The Assigned Distance Task

Distance Handicapped Tasks (DHT) have been trialled in rated competitions over the past three seasons, and have proved popular with many pilots. One of the main benefits of the DHT is that the 'variable barrel' concept allows a task to be set for a wide range of handicaps, giving lower handicap gliders a fairer chance to compete against higher handicap gliders. This can be particularly useful for smaller regional competitions where it is not feasible to split the field into separate classes.

Effectively DHTs are an attempt to set an appropriate task length for each handicap, such that all gliders fly the same handicapped distance around a similar course. The tasks use the same turnpoints for all gliders, but with variable sized observation zone 'barrels', so that low handicap gliders do not need to cover the same actual distance as the highest handicap glider, as on a conventional fixed course task.

However, DHTs in their current format have some shortcomings when used in rated competitions with the 1000 point scoring system. The Assigned Distance Task (ADT) is proposed as an alternative approach to distance handicapping, which avoids some of these shortcomings.

- The ADT can be set in SeeYou and scored with SeeYou Competition without any need for additional specialist software. DHTs require additional specialist software for task setting and to pre-process the pilots' IGC files. To score DHTs some task related settings have to be added to the IGC file before scoring, but these may override any modifications to the task definition in SeeYou Competition that the scorer may try to make during scoring, such as modifying finish or start line options.

- Leg distances for all gliders can be measured accurately by SeeYou, which cannot be done for DHTs. In DHTs landout distance anomalies can, in some circumstances, lead to unfair scoring for landouts. This is because SeeYou only measures distances between turnpoints and not edges of observation zones. If two gliders landout at the same point on a DHT, SeeYou will consider that they have covered the same distance, so they will receive the same distance points regardless of handicap and which leg of the task they are on.

- Wind adjustment can be applied accurately using actual leg distances and bearings, and using a more representative wind strength and direction, derived from flight traces, instead of a pre-task estimate, which invariably is inaccurate and so can skew results, especially for landouts. In DHTs it is not possible to calculate an accurate wind adjusted distance for landouts.

How a DHT is like an AAT

In some ways a DHT is quite similar to an Assigned Area Task (AAT). On an AAT, if a two hour task time is set, and all pilots achieve the same handicapped speed over two hours, then their handicapped distances will all be the same. On a DHT, all pilots are being sent into the same areas to fly the same handicapped distance, and remembering that '*Distance divided by Speed is equal to Time'*, then if all pilots were to fly at the same handicapped speeds, then their time on task will be equal.

For example, if a DHT is set with a handicapped distance of 150km and zero wind adjustment, then an ASW27 (handicap 104) will need to fly an actual distance of 156km and an ASW19 (handicap 93) will need to fly an actual distance of 139.5km. If they both achieve a handicapped speed of 75kph, then they will both take two hours to complete the task. If an AAT is set with a two hour time limit, and the same pilots again achieve a handicapped speed of 75kph for a duration of two hours, then they also will have covered 156km and 139.5 km respectively. The variable barrel concept merely requires all pilots to enter circular areas centred on the turnpoints, and each pilot to turn at a specified distance from the turnpoints in order to achieve the same handicapped distance.

The two task types differ in the setting and scoring; a DHT is a straight race in basically the same area, whereas in a conventional AAT each pilot flies the best distance they can, at the best speed, in the given time, with each leg handicapped and wind adjusted. The variety of shapes and sizes of the observation zones that can potentially be set in an AAT can sometimes mean that pilots may fly completely different routes to their competitors. Flying an AAT successfully requires skilled pre-flight planning and whilst on task, close attention to progress against the clock and distances being achieved on each leg. Additionally, the way that the distance and speeds are scored, and the time penalty for exceeding the task time limit, mean that is not immediately obvious to the inexperienced pilot what the best tactics will be. After finishing, it is not possible to determine how well various pilots have performed against each other until all of the flight traces have been processed and scored. In some circumstances landouts can score more points than a finisher, even being the only finisher on an AAT is no guarantee of winning the day. This all makes AATs unpopular with some pilots, particularly inexperienced pilots at Regionals level.

If we want a straight race giving low handicap gliders a chance to compete more fairly with high handicap gliders, but without the complexities of AAT time limits or scoring, and without the known shortcomings in DHTs, then a modified form of an AAT could serve this purpose.

The Assigned Distance Task

The Assigned Distance Task is an AAT with large circular areas but with no target task time.

Instead of having a target task time, a target distance is given for each handicap. Each glider is given a minimum number of kilometres it must cover. This distance is calculated such that all gliders will have the same handicapped (but not wind adjusted) target distance.

For example, if the target distance for an LS8 (handicap 100) is 242.2km, the target distance for an ASH26 (handicap 110) will be 266.7km and the target for a Standard Cirrus (handicap 90) will be 218.2km. The handicapped target distance for all three is 242.2km.

To qualify for speed points a pilot must complete the task and achieve at least their target distance (or be within a defined margin). The actual distance that they have flown will then be handicapped and wind adjusted to calculate a marking speed.

When setting a conventional AAT using SeeYou, it shows the minimum and maximum distances that can be achieved, and the distance through the turnpoints. These numbers are useful in setting an ADT (see Figure 1).

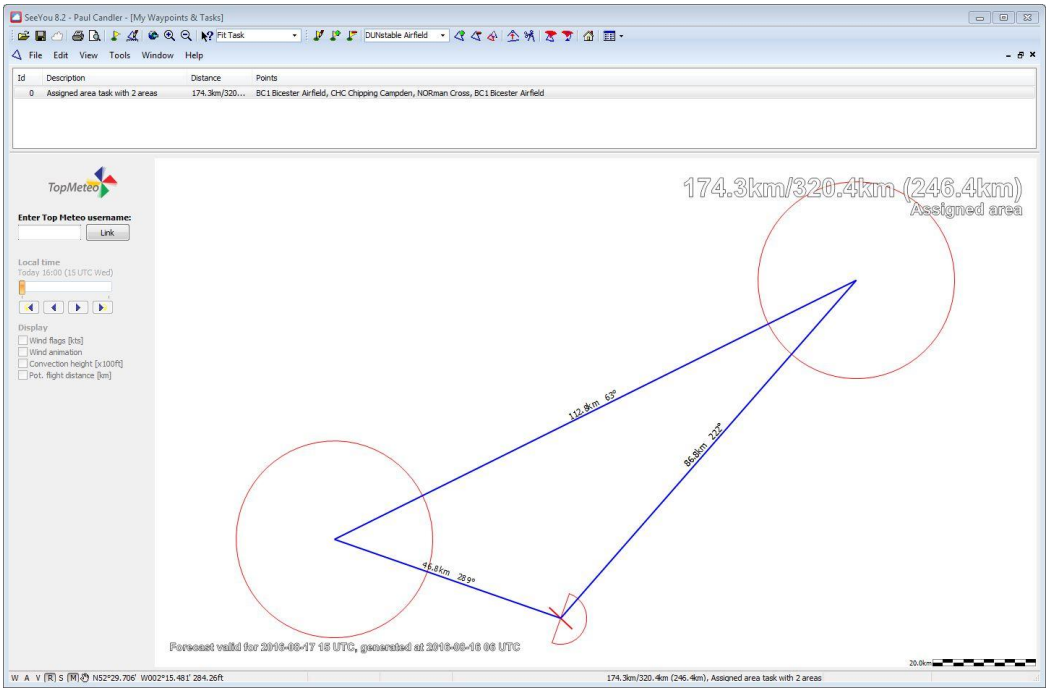

Figure 1 - SeeYou task setting screen showing an AAT with circular areas, with minimum distance 174.3km, maximum distance 320.4km and distance through turnpoints of 246.4km

The task is set such that if the highest handicap glider flies to the centre of each of the circular areas, it will achieve the required handicapped distance. So using the task shown in Figure 1, if the highest handicapped glider competing is an ASW22b (handicap 117), its actual target distance will be 246.4km and its handicapped target distance will be 210.6km. To achieve the same handicapped distance, the actual target distance for an ASW19 would be 195.9km and for an ASW27 it would be 219.0km.

Task Setting for an ADT

The task setter needs to ensure that the circle radii are sufficiently large to yield a minimum task distance that is smaller than the actual target distance for the lowest handicap glider. To give some margin on this, they should be set for 90% of the target distance of the lowest handicap glider competing and rounded up to the next whole kilometre. So if the ASW19 is the lowest handicapped glider, 90% of its target distance would be 176.3km. In the example shown in Figure 1, a circle radius of 19km yields a minimum task distance of 174.3km. Doing this gives the lower handicap gliders some routing options other than just reaching the edge of the circles. It also makes it less likely that any pilot will receive a turnpoint penalty.

It is possible to provide pilots with a barrel radius, as is done for a DHT, which if flown to, will yield a required target distance for each handicap. Using SeeYou alone, it is not possible to quickly derive a set of barrel radii for a range of given target distances. However, the relationship between the radii of the circles and the minimum task distance shown by SeeYou is roughly linear over short changes of the radii. i.e. if the task setter sets a radius of 5km and notes the minimum task distance, then sets a radius of 10km and notes the new minimum task distance, it is fairly easy to derive some estimates of the relationship between the circle radius and minimum distance (See Appendix A). Using this technique, it has therefore been possible to develop a simple spreadsheet to help calculate the required radii to a sufficient degree of accuracy, given a few samples of actual radius and minimum task distances. The task setter can quickly cross-check the results by modifying the circle radii to a sample set of given barrel radii and noting the new minimum distance is close enough to the required target distance. This cross-checking process potentially could be sped up by automatically generating a CUP file containing tasks using each of the given radii. As will become apparent below, absolute precision in calculating the barrel radii is not necessary.

Scoring

For the pilot, achieving precise distance in flight is not necessarily an easy proposition, especially if ‘eyeballing’ it, so to remove the need for a high degree of accuracy in judging when to turn in each circle, some leeway can be given around the target distance. In order to qualify for speed points each pilot must achieve at least 95% of their target distance. Their handicapped distance and speed can be calculated using the actual distance they have covered and the time that they took to complete the task.

To deter pilots from ‘flying for distance’, particularly on difficult days where many landouts are likely, but to avoid penalising pilots for playing safe and flying a short extra distance, an upper limit, say 105%, can be applied to the distance. Any distance flown over this limit would be ignored in scoring and, as in a conventional fixed course task, distance points for a landout would be limited so as not to exceed a finisher’s distance points.

So effectively, the target distance becomes a target range, which is why barrel radius calculations do not require a high degree of accuracy. All pilots’ performances will be measured over similar, but not necessarily exactly the same, handicapped distances. In the above example the handicapped distance range is 200.1km to 221.1km. Given a target of 195.9km (actual), the ASW19 pilot in the above example will know that they need to complete the task with an actual distance between 186.1km and 205.7km in order to maximise their points. If a pilot fails to achieve the lower limit they will be awarded distance points only (as for a landout on a conventional task), if they exceed the upper limit, their marking distance (and speed) will be calculated using that upper limit, regardless of how far they flew over the limit, so any additional distance represents wasted time.

As SeeYou Competition will use AAT distance measurement rules to provide an actual distance and course for each leg flown, in addition to handicapping, the UK scoring script can now apply wind adjustments to each leg flown. Using actual wind data derived from flight traces, as for a conventional AAT, accurate windicapped distances and speeds can then be calculated.

All day points calculations, devaluations and pilot speed and distance point calculations can be as for a fixed course task, making the ADT more of a straight race than an AAT.

Flying the task

Pilots have several options for how they might fly the task.

The easiest and simplest method is to fly it exactly the same way as they would fly a DHT. If using a basic GPS and ‘distance to go’, just fly to within the required distance of each TP and the target distance will be achieved.

If using a PNA with SeeYou Mobile (or XCSoar or LK8000) or LX type devices, the task can be set up almost exactly as it would be for a DHT, but setting the observation zones as circles only (not ‘thistle’), with the appropriate radius. As long as your navigation software shows that you have entered each circle, you will achieve the target distance. Note that the highest handicap glider cannnot use a barrel, so would need to round the turnpoint similarly to using a standard ‘FAI sector’.

In both of the above cases, as scoring will calculate leg distances as for an AAT, and not use the pilots’ own observation zone definitions, they are not constrained to using the set radius at each turnpoint. They may vary the route according to conditions, so might turn just short of one barrel edge and fly deeper into the next. Turning a little short, or making a small diversion at one turn will not incur a turnpoint penalty, but may erode some of the +/-5% margin available, so will require some appreciation of the geometry of the situation, and perhaps some mental arithmetic skill. Trying to fly precisely to the absolute minimum of 95% of target distance, without more sophisticated navigation software, would be a very high risk strategy.

Alternatively, pilots with the appropriate navigation tools may choose to plan and fly the task more like a conventional AAT, but without any concerns about a time limit. Pilots can use their navigation software to define their own turnpoints within the circles in order to achieve the required distance. (see Figure 2). Suitable navboxes in SeeYou Mobile etc. can show distance flown and distance to home, which would make the impact of any diversion easier to assess.

Figure 2 - SeeYou Mobile AAT Task setup with 19km circle centred on turnpoint CHC and user turnpoint set to yield a tDis (task distance) of 196km (lower left of screen). The inbound and outbound tracks can be seen on the right hand side of the screen.

What next?

So the ADT resolves some of the issues with DHTs, but is still not a perfect solution.

Although the ADT enables tasks to be accurately scored and wind adjusted in the 1000 point system, and without the need to use any additional specialist software to be able to set and score the tasks, it does have the problem that pilots flying the task without SeeYou Mobile or similar may consider themselves to be at a disadvantage. This is not so different to the issues that some pilots still using maps and cameras had in the 1990s, when GPS and then IGC flight recorders gradually became more affordable, and used more widely. The pilots most likely to want to make diversions are the pilots of the higher handicapped gliders, which are typically better equipped in terms of navigations aids.

Even pilots who do have suitable navigation devices could benefit from a new navbox which indicated task distance that would be achieved by turning 'now' for the finish line. This is something that developers of navigation software might be more likely to do than Naviter adding an entirely new task type to the SeeYou suite.

The Assigned Distance Task could potentially be set as an alternative to using enhanced (shower) sectors, which also have some inherent problems with distance measurement, especially for landouts close to, and at the extreme ends of, the 180 degree 'D' sector. But to do so would require that all pilots be able to easily assess the distance that they have covered if they make large diversions to avoid unsoarable conditions.

Another potential benefit of this concept is that AATs are infrequently used at Regionals level, but using ADTs at Regionals level may give aspiring National and International pilots more opportunities to practice using AAT task setting techniques in a competition environment.

None of these ideas described here are 'set in stone' and the concept is open to further discussion and development, and there are some alternative options that could be considered regarding scoring, but I think the basic concept is now sufficiently developed to allow it to be tested in its basic form.

A draft set of rules can be found in Appendix B, and a modified test version of the UK scoring script for SeeYou Competition to include ADTs has already been developed, so the next thing is to try setting and flying one.

A new rule (rule 4.7) was introduced in the *BGA Rules for Rated Competitions 2016* to allow alternative rules and/or procedures to be trialled, subject to prior approval from the Competitions and Awards Committee. So if any competition director would be interested in trialling the Assigned Distance Task, I would be happy to work with them to support a trial at a Regionals, or even a non-rated competition.

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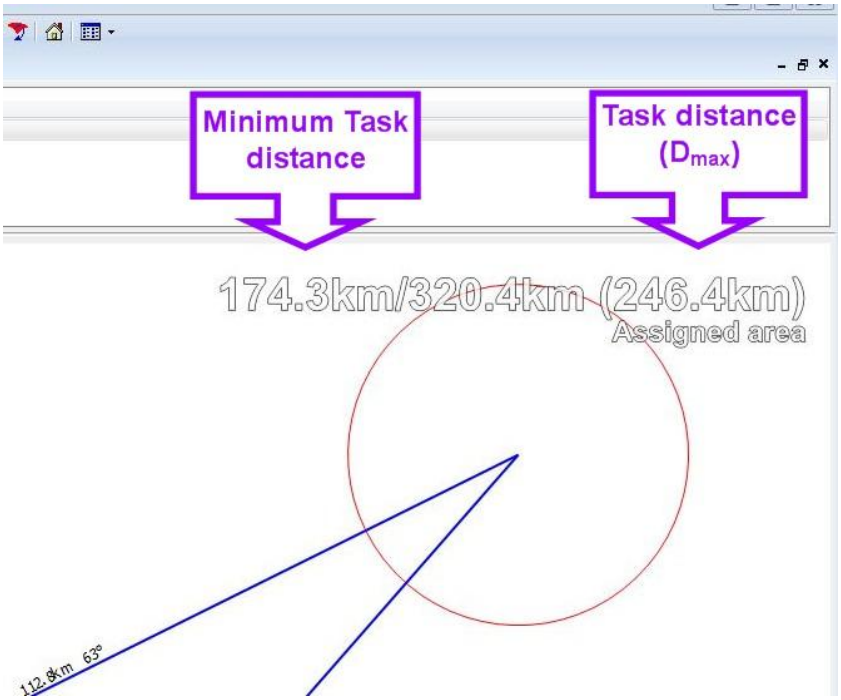
Appendix A – Task setting and Calculation of Circle Radii

Decide on a required target distance for the highest handicap glider and use SeeYou to set an AAT with 10km observation zones. Set any control points using a 1km radius circle.

D_{max} (the maximum target distance) is determined by noting the AAT task distance given by SeeYou for the AAT (the distance between the points of the task). Adjust the turnpoints to yield a distance as close as possible to the required Dmax and note the minimum task distance (See Figure A1)

Figure A1 SeeYou AAT task setting



The relationship between circle radius and minimum task distance is roughly linear over small ranges of radii (of around 5 to 10km in most cases), which makes it fairly simple to calculate the decrease in target distance per kilometre increase in circle radius.

For example, if D_{max} is 334.9km, and D_{10}, the minimum AAT distance at 10km radius is 309.4km, then ∂R, the reduction in minimum AAT distance per km increase in radius can be calculated as follows

$$\partial R = (D_{max} - D_{10}) / R_{10} = (334.9 - 309.4) / (10.0) = 2.55km$$

In the above example, if H_{max} (the highest handicap of any competing glider) is 115, then T_{110} (the target distance for a glider of handicap 110) will be

$T_{110} = (110 / H_{max}) * D_{max} = (110 / 115) * 334.9 = 320.3km$

So R_{110} (the barrel radius for a glider with handicap 110) will be

$R_{110} = ((D_{max} - T_{110}) / \partial R) = ((334.9 - 320.3) / 2.55) = 5.72km$

This number should be rounded down to one decimal place to give a barrel radius for handicap 110 of 5.7km.

T_H and R_H can then be calculated for each value of H, the handicap of any competing glider

N.B. For very large circles (which may be required if there is a wide spread of handicaps), ∂R may not remain constant for all values of R. This variation is most apparent if the angle between the track in and track out of any observation zones is greater than 90 degrees.
In these circumstances the variation of minimum AAT distance with radius should be checked across a range of radii, and different values for ∂R will be required as R increases.

For initial trial purposes, a spreadsheet has been developed in Excel to assist with these calculations, by taking minimum AAT distances for every 5km increase in radius and producing a table of target distance with sufficiently accurate barrel radii for each competing handicap.

R_{max} is the radius that would yield a minimum task distance equal to 90% of the target distance for the lowest handicap glider competing. R_{max} is used to define the radii of the observation zones for the AAT.

For example, if H_{min} (the lowest handicap of any competing glider) is 89

$T_{89} = (89 / 115) * 334.9 = 259.2km$
and
$R_{max} = ((D_{max} - (0.9 * T_{89})) / \partial R) = ((334.9 - 233.3) / 2.55) = 39.84km$

This number should be rounded up to the nearest kilometre, so for this example each observation zone will have a radius of 40km.

Appendix B - Draft Rules for Assigned Distance Task

ADT1. The task will be set as an AAT, with time limit set to zero. Observation zones must be circular, with a radius determined by the range of speed indices (see Appendix A for method of calculation of radii).

If control points are required, these should be circles fixed at 1km radius.

ADT2. A target distance and barrel radius (both in kilometres) for each handicap will be published with the task sheet for the day.

ADT3. Leg distances flown will be calculated as for an Assigned Area Task,

ADT4. All scoring is performed within SeeYou Competition, using a specially adapted version of the standard UK scoring script. The contest wind and the handicapped target distance need to be supplied via the Day Tag box, in the form **ddd/ss,nnn.n** where **ddd** is the wind direction, **ss** is the wind speed in knots and **nnn.n** is the handicapped target distance (the target distance for handicap 100).
IGC files can be received into SeeYou Competition without any need for pre-processing.

ADT5. For scoring purposes, the day and glider points calculations will use the same parameters and formulae as Fixed Course Tasks (see *BGA RULES FOR RATED COMPETITIONS 2017*) except that:

i. Y distance will be 40% of handicapped target distance (i.e. 0.4 * target distance for glider with handicap 100) with the same maxima and minima as for Fixed Course.

ii. The minimum task distance will be determined by the handicapped task distance (equal to the target distance for a glider with handicap 100).
The minimum handicapped task distance will be 100km.

iii. Finisher is defined as any pilot completing the task (i.e. making a valid start, registering a fix in each area and control point, and making a valid finish) and achieving 95% or more of target distance. All finishers will be awarded full day distance points, regardless of their actual performance against target.

ADT6. Dm (a pilot's Marking Distance) is defined as the sum of each leg distance, handicapped and wind adjusted. However, if the sum of the actual leg distances exceeds 105% of target distance, then any additional distance flown is ignored.

For example, if a pilot with a target distance of 200km finishes a leg taking them to 214km, 105% of target is 210km, so 4km is removed from that leg before handicapping and wind adjustment are applied, and any subsequent legs will be ignored, but the time taken to cover that 4km and any additional legs will still be included in the speed calculation for finishers.

ADT7. Pilots who complete the task but fail to achieve at least 95% of their marking distance will be classed as non-finishers. Non-finishers will receive distance points for their marking distance in proportion to the winner's marking distance not exceeding day distance points.

*(i.e. if day distance points are 677 and the winner's marking distance is 323km, then if a pilot lands out with a **Dm** greater than 323km, they will still receive only 677 distance points).*

ADT8. Sh, a finisher's speed will be their **Dm** divided by the time taken to complete the task.

i.e. If a finisher's distance is 97% of their target distance, their speed will be calculated using that distance with handicapping and wind applied, rather that their target distance. If they achieve 107% of their target distance, the additional 2% is ignored and their speed will be calculated using 105% of their target distance with handicapping and wind applied.

ADT9. Speed points are awarded as for Fixed Course Tasks (for speeds not less than 2/3 winner's marking speed, and in proportion to winner's speed).