## CTR Segment distances

## Summary



The incident with the warning for Corinna Schwiegersháusen at the Pre Worlds in Mount Cucco, Italy shows that the definition of segments in the OpenAir format is unclear. It is absolutely necessary that the scorekeepers as well as the software and hardware developers agree on the same interpretation of segment definitions in the OpenAir format of airspaces.
The problem arises because a definition of a segment with center point, point1 and point 2 is overdefined. In case of CTR 3 at the preworlds, the two distances differ by 400 to 430 m depending on the calculation method.

The other problem seems to be, that different software seems to interprete the direction in the segment definition in a different way. This has to be clarified.

The 6030 seems to handle the end points in a different way depending on the direction definition. But Flytec will only change the calculation method, if the main developers of software for flight calculations agree on the same calculation methods.

For pilots, Flytec proposes to insist on CTR definitions for competitions which are based only on lines. Here, all the calculations programs seem to behave the same way.

## Introduction

On the hang glider pre Worlds in Mount Cucco Italy, Corinna Schwiegershausen got a warning, because she had one trackpoint inside the set airspaces.


The instrument shows the CTR border to the left (See the small "v" als mark)

## CTR distances



## Measuring the difference

To measure the differences on the map screen of the CTR Mount Cucco 1 to 3, the following measurements have been performed.

First, the CTR's from MountCucco have been transformed to a position near Flytec. The position has been measured with Google Earth and with a 6030.


The differences of around 20 m may be caused due to reflections

## CTR distances



If the landscape is more open, the measurement is better.

## CTR distances



Overview on CTR Situation


Zoom onto the two measurement points
FS seems to be accurate within the overall accuracy of the whole GPS system.

## CTR distances



Situation on the instruments screen.

## Influences on the map screen

Because no problems have been seen with CTR's composed of lines, some tests have been performed with the definition of CTR's with lines and segments.
This is the definition of CTR 3 Mt . Cucco
AC CTR
AN CTRZone3
AL 6000FT AMSL
AH FL115
DP 43:15:34.0 N 12:46:38.0 E lower right corner
V D =-
$V X=43: 06: 06.0 \mathrm{~N}$ 12:30:43.0 E Segment from upper right to left corner DB 43:18:47.0 N 12:48:35.0 E , 43:15:03.0 N 12:09:23.0 E
DP 43:12:30.0 N 12:12:07.0 E lower left corner
DP 43:15:34.0 N 12:46:38.0 E

CTR distances
Fiscomp: 1

E12.84183 N43.16937

Distance: $\quad 0$
Started Speedsection:
Ended Speedsection:
Time in Speedsection
Task time:
Max altitude:
Task distance:
Speedsection distance:

Tlacklogs I:KundensupportiDatenbank AphabetischiErichiTest GP
OGPAOD W1. iac
06PabME1.igc
072ACYF2igc

43:15:03.0 N 12:09:23.0 E



12:30:43.0 E

The airspaces have been transformed to a location near Flytec and two airspaces have been added

- One without a segment, only the corner points
- One with the direction +


## CTR distances

This resulted in the following:
AC CTR
AN CTRZone3 Original
AL 6000FT AMSL
AH FL115
DP 46:57:40.9 N 08:16:32.0 E lower right corner
V D = -
V $X=46: 48: 12.9 \mathrm{~N}$ 08:00:37.0 E
DB 47:00:53.9 N 08:18:29.0 E, 46:57:09.9 N 07:39:17.0 E
DP 46:54:36.9 N 07:42:01.0 E lower left corner
DP 46:57:40.9 N 08:16:32.0 E back to lower right corner
AC CTR
AN CTRZone4 Only corner points
AL 6000FT AMSL
AH FL115
DP 46:57:40.9 N 08:16:32.0 E lower right corner
DP 47:00:53.9 N 08:18:29.0 E same direction as CTR3
DP 46:57:09.9 N 07:39:17.0 E
DP 46:54:36.9 N 07:42:01.0 E
DP 46:57:40.9 N 08:16:32.0 E back to lower right corner
AC CTR
AN CTRZone5 Direction + and corner points swapped
AL 6000FT AMSL
AH FL115
V D = +
V $X=46: 48: 12.9 \mathrm{~N}$ 08:00:37.0 E
DB 46:57:09.9 N 07:39:17.0 E, 47:00:53.9 N 08:18:29.0 E
DP 46:57:40.9 N 08:16:32.0 E
DP 46:54:36.9 N 07:42:01.0 E lower left corner

## CTR distances

FlyTEC switzeriand 6030


The instrument shows different radii and corner points depending on the direction. The CTR with only corner points is correct.


FS shows the corner point of the CTR with direction - and the corner point of the CTR with only corner points at the same spot. But the CTR with direction + and swapped corner points has the wrong direction in sense of the definition of the swapped corner points and the corner point is not at the same spot.

## CTR distances

Comment: It depends on how the directions and order of the corner points are interpreted.
The Flytec 6030 interprets the direction and order as follows.

- The distance between the centre point and the first point in the segment definition DB is the radius.
- Direction + is clockwise, direction - is counterclockwise from the first point in the DB
- The second point in the DB should be the end point of the segment and the start point of the next line. Then it follows the order of the corner points.


Maxpunkte has the same interpretation as FS


Whereas Flychart interprets the same like the instrument

## CTR distances

## Radii

The instrument shows 2 different radii depending on the direction of the segment. Also Maxpunkte shows the same behaviour. To check possible reasons, the radii from the centre point to Point 1 and to point two have been calculated In this calculation, the original CTR data of CTR3 have been used.
AC CTR
AN CTRZone3
AL 6000FT AMSL
AH FL115
DP 43:15:34.0 N 12:46:38.0 E lower right corner
V D =-
V $X=43: 06: 06.0 \mathrm{~N}$ 12:30:43.0 E
DB 43:18:47.0 N 12:48:35.0 E, 43:15:03.0 N 12:09:23.0 E
DP 43:12:30.0 N 12:12:07.0 E lower left corner
DP 43:15:34.0 N 12:46:38.0 E


Center to point 1


Center to point 2

## CTR distances



## WGS84 Center to point 1 with http://williams.best.vwh.net/gccalc.htm

| Input Data |  |  |  |
| :---: | :---: | :---: | :---: |
| Lat1 |  | Lon1 |  |
| 43:06:06.0 | N | 12:30:43.0 | E V |
| Lat2 |  | Lon2 |  |
| 43:15:03.0 | N | 12:09:23.0 | E V |

Output

$$
\begin{array}{|c|c|c|}
\hline \text { Course 1-2 } & \text { Course 2-1 } & \text { Distance } \\
\hline \hline 299.944402 ; & 119.701115 t & 33.32225919! \\
\hline
\end{array}
$$

Distance Units: km $\vee$ Earth model: WGS84/NAD83/GRS80 $\vee$

## WGS84 Center to point 2

| Input Data |  |  |  |
| :---: | :---: | :---: | :---: |
| Lat1 |  | Lon1 |  |
| 43:06:06.0 | $N \vee$ | 12:30:43.0 | E V |
| Lat2 |  | Lon2 |  |
| 43:18:47.0 | $N \vee$ | 12:48:35.0 | E V |


| Input Data |  |  |  |
| :---: | :---: | :---: | :---: |
| Lat1 |  | Lon1 |  |
| 43:06:06.0 | $N \vee$ | 12:30:43.0 | E V |
| Lat2 |  | Lon2 |  |
| 43:15:03.0 | N | 12:09:23.0 | E V |

Output

| Course 1-2 | Course 2-1 | Distance |
| :---: | :---: | :---: |
| 45.6544399 | $225.858311 ،$ | 33.68918525 |

Output
Course 1-2 Course 2-1 Distance

| 300.0329260 | $119.789638 *$ | 33.26226884 ! |
| :--- | :--- | :--- |

## CTR distances

| Calculation method | Radius Centre <br> to point 1 | Radius <br> Centre to <br> point 2 | Difference |
| :--- | :--- | :--- | :--- |
| Simple method with earth radius <br> 6'371'000m | 33719.1713 | 33180.6738 | 538.4975 |
| Haversine with 6'371'000m according <br> FAI SC 3.7.1.1 | 33689.1852 | 33262.8664 | 426.3188 |
| UTM and Pythagoras | 33722.8664 | 33328.1998 | 394.6666 |
| WGS 84 | 33721.3511 | 33322.2592 | 399.0919 |
| For control FAI sphere with <br> http://williams.best.vwh.net/gccalc.htm | 33689.1852 | 33262.6884 | 426.4968 |

The table above shows the main problem of CTR3. The centre point is not in the centre!
This explains the difference of the two radii in the instruments screen


It explains also the corner in Maxpunkte.


## CTR distances



It is not clear how SF calculates the radii but it seems also to be an issue, because the direction - and the direction+ does not meet in the same point 1.

## Points to improve in the 6030

The radius issue does not explain the difference of the corner points on the screen of the 6030. The last segment should meet the defined corner point as in the CTR with only corners or lines. This point has to be clarified.
But Flytec will only take action if it is clarified in the community how to handle inaccurate segment definitions.

