GPS Triangle Regulations for Scale-Gliders "1/3-Class" and SLS-Class

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1 Definition of GPS Triangle soaring for Scale Gliders

1.1 Purpose and Goals

GPS Triangle competitions are meant to build a bridge between model soaring and full-size soaring competitions. Its goal is to display cross country soaring competitions of full size soaring in the scale of our model aircraft. The main task, when participating in a GPS Triangle contest is to fly around a virtual triangle (perimeter ~2.4 km) as often as possible in a period of 30 minutes. In order to obtain comparable results, the maximum starting altitude (usually 500 m) and the maximum starting speed (usually 120 km/h) when crossing the starting line are equal for all pilots.

The fascinating aspects of a GPS Triangle contest are:

- Lots of activities in the air (e.g., various gliders flying at the same time, towplanes)
- A lot of flight time for each pilot during the competition
- Offering a wide variety of tactical decisions in combination with optimized teamwork between pilot and helpers.
- Flying with high performance scale gliders.
- Combining a complex flight task with rules as simple as possible
- Easy organization with only very few helpers

1.2 General Rules

For the execution of a GPS Triangle contest, the technology of satellite navigation with data communication from the model to the pilot is used. Together with the use of Data Loggers, the position (latitude, longitude and altitude) of the glider can be determined and verified in real-time. This simplifies both the flying operations and the evaluation of the flight.

Every pilot must use commercially available navigation equipment, compatible to the specifications described in **Appendix 2**. Pilots are not allowed to use more than two “onboard-systems”, whereas, one is the main system and the other is the backup system. The applied system must be certified by the GPS Triangle Committee, the required soft- and firmware-versions need to be installed.
Every pilot must control his aircraft himself. In the case that the aircraft is controlled by someone other than the pilot, the competitor will receive a zero score (0) for this round.
The scoring of the individual flights to compute the individual results is based on the logged flight data and is calculated in the contest directors’ office. The details of the data to be logged for scoring is shown and explained in **Appendix 2.**
The following flight data from existing and permitted navigation systems can be submitted to the competition officials in order to calculate the results.

The applied system must provide information after the flight about:

- Starting time (in UTC)
- Task starting altitude (in m)
- Task starting speed (in km/h)
- Flight time (i.e., a period starting when glider crosses starting line until it completes last triangle in min:sec)
- Number of triangles (n)
- Average speed, at which the triangles (multiple of 2.414km) were done
- Violation of safety area(s)
- Logging of Motor switch. “Motor off” shall be logged with according time-stamp (shall be implemented as soon as possible)

Note: To validate the logger the motor must be switched on for a short time prior to the launch.

In addition, the system must provide a check code. This is generated based on the data above (e.g., starting time, task starting altitude) and is to ensure that no errors occur when processing the information from the flight card to the stationary evaluation software.

The use of additional variometers is limited to devices operating on frequencies in the 2.4 GHz band.

Penalties may be imposed by the contest director, with the consent of the Jury, for:

- Unsporting behavior
- Technical Infringements

Unsporting behavior:
Cheating or unsportsmanlike conduct, including deliberate attempts to deceive or mislead officials, deliberate interference with other competitors, falsification of documents, use of prohibited equipment or prohibited drugs, airspace violations, or repeated serious rule violations should normally be punished by exclusion from the competition.
Unsportsmanlike conduct shall also be understood as a deliberate attempt by a competitor to influence, intimidate or threaten officials or other competitors or teams in order to gain an advantage over other competitors or teams - regardless of whether this occurs immediately before, during or immediately after the sporting event. This behavior may result in disqualification of the individual or team from the competition.

Technical Infringements:
Any competitor using a model or equipment that does not comply in all respects with the rules and regulations of the event or has not been approved by the organizer will be disqualified from the competition.

1.3 Use of Telecommunication Devices

The use of any electronic device other than for piloting or navigating the model aircraft is forbidden. Mobile phones have to be switched off or turned into flight mode on the flying site.

1.4 Insurance

Each participant must provide sufficient liability insurance with coverage of at least € 2 million for personal injury and property damage that covers damage resulting from the use of his model airplane.

1.5 Rules of conduct to avoid midair collisions

To avoid collisions in the air every pilot needs to obey following rules of conduct to avoid midair collisions, or even collisions on the ground.

- If two models head towards each other in straight line flight, every model has to be steered to the right (aileron right) to avoid a collision.
- In every group the circling direction for thermaling is fixed. Group A is circling left, group B right, group C left and so on.
- Circling models have the right of way. Models flying in a straight line must fly around circling models to avoid collisions.
- Avoiding optical crossings of the models' flight paths is mandatory
- In case of an abort of crossing the start line, a start-repetition after successfully entering the course or when turning around after missing a turn sector, these maneuvers must always be carried out with consideration for other models in the air.
- Abrupt turning maneuvers must always be avoided in order not to obstruct other pilots on their flight path.
- Models which came to rest after landing have to be removed from the touchdown area by each pilots' helper as quickly as possible.

Midair collisions or collision on the ground are no reasons for a reflight.

1.6 Safety on the flying site

The organizer must clearly mark the boundary between the landing area and the safety area assigned for other activities. (See sketch in 3: "flying field layout")
No matter how the layout of the safety zones is realized, the pilot box must be inside the boundary of a safety area at a distance of minimum five (5) meters (See sketch in 3: "flying field layout").
The minimum allowed altitude to overfly the pilot box must be 150m AGL independent of the setup of all other safety areas.

The maximum flight altitude is 750m above the launch site - unless it is even lower due to local restrictions.

The maximum specified flight altitude may not be exceeded at any time and must be stored in the competition task-file, so that it can be immediately detected by the navigation system if exceeded. Exceeding the maximum flight altitude before, during or after the scoring flight, will result in a zero score for the pilot for that heat. No check code may be generated.

The competition director has the right to interrupt the competition out of safety reasons (unsafe conditions) at any time.

1.7 Launching and Landing direction

All launching and landings shall take place in an area as designated by the organizer with provisions made for launching and landing into the wind (headwind component).

1.8 Weather Conditions / Interruptions

a) Interruption and Resumption of the competition due to bad visual conditions:

The Contest Director has to ensure that models flying the triangular course below the dedicated entry altitude will always be visible. If this is not the case (i.e. due to low cloud base or fog) the Contest Director has to neutralize the group in flight and interrupt the competition. It is recommended to launch the group again with a lower dedicated start altitude. If this is again not possible the group has to be launched again as soon as the visible conditions permit.

b) Interruption and Resumption of the competition due to high wind speeds:

The maximum wind speed for contests is twelve (12) m/sec. The contest has to be interrupted or the start has to be delayed by the contest director if the wind speed exceeds twelve (12) m/sec measured three (3) times for at least twenty (20) seconds in a time interval of five (5) minutes two (2) meters above the ground at the start and landing area.

c) Interruption and Resumption of the competition due to rain:

In the case of rain he ongoing round has to be interrupted as well. The Contest Director has to neutralize a group in flight and interrupt the competition until the rain will stop. All pilots have to land their planes as soon as possible as soon as the Contest Director neutralized a group in flight. The group which was neutralized will reassume the competition at a later time as soon as the rainfall has stopped.

2 Scale Glider and Technical Equipment

2.1 Definition of a Scale Glider

A scale glider is defined as a radio-controlled glider which is constructed based on a manned full-size glider or motor-glider. Furthermore, it must be verified that at least one airworthy full-sized aircraft of this type was produced. In addition, the scale glider must comply with the specifications mentioned in paragraph 2.2.

2.2 Specification of a Scale Glider

2.2.1 General

In general, the shape of the original glider must always be clearly recognizable. The number, type, and implementation of RC control functions is not regulated and thus there is no need to comply with the control functions of the original glider.
Even though there will be no scoring of the accuracy of the scale in detail, every competitor has to verify that his glider(s) are compliant to the rules. Therefore, he must provide the following data of the original glider based on manufacturer documents:

- 3 side view
- Width and height of the fuselage
- Root chord depth of the wing
- Wingspan

These documents can be manufacturer drawings, plans, 3 side view, scale-documentations or data obtained from the manufacturer homepages.

- The maximum deviation from the full-size aircraft are depicted and specified in size **in appendix 3.**
- The value for the maximum deviation of fuselage length is applicable for scale gliders which were manufactured or became commercially available after the year 2017 (+/- 50mm).
- Scale Gliders which are replicated from a full-size aircraft featuring a (in flight) variable wing geometry (i.e. telescope wings, fowler flap wings) can be built with any fixed planform between the minimum and maximum area of this variable geometry. The respective wing loading though must at no time exceed the maximum wing loading limit specified under 2.2.2.
- The type of undercarriage to be used is determined by the type of undercarriage of the full-size glider.
  If the full-size glider is/was built with an undercarriage, retractable or fixed, the respective undercarriage must be implemented in the model scale glider as well. In case of a fixed gear, it has to protrude out of the fuselage with an accuracy of +/- 15mm depending on the scale.

2.2.2 Class 1:3

The scale of the glider is specified by the competitor, however the scale must not exceed 1:3. Additionally, the maximum wing loading is limited to 115 g/m2 (at a scale of 1:3). For calculating the maximum wing loading the scaled wing area of the full-size aircraft is used. For gliders in a scale smaller than 1:3 a correction factor is applied as specified in paragraph 2.2.4.
The limit for the maximum takeoff weight of the scale glider is 25kg. This is independent of the maximum wing loading and must not be exceeded at any time.

2.2.3 Class SLS

In contrast to the competition class “1:3”, the scale of gliders competing in the “SLS”-class is not limited. The maximum take-off weight, independent of scale and wing loading, is limited to 25 kg.

Only electric motors are permitted for driving the following types of Self Launching Systems;

- FES (Front Electric Sustainer)
- (retractable) Impeller
- Retractable motor (“Up&Go)
- Any self-launch solution which is used by the respective full-size aircraft (i.e. orbitary propeller)

2.2.4 Maximum Take-off Weight

In addition to the legal limitations of specific countries, in the context of GPS Triangle the maximum take-off weight is calculated by the following equation:

$$\text{Max. Takeoff Weight} = (11.5 * \text{wing area original glider} \,/\, (((\text{scale of glider}^2 / 9) - 1) / 1.2) + 1))/9$$

The organizers of the GPS Triangle competition are authorized to check take-off weights at any time. Competitors whose model aircraft exceed the maximum take-off weight (maximum wing loading) will be disqualified from the GPS Triangle competition.

An overview of the current model take-off weight limitations in regard to the maximum wing loading limit is shown in **appendix 1**.

2.3 Number of Scale Gliders per Pilot

During a GPS Triangle competition each pilot may use a maximum of two scale gliders or two different configurations (related to the outline of the model, i.e. “short tips/long tips” if the full-size glider features these different configurations). These scale gliders are called A-Model and B-Model. Each detachable part of the aircraft which defines its outline must be marked with a distinctive identification label (for instance Model A, Model B). The labels have to be documented on the starting card and for each flight the pilot must checkmark the scale glider used.
(This rule stays active as long as scoring will be done using scorecards)

2.4 Replacements & Ballast

All parts can be interchanged between A-Model and B-Model. Further than that, the outline of the model must not be changed by other means than interchanging parts from A-Model to B-Model. Changing or replacing components of the radio equipment, navigation system, power unit or electronic items is allowed. Using ballast is permitted. Water ballast is also permitted and can be jettisoned during flight. When ballasting the maximum wing loading limit (see paragraph 2.2.3) must not be exceeded.

2.5 Loss of Parts

If the model aircraft loses a part (other than water ballast) during takeoff or flight the aggregate flight will be scored with zero points. The loss of a part after a midair collision or during the landing will not be considered in scoring.

2.6 Navigation & Data-logger

For navigation during flight a compatible navigation system has to be used. This system transfers GPS-data from the scale glider to a receiving device (Ground station) and/or records relevant flight data in an onboard-logger. Additionally following requirements must be fulfılled:

- The performance of a flight (number of triangles, starting altitude, average speed over all triangles) can be determined immediately after landing using the receiver equipment or readout of the onboard log file.
- Only systems fulfilling the specification (cf. Section 7 “Appendix 2”) are allowed for the flight navigation and flight evaluation.

The technical details for basic requirements concerning the navigation systems as well as a list of accredited systems are shown in Appendix 2.

2.7 Gyros, Auto Pilots & Telemetry

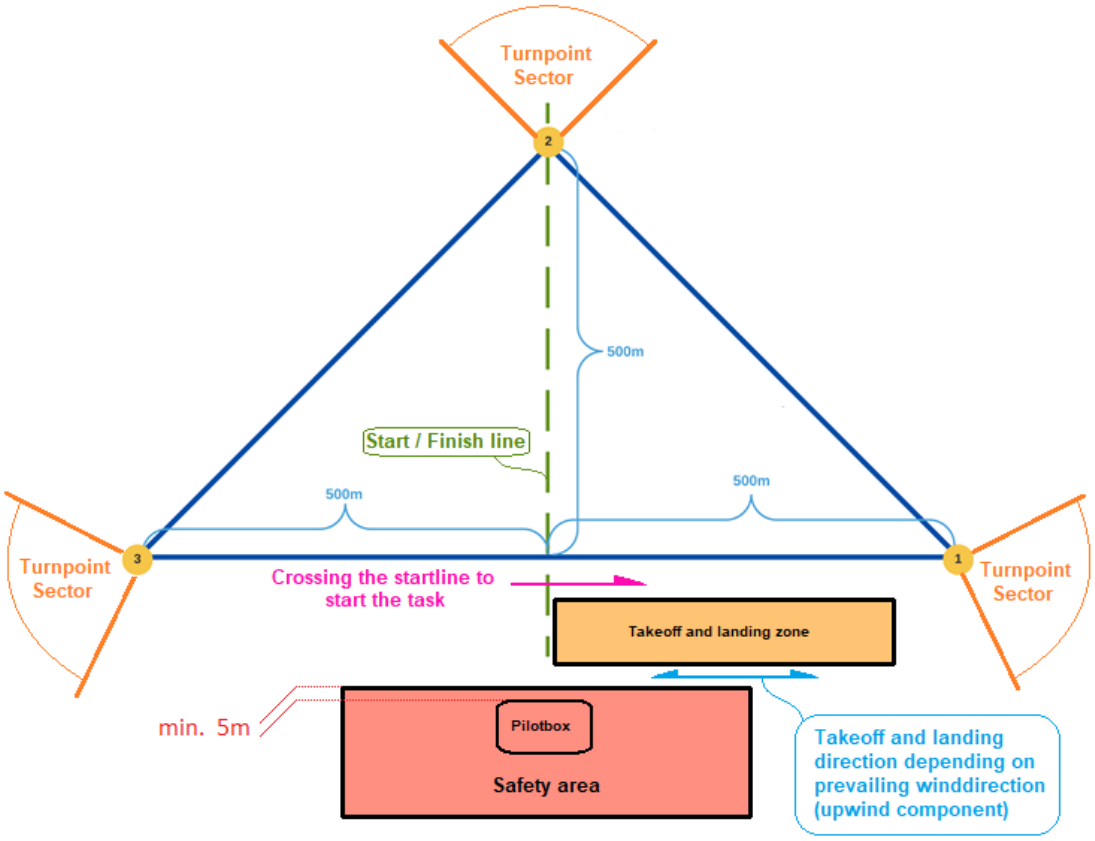
Gyros, flight augumentation systems or Autopilot systems, or the usage of data generated by such systems for flight attitude control are not permitted.

It is not permitted to connect the telemetry-receiving unit with the radio control transmitter (e.g. Speed Indicator Signal with Flap Function) in order to send a corrective signal to the model.

Doing so will result in disqualification from the GPS Triangle contest.

3 Flying Field

The flying field and the virtual triangle design:



The position and the size of the Take-off and Landing Zone as well as the Safety Zone may vary because of geographical circumstances of the flying field (see 5.6.2). The Take-off and Landing Zone conforms to the minimum width of the airstrip of 25 meters and a length of at least 80 meters. The position of the pilot box inside the Safety Zone can be chosen freely by the contest director, but has to be at least minimal 5m apart of its outside boundaries. The sketch above is not true to scale. The view into the area in which the triangle is placed should be unrestricted.
The altitude band of the Safety Zone above the Pilot box has to be at least 150m AGL.

Depending on the terrain the organizers of the competition may declare Security Zones which are defined by an outline and a height band. If one of these Security Zones is violated, the aggregate flight will be scored with zero points.

4 Organization of a GPS Triangle Contest

4.1 General Rules

4.1.1 Contest Organization

The contest organization provides the following personnel:

- Contest director: responsible for the entire GPS Triangle contest and shall not participate as active pilot in the contest.
- Supervisor of Flying (SOF): responsible for coordination of departures, landings, times and weight of the models. Every pilot having finished the official task will announce his landing. The SOF will confirm the correct landing procedure (see 5.6.2) on the control card.
- Evaluation officer: responsible for entering the flight results and creating intermediate and final ranking lists
- Jury: three persons well knowing the GPS Triangle contest rules and being able to decide in cases of doubt or problems. Jury members which are also pilots must be replaced by other persons for questions / problems concerning themselves.
- Tasks of the jury: Possible irregularities, or decisions made by the contest director or the supervisor of flying respectively can be claimed by every competitor. In case of an appeal the jury has to come together to decide whether or not the appeal will be overturned.
- The reason for a complaint in verbal- or in written form is to get a correction without the need of a formal protest. It is recommended to submit a complaint before submitting a protest.

4.1.2 Protests

Protests have to be submitted to the contest director in written form and in English language. Furthermore the protest is linked to a fee amounting to 100 Euro. The jury which has been nominated prior to the start of the competition has to come together and has to agree on a decision in this case. A simple majority within the jury members is sufficient to refuse or grant a protest. The protest fee is only going to be refunded if the protest is granted. No appeal or protest can be lodged against the decision of the jury.

Deadlines for submitting protests

- Deadlines for submitting protests

<u>Prior to the start of the event:</u>
A protest against the validity of participation, the qualification of the participants (pilots), the competition rules, the flying field and the competition area, the processing of glider models, the jury or other officials has to be submitted at least one hour before the event starts.

<u>During the event:</u>
A protest against a decision of the contest director, other officials, or against a mistake or irregularity committed by another participant during the event must be submitted as soon as the competition allows. The complaint must not be filed any later than 90 minutes after the start time frame of the respective group in which the incident occurred. Note: A protest against official results must be submitted immediately after the official results have been published on the airfield, but no later than at the award ceremony.

4.1.3 Pilot & Navigator

The participants are randomly assigned to a group by the GPS Triangle Evaluation Software. During a flight, a pilot may be assisted by a single navigator. It is of importance that only pilot and navigator are inside the Pilots Area. The noise level has to be reduced to a minimum. As a consequence voice prompts (except beeps and similar sound signals) should be transmitted via headphones.

4.1.4 Radio Frequency Control

Only frequencies authorized by the national authorities may be used; it is the responsibility of the participant to ensure this. The contest director or the Supervisor of Flying are authorized to perform a frequency control at any time.

4.1.5 Navigation System Frequency Control

The contest director assigns each pilot/navigator team a maximum of two frequencies for the transmission module of the GPS system in the glider model. The correct setting of the frequency is up to each pilot. It is recommended to make use of the four-eye principle (pilot/navigator are monitoring each other). There is a maximum of two frequencies for a pilot / navigator team. The operation of a navigation system with a frequency other than the assigned one will result in a zero score of this heat for the pilot.

The pilot disadvantaged by the incorrectly set frequency will receive a reflight in another group of the same heat. If this is not possible, the same group has to fly again. The causing pilot is excluded from this flight. For the re-flying pilots of this group the better of the two achieved results is valid.

This rule is not applicable for navigation systems with frequency hopping.

4.2 Definitions

4.2.1 Definition of the Contest

A GPS Triangle contest consists of at least three GPS Triangle heats.
After 6 heats (more than 5) the worst score of each pilot will be discarded (discard heat) from the overall results. For each competition the maximum number of discard heats is one (1), regardless of the number of heats flown.

4.2.2 Definition of a Heat

For each heat, the GPS Triangle Evaluation Software equally distributes (random) the participating pilots into groups. The number of pilots determines both the individual group size and the number of groups.

One Heat consists of at least 2 groups, whereby, each group contains a minimum of 3 and a maximum of 12 pilots.

A heat consist of one or more attempts for the pilot as per 4.2.3 and 4.2.4 and subsequently the official flight (see section 4.2.5)

When distributing the pilots into groups, it must be guaranteed that two pilots of one team are not assigned to the same group and subsequently do not have to fly at the same time. Therefore, the pilots need to inform the officials about their team membership when signing up for the contest. In a single heat, each competitor of pilot/navigator team will fly as a pilot once and help once as a navigator.

4.2.3 Definition of an Attempt

An attempt begins with the take-off of the glider. The attempt is completed when the glider is towed to the predefined starting altitude of the heat.

4.2.4 Repetition of an Attempt

An attempt may be repeated if the glider has not reached the predefined starting altitude of the heat. The number of repetitions is not limited as long as the official Flight Window of the group is open.

However, after the first attempt, it is not allowed to replace any parts of the scale glider. This applies to all mechanical parts. A pilot who wishes to repeat his attempt has to announce the desired repetition to the SOF within 15 seconds after breaking off the attempt. Additionally, he has to land his scale glider as fast as possible and has to join the end of the starting queue.

In the 1:3 class, it is not allowed to use an engine or self-starting system, even if the glider is equipped with one. In the SLS-Class, the engine or self launch system can only be used within the default start time window and before overflying the start line to start the new working time (evaluated flight). The engine can be switched on again to regain altitude for a new evaluated flight, as long as the start time window is still open. However, the previous evaluated flight is cancelled.

If the engine is turned on during the evaluated flight, it will be judged with zero points. Zero points will also be rewarded, if the flight has not been started before the start time window has been closed.

4.2.5 Definition of an official Contest Flight (evaluated flight)

After a completed attempt the pilot must start the official evaluated flight by crossing the starting line at or below the predefined starting altitude with a maximum of 120 km/h. If the pilot flies too high or too fast when crossing the starting line he may accept a penalty or needs to re-cross the starting line. Each pilot can do only one official evaluated flight per heat.

5 Flight and Scoring

5.1 Preparation

The groups are randomly determined via the GPS Triangle Evaluation Software. It has to be made sure that the two pilots of a helper team are never assigned to the same group. Should a heat consist of more than three groups, the pilots of the same team may not be assigned to consecutive groups within the heat. The Contest Director sets a start time window for each group and announces this time window before the start of the heat. The start time window determines within which time from the start time all pilots of the group have to have flown over the starting line. The duration of the start time window depends on the number of pilots in a group and the number of tow planes (see table below). It is never longer than 20 minutes and 59 seconds. The number of available tow planes is calculated from the number of operational tugs on the field – 1. Therefore there is a spare tug available at any time. The start time window is given in whole minutes, counting the last minute to the start time window.

In class "SLS" the start time window is always 10 minutes and 59 seconds, whereas, in class "1:3" the start time window is calculated as follows:

$Start\ time\ Window_{1\ Tow\ Plane} = 6\ minutes\ 59seconds + \big((Pilots\ per\ group) * 2\big)$ (Max. 7 pilots per group)

$Start\ time\ Window_{2\ Tow\ Planes} = 8\ minutes 59seconds + (Pilots\ per\ group)$ (Max. 12 pilots per group)

$Start\ time\ Window_{3\ Tow\ Planes} = \left\lceil 10\ minutes 59seconds + \left((Pilots\ per\ Group) * \frac{2}{3}\right)\right\rceil$ (Max. 12 pilots per group)

Table: Start time window in minutes, plus 59 seconds each depending on the group size and the number of tow planes:

Piloten per group	1 available towplane	2 available towplanes	3 available towplanes
3	12	11	12
4	14	12	13
5	16	13	13
6	18	14	14
7	20	15	15
8	x	16	15
9	x	17	16
10	x	18	17
11	x	19	17
12	x	20	18

The start time window is communicated by the contest director as soon as possible. Nonetheless, the start time window opens not earlier than 15 minutes after the last scale glider of the preceding group has landed. If a heat consists of less than four (4) groups, the start time window opens not earlier than 15 minutes after the last scale glider of the preceding group has landed. The pilots have to be ready to take off and be within the starting queue not later than 5 minutes before the start time window opens.
In the "1:3" class, the starting order is drawn by lot. This is done according to the principles of chance. The starting order must be posted together with the draw of the respective flight groups, visible to all pilots, at least 15 minutes before the opening of the start time window. According to this draw, the pilots must place their glider models in the starting queue. The first three pilots in the starting queue have the right to be towed 150m (instead of 100m) above the respective defined maximum entry altitude, as long as this does not violate the criterion of the maximum allowed flight altitude (see 1.6).

In the “1:3” class, the Contest Director has to ensure that the tow planes are in a condition to fly 5 minutes before the start time window opens. The Contest Director may approve the takeoff of the glider models 5 minutes before the start time window opens.

The SOF is authorized to re-order the starting queue, if the pilot who is next for launch (SLS) or aerotow (“1:3”), is not appropriately prepared within 20 seconds. In the latter case, the pilot has to join to the end of the starting queue.

5.2 Cancelation & Restart of a Group (only 1:3)

There are various reasons for canceling a group:

- The SOF cannot ensure a safe aerotow.
- Aerotow is not possible due to technical problems of the tow planes and no replacement tow plane is available.

The SOF is obliged to inform the Contest Director about the cancelation. Note that neither a broken tow rope nor a premature release of the scale glider leads to a cancelation of the group. Therefore there is no opportunity for the glider pilots to have an influence on a potential restart of the group.

After cancelling a group, the SOF has to make one of the following decisions:

1. The canceled group may be resumed with the remaining tow planes. The Flight Window depends on the remaining pilots (i.e., not yet started pilots) and is calculated as follows:

$$Start\ time\ Window = Remaining\ pilots * 2\ minutes$$

2. The started group will be divided, whereas no group must contain less than three pilots. In this case the pilots who have already been aerotowed to the starting altitude successfully will resume the heat. For the remaining pilots an additional group will be established with an own start time window which gets started 5 minutes after announcing the start time window. The start time window gets calculated according 5.1 and is based on the number of the remaining pilots and available tow planes.
3. The already started heat will be cancelled. All pilots must land the scale gliders in and the heat will be restarted.

The Contest Director shall make a correct and quick decision according to the diagram depicted in Appendix 4. All pilots must be timely informed by the SOF, if a group is cancelled due to technical problems of the tow planes. In addition, the SOF must communicate any adjustments to the groups or the start time window.

5.3 Altitude of Release (AEROTOW)

In order to make the aerotowing as efficient as possible, the first three gliders in the starting queue are getting towed up 150m above the maximum starting altitude; the other gilders are getting towed to a maximum of 100 meters above the maximum starting altitude. The towing pilot determines the release time in coordination with the navigator. In the phase of aerotowing, safety-zones need to be respected.

$$Max.\,Release\ Altitude = Max.\,Starting\ Altitude + 100m$$

5.4 Flight Task and Flight Time

The flight task consists in flying around the defined triangle as many times as possible within the specified flight time (usually 30 minutes). The flight time starts with the last crossing of the starting line within the predefined start time window.
The finish line must be crossed with a speed of at least 20km/h. Otherwise the crossing and the last flown triangle will not be counted.
After landing the pilot must fill out the scorecard and submit it to the SOF if landing points have to be deducted. The SOF confirms with his signature. The Pilot also confirms with his signature, that he agrees with the scoring.

5.5 Scoring rawpoints

The score is computed by the triangle points, the landing points, and the penalty points.

$$Rawpoints = Triangle\ Points + Landing\ Points - Penalty\ Points$$

$$Rawpoints = Rawpoints\ for\ \frac{individual\ average\ speed}{best\ average\ speed} - Penalty\ Points$$

5.5.1 Triangle Points

Every pilot gets 200 rawpoints per completed triangle. If there is more than one pilot in a group having the same number of completed triangles, the points for the last triangle are calculated as follows:

- Only the pilot with the highest average speed over all his triangles gets 200 rawpoints for the last triangle
- Pilots with the same amount of completed triangles are only getting partial points. These points are a certain proportionately to the highest possible score of 200 rawpoints the pilot with the highest average speed gets. The points are calculated as follows:

$$Rawpoints\ for\ the\ last\ absolved\ triangle_{pilot} = 200 * (\frac{v\emptyset_{Pilot}}{v\emptyset_{fastest\ Pilot}})$$

$$v\emptyset_{Pilot} = average\ speed\ of\ the\ according\ pilot$$
$$v\emptyset_{fastest\ Pilot} = average\ speed\ of\ the\ fastest\ pilot$$

Hereby the average speed is calculated as follows:

$$average\ speed\ v\emptyset = \frac{(number\ (n)\ of\ triangles\ *\ course\ distance\ of\ 1\ triangle\ in\ km)}{flight\ time\ in\ h}$$

5.5.2 Landing Points

The landing zone (“touchdown zone”) has to be clarified properly. The width is at least 25 meters and it is 80 meters or longer in length.

The direction of landing is declared by the SOF and is visibly displayed. If the wind conditions change the SOF may change the landing direction within the current group. Altering the landing direction is only viable, if no glider model is currently in the landing process.

400 landing points are awarded, if:

- The landing procedure of the scale glider must be equivalent to the landing procedure of the original glider (i.e., if the original glider uses a landing gear, the scale glider must use a landing gear as well)
- The landing must always take place by crossing the base line of the landing zone first (Not mandatory to do it in flying manner). The main landing gear is decisive for this. Crossing the side line of the landing zone is not permitted and results in 0 landing points.
- The glider model is immediately capable of starting again.

200 points are awarded, if:

- The glider model loses parts during the landing procedure
- The landing gear collapses, or was not deployed at all (in case of a retractable gear)
- The glider model is not in a condition to start again

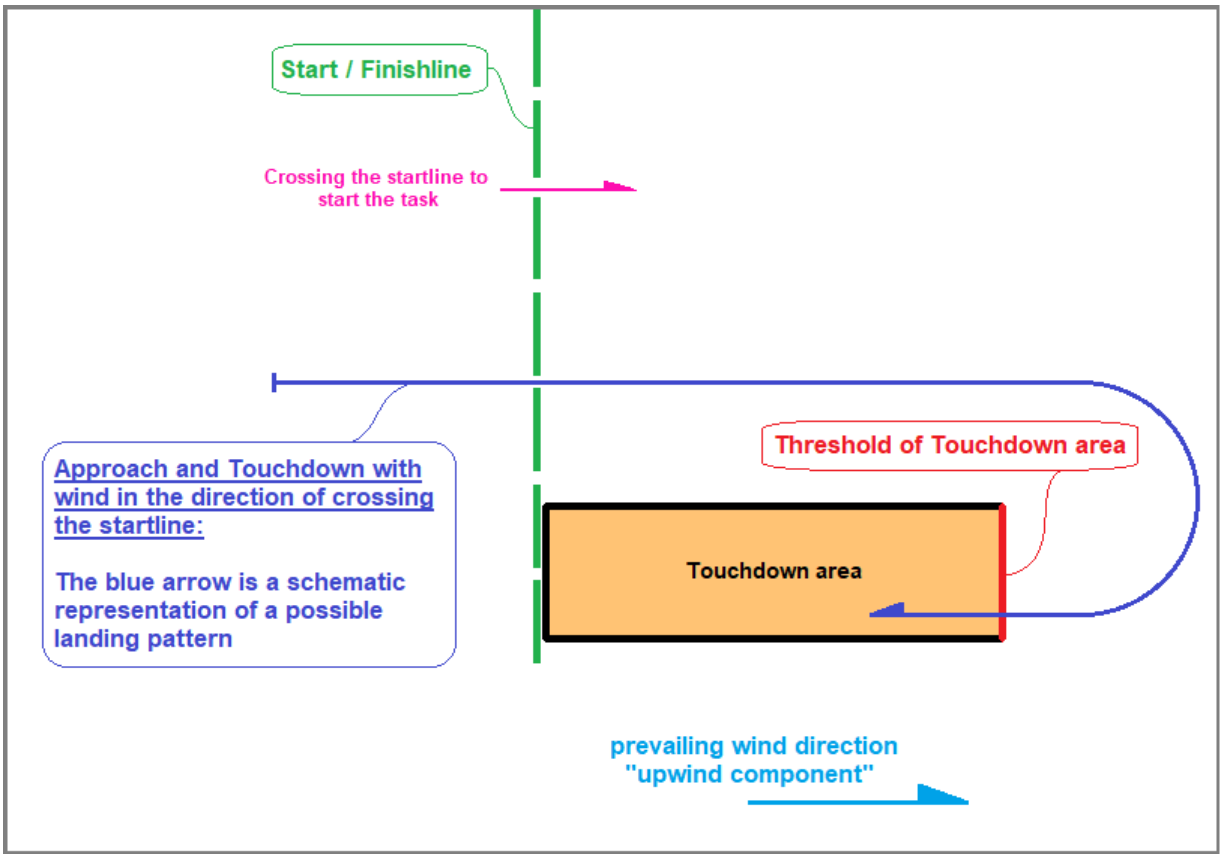
0 landing points are awarded, if:

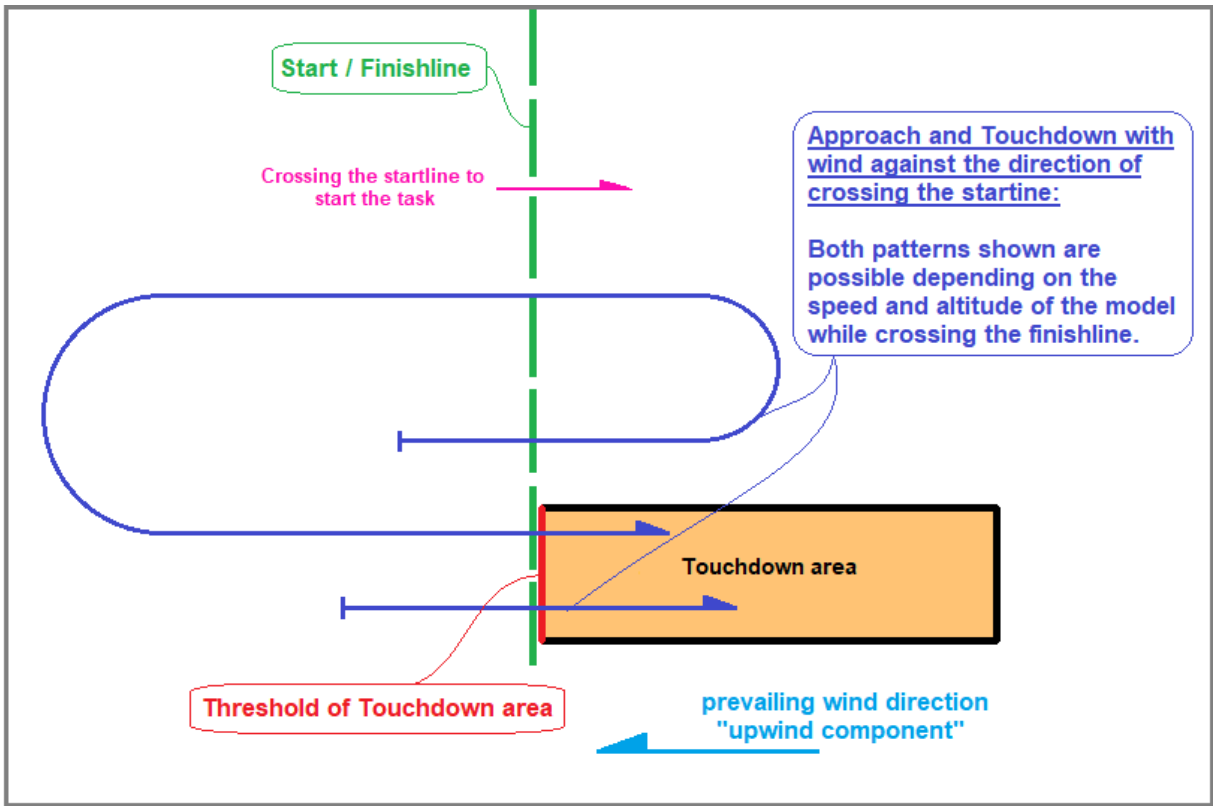
- The landing sequence is completed against the previously declared direction of landing
- The base line of the landing is not crossed
- The landing zone was entered over one of the side lines
- The Glider model was touched by the pilot or his helper before it came to a complete halt
- The glider model lands outside of the landing zone and comes to a halt
- A part of the glider model enters the Safety area while rolling out

To avoid several simultaneous landing approaches, the Contest Director or the SOF can instruct a pilot in the SLS-class and (if there is an engine) in the 1:3-class to switch on the engine for safety reasons. This doesn't affect the landing points.

If the engine is switched on without the instruction of the Contest Director after overflying the start line and the start line is not overflown again within the start time window, the flight is judged with 0 points.

The following schematic depicts flight paths for potential landing sequences according to the prevalent wind direction. The position of the start/finish line as well as the position of the landing zone may vary because of the geographical conditions of the airfield. However, the layout of the airfield should be as implemented as close as possible to Sketch 3 point 3 "airfield".


Start / Finishline
Crossing the startline to start the task
Approach and Touchdown with wind in the direction of crossing the startline:
The blue arrow is a schematic representation of a possible landing pattern
Threshold of Touchdown area
Touchdown area
prevailing wind direction "upwind component"


Start / Finishline
Crossing the startline to start the task
Approach and Touchdown with wind against the direction of crossing the startine:
Both patterns shown are possible depending on the speed and altitude of the model while crossing the finishline.
Touchdown area
Threshold of Touchdown area
prevailing wind direction "upwind component"

5.5.3 Penalty Points

Crossing the starting line above the predefined starting altitude and/or at a speed above the maximum starting speed of 120 km/h, the pilot gets penalty points as follows:

$$PenaltyPoints = 50 + 2 * (Starting\ Alt. - Max. Starting\ Alt.) + 2 * (Entry\ Starting - Max.\ Starting\ Speed)$$

The pilot may accept a penalty and start the official contest flight or may do a new attempt in re-crossing the starting line as long the start time window is open. The penalty points are deducted from the total rawpoints score of the pilot.

Note: violating a safety zone (area, height) will result in 0 points for this flight.
Launching out of a safety zone is possible in case it is necessary and permitted by the organizer.

5.6 Results

5.6.1 Evaluation of the Results

For every group there is a separate classification of 1000 points. The pilot with the highest score in rawpoints – possible Penalty Points taken into consideration – is awarded with 1000 points. The other pilots in this group are getting proportionate scores in relation to the highest score within the group.

$$Points_{Pilot} = \frac{Raw - points_{Pilot}}{Raw - points_{Best}} * 1000$$

$Rawpoints_{Pilot}$ = Points of the pilot

$Rawpoints_{Best}$ = Best score of a pilot in this group

It is not possible for a competitor to get a result lower than 0 points. The calculation methods, definitions and algorithms for the evaluation of the results are shown in Appendix 2.

5.6.2 Intermediate Score and Final Ranking

The evaluation officer creates an intermediate score list after each heat. The results have to be made public by the Contest Director not more than 30 minutes after the heat was completed (Chance to appeal and protest).

The cumulated points are the final results according to 5.7. If there are six (6) heats or more, the worst heat of a pilot is not added to the final result. Before publishing the final ranking, the contest director must control the final calculation of the results according to a standardized check list.

If multiple pilots reached the same final score, the ranking of these pilots depends on the following criteria sorted in order of priority:

1. The highest score omitted for calculation.
2. The overall number of completed triangles
3. The highest average speed in one Heat.