Safety II for the Improvement of Safety in Competitions

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Abstract

The commercial air transportation industries use effective, efficient and ubiquitous Safety Management Systems to continuously improve safety. In soaring competitions, nowadays only the reactive safety method (Safety I), i.e. learning from accidents, is used. Requiring the competition organization to use modern Safety Management techniques has the potential to significantly improve the safety in competition. If the effect is similar to the commercial air transportation industries, a factor of 5 to 20 improvement in safety may be expected.

Introduction

Competition flying carries by far the highest statistical risk for a pilot to be involved in a gliding accident. A recent data-based risk analysis, done by the IGC Safety Group, reported a calculated risk of 1,200 fatalities per one million starts over the last 10 years [1]. However, this number has a large variance since the number of starts is a necessary input for risk calculations and this number had to be estimated for this risk calculation.

Safety I versus Safety II

In aviation, two types of safety methods are used: Safety I and Safety II [2]. There are some variants of Safety II methods in use: Reason Safety Management [3], Threat and Error Management (TEM) [4], and Resilience Engineering [5]. Safety II methods, respectively TEM / SMS (Safety Management Systems) were globally introduced in the air transportation industry in 2010-2015 [2,6]. The effect was a dramatic decrease in accidents, as seen in Figure 1 [7]. In 2013 ICAO mandated that all commercial flight transportation companies, ATC, and aircraft manufacturers implement a Safety II based SMS. So Safety II must be used by all aviation service providers worldwide. Ultimately this has transformed the commercial air transportation companies into highly reliable organizations and made flying safe for us.

Safety Management

Safety II has at its roots this approach to safety: we do not wait until an accident happens. If we use the observation capability of all the members of the organization, we see what is going on. However, just seeing something is not doing any good for safety.
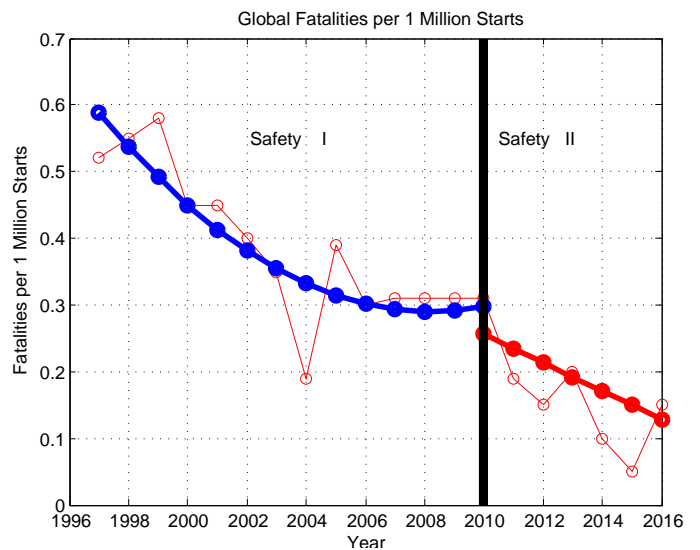

Fig. 1: Evolution of annual number of fatalities per million flights in global air transportation (adapted from [7]).

First, one needs to be able to understand what happened, even when this was an unwanted incident. For example, a pilot notices that he has performed an unsatisfactory pre-flight check and omitted some important point, such as forgotten to lock the air brakes. The most essential skill that all members of the organization must develop is understanding how human communication functions. In particular, every member should learn how to succeed in communicating effectively, especially on sensitive subjects. This skill can and should be taught.

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Second, every organization needs some Safety Management specialists, called Safety Managers. The Safety Managers are intensively trained to be able to earn the trust of, and provide shielding for, the individuals who report safety-relevant observations from all over the organization. From these safety-relevant observations the Safety Managers derive concrete projects which are measurably able to cope with a potential safety problem. These projects are delivered to the executive departments for an evaluation and eventual implementation. For the example of the unlocked airbrakes, one of the requirements for such a "project" is: given that every pilot will forget this point, how can one introduce a second safety barrier? One solution is that somebody else – this needs to be organized (= a project) – is cross-checking the state of the glider just before each takeoff.

The effectiveness of the Safety Management is measured and reported organization-wide. Two key performance indicators are used for this: the fraction of found safety-relevant observations per 1,000 starts and the fraction of projects derived per 1,000 starts. Both key performance indicators then can be combined into a qualitative measure: good safety, average safety, safety needs to be improved.

Safety Management for Competitions

What is necessary for implementing Safety II methods for gliding competitions? The key components are the training of the ICG steward assigned to the competition. The stewards shall not go to a competition unless they received the proper training and have passed an independent exam on a sufficiently high level. A second training is necessary for the members of the competition organization, so that all understand what Safety Management is and what the role of the ICG stewards (i.e., Safety Managers) is. A short training of not more than one hour is then conducted for all members of the competing teams shortly before the competition starts. All competing teams must hand in three safety-relevant observations (in shielded trust) for each flying day to the Safety Managers. Every day the Safety Managers deliver a two-slide safety briefing to all.

The first slide reports what safety projects have been implemented the previous day. Here is a template for such a slide:

Safety Briefing

Yesterday, the Competition organization realized
the following safety-relevant projects:

- All Tug planes now have a registration code that are readable from behind

- No Tow will launch until there is positive communication established between the tug and glider pilots

- …

The second slide provides feedback to all, how safe the competition is. The display is a so-called nomogram, and consists of two parallel lines with colored areas red, yellow and green. Figure 2 gives an example of such a nomogram used in a real competition in Germany. The left scale ranges from 0 to 100% and indicates the fraction of safety-relevant observations (SRO). In a number of trials in actual competitions in Germany it turned out that it is possible that each pilot or team (participant) can easily produce two safety-relevant observations per day. Since the derivation of safety-relevant measures from these observations is most important in the first days of a competition, six SROs in the first two days per participant represents a suitable 100% value for the left side of the nomogram. This coincides with the "six-percent-for-safety" rule which de Boer claimed for impoving the safety of a competition [8]. de Boer's proposal means that the organizers of a competition could eventually reward the participation in safety with one percent per SRO (up to 6%) of the total competition points of a participant.

The right scale also ranges from 0 to 10 and indicates the number of realized safety projects at this competition. Empirical experiments in competitions demonstrated, that at least 10 specific projects are typically possible.

The quality of the safety at the competition is the color of the midpoint of the actual indicators. Red stands for "safety is bad, something must be done to improve the situation". Yellow stands for "safety is sufficient, however could be improved". Green stands for "safety is good, we can keep on".

Discussion

What are the costs, efforts, additional workloads etc. for Safety Management at competitions? First, the IGC stewards must successfully pass a Safety Management training exam. Second, the Competition Organization must successfully complete a Safety Management training course. This can and should be at a time where the overhead for the Competition Organization can be minimized. So, the costs are basically the time spent by the ICG stewards and the members of the organization for learning Safety II methods.

And the best outcome: besides the provision of the safety-relevant observations, which can be done by the team members, there is no additional workload for the pilots at the competition. Handing in safety-relevant observations to the Safety Manager can be handled by the Teams anytime of the day.

What could be the benefits for implementing Safety II methods at competitions? In time, it might be possible to have as much of an increase in safety as has been observed when Safety II methods were introduced in the commercial air transportation Industry. The alternative means accepting the current state of safety in competitions.

Conclusion

This paper explained what Safety Management is - Safety II methods are the standard in the commercial air transport companies and other organization in aviation. In these organiza-

tions, safety improved tremendously following the introduction of these Safety II methods. Thus, Safety II methods for Safety Management are proposed to be implemented in competitions.

Acknowledgments

References

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Safety Measures for Glider Competitions

measured is the performance of the
Safety-Management-System (SMS)
during the competition

Percentage of
**Safety Relevant
Observations (SRO)**
as input to the SMS

**100% =
6 per participant
during the first
3 competition days**

**Example 30
participants
target: 180 SRO
found 176
= 98%**

100%
90
80
70
60
50
40
30
20
10
5
0

good

average

bad

> 10
10
9
8
7
6
5
4
3
2
1
0

Number of
In this competition
**Implemented
Safety Measures**

100% = more than 10 projects

**Example: target 10
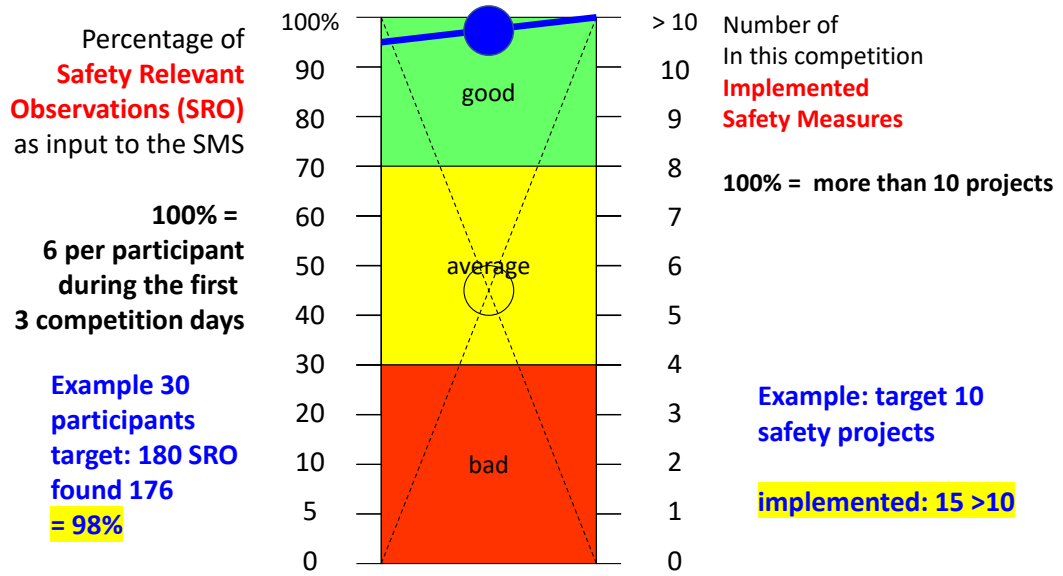safety projects**

implemented: 15 >10

Fig. 2: Nomogram indicating safety level of a gliding competition.