Flightperformance Comparison

Condor Arcus – Condor DuoDiscus

1. Asumptions

The calculations and pictures are made with the GliderDat software (Download 'www.Virtualsoaring.eu'). We will compare Arcus and DuoDiscus with full ballast (B=100%) on a virtual 250 km flight. We use the Condor Speed Polars (HU22, see Picture 1) at a height of 1000 m (FL=1000m). The start takes place at 1500 m altitude and the finish is at 500 m.


Picture 1: Speed Polars

A critical point is the calculation of climb rate CR. We must make a more or less accurate lift model. GliderDat describes the thermal with 3 parameters.

- maxCR: This is the maximal climb of the air in the center of the lift
- R0: This is the radius, where the climb of the air is 0 m/s
- n: Describes the shape of the lift. The Flighplanner of GliderDat uses a instead of n.

In the virtual flight we use the following values:

- maxCR= 3 m/s
- R0 = 150 m
- n or a = 20

As you can see in Picture 2 (black line) the CR of air is 3 m/s from radius = 0 to about r = 125 m. Then the curve will drop very steep to 0 m/s at radius = 150.
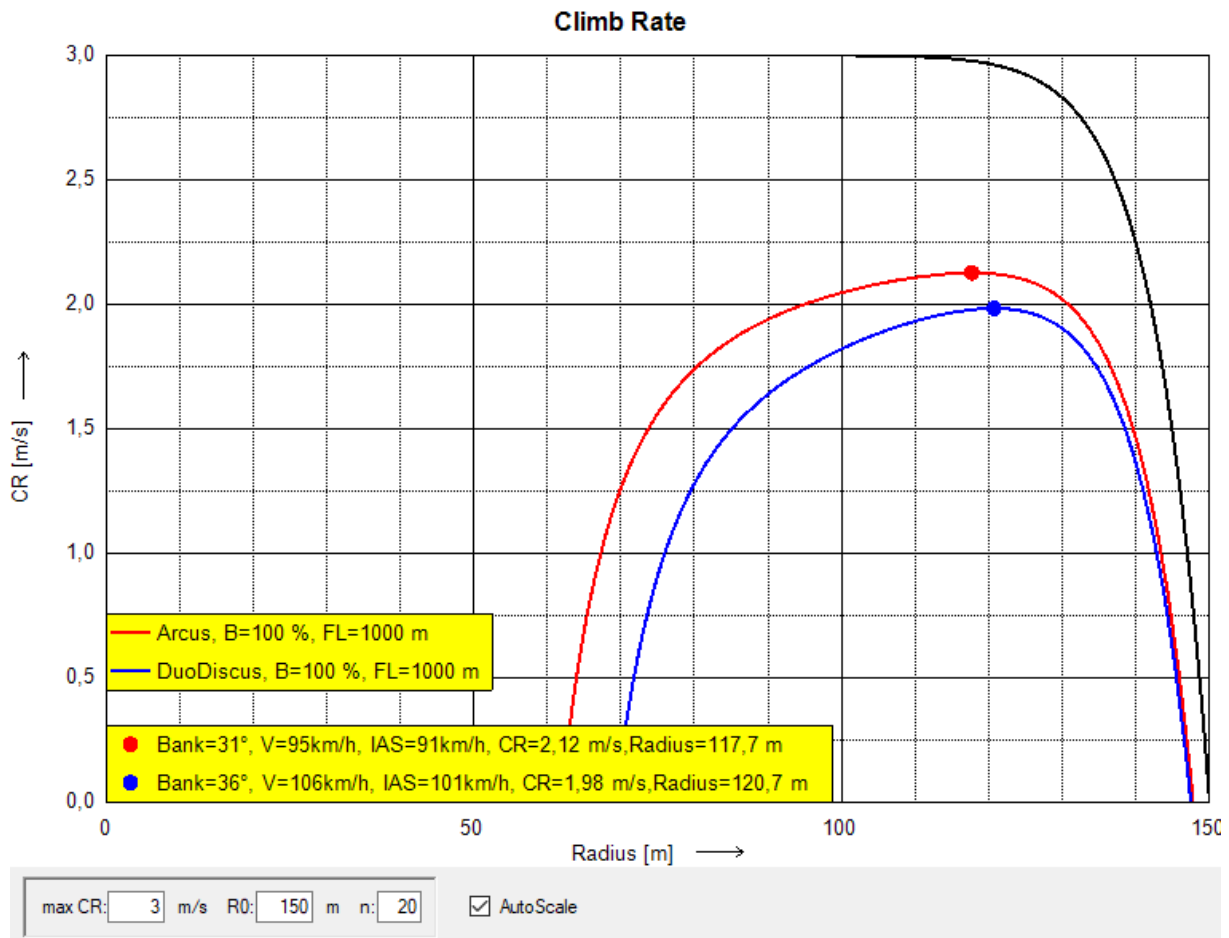
Climb Rate

Picture 2: Climb Rate

2. Calculation and Results

The Arcus has a CR of 2.12 m/s, The Duo has a CR of 1.98 m/s. In the yellow boxes you can find the bank, the real speed V, the indicated air speed IAS and the Radius. You should consider, that this values are calculated for optimal conditions which is mostly not the case in real flight. For further calculations we use the Flightplanner of GliderDat. Picture 3 shows the results of the DuoDiscus.

Type	Ballast	FL	Distance	Height	Direction	CR	Vmet	MC	V	GN	Tc	TG	Tt	Vavg
				1500										
Leg1			250,00	500	90	1,98	0,00	1,98	182,95	33,68	00:54:01	01:21:59	02:16:00	110,29
Total			250,00										02:16:00	110,29

Picture 3: Results DuoDiscus

The distance is 250 km. Start height 1500 m, finish height 500 m, flight direction 90 °, climb rate 1.98 m/s (like calculated before). Vmet (sinking or climbing air between lifts) is 0 m/s, McCready value is 1.98 m/s, V (TAS in 1000m) is 183 km/h, Gliding number (GN) is 32,68. The plane circled 54:01 (Tc) and glided 1:21:59. So total time Tt is 2:16:00. The average speed Vavg) is 110.29 km/h. In Picture 4 you see the results for the Arcus.

Type	Ballast	FL	Distance	Height	Direction	CR	Vmet	MC	V	GN	Tc	TG	Tt	Vavg
				1500										
Leg1			250,00	500	90	2,12	0,00	2,12	185,21	37,25	00:44:48	01:20:59	02:05:47	119,25
Total			250,00										02:05:47	119,25

Picture 4: Results Arcus

The Arcus has a climb rate of 2.12 m/s. His GN is 37.35 against 33. 68 for the Duo. Therefore the speed of the Arcus is with 119.25 km/h much bigger than the speed of the Duo. But you have to consider the index too.
- Index Arcus = 120 (used by Condor)
- Index DuoDiscus = 113 (used by Condor)
If you correct the speeds to an Index of 100 you get:

Arcus: **99.38 km/h**
DuoDiscus: **97.60 km/h**

We will change the maxCR parameter to 2 and 4. The table shows the results.

Plane	maxCR	CR	Vavg	Vindex
Arcus	2 m/s	1.19 m/s	93.04 km/h	77.53 km/h
DuoDiscus	2 m/s	1.00 m/s	82.00 km/h	72.57 km/h
Arcus	3 m/s	2.12 m/s	119.25 km/h	99.38 km/h
DuoDiscus	3 m/s	1.98 m/s	110.29 km/h	97.60 km/h
Arcus	4 m/s	3.12 m/s	135.79 km/h	113.16 km/h
DuoDiscus	4 m/s	2.97 m/s	128.04 km/h	113.31 km/h

Vindex is the handicapped speed (index=100). You get it by dividing Vavg by 100/index. As you can see, the advantage of the Arcus becomes smaller, if the climb rate increases. At maxCR=4 m/s the performance of both planes are equal, if you consider the index. But these calculations do not take into account the pilot factor.

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