GPS Triangle Regulations for Scale-Scale model gliders

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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 scale gliders. 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 on the airfield (scale model glider towing, self-launches, landings, several scale model gliders in flight at the same time)

- 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 model 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 scale model glider can be determined and verified in real-time. This simplifies both the flying operations and the evaluation of the flight.

Note: The altitude will be measured and logged by using barometric data

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 scale model glider himself. In the case that the scale model glider is controlled by someone other than the pilot, the competitor will receive a zero score (0) for this heat.
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 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 the scale model glider crosses the starting line until it completes the last triangle in min:sec)
- Number of triangles (n)
- Average speed, at which the triangles (multiple of 2.414km) were completed
- Violation of safety area(s)
- Logging of the self-launch-system. The Noise level of the self-launch-system is logged via ENL-sensor (ENL = environmental noise level) and can detect when the self-launch-system was switched "ON".
  Note: *To validate the logger the self launch system must be switched on for a short time prior to the launch.*

Pilots need to upload their flight-logs to a web-based scoring system.

Note: *The navigation system and/or the navigation-application need to be able to store each flight log-data in .igc-format. (Logfile-format is described in* ***Appendix 2****).*

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, deleting log-files from the web-based calculation platform, from the navigation tablet and/or the onboard data-logger with the aim to destroying evidence, 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 scale model glider is forbidden.
Mobile phones have to be switched off or turned into flight mode on the flying site during the time the scoring flights (heats) are running.

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 scale model glider. With his registration the participant agrees to not assert claims or legal action against the organizer or other competitors. The participant bears all risk of the causes followed by the usage of his scale model glider himself.

1.5 Rules of conduct to avoid collisions in the air and on the ground

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. If a competitor circles the wrong way around, he/she must immediately change the direction of the circle after being requested to do so by the competition director or the flight operations manager. If this request is not followed as soon as possible, the flight will be scored with 0 points.
- 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.
In case of unsportsmanlike conduct of a contestant, the contest director has the right to exclude the contestant from the contest.

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 before, during or after the scoring flight 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.
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 (at least with a 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 approximately 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 heavy and /or persistent rain the ongoing round has to be interrupted for safety reasons 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 model glider and Technical Equipment

2.1 Definition of a Scale model glider

A scale model 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 model glider must comply with the specifications mentioned in paragraph 2.2.

The radio-controlled scale model glider must be launched “scale-like” by ground launch.
Additional aids for the launch (e.g. launch trolley, bungee cord etc.) are not allowed.

2.2 Specification of a Scale model glider

2.2.1 General

In general, the shape of the original aircraft 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 aircraft.
Even though there will be no scoring of the accuracy of the scale in detail, every competitor has to verify that his scale model glider(s) are compliant to the rules. Therefore, he must provide the following data of the original aircraft 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 model gliders which were manufactured or became commercially available after the year 2017 (+/- 50mm).

- Scale model 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 2.2.3.
- The type of undercarriage to be used is determined by the type of undercarriage of the full-size aircraft.
  If the full-size aircraft is/was built with an undercarriage, retractable or fixed, the respective undercarriage must be implemented in the scale model 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 replica scale.

The scale of the scale model glider is specified by the competitor, however the scale must not exceed 1:3. For scale model glider designs that were available on the market or were developed and flown before 01.01.2024, the scale is free and not limited.
This means that scale model gliders that were already available before 01.01.2024 may still be newly purchased and flown after 01.01.2024. Additionally, the maximum wing loading is limited to 115 g/dm². For calculating the maximum wing loading the scaled wing area of the full-size aircraft is used. For scale model gliders in a scale smaller than 1:3 a correction factor is applied as specified in paragraph 2.2.3.
The limit for the maximum takeoff weight of the scale model glider is 25kg. This is independent of the maximum wing loading and must not be exceeded at any time.

2.2.2 Type of launch

The scale model gliders can be launched either by aerotow or self-launch. The competition organizer will decide at the beginning of the registration period whether the launching will be undertaken by aero tow or self-launch.

For self-launching only electric motors are permitted for driving the following types of Self Launch 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)

2.2.3 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 equations:

- Maximum takeoff weight for models in the scale smaller or equal to 1:3:

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

- Maximum takeoff weight for models in the scale larger than 1:3:

$$\text{Max. Takeoff Weight in } kg = 11.5 * \frac{\text{wing area original aircraft in } m^2}{\text{scale of scale model glider}^2}$$

The organizers of the GPS Triangle competition are authorized to check take-off weights at any time. If this exceeds the permitted maximum with a tolerance of more than 1 percent of the total weight (measured in calm wind conditions), the pilot will get a zero score for the respective heat. In the case of exceeding the permitted maximum weight repeatedly, the pilot will be disqualified from the competition.
An overview of the current take-off weight limitations in regard to the maximum wing loading limit is shown for several scale model gliders in **appendix 1**.

2.3 Number of Scale model gliders per Pilot

During a GPS Triangle competition each pilot may use a maximum of two scale model gliders or two different configurations (related to the outline of the model, i.e. “short tips/long tips” if the full-size aircraft features these different configurations). These scale model gliders are called A-Model and B-Model. Each detachable part of the scale model glider which defines its outline must be marked with a distinctive identification label (for instance Model A, Model B).
This includes all parts of the fuselage including the canopy (canopies), landing gear fairings and rudder as well as wings, winglets tail feathers and wing-joiners.
Not to be labeled are, landing gear, Pitot- and Prandtl tubes and parts of the self launch system including propellers, spinners etc.
See also paragraph 2.5.
The labels have to be documented on the starting card by the pilot and/or separately by the Supervisor of Flying (SOF). It must be documented for each flight, which scale model glider or model configuration was used.

A pilot/navigator team can use a shared glider model. In this case, the glider model must be marked by both persons (pilot and navigator) with their respective identification labels. The identification labels must be affixed latest when the glider model is used for the first time in the competition. In the event of damage to this shared glider model, it is not possible to register another glider model.

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 take-off weight and wing loading limit (see paragraph 2.2.3) must not be exceeded.

It is forbidden to change the dihedral of the Scale Class glider model by using different wing joiners (replacement-wing-joiners). The only permitted way to change a Scale Class model gliders dihedral is by interchanging wing joiners between the A-Model and B-Model (A- and B-configuration) as stated in Paragraph 2.3 and 2.4.

Changing the scale model glider in the current heat is only permitted if the attempt has not been completed successfully (see paragraph 4.2.3).

2.5 Loss of Parts

If the scale model glider loses a part (other than water ballast) during takeoff or flight the aggregate heat will be scored with zero points. This also includes unlabeled parts of the scale model glider (see paragraph 2.3). 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 model glider to a receiving device (Ground station) and/or records relevant flight data in an onboard-logger. Additionally following requirements must be fulfilled:

- 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.

A malfunctioning navigation system is no reason to claim a reflight in another group or to neutralize and refly the actual group. In the event of total failure of all navigation systems of the entire group, the group will be repeated as soon as possible at a later date.

The group will also be repeated if the number of pilots with a functioning navigation system falls below 3. The previous score of this group will be canceled and the entire group will be restarted as soon as possible at a later date.

2.7 Gyros, Auto Pilots & Telemetry

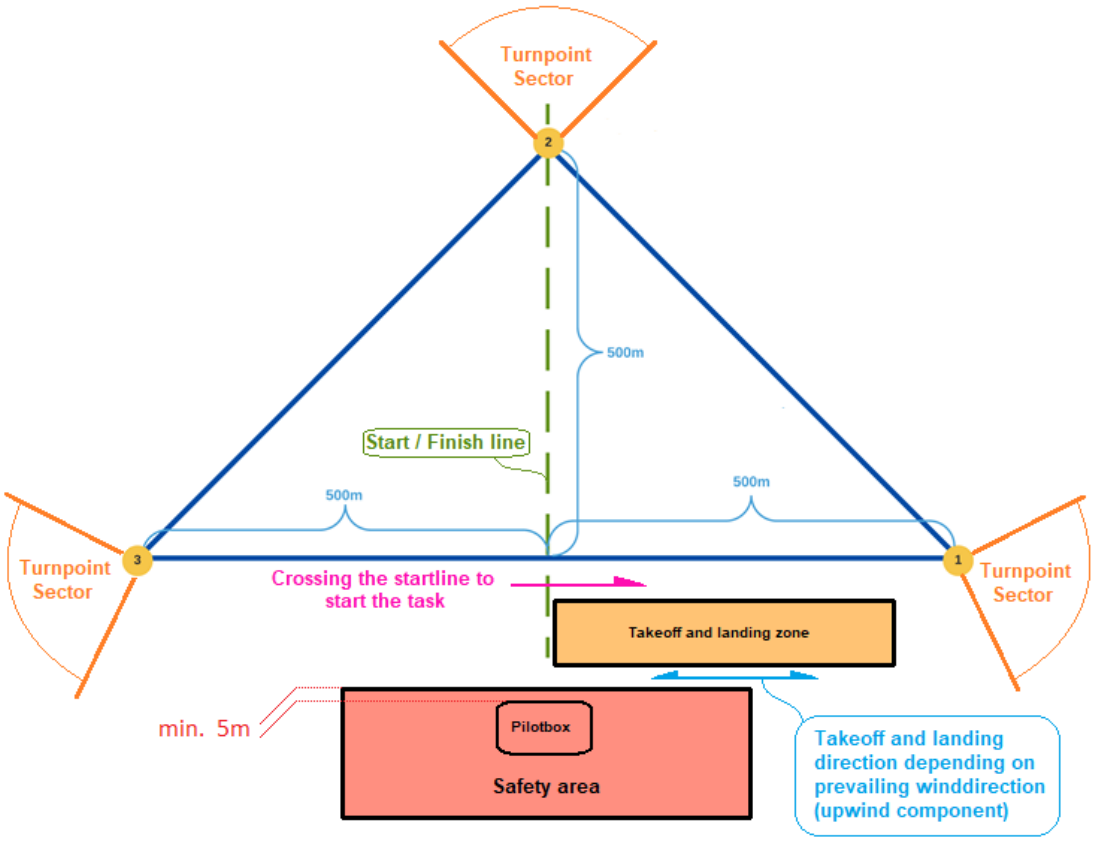
Gyros, flight augmentation systems or Autopilot systems, or the usage of data generated by such systems for flight attitude control are not permitted.

A coupling of the telemetry receiving system or any sensor system in the scale model glider with the remote control function (e.g. coupling of variometers/airspeed indicator and flaps / automatic flaps) is not permitted in the sense that no remote control correction signal may be sent to the scale model glider based on the flight-data or that the scale model glider autonomously sets or controls any functions.

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

3 Flying Field

The flying field and the virtual triangle design are depicted in the sketch



The position and the size of the Take-off (launching) 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 before, during or after the official scoring flight, the aggregate heat 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 (CD): 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 launching, landings and weight of the models. Every pilot having finished the official task will announce his landing. The SOF will confirm incorrect landing procedures (see 5.5.2) and document them.
- 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 scale model gliders, 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.

If the pilot accidentally fails to start at all or starts in the wrong group for a round, he will receive 0 (zero) points for that round. It is not possible to repeat the flight in the correct group.

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 CD assigns each pilot/navigator team a maximum of two frequencies for the transmission module of the GPS system in the scale model glider. 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. In such an event the entire group is neutralized and all pilots must land as fast as possible. The CD/SOF announces the restart of the group at the next possible time and sets a new start time window.

The causing pilot is excluded from this flight. For the group flying anew, only the score achieved after the restart of the group applies.

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 paragraph 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 scale model glider. The attempt is completed when the scale model glider has reached the predefined starting altitude of the heat.

4.2.4 Repetition of an Attempt

Start repetitions are permitted without limitations within the assigned start time window and are not dependent on whether the attempt was completed or not. The type of launch can be chosen freely. After the first launch for an attempt, no parts of the scale model glider may be replaced. This applies to all mechanical parts. Replacement of the drive battery (if applicable) is permitted. Pilots whose scale model gliders do not have a self launch system will announce the repetition of the attempt to the contest director and land their scale model glider as soon as possible. They will then rejoin the end of the queue of scale model gliders.

If aero tow is available, scale model gliders without a self launch system always have priority to get aerotowed first.

The 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 self launch system 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 including the landing evaluation is cancelled.

If the self launch system is turned on during the evaluated flight, it will be judged with zero points. Zero points will also be rewarded, if the evaluated flight was started outside the start time window.

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 minus 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.

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)

<u>Table:</u> 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

If the competition organizer has specified that only self launch systems are to be used for launching, the start time window will always be 10 minutes and 59 seconds long.

The start time window is communicated by the CD as soon as possible. Nonetheless, the start time window opens not earlier than 15 minutes after the last scale model 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 model 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.
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 scale model gliders 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).

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 CD may approve the takeoff of the scale model gliders 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 (aerotow or self launch), is not appropriately prepared within 20 seconds. In the latter case, the pilot has to join to the end of the starting queue.

The scale model gliders need to be switched on in a designated area between Zero (0) and Two (2) meters above the ground and kept there for at least 45 seconds before taking off. This measure is taken to assure that the barometric altitude measurement is calibrated to Zero before takeoff.

5.2 Cancelation & Restart of a Group

The start time window of a group can be interrupted for the following reasons:

- The SOF cannot ensure safe launching.
- Aerotow is not possible due to technical problems of the tow planes (e.g. engine start, engine shutdown) and no replacement tow plane is available and the scale model gliders remaining on the ground are not capable of self-launching.

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

After that, one of the following decisions must be made:

1. The started group can be flown to the end with the remaining start time window (remaining pilots x 2 min) and the remaining tow planes.

2. The started group will be divided, if scale model gliders not capable of self launching are still on the ground or have not yet been towed to the previously determined entry altitude. If aerotowing is not possible due to a tug failure the self launching scale model glider models remaining on the ground must launch under their own power.

   A divided group must not have less than three pilots. In this case the pilots who have already been aerotowed to the starting altitude successfully will resume the heat.
   The current start time window closes no later than 2 minutes 59 seconds after the last completed attempt according to paragraph 4.2.3.

   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 neutralized. All pilots must land their scale model gliders 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 aerotowing as efficient as possible, the first three scale model gliders in the starting queue are getting towed up 150m above the maximum starting altitude; the other scale model 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.
The last overflight over the finish line, which does not end with the landing immediately, must take place outside the landing area for safety reasons.

The pilot must upload the raw data digitally to the evaluation platform promptly after the flight, but not before all pilots of this group have landed their scale model gliders. The flight operations manager enters the landing points.

5.5 Scoring rawpoints

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

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

5.5.1 Triangle rawpoints

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

Landing points are only awarded after at least one triangle of the current heat has been successfully completed.

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 scale model glider is currently in the landing process.

The scale model glider does not necessarily have to come to rest in the landing zone. To avoid collisions with landing or already landed scale model gliders, the landing zone can be left by means of rolling without deduction of points. Before the start of the competition, the contest director defines the area of the landing zone from which it is possible to leave the landing zone, for example to the sides or further on straight ahead. The reference point is the nose of the fuselage of the scale model glider.

600 landing points are awarded, if:

- The landing procedure of the scale model glider must be equivalent to the landing procedure of the original scale model glider (i.e. if the original scale model glider uses a retractable landing gear, the scale model glider must use a retractable landing gear as well). The landing gear must not collapse.
- 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 zero landing points.
- The scale model glider model is immediately capable of starting again.

200 points are awarded, if:

- The scale model 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 scale model glider model is not in a condition to start again

Zero landing points are awarded, if:

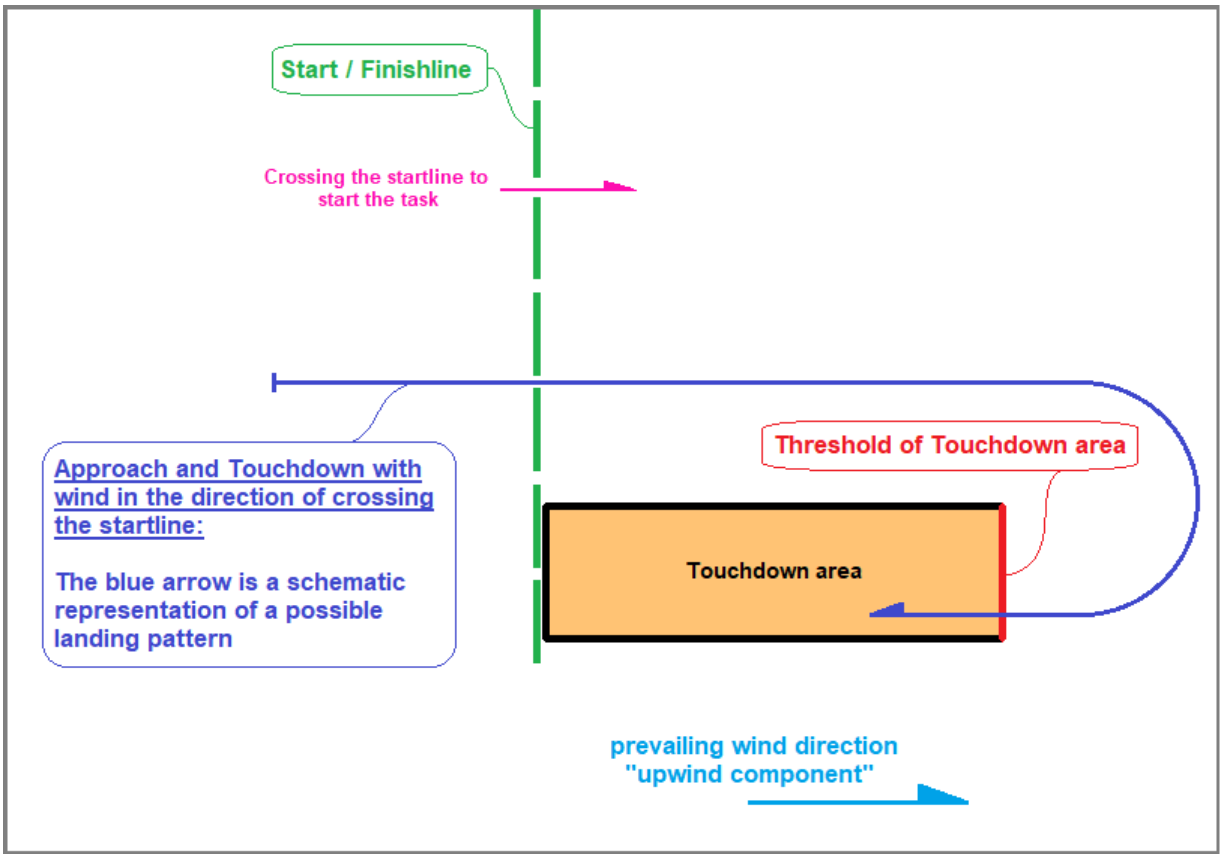
- The landing sequence is completed against the previously declared direction of landing
- The base line of the landing is not crossed
- The landing zone was entered over one of the side lines
- The scale model glider was touched by the pilot or his helper before it came to a complete halt
- The scale model glider lands outside of the landing zone and comes to a halt
- The scale model glider leaves the landing field flying after touchdown (Touch and Go)
- A part of the scale model glider enters the safety area while rolling out

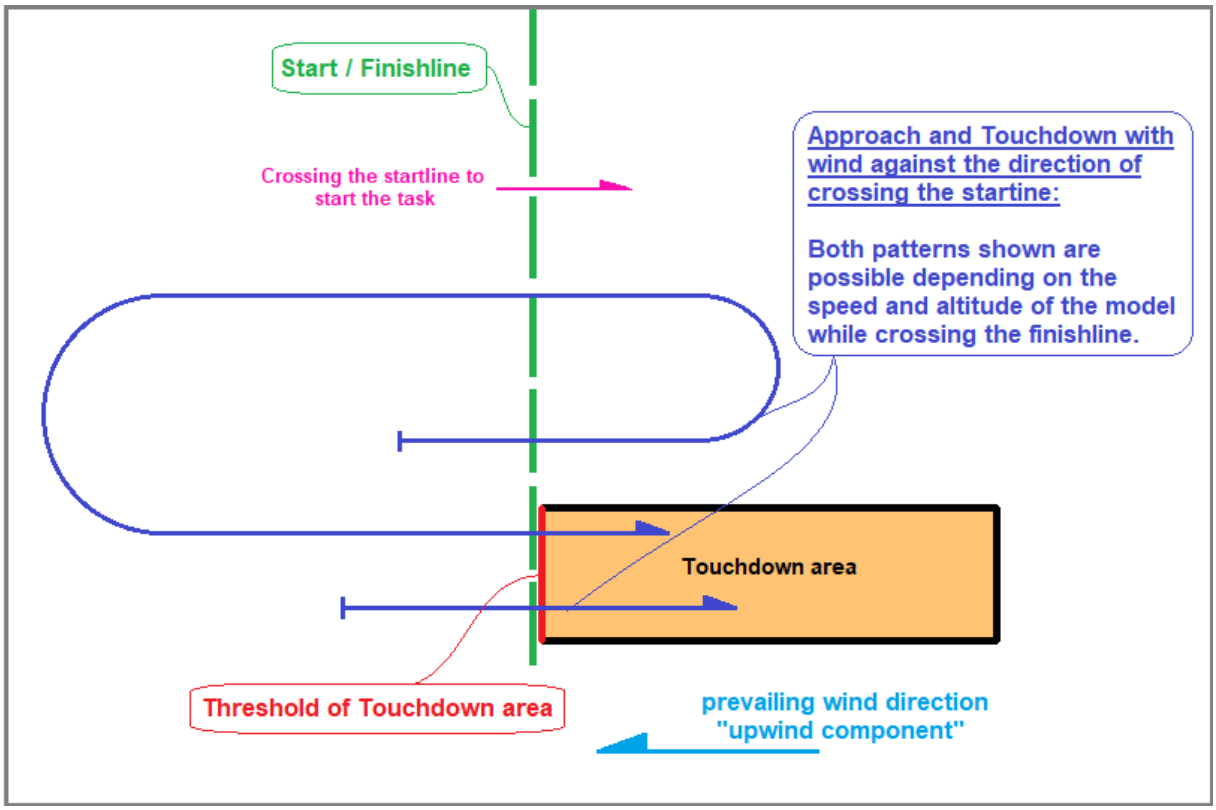
To avoid several simultaneous landing approaches, the Contest Director or the SOF can instruct a pilot to switch on the self launch system (if the scale model glider is equipped with such a system) for safety reasons. This doesn't affect the landing points.

To avoid collisions with landing glider models, it is possible to switch on the engine in flight after the final overflight of the finish line at the end of the scoring flight without losing landing points. It must be provided though, that turning sector 1 has not yet been entered.
To start the engine for this specific reason is permitted without consulting the Contest Director or the SOF.

If the self launch system is switched on without the instruction of the Contest Director or SOF at any other time during the flight, this flight is judged with zero 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 zero 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 zero 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 CD 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 CD 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 discard round.
2. The overall number of completed triangles.
3. The highest average speed in one Heat.