Proposal from Bulgarian NAC

Line as a task sector

The problem:

Currently the MD has only one option for task sector shape to design a task - the circle. The problem with the circle is that it has (in most of the cases) a very distinct sweet spot to touch it. Using only circles makes the optimum task routes from different positions to converge quickly. As a result - almost every task should be flown over the only optimum route by all pilots. No practical diversity of optimum routes.

The solution:

I believe that introduction of a straight line as an option for task sector shape will allow designing more interesting tasks and tasks with more practical options for optimum routes.

The proposal:

Add a second option for task sector shape - **line with defined position, orientation and length**.

The line definition requires:

- Waypoint
- Distance from the waypoint
- Orientation
- Length

The line has one Centerpoint and two Endpoints. Geodetic coordinates of those 3 points must be calculated by the procedures described below.

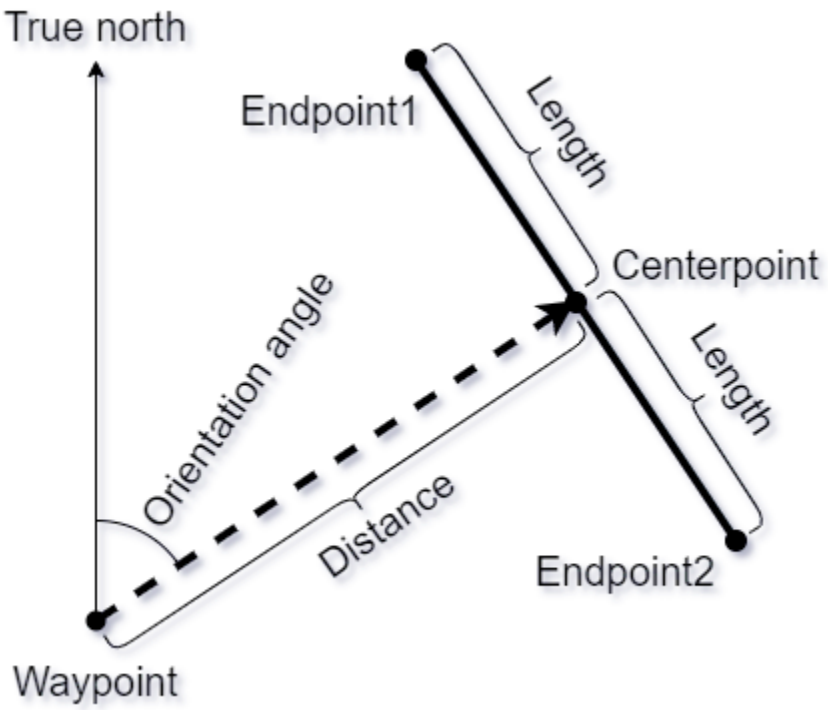
The Waypoint is one of the official competition waypoints. The information needed from the waypoint definition are only the geodetic coordinates (latitude, longitude). Those coordinates must be expressed as decimal degrees rounded to 5 digits after the decimal point.

Distance from the waypoint specifies how far from the Waypoint is the Centerpoint. It must be expressed in kilometers with one decimal digit after the decimal point. Default value for the Distance (if it’s not specified) is 0.0 km. Distance must be between -100.0 and 100.0 km.

Orientation specifies at what world direction (relative to the true north) we must travel from the defining Waypoint in order to reach the Centerpoint. Travel distance must be exactly the

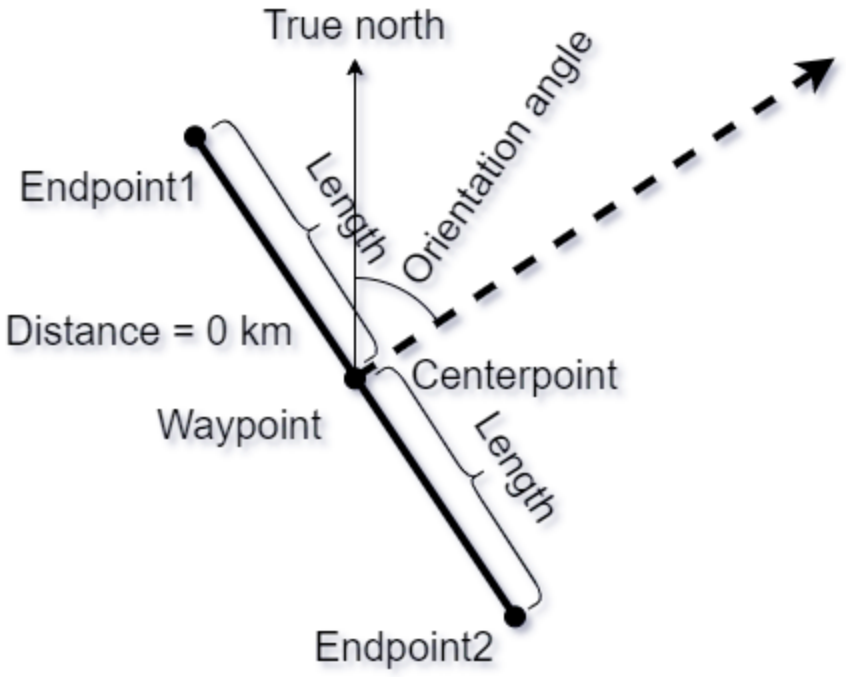
Distance above. Orientation can be expressed in one of two ways: (1) as decimal degrees in multiples of 2.5° and (2) as capital letters. There is no default orientation - it must be specified.

Length specifies how far from the Centerpoint are the two Endpoints. It must be expressed in kilometers with one decimal digit after the decimal point. Default value for the Length (if it's not specified) is 1.0 km. Length must be between 0.1 and 100.0 km.



Procedure for calculating the 3 points:

1. Calculate geodesic line starting from the definition Waypoint and initial azimuth equal to the Orientation angle.
2. On this geodesic line find the point at travel distance equal to Distance. This is the Centerpoint.
3. Find the arriving azimuth.
4. From the Centerpoint calculate a geodesic line at azimuth equal to the arriving azimuth (from step 3) plus 90.0°.
5. On this geodesic line find the point at travel distance equal to Length. This is the Endpoint1.
6. From the Centerpoint calculate another geodesic line at azimuth equal to the arriving azimuth (from step 3) minus 90.0°.
7. On this geodesic line find the point at travel distance equal to Length. This is the Endpoint2.



Procedure for calculating the 3 points in case of zero Distance:

1. The Centerpoint in this case is exactly the same as the defining Waypoint.
2. From the Centerpoint calculate a geodesic line at azimuth equal to Orientation angle minus 90.0°.
3. On this geodesic line find the point at travel distance equal to Length. This is the Endpoint1.
4. From the Centerpoint calculate another geodesic line at azimuth equal to Orientation angle plus 90.0°.
5. On this geodesic line find the point at travel distance equal to Length. This is the Endpoint2.

Additional technical details:

Orientation may be expressed as a decimal number (the angle in degrees between true north and distance vector in clockwise direction), but it also can be expressed as capital letters. The possible options for the capital letters and their meanings are:

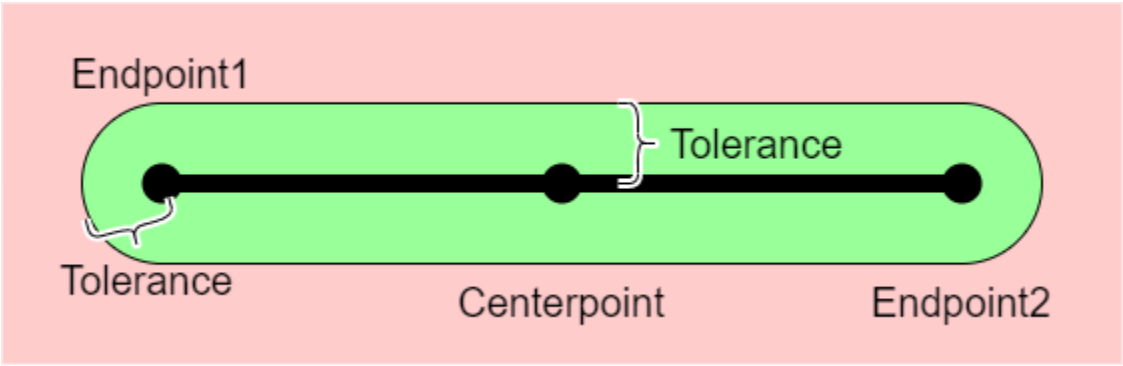
- N = 0.0°
- NNE = 22.5°
- NE = 45.0°
- ENE = 67.5°
- E = 90.0°
- ESE = 112.5°
- SE = 135.0°
- SSE = 157.5°

- S = 180.0°
- SSW = 202.5°
- SW = 225.0°
- WSW = 247.5°
- W = 270.0°
- WNW = 292.5°
- NW = 315.0°
- NNW = 337.5°

Total length of the line will always be equal to two times the Length. For example the default total line length will be 2.0 kilometers because the default Length is 1.0 km. Minimum total line length will be 200 meters because the minimum Length is 0.1 km = 100 meters.

Negative value for the Distance means the same absolute distance but in the opposite direction. For example line oriented at NE at distance -5.0 km will be absolutely the same as line at distance 5.0 km, but oriented at SW.

Validation of the line must be done with some tolerance. If there is a tracklog point closer to the line than the tolerance - the line sector is considered as validated and the pilot can continue to fly to the next sector in the task. The tolerance must be calculated from the absolute value of line Distance or the line Length (whichever is greater) multiplied by the official distance tolerance for the competition. Minimum value for the tolerance must be 5 meters. On the drawing below are shown the two zones: red zone - tracklog point in this zone does not validate the sector; green zone - tracklog point in this zone validates the sector.



Line sector may also be validated if in the tracklog are present two consecutive points - one on one side of the line and the other on the other side of the line. Timestamps of the two TL points must also be evaluated - the speed one must travel with in order to go around the line must be > 120 km/h.

Date: 15 Jan 2023
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