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FIS FACT SHEET

Important New Rules in Ski Jumping and Nordic Combined Summer Grand Prix

1 – Greater fairness and safety – end of a dogma, or why it is not necessary to do competition jumps with constant inrun lengths.

Professional Ski Jumping of the last few decades can be described in one sentence: the best athlete in the field determines the inrun length. The philosophy behind this is the following: all athletes (in individual events) should use the same inrun length during any given round of competition. Exceptional athletes such as Matti Nykänen, Jens Weißflog, Janne Ahonen etc. have been particularly good at leaving other competitors behind thanks to this stance -- they were still able to keep flying when others had landed just after the knoll of the hill.

This will no longer be the case for at least the near future. A new set of rules, designed to shake Ski Jumping's foundations, will be tested in the Ski Jumping and Nordic Combined Summer Grand Prix 2009. Two questions need to be taken into account: one can be answered quickly; the other is somewhat more complex.

- (1) When can the inrun length be changed in Ski Jumping?

Answer: when conditions have altered!

- (2) Can competition jumps be done using different inrun lengths?

This second question is more complex. How does the inrun affect the distance jumped? How do wind conditions affect the distance jumped?

Last season's experiences in Vancouver, Lillehammer and Garmisch-Partenkirchen have played a pivotal role in the debate on fixed inrun lengths:

- (1) In Vancouver, the jury chose the optimal inrun and everybody had perfect jumps except the last two athletes, who had upwind. The first of the two could not land his jump at 149 m. The jury only had limited room to maneuver: give the go-ahead to the last jumper under the same conditions and put him in danger; wait and disadvantage the final athlete; or stop the jump and restart the competition, resulting in an extreme time overrun.
- (2) In Lillehammer, the jury made their usual decision on the inrun, but after the 20th jumper conditions changed, as there was upwind. The competition was stopped after the 21st jumper and restarted. This meant discounting the good jumps of several athletes who had already taken their turns and dampening the excitement of the competition. The event's planned duration was also well exceeded. A few minutes later, wind conditions went back to normal again.
- (3) The jury had to choose the length of the inrun at a time when it had no idea if conditions would change in the next 30 minutes in Garmisch-Partenkirchen (and in the World Cup in general). As a result, they selected a moderate inrun as experience has shown there is often more wind toward the end of the competition. On this occasion, however, there was no wind and the resulting short jumps were not exciting

The jury consists of the best and most experienced experts FIS has in Ski Jumping. Even so, these experts are still somewhat dependent on luck in making sure an event is successful – and this is not possible 30 times per season.

Up to now, a wind corridor has been used for fairness. We know what difference one m/sec tailwind or upwind makes in terms of distance jumped and, to give all athletes an equal chance, a narrow corridor is usually chosen for each event. Having said this, there has to be a certain range to ensure smooth competition.

Suppose that the corridor is set to -1 m/sec to +1 m/sec (this can make a difference of up to 20m in distance), if the wind picks up to 1.2 or 1.5 m/sec, it will be still calm in the arena, conditions will still be perfect, but there will be no jumps as the data entered into the start-light system prior to the competition cannot be overruled!

It is all about inrun and wind

Hans-Heini Gasser, member of the FIS Sub-Committee for Jumping Hills, developed the basic formula used for calculating the relationship between inrun length and distance jumped. The **f value** has to be calculated for each hill separately, as they are all constructed differently.

The f value determines how many meters are jumped per 1m inrun on any particular hill.

One additional meter of inrun on a large hill translates into about 5 m more flight. Rung distances are mostly shorter than this and are between 60 cm and 70 cm on most jumps. Thus, if 1 m more inrun means 5 m more distance, that means changing the inrun by 60 cm results in a difference in jumping distance of 60% of the f value.

Example: if Jumper B were moved 50 cm lower on a large hill compared to Jumper A due to upwind, then a further 4.5 points would be added to his total -- 50% of 1 m inrun/5 m jumping distance is 2.5 m x 1.8 points = 4.5 (point value for every meter jumped). If Jumper C were to be moved to a rung 50 cm higher compared to Jumper A due to tailwind, then 4.5 would be subtracted from his total.

As already mentioned, the inrun has to be changed sometimes due to alterations in wind conditions. As a result, "wind" must also be added to the calculation. The wind corridor should then become history once wind conditions can be calculated for each athlete individually and in realtime. The results of the first jumper would be used as a basis for this. His coefficient would improve or be downgraded depending on whether the next jumper had better or worse conditions.

The New Wind Formula:

$$\Delta w = TWS \times (HS - 36)/20$$

HS - hill size (m)

TWS - tangential wind speed – mid-value (m/s)

Δw – wind effect on jumping distance (m)

Example: a jumper achieves 119.5 m on a large hill with HS = 130 m and the wind components measured are 1.55 m/s of tailwind. The distance is $[(130 - 36)/20] \times 1.55 = 4.7$

$x 1.55 = 7.28 \text{ m}$ – if rounded up to the nearest half meter, 7.5 m His final jump would be calculated as 127 m (119.5 m + 7.5 m).

2 – Interview with Walter Hofer: “Luck still plays too important a role”

Walter Hofer (54) is FIS Head of Ski Jumping and Nordic Combined and the man behind the idea of what might be the biggest revolution in the rules of Ski Jumping.

When and how did you become conscious of the need to change the philosophy of every jumper using the same inrun during a round?

Hofer: We hold a number of events during the season – Kulm, Vancouver, Oberstdorf, Lillehammer – which we get through with a queasy feeling in our stomachs. Horst Nilgen, FIS Media Coordinator, said to me in Vikersund: “This can’t go on any further. You must think of something”. His words were a signal, as Nilgen looks at the system from the outside, but also is aware of what is happening in this scene. At any rate, this comment was the final justification for me to discuss this matter with the FIS Jumping Committee.

What further steps were taken?

Hofer: We got the necessary persons in touch with each other: Hans-Heini Gasser from the Sub-Committee on Jumping Hills, who makes the hill calculations; FIS Ski Jumping expert Prof. Gerhard Hochmuth; hill constructor Wolfgang Happle; my assistant Miran Tepes; Enrico Richter from Swiss Timing Data Service and others. At the same time, I spoke to Dieter Thoma and Andreas Goldberger, as we wanted to hear the opinions of former ski jumpers who are now TV commentators on our new plans. Both were enthusiastic.

What was the feedback from the FIS Committees for Ski Jumping and Nordic Combined at the beginning of April?

Hofer: Both groups were in favor of tests during the summer, but also mentioned a full range of “ifs” and “buts”. It will be particularly important to see if the new points system will raise transparency for the public.

The trainer tower should be the main base for coaches so that they can decide on the inrun for their athletes.

Hofer: Yes, though it has been made clear that there will be no increase in rung changes. We believe that the trainers will get involved maybe three or four times during the 30 competitions. The jury will get more negotiation space in extreme situations thanks to the new rules and can move the beam up and down, while trainers can only shorten the inrun. The luck factor will be more controllable.

In addition, we are considering preventing trainers from making changes to avoid delays if weather conditions dictate it – e.g. snowfall. Thus, we can avoid possible irritations from getting in the way of a round.

It is also clear that the new system cannot compensate for different conditions on the inrun. When, for example, the inrun is slower due to snowfall, we simply cannot lengthen it, as the athlete would be automatically put at a disadvantage, according to our mathematical formula.

Do you think that these rule changes will be used in winter?

Hofer: We aren’t expecting anything at the moment. We are testing these changes in the summer, are doing our field trials, and hope to gain new insights through this. Maybe, there will be a partial alteration in the current World Cup regulations, or maybe we will throw the new rules out. We only know it would be a great leap forward – at least on paper -- in terms of safety and fairness in Ski Jumping.

3 - The importance of numbers in sport: math without sport is conceivable, sports without math isn't

If it is our nature to be competitive, then it is also our nature to measure the results.

The influence of mathematics goes beyond adding up goals in team sports; seconds and minutes, meters and centimeters in track and field; points in fencing, wrestling, the martial arts, golf, darts, snooker; or the number of given gates or marks in Alpine Skiing or sailing. Few examples:

Football (Soccer)

Author Matthias Ludwig calculated that a footballer usually covers a circular area with about 15m radius on the pitch -- an area of circa 707 square meters -- in his book "Mathematics and Sports". If we divide the standard area of 7,140 square meters of a football pitch by the area a player covers, we get a result of 10. A figure of 10 players per team is not far wrong from a mathematical point of view.

Baseball

The distance between bases is 90 feet or 27.43 meters. This optimal distance was the result of trial and error, as 100 feet would favor the defense and 80 feet the offense. In addition, Pythagoras's theorem is used to set up a standard baseball field.

Track and Field

The individual results of the decathlon are converted into points using a table oriented on the world records in the individual disciplines. The current world record in each discipline is valued at 1,200 points.

Diving

Athletes can choose between 90 dives with over 350 variations. The difficulty level lies between 1.2 and 3.6. Seven judges give marks from 0 to 10, whereby the highest and lowest score are disregarded. The total of the remaining five marks is multiplied by 0.6 and the respective difficulty level. The sum of the individual dives makes up the total score.

Ski Jumping

Ski jumping is also dominated by numbers and formulas. The jump distance is converted into points and the style marks of the five judges are added together (although the highest and lowest marks are discarded) to calculate the value of the jump. The total score after two jumps determines the winner.

4 – Statements

Jouko Tormänen, Chairman of FIS Ski Jumping Committee: "We are working toward greater security and fairness in our sport, but it is always difficult to say in advance what the outcome of changes in rules might be. For sure, the new rules have to bring big benefits to Ski Jumping to justify their possible use next winter. It is also important that a wide audience can understand what's going on, and this could cause the biggest problem."

Harald Aarhus, Chairman of FIS Executive Board for Nordic Combined: "I'm looking forward to the test at the Summer Grand Prix with enthusiasm. I think that we are moving in the right

direction. After the Summer Grand Prix, we will be in a situation where we have advanced conclusions.”

Gregor Schlierenzauer, Overall World Cup Winner in Ski Jumping: “I’m not that happy with these tests because I fear that the competitions may become a tactical game between coaches and their athletes. Secondly, it is not possible to computerize outdoor conditions. And, thirdly, the spectators won’t understand the new rules. It may be that an athlete who doesn’t jump that far could win – and I do not agree with this: the winner should be the guy who makes the show, who jumps the furthest.”