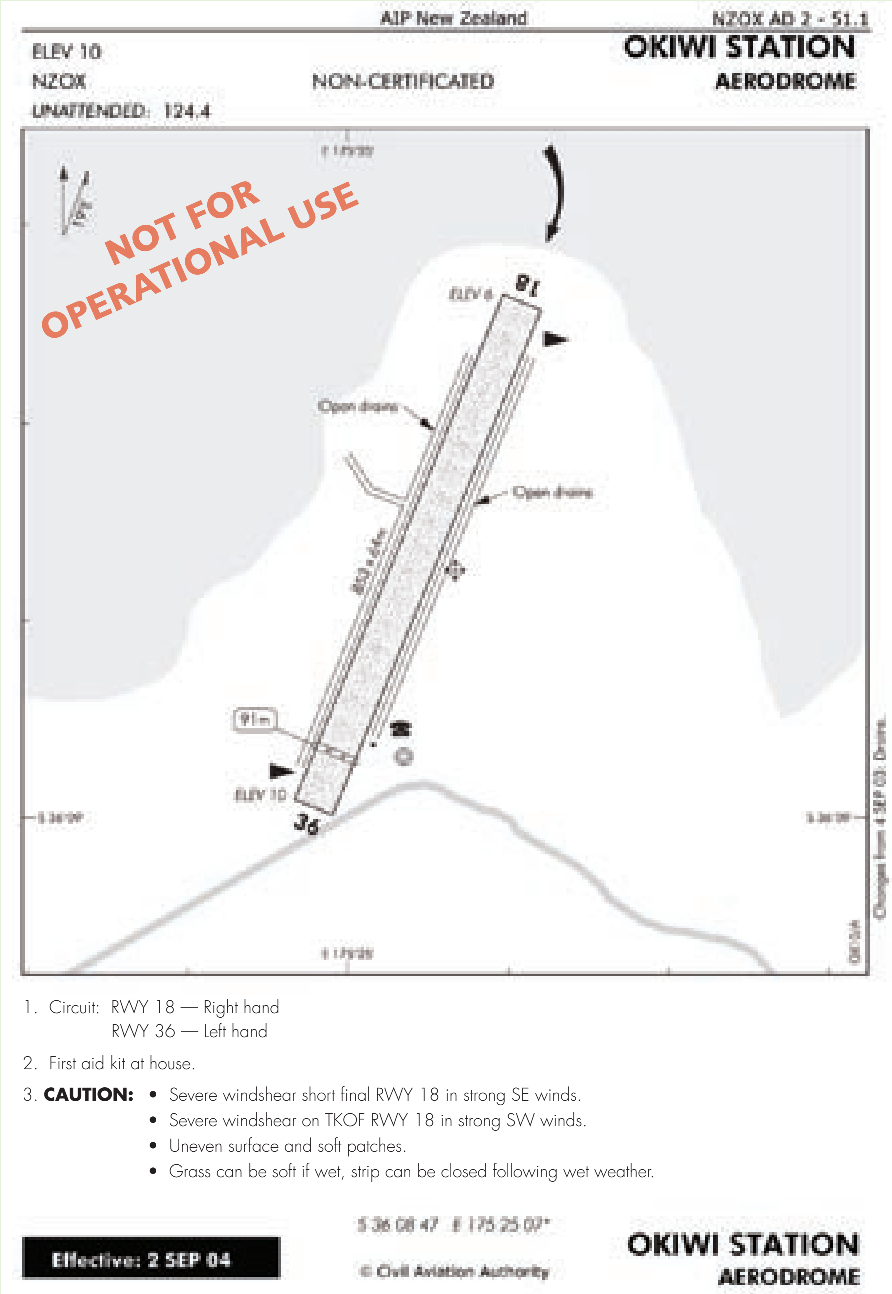


When planning your flight, check for comments on the aerodrome chart regarding the condition of grass runways and taxiways.

Be Aware Of...

At some aerodromes, the grass runway is marked out by close mowing. During the summer months, the runway can 'brown off', making it very difficult to see unless it is clearly marked by lime, white paint, tyres, cones, or marker boards. Caution is required if a 'browned off' grass runway is adjacent to areas of crop growing, as the greener areas can, from a distance, look enticingly like a runway.

During spring, freshly mown areas can be confused with grass runways. It can be hard to see where the grass runway is, especially if it has not been recently mown. The grass may partially cover marker boards and tyres outlining the runway. This is made more difficult if the painted tyres or posts have faded over time. Be aware that not all aerodromes have clearly defined edges. An approach and overshoot may be necessary to assist in locating the grass runway.

Exercise caution when using grass runways during winter months, and after periods of rain or heavy dew. The wet and soft conditions can result in poor braking action after landing. The soft conditions will increase the takeoff ground run, and it may be impossible for the aircraft to reach the required takeoff speed.

At unattended grass aerodromes, be on the lookout for aircraft that are operating without a radio (NORDO).

Be on the lookout for white crosses on grass runways and taxiways. **This means that these areas are closed.**

In Flight

If flying to an unfamiliar aerodrome that has a sealed and a grass runway, try to land on the sealed runway (unless the aircraft flight manual does not recommend it), as it will be easier to see. At some busy controlled aerodromes, it is preferred that smaller aircraft land on the grass runway, and ATC may well instruct pilots of light aircraft to use the grass runway. If ATC do not allow a request to land on the sealed runway – ask them for clarification on the position of the grass runway.

At aerodromes where the grass runway is parallel to the sealed runway, there is a reasonable distance between the edges of the sealed and the grass runways. This area is not normally available for aircraft operations, but it can be easily mistaken for part of the grass runway, as it is often greener than the surrounding areas.

This is what can happen if you land on a closed area.

It is recommended practice at most unattended aerodromes, to join via the standard overhead join. This will allow more time to see the layout of the aerodrome. If an overhead join is not possible, then try to join from the downwind leg. It will give you more time to sight the threshold marker boards, or cones outlining the runway, than from the base leg or final. Upon sighting the runway markers, keep these in sight to assist in planning the approach. If the aerodrome is unfamiliar, or if the runway width is not clearly marked, then avoid joining from the base leg or final, as it is more difficult to position the aircraft accurately for the approach.

Be on the lookout for white crosses, as these indicate that the grass runway is closed. White crosses are more easily seen during a standard overhead join, as they are normally placed at either end of the runway.

If on final approach you are still unsure about the exact location of the grass runway, then go around and re-circuit.

Be wary of establishing a mind-set when initially identifying what you think is the runway; review this decision at later stages of the approach.

Conclusion

Be aware that, when intending to land on an unfamiliar grass runway, it may not be easily seen from the air. Double-check its location by referring to the landing chart, position of marker boards, etc. It will be easier to see the aerodrome layout and runway locations if you join overhead. If in doubt at any stage on the approach, then it is safer to go around and re-circuit. ■

Rangiora Aerodrome

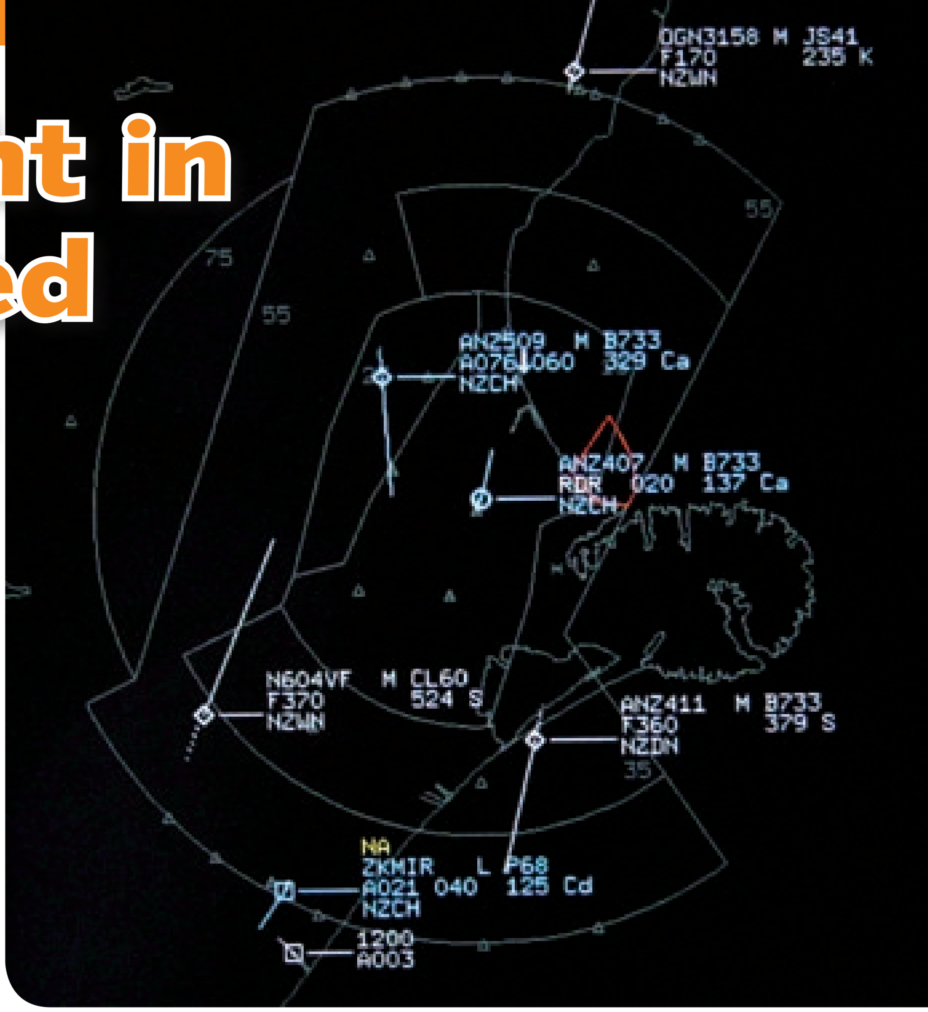
The following photos of Rangiora aerodrome illustrate how difficult it can be to spot the location of grass runways. The development of a new (and longer) grass runway 07/25 has meant a much narrower 07/25 runway being used in the interim adding another identification factor.

From a distance, the three runways are not easily seen.

From overhead the airfield, the aerodrome layout is more easily seen, including the white crosses indicating closed areas of the new runway under development beside Runway 07/25. Notice that, if the white crosses were not placed there, then it could be easy to assume that the greener area is the runway.

On final approach, notice that the grass runway is marked by painted tyres, and the threshold is marked by a painted fence. The runway area under development is to the right, as indicated by the white crosses.

VFR Flight in Controlled Airspace



It is surprising the lengths that some pilots will go to in order to avoid talking to Air Traffic Control (ATC), or to avoid flying in controlled airspace, particularly airspace that is unfamiliar to them. This is unfortunate, because flying VFR in controlled airspace (commonly referred to as controlled VFR – CVFR) can often be used to the pilot's advantage on local or cross-country flights. In some instances it may be easier or safer to obtain a clearance through controlled airspace, rather than flying around or beneath it. There may be additional benefits, such as more direct routing, avoiding turbulence, gaining more favourable wind conditions, or operating at a higher altitude – and therefore an increased TAS. A higher altitude provides an extra safety margin when flying over high terrain or crossing large stretches of water. A higher altitude can also assist in radio communications, as VHF coverage is improved.

The most common form of CVFR is when an aircraft is arriving or departing a control zone (CTR). This article, however, focuses on enroute CVFR.

Key Points to Consider

ATC Clearances and Radio Procedures

Flight into controlled airspace must be requested from ATC. The request should be made well before the clearance is required (5 to 10 minutes) to give ATC time to facilitate your entry. If departing from a controlled aerodrome, make your request before taxiing onto the manoeuvring area.

You may be advised to change to a specific frequency for your clearance – do not enter the airspace until you have received the clearance, understood its contents, and read it back to the controller. Any conditions of entry into controlled airspace must be complied with. You may be issued with a discrete transponder squawk code, which, by itself does not constitute a clearance to enter controlled airspace.

When established in controlled airspace, maintain a continuous listening watch on the given frequency, as ATC may change the conditions of your clearance, issue further instructions (ie, frequency change), or provide you with updated traffic information or weather. Where an aircraft is transiting from one ATC sector to another, ATC will coordinate the flight between themselves and issue instructions as required. ATC will advise you when to change to the next frequency. As pilot-in-command, however, you have a responsibility to monitor your flight, if you believe that you have transited into the next ATC sector and no frequency or reporting instructions have been given – then contact ATC.

Pilots must follow clearances accurately. It is important to adhere to these limits, particularly altitude restrictions, as there may be only 500 feet vertical separation between you and an IFR aircraft, and any height variations could reduce this safety margin.

If traffic conditions permit, you may request a block-level clearance which allows you to operate at any VFR cruising level up to a specified altitude, or between two specified altitudes. This gives you the flexibility to maintain the VFR minima rather than repeatedly having to request level changes because of changeable weather. It can also be handy in turbulent conditions, or when strong lee waves are affecting your aircraft and it becomes difficult to maintain a specified altitude. Letting ATC know why you want a block clearance may increase your chances of getting what you want. Be prepared for your request to be refused, however, as it is not always possible for ATC to accommodate a block clearance because of other traffic.

Remember, if you are unable to conform to an ATC instruction or clearance, then notify ATC.

Radar Services

To assist in navigation, radar vectoring or radar monitoring may be requested in Class C and Class D airspace, and ATC (workload permitting) may provide this facility. (**Note:** Radar vectoring is not normally provided to VFR flights within Class G airspace even if you are in radar coverage. However, every effort will be made to provide a service to assist and give navigational advice to an aircraft if necessary.)

When being radar vectored, the controller will issue instructions to the pilot to fly magnetic headings, or to maintain a specified track. This does not absolve the pilot from compliance with the requirements for operation under VFR. Terrain clearance remains the responsibility of the pilot. If you encounter a situation where terrain clearance could be compromised, any requests for assistance from ATC must include details of the circumstances. When radar vectoring is terminated, the pilot will be instructed to resume own navigation. If required, ATC may pass position or track and distance information to assist.

In some areas of uncontrolled airspace (especially over Cook Strait) a radar monitoring service may be requested. This can assist, as you will be able to receive traffic information on other traffic known to ATC (they won't know about all aircraft in class G airspace) and if anything goes wrong, assistance is possible without delay. The provision of these services is at the discretion and workload of the controller – they may be very busy on other frequencies or tasks, even if the radio traffic appears light.

Meteorological Conditions

Flying CVFR does not allow you to break any VFR requirements; for example, it does not mean that flight may be made through cloud. You must also maintain the appropriate VFR distance from cloud and VFR visibility requirements (Table 1). If at any stage you consider the flight conditions are lowering towards visual meteorological minimum requirements, contact ATC immediately and request a level change clearance and/or a heading alteration. It may facilitate your request if you supply ATC with a reason for the amendment. For example, "Wellington Control, Quebec Victor Victor, request descent to 3000 feet due cloud."

Remember, you may request a special VFR (SVFR) clearance within a control area or control zone, so it could be possible to maintain your cruising altitude or heading in SVFR conditions. This request must be made as early as possible to assist ATC in separating you from other IFR aircraft and, when the visibility falls below 5 km, from other SVFR aircraft.

Table 1: VFR Meteorological Minima

Class of Airspace	Distance from Cloud	Flight Visibility
Class C and D	2 km horizontally 1000 feet vertically outside a control zone 500 feet vertically within a control zone	8 km at or above 10,000 feet AMSL 5 km below 10,000 feet AMSL

Separation and Traffic Information

Controlled VFR **does not** necessarily mean that you will be separated from other traffic. In Class C airspace, VFR aircraft are separated from IFR aircraft at all times, but not from other VFR traffic. VFR aircraft, therefore, are responsible for their own separation and to avoid each other. The exception is when aircraft are operating SVFR with visibility less than 5 km.

In Class D airspace, VFR aircraft are not separated from IFR aircraft, or from other VFR aircraft. ATC will only provide traffic information to IFR and VFR aircraft about each other. VFR aircraft are not separated unless operating SVFR – the same as in class C airspace.

ATC will provide appropriate traffic information where separation is **not** provided. In Class C airspace, this is between VFR and VFR aircraft. In Class D airspace, ATC will provide traffic information between IFR and VFR aircraft. In both classes of airspace, traffic avoidance advice may be available on request.

Summary

There are often advantages in obtaining a CVFR clearance through controlled airspace, but this does place more responsibility and restrictions on the pilot. If the clearance you are given makes you question your ability to operate safely, then ask for an alternative. **You** are ultimately responsible for the decisions that you make regarding ATC clearances and instructions when operating in controlled airspace. Controlled VFR can make your flight easier in some circumstances, but do not assume that you will always be granted a clearance – traffic patterns or density may not allow it. Plan your flight to take this into account. ■

More on

Our article "TCAS II and VFR Traffic" (November / December 2004 issue of *Vector*) was aimed at giving VFR pilots an appreciation of how this equipment works, and the part they can play in reducing the possibility of mid-air collisions, by making sure transponders are used correctly.

In this article, we will take another look at TCAS II equipment and how it works to avoid collisions. We will also talk about pilot and air traffic controller training. In particular, we will examine the rule amendments that deal with resolution advisory (RA) action taking priority over ATC instructions.

History

In the early 1980s, ICAO started work on the development of standards for an "Airborne Collision Avoidance System" (ACAS). The term "ACAS", describes a system that provides an automatic warning to pilots when the system detects other aircraft in potentially hazardous proximity.

The US FAA made a decision in 1981 to develop and introduce a collision avoidance system capable of recommending to cockpit crew evasive manoeuvres in the vertical plane. This system is called "Traffic Alert and Collision Avoidance System" (TCAS). The term "TCAS" is used to describe the US developed equipment; it provides the functions of ACAS.

ACAS Indications

ACAS issues two types of warning:

- A traffic advisory (TA) is issued 20 to 48 seconds before the closest point of approach (CPA) to warn the pilots that a resolution advisory (RA) may follow and to assist in a visual search for the aircraft.
- A resolution advisory (RA) is issued 15 to 35 seconds before CPA, which provides the pilots with an indication of appropriate vertical manoeuvres, or vertical manoeuvre restrictions, to ensure the safe vertical separation of the ACAS aircraft. It should be noted, however, that the vertical separation provided by ACAS is independent of ATC separation standards. This is because ACAS does not seek to ensure separation, which is the role of ATC, but as a last resort, seeks to avoid collision.

TCAS II display showing targets (blue diamonds).

ACAS in Operation – Some New Zealand Examples

A commercial airliner was carrying out a VOR/DME approach to a provincial airport. The aircraft was instructed to (when visual) join lefthand downwind. A single-engine Cessna, on a cross-country flight to a nearby airport, called the tower, requesting clearance to traverse the control zone. The Cessna was cleared at 1500 feet or below. The airliner reported downwind and was cleared to land. The airliner acquired an RA on a target two nautical miles ahead and 100 feet above. Avoiding action was taken by descending and turning left. After landing, the pilot of the airliner phoned the tower to report having passed close to an unknown light aircraft on his downwind position.

An airliner was descending into an airport, and was cleared to 6000 feet. At approximately 6800 feet, a departing aircraft was noted on TCAS approximately 2500 feet below, crossing left to right. The airliner then received a TCAS RA to climb. When level at "6000 feet" ATC asked if the aircraft was still maintaining 6000 feet. It was at this point that it was realised that the QNH of 999 hPa had not been set.

An airliner on an IFR flight northbound was operating at FL350. Another airliner was on an IFR flight southbound at FL340. The pilot of the southbound aircraft requested, and was cleared to, non-standard FL350 due to weather conditions. The aircraft passed with less than the prescribed five nautical mile lateral separation. The southbound aircraft received and responded to an RA and descended 100 feet. Both aircraft had each other in sight.

There are many such examples of the value of ACAS as an accident prevention aid. Unless, however, sound operating procedures are followed by all pilots, the value of ACAS may be seriously eroded, or even negated.

Procedures to Follow When an RA is Received

Revised ACAS procedures and pilot training guidelines are now included in **ICAO PANS-OPS Doc 8168**.

The new procedures are a result of the experience gained from a decade of worldwide ACAS II operations, and as a result of several monitoring programmes.

In essence, these procedures are quite straightforward:

(a) Do not take any avoiding action on the sole basis of a TA.

(b) Do not rely on visual acquisition. The wrong aircraft could be identified and the situation may be wrongly assessed.

TCAS II

(c) On receipt of an RA:

- Respond immediately by following the RA as indicated, unless doing so would jeopardise the safety of the aircraft
- Follow the RA even if there is a conflict between the RA and air traffic control (ATC) instruction to manoeuvre. The slower update rate of the radar display, means that the vertical situation seen by the controller may be inaccurate, particularly when aircraft are climbing or descending rapidly
- As soon as possible, as permitted by flight crew workload, notify the appropriate ATC unit of the RA, including the direction of any deviation from the current air traffic control instruction or clearance. The RA manoeuvre may have implications for other traffic
- Do not manoeuvre in the opposite sense to an RA
- Do not manoeuvre laterally. [*Vector* comment: Lateral manoeuvre may be required if the aircraft does not have the performance, or is close to terrain. This has to be left to the pilot's discretion]
- Promptly comply with any modified RAs
- Limit the alterations of the flight path to the minimum extent necessary to comply with the RAs
- Promptly return to the terms of the ATC instruction or clearance when the conflict is resolved
- Notify ATC when returning to the current clearance.

Amendments have been made to NZ CAR 91.241 *Compliance with ATC clearances and instructions*, and to NZ CAR 172.91 *Deviation from an ATC clearance*, to accommodate the above procedures in New Zealand.

Training

The value of ACAS as an accident prevention aid has been amply demonstrated in New Zealand and overseas. It is important, however, that sound operating procedures are followed by all pilots, and by air traffic controllers. Standard Operating Procedures (SOPs) should stress that, in the event of a 'level bust' that involves an actual risk of collision, the ACAS is the only means to resolve the situation effectively. **It is imperative, therefore, that pilots follow the RA.**

ACAS Nuisance Alerts Increased

An increasing number of alerts generated by ACAS systems are being experienced, and many are being categorised as 'nuisance alerts' because correct air traffic control separation is being applied, or there is adequate vertical and/or horizontal distance between the aircraft. This situation can occur when the 500 feet vertical separation in controlled airspace is applied (rule 172.251 *Vertical Separation*).

In the last two years, 35 reported ACAS alerts at Christchurch have been categorised as nuisance alerts, and at Auckland there have been 11.

For example, at Christchurch, in Class C airspace, where IFR traffic is separated from VFR traffic, ACAS RAs may occur when IFR aircraft have been cleared to 2000 feet and are near a VFR aircraft operating (legitimately) at 1500 feet, just 500 feet below.

If an aircraft is climbing or descending, with a high vertical rate, to a level that is within 1000 feet from an adjacent aircraft, then an ACAS RA can result. This could be seen to be a nuisance alert, but it is not – because, if that aircraft does not level off at the cleared level, then a loss of separation, or a risk of collision can occur.

Suggestions for reducing the number of nuisance alerts:

- High performance aircraft in the climb or descent should reduce their rate of climb or descent for the last 1000 feet prior to the cleared altitude. "Adjust vertical speed" advisories should be followed.
- Aircraft operating at the lowest IFR cruising level within controlled airspace may be only 500 feet above the upper limit of uncontrolled airspace. Pilots of these aircraft should review operations at this level if VFR traffic is in the vicinity.
- When operating by visual reference within, or entering a controlled aerodrome traffic circuit, pilots should operate ACAS systems on Traffic Avoidance (TA) mode. This is to avoid unnecessary RA manoeuvres against controlled traffic where visual, composite visual, 500 feet vertical, or runway separation standards that are not considered by ACAS systems are being applied.

Continued over ...

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ACAS and Reduced Vertical Separation Minimums (RVSM)

Soon after RVSM was implemented in the North Atlantic Region, many pilots complained that their ACAS were generating TAs of long duration for aircraft being flown at adjacent flight levels.

A few nuisance RAs were also triggered by wake turbulence, meteorological turbulence, or 'imperfect altitude keeping.'

Most of the nuisance advisories were generated by TCAS equipment with version 6.04 software, which was designed for 2000 feet vertical separation of aircraft above FL 290. Eurocontrol said that among the modifications incorporated in current TCAS software, version 7.0, are a change from 1200 feet to 850 feet in the altitude threshold at which TAs are generated, a change from 800 feet to 700 feet in the altitude threshold at which RAs are generated, and a reduction of the target vertical miss distance from 700 feet to 600 feet.

TCAS with version 7.0 software performs well in RVSM airspace, according to Eurocontrol. Nevertheless, aircraft that are flown with high climb or descent rates before level-off at the assigned flight level will trigger nuisance RAs.

ICAO recommends that flight crews reduce vertical speed to less than 1500 feet per minute in the last 1000 feet before level-off to avoid triggering ACAS advisories and to avoid altitude deviations.

Summary

ACAS is an independent last resort system, which operates with very short time thresholds before a potential near mid-air collision. It assesses the situation every second, based on accurate surveillance in range and altitude. For maximum efficiency, when both aircraft are operating ACAS in RA mode, ACAS coordinates the RAs. ACAS is extremely effective.

Pilots must follow all RAs even when there is:

- An opposite avoiding instruction by the controller. If the RA is not followed, it can adversely affect safety when the other aircraft responds to a coordinated RA
- Conflict at maximum operating altitude. If a climb RA is generated, commence a climb. Do not descend opposite to the RA. Maximum altitude usually permits a 200 feet per minute capability. Otherwise, if the aircraft is performance limited, the ACAS is usually programmed not to give the relevant warning. Operators should check with equipment manufacturers and brief crews accordingly
- Traffic information from the controller. The slower update rate of the radar display means that the vertical situation seen by the controller may be inaccurate, particularly when aircraft are climbing or descending rapidly.
- Visual acquisition. The wrong aircraft could be identified and the situation may be wrongly assessed.

It is recognised that workload is often high during an ACAS RA encounter. Nevertheless, pilots must notify ATC as soon as possible using the standard phraseology, eg, "[callsign] TCAS CLIMB".

This information will help the controller in their task. When a controller is informed that a pilot is following an RA, the controller shall not attempt to modify the aircraft flight path until the pilot reports returning to the clearance. They shall provide traffic information as appropriate.

For maximum safety benefit from ACAS, follow RAs promptly and accurately. ■

(Reference: Eurocontrol)

Emergency Squawk Codes

Do you know the transponder emergency squawk codes? Would you use them without hesitation?

There have been instances where aircraft have been in situations where switching the transponder to the appropriate emergency squawk code could have helped everyone concerned.

In one instance, where a light aircraft experienced a radio failure and was overdue on SARTIME, Airways staff spent a lot of time trying to track down telephone and cellphone numbers of operators known to be in the general area to determine who had had the radio failure. This time wastage could have been averted had the pilot used the correct emergency squawk code to inform ATC of the problem. In this case, 7600 should have been used.

It is important to remember that Airways personnel must have positive confirmation that an overdue aircraft is in fact safe. Even if you have an allocated transponder code and radar identifies that target as still being in the air, they can not close the situation on the assumption that the observed target is the overdue aircraft.

Another instance involved an aircraft operating in controlled airspace where no emergency code was selected even though the pilot was in an *urgency* (PAN PAN) situation. *Vector* understands that the aircraft had an engine failure (which could put the situation more in the MAYDAY category, and would definitely warrant squawking 7700).

In the emergency procedures section of *AIP New Zealand* (ENR 1.15), pilots are advised to immediately select the emergency code 7700 when experiencing a *distress* (MAYDAY) situation (defined as a condition of being threatened by serious and/or imminent danger and requiring immediate assistance).

This action is not specifically mentioned for an *urgency* (PAN PAN) situation (defined as a condition concerning the safety of an aircraft, or of some person on board or within sight, but which does not require immediate assistance).

Flight service operators are trained to request that the aircraft transponder be switched to 7700 if the pilot reports any sort of abnormal situation.

If you experience a problem in flight, this is not the time to exercise that famous Kiwi reserve and tendency for understatement. It is okay – and desirable – to speak up (verbally, and/or

electronically by transponder). Using an emergency squawk code makes assisting you so much easier for Airways personnel. Your target is then easily identified (it flashes on the radar screen) and because it also displays on the screen at the Supervisor's desk, it is much easier for that person to coordinate the team's response.

While some parts of the country do not have radar coverage (refer to *AIP New Zealand* ENR 1.6-30), and in those areas Air Traffic Services may not be immediately alerted to your emergency transponder selection, pilots should still always select the emergency code as a standard procedure.

Don't wait for an urgency situation to possibly escalate into a distress situation. Air traffic controllers and flight information personnel would rather have a request for assistance, which may later turn out to be unnecessary, than have a pilot hesitate to 'make a fuss' and then end up in more serious situation. They love happy endings!

Use all the tools at your disposal to ensure a safe flight. Always file a flight plan and don't hesitate to alert others if you experience a problem or abnormal situation of any sort. You can always cancel the PAN PAN or MAYDAY, if the problem is resolved. But, if not, you will have the full attention and support of those who can help. ■

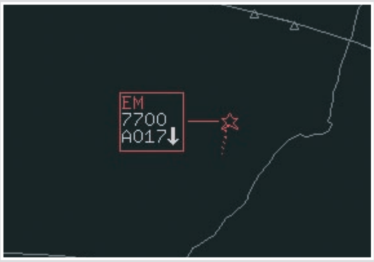
This series of photos show how the screen presentation changes when an emergency code is selected. If a controller selects a target for easier monitoring, a box appears around the target – this box is red when an emergency code is selected.

Normal IFR flight

IFR flight squawking 7600 for radio failure

Normal VFR flight on flight plan (selected)

VFR flight squawking 7700 for emergency



VFR flight squawking 7700 (selected for easier monitoring)

Field Safety Advisers

Don Waters
(North Island, north of line, and including, New Plymouth-Taupo-East Cape)
Tel: 0–7–823 7471
Fax: 0–7–823 7481
Mobile: 027–485 2096
Email: watersd@caa.govt.nz

Ross St George
(North Island, south of line New Plymouth–Taupo–East Cape)
Tel: 0–6–353 7443
Fax: 0–6–353 3374
Mobile: 027–485 2097
Email: stgeorger@caa.govt.nz

Murray Fowler
(South Island)
Tel: 0–3–349 8687
Fax: 0–3–349 5851
Mobile: 027–485 2098
Email: fowlerm@caa.govt.nz

Owen Walker
(Maintenance, North Island)
Tel: 0–7–866–0236
Fax: 0–7–866–0235
Mobile: 027–244 1425
Email: walkero@caa.govt.nz

Bob Jelley
(Maintenance, South Island)
Tel: 0–3–322 6388
Fax: 0–3–322 6379
Mobile: 027–285 2022
Email: jelleyb@caa.govt.nz

Accident Notification

24-hour 7-day toll-free telephone

0508 ACCIDENT
(0508 222 433)

The Civil Aviation Act (1990) requires notification "as soon as practicable".

Aviation Safety Concerns

A monitored toll-free telephone system during normal office hours.
A voicemail message service outside office hours.

0508 4 SAFETY
(0508 472 338)

For all aviation-related safety concerns

OCCURRENCE BRIEFS

Lessons for Safer Aviation

The content of *Occurrence Briefs* comprises notified aircraft accidents, GA defect incidents, and sometimes selected foreign occurrences, which we believe will most benefit operators and engineers. Individual Accident Briefs, and GA Defect Incidents are now available on CAA's web site, www.caa.govt.nz. Accident briefs on the web comprise those for accidents that have been investigated since 1 January 1996 and have been published in *Occurrence Briefs*, plus any that have been recently released on the web but not yet published. Defects on the web comprise most of those that have been investigated since 1 January 2002, including all that have been published in *Occurrence Briefs*.

Accidents

The pilot-in-command of an aircraft involved in an accident is required by the Civil Aviation Act to notify the Civil Aviation Authority "as soon as practicable", unless prevented by injury, in which case responsibility falls on the aircraft operator. The CAA has a dedicated telephone number 0508 ACCIDENT (0508 222 433) for this purpose. Follow-up details of accidents should normally be submitted on Form CA005 to the CAA Safety Investigation Unit.

Some accidents are investigated by the Transport Accident Investigation Commission, and it is the CAA's responsibility to notify TAIC of all accidents. The reports that follow are the results of either CAA or TAIC investigations. Full TAIC accident reports are available on the TAIC web site, www.taic.org.nz.

ZK-IUE, Bell (Garlick) UH-1E, 3 Jan 03 at 15:30, Paparangi Station. 1 POB, injuries 1 fatal, aircraft destroyed. Nature of flight, aerial work. Pilot CAA licence CPL (Helicopter), age 50 yrs, flying hours 16000 total, 3000 on type, 200 in last 90 days.

The helicopter was on logging operations and had just delivered a log to the milling site. As the pilot applied power to climb away after releasing the log, the automatic grapnel re-engaged on the log when the lifting longline tautened. The resulting jerk caused the line to pull free at the lower end, and flick up into the path of the main rotor. The tail rotor separated when struck by the flailing line, and control of the helicopter was lost. It struck the ground a short distance from the landing site and was destroyed on impact.

Main sources of information: CAA field investigation.

CAA Occurrence Ref 03/2

ZK-KFU, General Dynamics Allison Convair 340/580, 3 Oct 03 at 21:26, Kapiti Coast. 2 POB, injuries 2 fatal, aircraft destroyed. Nature of flight, freight. Pilot CAA licence ATPL (Aeroplane), age 58 yrs, flying hours 16928 total, 3286 on type, 106 in last 90 days.

On Friday 3 October 2003 at 2126, Convair 580 ZK-KFU was on a scheduled night freight flight from Christchurch to Palmerston North, when it was observed on radar to enter a tightening left turn and disappear. Attempts to contact the aircraft were unsuccessful and a search for the aircraft was started. The aircraft had impacted the sea about 10 km north of Paraparaumu, about vertically, and at high speed. The crew of two was killed on impact.

After crossing Cook Strait the aircraft probably became heavily iced up while descending through an area of severe icing, and stalled after flying level for a short time. The crew was unable to recover from the ensuing spiral dive, and the aircraft broke up as it descended.

Main sources of information: Abstract from TAIC Accident Report 03-006.

CAA Occurrence Ref 03/2803

ZK-HCC, Hughes 369HS, 30 Nov 03 at 10:15, Fox Glacier. 5 POB, injuries 1 minor, damage substantial. Nature of flight, transport passenger. Pilot CAA licence CPL (Helicopter), age 27 yrs, flying hours 956 total, 35 on type, 150 in last 90 days.

On Sunday 30 November 2003 at about 1015, ZK-HCC, a Hughes 369HS helicopter, was on a scenic flight near the head of Fox Glacier at about 9500 feet when its engine power turbine and main rotor speed suddenly reduced. The pilot descended the helicopter to 6500 feet, where power was restored. Several minutes later a second power loss occurred, so he carried out an emergency landing at the base of Fox Glacier. The right rear skid broke when it struck a large rock during the landing, and the helicopter consequently rolled onto its right side. No one was seriously injured in the accident.

A power turbine governor underspeed condition resulted when electrical continuity to the governor switch on the collective lever was lost, thus reducing the power turbine speed to its minimum setting.

Main sources of information: Accident details submitted by Rescue Coordination Centre plus TAIC investigation.

CAA Occurrence Ref 03/3412

N9163R, Boeing-Stearman A75N1, 13 Jan 04 at 17:20, Ngamatea Station. 1 POB, injuries nil, damage substantial. Nature of flight, private other. Pilot CAA licence PPL (Aeroplane), age 53 yrs, flying hours 300 total, 55 on type, 5 in last 90 days.

It was reported that, when faced with deteriorating weather conditions, the pilot elected to make a precautionary landing, during which the selected field was overshot and the aircraft suffered wing damage.

Main sources of information: Accident details submitted by pilot plus further enquiries by CAA.

CAA Occurrence Ref 04/97

GA Defect Incidents

The reports and recommendations that follow are based on details submitted mainly by Licensed Aircraft Maintenance Engineers on behalf of operators, in accordance with Civil Aviation Rule, Part 12 *Accidents, Incidents, and Statistics*. They relate only to aircraft of maximum certificated takeoff weight of 9000 lb (4082 kg) or less. These and more reports are available on the CAA web site, www.caa.govt.nz. Details of defects should normally be submitted on Form CA005 to the CAA Safety Investigation Unit.

The CAA Occurrence Number at the end of each report should be quoted in any enquiries.

Key to abbreviations:

AD = Airworthiness Directive	**TIS** = time in service
NDT = non-destructive testing	**TSI** = time since installation
P/N = part number	**TSO** = time since overhaul
SB = Service Bulletin	**TTIS** = total time in service

Bensen B8M Gyro-copter

Crankshaft

The gyrocopter experienced an engine failure and the pilot made a successful forced landing. Strip inspection of the engine revealed that the crankshaft had broken at the start of the first journal bearing (propeller end). One piston was damaged and two connecting rods were bent and roller bearings at the gudgeon pin end were damaged. There was minor scuffing inside the crankcase caused by bending of the crankshaft. A metallurgy report concluded that the crankshaft failed due to fatigue resulting from cyclic bending loads on the shaft at the bearing location. Possible causes suggested were: from vibration, misalignment, or high side loading. Additional factors could be the sharp change in crankshaft section, bearing fit, and the degree of propeller support. TSI 26 hours, TTIS 201 hours.

ATA 8520 CAA Occurrence Ref 03/4

Cessna 182T

Static line

During the climb, the pilot noticed that the airspeed indicator was locked on 100 knots, the vertical speed indicator was reading zero, and the altimeter was still reading sea level. Investigation established that the static line had become clamped between the instrument panel and panel frame, after a loosening of the panel for previous maintenance purposes.

ATA 3400 CAA Occurrence Ref 04/149

Cessna 206A

Solenoid

It was reported that, during a routine inspection, the starter solenoid was fitted and tested serviceable. During the engine run-up, however, the pilot found that the aircraft's ammeter was indicating a very high charge rate. It was found that the solenoid was jammed in the ON position. It had burnt out the field windings on the starter motor and the positive terminal on the battery. Replacement solenoid, battery, and starter motor were fitted.

ATA 2400 CAA Occurrence Ref 04/2681

Cessna 206F

Battery box

It was reported that there was an acid spill in the battery box and down the back of the battery box and firewall into the cabin. Spillage was possibly due to overcharging the battery. Replaced battery box, cleaned and repainted firewall. TTIS 9488 hours.

ATA 2400 CAA Occurrence Ref 04/2483

NZ Aerospace FU24-950

Nose steering

A bang was heard while the aircraft was being positioned in the hangar. Investigation found the steering post/tube assembly had fractured within the lower bearing block. Closer examination of the fracture surfaces indicated evidence of a pre-existing crack, with only a small section remaining, which then failed during ground positioning. Initial cracking was attributed to possible nosewheel shimmy and wheel out of balance. TSI 89 hours.

ATA 3250 CAA Occurrence Ref 04/1966

Piper PA-23-250

Righthand nose tubular frame

It was reported that while investigating a hydraulic leak under the forward fuselage, the maintenance engineer noted a hole in the lower righthand fuselage tubular structure. The tube concerned supports the nose gear mount, failure of which could result in nose gear collapse. The tube was corroded through from the inside, with no external corrosion evident. The hole was approximately 1/8 inch in diameter and was repaired in accordance with AC 43-13-1B. It is recommended that a detailed inspection be carried out in this area. TSI 30 hours, TTIS 7030 hours.

ATA 5300 CAA Occurrence Ref 04/3446

Piper PA-25-235

Magneto drive engine bearings

An engineer reported finding excessive wear in the magneto drive. The engine was controlled under on condition maintenance conditions and operated beyond manufacturer's limits. It was noted that excessive magneto drive bearing wear could not be detected with on condition maintenance and would have continued until eventual failure occurred. TSO 2536 hours, TTIS 6990 hours.

ATA 8500 CAA Occurrence Ref 03/3720

Robinson R22 Alpha

Horizontal stabiliser

It was reported that the pilot found loose rivets on the horizontal stabiliser. Inspection of the trailing edge revealed the rivet line to have working oversize rivets. The stabiliser assembly was removed, dismantled and the trailing edge de-rivetted. Two small internal cracks were found, along with corrosion and a damaged rib.

ATA 2700 CAA Occurrence Ref 04/3488

Schempp-Hirth Discus

Rudder cable

The pilot reported that, while cruising at slow speed, both rudder pedals went fully forward and the glider commenced a left turn. The pilot managed to regain some control and successfully landed the glider. Inspection of the rudder system found the righthand cable had failed at the forward swaged end fitting.

ATA 2721 CAA Occurrence Ref 03/796