

SAFETY PAYS!

A proposal to the International Gliding Commission (IGC)

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Summary

As a long term expert safety adviser to the IGC, OSTIV is offering this paper about the need to improve safety in gliding and proposals to enhance this on an international level. The indispensable role of the IGC is emphasized. The importance of international gliding competitions as market places of state of the art equipment and best pilots as role models for most other gliding pilots and clubs is underlined. The use of IGC-sanctioned gliding competitions as an instrument to improve safety is argued. Three proposals to enhance this are expanded and discussed.

Is gliding safe?

Gliding is a safe sport, isn't it? That is what we often pretend and like to think. We used to say that the trip from home to the airport and back was the most dangerous part of our gliding. And, we like to believe that. But is that true? Let us look at the statistics and in your own memory.

Not all gliding accidents are reported, but nearly all serious accidents are on a national base. Still it is not easy to get access to accident statistics in several countries. Although they all have their own arguments for this, it is a bad habit. Secrecy doesn't match with safety! Fortunately several countries like Germany and Switzerland are quite open about their aviation accident statistics. For Germany you can find them easily on the website of the German BFU. Let us have a look.

Roughly one third of all gliding activities in the world are done by German pilots. In 2006 they numbered 30,120 within a global total of 115,420. Germany has the longest and best developed gliding culture of all countries and certainly performs not worse than the World average.

Over the period 1990 – 2008 the risk for a glider pilot of being killed in a gliding accident in Germany was about *1:2500 per year*, with *no tendency to decrease*, in spite of much effort by many. Still, that is better than the World average

Is that safe? No it isn't! Nobody would accept such risks in normal road traffic.

During the same period, the number of fatalities in road traffic in Germany has steadily *decreased* from 11,300 (1991) to 4,477 (2008). At present the risk of being killed in a road accident in Germany is *1:18400 per year*.

This means that the decision to start or continue gliding will increase your risk to get killed with at least a factor 7 above the existing risk of being killed in road traffic. Statistics reveal that if you fly gliders you are more likely to die in a gliding accident than in any other accident.

To really understand these figures we should be aware that on *average* a glider pilot does not even spend 50 hours per year in his cockpit, whereas on average people spend more than 500 hours per year on the road (car, bicycle, walking).

That is why many glider pilots do not know anyone who has died in any accident other than a gliding accident. Most long-time glider pilots have lost one or more fellow pilots in gliding accidents whom they know from nearby or remote. Pilots who have been active for many years on an international scene (like many competition pilots) often lost track of the number of fellow pilots who have been involved in a serious gliding accident. For example, Bruno Gantenbrink wrote a stirring paper on this subject back in 1993 based on his lecture at the 51st German "Segelfliegertag" in Gersfeld, 1992; the paper was published in *Aerokurier* in Feb. 1993.

How many of you reading this paper have *not* yet stood at the grave of a gliding comrade? It is obvious that we can not maintain the suggestion that gliding is a safe sport. Nevertheless that is not the way we would like our family, the public or EASA and FAA to look at gliding. But above all we want to be safe ourselves: that's why the *safety of gliding must be improved*.

Improving safety

Basically there are two different ways to improve the safety of gliding:

- By *external* regulatory policies and measures which, in most cases, result in more restrictions, more complexity, more severe requirements and higher costs. This is the authoritarian way used by EASA, FAA, ICAO and most national CAA's and ATC's. Although this approach has been successful to a certain extent, most of us agree that we do not need/want more restrictions, more complexity or higher costs.

- The other way is via an active and effective *internal* safety policy which is recognized and applied by all glider pilots and people involved in gliding operations. This approach should employ any measure, provision or development which would really contribute to safer gliding and which is acceptable for the gliding community.

This paper intends to follow this latter approach.

Improvement of safety and the IGC

For most glider pilots, the IGC is associated with the Sporting Code for Gliding and with international gliding records, but most of all with the big international gliding competitions and competition classes. All this is solely directed at selecting the best pilot performance during a gliding competition or world wide.

The IGC has been involved in organizing international gliding competitions for many decades and with great success. These competitions contribute successfully to international contacts and understanding, exchange of experience and knowledge and to other benefits. Via the competing pilots and gliders, they also have a great impact on the market for new gliders, technology and tactics. Any manufacturer of sailplanes or gliding equipment is well aware of this. Winning the World Gliding Championship with a new glider type can be the best introduction to the market. This also applies to other new equipment used in these competitions; all aiming at better performance.

Unfortunately most competition pilots put much more emphasis on better performance of their glider, their equipment and their tactics than on better personal safety. "Accidents happen to other pilots, not me!" That is why safety provisions which might impair glider performance are not popular among competition pilots. Yet, competition flying occurs in a high risk environment.

If we think that improvement of safety in gliding is a serious issue which affects gliding operations all over the world, measures to improve it must be taken at an international level; spreading down to national, local and individual levels. As the IGC is the highest international authority within the gliding movement, it should be the body to address this global subject. This means that IGC should develop and introduce an effective Safety Policy for gliding and seek its implementation via the National Gliding Associations. If the IGC would adopt the improvement of safety in gliding as a full valued aim of its policy, it should attempt to achieve this with every means available in the 'basket'.

The attempt should not be over five years, but as soon as possible. Safety is not an issue for the future, after other current problems have been solved. Safety is a demand, conditional for the future of gliding, and needs action NOW!

Fortunately, unlike many other air-sport organizations, the IGC has the benefit of the OSTIV the members of which serve as an internal adviser with great knowledge and experience of actual gliding operations. The OSTIV has been an active adviser to IGC and FAI in the field of safety since 1931.

For many years the Sailplane Development Panel (SDP) and the Training and Safety Panel (TSP) of OSTIV have been working successfully to improve the safety of gliding; each in its specific area. Over the years gliders have become safer in their structural design, flight handling and crash protection and safer operating procedures have proliferated in most countries. Also many devices aiming at reducing accident risks and results have been developed successfully and put on the market during the last decades. Regrettably several of these devices,

which could make a further contribution to better safety, are hardly used by glider pilots.

This is not hot news, but in spite of all effort that has been put in developing better safety programs, better training and safer procedures and better flight equipment the risk of being involved in a serious gliding accident remains at a level that must be considered too high.

What more can IGC do to improve safety? How does IGC's safety policy read? And, how will it be further implemented? What other means than agreeing and endorsing safety advices and requesting national delegates to recommend these in their home countries does IGC have to improve safety?

Gliding competitions and safety

Flying international gliding competitions is exciting, glorious and a great privilege for the pilots. International gliding competitions also act as examples of how the Great Pilots fly. Their choices and ways of flying are an example for many other pilots and clubs. Similar to what Jacques Rogge, the President of the International Olympic Committee claims for Olympic athletes, *competitors in international gliding competitions should act as role models, inspiring the less experienced pilots*. Gliding competitions can have a significant influence on gliding operations and they also have a commercial impact. Just look at the "Winners List" at the website of each glider manufacturer.

In response to the privilege to participate in international gliding competitions and for the sake of their own well being, competitors should be prepared to actively contribute to the safety of gliding. So here is an opportunity to involve competition pilots in the cause of improvement of safety. But, there is an even more compelling reason to address safety in connection with gliding contests. Gliding competitions bring increased accident risks.

During the last 44 multi-class World Championships and 3 Gliding Grand Prix contests (comprising about 53,500 flights) at least 8 persons have been killed (see Appendix). That is about one fatality per 6690 flights. That fatality rate is more than *ten times as high* as the average of gliding world wide, which is already unacceptably high at 1.42 fatalities per 100,000 flights. So, it seems time is here to make gliding competitions safer and to use gliding competitions as a means to improve the safety of gliding at large and to enhance the development and use of improved safety procedures and provisions.

And indeed, do so not only by restrictions and penalties, but also by *rewarding* safe behavior, safe procedures and the use of onboard safety provisions. If the IGC, like OSTIV, adopts "the Improvement of the Safety of Gliding" as a major objective of its function, this would lead to a commitment to take any reasonable measure to reduce the far too high accident rate in gliding competitions and gliding at large. The IGC could consider putting this as a full valued aim for gliding competitions; at the same level as -and next to- the present aim of "*Selecting the Best Performing Pilot*" during the competition. In this way both "*Selecting the best pilot*" and "*Im-*

provement of Safety of Gliding" would be the official aims of international gliding competitions and can be integrated in a full-bodied competition strategy. Declaring the "Improvement of Safety of Gliding" an official aim of IGC-sanctioned gliding competitions opens the way to introduce programs, procedures and provisions to enhance safety without affecting the excitement of competition flying.

International gliding competitions, because of their strong appeal to other gliding pilots, offer a good opportunity to inspire all pilots in the direction of better safety. Safety improving measures can reduce the risk of accidents happening or mitigate the results of accidents (reduce the risk of injuries). Preventing accidents of course is far more effective to improve safety than then mitigating the results of accidents. But both should be addressed.

Preventing accidents to a large extent depends on pilot behavior and safety procedures. Safe procedures can be implemented by regulations and training. Introducing safety programs, like proposed by the OSTIV TSP, can contribute significantly to better safety in gliding world wide.

Safe behavior and good airmanship, implying human factors, are complex and have by far the greatest influence on flight safety. They depend heavily on variable personal circumstances, the mental and physical condition of the pilot and their ambition to win. This is a complicated area which needs much effort and study in the fields of pilot education, human factors, mental and physical training, pilot comfort, etc. Safety committees in many countries and in particular the OSTIV TSP are continuously working on this subject. Integrating their results in the organization, procedures and pilot behavior at gliding competitions can lower the risks of accidents. With that aim, competitions could be used as instruments of a well coordinated policy to promote the proliferation and use of safer procedures and equipment in gliding world wide.

The basic idea of this proposal to the IGC is to use international gliding competitions as an instrument to improve the safety of gliding at large. Gliding competitions act as an example for many gliding pilots. This paper contains three specific proposals aimed at reducing the accident rate and safety risks at competitions. The proposed measures are based on rewarding safe behavior and safe strategy during gliding competitions. The proposals are specified below.

Proposal A

It is proposed to introduce a Safety Award for exemplary safety enhancing behavior during international gliding competitions. This Safety Award Challenge Cup will be sponsored by the OSTIV and might be named the OSTIV Safety Award (yes, OSTIV needs some more reputation amongst in the gliding world!). The Safety Award will be presented at the prize giving ceremony to the pilot or other person who has made the most outstanding contribution to safety within the context of the competition. As this is a broad spectrum, it is proposed that a small group of safety oriented people will make the nomination for the winner. The Safety Award is related to the whole competition event; not restricted to a single class or only

to competing pilots or other groups. Presenting such a Safety Award to the winner during the prize giving ceremony would be in line with the proposed elevation of "Improvement of Safety" to an official aim of international gliding competitions.

Proposal B

This proposal is closely connected to one item of Proposal C i.e. enhancing emergency cockpit egress in order to improve the chance of a successful bail-out after a midair breakup. It is proposed that in anticipation of a possible introduction of Proposal C in 2012, prior to the start of the next European Gliding Championships (EGC) in 2011, training of rapid cockpit egress is undertaken by all participants and measured and video registered on the ground during some training days. After analysis and evaluation, the results will be shown and discussed during a special safety briefing for all teams.

To this end, the IGC is advised to instruct the organizers of the EGC 2011 to communicate to all participants in the EGC in 2011:

- substantiation of the need for a rapid emergency cockpit egress and the need to train this egress (Fig. 1).
- simplified information on cockpit egress techniques (including drawings by Professor Wolf Röger as in Fig. 2) and reference to the procedures described in the flight manual of the glider.
- an empirical investigation, prior to the start of each of the competitions, during which for all pilots the time they need to egress their cockpit on the ground is determined through measurement and video-registration.
- an award for the winner in each 10 years age category.
- all registered performances will be analyzed, compared and evaluated against the average available time for a safe bail-out at different altitudes (Fig. 1).
- the actual egress actions and the results of this study will be shown and discussed during a special safety meeting during the competition.

IGC is advised to set up a small group, also comprising some members of the OSTIV-TSP, to prepare and perform this experimental study and the safety meeting.

Proposal C

Introduction

The real *safety performance* of a pilot is difficult to value in an objective manner. Moreover, it is greatly determined by pilot behavior when flying the glider and that is even more difficult to check and assess. But, that is no reason not to reward what can be valued in an objective way, like safety provisions installed in the glider and used by the pilot during the contest.

Technical safety provisions can contribute to lower accident risks and to fewer injuries due to gliding accidents. The best example of this is the modern glider itself, which provides far better protection to the pilot than gliders of previous generations. During recent years, numerous safety provisions have been developed which can improve safety of gliding. Unfortunately, many of these are hardly used by competition

pilots. Their objections are often based on fear of a negative effect on the performance of their glider or on their flying tactics or on costs. Even so, pilots are willing to spend much money *to improve their chances of winning* the competition. Enhancing the use of such onboard safety devices is the subject of this proposal.

- Because they can contribute to lowering the risk of serious injuries due to gliding accidents either by reducing the risk of such accidents or by preventing or reducing injuries resulting from accidents.
- Because many safety devices are available at this moment but are not being used by competition pilots, often because they fear a negative effect on the performance of their gliders. By taking away this concern their use can be enhanced.
- Because it is expected that a system with positive rewards, which is easy to understand and to implement and which is balanced and transparent, will stimulate use of the rewards during gliding competitions.
- Because a wider use of these safety devices at gliding competitions most probably will enhance their use outside competitions by cross-country pilots and clubs world-wide.

The proposed way to involve competition pilots is by enhancing their safety awareness and convincing them of the need to improve safety of gliding for themselves and for other gliding pilots. Pilots should be aware that after a break-up of their glider at 1000m above the ground, the time to their grave might be less than 15 seconds, unless they are well prepared for a rapid bail out. Training rapid cockpit egress on the ground is a cheap and effective method to improve their chances of a successful bail-out.

Pilots must be persuaded, also for their own benefit, to actively contribute to improving safety. This will need a change of mindset for most competition pilots. This is difficult to achieve. Yet this is not a good reason to abandon this approach.

A new way to persuade pilots to use these safety devices and procedures is explained here.

No force of compulsion and penalties is used but rather the awareness of risk and responsibility, free choice and ample rewards.

The reward for installing and using such safety devices must be significant enough to appeal to competition pilots. Competition pilots are highly sensitive to any opportunity to gain, or risk to lose, competition points. For that reason, persuasive rewards should be in *competition points*. Initially, of course, this idea will meet with quite some opposition. Most probably many people will argue that this will distort the aim of gliding competitions, which at present is only to select the best performing pilot. This may be true as long as "Safety" is kept out of the official aim of international gliding competitions (which is the case at present).

But, if "Improvement of Safety" would be adopted as a full valued aim of gliding competitions -next to the present "Pilot Performance" aim- pilot competition strategy has to

include "Improvement of Safety". At that stage, competing pilots will have to develop a safety strategy as part of their competition strategy. So, then "Safety" will not be a distortion of the competition but rather an addition to competition flying, which from a point of view of safety would certainly qualify as an enrichment.

In fact, relating safety with competition points is not new at all. In present competition rules, safety *infringements* are often penalized with fines: in competition points! (negative). So why not reward *contributions to improve* safety also with competition points? (positive)

This all requires a change in our classical way of thinking about gliding competitions. We should recognize that so far gliding competitions have never been used as instruments to improve the safety of gliding, but there are compelling arguments to change that. *We should use all available means to improve safety in gliding!*

This is a proposal which is relatively easy to implement; with probably successful proliferation outside the competition area, due to its high level of publicity and attention. And, it is not pushed upon us by external authorities or regulators!

Proposal "Six percent for safety"

Most competition pilots will do anything they can afford to improve the performance of their glider by 2 or 3 points in L/D. Even smaller improvements are worth thousands of euros/dollars and, indeed, sometimes other glider types are chosen for even smaller improvements in performance. Although this is prior to the contest, for any pilot who has the ambition to win the competition this is already an indispensable part of their preparation. This is *part of their competition strategy*. So, here in the pilot's decision making, a *safety* strategy should also get a place. And, the reward for that strategy will be gained during the competition. For the competition pilot the only aim of better performance is *to gain more competition points*. During a competition a pilot thinks in terms of competition points. Therefore, if we want to influence their choices we should use *competition points* as a reward. A reward which the pilot will get every competition day in addition to the points gained by their flying that day.

In order to give the safety rewards enough significance, *six percent* of the maximum score seems to be a balanced limit for safety rewards, ultimately.

In order to keep the safety rewards in balance with the varying competition score, the 6% are related to the points of the *winner of the day*, and not to a fixed number of 1000 points per day. So, on a weak day, the safety reward also will be lower.

In order to ease the acceptance of the safety reward system and also to allow manufacturers time for the development of future safety provisions (like Pilot Rescue Systems (PRS) shown in Fig. 8 and Glider Parachute Recovery Systems (GPRS) shown in Fig. 7) an introduction in two steps, separated by three to four years is proposed. During the first phase, the total reward for onboard safety provisions is limited to 4%. Three to four years later, when new safety provisions like PRS

are expected to be available for many modern glider types, these may be added to the list and the limit is lifted to the eventual 6%.

By introducing a free choice “shopping list” of rewardable safety devices and by a cautious introduction, starting with a maximum of 4% for safety rewards, the playing field can be kept level for all pilots in the same class.

There is no need for any pilot to install all devices on the list. Each pilot should make a choice from the “shopping list” of rewardable safety provisions, considering their own safety priorities, their own purse and the maximum safety reward they can get. No big money is needed here. Every pilot flying at WGC’s can afford the expenses on safety devices needed to reach a 4% safety reward limit (valid during several years).

A strategy to integrate this proposal in a pilot’s competition flying would assure them the best position at the start of the competition. It also could be an inspiring example for many other pilots. For any serious competition pilot, such strategy should begin long before the competition and should include all choices to be made for the glider, the onboard equipment and the training of the pilot; just like the flight performance strategy.

If a pilot deliberately chooses *not* to install enough safety devices to reach the reward limit, their strategy fails both from a point of safety and in terms of the chances of winning the competition. That would not be smart. Obviously that pilot should not win a competition which is targeted at best performing pilot *and best safety*.

In the second and final phase of the introduction of the “6% for Safety” system, the reward limit can be lifted to 6%, provided that certified GPRS and PRS are available for use in all gliders in the same competition class. The knowledge of this intent will certainly enhance both the development and proliferation of GPRS and PRS, as we would like to see.

Most probably this proposal, at first, will meet strong emotional opposition from quite some people. But, this can be overcome by weighing it against the present far too high accident risk in gliding and the compelling need for effective means to improve this situation.

From a moral point of view, it would not be improper to expostulate competition pilots that they are privileged to be enabled to participate in international gliding competitions and that an easy contribution from their side to improve their own safety as well as the safety of gliding at large is asked in response.

Of course introduction of the proposed system should be carefully prepared and published.

It is expected that, after its introduction, pilots either will become responsive to this new opportunity to improve their chances in a competition or, maybe, to avoid the risk of flying in the arrears to their competitors. Most probably every competing pilot will make sure that they will get the maximum safety reward during the competition. In that case, the safety rewards will have no influence whatsoever on the relative scoring of pilots during the contest. But the safety devices are onboard and in use!

In choosing the rewards for the specific safety devices the following aspects have been considered:

- effectiveness in preventing accidents
- effectiveness in preventing or reducing injuries from accidents
- costs
- possible negative effect on glider performance
- availability on the market
- stimulus needed to persuade the pilot to install the device

In general, it can be stated that the greater the negative aspects are, the greater the reward needs to be to overcome these objections.

“Shopping list” of eligible safety devices

For each competition class, a list of eligible safety devices with rewards will be published at least one year before the IGC sanctioned gliding competition. The lists may be adapted to different competition classes (e.g. the Club class). But each list will be fixed for at least three years.

A pilot is free to install and operate as many safety devices from the list as they wish. The rewards for the specific devices will be added together, but the resulting reward will not exceed 4% during the first phase. In the second and final phase (2015?), this maximum will be increased to 6%. All percentages relate to the flight score of the day’s winning pilot in the class.

Each installed safety device must be ready for use in compliance with the instructions of the manufacturer in order to be eligible for reward. Readiness can be checked daily during the competition. All eligible safety devices must comply with applicable rules and aeronautical requirements.

At any moment prior to take-off, up to the pilot being seated for take-off, verification of the installed safety devices may be done by the organisers of the competition.

For the first phase, the following **list of eligible safety devices** is proposed:

	Safety device	Reward	Remarks
A	Energy Absorbing Foam seat cushions	0,4 %	Fixed to seat bottom
B	Anti submarining safety harness with 5 th belt (1)	0,6 %	
C	Spinal protection device (2)	0,5 %	To be worn during each flight
D	Increased shock absorbing landing gear (Fig. 3)	1,2 %	Certified evidence to be shown
E	Spoiler control restraining device (Piggot hook)	0,2 %	
F	Emergency egress help (like NOAH) (3)	1,5 %	Operability must be shown on site
G	Demonstrated cockpit evacuation time (static on the ground) T=egress time measured in sec. (3)	0–1,0%	(1,3 - 0,1T) %
H	Improved conspicuity by appropriate markings	0,4 %	Visible at least 15° up/down from the same level
I	Improved conspicuity by strobe light(s) on fuselage or wingtips (6)	1,0 %	
J	Collision warning system (compatible to FLARM or ADSB)	1,0 %	Continuous operation checked by logger trace
K	Emergency locator beacon or similar system	0,5 %	Operability must be shown
L	Side string angle of attack indicator (4)	0,3 %	
M	Acoustical stall warning system (5)	up to 0,8 %	To be specified
N	Glider Parachute Recovery System (GPRS) (3)	3,0 %	Wider production needed.
O	At a later stage (probably from 2015 onward): Pilot Rescue System (PRS) (3)	3,0 %	Needs development and certification

1) Here the 5th belt only should ensure that the lower belts of the safety harness are “anchoring” the pelvis and cannot be lifted to a higher position when strapping in. These hip belts, when stretched tightly, will prevent submarining. The 5th “positioning belt” can be made much weaker than the conventional 5th safety belt, in order not to hurt the pilots crotch in case of a crash landing.

2) Protective spinal shells, which reduce the risk of spinal injury, need more publicity, more discussion with pilots and glider manufacturers, and better instructions for possible home fabrication.

3) We all know that after a mid-air collision in most cases only a few seconds remain for surviving. During the time between a midair breakup of the glider and the opening of the parachute the height decreases at an alarming rate (up to 70m/s). Effective rescue systems like NOAH, PRS and GPRS are aimed at reducing this time loss and the associated loss of height. This is illustrated in Fig. 1. A height of 150m is considered a minimum for full parachute deployment at 70m/s decent rate. Rapid parachute deployment is of utmost importance and, therefore, deserves a significant safety reward. The time needed for cockpit evacuation mostly is the major obstacle for rapid parachute deployment.

With regard to the safety rewards for cockpit evacuation times the reasoning has been as follows:

The most sophisticated rescue system is the GPRS, which lowers the glider with the *pilot inside* safely to the ground below a big parachute. The system works automatically under all conditions after activation by the pilot. Rate of descent is 6m/s, which in combination with a “crashworthy” cockpit construction will avoid serious injuries to the pilot on impact. Under favourable conditions GPRS has been proven to be safe down to heights of less than 200m. At present GPRS has been certificated for 4 glider types. Because of its rapid automatic action and its complete protection of the pilot it seems reasonable to allow a safety reward of 3% for a GPRS.

In all other rescue systems, the pilot descends to safety as a parachutist.

A PRS pulls the pilot out of the cockpit by a small rocket or by the main parachute itself. The system works fully automatic in all conditions after activation by the pilot. This system has been tested with models and has shown to be effective

for rescue down to less than 200m. Further development is needed for integration and certification in gliders. A (future) safety reward of 3% for a PRS seems to be reasonable.

The NOAH system acts like an inflatable cushion which lifts the pilot in the cockpit to the height of the canopy sill in order to enable them to bail out more easily and quicker, also under adverse G-conditions (Figs. 5 and 6). Stationary on the ground egress times of less than 2s have been measured. Parachute deployment is manually by the pilot, after bail out. So, a slightly lower reward of 1.5% for the NOAH system seems to be consistent.

Measuring autonomous (without help) cockpit evacuation time by the pilot on the ground *in static conditions* gives results which do not account for adverse G-conditions and strong airstreams, which during actual emergency will cause significant delays. So, the maximum reward for measured cockpit evacuation times at the ground should be set significantly lower than the reward for NOAH. For that reason the maximum achievable safety reward for measured autonomous cockpit egress time is proposed at 1.0%.

In order to keep the calculation simple and transparent the formula:

$$\text{Reward for measured egress time} = (1,3 - 0,1T) \%$$

is proposed where T is the measured cockpit evacuation time in seconds. Unaided cockpit evacuation within 3s is impossible. An egress time of 13s or more gives no safety reward.

The intent is that the competition pilots will train and exercise rapid cockpit evacuation prior to the competition in order to increase their chances if they need to bail out, and (as a stimulus) to gain as many safety rewarding points as they can. After some training, their results should be much better than without training and they will gain competition points accordingly. Hopefully, this will become a challenge for other glider pilots world wide.

The rewards for GPRS, PRS, NOAH and measured cockpit evacuation time are mutually exclusive. So they cannot be added. Only the highest specific reward will apply.

4) A “side string” at the side of the forward canopy (left or right hand side) well visible to the pilot will, after calibration, inform the pilot about the actual angle of attack of the wing and the approach of stall (Fig. 4).

5) An acoustical stall warning system can improve safety especially when thermalling together, in mountainous regions and in conditions of lesser visibility; also in gliders with docile stalling characteristics. Such systems are being developed and can be retrofitted in most glider types.

6) Similar to FLARM, strobe lights will help to enhance the conspicuity of gliders. Not all competition pilots like that. FLARM has been criticized for the same reason in the past. After several lucky non-collisions due to FLARM that criticism is now fading. At present FLARM is compulsory at several gliding competitions and in some busy gliding areas. Strobe lights have an excellent safety track record in civil aviation.

Other safety devices which are still in development may be added to the list as they come available on the market.

Advantages of the "6% for safety" proposal

- The "6% for safety" proposal enhances the use of existing safety provisions in a fair and simple way.
- Each safety device will retain its value for many years; both in terms of improved safety and as a reward in competition points.
- It does not jeopardize existing glider types.
- It does not favour rich pilots.
- It is adaptable for different competition classes.
- It does not force manufacturers and their customers to develop new glider types but it may stimulate them to introduce certain adaptations in existing gliders or to further develop safety equipment (like NOAH, PRS and GPRS).
- It is open to adopt future safety provisions when these become available.
- It works all voluntary and it does not put restrictions or sanctions on non-compliance.
- Most probably it will be rather effective as it offers a persuasive incentive for ambitious competition pilots.

Challenges of the "6% for safety" proposal

- Most certainly this proposal will be met with much caution and reserve from the side of competition pilots and perhaps organizers. That is why a careful announcement followed by an introduction in two steps seems essential for success.
- The proposed new approach of using gliding competitions as an instrument in the struggle to improve safety in gliding will need a change in thinking about organizing and flying gliding competitions within IGC and in the arena of gliding competition. This will certainly meet a lot of resistance and objections. Yet, if improvement of safety in gliding is considered to be a serious issue, it is well worth the effort to attempt this new approach.

Recommendations

It is proposed that this paper containing the three proposals will be offered by the President of OSTIV to the IGC as soon as possible. After discussion, IGC might decide to implement **Proposals A and B** and to prepare an announcement and discussion of **Proposal C** at all World Gliding Championships in 2010.

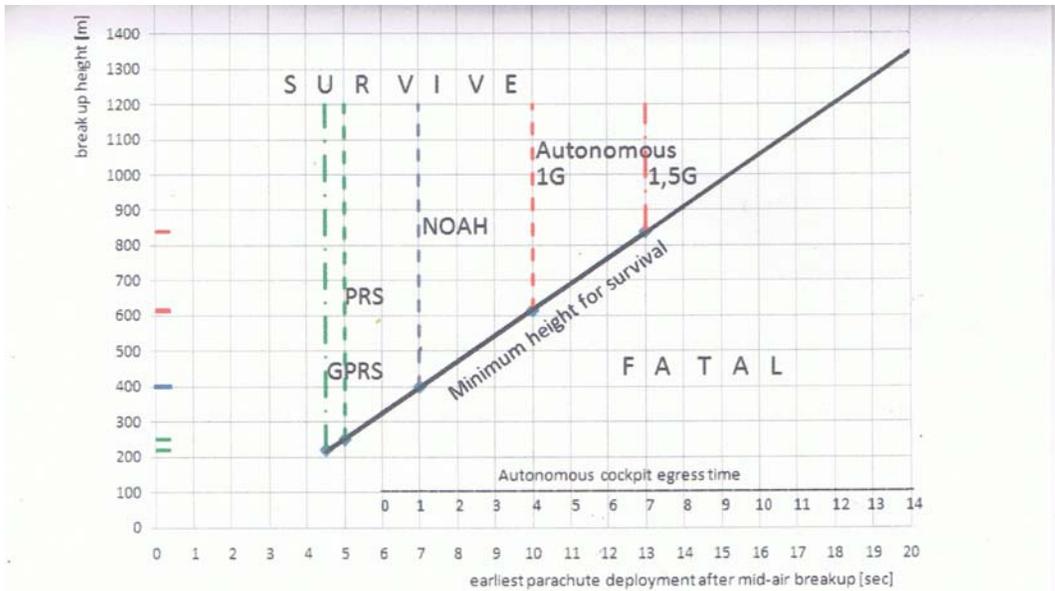
Target for the first experimental introduction of Proposal C (using virtual safety points) could be the European Gliding Championships or the Pre-WGC in 2011.

First official application could be at the World Gliding Championships in 2012.

But keep in mind, *improving the Safety of Gliding stands no delay!*

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Height to survive mid-air breakup using parachute systems.

Most mid-air collisions occur below 1000m !

Pilot actions after midair breakup:

- fright, recognition, decision: 3
- pull canopy jettison handles or actuate NOAH, GPRS or PRS: 1,5
- unlock safety belts manually: 1,5

first 4,5 seconds after breakup

first 6 seconds after breakup

Minimum time for parachute deployment after mid-air breakup:

Minimum height to survive:

Autonomous bailout, 1,5G conditions:	>13s	850 m
Autonomous bailout, 1G conditions:	>10s	600 m
Bail out with NOAH	7 s	400 m
Bail out with PRS:	5 s	250 m
Stay in cockpit with GPRS:	4,5 s	220 m

Mid-air damage: fuselage broken off behind wings.

Ref. Prof. Wolf Röger, FH Aachen

Figure 1 Height to survive a mid-air break-up using parachute systems: NOHA = NOt Ausstieg Hilfe = emergency bailout help, PRS = Pilot Rescue System, GPRS = Glider Parachute Recovery System. **Editor's note:** the 'minimum-height-to-survive' lines are in color in the online version of the paper at journals.sfu.ca/ts/.

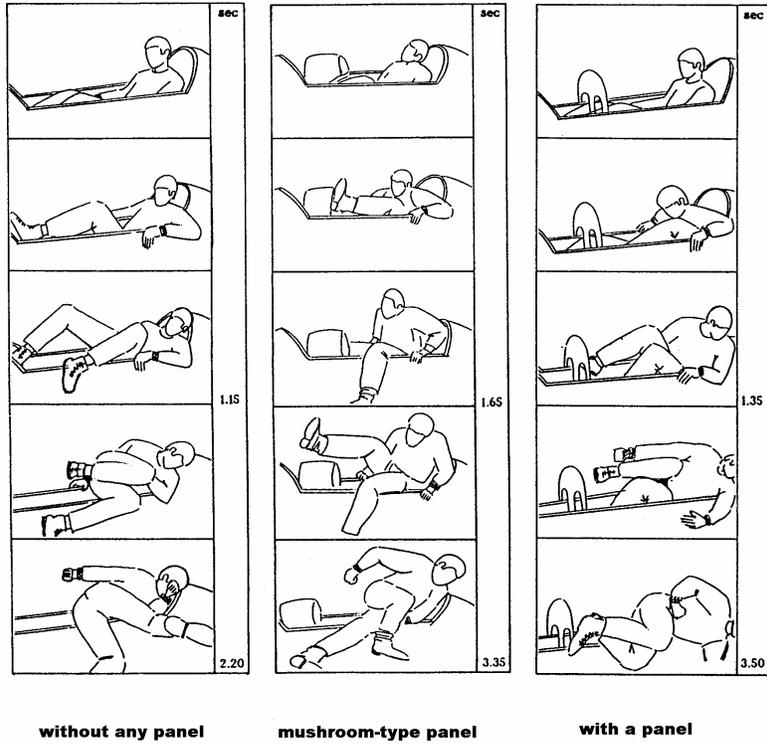


Figure 2a Roll maneuver depending on the type of panel

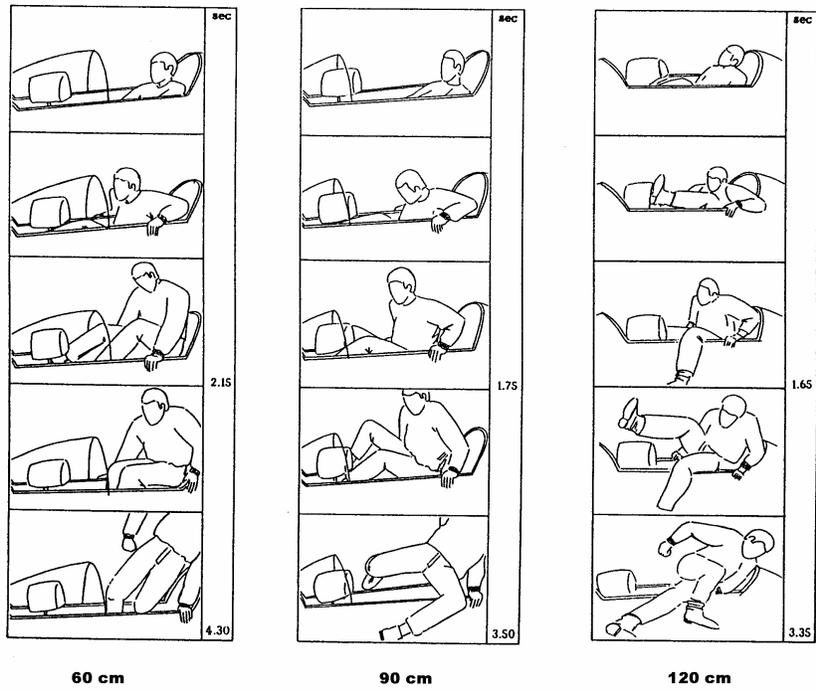


Figure 2b Roll maneuver depending on the length of the canopy

Editor's note: Figures 3 through 8 are in color in the online version of the paper at journals.sfu.ca/ts/.

OSTIV SDP Safety Pays



Proposal C

Examples

Item D

Shock absorbing landing gear

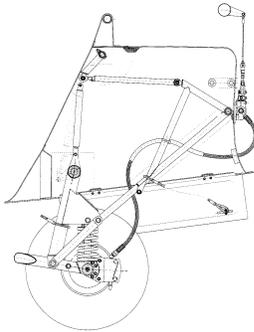


Figure 3

OSTIV SDP Safety Pays



Proposal C

Examples

Item F

**NOAH
(Photo DG Flugzeugbau)**



Figure 5

OSTIV SDP Safety Pays



Proposal C

Examples

Item L

**Side String
(Photo Prof. Ernst Schoeberl)**



Figure 4

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Examples

Item F

**NOAH
(Photo DG Flugzeugbau)**



Figure 6

Proposal C

Examples

Item N

GPRS
(Photo Peter. F. Selinger)



Appendix

Fatality rate during WGC's and Gliding Grand Prix competitions

Statistics relate to all 44 multi-class World Gliding Championships (Open, female and junior) and 3 Grand Prix Competitions from 1948 to 2010 inclusive.

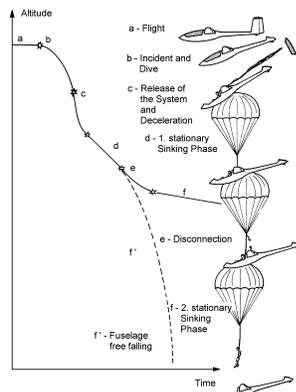
Only fatalities known to the author are used. There may have been more, not known to me. Those would even further darken the situation.

Year	Location of competition	Fatalities
1948	Samedan	2 pilots from UK
1972	Vracs	1 pilot from DDR 1 pilot from Canada
1991	Uvalde	1 pilot from Finland
2005	JWGC Husbands Bosworth	1 photographer from UK
2009	Grand Prix Omarama	1 pilot from Germany
2010	Prievidza	1 pilot from Russia

Figure 7

Proposal C

Example for PRS
("Kiffmeyer-System")
(Courtesy Prof. Röger, Fachhochschule Aachen)



Over the years the numbers of participants in the WGC's have gradually increased from less than 50 in Samedan in 1948 to 150 in Szeged 2010. In Grand Prix competitions the number of participants was far less (14 to 16).

In the calculation not only the number of actual competition days but also the number of pre-competition training days has been estimated and taken into account. On average, ten competition days and three training days have been assumed. Also, it is assumed that all participating pilots flew on all competition and training days (which is an overestimation). This is certainly somewhat optimistic, but intentionally avoids criticism of too pessimistic calculations.

These estimates bring the total of flights at WGC/Grand Prix competitions at about 53.500 flights up to now. The resulting fatality rate is 53,500:8. That is, one fatality per 6690 flights. World wide the fatality rate in gliding during the last ten years was 1.42 fatalities per 100,000 flights (1 in 70,422 flights). Thus, statistically the fatality rate during WGC/Grand Prix competitions is *more than ten times* as high as in gliding world wide!

Figure 8

Eric de Boer 22-08-2010