

**AIRCRAFT ACCIDENT REPORT
OCCURRENCE NUMBER 98/2360
RUTAN AIRCRAFT FACTORY VARIVIGGEN
ZK-FQN
7 nm NE from ROTORUA AERODROME
28 August 1998**



AIRCRAFT ACCIDENT REPORT

Occurrence number: 98 / 2360

Aircraft - Make and model: Rutan Aircraft Factory VariViggen
Serial Number: AACCA 254 #1061
Registration: ZK-FQN
Year of manufacture: 1988

Engines - Make and model: Lycoming O-320E-2D
Number: One

Date and time* of accident: 28 August 1998 About 1700 hours

Location - Name: North side, Lake Rotoiti, Bay of Plenty
Latitude: 176 degrees 26 minutes East
Longitude: 38 degrees 01 minute South

Type of Flight: Private - other

Persons on Board: Crew: One
Passengers: One

Injuries: Crew: Fatal
Passenger: Fatal

Nature of Damage: Aircraft destroyed by impact forces and post impact fire

Pilot-in-Command's Licence: Private Pilot Licence (Aeroplane)

Pilot-in-Command's Age: 42

Pilot-in-Command's Total Flying Experience: Powered aircraft 277 hours
Gliders 867 hours

Information Sources: CAA on-site investigation

Investigator in Charge: Harvey R Ritchie

* All times in this report are in NZST (UTC + 12 hours)

Synopsis

The Civil Aviation Authority (CAA) was notified of this accident by the New Zealand Police, Rotorua, on the evening of 28 August 1998. As required by legislation, the Transport Accident Investigation Commission (TAIC) was advised of the accident by the CAA but decided not to investigate. Mr Harvey R Ritchie, Safety Investigator Flight Operations of the CAA Safety Investigation Unit (SIU) was appointed Investigator-in-Charge (IIC) assisted by Mr Steven Walker, Safety Investigator Airworthiness. The investigators proceeded to Rotorua on 29 August to commence the investigation. This included inspecting the accident site and examining the aircraft wreckage, obtaining photographic and other records, and obtaining reports from various witnesses.

The aircraft departed from Rotorua aerodrome at 1638 hours for a 30-minute local flight. The pilot-in-command, who occupied the front seat, had not flown the aircraft before and was not type rated. The owner/builder, who was in the rear seat, did not hold any pilot qualifications. The aircraft was seen by a number of observers in the vicinity of Lake Rotoiti where it carried out several turns. The aircraft then headed to the north of the lake and made some more turns, at an estimated 300-500 feet above ground level, before heading back towards Rotorua. It then commenced another turn to the right near the north shore of the lake and was seen to roll into a near-vertical dive before impacting the ground. Fire broke out after the impact. Both occupants received fatal injuries. The engine appeared to be operating normally throughout the flight.

1. Factual Information

1.1 History of the flight

Background information

In 1975, the owner/builder of the aircraft (hereafter called the owner) submitted plans and technical details, for approval to commence building the aircraft, to the then Civil Aviation Division of the Ministry of Transport (replaced in 1992 by the Civil Aviation Authority). Construction did not commence until 1978 due to problems with the workshop arrangements proposed by the owner. Once building did commence, the normal process of stage inspections took place as construction progressed.

In early 1988 the owner applied for registration of the aircraft and the issue of a permit to fly. However, it was not until April 1994 that the aircraft underwent the necessary inspection for the issue of a special flight permit. Test flying began in May and two approved pilots (A and B) were used during the testing phase. By the end of September 1994, according to the records, the aircraft had been flown on about 20 flights for a total of approximately 16 hours flight time.

On 6 October 1994, while on a test flight over Lake Rotorua, the rear canopy of the aircraft came open, was torn off and went through the pusher propeller, causing the propeller to break. Pilot A was forced to ditch the aircraft on the lake. The pilot reported that the rear cockpit had been left unlatched. Once the pilot was in the front cockpit, there was no way to check the rear canopy latch.

The aircraft remains, including the engine, were salvaged from the lake. In February 1995, the owner notified the CAA that he was going to rebuild the aircraft, which had been substantially in the ditching accident and subsequent recovery. The rebuilding was completed by late 1996 and the aircraft underwent another inspection for the issue of a special flight permit.

On 17 December 1996, the CAA issued an Airworthiness Certificate for the aircraft, valid for one year, in the Special – Experimental category. Certain operating limitations were also placed on the aircraft during the initial 25-hour flight test period. The flying hours accrued prior to the ditching were not credited towards the new test period.

Pilot A, who had ditched the aircraft, was not invited to participate in the test flying of the rebuilt aircraft and arrangements were made for another pilot (C) to assist pilot B. Pilot C was given a type rating on the aircraft by pilot B.

On a number of occasions during the test flying, pilot B reported that the engine power would surge, apparently associated with a fuel feed problem. He also reported that there had been many, small problems encountered during the test phase. As a result, he would conduct thorough pre-flight inspections of the aircraft but this

apparently annoyed the owner who did not accept that there was anything wrong with his workmanship.

In mid-January 1997, during the test flying phase, another pilot (D) was invited by the owner to look at and then fly the aircraft. This pilot was not given a type rating for the aircraft, did not hold a type rating on an equivalent type, was not approved to act as a test pilot, and was not legally qualified to fly the aircraft. He accepted the invitation but on his first flight, with himself as the only person on board, the aircraft became directionally unstable just after take off. Following an eventful circuit and landing, he checked with pilot B and about 20 kilograms (kg) of lead sheet was placed in the pilot's seat. This was to adjust for pilot D's lighter weight and to place the aircraft's centre of gravity into the normal limits. Pilot D flew the aircraft again two days later, without further significant incident, although he was not comfortable with the aircraft's handling characteristics and chose not to fly it again.

On 12 February 1997, when pilot B was conducting a test flight, a 30 kilogram (kg) lead weight fell from the aircraft and landed on private property causing minor damage. The lead weight was used to balance the aircraft on the ground and was normally removed from where it hung under the nose before flight.

In March 1997, the CAA amended the operating limitations placed on the aircraft to allow the owner to be carried as a designated engineer, once 20 hours test flying had been completed. The owner made several flights in this capacity and was occasionally allowed by the pilot-in-command to fly the aircraft. Both approved test pilots indicated that the owner's piloting skills were considered to be average.

By late March 1997, the required 25 hours test flying had been completed. The results of the test program were written up in the aircraft log book by pilot C. He specifically commented that pilots would need to understand the flight control system (to ensure safe flight) and the undercarriage operating systems. The duplicate inspection of the flying control system was signed off by both pilots. However, pilot B added some more comments, viz, "In addition to (pilot C's) report - all slow flying manoeuvres were carried out and found that with one POB (person on board) the aircraft would not stall but would start porpoising at about 43 kts (knots) - mushing - with rapid loss of height. At maximum all up weight, the aircraft did start to lose directional control at 45 kts and with little warning - stalled and went into a spin. The recovery was by normal application of controls for spin recovery".

On 9 June 1997, the CAA issued a non-terminating Airworthiness Certificate for the aircraft, in the Special - Experimental category, for the purpose of Private Operations. Again, the CAA issued certain operating limitations - refer to the appendices to this report (in particular note items 8 - 11 inclusive). The aircraft log book was duly annotated by the CAA.

On 26 July 1997, another pilot (E) was invited by the owner to fly the aircraft with the owner occupying the rear seat. The pilot was not type rated on the VariViggen. During the landing at Rotorua aerodrome, the right main undercarriage leg collapsed. The pilot was adamant that the undercarriage indicator was showing that the landing gear was down and locked prior to touchdown but the owner subsequently blamed the pilot for incorrect use of the undercarriage selector system. The owner spent the next three months repairing the damage.

Following the repairs, another pilot (F) accepted the owner's invitation to fly the aircraft and did so, with the owner in the back seat, once in October and once in late November 1997. This pilot was also not type rated on the VariViggen. During the first flight, the airspeed indicator in the front cockpit was not working. This was fixed before the second flight. The undercarriage remained down throughout the duration of these two flights. About 20 minutes into the first flight, the owner asked the pilot if he (the owner) could fly the aircraft. At this time the aircraft was flying about 1500 feet AGL (above ground level). There was a formal hand over of the controls and the owner put the aircraft into a turn with about 30 degrees of bank. Apparently the owner did not apply any up-elevator control and, within about 90 degrees of turn, the aircraft rolled into a spiral dive. Pilot F took over control and recovered from the dive with a height loss of about 500 feet and climbed the aircraft back to about 1500 feet AGL.

Control was handed back to the owner who initiated another turn, this time in the opposite direction, with the same result. The pilot again recovered from the dive and did not give control back to the owner. There was no subsequent discussion between the owner and the pilot about these manoeuvres.

Following this flight, the owner decided that the aircraft would be given an annual or 100-hour maintenance inspection, in accordance with Operating Limitation 9 (refer to Appendix 2). The aircraft had only flown about 31 (recorded) hours since the rebuild but it was approaching 12 months since the issue of the original airworthiness certificate. Pilot F, who was also building his own aircraft, assisted with this maintenance, even though neither he nor the owner were qualified in accordance with Operating Limitation 10. Pilot F had also indicated that he would not fly the aircraft again until all the documentation and required maintenance had been completed and signed off. It was intended that they would complete the required work and have the maintenance signed off by a local Licensed Aircraft Maintenance Engineer (LAME) who had been involved in stage inspections of the aircraft during its construction.

After removal of its wings at the aerodrome, the aircraft was trailered to the owner's home nearby for the proposed work. At about this time, the owner spoke to the LAME about signing off the work. The LAME was reluctant to do this because of his knowledge of the owner's habit of making changes to the aircraft. As a result, the annual maintenance inspection was never signed off.

At some time, probably during early 1998, the owner decided that he would be taking the aircraft to the sport aircraft fly-in at Matamata aerodrome on 7 February 1998. He requested pilot F to fly the aircraft on 6 February to check it out prior to him (pilot F) flying the aircraft to the meeting the next day. On the first check flight, when the aircraft was about 50 feet above the ground just after taking off, the engine lost all power. The pilot put the aircraft back onto the aerodrome and managed to stop it on the grass. Pilot F was aware that the owner had fitted an electric, fuel boost pump to overcome the power surging problem experienced during the testing phase, but had not turned it on for the take off.

Prior to attempting another check flight, the owner advised pilot F to take off with the boost pump "on" and to turn it "off" at 500 feet. When the pilot did as suggested, the engine lost power and was not controllable with the throttle. The engine began surging and, with extreme difficulty, pilot F managed to land the aircraft. It was subsequently discovered that the owner had not fitted a bypass line to relieve the excessive fuel supplied by the boost pump.

This problem was corrected and, according to pilot F, the owner convinced him to fly the aircraft to Matamata on 7 February. After a reportedly nervous start, pilot F got the aircraft airborne with the owner in the back seat. After take off, the pilot retracted the undercarriage but the aircraft began to yaw and did not feel right.

At about the same time, another aircraft had taken off from Rotorua aerodrome to fly to Matamata. Its pilot advised pilot F that the right main undercarriage leg on the VariViggen was still down. Both aircraft headed back towards Rotorua and, after considerable effort with the normal and emergency undercarriage systems, pilot F managed to get all three wheels down. Rather than land at Rotorua aerodrome, it was decided they would continue to Matamata with the undercarriage down.

The aircraft landing safely at Matamata and later in the day, after some problems getting the aircraft refuelled, it was flown back to Rotorua, with the gear down, without further incident. This was the last time pilot F flew the aircraft. After this flight, the owner decided that the aircraft would only be flown with the undercarriage remaining in the down position.

In 1997, the CAA introduced Civil Aviation Rule 91.619 which stated that no person shall operate an aircraft unless an annual review of airworthiness (ARA) has been performed in the preceding 12 months. The first ARA was required before 1 April 1998. In respect of ZK-FQN, no ARA was ever completed reportedly because of the number of unapproved modifications the owner had made to the aircraft since its Airworthiness Certificate had been issued.

The accident flight

At some time prior to the day of the accident, pilot G was informed that the owner was looking for pilots to fly the VariViggen. A number of pilots had been approached by the owner but refused his invitation because of the history of the aircraft. The owner contacted pilot G and arrangements were made for this pilot to look at the

aircraft on 28 August 1998. Early on that afternoon pilot G telephoned his father-in-law, another glider pilot, and invited him to go to Rotorua aerodrome to look at the aircraft. On his arrival at the aerodrome, the father-in-law met the owner and watched for more than an hour while pilot G and the owner inspected the aircraft which was still in the hangar.

The aircraft was moved out of the hangar and rolled to the fuel bowser where the owner added 60 litres of Avgas to the tank. The engine was then started by the owner hand-swinging the propeller (no electric starter fitted). Pilot G then taxied the aircraft around the grassed area to get used to its ground handling. The owner was in the back seat. After a while the aircraft was taxied to the refuelling area and shut down.

The decision was made that they would fly the aircraft so the owner drove to his home and collected the aircraft radio which they would need to go flying. On his return to the aerodrome about 20-30 minutes later, the owner fitted the radio to the aircraft and then attempted to start the hot engine. After many attempts it eventually started and the aircraft was then taxied to the north end of the tarmac where the engine run-up and pre-take-off checks were probably completed.

Just before 1630 hours, the one of the occupants of the aircraft called Rotorua Tower on the radio and indicated that the aircraft was taxiing for the training area "for half an hour or so". After some delay due other aircraft traffic, the VariViggen was cleared for take off from Runway 19 with a left turn after take off. The acknowledgment of the take off clearance was the last transmission received from the aircraft. Observers reported that the landing gear was not retracted after take off.

In the course of the next half hour, the aircraft was seen by a number of people in the vicinity of Lake Rotoiti. Throughout this time, it seen to perform a series of turns and the engine sound was "normal", apparently changing only as the aircraft attitude changed.

A few minutes before the crash, the aircraft was seen to perform turns in both directions over a farm to the north of the lake. At that time the aircraft was estimated to be 300-500 feet above ground level. From there it headed back towards the north shore of the lake without gaining any height and commenced a tight turn to the right, near the lake edge. After about 270 degrees of the turn, the angle of bank increased rapidly and the aircraft dived ("cork screwed") towards the ground in a near-vertical, nose-down attitude. There was the sound of impact and smoke rose from the accident site. Following numerous reports from the public, rescue services were sent to the scene.

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	1	1	0
Serious	0	0	0
Minor/None	0	0	

1.3 Damage to aircraft

The aircraft was destroyed by the impact forces and the post-impact fire.

1.4 Other Damage

Nil

1.5 Personnel information

The pilot on the accident flight was 42 years of age and had begun his flying in gliders during the mid-1980's. At the time of the accident he had accumulated about 867 hours in gliders and held a B category glider instructor rating. He was the Chief Flying Instructor (CFI) at a local gliding club.

He began flying powered aircraft in late 1988 and held a lifetime Private Pilot Licence, valid from 14 December 1994, with a Glider Towing Rating and a Class 2 medical certificate with no restrictions, valid to 28 November 1998. He did not hold a type rating for the VariViggen or any similar aircraft type and had accumulated approximately 277 hours on conventional powered aircraft, mainly Cessna 152 and Piper Pawnee types. Most of his powered flying was on glider towing operations.

Since 1992, the CAA has required that each pilot of a New Zealand registered aircraft hold a current type rating for that aircraft. The rules, regulations and advisory circulars produced by the CAA describe these requirements in detail. No exemption from the requirements existed for the pilot on the accident flight.

During the accident flight, the pilot occupied the front seat of the aircraft, which was the normal seat for the pilot-in-command (PIC).

The owner of the aircraft was 77 years of age and did not hold any formal pilot qualifications. It was reported that he had been an aircraft fitter during World War II and he had made many parts for homebuilt aircraft including his own and those belonging to other persons. He had undergone some flying training at Rotorua in the 1960's, reaching solo standard. However, he had never been issued with a pilot licence because of a heart murmur. Several of the pilots who flew the aircraft with the owner on board indicated that he often asked and was allowed to fly the aircraft, from the back seat.

For the flight-testing phase, subsequent to the rebuild of the aircraft, two pilots had been approved by the CAA to conduct the test flying and sign off the aircraft on completion of the test program. As well, approval from the CAA was sought and given for the owner to be carried as a designated engineer, after the initial 20 hours of test flying.

Once the test program of 25 hours was completed, any pilot wishing to fly the VariViggen would be required to obtain a type rating from a suitably qualified instructor pilot. The only pilot qualified to give a type rating on the VariViggen was one of those who flew the test program and who also held an instructor rating. However, this person had only given a type rating to one other pilot used during the test program. No other pilot who had flown or intended to fly the VariViggen had been endorsed on the type.

It was established that several of the pilots who had flown the VariViggen had done so without obtaining the required type rating. The pilots had been invited initially by the owner to look over the aircraft and then he invited them to fly it. Usually the owner provided such pilots with a detailed briefing on the aircraft but they received no flight instruction from an appropriately qualified person.

1.6 Aircraft information

“Bert” Rutan began designing the aircraft by in 1968 and the aircraft first flew in 1974. Plans then became available for home builders and several sets of plans were purchased by would-be builders in New Zealand. However, the design was complex and ZK-FQN was the only NZ VariViggen to be completed and flown.

The owner began building in 1978. Different engineers carried out stage inspections during the construction of the aircraft and periodically Certifying Authority Surveyors viewed the construction. A comment was made in one survey report that “this was an extremely complex aircraft for an amateur builder but the owner with his aircraft background appears to be coping well and turning out a good project”.

The aircraft was involved in a number of occurrences including:

05/10/94 - ditched following canopy detachment

12/02/97 - lead balance weight dropped in flight

15/03/97 - magneto failure

25/07/97 - right undercarriage collapsed on landing

06/02/98 - engine failure on take off / engine power loss after take off

07/02/98 - left main gear did not retract.

Of the above, the only log book entry for a flight on which problems occurred was the undercarriage collapse on 25 July 1997 although reference to the ditching was made in December 1996 after the aircraft had been rebuilt.

The fuel tank capacity of the aircraft was 93 litres. On 17 April, 30 litres of Avgas were purchased at Rotorua airport on the owner's fuel credit card but it could not be confirmed that this fuel was for the VariViggen. On the day of the accident 60 litres of fuel were added to the aircraft. At an estimated fuel consumption rate of 40 litres per hour, at the time of the accident the aircraft probably had between 40 and 70 litres of fuel on board.

There was no Flight Manual or Pilots Operating Handbook for the aircraft. The owner would make available to prospective pilots his copy of the VariViggen Technical Report, 3rd edition. This document was undated but would appear to have been produced in late 1974. In the introduction in the booklet, it was explained that the report was intended to provide information mainly for designers and builders. The publication contained a limited amount of information applicable to flying the aircraft.

1.7 Meteorological information

The meteorological conditions at the time of the accident, as recorded on the Rotorua Airport Automatic Terminal Information Service (ATIS) were a south westerly wind at five knots, temperature 17 degrees Celsius, visibility 40 kilometres and a few clouds at 2500 feet. The accident occurred during daylight hours in bright sunlight.

1.8 Aids to navigation

Not applicable

1.9 Communications

The aircraft was fitted with a hand-held VHF radio and an intercom. The owner had experienced previous problems with this equipment and there was an initial problem on the day of the accident with contacting Rotorua Tower. However, this was apparently corrected before the aircraft taxied for the accident flight.

1.10 Aerodrome information

Not applicable

1.11 Flight recorders

Not applicable

1.12 Wreckage and impact information

The bulk of the aircraft wreckage was contained on the top of a cutting through which there was a farm track. The aircraft had impacted while descending vertically and skidding to the right. This was concluded from the impact of the leading edge of the right wing which had been forced uniformly into the ground. All major parts of the aircraft were accounted for at the accident site.

The engine, which was basically intact, was lying slightly to the right of the cabin debris. The post-impact fire had consumed most of the timber and composite items, and melted many of the aluminium alloy components.

The control cables were extracted from the wreckage and there was no evidence found of cable failure prior to impact. Although many alloy components of the flight control system were melted in the fire, there was no evidence found that indicated a failure of the control system leading to a loss of control in flight, during the last turn. Evidence was found that confirmed the presence of all control surfaces at the time of the impact.

Small pieces of plywood skin of the aircraft and other small items including the contents of the aircraft first aid kit were spread extensively around the site. The wooden propeller had splintered into many pieces that were also found scattered throughout the site. A portion of one of the propeller tips was found some 40 metres from the point of impact. Those items outside the post-impact fire zone were unburnt. There was a circular strike mark in the ground next to the engine that, together with the shattering of the wooden propeller, indicated that there was rotation of the propeller and the engine was under power, at impact.

The landing gear was found to be in the extended position. It was subsequently confirmed that the owner had decided that, following the problems encountered during the flights in February, the aircraft would only be flown with the undercarriage in the down position.

The fuel tank was extensively damaged (ruptured) and burnt.

1.13 Medical and pathological information

In respect of post mortem examinations conducted on each of the two occupants, the pathologist concluded that, "In my opinion the cause of death was traumatic injuries due to an aircraft accident".

1.14 Fire

At the time of impact, the fuel tank probably contained 40 – 70 litres of aviation gasoline. On impact it is most probable that the fuel tank was ruptured and its contents ignited by any one of a number of possible sources in the aircraft wreckage. The pattern of the burnt and singed grass around the aircraft wreckage indicates that the bulk of the fuel was sprayed in the direction of impact and then ignited. This would account for the black smoke seen shortly after the impact.

The timber aircraft was quickly and almost totally consumed by the fire.

1.15 Survival aspects

This was a non-survivable accident.

1.16 Tests and research

Initially consideration was given to conducting a strip examination of the engine. However, as a result of the site examination including the impact attitude and the damage to the propeller, and the number of witness reports received referring to the sound of the engine, it was decided that such an examination was unnecessary.

1.17 Organisational and management information

Not applicable

1.18 Additional information

Nil

1.19 Useful or effective investigating techniques

Nil

2. Analysis

Weather conditions were not a factor in the accident.

The pathologist reported that death was due to injuries suffered on impact. There was no reference to prior incapacitation.

The aircraft weight and centre of gravity were estimated to be within limits.

The pilot was not qualified to fly the aircraft in that he did not hold a type rating for the VariViggen. None of his previous flying experience was on a similar type of aircraft. It was not determined as to why the pilot was willing to fly the aircraft without holding a type rating.

The owner was not qualified to fly the aircraft as he did not and had never held any pilot licence.

The aircraft was not in an airworthy condition at the time of the accident because:

- No annual or 100 hour inspection had been completed on the aircraft in the preceding 12 calendar months and no such inspection was recorded in the aircraft maintenance records with an associated release to service statement.
- No annual review of airworthiness had been completed on the aircraft in the preceding 12 months.
- Maintenance had been performed on the aircraft by unqualified and unsupervised persons.
- Several major modifications and repairs had been incorporated without the aircraft owner notifying the CAA and receiving its response, in writing.

However, as far as the condition of the wreckage would allow examination, the aircraft did not appear to have suffered any mechanical failure or malfunction prior to the accident. Witness observations suggest that the aircraft was flying normally until it began the steep dive just before impact.

In the absence of any evidence of mechanical failure or malfunction being found, consideration must be given to mishandling of the flight controls, by one or the other of the occupants, as the major contributing cause of the accident. Reference to the description provided by pilot F of his first flight of the aircraft in October 1997 (page 6) reveals a similar scenario to the accident flight. About 20 minutes into the first flight by pilot F he was asked by the owner if he (the owner) may fly the aircraft. A turn was commenced, no up-elevator was applied and, in a very short time, the aircraft was spiralling vertically towards the ground. In the two cases described by pilot F, the aircraft had sufficient height above the ground for the pilot to take back control of the aircraft and recover. Note that there was no suggestion by pilot F that the owner had tried to stall the aircraft or flown it in any unusual way.

On the day of the fatal accident, the aircraft had been flying for about 20 minutes and was observed apparently heading back in the direction of Rotorua aerodrome after completing some turns. It was in steady flight and a turn to the right was commenced. The aircraft rolled into a steeper turn with its nose dropping until it pointed towards the ground. There was no evidence of any attempted recovery before impact.

It could not be determined which occupant was operating the controls. However, it seems unlikely that pilot G was flying at the time of the accident. It is likely that he had undertaken most if not all the flying from take off at Rotorua aerodrome. The aircraft had been seen performing various turns and there was no observer comment about anything unusual during the earlier manoeuvres. It seems likely that the owner took over the controls as the aircraft headed back towards the aerodrome.

In respect of the turn before the impact, there was no observer comment suggesting other than a normal entry to the turn. It is concluded that pilot G was sufficiently experienced, both in total and recent hours although not on this aircraft type, to be able to recognise the normal parameters for safe operation. This would include preventing the nose of the aircraft dropping excessively during turns. It would be contrary to an experienced pilot's normal reactions to allow an unintentional spiral dive to develop at low level.

However, such a situation may have occurred if the owner was flying the aircraft. It is not known how much the pilot knew of the owner's limited piloting experience. It is possible that the pilot assumed the owner would know how to fly the aircraft although not qualified to fly it. If this was the case, the pilot may not have recognised that an unacceptable situation was developing before it became irretrievable. Given the short period of time involved, it would be unlikely that any pilot could have taken over control and recovered the situation once the spiral dive had developed, at that height above the ground.

Various witnesses referred to the owner's objections to any claims that there were things wrong with his aircraft. As indicated earlier, he did not normally record any item in the aircraft log book which reflected badly on the aircraft. It may therefore have been irritating to the owner to have the comments recorded by one of the test pilots in the aircraft log book, about the aircraft handling (refer to page 5). These comments were in direct conflict with the designer's claim that "The VariViggen will not stall or spin ", refer to Appendix 3, item 1, on page 22.

It could have been that when he flew the aircraft, the owner was trying to disprove the test pilot's comments. However, the owner had very limited flying experience and may have been mishandling the controls for the manoeuvres he was intending to fly, resulting in a spiral dive instead of a stall/spin situation.

The cause of the accident was not positively determined.

3. Conclusion

Findings and causal factors

1. The owner of the aircraft allowed the aircraft to be used when it was not in an airworthy condition. He was aware that the required maintenance had not been completed and that unapproved modifications had been made to the aircraft

- the owner was apparently willing to break the rules to operate his aircraft.

2. The pilot operated the aircraft when it was not in an airworthy condition. The required maintenance had not been completed and unapproved modifications had been made

- the pilot was apparently ignorant of the unairworthy condition of the aircraft. A check by him of the aircraft documentation would have revealed the discrepancies.

3. The owner of the aircraft flew the aircraft but did not hold an appropriate pilot licence and was not a student pilot

- the owner could not obtain a pilot licence due to medical reasons but, regardless of the legal requirements, was willing to fly his aircraft.

4. The pilot did not hold a type rating for the aircraft and the owner with whom the pilot was flying could not give a type rating

- the reason why the pilot chose to fly the aircraft without a type rating could not be determined.

4. Safety Recommendations

Direct corrective action in respect of the owner and pilot is no longer applicable. However, the CAA will continue to disseminate information to the aviation community on the need for pilot type ratings and the completion of required maintenance and will continue to take appropriate action against transgressors.

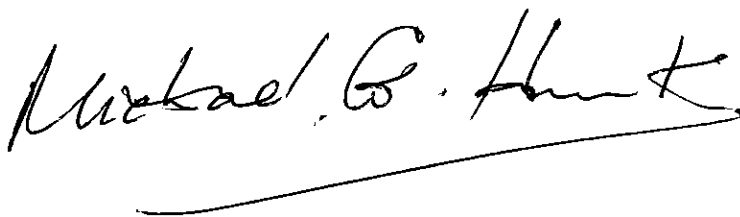
It is recommended that the CAA (continue to) publish safety education articles, in appropriate documents, stressing the need for:

- Appropriate maintenance,
- Proper authorisation to act as pilot-in-command, and
- Recognition that aviation legislation is provided for safety purposes.

Appendices

1. Photographs
2. Airworthiness Certificate and Operating Limitations for ZK-FQN
- applicable at the time of the accident
3. Extract from VariViggen Technical Report - page 4

Approved for release to the Coroner

A handwritten signature in black ink that reads "Michael G. Hunt". The signature is written in a cursive style and is underlined with a single horizontal line.

Michael G Hunt

Assistant Director, Safety Investigation and Analysis

13 April 1999




Caption 1. General view of the wreckage across the farm track cutting . Note the collapse of the dirt bank where the left wing impacted. The engine is in the centre of the wreckage.



Caption 2. General view of the wreckage across the wingspan of the aircraft. Note the right wing leading edge impact in centre foreground, the remains of the outer, right wing and the engine in the centre. The left wing leading edge is on the far side.

NEW ZEALAND
AIRWORTHINESS CERTIFICATE



Nationality and Registration Marks	Manufacturer and Manufacturer's Designation of Aircraft	Aircraft Serial Number
ZK-FQN	Amateur-Built Rutan Variviggen	AACA/254
Categories: SPECIAL - EXPERIMENTAL for the purpose of Private Operations.		
Flight Manual Ref: This certificate and attached limitations constitute the required flight manual.	Period of Validity Non-terminating	
Conditions: PRIVATE OPERATIONS ONLY. Compliance with additional conditions and limitations given overleaf and on sheet 2. This aircraft does not comply with the international airworthiness standards of Annex 8 to the convention on International Civil Aviation. Special Permission to operate must be obtained from any other country whose territory the aircraft is to be flown. The Director may amend, suspend or cancel this certificate at any time.		
This Certificate of Airworthiness is issued pursuant to the Convention on International Civil Aviation dated 7 December 1944 and the New Zealand Civil Aviation Rules in respect of the above-mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the foregoing and the pertinent operating limitations.		
Date of issue: 9 JUNE 1997	Signature:  for Director of Civil Aviation	

No entries or endorsements may be made on this Airworthiness Certificate and associated Flight Manual or other approved document except in the manner and by the persons authorised by the Director. If this Certificate is suspended or revoked as prescribed in the Civil Aviation Act 1990 or if the aircraft is deleted from the register for any cause this Certificate shall be returned to the Director.



Note - These Operating Limitations shall be accessible to the Pilot and be attached to the Airworthiness Certificate as an addendum to the document.

Operating Limitations

ZK-FQN

1. This aircraft shall not be operated over populous areas except with the written permission of the Director.
2. This aircraft shall be used only for Private Operations as classified in Regulation 131 of the Civil Aviation Regulations 1953.
3. This aircraft is approved for DAY VFR operations only.
4. This aircraft shall display the placards, markings, etc. required by CAR 156, 157-160.
5. This aircraft is prohibited from aerobatic flight, unless such flights were satisfactorily accomplished and recorded in the aircraft logbook during the Phase 1 test flight period. A recording 'G' Meter shall be fitted for aerobatic flight.
6. No person may operate this aircraft for carrying persons or property for compensation or hire and reward.
7. The person operating this aircraft shall advise each person carried of the nature of the Experimental Airworthiness Certificate for this aircraft.
8. The Civil Aviation Authority must be notified and their response received in writing prior to flying this aircraft after incorporating a major modification or repair as defined in Civil Aviation Rules Part 1.
9. No person shall operate this aircraft unless within the preceding 12 calendar months it has had an **Annual or 100 hour Inspection** performed in accordance with Part 43.61, or an equivalent approved Maintenance Programme, and has been found to be in a condition for safe operation. This inspection shall be recorded in the aircraft maintenance records along with a release to service statement in accordance with Part 43.107.
10. The builder of this aircraft, if holding a Maintenance Approval on this aircraft, a LAME rated, or a person holding a Maintenance Approval issued specifically for the purpose may perform Annual or 100 hour Inspection.
11. The pilot-in-command of this aircraft shall comply with the requirements of CAR Part 61 and the recommendations in CAP20-1, Para 19 regarding experience and currency requirements for test flying.

Aircraft Limitations are detailed on page 2



Aircraft Limitations

ENGINE TYPE: Lycoming O-320 E2D
 PROPELLER TYPE: Henry 2 Blade Wooden
 MAXIMUM TOTAL OCCUPANTS: 2

* NO SMOKING

WEIGHT AND BALANCE

Maximum Weight: 1525 lbs
 Datum Point: Nose cone
 Centre of Gravity Range
 Forward limit: 119 in aft of datum
 Aft limit: 124.3 in aft of datum
 Maximum baggage: 180 lb

* AIRSPEED LIMITATIONS (IAS):

Never Exceed Speed V_{NE} 145 kt
 Manoeuvring Limit V_A 110 kt
 Flaps Extended Speed V_{FE} N/A

FLIGHT LOAD FACTOR LIMITS:

Normal Flight +5.0g -g
 Aerobatic Flight Not Applicable

* ENGINE

Maximum Engine Speeds:

Take off: 2450 r.p.m
 Continuous: 2450 r.p.m

Maximum cylinder head temperature: 290 Degrees C

OIL SYSTEM

Oil grade: Manufacturers Recommendation
 Capacity: 6 Quarts
 * Maximum oil pressure: 115 psi
 * Minimum oil pressure: 25 psi
 * Maximum oil temperature: 118 Degrees C

FUEL SYSTEM:

Fuel grade: AVGAS 100 Octane minimum
 * Total capacity: 93 litres

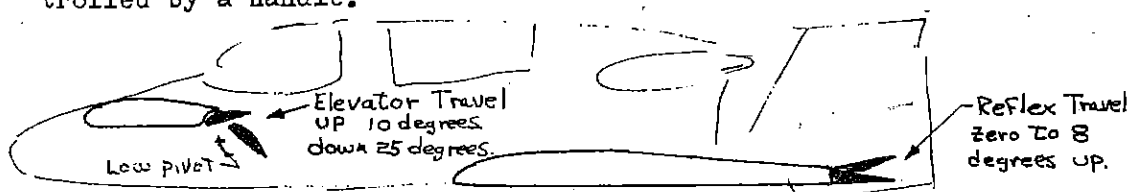
NO AEROBATIC MANOEUVRES PERMITTED

**To be placarded in full view of pilot or marked on instrument in approved colour code*

09/06/97

MAJOR FEATURES

1. Basic Aerodynamic Design Resists Stall or Spin
The stall spin accident is the greatest killer in general aviation. The VariViggen will not stall or spin because its aerodynamic design does not permit its critical angle-of-attack to be exceeded for most maneuvers and flight conditions. It does not "mush in" at low speed like the common delta wing aircraft. The VariViggen has a comfortable rate-of-climb even while flying at full aft stick. Full aft stick can safely be used for maneuvering even at low altitude in close proximity to the ground. At high angle-of-attack the down wash of the canard rises above the main wing, making the main wing more effective, thus the aircraft strongly resists further angle-of-attack increase.
2. Basic Aerodynamic Design Counters Adverse Yaw
Differential ailerons cannot be used on a VariViggen because they would cause nose-up pitching with aileron deflection. However, the aircraft's design offers pro-turn yawing that is even more effective. When the aircraft is rolled right, the increased pressure on top of the right wing pushes left on the right vertical fin. Also, the decreased pressure on the left wing pulls the left fin left. This is very effective in eliminating a natural tendency to yaw away from a turn, particularly at low speed.
3. Basic Aerodynamic Design Improves Ground Handling
The low aspect ratio, low mounted, low dihedral wing is less affected by winds during taxiing. A VariViggen can be safely taxied when most light planes must be tied down. When taxiing in a direct crosswind, one vertical fin blanks the other, eliminating the usual, bothersome weathervaning tendency of conventional aircraft. The wing will slide under any low wing aircraft for parking; thus, VariViggen take far less hangar space.
4. Reflex Control Increases Performance
The VariViggen's elevator is a slotted flap-type surface on the canard wing. The ailerons on the back wing are also adjustable up and down together with an electric motor. This collective setting of the aileron is called reflex. Reflex control could also be manually controlled by a handle.



Up reflex allows the aircraft to fly at a higher maximum angle-of-attack for lower landing speed and allows an earlier nosewheel lift-off speed for shorter takeoff. Down reflex increases rate-of-climb and cruise speed. However, a fixed reflex of four degrees provides satisfactory performance for all flight conditions.

5. Cross-Country Utility
The VariViggen's cruise speed, baggage carrying capability (three-suitcase +), and miles per gallon compare favorably with other two place types. Its unusual design turns routine trips into fun-trips. Gas service and other airport services are better, too! The VariViggen will hold two 6'6" adults comfortably and can easily be made into a 2 + 2 configuration.