



## Investigation report

C 6/2006 L

# Collision of two glider aircraft in Orimattila on 15 July 2006

Translation of the Finnish original report

OH-956 (AC) Sportine Aviacija LAK-17AT

OH-945 (T8) Rolladen-Schneider LS8-t

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## SUMMARY

On Saturday 15 July 2006 at 14:37 local time, a collision of two glider aircraft occurred above the Heinämaa village of Orimattila city, in which a privately owned LAK-17AT type glider aircraft, competition sign AC, and a Rolladen-Schneider LS8-t owned by Pernun Pilotit ry, competition sign T8, were damaged. The pilots of both aircraft were unharmed. On 18 July 2006 the Accident Investigation Board Finland (AIBF) appointed in its decision no. C 6/2006 L an investigation commission with accident investigator Reijo Mäkeläinen as chairman and investigator Tuukka Takala as a member of the commission.

The pilots of both gliders AC and T8 were taking part in the Jannen Kisat gliding competition held at Räyskälä aerodrome. Both gliders took off by aeroplane towing from Räyskälä aerodrome. AC reached the Heinämaa waypoint from the west and after passing the waypoint turned back towards a lift it had left earlier. The pilot of AC did not see T8, which was approaching from the opposite direction. The left wings of the aircraft hit each other at an altitude of 1490 m above ground level. The closing speed of the two aircraft was approximately 250 km/h at the time of collision. Both aircraft remained airworthy after the collision. T8 made an uneventful landing at Lahti-Vesivehmaa aerodrome at 15:00 hours and AC at Räyskälä aerodrome at 15:47 hours.

Due to the small angle between the inbound and outbound routes to Heinämaa waypoint given in the competition task, the inbound and outbound traffic were close to each other. When examining the emergency canopy jettison mechanism of AC it was found that the canopy of the aircraft had not separated in spite of the pilot carrying out the correct canopy jettison procedure. The locking handle of the spring-type jettison mechanism had been left in an incorrect position and it did not operate in the intended manner. The LAK-17AT instructions concerning the canopy jettison mechanism are inadequate and do not give a clear indication of the correct position of the spring locking handle. There are no markings of the correct position for the red locking handle on the locking system in the aircraft.

The pilots did not see each other in time to avoid the collision. Contributing factors to the accident were the routing of the competition task, which caused the inbound and outbound traffic at the waypoint to pass near each other, and the poor visibility of a glider approaching from a directly opposite direction.

The investigation commission issued two safety recommendations. The commission recommends that the manufacturer of the LAK-17AT specify the instructions in the flight manual and markings in the aircraft concerned with the canopy jettison mechanism in such a way that the correct position of the spring locking handle is evident and unambiguous. The commission also recommends that the organisers of gliding competitions investigate the possibility of requiring the use of collision warning systems in competitions.

This table of contents and investigation report have been abridged from the original investigation report in Finnish, which follows the ICAO Annex 13 table of contents.

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## ABBREVIATIONS

<b>Abbreviation</b>	<b>Explanation</b>
°C	Degrees Celsius
CF	Cloud Flight Rating
cm	Centimetre(s)
E	East
GPL	Glider Pilot License
GPS	Global Positioning System
kg	Kilogram(s)
km	Kilometre(s)
km/h	Kilometres per hour
m	Metre(s)
m/s	Metres per second
MGPL	Motor Glider Pilot License
MHz	Megahertz
min	Minute(s)
N	North
s	Second(s)
TMA	Terminal Control Area
VFR	Visual Flight Rules
VOR	VHF omnidirectional radio range



## 1 FACTUAL INFORMATION

### 1.1 History of the flight

#### 1.1.1 Events preceding the collision

The pilots of both gliders AC and T8 were taking part in the Jannen Kisat gliding competition held at Räyskälä aerodrome. The competition had started a week earlier on Sunday 9 July 2006 and it was to end on the day of the accident.

The goal of the competition task given on the 15 July 2006 was to fly a cross country route passing through pre-determined waypoints. The task of the day was a polygonal route going through the waypoints Porras–Kiikala–Urjala–Heinämaa–Syrjäntaka–Räyskälä. The total distance of the route was 345.6 km. The inbound course given in the competition task to the Heinämaa waypoint was 100° and the outbound course from the waypoint was 297°. The angle between the inbound and outbound tracks was 17°. 22 glider aircraft were taking part in the task on the day of the accident.

Both gliders took off by aeroplane towing from runway 30R at Räyskälä aerodrome. AC took off at 11:48 hours reaching the Kiikala waypoint at 12:49 and the Urjala waypoint at 13:34. T8 took off at 12:13 and it was at the Kiikala waypoint seven minutes after AC at 12:56 and at Urjala four minutes after AC at 13:38.

AC arrived in the vicinity of the Heinämaa waypoint approaching from the west, along with three other aircraft. The other aircraft stayed to orbit in a lift (lifting air mass) approximately 2 km before the waypoint. AC however, unlike the other three aircraft, continued straight through the lift towards the waypoint. At 14:36, after passing over the waypoint, AC turned back towards the lift it had left earlier. At the waypoint AC was at an altitude of 1583 m. While AC was over the waypoint, the other three aircraft had vacated the lift flying towards the waypoint in search of a new lift. At this time, T8 arrived to the lift vacated by the other three aircraft, making one orbit right. The other three aircraft had also used a right-hand turning direction. As the lift was weak, T8 continued on towards another lift, closer to the waypoint, to which the other three aircraft had flown.

AC approached, in straight and level flight, the lift that T8 had just vacated, with intention of returning to the lift it had flown through earlier when flying to the waypoint. AC reached an area of sustaining lift and the pilot reduced the airspeed by raising the nose, gaining 56 m of altitude during the last GPS data recorder recording interval (18 s). The pilot of AC did not see T8 approaching from the opposite direction. The left wings of the aircraft hit each other at 14:37:15 at an altitude of 1490 m above ground level. The closing speed of the two aircraft was approximately 250 km/h at the time of collision.

At the moment of collision, T8 was turning right to enter a left-hand orbiting lift. The pilot of T8 noticed the approaching aircraft approximately 1–2 s before the impact. The pilot

recalled that he had attempted to steer right to avoid the collision, but he was not sure if the aircraft had the time to react to his control movement.

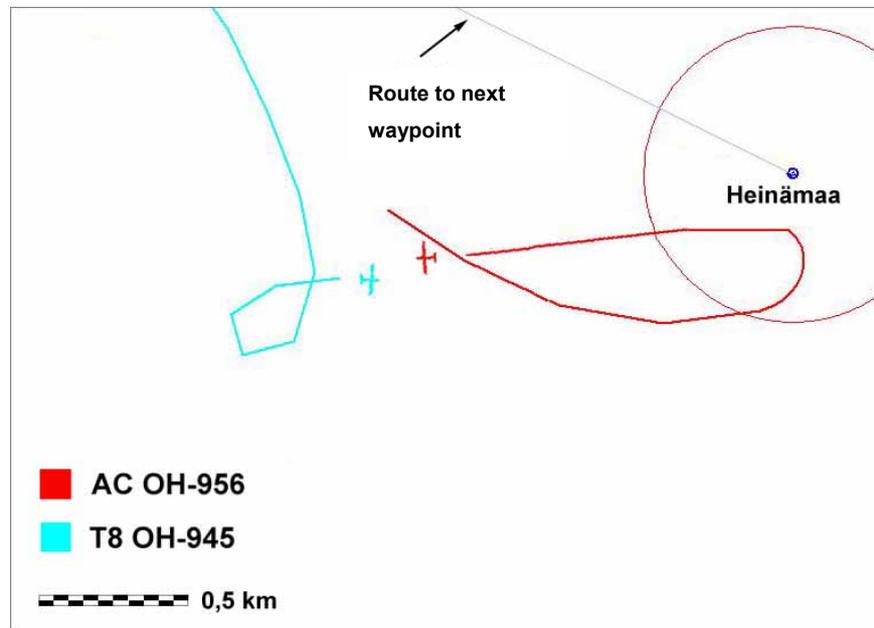


Figure 1. The situation at the time of collision. AC marked in red and T8 in blue.  
(Volkslogger recorder data)

### 1.1.2 AC actions after the collision

As a consequence of the collision, AC went into a spin, which the pilot recovered from into a dive after one rotation. The pilot opened the airbrakes and pulled on the canopy jettison handle. The canopy did not separate from the aircraft. During the spin and recovery the aircraft lost a total of 180 m of altitude. After recovering the pilot flew southwards for a distance of 4 km.

The pilot of AC asked on the radio if someone could check if the empennage of the aircraft was intact. The other aircraft, however, had already continued their flight northeast and did not know of the exact position of AC. A moment later the pilot reported on the radio that everything seemed to be working. The pilot saw only a crack in the leading edge of the wing; no other damages were visible to the cockpit. The pilot elected to stay at a high altitude and not to use the retractable powerplant, flying at a low airspeed towards Räyskälä aerodrome. Abeam Hyvinkää a towing aircraft came to inspect the damages. The tow pilot saw no external damages except for those on the wing. After testing the slow-flight behaviour of the aircraft, the pilot of AC decided to fly to Räyskälä and made an uneventful landing there at 15:47.

### 1.1.3 T8 actions after the collision

After the collision T8 remained in control of the pilot and the aircraft was manoeuvrable. The pilot noticed that the wing extension, approximately 2 m in length, had been torn off at its attachment point. The aircraft controls responded normally. After assessing the situation the pilot flew towards the closest aerodrome, which was Lahti-Vesivehmaa aerodrome 31 km away. To ensure a direct access to the aerodrome the pilot extended and operated the retractable powerplant for a period of 6 min. The pilot made an uneventful landing at Lahti-Vesivehmaa at 15:00.

### 1.2 Injuries to persons

No injuries.

### 1.3 Damage to aircraft

The left wings of both aircraft suffered significant damages.

### 1.4 Aircraft information

#### 1.4.1 OH-956 (AC)

The LAK-17AT is a single-seat, composite glider aircraft, equipped with a retractable powerplant. The wing span is 15 m, which can be increased to 18 m using wingtip mounted wing extensions.

#### **Aircraft:**

Type:	LAK-17AT
Registration:	OH-956
Registration number:	P-956
Manufacturer:	Sportine Aviacija
Serial number:	168
Year of manufacture:	2005
Maximum takeoff weight:	500 kg
Fuel capacity:	7,5 litres
Total time since new:	198 h

#### **Powerplant:**

Type:	SOLO 2350
Serial number:	676
Manufacturer:	Solo Kleinmotoren GmbH
Total time since new:	2 h 51 min
Fuel:	96 RON or AVGAS 100LL

**Propeller:**

Type: LAK-P4-90, 2-blade constant pitch propeller  
Total time since new: 2 h 51 min

**1.4.2 OH-945 (T8)**

The LS8-t is a single-seat, composite glider aircraft, equipped with a retractable powerplant. The wing span is 15 m, which can be increased to 18 m using wingtip mounted wing extensions.

**Aircraft:**

Type: LS8-t  
Registration: OH-945  
Registration number: P-945  
Manufacturer: Rolladen-Schneider Flugzeugbau GmbH  
Serial number: 8472  
Year of manufacture: 2003  
Maximum takeoff weight: 525 kg  
Fuel capacity: 14.0 litres  
Total time since new: 261 h

**Powerplant:**

Type: Flugmotor 2350  
Serial number: 575  
Manufacturer: Solo Kleinmotoren GmbH  
Total time since new: 8 h 17 min  
Fuel: 95 ROZ DIN228 or AVGAS 100 LL

**Propeller:**

Type: KS-1-G-079-L-050W, 2-blade constant pitch propeller  
Total time since new: 8 h 17 min

**1.5 Flight recorders**

Both aircraft were equipped with a Volkslogger flight data recorder.

Volkslogger is a recorder device based on GPS technology made for evaluating and monitoring flights in gliding competitions and similar gliding activities. The device can also be used for navigation purposes. The device provides the pilot with distance and heading information to the target, as well as the groundspeed and track of the aircraft. A separate pressure sensor is installed into the device for measuring altitude. The recording interval can be selected between 1-60 s. The device can be pre-programmed

with 500 waypoints. At the time of the collision, the recording interval was 12 s for T8, and 12 s for AC. The data from both recorders was downloaded by the competition organisers on the day of the accident.

## 1.6 Test and research

### 1.6.1 Investigation of the points of impact

The detailed investigation of the damages sustained by the aircraft was done at Rääskälä aerodrome between 15 July and 1 August 2006. The collision was investigated by reconstructing the positions of the aircraft at the time of collision.

#### AC damage

A small crack was found in the paint 2.3 m outboard from the base of the left wing. There were in total three holes on the lower side of the wing in the wing leading edge and in the area between the leading edge and the main spar (fig. 2). Several of the carbon-fibre bundles of the main wing spar had detached at the outermost hole. The main wing spar is exceptionally manufactured from carbon-fibre bundles, 3 mm in diameter and bound together with epoxy resin to form the main spar. A small dent was found in the left wing flap.



Figure 2. AC left wing lower surface. The arrows indicate the holes found on the wing.

#### T8 damage

The detachable wing extension (fig. 3) had completely separated from the left wing at its attachment point. The attachment screw had broken at the left wing tip. The wing extension rear attachment metal guiding pin had broken off. The wing extension was crushed at the tip, and a 90 cm section had separated from it. The wing extension aileron adhesive bond was detached for a length of 10 cm at the edge on the base side. The wing extension main spar was broken at the wing base rib. The base rib fore and aft corners were fractured.

There was a trace of blue paint on the lower surface of the separated wing extension. The blue colour was found to be the same as on the AC registration markings on the lower surface of the wing.

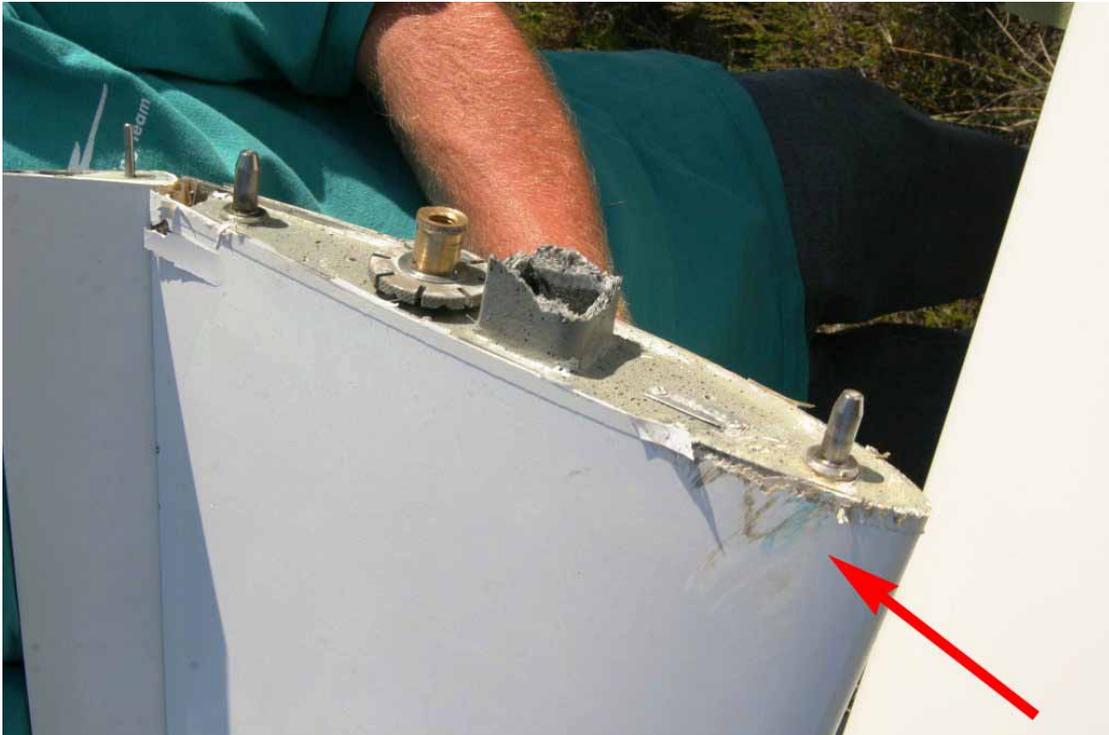


Figure 3. The wing base rib of the separated wing extension of T8.  
The blue paint trace on the right is indicated by the arrow.

### 1.6.2 AC canopy jettison mechanism

When investigating the canopy jettison mechanism of AC, it was found that it had been operated from the canopy jettison handle in the cockpit. The canopy locks had opened, but the compression spring that pushes the canopy upwards had not activated, because it was incorrectly locked in the canopy mounting position.

## **2 ANALYSIS**

### **2.1 Pilot actions**

The glider aircraft AC turned around to return to the lift it had left earlier, against the general flow of the other competition traffic. The angle between the path chosen by AC and the assigned competition path was approximately 40 degrees. Considering the existing thermal conditions, the altitude of the aircraft did not require returning backwards to a previously found lift for competition purposes. In the existing conditions, there would have been sufficient lifting air for AC to continue directly towards the next waypoint without turning back.

The angle between the inbound and outbound tracks given in the competition task for Heinämaa waypoint was very small, 17 degrees, which caused the inbound and outbound traffic at the waypoint to pass near each other. In this kind of situation pilots should give special attention to their lookout for other traffic.

Just before the collision AC reduced speed as it reached an area of sustaining lift by raising the nose, reducing the visibility from the cockpit forwards and downwards. The cross-sectional area of a glider aircraft approaching from a directly opposite direction is so small, that noticing it with bare eyes is difficult. The closing speed of the two aircraft was approximately 250 km/h, giving little time to see the approaching aircraft.

### **2.2 Collision**

The left wing extension of glider aircraft T8 was crushed at the wingtip for a length of 90 cm. The wing extension had torn off at the attachment point and the main spar of the wing extension was broken. The left aileron outboard corner adhesive bond had detached.

There were three holes on the lower surface of the left wing of glider aircraft AC: one in the middle section of the wing in the leading edge; a second in the middle section of the wing between the leading edge and the main spar and a third, larger, hole about 4 m from the wing base. These damages were most likely formed by the separated wing extension of T8 hitting the AC wing lower surface after breaking off.

The first collision impact occurred, when the wingtip of T8 hit the wing leading edge of AC about 2.3 m from the base of the wing, leaving a crack in the AC wing leading edge. The force of the impact tore open the T8 wing extension attachment and the wing extension broke off, swinging around and hitting the lower surface of AC's wing, leaving a blue paint trace from the registration markings of AC on the wing extension. The protrusions in the wing extension caused damages to the wing lower surface, the main spar and the water ballast tanks of AC.

### 2.3 The LAK-17AT canopy jettison mechanism

When examining the emergency canopy jettison mechanism of AC it was found that the canopy of the aircraft had not separated in spite of the pilot carrying out the correct canopy jettison procedure. On the ground, the canopy was found to be detached. The locks of the canopy had opened after the pilot operated the canopy jettison handle in the cockpit. According to the pilot, the airflow-induced cabin noise had increased which suggests that the canopy has opened slightly. Nevertheless, the canopy stayed in place for the remainder of the flight as there was no force pushing it outwards. The pilot used low air-speeds for the remainder of the flight after noticing that the canopy was detached. The airspeed was maintained between 100–120 km/h.

There is a compression spring (2) in the canopy locking mechanism, which pushes the front end of the canopy approximately 10 cm upwards and outwards when the canopy jettison handle in the cockpit is operated, allowing the airflow to lift the canopy up and away, clear of the cockpit. For this to take place the compression spring must be in the unlocked (working) position. The locked position is necessary for mounting the canopy, when the spring must be pulled and locked. After mounting the canopy, the spring must be unlocked. There are no markings in the aircraft revealing the correct position of the red locking handle (1) on the spring locking system. On the handle itself, the only marking is the red colour of the handle. There is a warning in the flight manual, the maintenance manual and the pre-flight checklist located in the cockpit, that the spring must be in the unlocked position for the canopy jettison mechanism to function correctly.

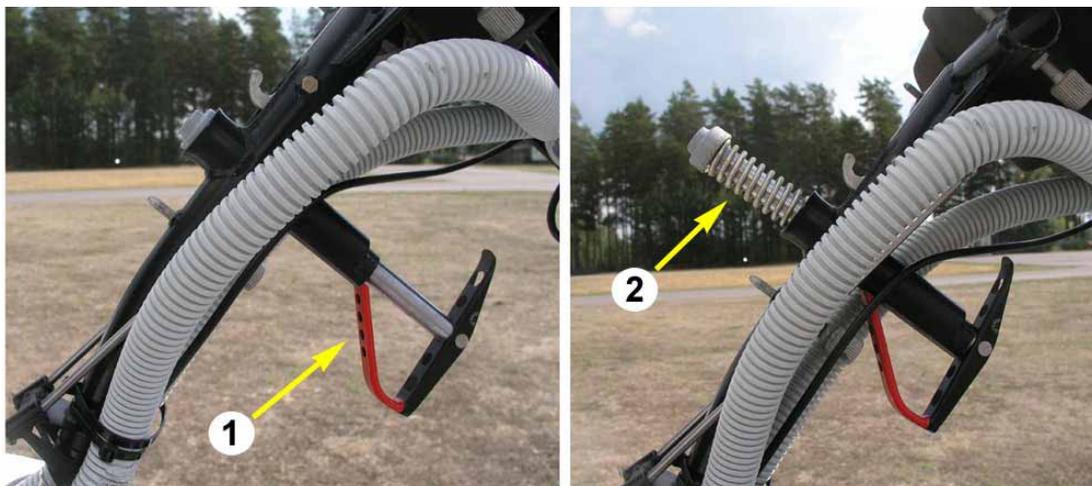


Figure 4. The compression spring locking system of the spring-type canopy jettison mechanism. The left-hand picture shows the red locking handle (1) in the locked position for canopy mounting. The right-hand picture shows the compression spring (2) in the extended, canopy jettison position.

The pilot had not fully understood the canopy locking mechanism, and after mounting the canopy had left the spring locking handle incorrectly in the locked position. The locking handle was also found in the locked position in another aircraft of the same type.

The pilot of this second aircraft was also unaware of the correct locking system operation. In the view of the investigation commission, the incorrect position of the locking handle in the aircraft is a consequence of the inadequate instructions in the flight manual concerning the canopy jettison mechanism, as well as the lack of warning markings on, or in the vicinity of, the spring locking handle. Although the inspection of the correct position of the locking handle is mentioned in several different sources, the different positions of the locking handle are clearly depicted in only one diagram of the maintenance manual.

#### **2.4 Collision warning systems**

At the time of collision there were two aircraft within a diameter of 1 km from the Heinämaa waypoint. Within a diameter of 2 km there were six aircraft, and within 5 km there were 13 aircraft, of which 10 were in the front sector of AC. Such traffic densities are not unusual in glider operations due to the nature of glider flying. While searching for lifts gliders may concentrate in very small areas in order to gain altitude.

Collision warning systems based on GPS and radio technology are available for gliders. The use of such a system could reduce the risk of mid-air collisions in glider operations. However, the use of such a system requires that all aircraft are equipped with it, as aircraft not equipped with warning devices do not create warnings in the system.

### **3 CONCLUSIONS**

#### **3.1 Findings**

1. The pilots of both aircraft involved in the collision held the required licenses and ratings, and they were valid.
2. Both glider aircraft had a permission to fly. Both gliders were on the temporary aircraft register.
3. The pilots of both gliders were taking part in the Jannen Kisat gliding competition held at Rääskälä aerodrome. Both gliders took off by aeroplane towing from Rääskälä aerodrome.
4. Due to the small angle between the inbound and outbound routes to Heinämaa waypoint given in the competition task, the inbound and outbound traffic passed close to each other.
5. The pilots did not see each other in time to avoid the collision.
6. The left wings of the aircraft hit each other at an altitude of 1490 m above ground level. The closing speed of the two aircraft was approximately 250 km/h at the time of collision.
7. Both aircraft remained airworthy after the collision.
8. The other participants of the competition reported the accident to the Area Control Centre (ACC), which further reported to the Emergency Response Centre (ERC). The ERC alerted an ambulance and a rescue helicopter to Rääskälä aerodrome. No rescue units were alerted to Lahti-Vesivehmaa aerodrome.
9. AC landed at Rääskälä aerodrome and T8 at Lahti-Vesivehmaa aerodrome.
10. The locking handle of AC's (The LAK-17AT) spring-type jettison mechanism had been left in an incorrect position and did not operate in the intended manner.
11. The LAK-17AT instructions concerning the canopy jettison mechanism are inadequate and do not give a clear indication of the correct position of the spring locking handle. There are no markings of the correct position for the red locking handle on the locking system in the aircraft.

### **3.2 Probable cause**

The pilots did not see each other in time to avoid the collision. Contributing factors to the accident were the routing of the competition task, which caused the inbound and out-bound traffic at the waypoint to pass near each other, and the poor visibility of a glider approaching from a directly opposite direction.

#### 4 RECOMMENDATIONS

There is a risk that the LAK-17AT canopy jettison spring locking handle is left in the locked position due to the inadequate instructions of the flight manual and maintenance manual, and due to the lack of markings on the locking handle itself and in its vicinity. Although the inspection of the correct position of the locking handle is mentioned in several different sources, the different positions of the locking handle are clearly described in only one diagram of the maintenance manual.

1. The investigation commission recommends, that the manufacturer specify the instructions concerning the canopy jettison mechanism given in the flight manual and the markings on the aircraft in such a way that the correct position of the spring locking system is evident and unambiguous.

In glider operations and especially gliding competitions, high traffic densities are not unusual due to the nature of glider flying. While searching for lifts, glider aircraft may concentrate in very small areas to gain altitude. The use of collision warning systems based on GPS and radio technology for gliders could reduce the risk of mid-air collisions.

2. The investigation commission recommends that the organisers of gliding competitions investigate the possibilities of requiring the use of collision warning systems in competitions.

Helsinki, 21.2.2007



Reijo Mäkeläinen



Tuukka Takala



## **LIST OF SOURCES**

The following material is stored at the Accident Investigation Board Finland.

1. The Accident Investigation Board Finland decision no. C 6/2006 L
2. Investigation report
3. Incident reports
4. Interview transcripts
5. Weather information
6. Excerpts from the LAK-17AT manuals
7. Volkslogger recorder data
8. Comments by the pilots and the Finnish Aeronautical Association
9. Photographs