# AVIATION INVESTIGATION REPORT
# A02A0065

## SEAT FAILURE AND LOSS OF CONTROL

BLUENOSE SOARING CLUB
SCHEMPP-HIRTH KG CIRRUS (GLIDER)  C-GUIL
STANLEY AIRPORT, NOVA SCOTIA
21 MAY 2002

# Aviation Investigation Report

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## *Summary*

The Schempp-Hirth KG Cirrus glider, C-GUIL, serial number 77, was lined up for a winch take-off on the grass beside Runway 20 at Stanley Airport. The wind was from the west-northwest at approximately eight knots, resulting in a quartering tail wind of a few knots. At approximately 1505 Atlantic daylight time, the pilot gave the signal to commence take-off and, in accordance with the *Bluenose Soaring Club Operations Manual*, the winch operator initiated a "full-out" launch to compensate for the wind conditions. The glider lifted off normally; levelled for less than five seconds, then pitched up in a steep climb to an estimated 200 feet above ground level and rolled inverted to the right. When the winch operator noticed the glider pitch up abruptly and prematurely, he applied more power to the winch because he believed the glider was about to stall. The tow cable released after the glider rolled inverted, and the glider descended and struck the ground in an inverted altitude. Once the glider came to a rest, the end of the tow cable was approximately 50 feet ahead of, and directly in line with, the glider. The pilot was fatally injured and the glider was destroyed.

*Ce rapport est également disponible en français.*

# *Other Factual Information*

The pilot was an experienced powered aircraft and glider pilot who held a current glider pilot instructor licence. He was regarded as a safety-conscious individual and had previously held the position of Safety Officer at the Bluenose Soaring Club (BSC). He had accumulated 525 hours on gliders, of which 4.2 hours were on the Cirrus. He had not flown the Cirrus since 16 September 2001.

Flying operations for the day began at approximately 0700 with wind conditions favouring Runway 20. BSC members completed several flights without incident, including an instructional flight given by the occurrence pilot in a Schleicher K7. Between 1415 and 1500, wind conditions began to vary in speed and direction, favouring Runway 02. During the accident launch, the wind was estimated to be from the west-northwest at approximately eight knots. Those persons taking part in the flying activity on the field, including the accident pilot, decided to switch operations to Runway 02.

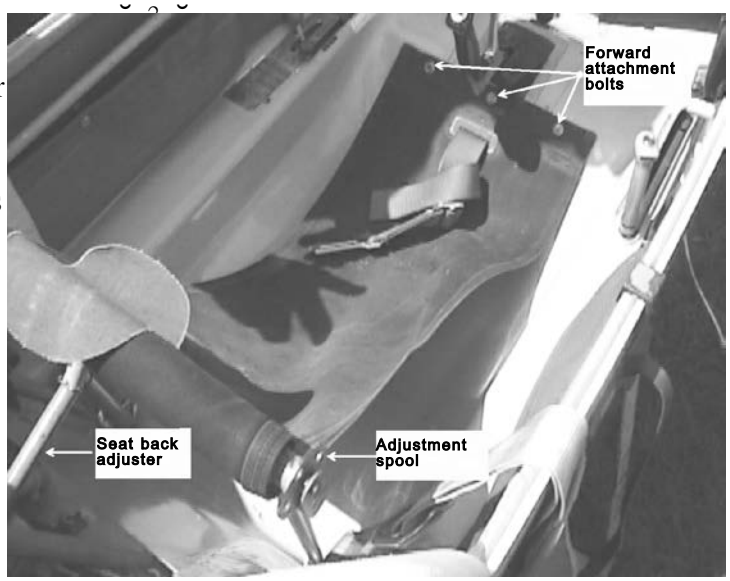
At the time, the pilot of C-GUIL was at the take-off end of Runway 20, and rather than have the glider towed by ground vehicle, he elected to fly off and land at the other end of the runway. The pilot then entered the glider and sat for several minutes waiting for a decrease in wind strength. When using Runway 20, BSC pilots estimate the wind by observing a signalling flag held by a person positioned in the area of the left wingtip, or by observing a piece of plastic tape attached to a nearby radio antenna. The one windsock on the airfield was about 5000 feet away and was not clearly visible from the launch position at Runway 20.

The glider was equipped with a "TOST" tow hook assembly which provides automatic release of the tow cable if the cable tension decreases during a launch sequence or if the glider overflies the cable. The conditions for automatic cable release were present during the last moments of flight.

The glider was single-place, high-performance, and of glass fibre-construction. It had undergone an annual inspection approximately three months prior to the accident. The glider had been flown the day before the occurrence and on two other occasions since the inspection.

Wreckage examination revealed that the glider flight controls were connected and functional prior to impact, and there was no indication of airframe structural failure.

The seat is a slung cloth hammock (See Figure 1 - Seat Assembly). The front attachment, under the pilot's legs, is secured to the floor by three bolts, and is not adjustable. The aft attachment, behind the pilot's shoulders, is a spool attached to a movable seat frame. The spool allows the pilot to vary the number of material wraps, and provides height adjustment. The seat back frame adjusts fore and aft to move the pilot's body fore or aft. Adjustment is accomplished by selecting the appropriate hole in the spring loaded lever and aligning it with a stationary pin attached to the airframe structure. In the most forward position, the pilot is in a semi-reclined seating position; the further rearward the selection, the more reclined the upper torso of the occupant. Examination of the glider seat assembly did not establish the exact position of seat adjustment at impact. After the accident, the right and centre attachment bolts were found to have pulled out of their anchor nuts, the bolts remaining within the seat fabric and aluminum attachment strip. The left bolt was still in its anchor nut, but was only finger tight.




The seat assembly and the airframe anchor nuts were removed and sent to the TSB Engineering Branch for examination to determine the thread condition of the bolts and anchor nuts. There was no indication of excessive wear, deformation, or other damage to the threads of the bolts. The threads on the right and the centre anchor nuts indicated that they had been previously cross-threaded, resulting in significant damage. The first four threads of the right anchor nut had a shinier surface appearance than the remainder of the threads in that anchor nut. It was not possible to quantify the extent to which this thread damage reduced the clamping strength of the anchor nuts. It could not be determined, through engineering analysis of the seat and attachment hardware, whether the bolts pulled out prior to ground impact or as a result of ground impact loads.

The winch system was inspected and tested after the occurrence and no defects were found.

Examination of another Cirrus glider revealed ergonomic features which could provide challenges to shorter pilots. A TSB investigator of about the same stature as the accident pilot (five feet six inches) could not manipulate the rudder pedals fully unless the seat adjustment was full forward. Even then he was required to stretch to achieve full rudder deflection. Also, the tow hook emergency release handle is positioned on the cabin floor to the left and forward of the control yoke. The handle is difficult to reach because the upper body is restrained by the five-point safety harness. As the angle of seat recline is made greater, the distance between the handle and the pilot's reach increases, and the handle becomes more difficult to reach.

## *Analysis*

During the launch the winch operator correctly provided a "full-out" launch to compensate for the wind conditions. It is unlikely therefore, that the loss of control was due to insufficient winch speed, which could lead to aerodynamic stall.

During the accident launch, acceleration forces would have effectively pressed the pilot rearward, transferring high load forces to the seat and its attachment hardware. Two of the three forward seat attachment bolts were found detached. The shiny appearance of the threads on the right anchor nut was likely due to the bolt tearing out, which would suggest that the bolt in the right anchor nut was only engaged by a maximum of four threads. Ordinarily, this amount of thread engagement would be sufficient to provide the maximum strength of the bolt and anchor nut assembly. However, in this occurrence, the threads had been previously damaged by cross-threading, and the assembly may not have been able to develop the full clamping force. It could not be determined why the bolts were not completely fastened.

Although there was not enough information available from the engineering analysis to determine whether the bolts pulled out in the air or at ground impact, other information supports the conclusion that the bolts pulled out in the air. The glider pitched up excessively a short time after lift-off. This was certainly abnormal and no fault was found with the glider's control system or structure. It is concluded that the combined effect of the cross-threading damage, the probability that the centre and right bolts were not fully engaged, and the acceleration forces of the launch resulted in the bolts pulling free from the anchor nuts resulting in seat failure. When the seat failed, the pilot would have moved downward and aft, away from the controls. This sudden rearward movement would have resulted in a corresponding rearward control stick movement, and an abrupt pitch upward, with subsequent loss of control. In addition, the pilot would have been unable to reach the manual tow cable release.

The practice of utilizing a signal flag or a piece of plastic tape for estimating the wind direction and speed does not provide sufficiently accurate information, and is not adequate when operating in light and variable wind conditions. This means of assessing wind conditions is not without potential risk. A windsock would provide pilots with more accurate wind information, during takeoff, and while on approach for landing.

The following Engineering Laboratory Report was completed:

LP 056/2002 – Examination of Pilot Seat Attachments.

## *Findings as to Causes and Contributing Factors*

1. The combined effect of the cross-threading damage, the probability that the centre and right bolts were not fully engaged, and the acceleration forces of the launch resulted in the bolts pulling free from the anchor nuts, resulting in seat failure.

2. The pilot lost control of the glider when the seat failed.

## *Findings as to Risk*

1. In the normally reclined seat position, the tow hook release handle in the Cirrus is difficult for short pilots to reach.

2. The threads on the right and the centre anchor nuts of the forward seat attachment had been previously cross-threaded and likely had not developed full strength.

3. A signal flag, or a piece of plastic tape, does not provide adequate wind information when operating in light and variable wind conditions.

## *Safety Action Taken*

The Bluenose Soaring Club has erected a windsock at the north end of runway 20. The Club has also clarified responsibility and authority with respect to decisions to change the direction of launch.

*This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 03 July 2003.*

*Visit the TSB's Web site (www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.*