FIVE YEARS OF WEB BASED INCIDENT REPORTING

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ABSTRACT

Handling of flight safety incidents in a flying club can be a delicate matter for the people involved. This paper describes the incident reporting system that has been in use in the flying club PIK at Helsinki University of Technology. The system was started after a general gallup on flight safety issues and has been in use for five years. A general description on the web based system and an analysis on the reported cases is given in this paper.

THE FLYING CLUB

Polyteknikkojen Ilmailukerho or shortly PIK stands for Poly-technical Students' Aviation Club and is the home of PIK series aircraft, the most well known of which is probably the PIK-20 glider. For more information about the club, see the home page http://www.tky.hut.fi/-pik/english.html. The club was founded in 1931 and has today around 120 flying members of which around half enjoy flying gliders and two-thirds motor aircraft (consequently some enjoy even both). The club board is run by the ordinary student members but the senior members are allowed to fly the aircraft in space of capacity, which has been the case in the past years. The club owns 6 gliders and 6 motor aircraft, see fig 1.

The home base for gliding, R1iyskiil1i airfield, is situated in southern Finland 90 km north of Helsinki outside the airport terminal area. This enables even cloud flying which is permitted in Finland outside controlled airspace. The area provides good conditions for cross-country flights from April to August. Training of new glider pilots takes normally place in R1iysk1il1i. Wave flying is performed every spring in a camp (on a frozen lake, see fig. 2) in northern Sweden in the vicinity of the polar circle. Winter weather with snow showers sometimes sets stringent conditions for glider towing during the 1000 km long ferry flight. The club has at present following gliders:

G 103A Twin II Acro	two seater, acrobatic
G 102 Club Astir	club class
LS 4a	standard class
LS 7	standard class
LS 8	standard class, 18 m
PIK-20D	15 m

The base for motor flying is the Malmi airport in Helsinki. Training of new motor pilots takes mainly place on this airport. An important part of motor flying is glider towing in R1iysk1il1i with the club's PIK-23 tug aircraft. The club has today following motor aircraft:

Cessna 150	primary trainer
Cessna 152 II	primary trainer
Cessna 172N	four seater
Cessna 140	tail wheel!
PA28-181 Piper Archer II	IFR instruments
PIK-23 Suhinu	tow plane

The club has the required know-how and organization to give flying training for a license both with gliders and motor aircraft. The flying training is organized by having one person in charge of training with motor aircraft and another one with gliders as required by the authorities. Both gliding and motor flying come under the same authority in Finland, the National Board of Aviation. Individual flying instructors take care of the training flights and theoretical lessons. The accumulated flying time in the year 2000 was 820 hours with gliders and 1195 hours with motor aircraft totaling 2015 hours.

The overhaul and maintenance of the gliders, trailers and motor aircraft etc. is done by the students themselves. The maintenance work is organized by having separate maintenance chiefs for motor aircraft and gliders respectively, a responsible person for each aircraft to coordinate the work. A licensed mechanic is paid for the work performed on the motor aircraft requiring a license. The club gets no subsidies from the University of Technology, but has to pay a rent for overhaul room on the student campus. To get money for paying the mechanic and the rent, new aircraft, spare parts, fuel and other consumables the club has run car parking outside an exhibition hall, which can be hard work in wintertime when the ambient temperature often sinks below -200 C.

FLIGHT SAFETY GALLUP

One of my favorite quotations is from the year 1988 (ref. [2]): "It is now believed here and overseas that civil aviation generally may have reached the limit of accident prevention through regulation and the way forward is through improved safety education". To check the prevailing status in the club, a flight safety gallup was initiated in 1995 to investigate the potential risks in flying. The query posed four questions:

- What are the most serious risks in the gliding activities of the club?
- What are the most serious risks in your own gliding activities?
- What are the most serious risks in the motor flying activities of the club?
- What are the most serious risks in your own motor flying activities?

21 % of the flying members answered the query. The answers could be given on paper or by anonymous email. A script sent the anonymous email from a form, filled by the sender, on the club home page so that it was impossible to trace the sender. 36% of the answers were sent by the anonymous email. The flying experience of the respondees is shown in tables 1 and 2. The following summaries were made of the results, not in order of significance:

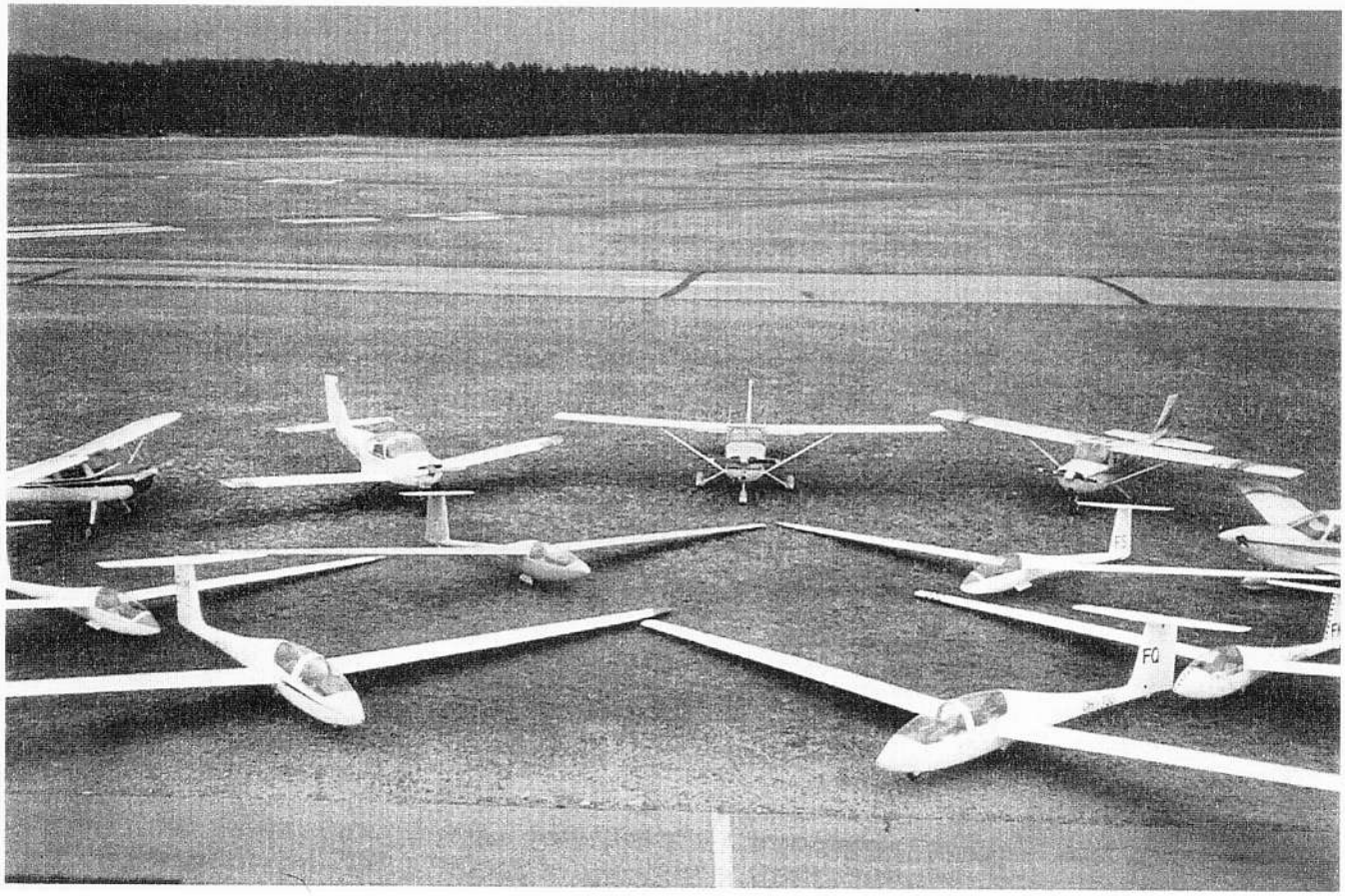

Figure 1. Gliders and motor aircraft of the flying club PIK at Räyskälä airfield.

Table 1. Distribution of flying experience of respondees during the last season.

flying hours	gliding	motor flying	total
0	2	3	5
<20	2	2	4
20...50	10	6	16
>50	6	2	8
total	20	13	33

Table 2. Distribution of total flying experience of respondees.

flying hours	gliding	motor flying	total
0	1	2	3
<50	2	0	2
50...200	7	7	14
200...500	4	3	7
>500	6	1	7
total	20	13	33

RISKS IN THE GLIDING ACTIVITIES OF THE CLUB

- car races to the airfield
- too little flying
- during the primary course the flying students have sent each other to the air
- too little supervision after the primary course
- flights with new glider types have been given too loosely; also the total flying hours also the flying time during the last season should be taken into account
- the required minimum flying experience is too low for some glider types
- the applicable minimum experience limits with different glider types have not been followed as a pre sumption for cross-country flights
- a 5 hour endurance flight should be required before the first cross-country flight
- poor criteria for assigning a glider to a pilot for competition flying
- a collision in the air, especially in large gaggles, competitions and below clouds streets - unplanned flying, poorly planned out field landings - amount of water ballast and corresponding center of gravity poorly checked, leaking water bags
- poor maintenance; some people only fly, others do the maintenance- incorrect/incomplete rigging of a glider
- ferry flights to the wave flying camp (a total crash was near)

Figure 2. On final to the wave flying camp at Kebnekajse. Notice the badly closed canopy of the two-seater with the locking pin by-passing the aft bracket.

- cloud flying has been performed without an appropriate license
- carelessness about other people in the air
- hassle, hurry, carelessness
- general anarchy, lacking respect of authorities
- hedonist piloting, improper attitudes
- lack of control and supervision; incidents have passed without any feedback

RISKS IN THE GLIDING ACTIVITIES OF THE RESPONDING PILOT

- approach and landing with limited experience
- lack of flying time and experience
- flying when tired and hungry
- coordination with the parachutists on the airfield
- experimenting with new issues like aerobatics with out proper training
- bad weather at the wave flying camp
- collision in the air, flying in gaggles and just below the cloud base
- cloud flying in turbulent clouds with limited experience
- limited experience in field landings
- a feeling of safety brought by increased experience

RISKS IN THE MOTOR FLYING ACTIVITIES OF THE CLUB

- bad condition of the motor aircraft
- the maintenance of the fleet is not acceptable, emphasis should be put especially on the training aircraft
- notes have not been put into the hold item lists. Notes in the logbooks have been written using pencil so that they can be swept out before annual checks by authorities
- testing with PIK-23 how a pizza looks like under g-loading
- long hours of towing
- running out of fuel
- going into bad weather
- ferry flights to the wave flying camp (a total crash was near[1])
- bad attitudes, even serious items are ignored
- bad safety culture, taking too many risks
- hedonist piloting, lack of sound self-protection

RISKS IN THE MOTOR FLYING ACTIVITIES OF THE RESPONDING PILOT

[1] Freezing drizzle reduced the visibility to zero except through the ventilation opening on the canopy

- lack of experience and routines, too little flying ("for got to turn on the fuel pump before landing")
- navigation in visual and by night, radio navigation
- long days when towing, becoming dull, tiredness and loss of alertness
- descents after towing (PIK-23 has very effective flaps permitting steep descents)

The results of the gallup reflect the incidents in the club during a long, say a 10-year time period, and show some common features. The pilots were more concerned about other peoples flying. It is easier to notice shortcomings in the activities of others than oneself. However, the gallup made the pilots to think about their own flying and people were aware of the risks of too little flying, tiredness and hunger, collision in the air, limited experience, and even a false feeling of safety brought by increased experience. The anonymous way of reporting revealed a number of cases with rule breaking.

INCIDENT REPORTING

It was realized that to gain the trust of the club members, the incident reporting system had to be voluntary and offer total confidentiality. To emphasize this, the system is not run by the club board but a senior member.'-' Thus the system is run by a third party without a direct connection to the authoritative organization in the same way as NASA is running the Aviation Safety Reporting System in the United States, see ref. [I]. Confidentiality is built up by "use immunity" and "transactional immunity". Thus the information collected is used only for flight safety purposes. Transactional immunity means that the identity of the respondees is guaranteed against disciplinary actions. An additional factor having an effect on the success of the system is motivation and feedback. The submitters need to see that their information is an important part of the system and has an impact on flight safety. Hence a summary of the incidents reported is published annually in the club newsletter. The incident reports were made with the same system that was used for the gallup with the possibility for the anonymous email channel and an open personal reporting. Also details were collected actively of generally known incidents.

The incidents are classified using the scale below:

10000 death
1000 permanent handicap
100 temporary handicap, total crash
10 major damage, repair at a licensed workshop
1 minor damage, can be repaired in the club
0 near miss but no damage

For example landing a glider with the gear retracted usually causes a damage scaled as 1, whereas a motor aircraft ending up in a snow bank in landing would probably be damaged up to a scale value of 10. By taking a logarithm of the numbers the relation to Richters' scale is obvious.

RESULTS

The frequency of incidents during the past five years is shown in fig. 3. In 1997 no incidents were reported on gliders and the total amount of flying hours with gliders is then given in this column. Otherwise the mean time between incidents has been in the interval of 100 to 500 flight hours. Fig. 4 gives more information about the nature of the incidents.

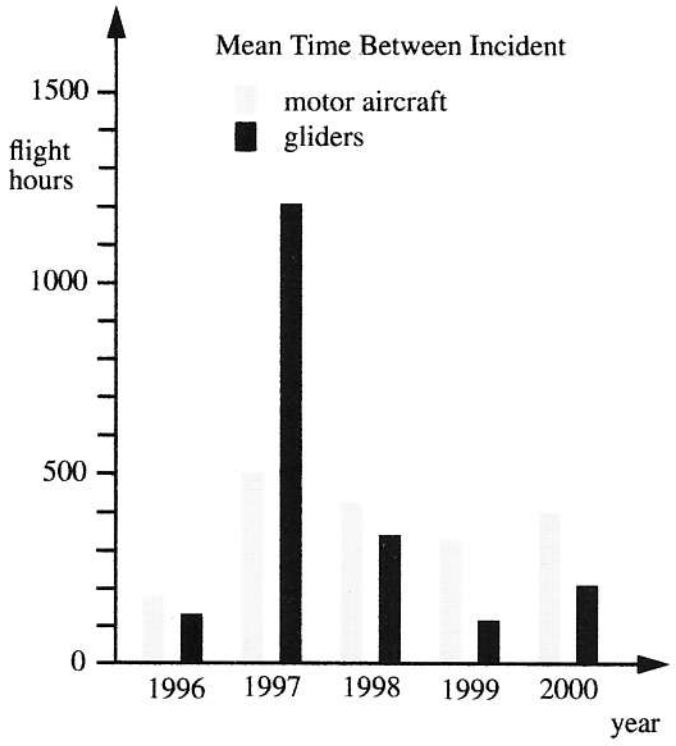

Figure 3. Mean Time Between Incident with motor aircraft and gliders used by the club.

In 1996 the high scale values of damage were caused in motor flying by a heavy landing with the Piper Archer (permanent deformation on the wing), and a collision with a snowdrift in landing with the Cessna 140 (the aircraft almost flipped over). The same year the two-seater glider was damaged by an external towing plane. Because there were high snowdrifts on either side of the runway early in spring, the tow plane had to land over the queue of gliders and back track for takeoff. The approach was too low and the towing rope ripped off part of the two-seater tailplane. Two incidents in motor flying increased the damage scale value in 1998. The Piper Archer was taxied against an anchoring weight so that the propeller blades were bent and the engine had to be checked. In another case with the same aircraft the antenna for ILS glide path was found in a pocket in the cockpit. Obviously the antenna was fractured by fatigue as it was in the way when cleaning the windows. However, the antenna was put into the pocket without a notice in the logbook. A logbook entry should have been made as the antenna is a prerequisite for IFR operations. The same year the incidents in gliding consisted of small damages in out-field landings.

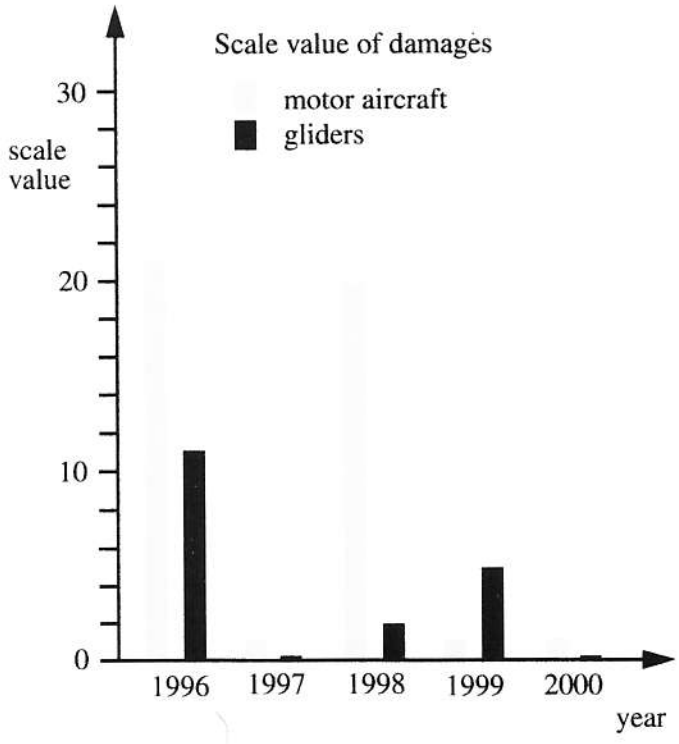

Figure 4. Scale value distribution with motor aircraft and gliders used by the club.

In 1999 the accumulated scale value of damages in gliding was caused by incidents in towing, landing and ground handling. The towing incident took place in the wave flying camp in a 45° banked turn. The cable got slack and released. The end of the cable, however, went around the left wing trailing edge of the glider and before coming loose, hit the canopy frame and the lower surface of the wing, but the damages were small. In two of the landing incidents at the airfield, the glider fuselage bottom touched slightly the ground; in one of the cases with the Club Astir due to extensive use of the wheel brake and in the other one with the LS 4a due to a near stall. The third landing incident happened with the two seater during a field landing. The final was somewhat high and this was compensated with sideslipping. In the touch down there still was a 15° sideslip causing a fracture on the nose wheel frame. In the ground handling case, the LS 8 turned down the other wing when water ballast was filled and the down going wing hit a water can causing small damage on the trailing edge.

The incidents with a 0 damage scale classification contain very different issues. In motor flying there were incidents with

- taxing with towing bar connected to the nose gear
- engine power disturbances in take-off
- tow plane starting take-off acceleration without first pulling the towing rope straight
- failure of communication radio
- near collisions in the air
- getting lost temporarily
- flat tire when coming into landing

In gliding there was incidents with

- finding loose items (screw, variometer knob) in the cockpit in the daily check
- take-off without buckling the safety harness
- medical problems of the pilot (spastic cramps in the hands)
- failure of the air speed indicator during a cross-country flight
- out field landing in a com field after cloud flying due to large areas of rain
- intentional ground loop in an outfield landing due to a short field
- leaving a glider overnight at the runway end

ANALYSIS

Altogether there were 43 incidents reported during the 5 years. Tables 3 and 4 show the frequency of the different types of causes for the incidents. Human errors were a cause in 72% of the cases of which 7 percentage units were assessed as events with questionable pilot attitudes. In NASA's statistics of the 34000 incidents during a seven year period (ref. [1]) over 70% were due to human errors. The fairly high amount of incidents, 23%, due to technical

	gliding	motor flying	total
human error	19	12	31
technical	3	7	10
weather	1	0	1
medical	1	0	1
total	24	19	43

Table 3. Number of cases for incidents.

	gliding	motor flying	total
human error	8	6	14
technical	0	3	3
weather	0	0	0
medical	0	0	0
total	8	9	17

Table 4. Number of cases for incidents leading to damage.

problems mainly reflects the activity of flying with aging motor aircraft.

The graph on scale value of damages in fig. 4 gives an appearance of a slightly reducing trend in damages, which might be attributed as the feedback effect of the reporting system. However, the populations studied are statistically so small that the above is not believed to be true. Fairly large variations in the damages are expected also in the future.

Comparison of the results between gliding and motor flying is somewhat uncertain due to three reasons. The annual flight hours in motor flying were on average 30% higher than in gliding which is not taken into account in the results presented. On the other hand, the incident reporting from motor flying has been less active. The third factor to be kept in mind is the statistically small populations studied. However, it can be concluded that incidents leading to damage were more common in gliding but the amount of damage was typically smaller. There were no incidents causing damage on gliders due to technical problems.

The reporting activity varied considerably during the five years. In many cases people voluntarily described their experiences. In generally known cases a query through email to the pilot in question brought a description of the actual event.

A delicate matter was the failure of an airspeed indicator during a cross-country flight. The pilot openly told at the airfield that the instrument failed 30 km away from the airfield at the beginning of the flight that eventually ended in an out-field landing without any damage on the glider. In spite of this, a debate was blown up about the decision to continue the flight instead of turning back to the airfield. An inflamed discussion continued for three months with flames on the club chat site. This kind of reaction does of course not promote open reporting of incidents. Hopefully the annual summary of incidents, published later on in the club newspaper, helped to put this event to the appropriate proportions. Afterwards the voluntary reporting of incidents has continued again.

CONCLUSIONS

A web based flight safety gallup and incident reporting system was described in this paper. The results of the gallup show that the pilots were generally aware of the flight safety risks and were concerned about the psychological issues. The anonymous web based reporting revealed some cases of rule breaking.

The incident reporting system was established on the principles of voluntariness and confidentiality with a possibility for anonymous web based reporting. During the five years the reporting activity and number of incidents varied considerably. 72% of all reported incidents were caused by human errors. The next largest group of .23% was due to technical problems and those with weather and medical causes contributing only to off cases. The populations studied were however statistically small.

Even if the population and flying hours are too small for statistical confidence the system draws the attention of all club members to ongoing problems. The web based anonymous system enables reporting without risk of punishment or personal conflicts.

Attitudes are an issue that takes the longest time to change. Somebody expressed this in the first gallup as: "How could we get rid of the habit that all lunatic incidents are, however, afterwards spoken of as heroic tales?" It was also quoted in many of the gallup answers that the example of instructors and older pilots is crucial in creating a flying discipline of good airmanship.

REFERENCES

[1] Reynard W.D., Incident reporting: Its role in aviation safety and the acquisition of human error data, in AGARD Flight Mech. and System Design Lessons from Operational Experience, Oct 01 1983, 8 p.

[2] Spillane K.T., Hess G.D., Fair Weather Convection and Light Aircraft, Helicopter, and Glider Accidents, Journal of Aircraft, Vol. 25, No.1, January 1988, pp. 55...61.