UoP Racing Team



UoP4e-2014

|  |  |
| --- | --- |
| **PARAMETERS :** | **Downforce and Drag** |
| **SECTION :** | **Aerodynamics** |

[Design Targets 2](#_Toc362361234)

[ Purpose/Description 3](#_Toc362361235)

[ Proposed solution 3](#_Toc362361236)

[ Adhesive selection 3](#_Toc362361237)

[ Calculations 3](#_Toc362361238)

[ Dimensioning 5](#_Toc362361239)

[ Bonding process 5](#_Toc362361240)

[ Testing 7](#_Toc362361241)

# Design Targets

## Purpose/Description

After the team decided to develop an aero pack for the UoP4e for better performance we had to make some pre-estimations of the desired downforce, drag and weight of the aero. After reading papers and running some rough calculations we cocluded to the best Downforce to drag ratio, frontal area and weight we could achieve. The only parameters we need now to calculate, are:

* **Downforce**
* **Drag**

## Optimum Lap simulation results

**ENDURANCE:**

**Endurance race altering downforce coefficient (compared to model with**

**CL: 2.57/CD:1.33 @ 75.27s lap )**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Downforce Coeff. | Drag Coeff. | Laptime gain (s) | CL scaling % | Laptime gain % |
| 1,8 | 0,8 | -0,99 | 70,04 | -1,32 |
| 1,92 | 0,9 | -0,84 | 74,71 | -1,12 |
| 2,04 | 1 | -0,69 | 79,38 | -0,92 |
| 2,16 | 1,1 | -0,55 | 84,05 | -0,73 |
| 2,28 | 1,2 | -0,41 | 88,72 | -0,54 |
| 2,4 | 1,3 | -0,27 | 93,39 | -0,36 |
| 2,52 | 1,4 | -0,14 | 98,05 | -0,19 |
| 2,64 | 1,5 | -0,01 | 102,72 | -0,01 |
| 2,76 | 1,6 | 0,11 | 107,39 | 0,15 |
| 2,88 | 1,7 | 0,23 | 112,06 | 0,31 |
| 3 | 1,8 | 0,35 | 116,73 | 0,46 |

**Endurance race altering downforce coefficient (compared to NoAero model**

**with 79.68s lap )**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Downforce Coeff. | Drag Coeff. | Laptime gain (s) | CL scaling % | Laptime gain % |
| 1,8 | 0,8 | 3,42 | 70,04 | 4,29 |
| 1,92 | 0,9 | 3,57 | 74,71 | 4,48 |
| 2,04 | 1 | 3,72 | 79,38 | 4,67 |
| 2,16 | 1,1 | 3,86 | 84,05 | 4,84 |
| 2,28 | 1,2 | 4 | 88,72 | 5,02 |
| 2,4 | 1,3 | 4,14 | 93,39 | 5,20 |
| 2,52 | 1,4 | 4,27 | 98,05 | 5,36 |
| 2,64 | 1,5 | 4,4 | 102,72 | 5,52 |
| 2,76 | 1,6 | 4,52 | 107,39 | 5,67 |
| 2,88 | 1,7 | 4,64 | 112,06 | 5,82 |
| 3 | 1,8 | 4,76 | 116,73 | 5,97 |

**SKIDPAD:**

**Skidpad race altering downforce coefficient (compared to model with**

**CL: 2.57/CD:1.33 @ 6.98s lap)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Downforce Coeff. | Drag Coeff. | Laptime gain (s) | CL scaling % | Laptime gain % |
| 1,8 | 0,8 | -0,1 | 70,04 | -1,38 |
| 1,92 | 0,9 | -0,09 | 74,71 | -1,24 |
| 2,04 | 1 | -0,07 | 79,38 | -0,97 |
| 2,16 | 1,1 | -0,05 | 84,05 | -0,69 |
| 2,28 | 1,2 | -0,04 | 88,72 | -0,55 |
| 2,4 | 1,3 | -0,02 | 93,39 | -0,28 |
| 2,52 | 1,4 | -0,01 | 98,05 | -0,14 |
| 2,64 | 1,5 | 0,01 | 102,72 | 0,14 |
| 2,76 | 1,6 | 0,02 | 107,39 | 0,28 |
| 2,88 | 1,7 | 0,04 | 112,06 | 0,55 |
| 3 | 1,8 | 0,06 | 116,73 | 0,83 |

**Skidpad race altering downforce coefficient (compared to NoAero model**

**with 7.57s lap)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Downforce Coeff. | Drag Coeff. | Laptime gain (s) | CL scaling % | Laptime gain % |
| 1,8 | 0,8 | 0,47 | 70,04 | 6,21 |
| 1,92 | 0,9 | 0,49 | 74,71 | 6,47 |
| 2,04 | 1 | 0,5 | 79,38 | 6,61 |
| 2,16 | 1,1 | 0,52 | 84,05 | 6,87 |
| 2,28 | 1,2 | 0,54 | 88,72 | 7,13 |
| 2,4 | 1,3 | 0,56 | 93,39 | 7,40 |
| 2,52 | 1,4 | 0,58 | 98,05 | 7,66 |
| 2,64 | 1,5 | 0,6 | 102,72 | 7,93 |
| 2,76 | 1,6 | 0,62 | 107,39 | 8,19 |
| 2,88 | 1,7 | 0,64 | 112,06 | 8,45 |
| 3 | 1,8 | 0,65 | 116,73 | 8,59 |

**ACCELERATION:**

**Acceleration race altering downforce coefficient (compared to NoAero model**

**with 4.39s lap)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Downforce Coeff. | Drag Coeff. | Laptime gain (s) | CL scaling % | Laptime gain % |
| 1,8 | 0,8 | 0,1 | 70,04 | 2,28 |
| 1,92 | 0,9 | 0,1 | 74,71 | 2,28 |
| 2,04 | 1 | 0,09 | 79,38 | 2,05 |
| 2,16 | 1,1 | 0,09 | 84,05 | 2,05 |
| 2,28 | 1,2 | 0,08 | 88,72 | 1,82 |
| 2,4 | 1,3 | 0,07 | 93,39 | 1,59 |
| 2,52 | 1,4 | 0,07 | 98,05 | 1,59 |
| 2,64 | 1,5 | 0,06 | 102,72 | 1,37 |
| 2,76 | 1,6 | 0,05 | 107,39 | 1,14 |
| 2,88 | 1,7 | 0,05 | 112,06 | 1,14 |
| 3 | 1,8 | 0,04 | 116,73 | 0,91 |

**Note:** Basic model is the Aero with frontal area 1.15m²

**Software:**

OptimumLap V1.3.4 : <http://www.optimumg.com/software/optimumlap/>