

# AIRCRAFT ACCIDENT REPORT

**No. 91-011**

**Rotec Rally 3 Microlight**

**ZK-WAC**

**near Warkworth**

**14 April 1991**

**Transport Accident Investigation Commission  
Wellington - New Zealand**

# TRANSPORT ACCIDENT INVESTIGATION COMMISSION

## AIRCRAFT ACCIDENT REPORT No. 91-011

<b>Aircraft Type, Serial Number and Registration:</b>	Rotec Rally 3, 25568, MAANZ/416, ZK-WAC
<b>Number and Type of Engines:</b>	One Rotax 503
<b>Year of Manufacture:</b>	1988
<b>Date and Time:</b>	14 April 1991, 1235 hours NZST
<b>Location:</b>	Matakana, near Warkworth Latitude: 36°20'S Longitude: 174°43'E
<b>Type of Flight:</b>	Pleasure, Private
<b>Persons on Board:</b>	Crew: 1 Passengers: 1
<b>Injuries:</b>	Crew: 1 Fatal Passenger: 1 Fatal
<b>Nature of Damage:</b>	Destroyed
<b>Pilot in Command's Licence:</b>	MAANZ Novice Certificate
<b>Pilot in Command's Age:</b>	41
<b>Pilot in Command's Total Flying Experience:</b>	31 hours 20 hours on type
<b>Information Sources:</b>	Transport Accident Investigation Commission field investigation
<b>Investigator in Charge:</b>	Mr D V Zotov

Accident Report 82-003, ZK-WAC, issued by the Office of Air Accident Investigation, refers to a different aircraft, which is still missing. The registration was re-allocated to the aircraft concerned in this report, without taking cognizance of the earlier aircraft being missing.

Report No. 82-003 states that should the aircraft be found the investigation may be re-opened and a further report made. This report is not a result of such an event.

## 1. ABSTRACT

1.1 This report relates to the possible inflight incapacitation of the pilot of Rotec Rally 3, microlight aircraft ZK-WAC near Warkworth on 14 April 1991. The safety issues discussed are the maintenance of a minimum fabric strength on microlight aircraft and measures for improving the monitoring of microlight pilots' fitness to fly.

## 2. NARRATIVE

2.1 The local microlight club operated from the Warkworth showgrounds. Hangarage had ceased to be available there, so some of the club members had built themselves a hangar on a nearby farm at Matakana, and operated their aircraft from the paddock containing the hangar. ZK-WAC was one of the aircraft based at this farm.

2.2 ZK-WAC, a Rotec Rally 3, had a single-surface wing, the fabric covering being stretched between leading and trailing edge tubes, over bent tubular ribs. The wing was braced by three pairs of landing wires per side, to a kingpost, and by three pairs of flying wires per side, to the hang cage in which the occupants sat (See diagram 1). The empennage was mounted on an articulated tubular framework hinged at the wing trailing edge tubes. Tensioning of twin back-stays raised or lowered the empennage, adjusting trim by altering the (pre-set) tailplane incidence. The engine was mounted on the spine to which the wings and hangcage were mounted, and drove a 3-blade carbon fibre pusher propeller which turned between the tailbooms. (Diagram 1 shows the aircraft in its original form; the overhead control column (22) with cable linkage was replaced by two conventional control columns and a pushrod linkage to the elevators).

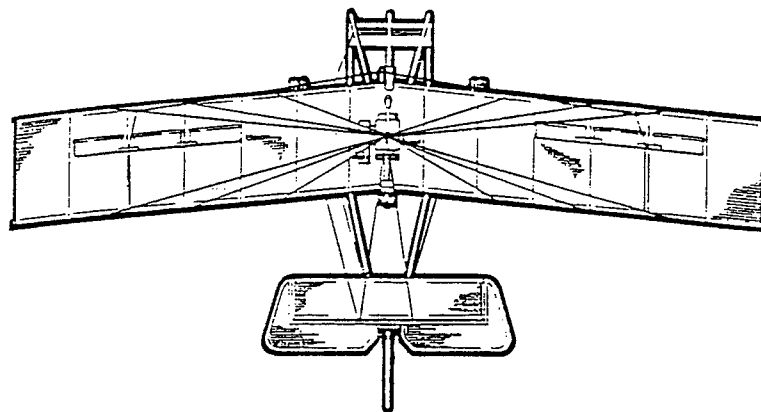
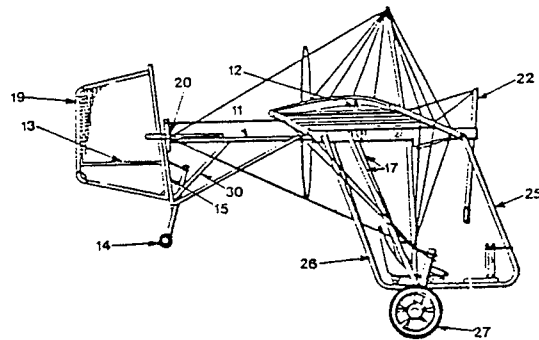
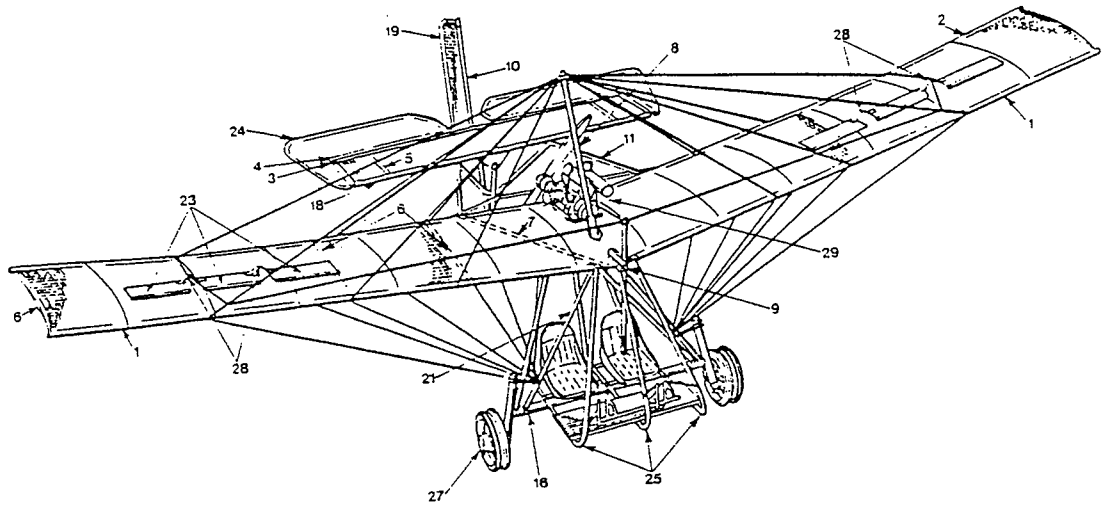
2.3 On the day of the accident the pilot had already flown the aircraft. He then took the passenger, who had no flying experience as a pilot, on a local flight. The aircraft overflew the airstrip heading east, and shortly after was seen to oscillate a number of times in pitch. The witness, who was standing some 1.5 km behind the aircraft, was able to see the upper surface of the wings when the aircraft pitched up. From his assessment of the angle between the aircraft and the horizon, the aircraft's height was estimated as about 500 feet above the terrain. The aircraft then made a descending turn to the right, turning rapidly. The witness thought there was something the matter with the right wing, but could not say what it was.

2.4 Another witness heard the aircraft fly over, the engine sounding normal, then the engine gave a short burst of high power, made a popping sound, and the noise stopped.

2.5 A pilot in another microlight took off to search for the missing aircraft, which he found near the edge of a patch of tall kanuka. He reported that turbulence in the vicinity was such as to require him to use full control deflections in flight. He estimated the wind as easterly at 10 knots, and attributed the turbulence to a ridge immediately upwind.

2.6 When a rescue party arrived, the occupants were both dead. Despite extensive injuries, there was little blood in the vicinity of the pilot, who was

# Diagram 1



**ZK - WAC  
ROTEC RALLY - GENERAL ARRANGEMENT**

occupying the right hand seat. The syndicate members advised that it was customary for the pilot to sit in the right seat, in the aircraft, because the dual control column installation then allowed the pilot to hold the column in his right hand, with his left hand on the throttle.

2.7 The wreckage was found at the foot of a large kanuka tree. Broken branches on this tree suggested the aircraft had descended steeply prior to striking the tree, and other trees in the vicinity were unaffected. The wreckage was in a steep nose-down attitude, heading approximately south, with the right wing folded over the left wing and the empennage on top of everything.

2.8 Melted fabric where the right wing had touched the silencer indicated that the latter had been hot on impact.

2.9 One of the composite propeller blades had bent rearwards. All three blades showed signs of strikes at the tips, and there were indications of wirestrikes on all three blades; otherwise there was little indication of power at impact. The fuel tank was half full of 2-stroke fuel which appeared to be clean.

2.10 A number of wing bracing wires had been cut. One flying wire was missing in part; the tang which had attached it to the wing was still present, but there was no sign of the wire which had been formed into a hard eye through the tang and held with two swages.

2.11 At the inboard end of the right wing there appeared to be a compression failure of the trailing edge tube, and outboard of this failure the two tubes supporting the empennage on that side had been cut by the propeller.

2.12 Some 50 m to the north of the impact site, there was a 50 mm length of white plastic coated wire, of the same type as some of the flying wires on ZK-WAC.

2.13 Swage failure on a flying wire, apparent compression damage to the right wing trailing edge, finding of a section of flying wire remote from the impact point, and absence of part of the failed flying wire, pointed to the possibility of in-flight break up. This possibility was reinforced by the eyewitness's impression that there was something wrong with the right wing before impact. The wreckage was therefore recovered to a workshop for reconstruction and detailed examination.

2.14 It was found that there were torsional failures in the outboard section of the right wing trailing edge, attributable to impact loads. These necessarily preceded the failure at the root, which was therefore a consequence of the impact. The flying wire from which part was missing was identified as the right hand forward intermediate wire. The short section which was found distant from the accident site was shown to have come from this wire. This wire was also shown to have been cut after the structure had started to distort during the impact sequence, and this was probably the load which caused swages to slip. There was evidence of a tree-strike on the corresponding landing wire. Nevertheless, the slippage of the aluminium swages was a matter for concern. The corresponding swages on the left wing were examined, and found to be affected severely by dissimilar metal corrosion in a marine atmospheric environment. The Microlight Aircraft Association of New Zealand was advised of the findings on this matter.

2.15 Scarring from the propeller locating bolts on the propeller shaft pillow block showed that the propeller had rotated for a number of turns after

the structure distorted on impact. Despite the minimal damage to the propeller blades the propeller had sufficient rotational inertia to cut aluminium tubes and a number of bracing wires during the impact sequence. It was presumed therefore that it had been able to throw the loose end of the failed flying wire away from the impact site.

2.16 Diagonal bursting of the fabric was associated with shear and may have occurred during the impact sequence. However, a significant proportion of the fabric from the right wing was missing, and it was possible that its absence may have been the discrepancy seen by the witness. The fabric was tested with a point-load meter. None of the wing fabric passed the 12 pound test recommended by the instrument manufacturer, and only about half of the tests passed at the reduced 6 pound load advocated by the MAANZ (though the fabric might have passed at the reduced load when the Permit to Fly was renewed on 23 December 1990). On the Rotec Rally, the single fabric surface provided the drag bracing, so a fabric failure had the potential to be catastrophic. Accordingly, it was recommended to MAANZ that the fabric on single-surface microlight aircraft should be required to pass a 12 pound point-load test.

2.17 The engine was mounted on a test-stand and run using fuel from the aircraft's tank. It started easily and appeared to run normally.

2.18 The pilot's control column had failed forward, but that on the passenger's side had a rearward set of 6 mm at the top. Disruption of the linking tube left no mechanism to react the force necessary to bend the tube rearward, during the impact sequence, and in any case the bend was in the wrong sense to have been the result of impact forces. The evidence therefore indicated that the bend was made by a rearward pull by the passenger in flight.

2.19 The flight controls were all connected and unobstructed at impact, and no mechanical fault was found which could have initiated a loss of control.

2.20 The syndicate members who owned ZK-WAC advised that the aircraft was stable in pitch, and the drag was so high that pilot-induced oscillation was unlikely. However, if the control column was held hard back, the aircraft would describe a phugoid (an oscillation in pitch) similar to that described by the witness.

2.21 When the pilot approached the owners of ZK-WAC with a view to joining the syndicate, local dual instruction was not available readily. He was advised to train with another club, some distance away. This he did, and when he had trained to solo standard he returned to fly at Matakana. As his membership of the club with which he trained also made him a member of MAANZ, there was no requirement for him to join the Warkworth Aviation Group, and he did not do so.

2.22 The Novice Certificate which he held had no expiry date, but was required to be revalidated every 90 days. This would have entailed him presenting his logbook and medical certificate to an instructor, but there was no indication that this was done. A Novice Certificate prohibited the carriage of passengers (see Civil Aviation Safety Order No.19 dated 30 June 1988).

2.23 His membership of MAANZ lapsed on 31 March 1991.

2.24 The pilot's occupation enabled him to fly during the week; the other owners, in common with most members of the club, usually flew at weekends

and so did not see much of the pilot. They were not aware of the status of his MAANZ certificate or membership.

2.25 The pathological report disclosed that the pilot had severe coronary artery disease. This had the potential, under conditions of stress or exertion, to cause an inadequate blood supply to the heart muscle, causing symptoms such as angina or faintness. Alternatively it could precipitate an abrupt change in the heart rhythm, disrupting the circulation of blood by the heart by reducing the effectiveness of the pumping action of the heart. The lack of bleeding from serious injuries suggested that the pilot's heart had stopped beating or was beating ineffectually at the time of impact. It was not possible to determine from the pathological evidence whether this was a causal factor, or whether it resulted from the stress of an in-flight emergency.

2.26 A medical certificate was a prerequisite to flying microlight aircraft. This certificate had to be renewed every two years up to the age of 50, and annually thereafter. It could be issued either by the applicant's general practitioner, or by a Designated Medical Examiner. Where cardiovascular risk factors, such as obesity or high blood pressure were present, the doctor would have been well advised to make further investigations intended to disclose potentially disabling conditions. The pilot was overweight, and was being treated for high blood pressure, so further investigations would have been warranted. In the opinion of the consultant aviation medicine specialist advising the Commission, the condition from which the pilot suffered ought to have been detectable by such examination.

2.27 The pilot's medical certificate was sighted by the instructor who issued his Novice Certificate. After the accident it could not be found. Enquiries of his General Practitioner, employer's medical specialist, and the Designated Medical Examiners in the area in which he lived did not discover any doctor who could recall issuing him with a certificate, so it was not possible to tell what medical screening examination had been undertaken, either as a routine or following the identification of additional cardiovascular risk factors, nor with what results.

2.28 The MAANZ rules only required an instructor to sight the medical certificate, whereafter it was retained by the pilot. Notwithstanding the possible administrative burden, there would be some merit in the certificate being retained by the club. This would allow the validity of certificates to be checked; when a pilot moved to another area the certificate could be sent directly to the new club, thus drawing their attention to the new arrival. The New Zealand Gliding Association required clubs to hold pilots' medical certificates. A recommendation that MAANZ be required to institute a similar procedure was made to the Director of Civil Aviation. It was also recommended that MAANZ be required to appoint a Medical Adviser who could hold the certificates of pilots who were not flying with a club. The Association would also benefit from medical advice independent from that provided by the Principal Medical Officer of the Civil Aviation Authority. This would be likely to reduce any problems with non-disclosure of medical information relating to unfit members.

2.29 MAANZ, in its pilot training syllabus, emphasised the effects of terrain and wind in producing local turbulence. The pilot, who was familiar with the area, flew for some time straight towards an area where considerable turbulence was to be expected in the prevailing conditions. This might suggest

the possibility that he was already being distracted by the symptoms of an impending heart attack. Alternatively, if he entered the turbulent area through inattention, the stress of trying to handle the aircraft in that situation might have precipitated the attack.

2.30 The pitch oscillations might have resulted from an incapacitated pilot trying to maintain control in turbulent conditions. However, a similar effect could have occurred if the pilot had become incapacitated and slumped over the controls, and the non-pilot passenger had tried to control the aircraft by pulling back on the control column. This possibility was supported by the rearward distortion of the control column on the passenger side: this effect had been seen in a previous accident which was shown to have been caused by medical incapacitation. The engine sounds heard were consistent with the passenger closing the throttle after first moving it the wrong way - the throttle levers on some microlight aircraft operate in the reverse sense to those on other aeroplanes.

2.31 The injuries which the passenger sustained indicated that the impact forces were not survivable.

2.32 The pilot's Novice Certificate was required to be endorsed every 90 days by an instructor. Had this been done, the absence of a medical certificate would have been noticed and the pilot could have been required to undergo the necessary examination. There were a number of factors which led to the pilot's certificate going unchecked:

- (a) Microlight pilots were only required to be members of a club, not necessarily the nearest club or even the club from which they flew regularly. The pilot had become a member of the club at which he did his basic training, and so did not need to join the Warkworth club when he began to fly there subsequently.
- (b) There was no mechanism for the local club to know what restrictions applied to the pilot, when renewals were due, or even whether his membership of MAANZ had lapsed.
- (c) Normally the pilot flew during the week, when few club members were about.
- (d) Most of the time the aircraft was operated from a site remote from the club's base.

2.33 The medical standards required of microlight aircraft pilots existed largely to protect bystanders and passengers. They were ineffective in this case because the rules were not followed, and MAANZ had no effective way of ensuring that they were.

2.34 While there was a possibility that the fabric on the right wing burst during the spiral dive following loss of control, this was likely to have been a consequence of the upset, not a cause of it.

### **3. FINDINGS**

3.1 The aircraft had a valid Permit to Fly.

3.2 No mechanical cause was found for the loss of control observed by the witness.



- 3.3 The aircraft structure was intact until impact.
- 3.4 The pilot's Novice Certificate had not been validated and his Medical Certificate had not been sighted within the 90 days before the accident.
- 3.5 The pilot suffered from a medical condition which could cause incapacitation.
- 3.6 The pilot's medical condition was probably discoverable by medical examination.
- 3.7 The prescribed medical certification process did not result in detection of the pilot's medical condition.
- 3.8 The loss of control which led to the accident was probably caused by medical incapacitation of the pilot during the flight.

#### **4. SAFETY RECOMMENDATIONS**

4.1 As a result of the investigation of this accident, it was recommended to the President of the Microlight Aircraft Association of New Zealand that:

The Association adopt a minimum fabric strength value of twelve pounds on microlight aeroplanes having single-skinned aerodynamic surfaces, (Recommendation 018/92).

4.2 It was recommended to the Director of Civil Aviation that:

The Microlight Aircraft Association of New Zealand be required to provide for pilots' Medical Certificates to be retained by their clubs, (Recommendation 060/92).

The Microlight Aircraft Association of New Zealand be required to appoint a Medical Adviser, (Recommendation 061/92).

#### **5. OBSERVATIONS**

5.1 There was no requirement for MAANZ members to notify the Chief Flying Instructor of their club when they moved to another area. CFI's were therefore unable to notify clubs, in areas to which their members moved, of limitations of such members' licences. However, when a CFI became aware of a move, it would have been useful for him/her to notify the new club concerned.

5.2 A general limitation on the control of microlight aircraft operations by MAANZ was the ability of these aircraft to operate from sites remote from club bases. The pilots concerned might not have been members of MAANZ. While MAANZ had no authority to enforce the requirements of Civil Aviation Safety Order No. 19, local clubs were likely to become aware of illegal operations. It would be in the interests of the public and of the clubs themselves for illegal operations to be brought to the attention of the Civil Aviation Authority.

The MAANZ President advised that as at 5 March 1993:

“The Novice Pilot Certificate has since been amended to a 12 month expiry date and is endorsed “not valid for the carriage of passengers.” The Solo Authorisation is signed out by an instructor log book entry endorsement. An information sheet detailing the restrictions of a Novice Certificate, and urging the holder to proceed to a higher certificate, is now issued with every Novice Certificate. The novice still needs authorisation from an instructor, for every flight”, and

“members transferring from one area to another, must notify the local club of their flight status and intentions. ALL memberships to MAANZ expire on the 31st March annually. Clubs are aware of members status at this time, and when renewing membership, they have to state the expiry date of their medicals, and this, with pilot certificate information is circulated back to clubs regularly during the year.”

24 June 1993

M F Dunphy  
Chief Commissioner

#### **GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT**

CFI	Chief Flying Instructor
MAANZ	Microlight Aircraft Association of New Zealand
NZST	New Zealand Standard Time