

7. Analysis

7.1 Introduction

The analysis of what is in place is a crucial step in the design process of a product whatever it is.

This analysis is essential:

- To have a precise idea of the current state of the art
- To determine a scale of sizes for the dimensions, performances, weight and aerodynamic quality criteria.
- To finish off the definition of the characteristics or specifications of the new aircraft
- To better compare the new product against the competitors and thanks to that, to make the most of its qualities.




While conceiving a new aircraft, we advise you to analyze at least **ten** similar aircrafts to have a precise idea of the quality of the competitive products and therefore better compare the new product against the competitors.

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7.3 Analysis

7.3.1 Description

To access the « Analysis » module, **click** on **[Analysis]**, **[Airplanes]** then **[Level 1]** of the toolbar of the main window. You can also access it directly by clicking on  in the vertical toolbar.

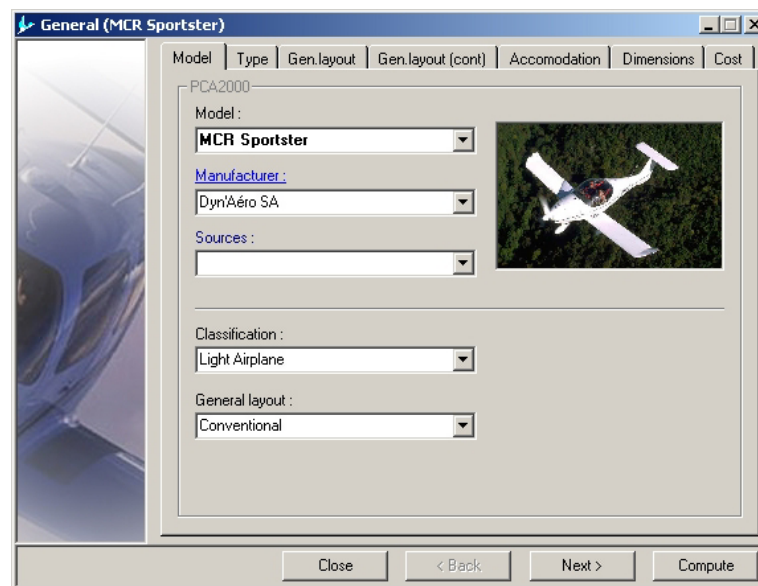



Figure 7.1 : Analysis

If you have chosen to access the « Analysis » module via the control button , you might have to define more precisely the desired analysis level. This can be done via the toolbar in the main window. **Click** on the indicated spot until the number being displayed is 1.



Analysis level

Figure 7.2 : Analysis



Analysis

The thing that will differentiate the various levels of analysis is the number of data that you have in your possession about a given aircraft.

- A **level 1 analysis** will be carried out if you have very little information in your possession, i.e. the type of information that you could find in a commercial folder.
- A **level 2 analysis** will be carried out if you have in your possession an article to present the given aircraft taken out from a specialized magazine.
- A **level 3 analysis** will be carried out if you have in your possession results from a flight testing carried out on the given aircraft.

The acquisition of input data is done via 11 specific windows:

1. Generalities
2. Wing
3. Horizontal tail
4. Vertical tail
5. Fuselage
6. Landing gear
7. Engine
8. Propeller
9. Systems
10. Performances
11. Weights

Each window contains a certain number of fields that the user has to fill in order to be able to carry out the design. The **gray fields** are inaccessible and reserved for a different level than the one in progress.

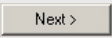
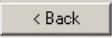


You can press on the **F1** key at any time to reach the contextual help.



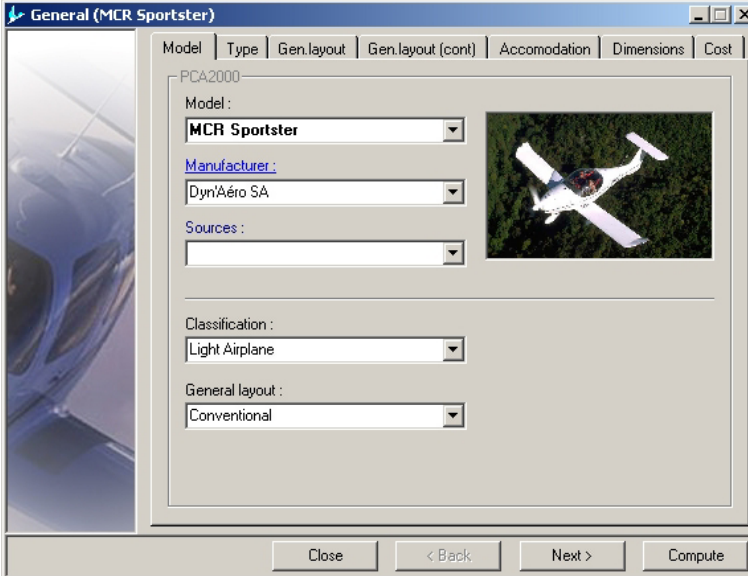
To navigate within the controls of a window, use the **tab key**.



To navigate within the windows, use the keys  or  or the menu of the vertical toolbar.

7.3.2 Input data

7.3.2.1 Generalities



General (MCR Sportster)

Model | Type | Gen.layout | Gen.layout (cont) | Accomodation | Dimensions | Cost

PCA2000

Model : **MCR Sportster**

Manufacturer : **Dyn'Aéro SA**

Sources :

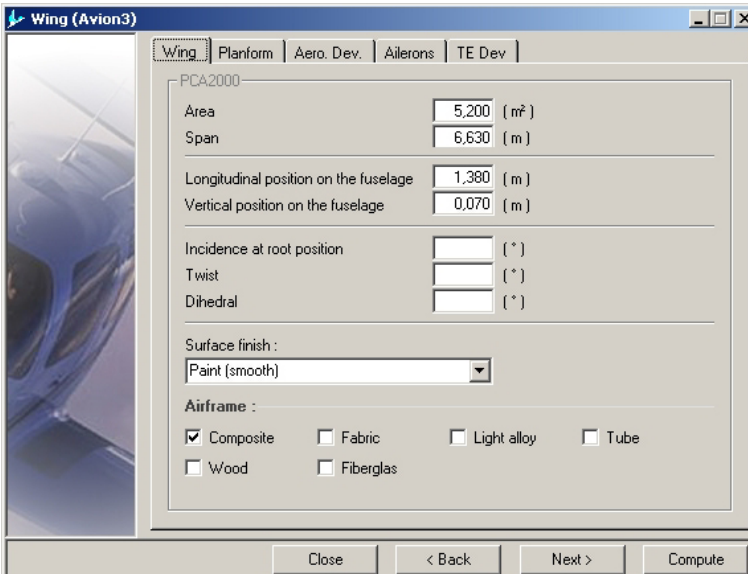
Classification : **Light Airplane**

General layout : **Conventional**

Close < Back Next > Compute

Figure 7.3 : Analysis (General)

7.3.2.2 Wing



Wing (Avion3)

Wing | Planform | Aero. Dev. | Ailerons | TE Dev

PCA2000

Area : **5,200** (m²)

Span : **6,630** (m)

Longitudinal position on the fuselage : **1,360** (m)

Vertical position on the fuselage : **0,070** (m)

Incidence at root position : (°)

Twist : (°)

Dihedral : (°)

Surface finish : **Paint (smooth)**

Airframe :

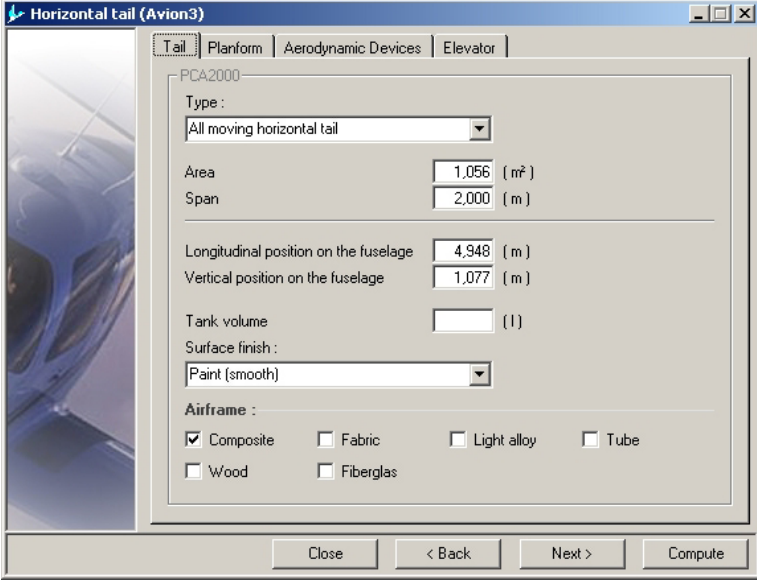
☒ Composite ☐ Fabric ☐ Light alloy ☐ Tube

☐ Wood ☐ Fibreglas

Close < Back Next > Compute

Figure 7.4 : Analysis (Wing)

7.3.2.3 Horizontal tail



Horizontal tail (Avion3)

Tail | Planform | Aerodynamic Devices | Elevator

PCA2000

Type :
All moving horizontal tail

Area : 1,056 (m²)
Span : 2,000 (m)

Longitudinal position on the fuselage : 4,948 (m)
Vertical position on the fuselage : 1,077 (m)

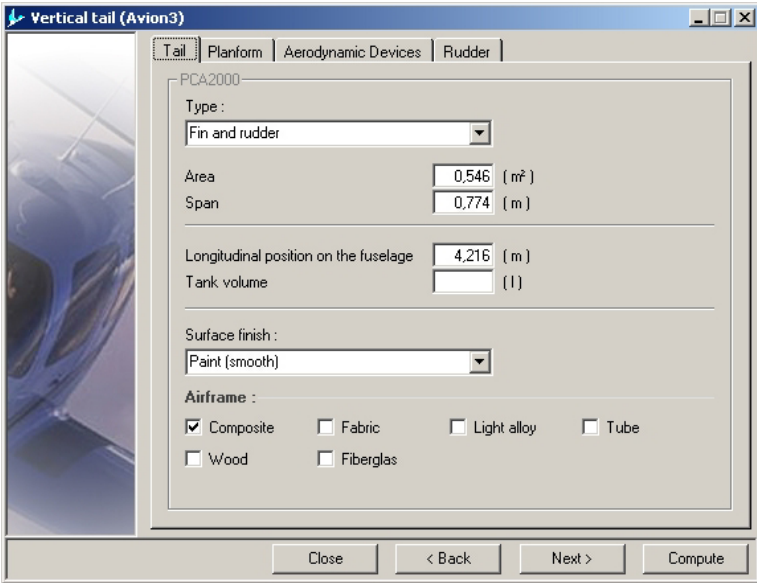
Tank volume :
Surface finish :
Paint (smooth)

Airframe :
☒ Composite ☐ Fabric ☐ Light alloy ☐ Tube
☐ Wood ☐ Fiberglas

Close < Back Next > Compute

Figure 7.5 : Analysis (Horizontal tail)

7.3.2.4 Vertical tail



Vertical tail (Avion3)

Tail | Planform | Aerodynamic Devices | Rudder

PCA2000

Type :
Fin and rudder

Area : 0,546 (m²)
Span : 0,774 (m)

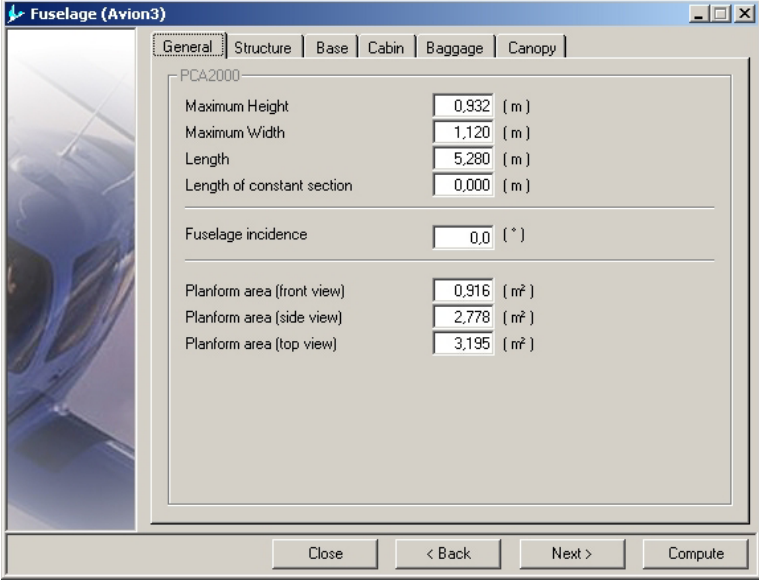
Longitudinal position on the fuselage : 4,216 (m)
Tank volume :
Surface finish :
Paint (smooth)

Airframe :
☒ Composite ☐ Fabric ☐ Light alloy ☐ Tube
☐ Wood ☐ Fiberglas

Close < Back Next > Compute

Figure 7.6 : Analysis (Vertical tail)

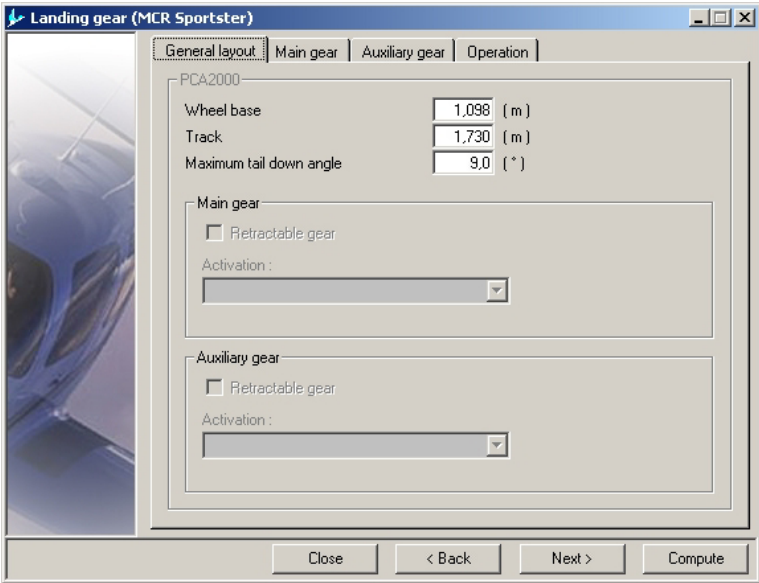
7.3.2.5 Fuselage



Parameter	Value	Unit
Maximum Height	0.932	(m)
Maximum Width	1.120	(m)
Length	5.280	(m)
Length of constant section	0.000	(m)
Fuselage incidence	0.0	(°)
Planform area (front view)	0.916	(m²)
Planform area (side view)	2.778	(m²)
Planform area (top view)	3.195	(m²)

Figure 7.7 : Analysis (Fuselage)

7.3.2.6 Landing gear



Parameter	Value	Unit
Wheel base	1.098	(m)
Track	1.730	(m)
Maximum tail down angle	9.0	(°)

Main gear

☐ Retractable gear

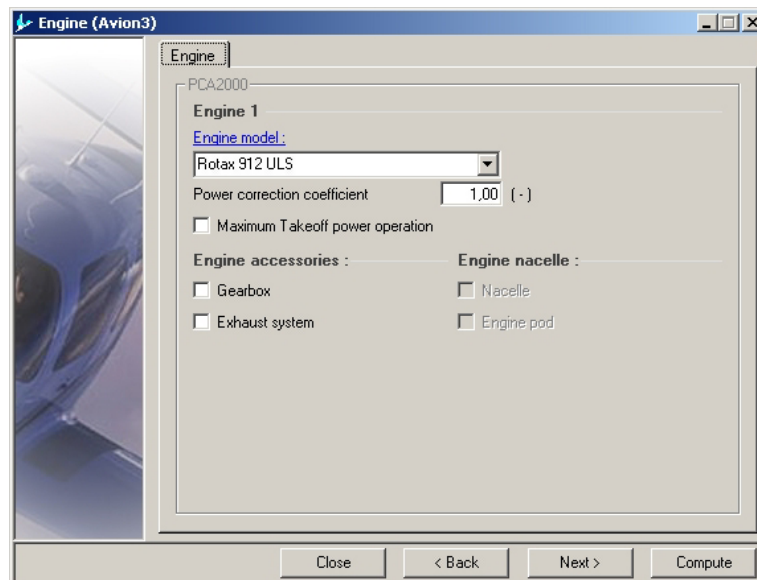
Activation : ▼

Auxiliary gear

☐ Retractable gear

Activation : ▼

Figure 7.8 : Analysis (Landing gear)

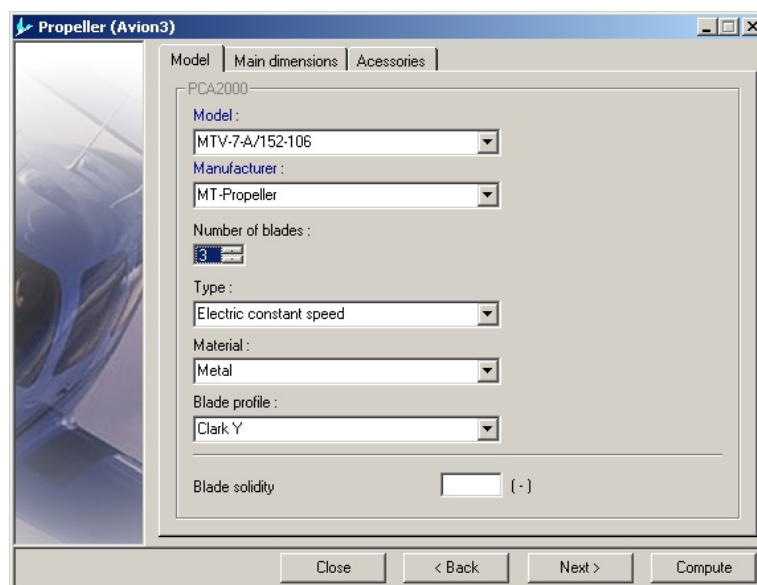
7.3.2.7 Engine

The 'Engine (Avion3)' dialog box is shown. It has a title bar with a blue icon and the text 'Engine (Avion3)'. The main area is titled 'Engine' and contains the following fields and options:

- Engine 1**
- Engine model :** A dropdown menu showing 'Rotax 912 ULS'.
- Power correction coefficient**: A text box with '1.00' and a unit indicator '(-)'.
- ☐ Maximum Takeoff power operation
- Engine accessories :**
 - ☐ Gearbox
 - ☐ Exhaust system
- Engine nacelle :**
 - ☐ Nacelle
 - ☐ Engine pod

At the bottom, there are four buttons: 'Close', '< Back', 'Next >', and 'Compute'.

Figure 7.9 : Analysis (Engine)

7.3.2.8 Propeller

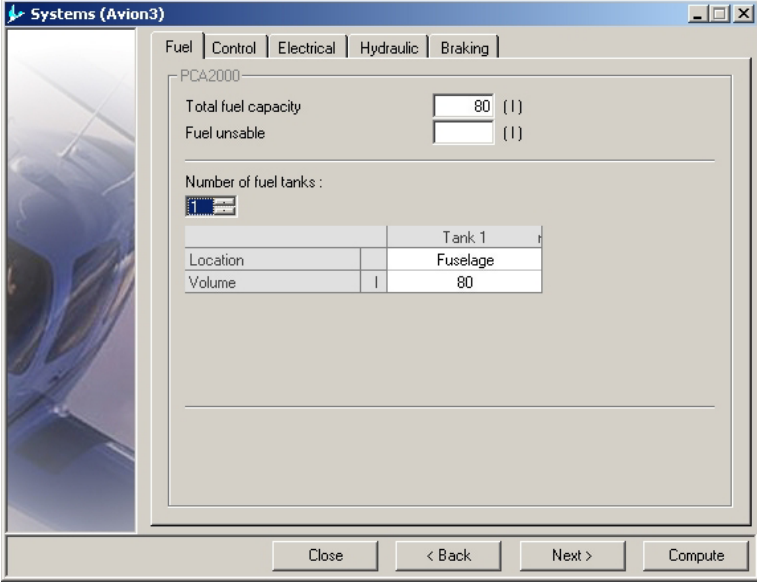
The 'Propeller (Avion3)' dialog box is shown. It has a title bar with a blue icon and the text 'Propeller (Avion3)'. The main area is titled 'Propeller' and contains the following fields and options:

- Model :** A dropdown menu showing 'MTV-7-A/152-106'.
- Manufacturer :** A dropdown menu showing 'MT-Propeller'.
- Number of blades :** A spin box showing '3'.
- Type :** A dropdown menu showing 'Electric constant speed'.
- Material :** A dropdown menu showing 'Metal'.
- Blade profile :** A dropdown menu showing 'Clark Y'.
- Blade solidity**: A text box with a unit indicator '(-)'.

At the bottom, there are four buttons: 'Close', '< Back', 'Next >', and 'Compute'.

Figure 7.10 : Analysis (Propeller)

7.3.2.9 Systems



The screenshot shows a software window titled "Systems (Avion3)" with a sidebar image of an aircraft and a main configuration area. The main area has tabs for "Fuel", "Control", "Electrical", "Hydraulic", and "Braking", with "Fuel" selected. The configuration is for "PCA2000".

Configuration fields:

- Total fuel capacity: (l)
- Fuel unusable: (l)

Number of fuel tanks :

Tank 1	
Location	Fuselage
Volume	80

At the bottom of the window are buttons: "Close", "< Back", "Next >", and "Compute".

Figure 7.11 : Analysis (Systems)

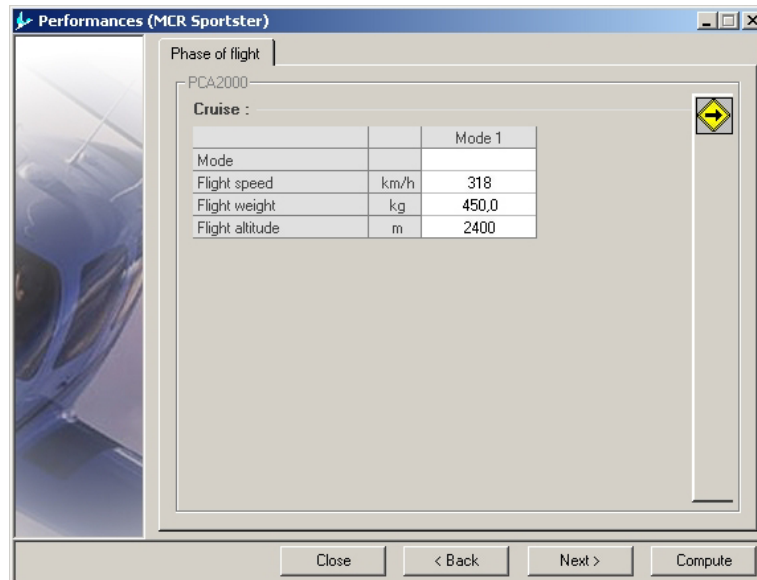
7.3.2.10 Performances

Figure 7.12 : Analysis (Performances)

The performances are given for various flight phases. To access the specific acquisition grids for a given flight phase:

1. **Move** the mouse pointer on the drawer to open it
2. **Select** the desired flight phase.

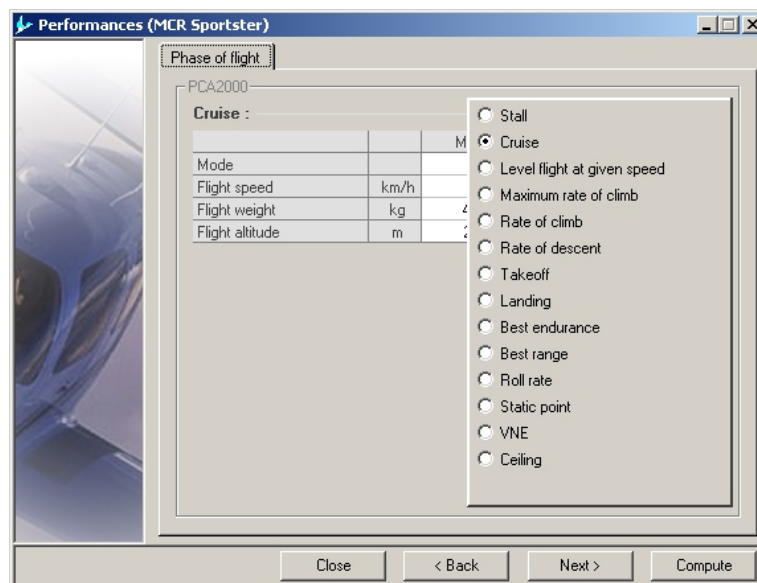
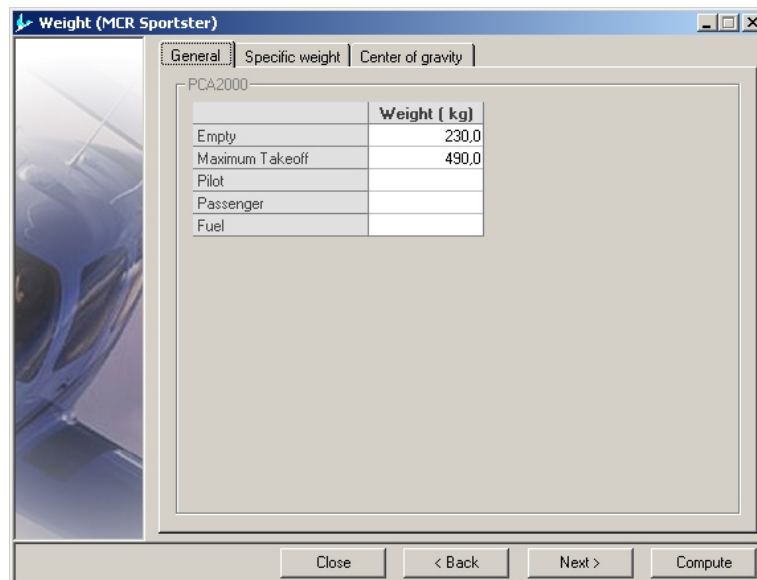


Figure 7.13 : Analysis (Performances)

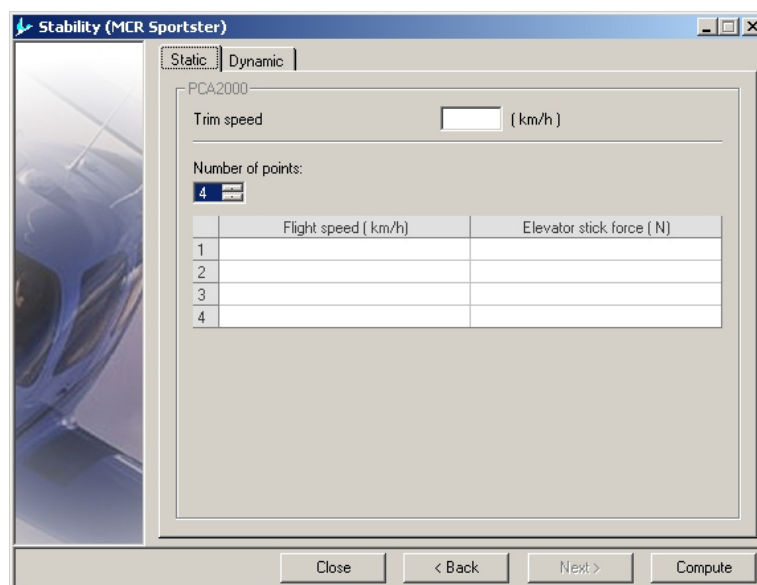
7.3.2.11 Weights

The dialog box titled "Weight (MCR Sportster)" has three tabs: "General", "Specific weight", and "Center of gravity". The "General" tab is selected. It contains a table with the following data:

	Weight (kg)
Empty	230.0
Maximum Takeoff	490.0
Pilot	
Passenger	
Fuel	

At the bottom of the dialog box are four buttons: "Close", "< Back", "Next >", and "Compute".

Figure 7.14 : Analysis (Weights)


7.3.2.12 Stability

The dialog box titled "Stability (MCR Sportster)" has two tabs: "Static" and "Dynamic". The "Static" tab is selected. It contains a text input field for "Trim speed" with the unit "{ km/h }". Below this is a section labeled "Number of points:" with a dropdown menu set to "4". At the bottom of the dialog box are four buttons: "Close", "< Back", "Next >", and "Compute".

	Flight speed (km/h)	Elevator stick force (N)
1		
2		
3		
4		

Figure 7.15 : Analysis (Stability)

7.3.3 Calculations

In order to make the calculations, click on  that appears in each data acquisition window.



In order to obtain more detailed information concerning the algorithms used during the design process, we invite you to look at the various technical notes available on the PCA2000 website.

7.3.4 Results

7.3.4.1 Introduction

Once the calculations are made, the results window is displayed automatically.

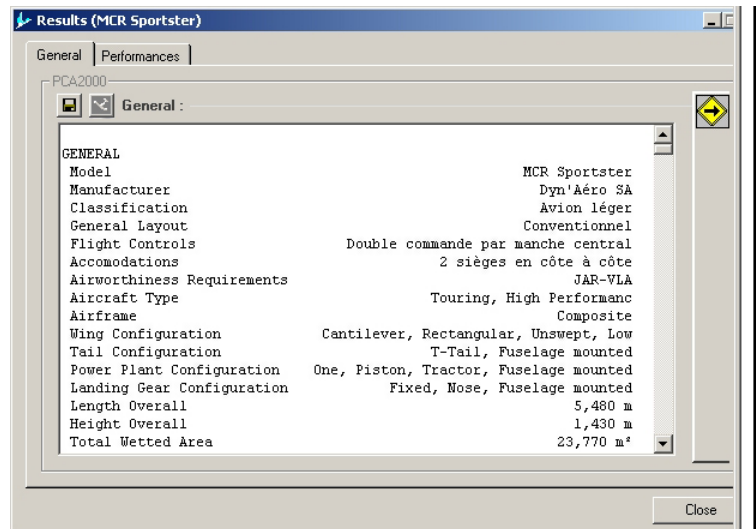


Figure 7.16 : Analysis (Generalities)



The first part contains all the information except for those related to the performances. The second part contains only the information related to the performances.

In order to display all the results:

1. **Open** the drawer by moving the mouse pointer on it,
2. **Click** on the option button called Generalities.

All the results are now being displayed on the same sheet.

In order to visualize the results in relation with one particular item:

1. **Open** the drawer
2. **Click** on the corresponding option button.

7.3.4.2 Generalities

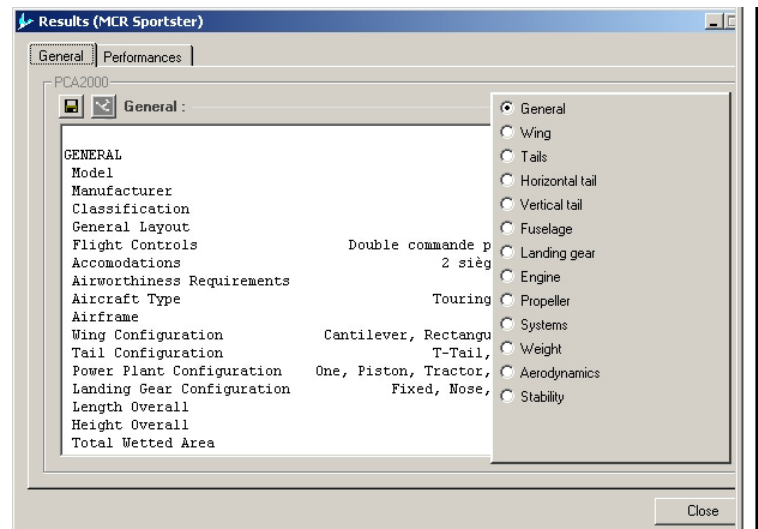


Figure 7.17 : Analysis (Selective display)

In order to display the results in relation with one particular component:

1. **Open** the drawer
2. **Click** on the corresponding option button.

7.3.4.3 Performances

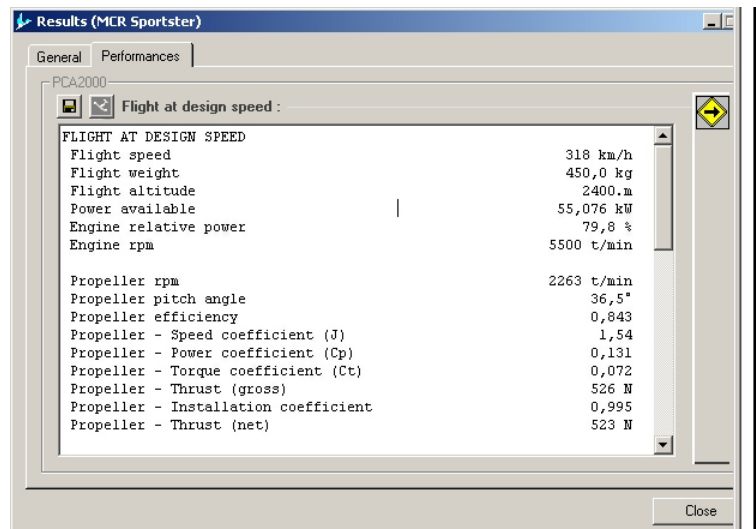


Figure 7.18 : Analysis (Performances)

To display the results in relation with one particular flight phase:

1. **Open** the drawer
2. **Click** on the corresponding option button.

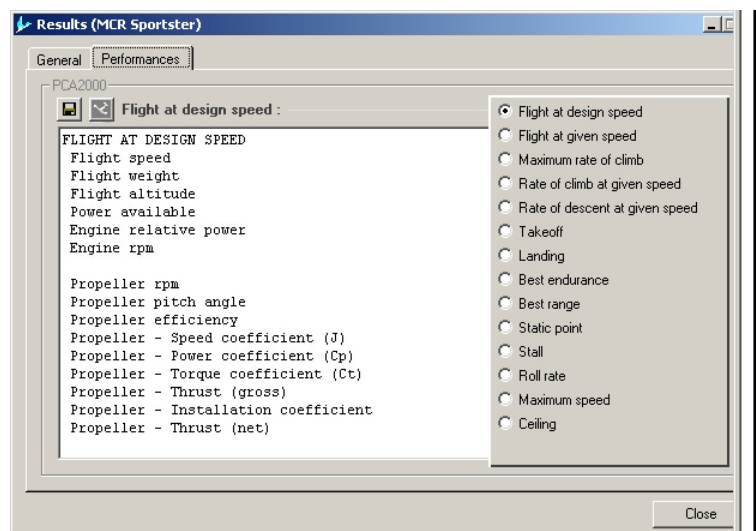




Figure 7.19 : Analysis (Selective display)

7.3.4.4 Print the results


To print the analysis results, **click** on the control button  in the toolbar in the main window.

7.3.4.5 Save the results

To save the analysis results, **click** on the control button  in the toolbar in the main window. A message appears in the comments display area to inform you about the recording status.

7.3.4.6 Save the content of the display area

To save the content of the display area:

1. **Click** on one of the option buttons available in the box
2. **Click** on the control button  located on top of the results display area.

A message appears in the comments display area to inform you about the recording status.



Two results file have been created:

1. The first one is a text file (format .rtf) that you can open with any word processing software.
2. The second one is a text file (format .csv) that you can open with any spreadsheet program such as Excel for example.