Department of Transport and Regional Services

Australian Transport Safety Bureau

INVESTIGATION REPORT
200101903

Parachuting accident involving Cessna Caravan VH-MMV at Nagambie, Victoria

29 April 2001

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This report was produced by the Australian Transport Safety Bureau (ATSB), PO Box 967, Civic Square ACT 2608.

Contents

INTRODUCTION

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Commonwealth Department of Transport and Regional Services. ATSB safety investigations are independent of regulatory, operator or other external bodies.

In terms of aviation, the ATSB, through the Director of Air Safety Investigation, is responsible for investigating accidents, serious incidents, incidents and safety deficiencies involving civil aircraft operations in Australia, as well as participating in overseas investigations of accidents and serious incidents involving Australian registered aircraft. The ATSB also conducts investigations and studies of the aviation system to identify underlying factors and trends that have the potential to adversely affect safety. A primary concern is the safety of commercial air transport, with particular regard to fare-paying passenger operations.

The ATSB performs its aviation functions in accordance with the provisions of the *Air Navigation Act 1920*, Part 2A. Section 19CA of the Act states that the object of an investigation is to determine the circumstances surrounding any accident, serious incident, incident or safety deficiency to prevent the occurrence of other similar events. The results of these determinations form the basis for safety recommendations and advisory notices, statistical analyses, research, safety studies and ultimately accident prevention programs. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. The Act does not impose on the Director of Air Safety Investigation any duty to investigate a particular accident, serious incident, incident, or safety deficiency, and the Director is not subject to any liability whatever should other priorities lead to a decision not to investigate.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and conclusions reached. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. At all times the ATSB endeavours to balance the use of material that could imply adverse comment, with the need to properly explain what happened, and why, in a fair and unbiased manner.

1. FACTUAL INFORMATION

Four parachutists were practising as a team for a skydiving competition. They had completed seven parachute descents prior to the accident flight. Each descent had been video recorded by a cameraman using a helmet-mounted camera.

The parachutists used a Cessna Aircraft Company Caravan aircraft. That aircraft was climbed to 14,000 ft with the team of four parachutists, their cameraman, six other parachutists and the pilot. At the drop altitude, the team members carried out their 'pin check' in which each parachutist's equipment was checked to ensure that the release pins for the main and reserve parachutes were correctly positioned. Approaching overhead the drop zone, a roller blind, which covered the exit doorway on the left side of the aircraft, and minimised windblast during the climb, was raised. The cameraman positioned himself on the step outside and to the rear of the exit doorway. The first three members of the team positioned themselves in the exit doorway. The team member nearest to the front of the aircraft faced out and the next two members faced into the aircraft. The team member in the middle grasped the jumpsuits of the adjacent parachutists. The fourth member was inside the aircraft facing the exit.

As the team exited the aircraft, the middle parachutist's reserve parachute's pilot chute deployed. Due to the bent over position of that parachutist, the action of the ejector spring in the pilot chute pushed the chute upwards and over the horizontal stabiliser of the aircraft, pulling the reserve canopy with it. The parachutist passed below the horizontal stabiliser resulting in the reserve parachute risers and lines tangling around the left elevator and horizontal stabiliser. Eleven seconds later, the empennage separated from the aircraft and the left elevator and the parachutist separated from the empennage. The parachutist descended to the ground with the reserve and main parachutes entangled and landed 800 metres west of the drop zone landing strip. A short section of the elevator was tangled in the parachute lines. The parachutist's rate of descent was estimated to be 3.6 times greater than that for an average parachutist under canopy.

Immediately after the empennage separated, the aircraft entered a steep, nose-down spiral descent. The pilot instructed the remaining parachutists to abandon the aircraft. The last one left the aircraft before it descended through 9,000 ft. The pilot transmitted a mayday call, shutdown the engine and left his seat. On reaching the rear of the cabin, he found that the roller blind had closed, preventing him from leaving the aircraft. After several attempts, the pilot raised the blind sufficiently to allow him to exit the aircraft, and at an altitude of approximately 1,000 ft above ground level, he deployed his parachute and landed safely.

The aircraft, minus the empennage, descended almost vertically and crashed on the drop zone landing strip. It was destroyed by impact forces and the post-impact fire. The empennage, in several pieces, landed 600 metres west of the landing strip. A Country Fire Authority fire vehicle arrived at the accident site within two minutes of the accident and extinguished the fire.

The parachutist that had been entangled was fatally injured. The injuries sustained when entangled on the horizontal stabiliser made the parachutist incapable of operating the main parachute. The other parachutists and the pilot were uninjured.

1.1 Personnel information

The parachutist was experienced, having been actively involved in the sport for 11 years, and had been a member of the skydiving team for one year with at least 400 descents in the previous ten months.

The pilot was correctly licensed and endorsed to fly the aircraft. He was an experienced pilot, with approximately 4,000 flying hours. He had been flying the Cessna Caravan for over a year, with about 700 hours on that aircraft type. The pilot had completed a number of parachute descents and had been wearing a parachute during parachute operations from early 2001. Pilots were not required to wear a parachute during parachuting operations.

1.2 Parachute equipment

The parachutist was using a Javelin harness/container that had been manufactured in April 1996. The main canopy was a Stiletto 120 and the reserve canopy, an Air Force 120. Neither parachute was equipped with an automatic activation device. The container and parachutes were originally owned by the parachutist but had been sold to a new owner who had subsequently loaned them to the parachutist.

Although the Parachute Log Card showed that the reserve parachute had last been packed on 10 September 2000, a parachute packer provided evidence that it had been inspected and packed on 18 March 2001. Australian Parachute Federation (APF) regulations stated that a reserve parachute was airworthy for six months after packing.

Examination of the parachute equipment found no unserviceabilities, other than those consistent with contact with the tail of the aircraft and tangling during the descent. Approximately one quarter of the reserve parachute lines had been cut or showed signs of friction burns. The reserve ripcord had not been pulled from its stowed position. The pilot chute from the reserve parachute was found undamaged approximately 3 km west of the drop zone. Both main and reserve release mechanisms met all the manufacturer's specifications, including the force required to pull the release pins out of their closing loops. The main parachute, which had deployed from its container, was undamaged but was tangled with the reserve parachute.

The release mechanisms for the main and reserve canopies were part of the parachute container. From data supplied by the APF, the rate of premature openings involving the Javelin type container between 1990 and the time of the accident was less than two per 100,000 parachute descents. That was considerably less than the rate for all types of parachute containers used in Australia over the same period.

1.3 The aircraft

The aircraft was manufactured in 1985 and had accumulated approximately 8,576 airframe hours. All required maintenance had been performed and the aircraft had a current maintenance release that listed no outstanding defects.

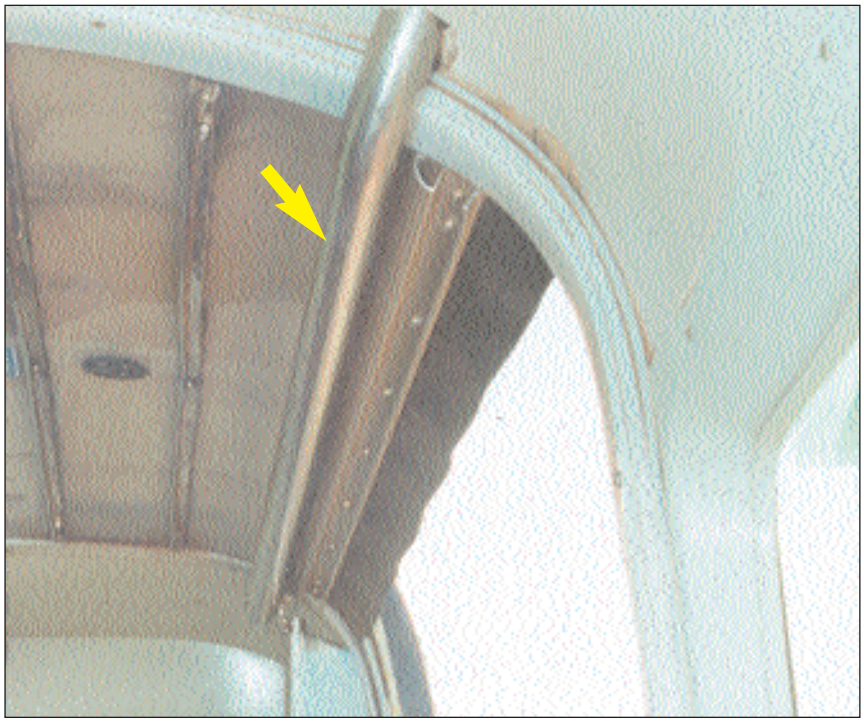
The aircraft had a cargo door on the left side of the fuselage, behind the wing. As the door cannot be opened in flight, it was removed for parachuting operations. To reduce drag and minimise windblast during the takeoff and climb, the aircraft was fitted with a roller blind of transparent material that covered the cargo doorway. The roller-blind assembly was approved under Civil Aviation Regulation (CAR) 35(2). To open, the blind was raised by hand and slid in runners located inside the cabin, just below the roof. There were no locking devices to hold the blind in either the open or closed

position. As none of the other doors in the aircraft could be opened or jettisoned in-flight, the cargo doorway was the only emergency exit for abandoning the aircraft. The fitted roller blind was not an aircraft manufacturer supplied or optional item. The aircraft manufacturer had an optional metal roller door that included locks for the open and closed positions.

A tubular steel handrail was located inside, and at the top, of the cargo doorway. That handrail was for the parachutists to hold while positioning prior to exiting the aircraft (see fig. 1).

During the investigation it was calculated that on opening after entanglement, the reserve parachute would have applied a load of approximately 1.6 tonnes to the horizontal stabiliser. That load exceeded the aircraft design limits.

FIGURE 1:
Handrail located inside aircraft



1.4 Exiting technique

The team used an exiting technique of three parachutists in the doorway and one, positioned behind those three, inside the aircraft. To maintain their relative positions during the exit, each team member held onto to the jumpsuits of the parachutists next to them. The parachutist, who occupied the middle position of the first three, had to use both hands to hold on to the adjacent team members and had no hand free to hold on to the aircraft. While awaiting the instruction to exit, that parachutist normally used a 'head jam' position, in which the back of the helmet was pressed against the top of the doorframe/handrail to maintain a steady position. That was a common technique used by parachutists when exiting aircraft for team skydiving formations.

On an earlier flight on the day, the panel covering the parachutist's reserve parachute release mechanism opened during the exit from the aircraft. The parachutist continued that descent normally and, after landing, was advised by the other team

members of the incident. The video of that descent showed that the parachutist used an exit position similar to that used on the accident flight. The parachute container was in contact with the top of the doorframe/handrail (see fig. 2, 3 and 4).

FIGURE 2:
A previous jump – exit readiness position with parachute container against door

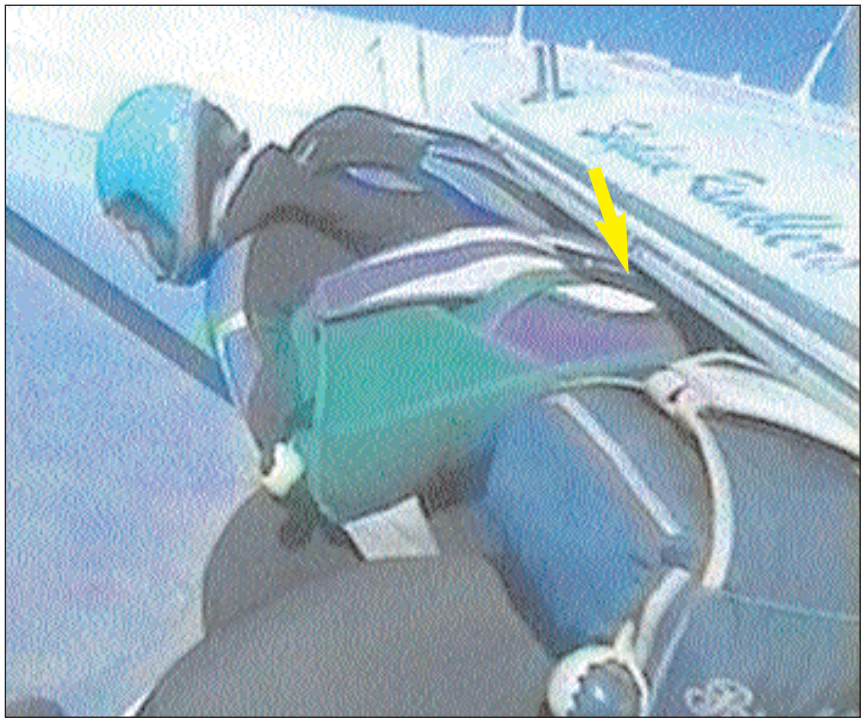


FIGURE 3:
A previous jump – loose release mechanism panel on exit

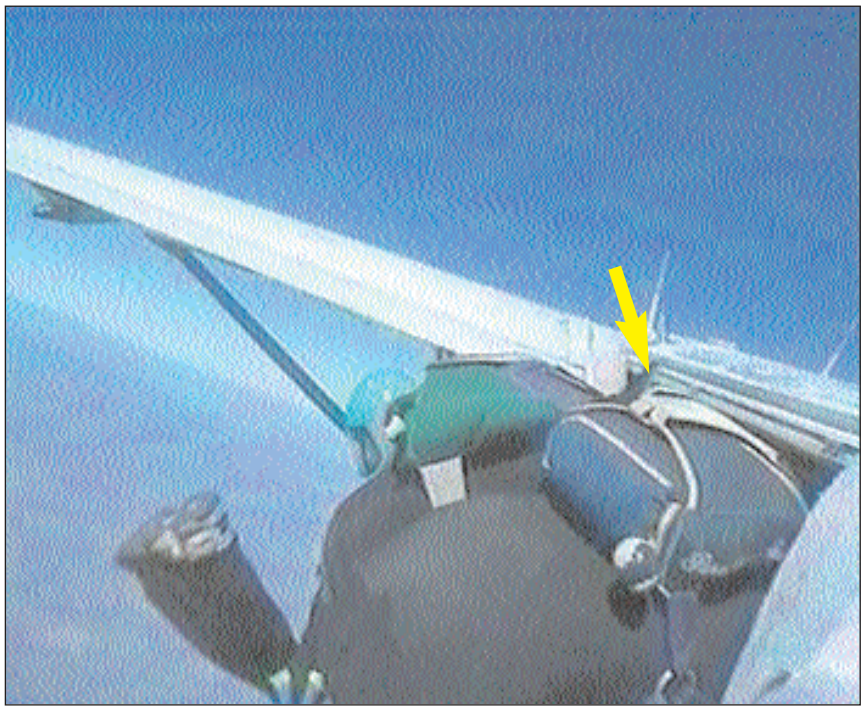


FIGURE 4:
A previous jump – loose release mechanism panel during freefall

A video of the accident flight showed the parachutist in the aircraft doorway in a position in which the parachute container, instead of the helmet, was in contact with the top of the doorframe/handrail (see fig 5). Subsequent frames from the video showed the deployment of the reserve parachute as the team exited (see fig. 6, 7 and 8).

FIGURE 5:
Accident jump – exit readiness position with reserve parachute cover against door frame

FIGURE 6:
Accident jump – pilot chute cover open

FIGURE 7:
Accident jump – ejector spring deploys pilot chute of reserve parachute

FIGURE 8:
Accident jump – pilot chute deploys

1.5 Survival aspects

The aircraft descended and impacted the ground at a rate of more than 16,000 feet per minute. Due to the total destruction of the aircraft cockpit and cabin by impact forces, the ground impact was not survivable.

The aircraft was fitted with an Emergency Locater Transmitter (ELT) which was permanently mounted in the rear of the aircraft. Aircraft in the area reported receiving a distress beacon for 6 minutes after the accident. The pilot's mayday transmission and the receipt of ELT transmissions resulted in the immediate activation of emergency services.

1.6 Related occurrences

In 1992, a Cessna 182 stalled and entered a spin as the parachutists left the aircraft. Two of the parachutists contacted the aircraft and received minor injuries. (BASI 199201233)

In 1997, as a parachutist stood in the exit doorway of a Piper Navajo, his reserve parachute deployed into the slipstream. He was dragged from the aircraft and received a broken arm when struck by the tailplane. (BASI 199702666)

In 1998, three parachutists were climbing out of a Piper Navajo when one fell free and struck the tailplane. The parachutist received minor injuries. The leading edge of the tailplane received minor damage. (BASI 19980762)

In 1999, a student parachutist was climbing out of a Cessna 182 onto the step. The static lanyard of his reserve parachute caught on the door lock, releasing the reserve pilot chute and reserve canopy. Some of the parachute lines caught on the horizontal stabiliser, causing twisting and buckling. When the parachute lines severed, the student descended with partial canopy control and suffered leg injuries on landing.

The pilot had sufficient control of the aircraft to allow him to land without further incident. (BASI 199900683)

Also in 1999, a parachutist's reserve parachute deployed as he was preparing to exit a Cessna 206 aircraft. The parachutist was dragged from the aircraft and received minor leg injuries when he collided with the horizontal stabiliser. The collision damaged the right stabiliser and twisted the rear fuselage. With limited pitch control of the aircraft, the pilot retained control and landed the aircraft without further incident. (BASI 199903706)

While exiting a Piper Navajo aircraft in 2000, a parachutist struck the tailplane. The parachutist received a broken leg and minor damage was caused to the tailplane. The pilot landed the aircraft without further incident. (ATSB 200002706)

2. ANALYSIS

The fact that the cover panel on the parachutist's container came open during the exit on a previous flight suggests that the exit technique put pressure on the parachute container and increased the risk of a premature opening. The low rate of premature parachuting opening occurrences indicates that the design of the Javelin container, when considered in isolation, was not a factor in the accident.

Even though there was conflicting evidence on the date the reserve parachute was last packed, examination after the accident suggested that the parachute was airworthy as the parachutist prepared to exit the aircraft. Therefore, the date on which the reserve parachute was last packed was not considered a factor in the accident.

The nature of occurrences involving parachutists and/or their equipment contacting aircraft during exit, indicated that parachute operations have an increased risk of the aircraft becoming uncontrollable compared with non-parachuting operations in the same aircraft. Parachutists need to be vigilant of the need to ensure that their equipment does not contact any part of an aircraft when conducting parachuting. Also, pilots and parachutists need to be able to readily exit an uncontrollable aircraft and have the equipment and training to reach the ground safely. The potential consequence in all cases was significant and thus the addition of safety devices for the protection of the crew and observers would be prudent.

3. SIGNIFICANT FACTORS

1. The parachutist's reserve parachute deployed prematurely, probably as a result of the parachute container coming into contact with the aircraft doorframe/handrail.
2. The reserve parachute risers and lines tangled around the horizontal stabiliser and elevator.
3. The reserve canopy partially filled, applying to the aircraft empennage a load that exceeded its design limits.
4. The empennage separated from the aircraft and the elevator separated from the empennage, releasing the parachutist and sending the aircraft out of control.

4. SAFETY ACTION

4.1 Local safety action

The Australian Parachute Federation (APF) included a report of the accident that highlighted the dangers inherent in containers contacting parts of aircraft in Issue No. 6 (July 2001) of the Australian Skydiving magazine and the Federation's News-Sheet No 119 (July 2001). A follow up article and drawing was included in issue No. 7 (Sept 2001) of the magazine. The APF also issued a warning poster (see fig. 9) to personnel at drop zones and instructors.

The designer of the roller blind has amended the design to include:

- a device to lock the blind in the open position, and
- a placard warning that the blind must be locked open during parachuting.

These design changes have been conveyed to the operators of aircraft that are fitted with a blind of this design.

The Australian Transport Safety Bureau advised the parachute container manufacturer of this accident so that the safety issues can be taken into consideration in the design of future parachute equipment.

As a result of this investigation, the Australian Transport Safety Bureau issues the following recommendations:

Safety recommendation R20010185

The Australian Transport Safety Bureau recommends that the Australian Parachute Federation advise its members of the need to use exit techniques and positions that avoid any contact between the parachute container and the aircraft.

Safety recommendation R20010186

The Australian Transport Safety Bureau recommends that the Australian Skydiving Association advise its members of the need to use exit techniques and positions that avoid any contact between the parachute container and the aircraft.

Safety recommendation R20010187

The Australian Transport Safety Bureau recommends that the Civil Aviation Safety Authority, the Australian Parachute Federation and the Australian Skydiving Association review the safety advantages of requiring pilots, where practicable, to wear parachutes during parachute operations.

CASA response dated 14 March 2002 included the following statement:

> CASA accepts the above draft Recommendation. CASA also notes that the wearing of emergency parachutes by the pilots of aeroplanes dropping parachutists has in fact been an 'almost universal' common practice for many years, and the experience of this accident will serve to reinforce that practice.

The Bureau has classified this response as CLOSED - ACCEPTED

FIGURE 9:
Poster