



Glider Accidents

1999 - 2001

STUDY

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Glossary

AD	Aerodrome
ATC	Air Traffic Control
ATR	Air Traffic Rules
BEA	Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (Bureau of Investigation and Analysis for Civil Aviation Safety)
BKN	Broken cloud (5 to 7 octas), followed by the height of the cloud base
DGAC	Direction Générale de l'Aviation Civile (General Directorate for Civil Aviation)
FEW	Few clouds (1 to 2 octas), followed by the height of the cloud base
FFVV	Fédération Française de Vol à Voile (French Gliding Federation)
FH	Flying hours
GPS	Global Positioning System
IMC	Instrument Meteorological Conditions
km	Kilometre
kt	Knot
PPGL	Private Pilot's Glider Licence
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
SFACT	Service de la Formation Aéronautique et du Contrôle Technique (Aeronautical Training and Technical Control Service)
ULM	Ultra Light Motorised
VFR	Visual Flight Rules

CONTEXT

After 1996, a year notable for numerous accidents¹ in the gliding community (gliders and motorised gliders), the statistics have shown a decrease in the number of people killed or injured. After stagnation until 1999, the years 2000 and 2001 had a small number of fatal gliding accidents in France, compared to the previous years. There were four in 2000 and four in 2001 with, respectively, four and five deaths.

The following table shows the evolution in the consequences of glider accidents² in France since 1990.

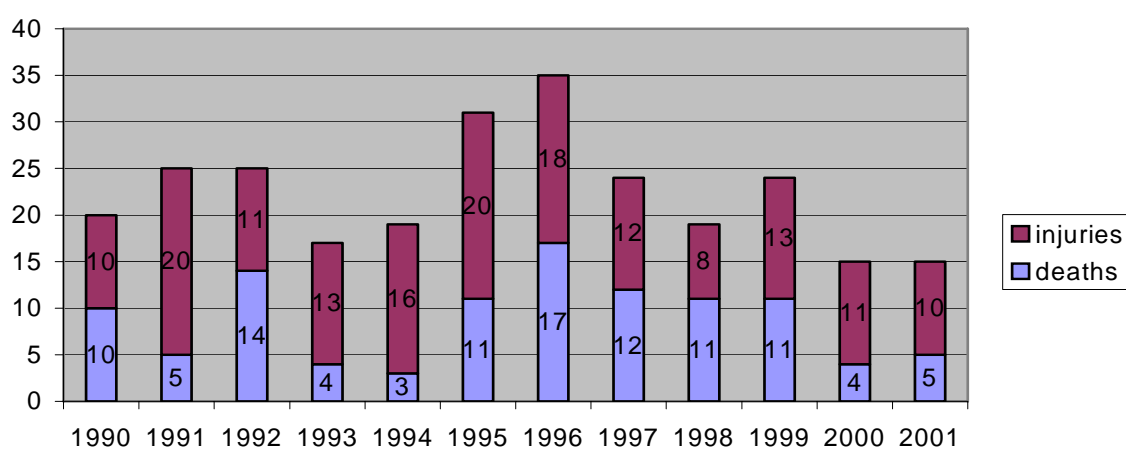


Figure 1 : Evolution in the number of casualties in gliding accidents
(occurring in France to French and foreign aircraft)

This study proposes to show the circumstances in which these accidents occurred and to analyse their causes.

¹ See definitions in appendix 5.

² Until 1997, an accident was defined according to the IGAC 300. Since the 1st January 1997, the international definition (Appendix 13 to the Convention on International Civil Aviation) has been applied. Application of this definition, which has no bearing on the numbers of those killed or injured, may have affected events considered as incidents, where the previous definition classified them as accidents.

1 - PRESENTATION OF ACCIDENTS

1.1 Statistics

The statistics were established based on data provided to the BEA, relating to French or foreign gliders and motorised gliders involved in accident in France.

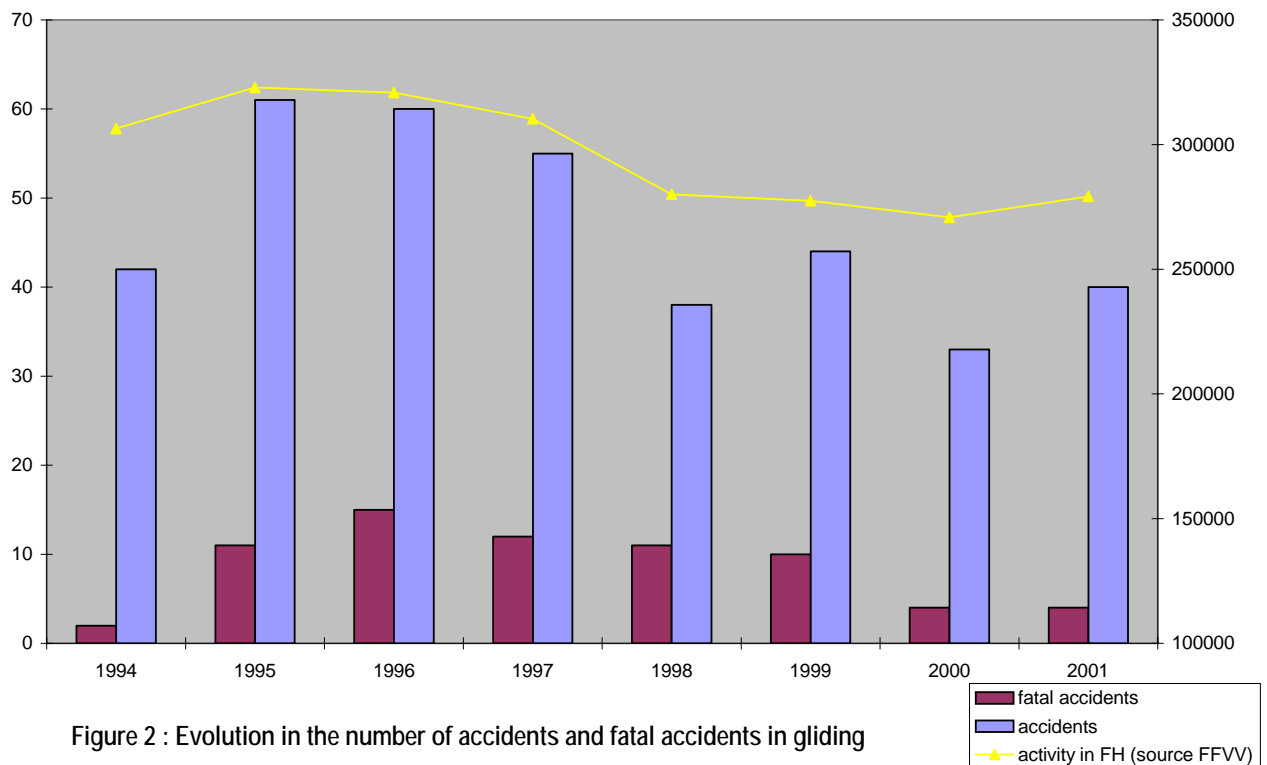


Figure 2 : Evolution in the number of accidents and fatal accidents in gliding

Between 1998 and 2001, the number of accidents in relation to gliding activity remained approximately constant (see figure 2). Figure 1 indicates that the number of deaths in 2000 and 2001 was on the decrease compared to the previous years. This reduction is in line with a more or less continuous decrease in the number of deaths since 1996. The number of injured has remained on the same scale since 1997.

The graph below shows the data relating to fatal accidents in general aviation (all types of activities included: gliders, airplanes, ULM's, rotary wing aircraft, balloons) which occurred in France to French or foreign operated aircraft. These statistics show stagnation in the number of fatal accidents since 1998, with a rise in 2001.

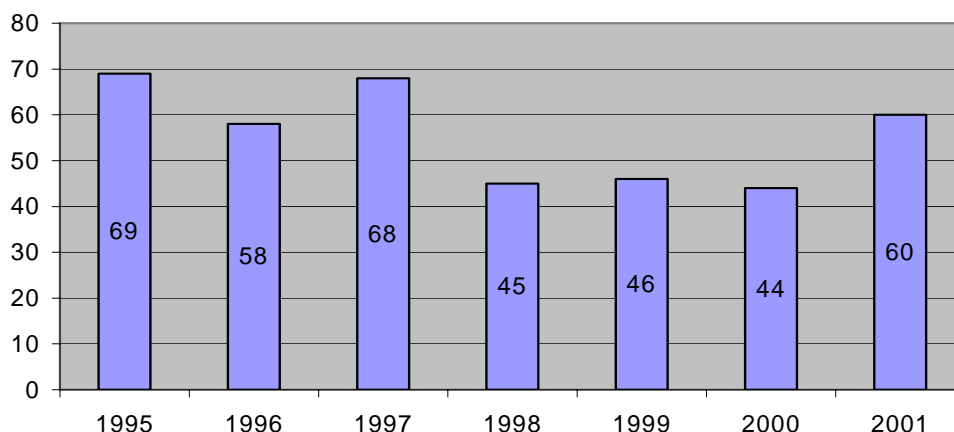


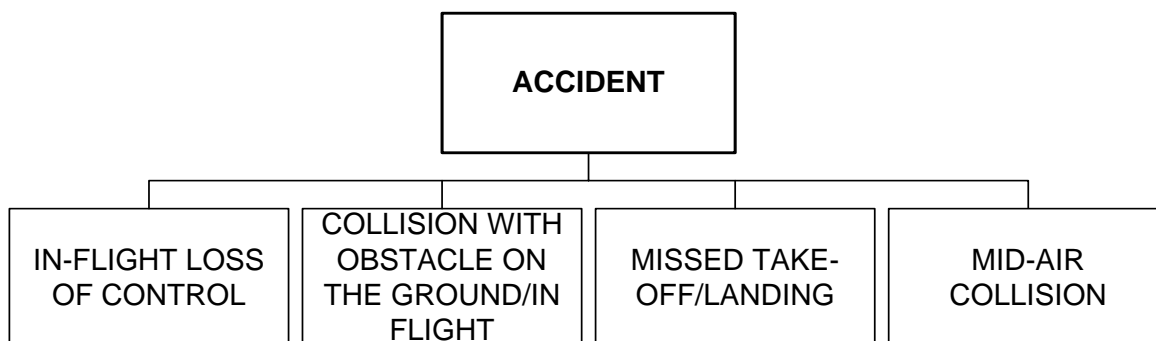
Figure 3 : Evolution in the number of fatal accidents in general aviation

These accidents may be linked to pilots, to the environment, to the nature of the flight, to the operational environment or to technical failure. In the following chapter, certain circumstances common to a significant number of events in gliding are summarised.

1.2 Events Studied

This study covers accidents to one hundred and seventeen French or foreign operated gliders or motorised gliders on French territory between 1999-2001. For each accident, the BEA's approach to the technical investigation involves gathering evidence, analysing them, and determining the probable or identified causes in order to draw lessons aimed at prevention of future accidents.

Four types of events make up the majority of glider accidents: loss of control in flight, collisions with the ground and in flight with obstacles, missed landings or take-offs and finally, mid-air collisions.



For each type of event, a fault tree has been developed, showing the descriptive and explanatory causal factors which may lead to these types of accidents. These

charts, presented in the appendices, were developed from the one hundred and seventeen accidents on which this study is based, and are thus progressive.

1.2.1 In-flight loss of control

Loss of control in flight (on take-off, in cruise or during landing) appears in nineteen accidents, which caused nine deaths and six injuries.

Loss of control in flight is characterised by a considerable gap between the glider's flight parameters (angle of attack, speed, symmetry, ...) and the parameters sought by the pilots, to the extent that they can no longer manage to follow the desired track for the glider (see fault tree in appendices).

These accidents generally occur during flight at low speed in turbulent conditions and close to high ground³ or during the phases of take-off or forced landing. They can also occur on an aerodrome, during flight near the ground and at relatively low speeds. The pilot's work load is then high and the track must be followed precisely. Surveillance of the environment requires a rigorously organised focus of attention. These skills require, for example, a high level of energy on the part of a trainee in initial training. When the height of a glider is great enough, any loss of control is usually retrievable before a collision with the ground.

Among the events studied, one accident in this category was due to an in-flight rupture following loss of control which resulted from the loss of external visual references.

1.2.2 Collision with obstacle/terrain

Twenty-three collisions with high ground⁴ were reported between 1999 and 2001. These collisions caused fourteen deaths and seven injuries. Most of these accidents occurred in the south-east of France.

Collisions with high ground or with obstacles occur when pilots fly near ridges or high ground or following loss of control in flight. Several factors linked to the environment or directly to pilots, to their representation of the situation, technical skills or personality then come into play (see fault trees in appendices 3 and 3A).

Article 4.5 of the AFR 1⁵ specifies margins for clearance of obstacles and minimum flight levels concerning aircraft. It is, however, specified in the article that *"un-powered aircraft performing wave flights may make exceptions to this rule"*

³ Accident to glider registered I-DLEA in appendix 2.

⁴ Accident to glider registered F-CHDS in appendix 3.

⁵ AFR 1, Art. 4.5 : except for the requirements of take-off, landing (...), no VFR flight may be performed :

- Above densely populated areas, towns and other built-up areas or large assemblies of people in the open air, lower than 300 metres above the highest obstacle located within a radius of 600 metres around the aircraft;
- Other than in the areas specified above, at a height lower than 150m above the ground or water and at a distance of less than 150m from any person or vehicle (...) from the surface or from any artificial obstacle. Un-powered aircraft performing wave flights may make exceptions to this rule providing it does not lead to risk for persons or property on the surface.

providing it does not lead to risk for persons or property on the surface". This article allows glider pilots to evaluate for themselves the safety height.

1.2.3 Missed landing / takeoff

In 1999, 2000 and 2001, fifty-nine accidents occurred during the landing phases. These accidents caused ten injuries during forced landings and one death and six injuries on or near an aerodrome. It should be noted that only one fatal accident occurred during a missed landing over this three-year period. Twenty-two accidents occurred during take-off phases causing four deaths and eight injuries.

The missed landings include:

- non-stabilised approaches often resulting in a hard landing or a runway excursion⁶,
- loss of control at the time of the flare,
- collisions with obstacles, either on the landing roll, or in the last moments of the flight when the choice of the landing field is inappropriate.

Missed take-offs include:

- loss of control during take-off roll or in the first moments after take-off⁷,
- collisions with an obstacle situated on the runway or in the funnel,
- loss of power during take-off in a motorised glider.

The causes may be diverse, directly implicating the pilots, the procedures applied or the environment. (see fault trees in appendices 4 and 4A)

1.2.4 Mid-air collisions

Three mid-air collisions which caused two deaths and one injury occurred in 1999, two between gliders and a third involving a glider and an airliner. No mid-air collisions occurred in 2000 and 2001. Of the two mid-air collisions which occurred between gliders, one occurred in a transition phase when the two gliders were flying in line with tracks more or less opposite to each other, the other occurred following a change of spiral direction when the two gliders had initially been spiraling in the same direction. The third mid-air collision involved a glider in wave flight at flight level 80 and an Airbus A320 on approach to Montpellier airport⁸.

1.3 Additional Information

The details in this paragraph reproduce certain circumstances related to accidents studied between 1999 and 2001.

⁶ Accident to the glider registered F-CEXP in appendix 4.

⁷ Accident to the glider registered D-7390 in appendix 4A.

⁸ Report n° F-VG990212 and F-XB990212 concerning the mid-air collision which occurred on 12 February 1999 at Gornières (34) between an Airbus A320 and a Grob 103 C glider.

1.3.1 Information on pilots

1.3.1.1 Instruction

The events studied hereafter concern instruction flights with an instructor on board (flight with dual control).

Accidents occurring during instruction are relatively few compared to instruction activity. Instruction flights under dual control represent around 25 % of flying hours performed in France⁹, while accidents which occurred for this type flight number thirteen, which is 11 % of the total of one hundred and seventeen accidents in the period 1999-2001.

Further, five accidents occurred during solo flights supervised by an instructor and caused one injury and light damage to equipment.

1.3.1.2 Age of pilots

The figures for 1999, 2000 and 2001 show the pilots less than twenty-five years old are relatively less subject to accidents (6 % of accidents for an activity representing nearly 20 % of overall activity), these accidents also having relatively minor consequences (no deaths or injuries for this age range between 1999 and 2001). Proportionally, pilots under twenty-five fly more often in the context of instruction than older pilots, who are often more experienced.

Between 1999 and 2001, eight accidents involved pilots over seventy (7 % of accidents). The number of licences held by these pilots is relatively low (3 % of licence holders in France). Although, in absolute terms, few events occurred to these pilots, the proportion shows that they are more often involved in serious accidents.

Figure 4 : Accidents by pilot age groups

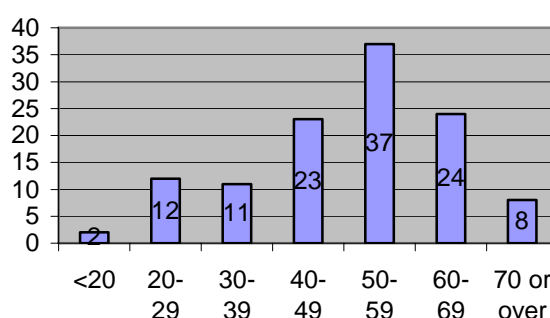


Figure 5 : Age of pilots involved in an accident



⁹ The figures relating to accidents are sometimes assembled by activity indicators (number of flying hours for example) supplied by the SFACT or the FFVV. The results are then rounded up when they are obtained by extrapolation of partial data .

Notes:

- The statistics are based on small numbers, making deeper interpretation more difficult. A precise knowledge of the overall activity of glider pilots would provide interesting comparative elements.
- The age of a pilot is automatically noted during an investigation. It is clear that it is not a cause in itself.

1.3.1.3 Pilots' experience

	Number of accidents	Number of deaths	Number of injuries
Experience < 100 FH	16	1	4
Experience 100 FH or more	98	19	29
Total	114	20	33

This table¹⁰ shows that limited flying experience does not appear to constitute a significant risk factor. Of the sixteen accidents involving pilots whose experience is less than a hundred hours, there were four injuries and one death. This category of pilots represents around 40 % of licence holders.

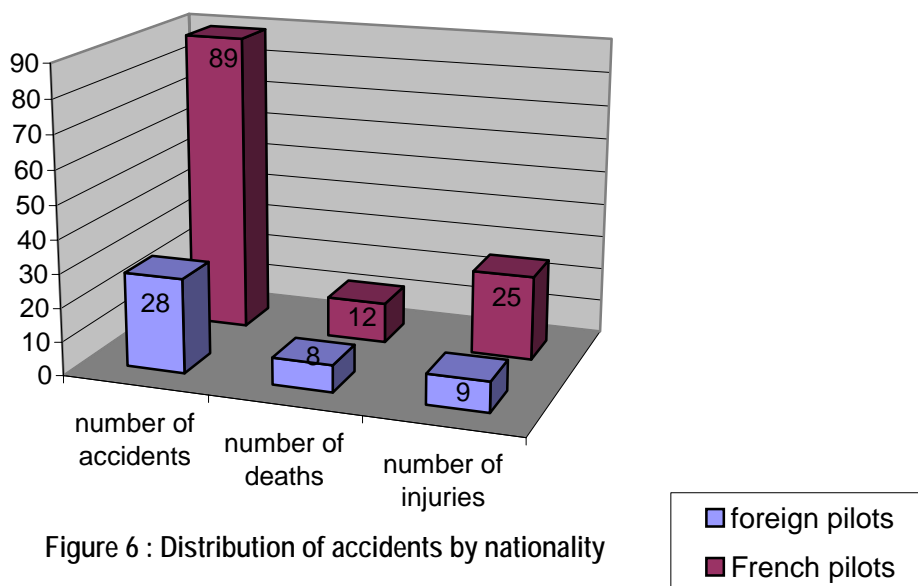


Figure 6 : Distribution of accidents by nationality

1.3.1.4 Nationality of participants

Foreign pilots are involved in a quarter of glider accidents in France. The number flying hours that they perform is not known precisely. If we refer to the estimation made by the FFVV (around 20 to 22 %), they are slightly more involved in accidents than French pilots. The seriousness of these events seems greater, however (40 % of deaths are of foreign pilots). Of eight foreign pilots killed

¹⁰ The data relating to the experience of the pilots was not available for three accidents.

between 1999 and 2001, five were German, two Dutch and one Italian. This figure is quite high in relation to the deaths of twelve French citizens.

1.3.2 Distribution of accidents

1.3.2.1 Seasonal distribution

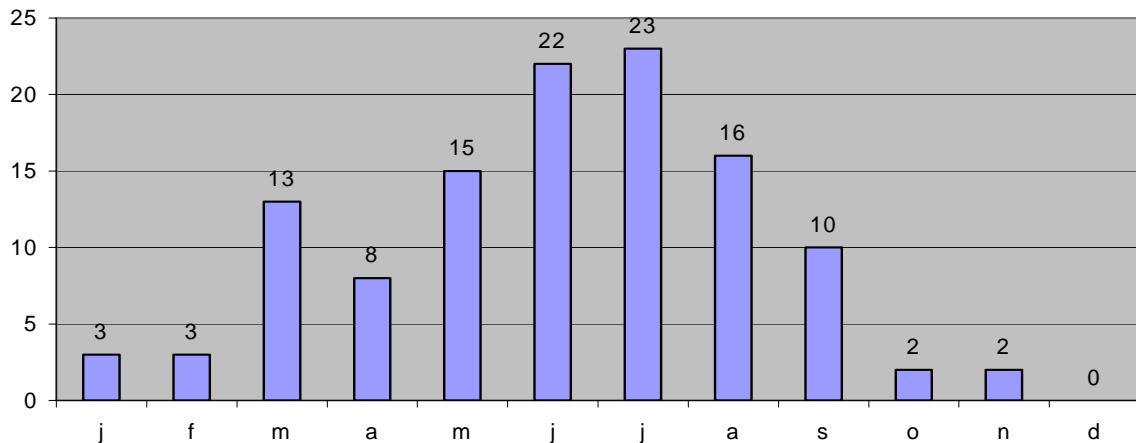


Figure 7 : Monthly distribution of accidents

Gliding is a seasonal activity. It is at a low level in the winter months and the month of March is marked by an influx of fliers into the southern Alps. The number of accidents follows this seasonal variation modified, however, by factors such as the lack of training at the beginning of the season or the desire to perform flights in meteorological conditions which are not very favorable.

1.3.2.2 Place of occurrence

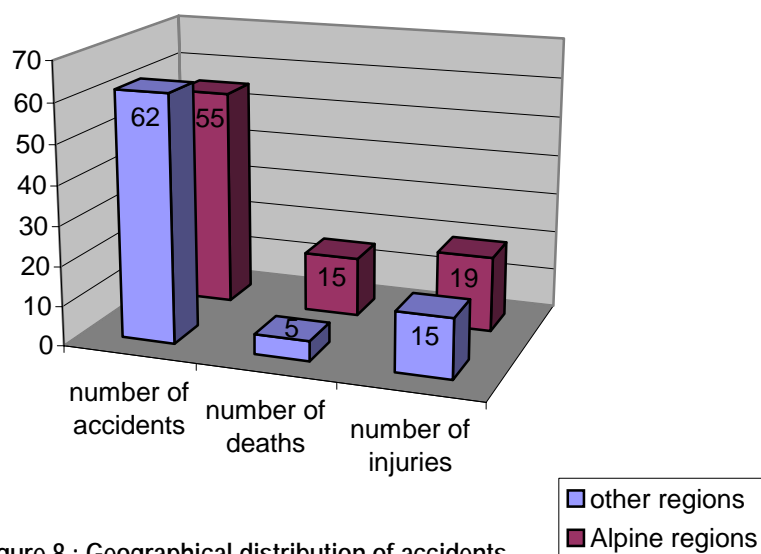


Figure 8 : Geographical distribution of accidents

Around 45 % of gliding accidents occur in alpine regions. Accidents located in these regions are considerably more serious than those located in the other regions of France. For the period 1999-2001, there were fifteen deaths in the alpine regions against five in other regions. For the years 2000 and 2001, it is noticeable that all of the fatal accidents occurred in this region (nine accidents, of which five following a collision with high ground). According to FFVV figures, around a third of national gliding activity is performed in this area. Two thirds of injuries occur there as well.

1.3.2.3 Phase of flight

The following graph shows the distribution of accidents and their consequences according to the phases of flight: take-off, cruise and landing. This graph shows that the majority of fatal accidents occur in cruise (flight near high ground). On the other hand, the largest numbers of accidents occur during the landing phases. However, the consequences to individuals are less significant.

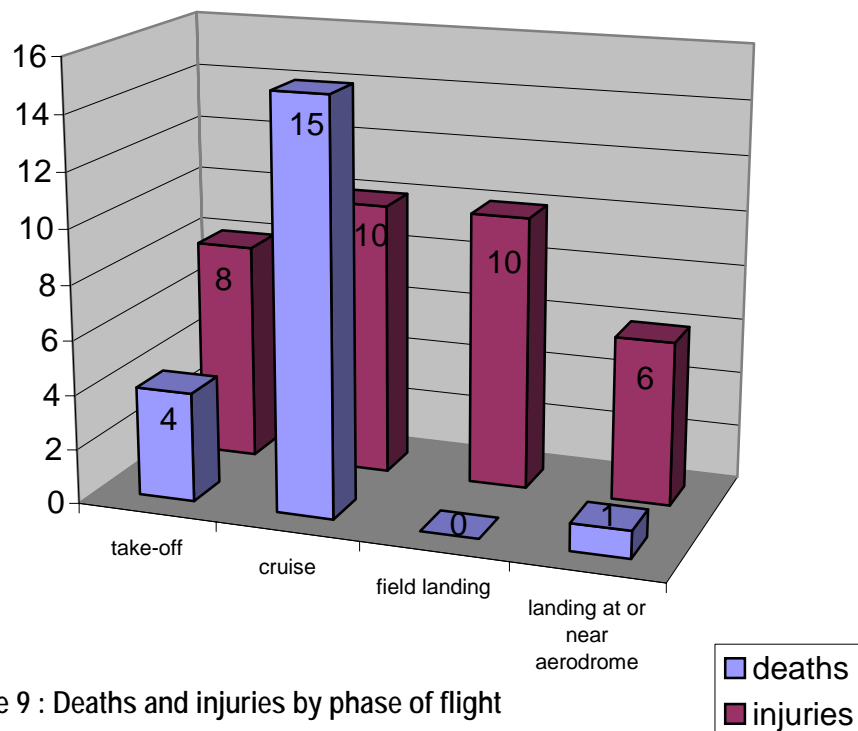


Figure 9 : Deaths and injuries by phase of flight

1.3.2.4 Type of aircraft

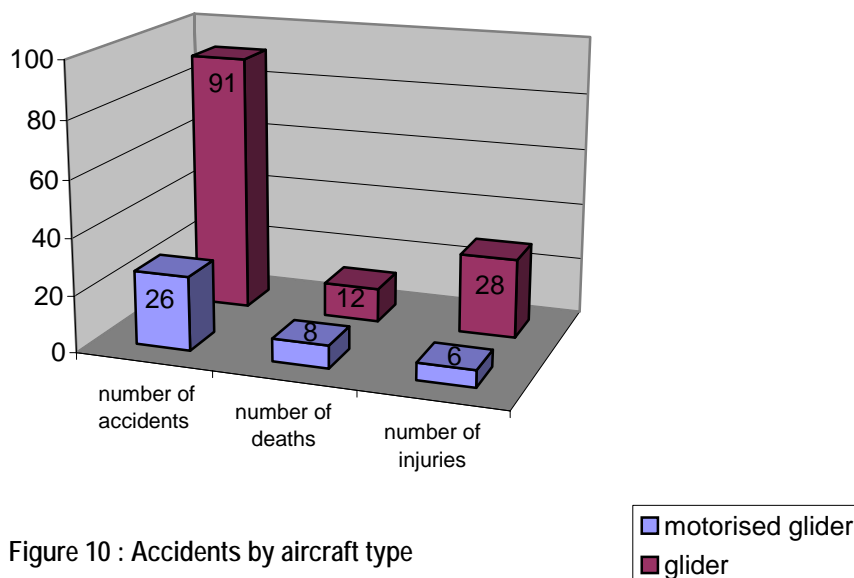


Figure 10 : Accidents by aircraft type

The comparison of statistics between gliders and motorised gliders shows that accidents involving motorised gliders are more often fatal than those involving gliders. Ninety-one glider accidents over the three years 1999, 2000 and 2001 caused twelve deaths (one death for eight accidents) while the twenty-eight motorised glider accidents, during the same period, caused eight deaths (a death in every three accidents).

1.3.2.5. Operational context

French pilots:

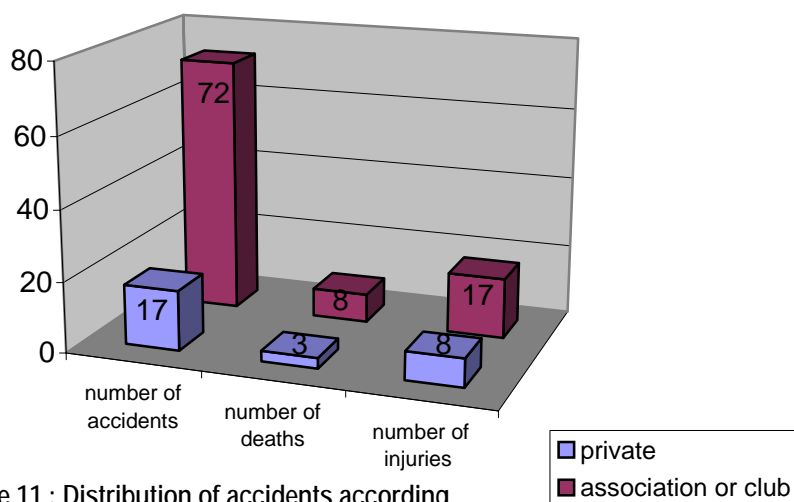


Figure 11 : Distribution of accidents according to operational context (French pilots)

The proportion of accidents which occurred to aircraft operated by their owners is significant when compared to overall activity. The consequences of these

accidents are generally more serious. Their study shows a lack or an absence of oversight and shows failings in skills maintenance and in flight preparation.

In case of malfunction of the homing beacon, during an accident, the alarm is generally raised later than when the glider is flying with an aero club.

Note: Events occurring to individual pilots flying outside of the context of an association or club are not always brought to the attention of the BEA when the damage is only to equipment.

Foreign pilots:

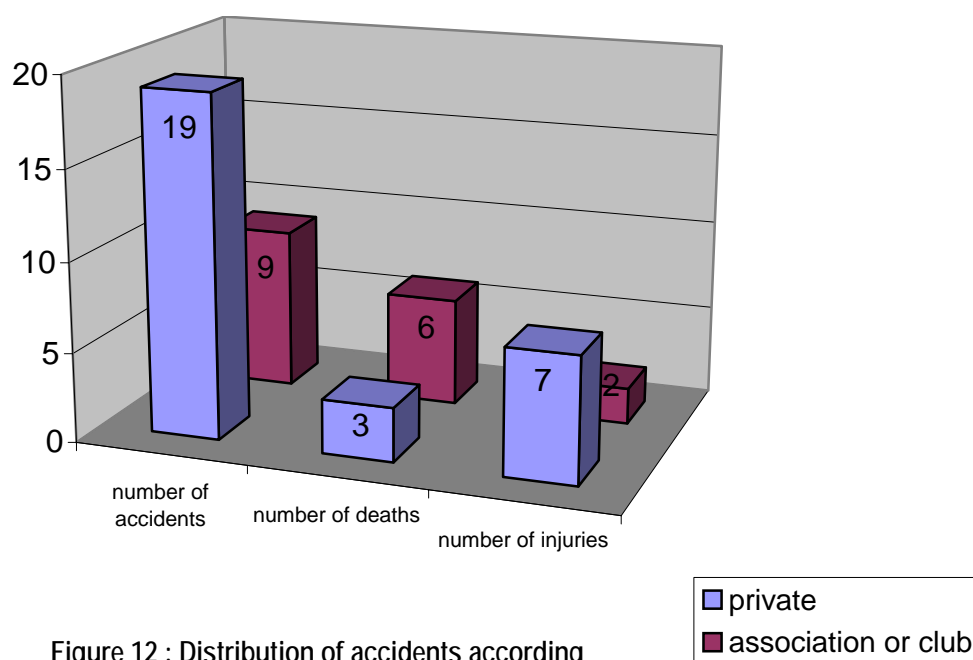


Figure 12 : Distribution of accidents according to operational context (foreign pilots)

During the season, only a few foreign aero clubs come to France with their equipment at the same time as their members and staff. The majority of foreign pilots flying in France are themselves owners of their aircraft. As a result, they do not benefit systematically from the support that the associations provide for their members, both for evaluation of their skills and for flight preparation.

2 - ANALYSIS AND CAUSAL FACTORS

An accident is not generally the direct consequence of a single cause but results from a chain or an accumulation of several factors. A factor which sets off an event is generally accompanied by factors contributing to its occurrence. In the following paragraphs the recurrent factors observed in the accidents studied are described.

2.1 Failings Occurring during Flight Preparation

Failings in taking action before the flight contributed directly to eleven accidents which caused five deaths and two injuries.

Pre-flight actions include both the tasks relating to the preparation of the flight (examination of the meteorological situation, study of the chart, etc.) and the checks on equipment to be performed before departure (pre-flight inspection, pre-take-off check-list, etc.).

In the associations, those responsible for flights give specific information, in the course of daily briefings, on the meteorological situation and forecast, the specifics of the airspace, instructions specific to the activity or for the aerodrome as well as other information essential for the flying operations. A debriefing on the flying conditions for the previous day is also sometimes carried out and allows pilots an a posteriori analysis of the situation. These briefings are also intended to draw the pilots' attention to any potential danger or to remind them of safety regulations. Lack of knowledge of these various elements is not generally the primary cause of an accident, but may favour its occurrence. The importance of the management in an association and the application of the internal regulations are clear in this situation. It is important to underline that this organised structure, with the provision of meteorological information and flight rules, is not systematically present in all associations or clubs.

The person responsible for flights ensures correct application of procedures, flight preparation and recent experience of pilots. Failings in the preparation of flights appear more frequently as causal factors in accidents occurring to pilots owning their own aircraft.

2.2 Decision Making

Late decision making was identified in twenty-six accidents which caused seven injuries.

Decision-making is an integral part of flight strategy. It corresponds to a succession of mental operations which must be performed in a period of time which is sometimes extremely short, particularly if the glider is flying at a low height.

It includes:

- the perception of information,
- the selection of relevant information and its comprehension,
- the representation of the situation,
- the integration of known procedures and of the regulations,
- decision-making in the available,
- carrying out the decision by acting,
- observation of the effects of actions and a « post-check » which initiates a new operational loop.

In the context of an investigation, only the pilots' actions are generally identifiable. If it appears that these actions are late or hurried, it is often because decision-making was not performed in time. This anomaly perhaps originates in a previous failure in the perception of information, in its comprehension in the representation of the situation or in the application of the pilot's knowledge.

Another element, difficult to determine during investigations, is the obstinacy of pilots wanting to continue their flight in unfavorable conditions. The reasons for this are various: performance objective during a circuit, competition between pilots, desire to return to the departure aerodrome... So many things may push pilots to want to continue their flights in an unfavorable environment. This cause was clearly identified in a forced landing which caused one injury (to be added to the figures above). It is however an underlying factor in numerous other cases.

Late decision-making and the obstinate continuation of the flight were brought to light in nineteen forced landings. All of these cases were characterised by an extremely short approach track, with a final turn at a very low height. The reduction of the track on final prevents any stabilisation of the aircraft, compromises the precision of the touchdown point and control of the flare. During this phase of flight and in particularly on the last turn, pilots can lose confidence and lose control of their aircraft as a result of flying too low, of the high work load, of stress due to the uncertainty of succeeding in the manoeuvre and of the pressure of time.

In accidents occurring during approach to an aerodrome, late decision-making generally results by an arrival at too low a height. This leads to either a collision with obstacles situated before the threshold of the runway (hedge, fence) or a landing in a field within immediate proximity of the installations.

2.3 Representation of the Situation, Evaluation of Meteorological Conditions

Twenty-six accidents which caused nine deaths and six injuries were mainly due to an incorrect assessment of meteorological and aerological conditions. Failure to take adequate account of some meteorological conditions may result in loss of control in flight or collision with high ground. The accidents which occur in these circumstances are frequently fatal.

For the year 2000, accidents which occurred following failure to take into account meteorological conditions mainly involved foreign pilots. More precisely, three quarters of fatal accidents involved foreign pilots surprised by certain aerological conditions near to high ground, essentially in the Alps. Certain specific meteorological situations can produce high sink rates, such as for example with well established airflows (Mistral or Tramontane) if one is under the wind on high ground or in a combination of downdraft breezes, when the slopes are no longer warmed by the sun, and subsidence near cumulus.

Several accidents involve a field landing or a take-off with an element of tailwind or an under-estimation of head wind on final.

Finally, an error of representation can sometimes be classed as an erroneous evaluation of the characteristics of the field chosen for an emergency landing or to an idea of the track which is inappropriate to the approach decided on.

2.4 Lack of Vigilance

Lack of vigilance was shown in eleven accidents which caused one death and four injuries.

These events generally occurred during the cruise phase (spiral, transition) and often occurred in the Alps. Gliders can fly there on circuit tracks, in localised updrafts or along slopes where the aerology is favorable. Thus, these aircraft fly near each other, or close to high ground, trees or cables.

Lack of vigilance can, for example, emerge when a poorly organised visual circuit leads the pilot to concentrate his attention on one specific flight parameter to the detriment of the required observation of the environment. This failure in more widespread attention during a visual circuit is particularly noticeable where the pilot's attention is focused on an anomaly, on a particularly difficult task (reading a chart) or on the instrument panel. New equipment, such as onboard computers or GPS, requires pilots to concentrate on reading indications or programming the system.

Lack of vigilance may sometimes lead to loss of control or a mid-air collision. It can also result in incorrect evaluation of height or distance. In this case, the anomaly may be linked to poor judgment, noted in late decision-making.

2.5 Fatigue

Fatigue is suspected to contribute to many accidents. It was clearly identified in four accidents which caused two deaths and an injury. The consequences of fatigue are often evident in missed landings. Fatigue is one of the factors which contribute to the chance of an accident. In the course of an investigation, this element is often difficult to discern. Glider flights are often of long duration. Without the pilot becoming really conscious of it, fatigue reduces effective action in an insidious manner. This can sometimes be added to the effects of heat, sun,

altitude and turbulence on the body. Eating and drinking, in particular on long flights, are also particularly important. In addition, for pilots coming from far away, the fatigue engendered by the trip is often not fully recovered from before the first flights, and the lack of practice in the previous months becomes a contributory factor. This phenomenon is particularly noticeable for foreign pilots coming to fly in France or for French pilots who have made a long trip a short time before flights.

2.6 Skill

Skill may be defined as a pilot's aptitude or ability to manoeuvre his aircraft.

This was a factor in forty-five events which caused six deaths and twelve injuries. Clumsiness or piloting errors lead to errors in control inputs. This anomaly followed by loss of control in flight. Lack of skills also occurs in phases of flight near the ground take-off, forced landing or at an aerodrome). This failing frequently appears in the causes of accidents occurring during flights at the beginning of the season or when the pilot has little experience of the glider type. The ergonomics of different types of gliders, frequently lacking homogeneity, sometimes causes confusion between controls when the pilots change type. This phenomenon happens more frequently in a period when the pilot is fatigued or under stress. Recent experience on and knowledge of the glider in use helps pilots to avoid these types of confusion.

For motorised gliders (autonomous gliders or gliders with stand-by engine), an inappropriate application of procedures for using the engine in flight may also lead to a rushed landing.

2.7 Training, Knowledge and Experience

In the course of a pilot's training, three areas can be identified:

- theoretical knowledge,
- practice,
- the pilot's personality.

Theoretical knowledge is acquired by reading specialised works or during courses given by instructors. Each new experience met by a pilot in the course of a flight builds onto this knowledge. Practice begins with the first lessons with the aid of an instructor and is then perfected over time. The personality of the pilot, his way of behaving faced with a given situation, are particular to him. However, the role of the instructor is also to exert an influence on the student's capacity to take appropriate decisions. The instructor is an example for the student who, during his initial flights, will try to apply what the instructor has taught him. He will be tempted to try to reproduce in solo flight the manoeuvres demonstrated under dual control. The instructor, aware of this phenomenon, takes precautions or avoids demonstrations which could be dangerous if the student subsequently tried to perform them prematurely in solo flight.

These three areas of pilots' training have an effect on his decision-making mechanisms. A failure in one of these areas may be the cause of inappropriate and potentially risky decision-making. A failure in basic training is difficult to detect in an investigation. Often, only the last actions leading to an accident may be noted.

An aggravating factor appears to come from premature and excessive self-confidence which may occur in the phase when the pilot has performed many flying hours after obtaining the licence. A lack of experience may lead a pilot to get himself into certain unusual situations, in particular during flight across the countryside.

3 - CONCLUSIONS

3.1 Some Characteristics of the Accidents Studied

Relating to pilots:

- accidents which occur to young pilots (under 25) are, proportionally, less frequent and less serious than accidents which occur to older pilots (70 and over),
- individual pilots are more susceptible to accidents than pilots flying within an organised structure,
- a low level of experience does not appear to constitute a significant risk factor,
- foreign pilots seem to have proportionally more serious accidents than French pilots.

Relating to the environment:

- accidents occurring in the Alps are often more serious than those occurring in other regions of France (double the mortality rate for an identical number of accidents),
- accidents occurring during landing phases (in the country or at an aerodrome) have less serious physical consequences compared to those occurring during cruise phases,
- the death rate is higher in accidents involving motorised gliders.

3.2 The Most Frequent Causes of Accidents

The study shows that the main causes leading the most frequent and the most serious accidents are:

- failings in pre-flight actions, which include both participation in briefings and pre-takeoff checks,
- erroneous evaluation of meteorological conditions. This may lead to a collision with high ground,
- inappropriate piloting actions (confusion between controls or inappropriate actions on the stick), accentuated by lack of recent experience or on type,
- late decision-making to return to the aerodrome or to land in an identified site.

Note: fatigue was suspected in numerous accidents following long flights or long car trips.

4 - ACTIONS AND SAFETY ADVICE

4.1 Actions for Safety

Following accidents in 1996, the BEA approached some European organisations, in particular the Deutsche Aeroclub. Since 1996, the permanent accident investigation organisations and user groups have been invited to a meeting every two years in order to promote an exchange of information aimed at improving prevention among practitioners.

4.2 Principal Recommendations already Issued by the BEA

The investigation into a mid-air collision between two gliders¹¹ led the BEA to issue two safety recommendations:

1. « *that the DGAC conduct a study of the various means available to make gliders more visible (reflective strips, flashing lights, etc...) with a view to making such equipment mandatory.* »
2. « *that the DGAC establish as quickly as possible the conditions for authorising flight in mountainous regions.* »

Following this mid-air collision, certain clubs and organisations began to install reflective strips on gliders¹². This equipment was then made mandatory for events in the French Championship. It is however important to note that the prevention of mid-air collisions is directly linked to external vigilance and to the detection of other gliders flying in the vicinity while respecting the general rules of priority and those which apply during mountain flights. This point must be emphasized during training of private pilots and of instructors.

4.3 Training and Risk Awareness

It is vital, during pilot and instructor training, to insist on the importance of pilots' judgment and decision-making during a flight. Late decision-making was clearly identified in twenty-six accidents which occurred between 1999 and 2001. Real-life cases calling upon the pilot's judgment could thus be more systematically studied during pilot training.

Pilots who own their own aircraft more often fly outside of any organised structure and thus do not benefit from advice from senior pilots or the briefings offered by a club. These pilots could benefit from advice and support from the person responsible for an aerodrome. Analysis of the statistics shows that meteorological and flight safety briefings given in aero clubs are essential elements for the good

¹¹ Mid-air collision which occurred on 4 June 1998 at Hautes Duyes (04) between two gliders.

¹² A mid-air collision appears to have been avoided. (see REC info n°6 of 2002)

flight performance. Those responsible for must insist on maintaining and promoting this practice.

It is important to make foreign pilots aware of flying conditions in the mountains, of taking into account the aerology near high ground and of the risks run in flying under the wind in these locations. It is also important to stress the phenomenon of fatigue which occurs after a long trip or a succession of long flights several days in a row. This fatigue, which is often insidious, leads to a lowering of vigilance and a modification of judgment and decision-making capability.

Finally, it is important to promote feedback, since minor events experienced by pilots can:

- be precursors to other events which may be more serious,
- provide examples to be used during pilot training.

List of appendices

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Fault tree

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Appendix 4A: Missed take-off

Fault tree

Example of the accident to the glider registered D-7390

Appendix 5: Definitions

List of Accidents

Dpt : Department

D : Deaths

I : Injuries

U : Unhurt

Date	Place	Dpt	Model	Event	D	I	U
02/01/99	ISSOIRE Aerodrome	63	Wassmer WA 22 A	Hard Landing on solo flight.	0	0	1
15/01/99	SEILLANS	83	Schleicher S.F.B KA 6 E	Collision with trees.	0	0	1
16/01/99	ITXASSOU Aerodrome	64	Centrair 101 T « pégase »	Hard landing following a non-stabilised approach.	0	0	1
12/02/99	GORNIES	34	Grob 103 C « Twin 3 Accro »	Mid-air collision in flight with an airliner.	0	0	2
25/02/99	LA BREDE	33	Scheibe SF28A « Tandem Falke »	Engine stopped followed by an emergency landing in a vineyard.	0	0	2
14/03/99	LA MOTTE DU CAIRE	04	Przedsiebiorstwo SZD 55- 1	Collision with high ground.	1	0	0
20/03/99	REVEL Aerodrome	31	Scheibe SF 25 C « Falke »	Collision with the ground, missed go-around in a motorised glider.	0	0	1
24/03/99	OLORON Aerodrome	64	Schempp Hirth « Janus C »	Passage in high position during tow. The pilots released the cable and the glider crashed into the ground.	0	1	1
22/04/99	THEIZE	69	Schempp Hirth CS 11-75	Missed forced landing.	0	0	1
25/04/99	VEYNES	05	Schempp Hirth « Ventus B 16 »	Passage through IMC, in-flight rupture.	0	0	1
28/04/99	BAILLEAU Aerodrome	28	Glaser Dirks DG 500 Elan TR « Trainer »	Ground loop on landing.	0	0	2
01/05/99	STRASBOURG NEUHOF Aerodrome	67	Vazduhoplovno Cirrus	Pilots ill during take-off with winch.	1	0	0
08/05/99	ROCHEFORT Aerodrome	17	Scheibe SF25 B « Falke »	Ground loop on landing.	0	0	2
09/05/99	SEYNE LES ALPES	04	SZD 48-1 Jantar Standard 2	Collision with high ground.	0	1	0
24/05/99	DIJON-DAROIS Aerodrome	21	Grob G103 « Twin Astir »	Loss of control of glider during take-off with winch.	0	0	2
04/06/99	MALLEFOUGASSE	04	Rolladen Schneider LS3- 17	The glider was caught in downdrafts and crashed into the ground.	0	1	0
05/06/99	OLORON Aerodrome	64	Grob G103 « Twin Astir »	Ground loop on landing while under instruction.	0	0	2
08/06/99	MENESTREAU EN VILLETTE	45	Centrair 101 T « Pégase »	Collision with trees.	1	0	0
12/06/99	CHATEAU-ARNOUX Aerodrome	04	Schempp Hirth « Ventus B »	Loss of control on take-off.	0	1	0
13/06/99	PUY SAINT EUSEBE	05	Schleicher ASW20 F	Spin followed by collision with high ground.	1	0	0

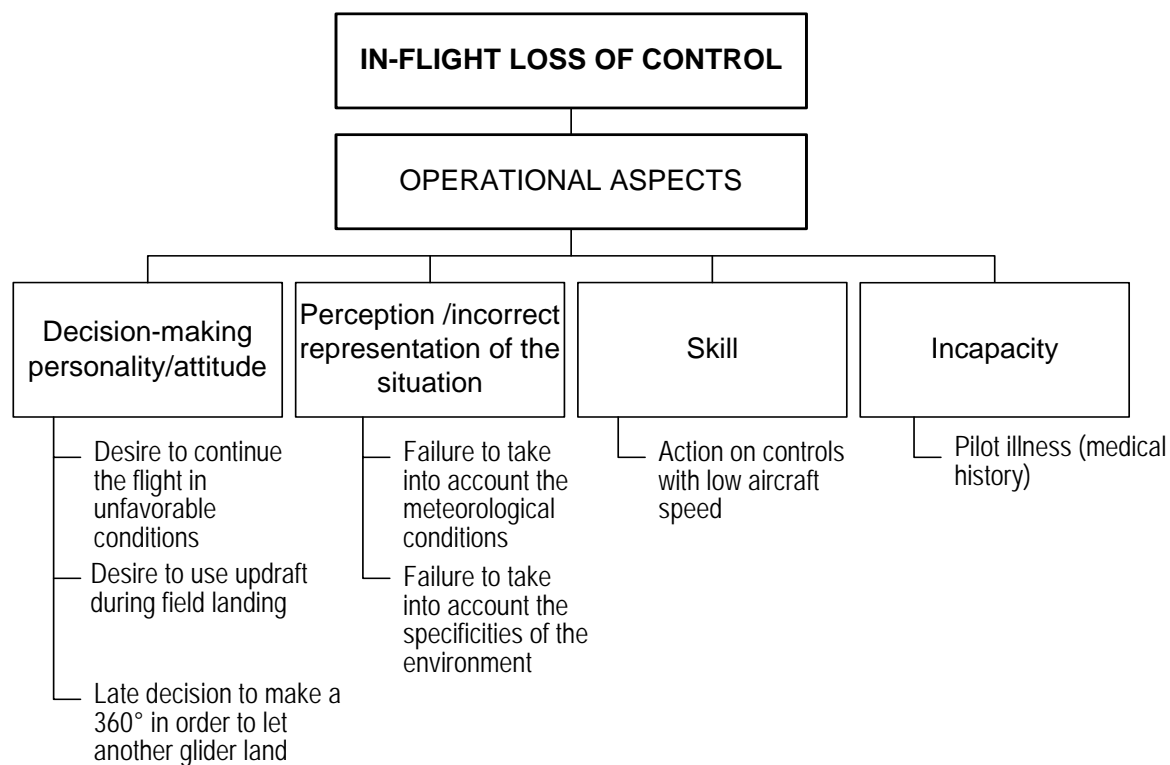
Date	Place	Dpt	Model	Event	D	I	U
16/06/99	PEYRESTORTES	66	Glaser Dirks DG500 M « Trainer »	Problem with engine retraction followed by missed forced landing.	0	0	2
19/06/99	CHATILLON SUR MORIN	51	Glaser Dirks DG 600	Mid-air collision between a LS4 and a Glaser Dirks glider.	0	1	0
19/06/99	CHATILLON SUR MORIN	51	Rolladen Schneider LS4	Mid-air collision between a LS4 and a Glaser Dirks glider.	1	0	0
02/07/99	BESSANS	73	Glaser Dirks DG 800 B	Spin followed by collision with high ground.	1	0	0
03/07/99	SAINT SYMPHORIEN D'OZON	69	Rolladen Schneider LS6 B	Loss of altitude missed forced landing.	0	1	0
07/07/99	ISSOUDUN Aerodrome	36	Schempp Hirth « Nimbus 4 D »	Missed landing during a stage in the French Championship.	0	0	2
09/07/99	SAINT MARTIN OF LONDRES	34	Schempp Hirth CS 11	Missed forced landing.	0	0	1
11/07/99	JOIGNY Aerodrome	89	Hoffman H 36 Dimona	Loss of control during initial climb.	2	0	0
15/07/99	MERVILLE Aerodrome	59	Carman M100 S « Mésange »	Missed landing.	0	0	1
16/07/99	CHESSY LES MINES	69	Scheibe 11 L.C.A	Forced landing, collision with trees.	0	0	1
17/07/99	SEURRE	21	Stemme S10V	Loss of propeller blade in flight.	0	0	2
17/07/99	PEYRUS	26	Scheibe SF28A « Tandem Falke »	Loss of control in flight, collision with trees.	1	1	0
19/07/99	BLOIS Aerodrome	41	Schleicher ASW20 L Top	Stall during final turn, collision with the ground.	0	1	0
21/07/99	LA ROCHE BERNAUDE Pass	05	Schleicher ASH 26E	Collision with the high ground.	1	0	0
30/07/99	ECHALLON	01	Grob G102-77 Astir CS	Missed forced landing.	0	0	1
01/08/99	CHAUVIGNY	86	Schempp Hirth « Nimbus 2 »	Release at height of 40 metres after take-off, collision with the ground.	0	1	0
20/08/99	VIGOUX	36	Aviasa CR A60 Fauconnet	Missed forced landing.	0	1	0
24/08/99	MONT LOUIS LA QUILAINE Aerodrome	66	Centrair CT 201 B « Marianne »	Loss of control during landing with tailwind while under instruction.	0	1	0
31/08/99	PERIGUEUX Aerodrome	24	Grob G103 « Twin Astir »	Hard landing on solo flight.	0	0	1
04/09/99	LES MOISES	74	S.T.R.A CB 15 « Cristal »	Loss of control during winched take-off.	0	1	0
05/09/99	PEYROULES	04	Schleicher ASW20 L	Mid-air collision between an ASW20 and a Ventus.	0	0	1
05/09/99	PEYROULES	04	Schempp Hirth Ventus CM	Mid-air collision between an ASW20 and a Ventus.	1	0	0
10/10/99	VALERNES	04	Rolladen Schneider LS4 A	Stall in a turn, collision with the ground.	0	1	0
25/11/99	PERPIGNAN-RIVESALTES Aerodrome	66	Scheibe SF 28A « Tandem Falke »	Hard landing.	0	0	1
06/02/00	NANCY MALZEVILLE	54	Scheibe SF 28 A	Loss of control on final after canopy	0	0	2

Date	Place	Dpt	Model	Event	D	I	U
	Aerodrome		« Tandem Falke »	opened unexpectedly.			
01/03/00	VIENNE Aerodrome	38	Scheibe SF 25 E « Super Falke »	Loss of control on take-off.	0	0	2
08/03/00	VERDACHES	04	Glaser Dirks DG 200	Forced landing, collision with the terrain.	0	0	1
11/03/00	OLORON SAINTE MARIE	64	Centrair 101 A «Pégase»	Forced landing, confusion between controls on final.	0	0	1
16/03/00	SEYNE LES ALPES	04	Schempp Hirth Discus BT	Collision with trees.	0	1	0
19/03/00	PUIVERT Aerodrome	11	Avialsa A60 « Fauconnet »	Forced landing, collision with an electric cable.	0	1	0
21/03/00	FAYENCE Aerodrome	83	Stemme S10 VT	Missed landing.	0	0	1
21/03/00	AVRIEUX, Pelouse pass	73	Glaser Dirks DG 600 M	Spin, collision with high ground.	1	0	0
22/04/00	STRASBOURG NEUHOF Aerodrome	67	Schleicher ASW20 F	Collision with a winch cable during take-off roll.	0	1	0
01/05/00	ISSOUDUN Aerodrome	36	Centrair 201 A «Marianne»	Missed landing.	0	0	2
03/05/00	SAUCATS	33	Centrair C 101 A «Pégase»	Forced landing, collision with trees.	0	0	1
08/05/00	SAUMUR Aerodrome	49	Centrair C 101 A «Pégase»	Missed abandoned take-off.	0	0	1
22/05/00	SOLLIERES Aerodrome	73	Rolladen Schneider LS 6 C	Loss of control during low wing tow.	0	1	0
01/06/00	SERANON	06	Glaser Dirks DG200-17	Missed forced landing.	0	0	1
07/06/00	VINON	04	Condor (Construction amateur)	Loss of power of motorised glider on take-off, collision with the ground during turn back to the runway.	0	1	0
07/06/00	FLORAC Aerodrome	48	Centrair 201 B 1 « Marianne »	Loss of control during winched take-off on instruction flight.	0	0	2
11/06/00	METZ EN COUTURE	62	Grob G103 « Twin Astir »	Missed forced landing.	0	0	2
16/06/00	MONT DAUPHIN Aerodrome	05	Glaser Dirks DG 500 M « Trainer »	Unintended cable release, missed forced landing.	0	0	2
22/06/00	BUNO BONNEVAUX	91	Grob G103 « Twin Astir 2 »	Forced landing, collision with obstacles.	0	0	2
24/06/00	CANJUERS	83	Glasflugel 201 B « Standard Libelle »	Loss of control, collision with high ground.	1	0	0
05/07/00	SEGRY	36	Schempp Hirth « Discus 2 B »	Collision with an electric line.	0	0	1
11/07/00	LA CHARCE	26	Schempp Hirth « duo Discus »	Missed forced landing.	0	2	0
16/07/00	BARCELONNETTE Aerodrome	04	Glasflugel « Standard Libelle » 201 B	Short landing, collision with trees.	0	0	1
18/07/00	LA ROCHE ESCLAPON	83	Glasflugel H304	Missed forced landing, failure to allow for wind.	0	0	1
22/07/00	MAJASTRES	04	Schempp Hirth « Ventus 2	Collision with high ground.	0	1	0

Date	Place	Dpt	Model	Event	D	I	U
			C »				
27/07/00	SERRES	05	S.D.A. Rallye 235 E-D	Passage in high position by glider during tow, tow plane collided with the ground.	1	0	0
01/08/00	LYON CORBAS Aerodrome	69	Grob G102-77 Astir CS	Short landing, collision with obstacles.	0	0	1
02/08/00	TOURS LE LOUROUX Aerodrome	37	Wassmer 30 « Bijave »	Collision with obstacles during a short landing court, failure to allow for wind on final.	0	1	1
03/08/00	SAINTES Aerodrome	17	Grob G102-77 Astir CS	Missed landing.	0	0	1
10/08/00	ALDUDES	64	Schleicher ASK 21	Hard forced landing.	0	1	1
15/08/00	COULOMMIERS Aerodrome	77	Grob G102 Astir J	Missed landing.	0	0	1
10/09/00	PORTA, CAMPCARDOS Range	66	Glaser Dirks DG 400	Collision with high ground, inadequate allowance for meteorological conditions.	0	1	0
18/09/00	SAINT JURs Pass	04	Glaser Dirks DG 400	Collision with the high ground.	1	0	0
03/03/01	AILLON LE JEUNE	73	Schleicher ASK 13	Collision with the high ground.	0	0	1
16/03/01	BARCELONNETTE Aerodrome	04	Schempp Hirth « Discus » BT	Missed landing, inappropriate use of turbo.	0	0	1
24/03/01	SERRES LA BATIE Aerodrome	05	Schleicher ASH 25	Loss of control on take-off in motorised glider.	0	1	1
07/04/01	FAYENCE Aerodrome	83	H.A.O.C. HK 36 R « Super Dimona »	Hard landing, confusion between controls.	0	0	2
12/04/01	MONTAGNAC MONTPEZAT	04	Schleicher ASK 13 B	Missed forced landing.	0	1	0
12/04/01	GRAULHET Aerodrome	81	Grob G 102-77 Astir CS	Hard landing, confusion between controls.	0	0	1
14/04/01	PONT SAINTE MARIE	10	Rolladen Schneider LS4 B	Missed forced landing.	0	1	0
08/05/01	PONT SUR YONNE Aerodrome	89	Rolladen Schneider LS1 F	Loss of control after take-off during towing.	0	0	1
11/05/01	VILLEFRANCHE TARARE Aerodrome	89	Scheibe SF 25 E « Super Falke »	Ground loop during landing.	0	0	1
16/05/01	BORDEAUX LEOGNAN Aerodrome	33	Rolladen Schneider LS1 D	Ground loop during take-off.	0	0	1
24/05/01	SAINT QUENTIN Aerodrome	02	Schleicher ASK 13	Missed landing, collision with the ground.	0	1	0
26/05/01	SARROGNAN	39	Schempp Hirth Janus B	Missed forced landing.	0	0	1
26/05/01	ANDELOT EN MONTAGNE	39	Centrair 101 A « Pégase »	Collision with electric line during forced landing.	0	0	1
28/05/01	BLOIS Aerodrome	41	H.A.O.C. HK 36 TTC « Super Dimona »	Missed touch and go while under instruction in motorised glider.	0	0	2
07/06/01	PEYROULE	04	Centrair 101 A « Pégase »	Missed forced landing , collision with obstacle.	0	0	1
07/06/01	PRESLES	38	Centrair 101 A « Pégase »	Collision with trees on a ridge.	0	0	1

Date	Place	Dpt	Model	Event	D	I	U
13/06/01	LYON BRINDAS Aerodrome	69	Centrair 201 B 1 « Marianne »	Missed landing.	0	0	2
20/06/01	FAYENCE Aerodrome	83	Schempp Hirth « Ventus CM »	Missed take-off in motorised glider.	0	0	1
21/06/01	MAS DE LONDRE	34	Rolladen Schneider LS 4	Missed forced landing.	0	0	1
29/06/01	SAINT GIRONS ANTICHAN Aerodrome	09	Centrair 201 B « Marianne »	Missed winching.	0	0	2
30/06/01	COLMAR HOUSSEN Aerodrome	68	Grob G 102-77 ASTIR CS	Ground loop on landing while under instruction.	0	1	0
13/07/01	GUILLESTRE	05	Rolladen Schneider LS 7	Collision with trees on a ridge.	0	0	1
23/07/01	SAINT JURs	04	Schleicher ASW 24	Stall on final following a simultaneous landing with another glider on the same runway.	1	0	0
23/07/01	MONTAGNE DU SEMNOZ	74	Schempp Hirth « Janus CM »	Missed forced landing.	0	0	2
26/07/01	ENTREPIERRES	04	Centrair 101 A « Pégase »	Collision with electric line.	0	1	0
27/07/01	GRAND ARC Massif	73	Schleicher ASW 20 F	Collision with high ground.	1	0	0
01/08/01	BLEGIERS	04	Rolladen Schneider LS 4	Collision with high ground.	0	1	0
03/08/01	LA FERRIERE	85	Centrair 101 A « Pégase »	Landing in field with tail wind.	0	0	1
10/08/01	VEBRON	48	Centrair SNC 34 C « Alliance »	Collision with trees during instruction.	0	0	1
14/08/01	LABROSSE	45	H.A.O.C. HK 36 TTC « Super Dimona »	Collision with an electric line during exercise to land in field during instruction.	0	2	0
14/08/01	TOURS LE LOUROY Aerodrome	37	Schleicher ASW 15 B	Missed landing in flight solo.	0	0	1
23/08/01	VESCÉMONT	90	Centrair 101 A « Pégase »	Confusion between controls during forced landing.	0	0	1
25/08/01	FALAISE Aerodrome	14	Glaser Dirks DG500/22	Poorly controlled ground roll, collision with a hangar.	0	0	2
02/09/01	BARCELONNETTE Aerodrome	04	Rolladen Schneider LS 6 B	Collision with trees in finale.	0	0	1
10/09/01	VALAVOIRE	04	Centrair 101 A « Pégase »	Passage under the wind over high ground, forced landing.	0	0	1
12/09/01	LES MEES	04	Centrair 101 A « Pégase »	Missed landing in field.	0	1	0
28/09/01	SAINT PAUL SUR UBAYE	04	Centrair SNC 34 C « Alliance »	Collision with high ground during instruction.	2	0	0
28/09/01	BEAUREGARD BARET	26	Centrair 101 A « Pégase »	Collision with trees on a ridge.	1	0	0
06/10/01	SAINT ANTOLY	31	Centrair 201 B1 « Marianne »	Missed landing in field.	0	0	2
01/11/01	OUENGHI Aerodrome	NC	Grob G 103 G « Twin Astir »	Rupture of tow cable.	0	0	2

Appendix 2: Fault tree



ACCIDENT
to the glider registered I-DLEA

Event :	loss of control, collision with high ground.
Probable cause:	flying at low speed and height in a very turbulent atmosphere.

Consequences and damage:	pilots killed, aircraft destroyed.
Aircraft:	Glasflügel H201B Standard Libelle glider.
Date and time:	Saturday 24 June 2000 at 13 h 30.
Operator:	private.
Place:	Canjuers (83).
Nature of flight:	circuit.
Persons on board:	pilots.
Qualifications and experience :	pilots, aged 59, PPGL issued 1983 by Italy, 1 200 flying hours flight, of which 200 h on type and 30 h in the three previous months.
Meteorological Conditions:	estimated at the accident site: convergence of a 10 kt sea breeze from the south-east and a westerly flow, generating strong turbulence, CAVOK.

Circumstances

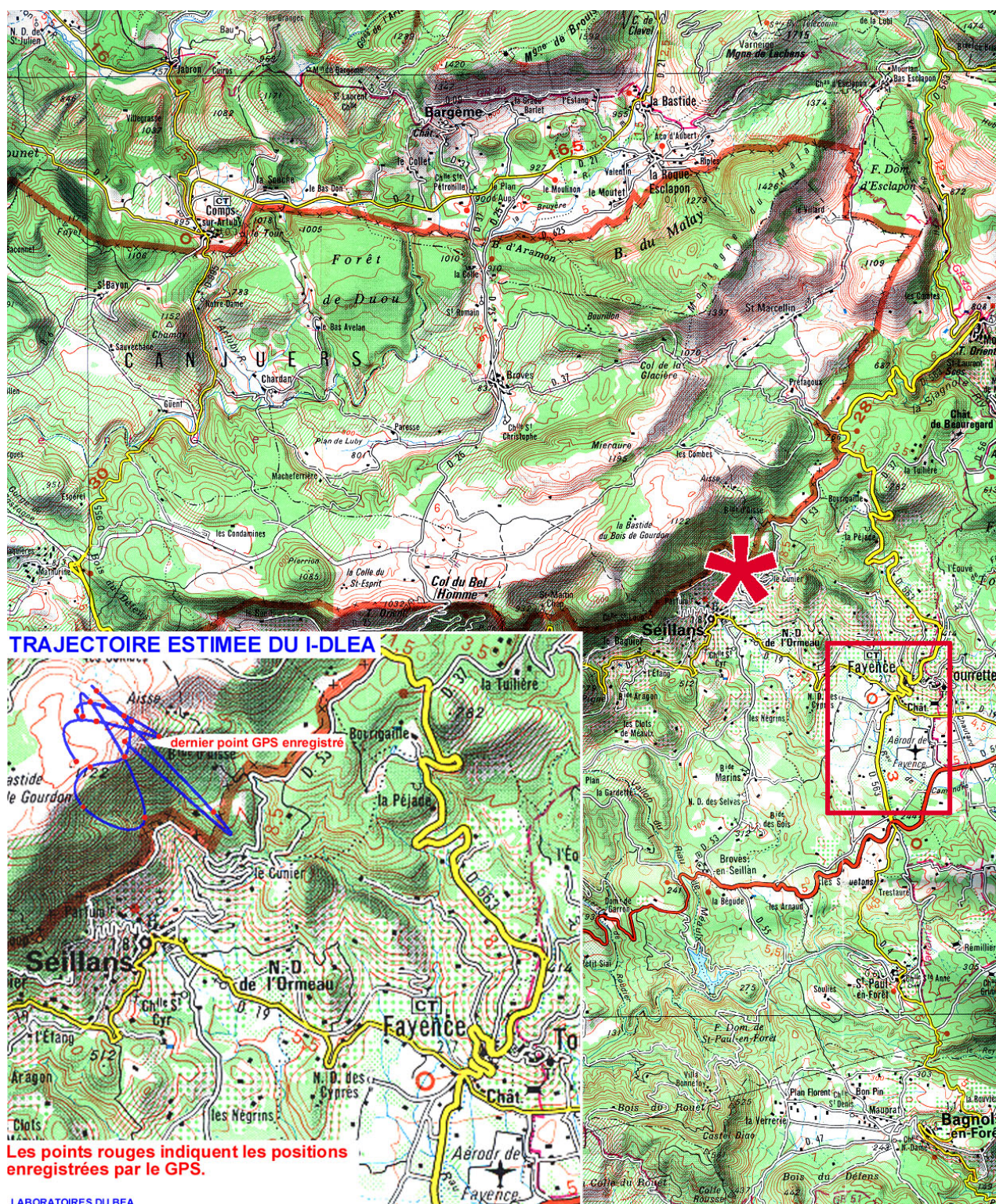
After seven minutes of towing, the pilot released the cable at an altitude of 1 100 metres. The pilot of the tow aircraft saw it bank to the left towards the slope. The glider then flew for less than fifteen minutes before crashing at the top of the slope of the high ground at Seillans.

The wreckage was located by the pilot of an aircraft which raised the alarm. It was not dispersed over a large area. Examination showed that the glider struck the high ground very near the top with a relatively high speed and when banking to the right.

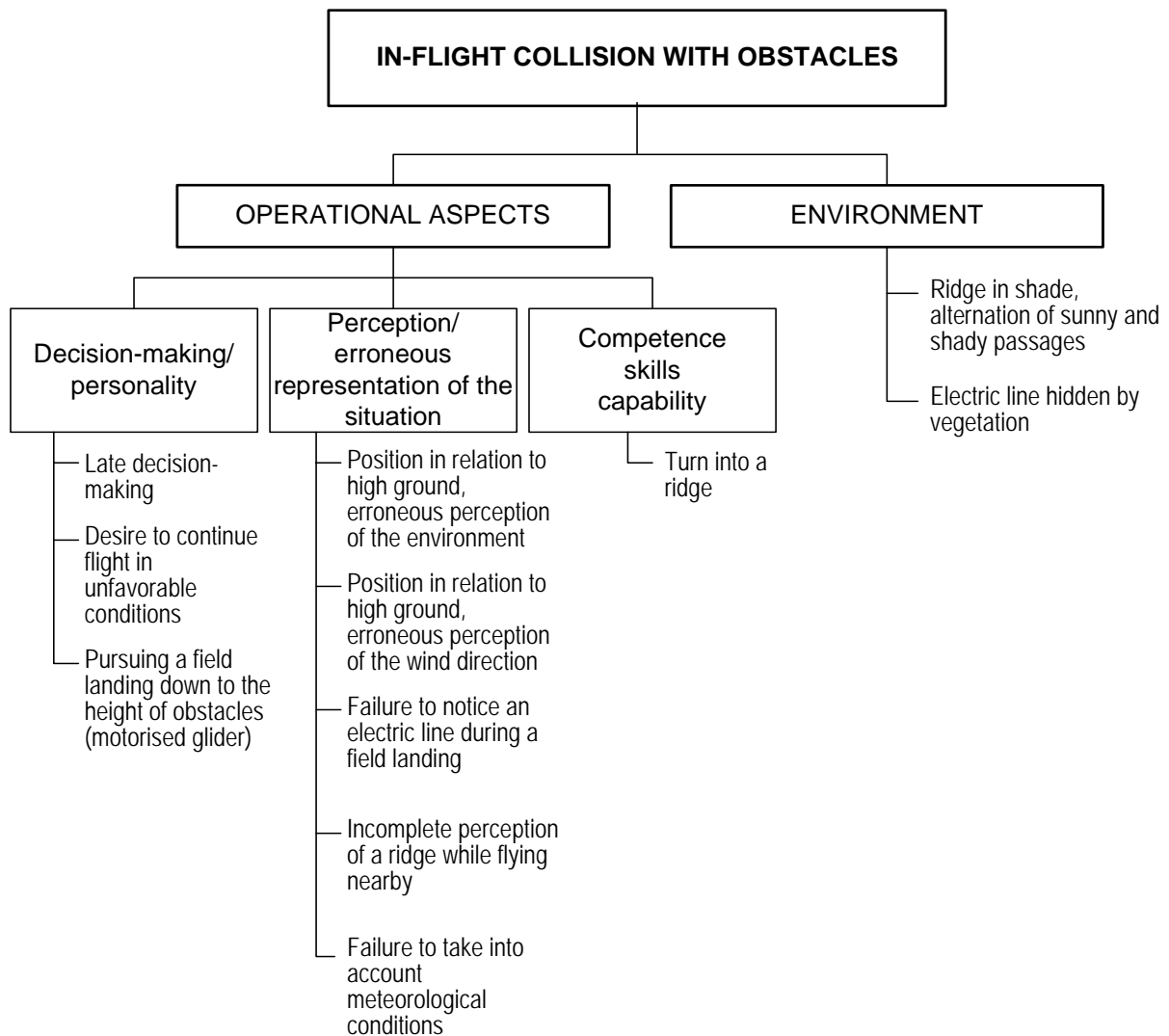
The glider had remained in the air for a short time. Its pilot was doubtless trying to make use of updrafts by flying near to the south-west slope of the high ground at Seillans, from where he had set off.

The position of the wreckage showed that the pilot had banked to the right very near the top of the slope. It is likely that he performed this bank at too low a speed, a manoeuvre which, combined with the turbulence, could have caused the glider to go into a spin and a loss of control, leading to the collision with the nearby high ground.

Accident to I-DLEA on 24 June 2000



Appendix 3: fault tree



ACCIDENT

to the glider registered F-CHDS

Event :	collision with trees.
Probable cause:	incomplete perception of the environment.

Consequences and damages:	aircraft severely damaged.
Aircraft:	single-seat Centrair C 101 A " Pégase " glider.
Date and time:	Thursday 7 June 2001 at 16 h 15.
Operator:	private.
Place:	Les Ramiettes, near Presles (38), altitude 1400 metres.
Nature of flight:	circuit.
Persons on board:	pilot.
Qualifications and experience :	pilot, aged 51, PPGL issued 1979, 860 flying hours, of which 339 on type and 67 in the previous three months, all on type.
Meteorological Conditions:	estimated at the site of the accident : wind 040°/ 10 kt, visibility over 10km, FEW at 5000 feet.

Circumstances

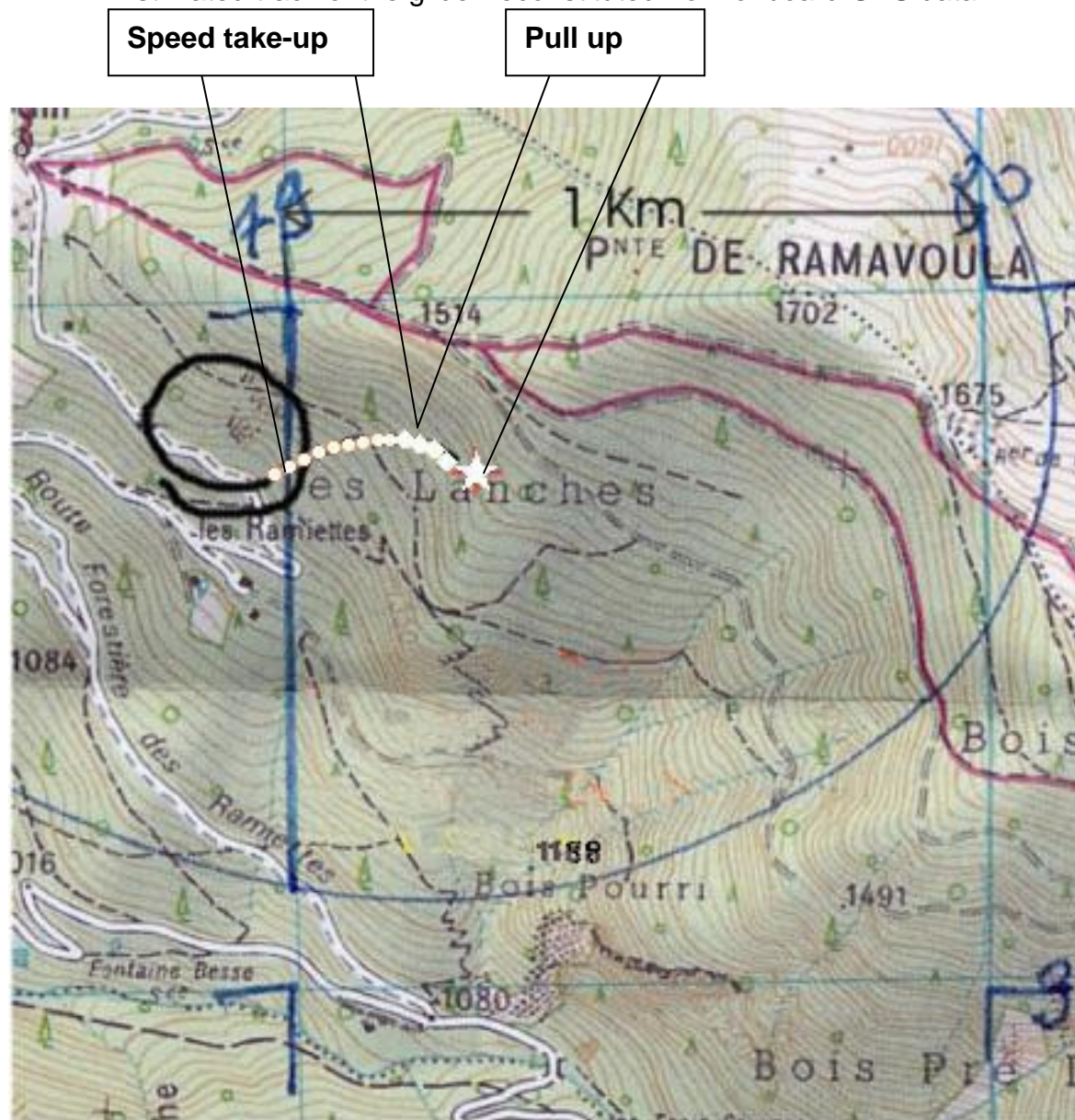
Information on the conduct of this flight was obtained from the pilot.

He took off from Grenoble Le Versoud at 12 h 53. After an hour and fifteen minutes flying, he arrived in the Ramavoula point sector (see chart on following page). He went into a left spiral over the area known as Les Ramiettes. The updraft, difficult to centre, was at 1 m / s.

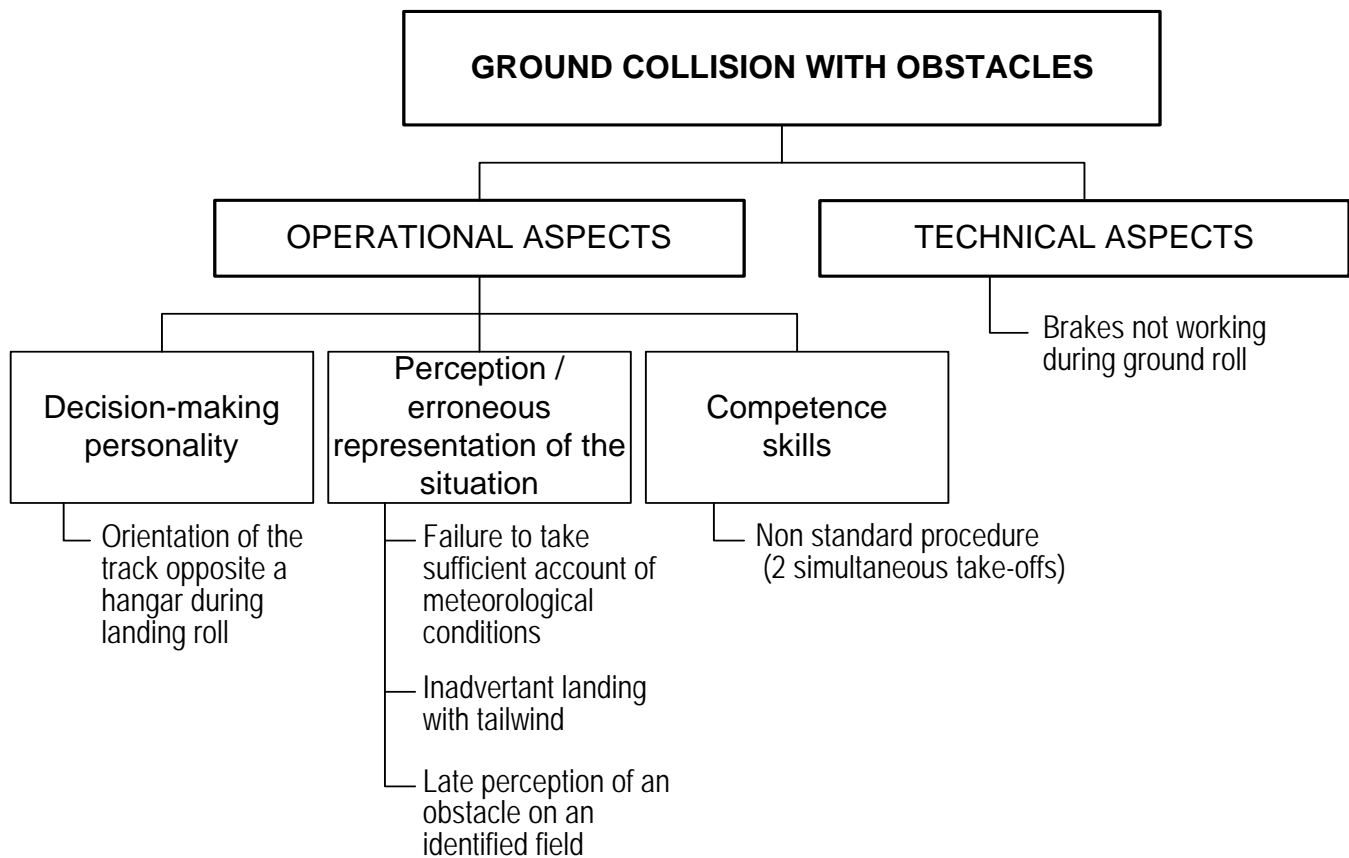
The indicated speed of the glider was 100 km / h. At the level of the ridge, the vertical speed became negative. In order to shift a little to the east where cumulus was forming, the pilot changed the direction of his spiral. Although he began this manoeuvre at the farthest point from the high ground, he found himself facing a ridge whose presence he had not noticed and whose contours he had not evaluated. He picked up speed and pulled up to cross the high ground. The aircraft touched the line of trees with its left wing without having stalled and crashed to the ground. The pilot had already flown over the area but had never flown over this ridge. He added that the light was un-contrasted. This phenomenon may have contributed to his incomplete perception of the environment.

Accident to F-CHDS on 7 June 2001

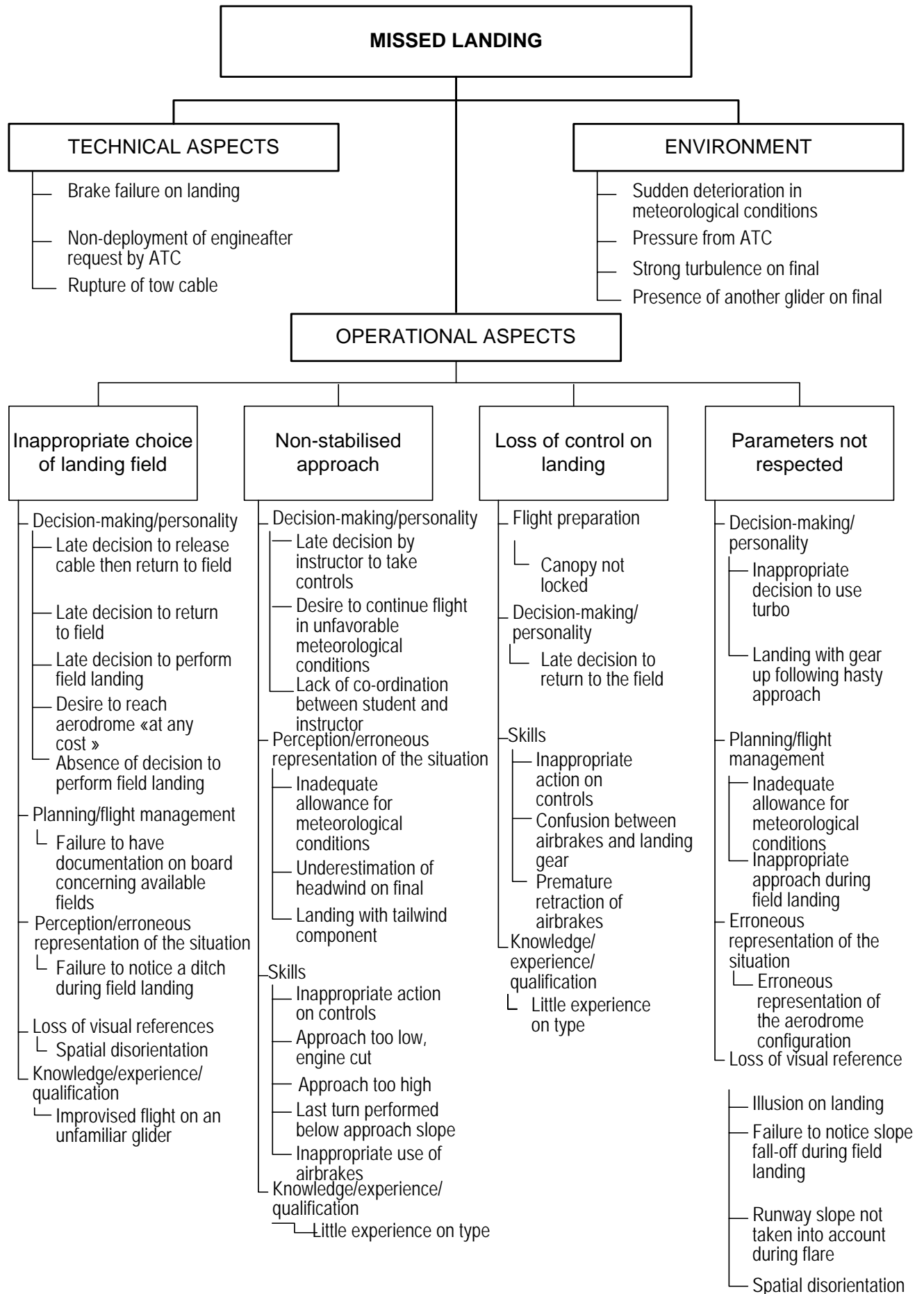
Estimated track of the glider reconstituted from onboard GPS data



Appendix 3A: fault tree



Appendix 4: fault tree



ACCIDENT

to the glider registered F-CEXP

Event :	hard landing.
Probable cause:	confusion between the landing gear control and the airbrake control.

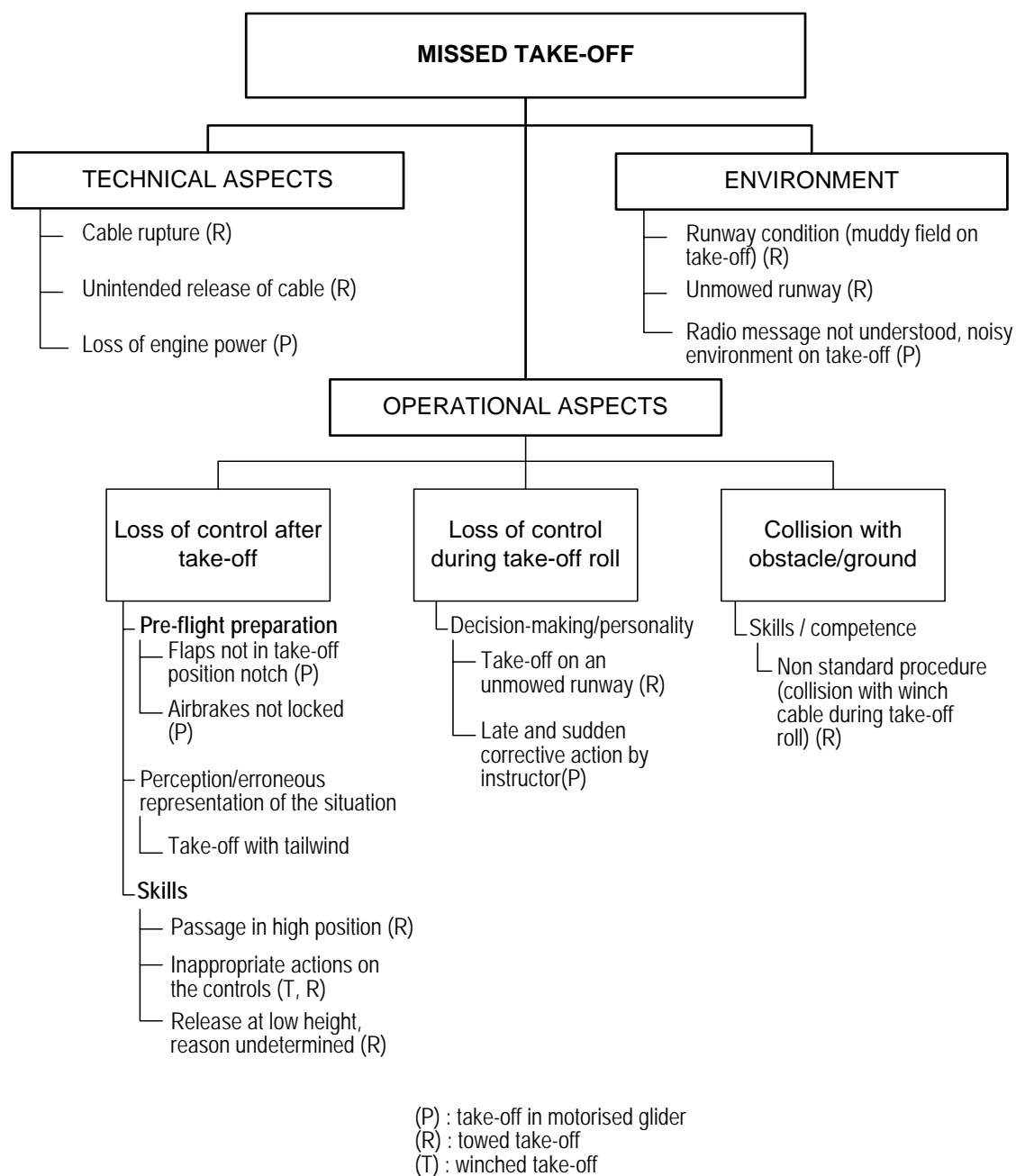
Consequences and damage:	aircraft severely damaged.
Aircraft:	Grob G102 " Astir CS " glider.
Date and time:	Thursday 12 April 2001 at 09 h 45.
Operator:	club.
Place:	Graulhet AD (81).
Nature of flight:	local.
Persons on board:	pilot.
Qualifications and experience :	pilot, aged 22 , PPGL issued in 2000, 37 h 10 flying hours of which 0 h 15 on type and 6 h 15 in the three previous months.
Meteorological Conditions:	observations at 10 h 00 at Albi, located 25 km north-east of Graulhet : wind 310° / 06 kt, visibility over 10 km, BKN at 4600 feet, temperature 9 °C, QNH 1027 hPa.

Circumstances

The pilot indicated that on arrival he extended the landing gear with a tailwind on the base leg and extended the airbrakes halfway. On final he reckoned that he was a little high. He extended the airbrakes fully but the glider's speed increased. An instructor on the ground explained that at that moment he saw the glider's landing gear retract. He contacted the glider's pilot by radio while the glider was arriving on short final and told him to extend the airbrakes. He then saw the landing gear extend. The glider touched down hard on the runway, rebounded and came to a stop on the runway.

The pilot was performing his second flight on this type of glider. He had mainly flown on gliders with fixed landing gear.

Appendix 4A: Fault tree



ACCIDENT

to the glider registered D-7390

Event :	glider turned over on take-off during tow.
Probable cause:	decision to undertake the return flight in unfavourable conditions.

Consequences and damage: pilot slightly injured, aircraft severely damaged.

Aircraft: Rolladen-Schneider LS6C glider.

Date and time: 22 May 2000 at 20 h 10.

Operator: private.

Place: Sollières-Sardières AD (73).

Nature of flight: ferry.

Persons on board: pilot.

Qualifications and experience : German pilot, aged 73, PPGL issued 1978 in Germany, 8 300 flying hours of which 150 h in the previous three months and 15 h in the previous three days.

Meteorological Conditions: estimated at the accident site: wind 300°/10 at 15 kt.

Circumstances

The pilot took off from Barcelonnette AD (05) for a local flight. Not finding adequate updrafts to continue the flight, he decided to land at de Sollières aerodrome (73). A tow aircraft came to pick him up. On take-off, for the return to Barcelonnette, at about 20 h 00, there was nobody at the aerodrome to hold the glider's wing. The glider went up to about 50 cm and leaned to the left. The left wing struck the ground. The glider turned over and struck the ground violently. The cable detached automatically during the accident and the tow aircraft abandoned its take-off. The pilot got out of the wreckage with no difficulty.

The fatigue caused by fifteen flying hours performed in the three previous days may have been a contributory factor in the accident.

Accident to D-7390 on 22 May 2000



Appendix 5 : Definitions

Accident : an occurrence associated with the operation of an aircraft which takes place between the time any person boards with the intention of flight until such time as all persons have disembarked, in which :

a) a person is fatally or seriously injured as a result of:

- being in the aircraft, or
- direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- direct exposure to engine blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to passengers and crew ; or

b) the aircraft sustains damage or structural failure which :

- adversely affects the structural strength, performance or flight characteristics of the aircraft, and
- would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories ; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

Serious injury: an injury which is sustained in an accident and which:

1. requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received ; or
2. results in the fracture of any bone (except simple fractures of fingers, toes or nose); or
3. involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or
4. involves injury to any internal organ; or
5. involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or
6. involves verified exposure to infectious substances or injurious radiation.

Fatal injury : any injury suffered by a person in the course of an accident which causes death within 30 days following the date of the accident.

Incident : an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

Serious incident: an incident involving circumstances indicating that an accident nearly occurred.

Examples of serious incidents (from Attachment C of Annex 13 to Convention on International Civil Aviation):

- Near collisions requiring an avoidance manoeuvre to avoid a collision.
- Controlled flight into terrain only marginally avoided.
- Landings or attempted landings on a closed or engaged runway.
- Take-off or landing incidents. Incidents such as undershooting, overrunning or running off the side of runways.