The GAP

Scoring formula explained

For GAP version 2008

As implemented in the FAI/CIVL scoring system FS.

The idea is to create a fair scoring system easily adaptable to any competition anywhere in the world, both for hang gliding and paragliding, with a philosophy that is easy for the pilot to understand, regardless of the mathematical complexity of the underlying formulas.

The GAP scoring formula was developed for CIVL by Gerolf Heinrichs - Angelo Crapanzano - Paul Mollison. It has been updated and enhanced by Stein-Tore Erdal and others.

Official releases of GAP are:

- Gap 2000
- Gap 2002
- Gap 2008
- OzGap is an Australian variation of GAP

1. GAP Scoring Parameters

The Scoring Parameters in GAP are designed to ensure compatibility between different tasks within a competition, to adapt the scoring to hang gliders or paragliders, to different flying sites, to pilots' skill levels and task philosophies.

Before the first task the meet director (or others depending on the Local Regulations of the competition) sets some of the GAP Scoring Parameters for the competition. Exceptionally some scoring options can be set at each task briefing and will be used in scoring that task only.

1.1 The GAP Nominal Parameters are:
- Nominal Distance (see 1.5)
- Minimum Distance (see 1.6)
- Nominal Goal (see 1.7)
- Nominal Time (see 1.8)

1.2 Calculated GAP factors
- Day Quality (see 2.1)
- Launch Validity (see 2.2)
- Distance Validity (see 2.3)
- Time Validity (see 2.4)

1.3 Other Scoring Parameter options are:
- Use Distance Points (see 3.2)
- Use Departure Points (GAP 2000) (See 3.8)
- Use Leading Points (GAP 2002) (See 3.7)
- Use Arrival Position Points (see 3.9)
- Use Arrival Time Points (see 3.9)
- Use Time Points (see 3.3)
- Jump The Gun (see 3.6)
- Penalty for reaching End of Speed Section but not Goal (see 3.1)
- Speed Rank (see 2.4)
- 1000 points for the winner (See 3.1)
- 1000 points for the winner before DayQuality (See 3.1)
- Day Quality Override (see 2.1)

The selection of Parameters can be used to select different versions of GAP scoring formula:

GAP2002 = Distance Points + Time Points + Arrival Position Points + Leading Points (LC as in CompeGPS)

GAP2000 = Distance Points + Time Points + Arrival Position Points + Departure Points

OzGAP   = Distance Points + Time Points + Arrival Time Points (As used in Race)

GAP Version 2008 = A package containing options to score the above formulae and more

Leading points and Departure points may be turned off by Meet Director at Pilot Task Briefing, only if the conditions make it unfair to award lead out bonus.

1.4   **Common Terminology for scoring tasks.**

Following is list of terms used in GAP:

1.4.1   Takeoff: Place where pilots take off for the task.

1.4.2   SpeedSection: A timed section of the task where time points (speed points) are awarded. The pilots that complete the speed section fastest receive the most time points.

1.4.3   Start of SpeedSection (**SS**): The circle/line/point where we start the timing of the task.

1.4.4   Start of SpeedSection Open Time: The time when pilots are allowed to start SS flight.

1.4.5   End of SpeedSection (**ES**): The circle/line/point where we finish timing of the task.

1.4.6   Goal: The finish line or circle defining end of the task. Can be same as ES. In PG ES is normally before goal because of safety reasons.

1.4.7   Startgate: A timing reference for SS. If multiple Startgates are used they are the start of timing of speed section, not the time when pilots cross the SS boundary.

1.4.8   Turnpoint (TP): Turnpoint is a geographical point with coordinates (lat/long)

1.4.9   Cylinder: A radius around turnpoint, normally 400 meter radius.

1.4.10   Task distance: The shortest possible distance a pilot has to fly to finish the task. This means he has to fly to the boundary of a Turnpoint Cylinder, not the center of the Turnpoint.

1.4.11   Launch Window Open Time: The time frame when pilots are allowed to takeoff.

1.5 NominalDistance:
The minimum task distance that should be worth 1000 points.
(For example, in hang gliding competitions, Nominal Distance is suggested at 50-70 km, and for paragliding 30-50 km). If a task distance is less than Nominal Distance, the day will probably be devalued.
There is no penalty for a task that is longer than Nominal Distance providing the task results in an even distribution of the pilots along the course.

1.6 MinimumDistance:
The distance awarded to every pilot who takes off. It is the distance below which it is pointless to measure a pilot's performance. This distance should be at least one tenth of NominalDistance. (For example, in hang gliding competitions 8 to 10 km is suggested as Minimum Distance, in paragliding, 3 to 5 km).
The MinimumDistance parameter is set so that pilots who are about to "bomb out" will not be tempted to fly into the next paddock to get past a group of pilots. It is not in the interests of safety, retrieval or landowners to encourage pilots to try to stretch their flight when they clearly have been beaten on the day by either poor weather or a poor flight.

1.7 NominalGoal:
The percentage of pilots in goal the meet director would wish to have in a well-chosen task. (For example, this is typically 20 to 40%)

1.8 NominalTime:
It is the time taken to complete the SpeedSection, below which the task should be devalued. It can be considered as equivalent in time to NominalDistance, that is the time necessary for the fastest pilot to fly the NominalDistance, but only when the SpeedSection comprises the majority of the

task distance. (In the Alps, for example, it is generally suggested to be 1 to 2 hours). There is no penalty for having the fastest pilot take longer to complete the task.

KEEP IN MIND:

To get a fair competition task, you should normally have pilots in goal and pilots need to be in the air for a period of time so that the competitors make a series of different decisions, thereby sorting out the best pilots from the good ones. If a pilot reaches goal with just two thermals, then this is not necessarily a good test of skill. This task may have a tailwind and a high cloud base and therefore could be maybe, 100 km long (or it could just be a short task). In this case the fastest time can still be short and the day will be devalued because of the Nominal Time factor. In this case there was not much scope for the pilots to make decisions and the day was not such a fair test of skill. It is important to remember that it is mainly time in the air (to make decisions about the flight) that separates different levels of pilot skill. Set tasks that will take a reasonable amount of time to complete and have no difficult part at the beginning. A good task will have pilots making many decisions in the air, and the pilots who do not reach the goal would be landing evenly along the course.

How to choose the parameters:

The Nominal Distance parameter is the minimum distance that would still result in a good task worth 1000 points. Nominal Distance ties in with Nominal Time, and these two parameters need to be considered together.

If a task distance is less than Nominal Distance, the day will probably be devalued. There is no penalty for a task to be set that is longer than Nominal Distance as long as the task results in an even distribution of the pilots along the course.

The suggested distances are not mandatory, as what makes a good Nominal Distance length depends on the terrain, the weather that would normally be expected for the duration of the competition and, quite important, the level of skill that you would expect from the pilots in the competition.

Minimum Distance is the distance that, generally, a normal pilot will easily achieve climbing out over takeoff and gliding down. It is often set to around 1/10 of Nominal Distance.

Nominal Goal depends on the philosophy of the competition: if it's a pure free distance competition where there are no goals, it should be set to 0% while, if it's a pure race competition where everybody is expected in goal every day, it could be set to 100%.

2. The calculated GAP factors

2.1 DayQuality

The DayQuality varies between 0 and 1 and measures how suitable a competition day is to evaluate pilot's skill. It is obtained by multiplying the three validity coefficients: LaunchValidity, DistanceValidity and TimeValidity

There is an option to set the "**Day Quality**" to a fixed value in the Scoring Parameters. In case this option is used, the LaunchValidity, DistanceValidity and TimeValidity are calculated as normal but the DayQuality is set to the fixed value.

KEEP IN MIND:

Nominal Parameters need to be set reasonably and the task setter needs to set achievable tasks to get a good and fair competition!

TAKE CARE WHEN CHOOSING THE NOMINAL PARAMETERS

Changes to Nominal Parameters are not recommended after the start of the first task. It is possible to have the Nominal Parameters set for one takeoff and another set of Nominal Parameters for a different takeoff, if for example there is a significant difference between the sites.

> **DayQuality Technical details:**
>
> ```
> DayQuality = LaunchValidity*DistanceValidity*TimeValidity
>
> Or in case of DayQuality override then DayQuality = DayQuality parameter
> ```

2.2 LaunchValidity

Coefficient depending on the percentage of pilots actually present at takeoff who launched.

If everybody on takeoff launches, LaunchValidity is 1 while if only 20% of the pilots present at takeoff launch, LaunchValidity goes down to about 0.1

Launch conditions may be dangerous, or otherwise unfavourable. If a significant number of pilots at launch think that the day is not worth the risk of launching, then the gung-ho pilots who did go will not get so many points. This is a safety mechanism.
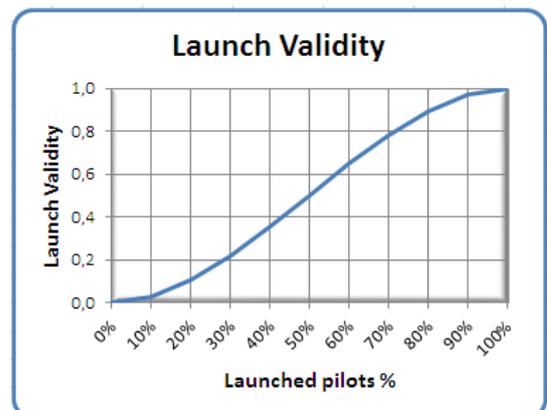
'Pilots present' is interpreted to be all pilots <u>not</u> having the status of Absent (ABS). Pilots taking off plus pilots present but did not fly (DNF) are the pilots present at takeoff.
Pilots present are pilots arriving on takeoff with their gear with the intention of flying.

> **LaunchValidity Technical details:**
>
> ```
>    CalcLaunchValidity(int no_of_pilots_flying, int
> no_of_pilots_present)
>    {
>      lv_raw = no_of_pilots_flying * 1.0 / no_of_pilots_present;
>      lv_raw2
>        = 0.028 * lv_raw
>        + 2.917 * Math.Pow(lv_raw, 2)
>        - 1.944 * Math.Pow(lv_raw, 3);
>      return lv_raw2 >= 1 ? 1 : lv_raw2;
>    }
> ```

2.3 DistanceValidity

A coefficient which depends on the NominalDistance ,the longest distance flown and sum of flown distances over minimum distance. If the task distance is quite short (in relation to NominalDistance) the day is probably not a good measure of pilot skill because there would not be many decisions to make. DistanceValidity uses the task distance. If no pilot makes goal the longest distance flown is used in the calculation in relation to NominalDistance

KEEP IN MIND:

If you set tasks that are longer than NominalDistance, the day will not be devalued because of DistanceValidity, even if nominal goal parameter value is not achieved , as long as a fair percentage of pilots fly a good distance. This sounds like a vague statement, but the task setter should be trying to set tasks that are reasonable for the day and achievable. If everyone lands in goal you must ask if this was a valid test of skill (it probably was if the fastest time and the distance flown were reasonably long). If everyone lands short of goal, was it an unsuitable task but still a good test of pilot skill? You also can have the case where a task that is shorter than the NominalDistance, has a DistanceValidity of approaching 1. This will happen when a large percentage of the pilots fly a large percentage of the course but, in this case, you still have a practical devaluation because there will be little spreading between pilots' scores.

DistanceValidity Technical details:

```
CalcDistanceValidity(sum_dist_over_min_dist, no_of_pilots_flying,
    nom_goal, nom_dist, min_dist, best_dist)
  {
    dv_raw = sum_dist_over_min_dist /
      (
        no_of_pilots_flying / 2.0 *
        ((nom_goal + 1.0) * (nom_dist - min_dist)
          + nom_goal * (best_dist - nom_dist))
      );

    if (dv_raw > 1 || dv_raw < 0) dv_raw = 1;
    return dv_raw;
  }
```
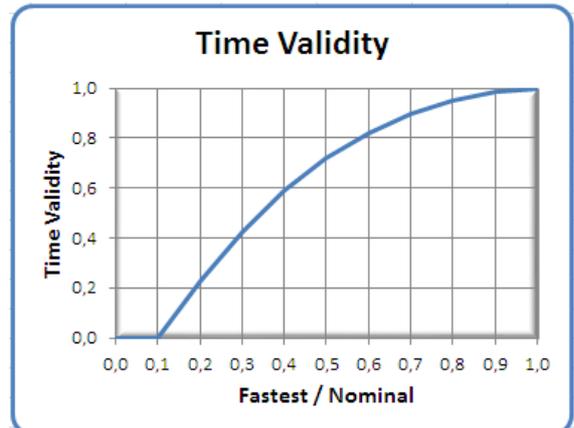
2.4 TimeValidity

Coefficient depending on the NominalTime and the fastest time to complete the SpeedSection.

If the fastest time to complete the SpeedSection is longer than NominalTime, then TimeValidity is always equal to 1.

If the fastest time is quite short the day is probably not a good measure of pilot skill because there would not be many decisions to make and, because of this, luck can distort scores as there will be little possibility to recover any accidental loss of time.

Time validity uses the time of the fastest pilot to finish the speed section in the calculation in relation to NominalTime.

If the Scoring Parameter **"SpeedRank"** is set to 1, then time in the calculation is based on the pilot flying the speed section fastest in relation to NominalTime. If Speedrank is set to 2 then it is calculated based on the second fastest pilot.

If no pilot finishes speed section then TimeValidity is <u>not based on time but distance</u>!
The distance of the pilot who flies the most distance in relation to nominal distance is used to calculate the TimeValidity the same way as if it was the time.

TimeValidity Technical details:

```
CalcTimeValidity(double best_time, double nom_time,
                 double best_dist, double nom_dist)
    {
      double tv_raw = 0;
      if (best_time > 0)
      {
        if (best_time < nom_time) tv_raw = best_time / nom_time;
        else tv_raw = 1;
      }
      else
      {
        if (best_dist < nom_dist) tv_raw = best_dist / nom_dist;
        else tv_raw = 1;
      }
      double res =
        -0.271
        + 2.912 * tv_raw
        - 2.098 * Math.Pow(tv_raw, 2)
        + 0.457 * Math.Pow(tv_raw, 3);
      if (res > 1)  res = 1;
      return res;
    }
```

3 Scoring parameter options

3.1 Points Allocation

The available points for each task (1000*DayQuality) are distributed between **Distance points**, **Time points**, **Departure/Leading points** and **Arrival points**, using a function of percentage of pilots getting to the End of Speed Section (ES) (before the Zero Score time) compared to launched pilots.

Out of the total of 1000 points that are available for a full value task, if 25% of launched pilots reach End of Speed Section (ES), there are available approximately:
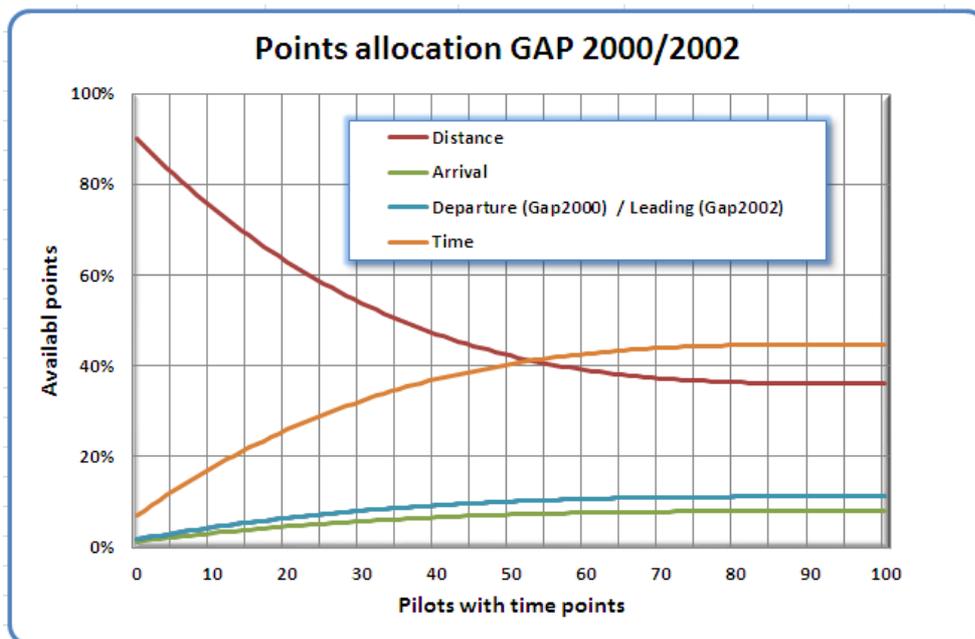
582 Distance points
293 Time points
73 Leading (Gap2002)
or Departure (Gap2000)
52 Arrival points

If nobody reaches ES there are a maximum of 900 points available for Distance plus 18 points for Departure/Leading but, of course, no points for Time (Speed) and Arrival.

Various options are available that change the above points allocation graph. By disabling arrival points and/or Leading/Departure the available points will increase the Time points the same amount.

In previous implementations of GAP Open Distance tasks would get maximum 900 points, or 918 points including Departure/Leading points (DayQuality can reduce this). The Scoring option "**1000 points for the winner**" changes this to allocate the winner 1000 points instead of 918 points. This applies for Open Distance tasks or tasks where no pilot reaches End of Speed Section (ES).

Another Scoring option: "**1000 points to the winner before DayQuality**" can be applied. This is for tasks with elapsed time or multiple startgates. The maximum points for Distance, Time, Departure, Arrival or Leading may be given to different pilots so the sum for the best pilot may still not be 1000 points. With this option the winner will get 1000 points if the DayQuality is 1.0.

The number of time points available is determined by the percentage of pilots who reach goal (see graph above). If no pilots reach Goal, no time points are available even if some pilots reach ES. The allocation/distribution of these points is described in 3.3 below.

The organisers have the option to put End of Speed Section (ES) cylinder and the "Goal" circle/line in two different places (reasonably just a few kilometers apart). When using the option where ES and Goal are not the same a positive decision must be made on **"penalty for reaching ES but not Goal."**

The Scoring option "penalty for ES not goal" defines the penalty of decreased time points in percentage terms, should the pilot make ES and fail to cross the goal line. For example, if it is set to 80% , a pilot gets 80% of the time points that he would have received if he had reached goal. If it is set to 0, he gets zero time points, scoring only the distance points to where he landed.

Setting ES before the goal cylinder/line increases both safety, especially with paragliders, and fairness, because a pilot will always try to cross the Goal line, in order not to be penalized on Speed points. He doesn't need to do it fast, he just needs to get there.

If End of Speed Section (ES) and Goal are the same, pilots may calculate their final glide in such a fashion that they risk landing short in order to be fast.

KEEP IN MIND:

If a good task does not produce 1000 points, this is not a problem providing there is a reasonable spread of points in between pilots. A day that has a small spread of points between pilots will have less weight towards the final scores regardless of the winners score. To find out the importance of a task within a competition, do not look at the winners score: what really counts is the spreading between pilots' scores i.e. the Task Weight Coefficient.

**Points allocation Technical details:**

```
// Distance points (depends, among other things, on ratio of pilots at ES
and flying)
      if (sfg.Use_distance_points)
       sp.K = 0; // if not using time points: K=0 giving Distance_weight=0.9
… else //using time points ..
        sp.K = sp.No_of_pilots_with_time_points / sp.No_of_pilots_flying;
…
       sp.Distance_weight = 0.9 - 1.665 * sp.K + 1.713 * Math.Pow(sp.K, 2)
- 0.587 * Math.Pow(sp.K, 3);
      }
…
```

3.2 Pilot Distance Points

One half of the available **"Distance Points"** are assigned to the pilots linearly with the distance flown while the other half is assigned taking into consideration the difficulty of the kilometers flown.

To measure the relative difficulty of each 100 meters of the task we consider the number of pilots who landed in the successive few kilometers (depending on pilots landed and distance flown).

With this system each 100 meters has a different value depending on the relative difficulty (for example upwind and downwind) but, nevertheless, it's easy for the pilot to judge this value because it simply depends on the number of pilots that will land in that area.
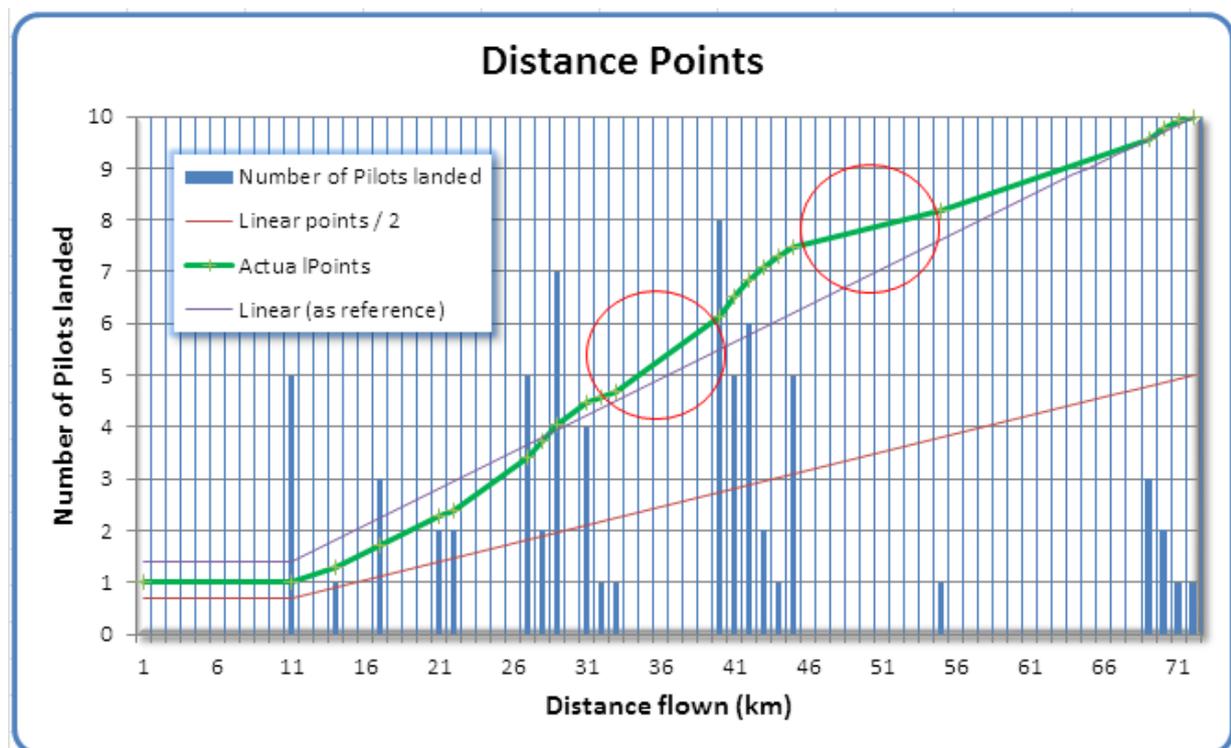
Note that the slope becomes steeper <u>before</u> the area where more pilots landed and less steep just after. On the graph (Red circles) the slope is steeper before the big group at the 41km mark and the slope is less steep after the 46km mark.
There are two reasons for this:

- for safety (and retrieval) reasons, we do not want to encourage pilots to fly only a short distance past a group of landed pilots
- if you land somewhere, probably you got in trouble just before, then you glided a while before landing.

KEEP IN MIND:

If you are flying an easy part of the task (for example tailwind along a ridge) where nobody will land, you will get only half the points per kilometer compared to linear scoring systems.

3.3 Pilot Time Points

The TimePoints can be looked at as Speed Points. TimePoints are assigned to the pilot with a function of FastestTime and PilotTime. Slow pilots will get zero points for speed if their time to complete the SpeedSection is longer than FastestTime plus the square root of FastestTime (time measured in hours). Conversely, a fast pilot who lands just before End of Speed Section (ES), although receiving no TimePoints, will receive a fair share of distance points, and so is not too heavily penalised on days where most of the competition field makes goal.
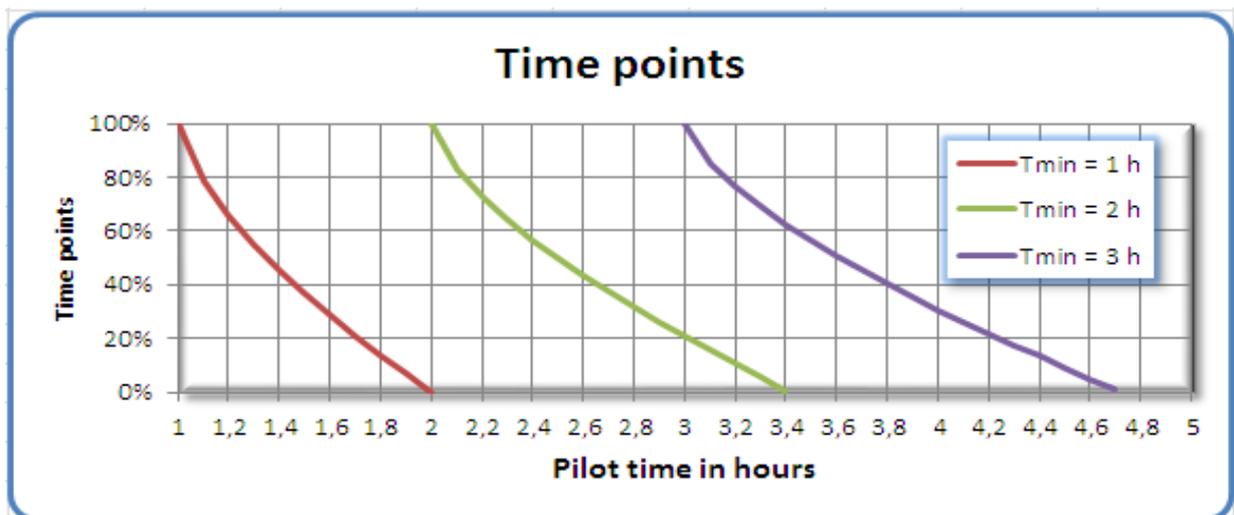
This is an example showing three different tasks where the time of the fastest pilot is different.

FastestTime = 1 hour	FastestTime = 2 hours	FastestTime = 3 hours
80% Score time = 1:05	80% Score time = 2:08	80% Score time = 3:09
50% Score time = 1:21	50% Score time = 2:30	50% Score time = 3:37
Zero Score time = 2 hours	Zero Score time = 3:24	Zero Score time = 4:42
	(3.4 hours)	(4.7 hours)

A pilot who gets the ES but not Goal will normally be penalized by losing some or all of his time points

KEEP IN MIND:

If the zero score time ratio is fixed then, in a short task, slow pilots will be more likely to get zero Time points and therefore there will be a group of pilots with the same (or very similar) points for the day. On a long task, those same pilots would run out of day and land before goal, hence avoiding this evident anomaly. The scoring system tries to overcome this problem but, of course, it is important to set tasks that require the pilots to be in the air for a reasonable amount of time.

PilotsTimePoints (SpeetPoints) Technical details:

```
// time points
..
foreach (Participant p in ps)
{
  double time_points = 0;
  double time = p.Result.Ss_Time_Dec_Hours;
  if (time > 0)
  {
      time_points = 1 - Math.Pow((time - sp.Best_time)
                 / Math.Sqrt(sp.Best_time)), 2.0 / 3);
      if (time_points < 0) time_points = 0;
      time_points *= sp.Available_points_time;
      // All versions of GAP formula use this module as base.
      // Any time penalty is only applied if at least one pilot reach GOAL
      if (some_reached_goal && p._distance < t.DistanceExact)
      {
        // ES but not goal penalty
        // "20%" penalty would mean time_points_if_not_in_goal=0.8.
        // No time points would mean time_points_if_not_in_goal=0.0.
        // Full time points would mean time_points_if_not_in_goal=1.0.
        time_points *= sfg.Time_points_if_not_in_goal;
        p.Result.Got_time_but_not_goal_penalty = true;
      }
  }
  p.Result.Time_points = time_points;
}
..
```

3.4 Launch Window Open Time

Pilots are not allowed to takeoff before the launch open time. The Launch Window has to be open for long enough time for all the pilots to be able to take of safely. Normally a task is based on air start when pilots take off (within the Launch Window Open Time) and fly the speed section when SS Open Time has arrived.

3.5 Start of Speed Section (SS) Open Time

The time when pilots are allowed to start the speed section of a task. If a pilots crosses the SS line/cylinder border before SS Open Time a pilot gets scored for the distance flown to the SS Jump the Gun is a small/specific exception to this.

3.6 Jump the Gun option

"**Jump the gun**" option is to allow pilots to start before the startgate. This option is normally only used in HG competitions. By setting this option, a pilot can start before the first start time or Startgate time and will get time points for the task. But by starting earlier (if that is allowed) the pilot is penalized for his early start in relation to start time.

A setting of 2 in "Jump the Gun" option will give a pilot starting before the first startgate additional time in the SpeedSection of X 2 the time he started earlier. For example if the Jump The Gun factor is set to 2 and a pilot starts 20 seconds earlier than the first startgate he will get 40 seconds added to his speed section time.

REMEMBER:

To make this work the "Jump the Gun" factor has to be set. Also, the StartOfSpeed Section (SS) start time must be set to be before the first startgate time. The SS time can be set to define how early a pilot can start before the startgate.

For example if the SS start time is set to 2 minutes prior to the first start gate time, then this limits the pilot to a maximum of 2mins early start.

A pilot starting before SS opening will get 0 time points, scoring only distance points to the SS.

3.7 Pilot Leading Points (GAP2002)

The "**Use leading points**" option is provided to encourage pilots to take off early and rewards the risk involved in being in the leading group. This bonus was introduced in GAP2002 and rewards the pilots which are leading and using better the earlier part of the day (not to waste useful thermals waiting on takeoff). Pilots will get points even if they landed before the End of Speed Section (ES). The tracklogs of all the pilots who started are used and the Leading Coefficient (LC) is calculated by comparing the area between each tracklog and the Start of Speed Section (SS) using the Earliest Start time, among pilots completing the SpeedSection.

Track log evaluation for Leading Coefficent calculation
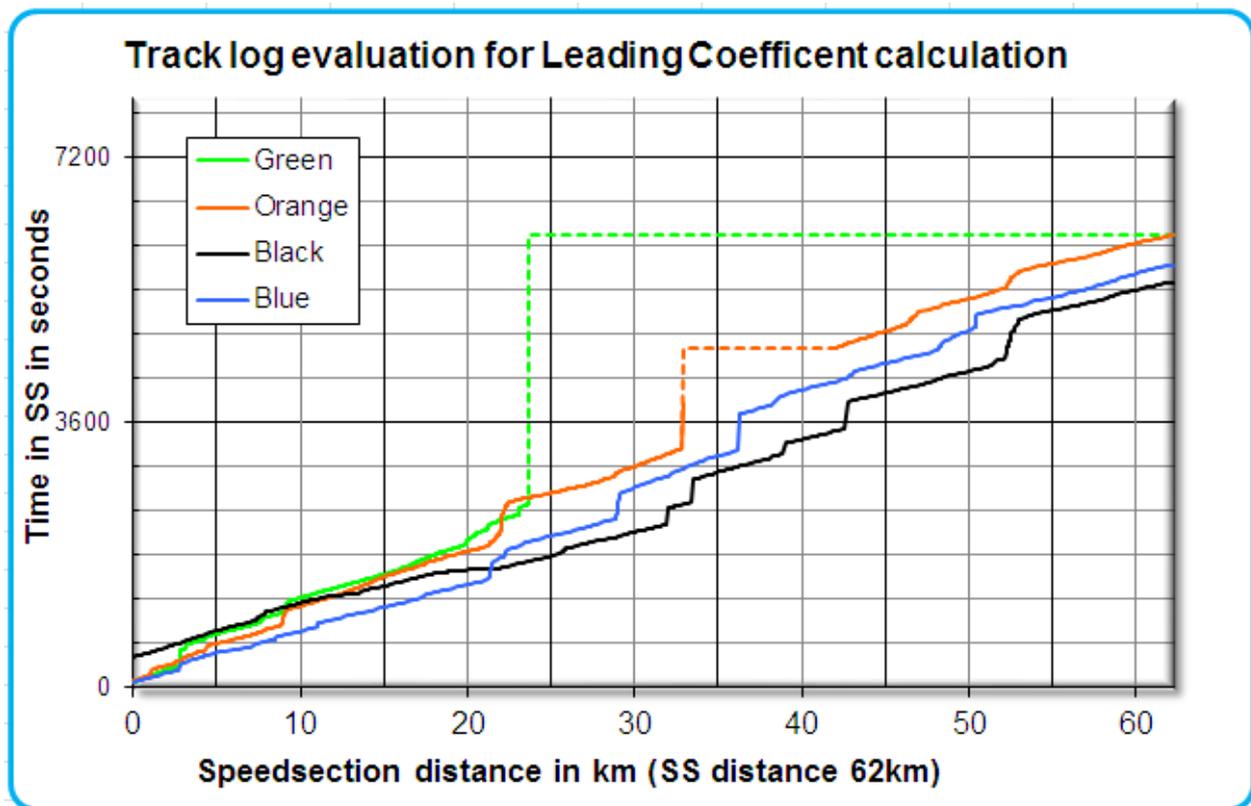
Blue started first in the Speed Section (SS) but Black was the first pilot crossing End of SpeedSection (ES).

Green started the same time as Blue but land short, about 23km after just over 40 minutes of flight in SS.

Black was fastest (thus will get more Speed points) but started late; he likely had pilots in front to show in the first 22km but was leading after that.

If a pilot lands along the course (Green) or his tracklog is interrupted (Orange), his tracklog is completed as shown by the dotted lines . As shown on the graph the missing part of the Orange tracklog it is calculated as if the dotted line was the actual tracklog, so his LC is lower than if it is expected if the section of the tracklog was not missing. A pilot landing just short of goal would be less penalised and could even get full Leading points if he led for a long while.

If a pilot starts before the SS open time and 'jump the gun' is enabled , his Leading Coefficient is calculated from his own time when he crosses the SS, not the SS open time

The pilot who used best the earliest part of the day (i.e. Black, who has the smallest area below the tracklog) gets all the available Leading points, while the others gets their points according to the same formula used for the Time points for the same reasons.
If the task in the example is full value and 30% of pilots made the End of Speed Section (ES) then Black will get all of the available 81 Leading points and full Time points as he was fastest; Blue gets 45 points because he started early but was slower; Orange receives only 18 Leading points as he was slow and had a gap in his tracklog.; Green gets 0 points even he started early because he was the slowest and landed fairly short.

Even if a pilot doesn't get to End of Speed Section (ES) he will still get some Leading points if he started early enough, was fast enough and landed close enough to the ES. Even if two pilots started and arrived with equal times the Leading points would still be different, especially if one pilot was leading for most of the course compared to the other.

```
     Pilots LeadingPoints Technical details:

..
foreach (Participant p in ps)
{
  double leading_points = 0;
  double lc = p._lc;
  if (lc > 0)
  {
      double lc_diff = Math.Round(lc - smallest_leading_coefficient,
                                  5, MidpointRounding.AwayFromZero);
      double slc5 = Math.Pow(smallest_leading_coefficient, 0.5);
      double tmp = lc_diff / slc5;
      leading_points = 1 - Math.Pow(tmp, 0.666);
      if (leading_points < 0) leading_points = 0;

      if (sp.Available_points_leading > 0)
              leading_points *= sp.Available_points_leading;
      if (leading_points > sp.Available_points_leading)
              leading_points = sp.Available_points_leading;
  }
  p.Result.Leading_points = leading_points;
  p.Result.Departure_points = 0;
}
..
```

3.8 Pilot Departure Points (GAP 2000)

Initially known as the 'early bird bonus' the **"use departure points"** option is provided to encourage fast pilots to take off early and rewards the risk involved in being in the leading group.

This option has been replaced with Leading Points in GAP2002 (see 3.7).

The maximum available points for any pilot is 1/4 of his own speed points. The first pilot who launches and also makes goal is awarded the highest number of "departure points". Pilots not making goal are not considered for the departure bonus. If the departure delay (the time difference between the start time of the first pilot in goal, and the start time of another pilot who makes the goal) is bigger than 1/2 Nominal Time, the departure bonus is zero.

The other pilots will score according to their speed points and their departure delay over the first pilot who launched and made goal.

A fast pilot will get more departure points than a slow pilot taking off at the same time because he was probably leading for a longer time.

Example with Nominal Time = 120 minutes (2 hours)
A pilot that launches with a departure delay of 1/10 of the Nominal Time will get a departure bonus of 0.60/4 of his own speed points.

The result is that fast pilots will get more points if they take off early, because they will stay in front for longer, and then collect an arrival bonus as well.
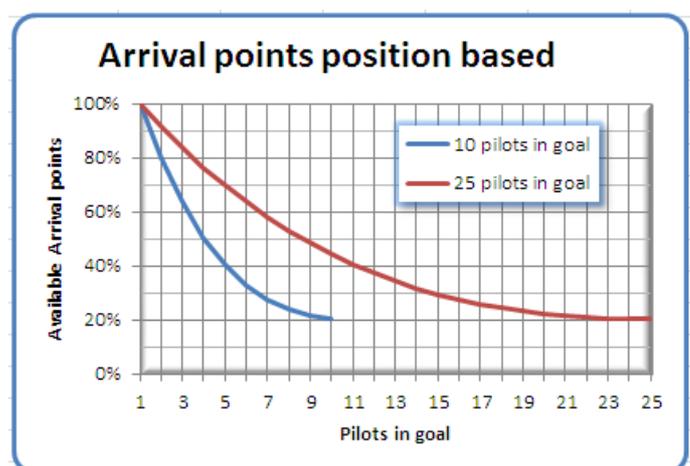
KEEP IN MIND:

Departure points are a percentage of your own speed points. If all the pilots start at the same time like in a pure race, departure points will still be different, because the fast pilots (who will get more arrival points as well in this case) will have the same percentage of a higher number of points.
You could say that in tasks with a single start time for all pilots, speed points are effectively increased.

3.9 Pilot Arrival Points

Arrival Points reward pilots for racing to the End of Speed Section (ES). If the points should be based on a pure position score (GAP2000/GAP2002), then select the **"Use Arrival Position Points"** option.

Or as used in OZGap version the points are based on Arrival Time, the **"Use Arrival Time Points"** option is used.. The first pilot completing the SpeedSection gets the maximum available Arrival points while the others get points according to their Arrival Position or Arrival Time. The last pilot will always get a minimum of 20% of the available Arrival points.

Arrival points position based

10 pilots in goal
25 pilots in goal

The Departure/Leading and Arrival points system is there to reward the pilot who leads out. If you lead out, you make decisions yourself and you take more risks of bombing out or being slower. If you follow other pilots, you might get a faster time, but your overall points will be less than the pilot who flew with the same elapsed time (or maybe a slightly slower one), but who flew in front of you for most of the course.

Pilots ArrivalPoints Technical details:

```
foreach (Participant p in ps)
{
  double arrival_points = 0;
  double time = p.Result.Ss_Time_Dec_Hours;
  if (time > 0) // reached ES
  {
      double x = 0;
      if (sfg.Use_arrival_position_points)  // position based
      {
        x = 1 - (p.Result.Finished_ss_rank - 1.0) /
                 sp.No_of_pilots_reaching_ES;
        x = 0.2 + 0.037 * x + 0.13 * Math.Pow(x, 2)
                + 0.633 * Math.Pow(x, 3);
       }
       else if (sfg.Use_arrival_time_points) // time based
       {
         x = Math.Round( Math.Pow(
              1 + (2.0 / 3.0) * (sp.First_finish_time.Utc_time -
                    p.Result.Finished_ss.Utc_time).TotalHours, 3)
                    , 4, MidpointRounding.AwayFromZero);
         if (x < 0) x = 0;
      }
      arrival_points = x * sp.Available_points_arrival;
      if (some_reached_goal && p._distance < t.DistanceExact)
      {
        // ES but not goal penalty
        //"20%" penalty would mean time_points_if_not_in_goal=0.8.
        //No time points would mean time_points_if_not_in_goal=0.0.
        arrival_points *= sfg.Time_points_if_not_in_goal;
      }
  }
  p.Result.Arrival_points = arrival_points;
}
```

4 Summary

Pilot Score is the sum of Distance points, plus Speed points, plus Departure/Leading bonus and Arrival bonus ... and the best pilot wins!

The GAP scoring system rewards the pilot who makes his own decisions and stays in front of the others. Waiting on takeoff for the other pilots to fly, then follows to be safer and faster, is a less valuable tactic in terms of this scoring.

With previous scoring systems your best tactic to recover points over your opponent was to start a few minutes after him, then catch him. His best tactic was to wait for you and fly with you. Everybody was always waiting on takeoff because everyone was following the same tactic!

With this scoring system a good tactic to catch up points on your opponents is to start early and fly fast. This way you force your opponents to take the risk of being an early bird with you, or wait for more pilots to be in the air for safer (scoring wise) flying.

With GAP scoring, even if the day quality is 1, the winner will automatically get 1000 points, but only if the task is a 'race to goal' and he leads out most of the way when leading points are used.

In an elapsed time task the winner gets 1000 points only if he is the fastest one, got first to goal and also used best the earlier part of the day, leading for most of the task. If nobody reaches goal the maximum available are 900 points for Distance plus 18 points for Departure.

Note that, when DayQuality=1 (even if the winner does not take 1000 points) it's still a full value day because, although the winner has not gained as many points as he could have, this does not influence other pilots' scores. Remember there are a number of Scoring Options to select and can even override the DayQuality depending on how the organizer wants the task to be scored.

The actual pilot score is calculated as:

Pilot Score = Distance points + Time points + Departure points + Leading points + Arrival points

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GAP is designed to reward the pilots who make the right decisions