

## 12. Digitizer

### 12.1 Introduction

The **Digitizer** module is a tool that has been developed to:

1. Use quickly and efficiently all the information contained in a **3 views drawing**.
  - To measure distances
  - To measure distance ratios
  - To measure angles
  - To measure surfaces
2. Digitize quickly a **curve** that will have been scanned previously such as the polar of a glider for example.

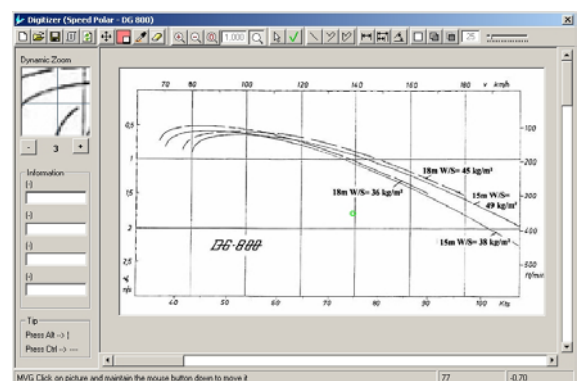
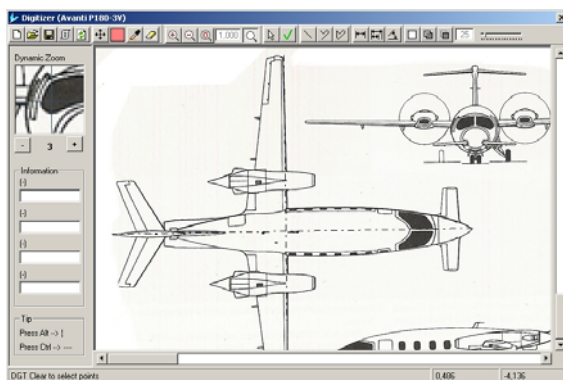


Table 1 : Use a 3 views drawing or Digitalize a curve

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## 12.3 Description

To access the **Digitizer** module, click on **[Tools]** then **[Digitizer]** in the menu bar in the main window.

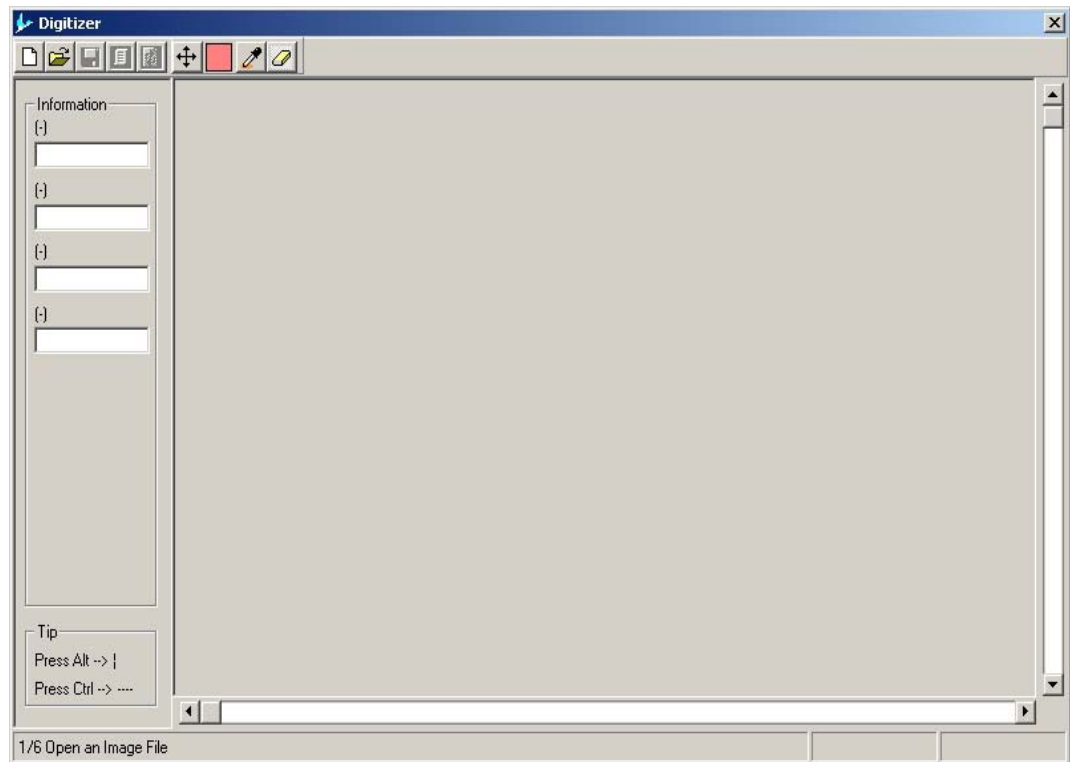


Figure 12.1 : Window Digitizer

The **Digitizer** appears with a toolbar, displayed entirely or partially, that proposes a certain number of functions to operate images, change the display, draw lines and polygons, digitalize a curve and take dimensions on a 3 views plan.

	New image file (.bmp or .jpg) or referenced (.cxy)
	Open an image file (.bmp or .jpg) or referenced (.cxy)
	Save an image file (.bmp ou .jpg) or referenced (.cxy)
	Georeference an image
	Refresh the display
	Move an image
	Determine the filling color
	Select a color on the screen
	To erase lines
	Increase the image size
	Decrease the image size
	Restore the original size of the image
	Activate the dynamic loupe
	Select points on the image
	Check the selection
	Draw a line
	Draw a polyline
	Draw a polygon
	Measure a distance
	Measure a distance ratio
	Measure an angle
	Measure an area
	Add a surface to the current selection
	Withdraw a surface to the current selection
	Determine the tolerance of the selection or the size of the eraser (according to the context)

## 12.4 To load an image

To display an image on the **Digitizer**, you have to load an image file. In order to do that:

1. **Click** on the control button  or on **[File]** then **[Open]** in the menu bar in the main window.

The dialogue box **Open** appears on the screen.

2. **Select** the type of image file (.bmp or .jpg).
3. **Select** the image file

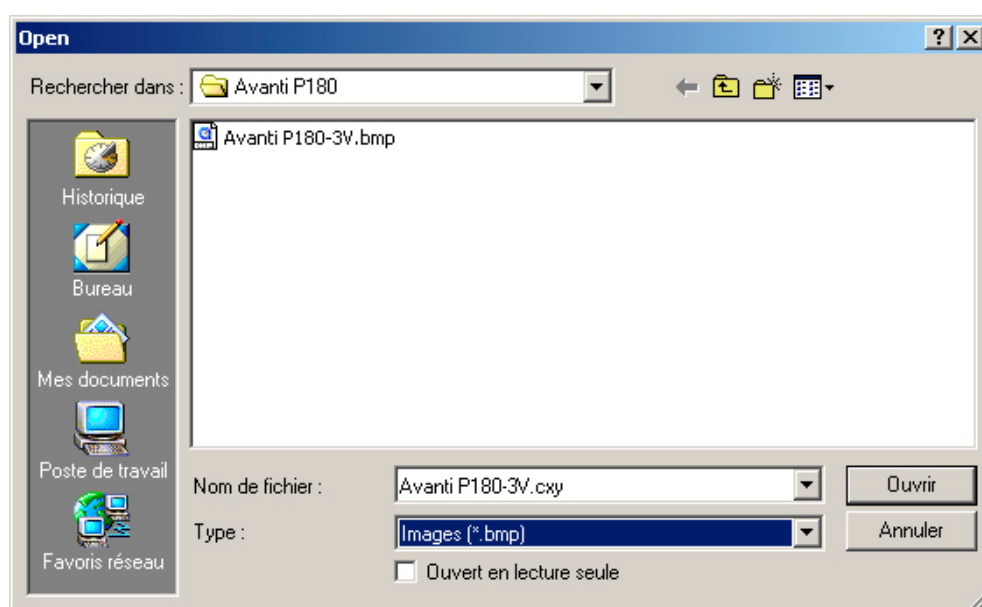


Figure 12.2 Open an image file

When the image is displayed, the next step consists in **georeferencing**.



### **Definition: To georeference – Georeferencing**

To georeference an image consists in giving it dimensions.

## 12.5 To georeference an image

### 12.5.1 Introduction

Once the image is displayed on the **Digitizer**, you have to georeference it in order to be able to use the information it contains.

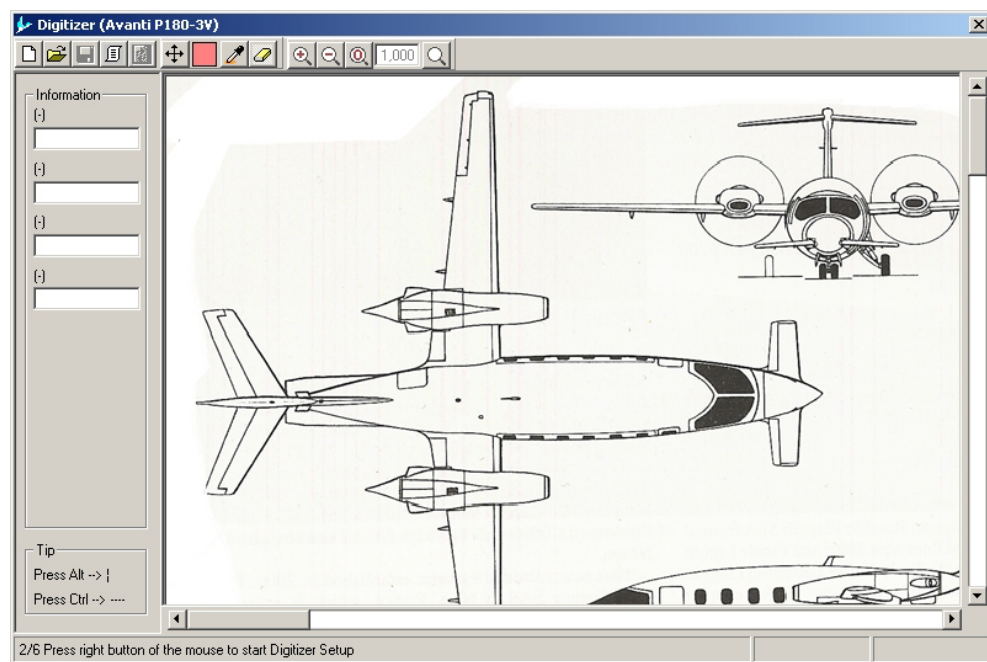


Figure 12.3 Image displayed on the Digitizer

The georeferencing is done in 5 steps:

- Step 1/5: To determine the image attributes.
- Step 2/5: To localize the first reference point on the X axis.
- Step 3/5: To localize the second reference point on the X axis.
- Step 4/5: To localize the first reference point on the Y axis.
- Step 5/5: To localize the second reference point on the Y axis.




It is not unusual to take the horizontal axis as **X** axis as well as the vertical axis as **Y** axis  
The **X** axis can be oblique (bent compared to the horizontal one)  
The **Y** axis can be oblique (bent compared to the vertical one)  
It is possible that the **X** and **Y** axis are not orthogonal



When initializing the image, follow the instructions that appear in the status bar in the **Digitizer** window.

### 12.5.2 Determine the image attributes (1/5)

The attributes of the image are determined in the **Initialization** window. To display the **Initialization** window, click on  in the toolbar in the **Digitizer** window.

The attributes of the image are:

1. On the first tab [Axis]:
  - A minimum value on the X axis,
  - A maximum value on the X axis,
  - The number of decimals to display for a value in X,
  - A minimum value on the Y axis,
  - A maximum value on the Y axis,
  - The number of decimals to display for a value in Y,
2. On the second tab [Landmarks]
  - The size, the color and the shape of the landmarks,
3. On the third tab [Control points]
  - The size, the color, the shape and the number of control points.

The first tab of the **Initialization** window serves to determine the coordinates of the landmarks on the X and Y axis as well as the display accuracy (number of decimals to display).

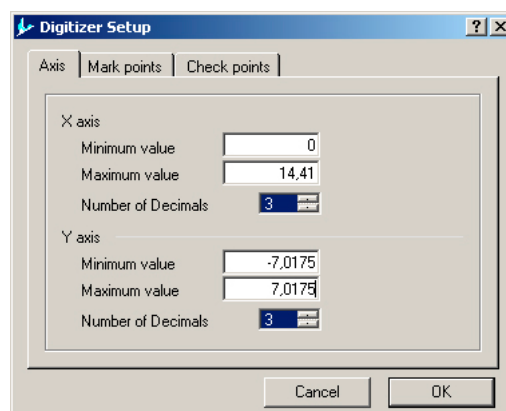


Figure 12.4: Definition of the X and Y axis



The second tab of the **Initialization** window serves to determine the characteristics of the digitalized points (shape, color and size).

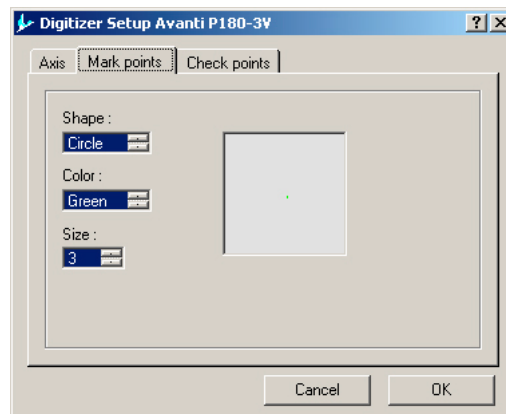


Figure 12.5 : Definition of the landmarks

The third tab of the **Initialization** window serves to determine the characteristics of the control points (shape, color, size, number). Those points will be used to check that the curve that has been digitalized has been digitalized with a sufficient number of points.

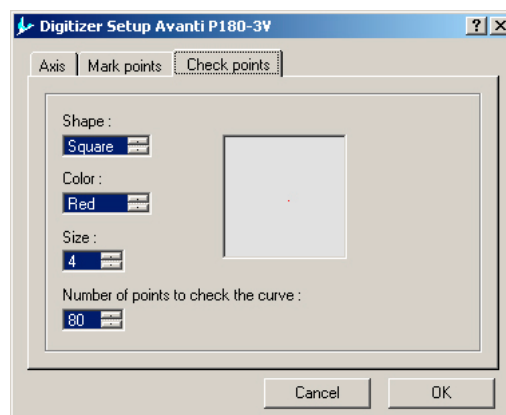
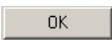


Figure 12.6 : Definition of the control points

Once the various values have been introduced or determined more precisely:

1. Click on  to close the **Initialization** window and come back on the **Digitizer** window in order to start the georeferencing of the image.

### 12.5.3 To localize the first reference point on the X axis (2/5)

The following step consists in finding the first reference point on the **X** axis. In that case, the point  $X=0$  is localized on the extreme fuselage nose (cf. image increased on the dynamic magnifying glass).

1. **Localize** the point on the image thanks to the mouse
2. **Press** the [Return] key to validate your choice

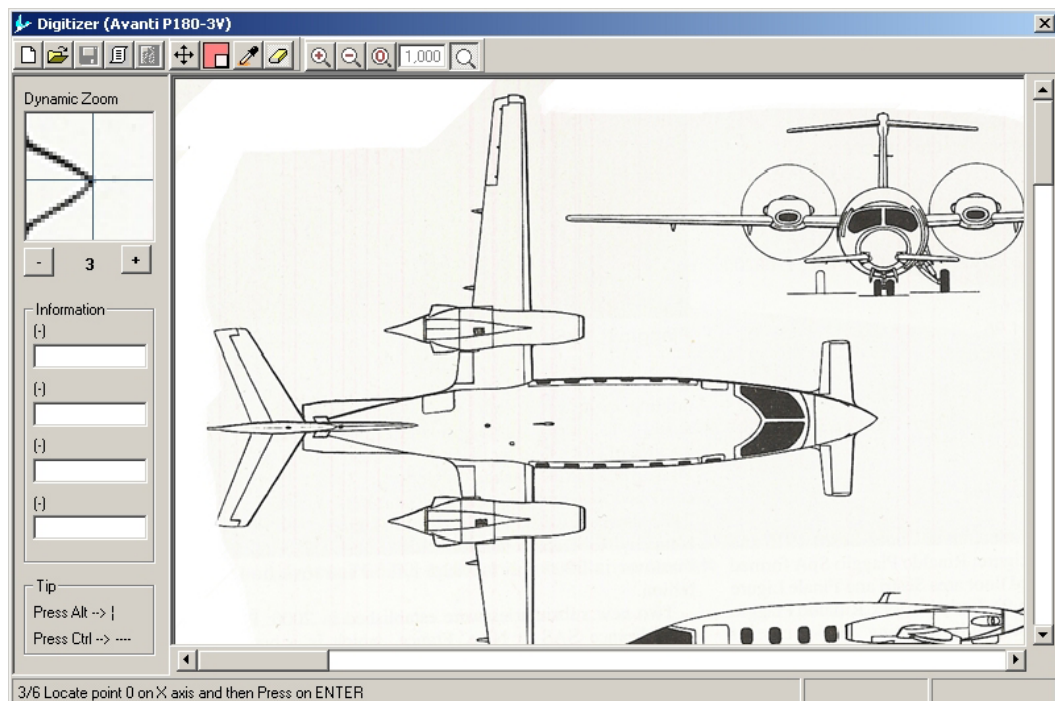


Figure 12.7 : Localize the first reference point on the X axis



Follow the instructions that appear in the status bar of the **Digitizer** window at any time




Use the arrows ← → ↑ ↓ of the keyboard to move precisely the pointer of the mouse.

Once the pointer of the mouse is on the image:

**Ctrl** + ← → ↑ ↓ speeds up the moving of the pointer.

**Shift** + ← → ↑ ↓ allows moving the image without having to move the mouse on the scroll bars.



Use the dynamic magnifying glass  to make it easier to find a point on the screen.

The zoom function can be changed by clicking on the keys + and – placed under the magnifying glass.

In most cases, we advise you to use a zoom factor equal to **3**.

#### 12.5.4 To localize the second reference point on the X axis (3/5)

The following step consists in finding the second reference point on the **X** axis. In that case, the point  $X=14.41$  is localized at the extreme tail cone of the fuselage (cf. image increased on the dynamic magnifying glass).

1. **Localize** the point on the image thanks to the mouse
2. **Press** the [Return] key to validate your choice

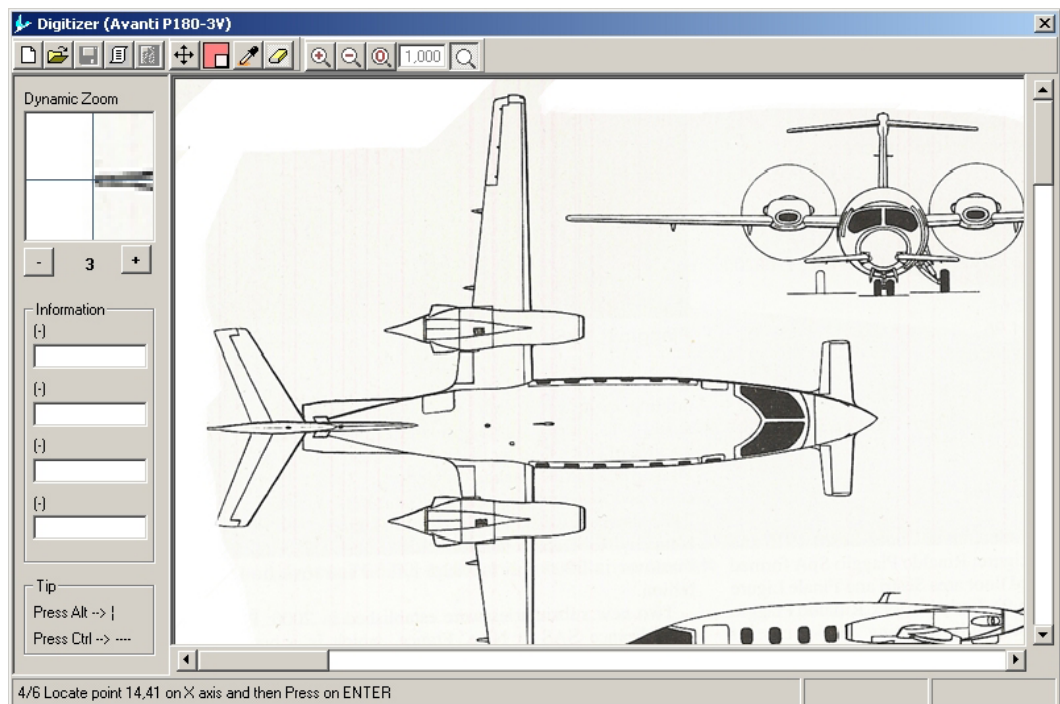


Figure 12.8 : To localize the second reference point on the X axis



Follow the instructions that appear in the status bar of the **Digitizer** window at any time

### 12.5.5 To localize the first reference point on the Y axis (4/5)

The following step consists in finding the first reference point on the **Y** axis. In that case, the point  $Y = -7.0175$  is localized at the tip of the left wing (cf. image increased on the dynamic magnifying glass).

1. **Localize** the point on the image thanks to the mouse
2. **Press** the [Return] key to validate your choice

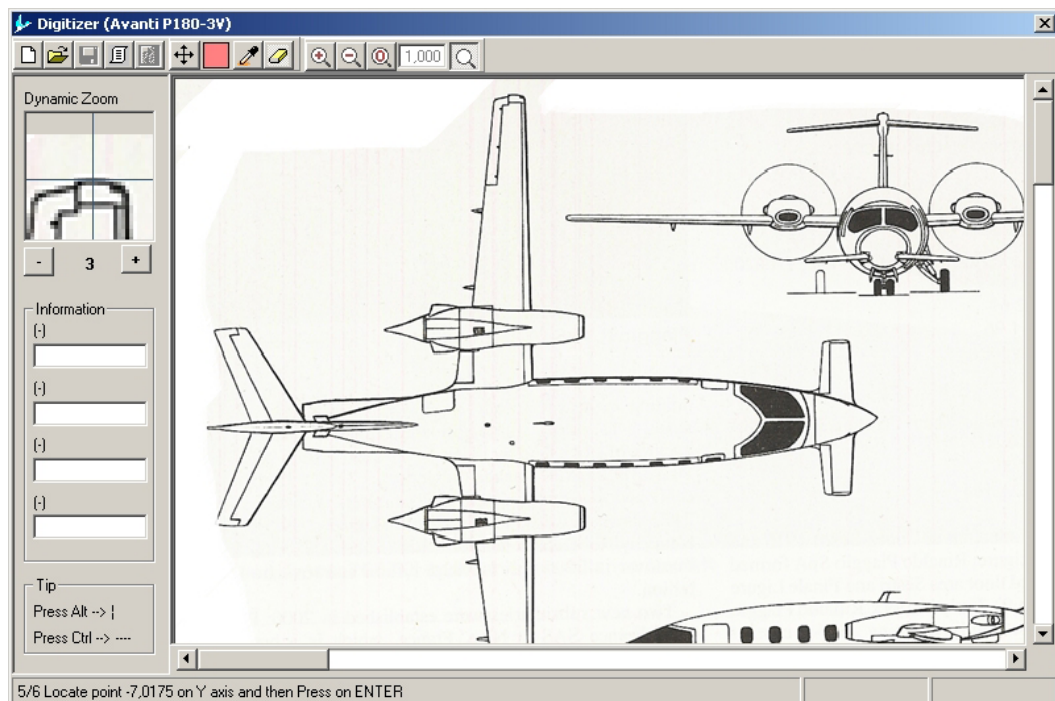


Figure 12.9 : To localize the first reference point on the Y axis



Follow the instructions that appear in the status bar of the **Digitizer** window at any time

### 12.5.6 To localize the second reference point on the Y axis (5/5)

The following step consists in finding the second reference point on the **Y** axis. In that case, the point  $Y = 7.0175$  is localized at the tip of the right wing (cf. image increased on the dynamic magnifying glass)

1. **Localize** the point on the image thanks to the mouse
2. **Press** the [Return] key to validate your choice

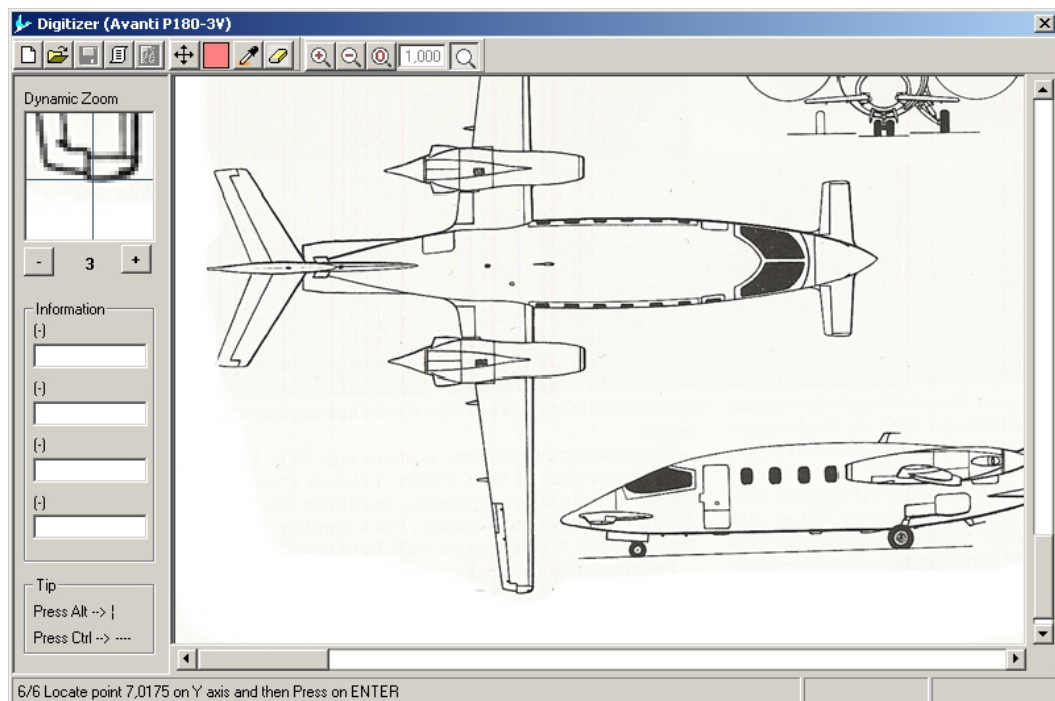


Figure 12.10 : To localize the second reference point on the Y axis



Follow the instructions that appear in the status bar of the **Digitizer** window at any time

## 12.6 To save a georeferenced image

Once the georeferencing of the image is finished, we invite you to save the georeferenced image file.

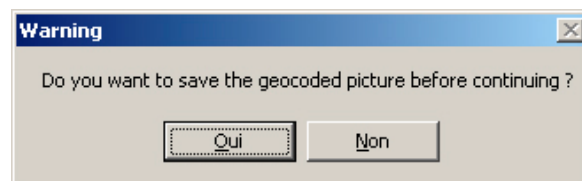

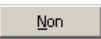



Figure 12.11 : To save the georeferenced image file

- **Click** on the control button  to save the file
- **Click** on the control button  not to save the file

Remark

- a) It is compulsory that the georeferenced image file:
  - Has the same name as the image file,
  - Receives the extension **.cxy**,
  - Is stored in the same folder as the image file.
- b) You can also save the georeferenced image file at any time. In order to do that:
  - **Click** on the control button  in the toolbar in the main window

## 12.7 To open a georeferenced file

To open a georeferenced image file:

1. **Click** on [**File**] in the menu bar in the main window
2. **Click** on [**Open**] in the menu bar in the main window.

The dialogue box **Open** appears on the screen.

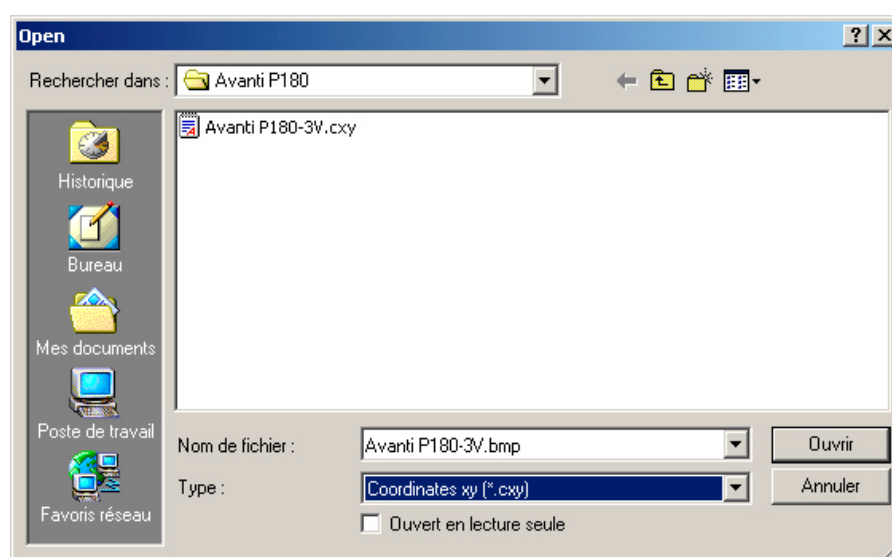



Figure 12.12 : To open a georeferenced image

3. **Select** the georeferenced image file (.cxy) that you wish to work on.

Once you have done the selection

4. **Click** on ,

The **Digitizer** window appears automatically and you can immediately work on the image.



**A compulsory validation**

In order to check the quality of the image as well as the good progress of the georeferencing, we strongly advise you to proceed with the validation of the georeferenced image.

The validation consists in comparing the result of a measure (distance or surface) done on a georeferenced image with known information (wing span or surface in the case of a 3 views plan for example).

**In the case of a 3 views plan:**

The first checking consists in measuring the wing span. In order to do that, we invite you to follow the procedure described under **12.8.2**

The second checking consists in measuring the wing surface. In order to do that, we invite you to follow the procedure described under **12.8.5**. A difference of  $\pm 3\%$  remains acceptable.

**In the case of a graphic:**

The checking consists in placing the cursor on different points of known coordinates (the origin of the graph for example, one or more points on the main axis, ...) and checking that the coordinates sent back by the cursor that are displayed in the upper right corner of the **Digitizer** correspond to each other.

## 12.8 To use the information contained in a 3 views plan

### 12.8.1 Introduction

The **Digitizer** module makes it possible to use an image to extract from it:

- distances,
- distance ratios,
- angle data,
- areas.

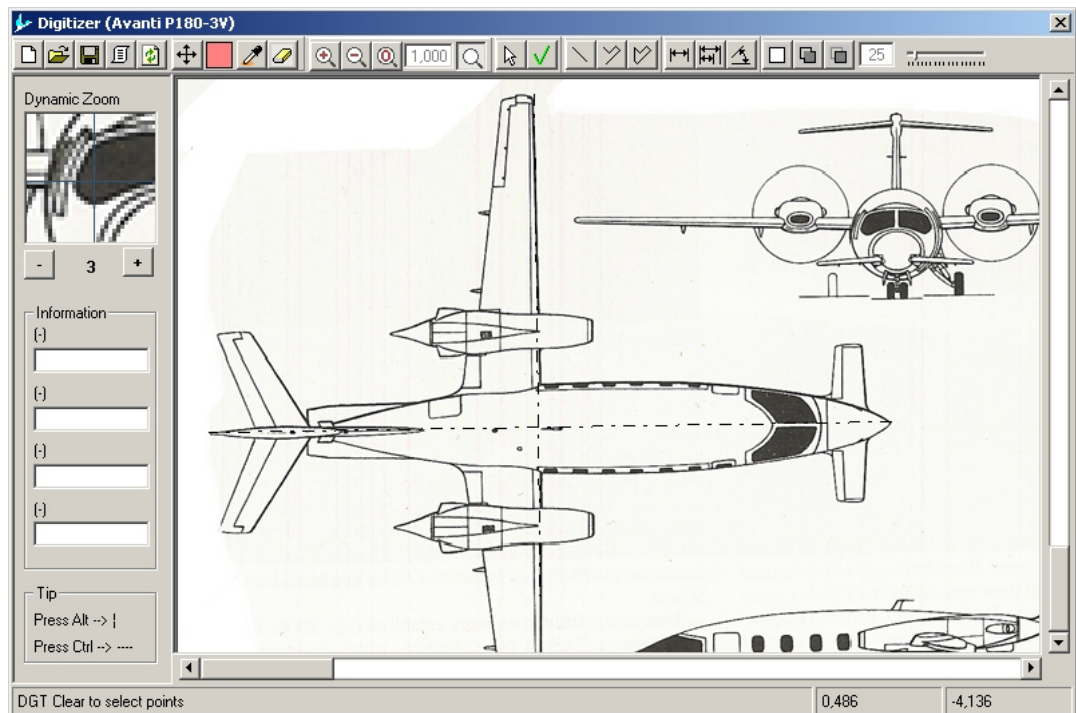



Figure 12.13 : Use of a 3 views plan

Before going on, please remember the following tips:



Follow the instructions that appear in the status bar in the **Digitizer** window at any time



**Activate** the dynamic magnifying glass  to make it easier to find a point on the screen.

The zoom function can be changed by clicking on the keys + and – placed under the magnifying glass. In most cases, we advise you to use a zoom factor equal to **3**.



Use the arrows ← → ↑ ↓ of the keyboard to move precisely the pointer of the mouse.

Once the pointer of the mouse is on the image:

**Ctrl** + ← → ↑ ↓ speeds up the moving of the pointer.

**Shift** + ← → ↑ ↓ allows to move the image without having to move the mouse on the scroll bars.




When the pointer is being moved thanks to the mouse:

+ **Ctrl** entails a perfect **horizontal** move of the pointer.

+ **Alt** entails a perfect **vertical** move of the pointer.

### 12.8.2 To measure a distance

To measure a distance (in this case, the distance between the trailing edge of the tip of the canard surface to the leading edge of the wing tip):

1. Click on  in the toolbar in the **Digitizer** window

Follow then the instructions that appear in the status bar (DST ...).

2. DST 1/2 **Select** the first point
3. DST 2/2 **Select** the second point

Once two points have been selected, the value of the measure is displayed in the area allocated to it on the left of the image.

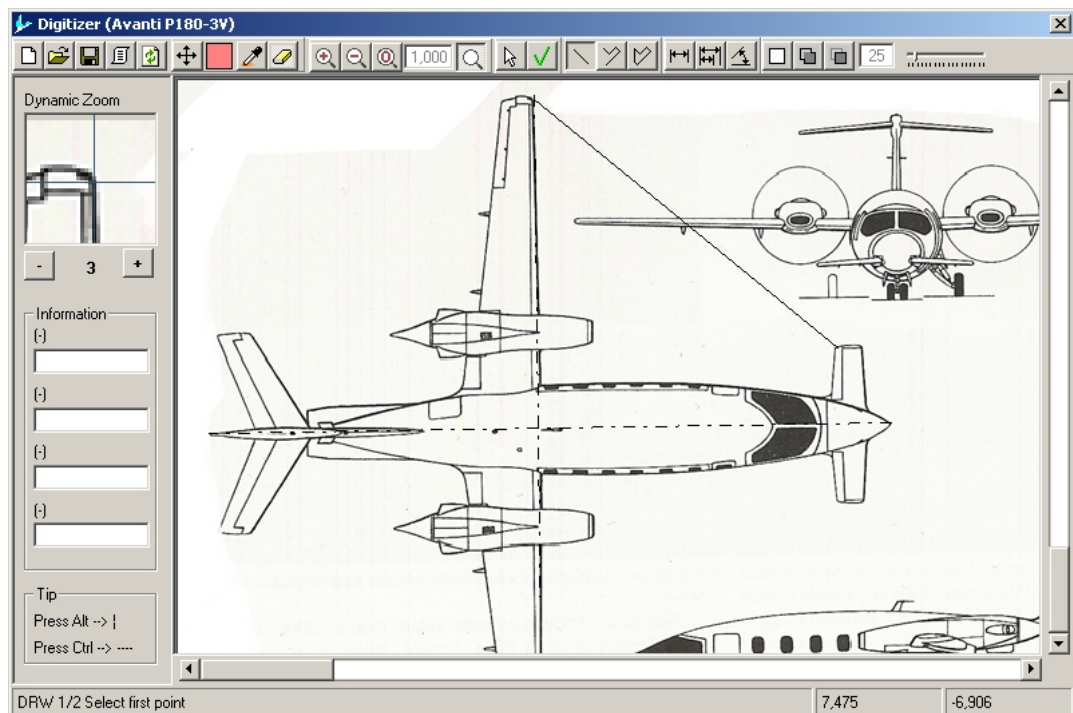



Figure 12.14 : Measure of a distance

### 12.8.3 Calculation of a distance ratio

In order to calculate a distance ratio (in this case, the relative chord of the left aileron):

1. **Click** on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (DSR ...).

2. DSR 1/4 **Select** the first point
3. DSR 2/4 **Select** the second point
4. DSR 3/4 **Select** the third point
5. DSR 4/4 **Select** the fourth point

Once four points have been selected, the value of the measure is displayed in the area allocated to it on the left of the image.

The relative distance is given in its decimal value as well as in %.

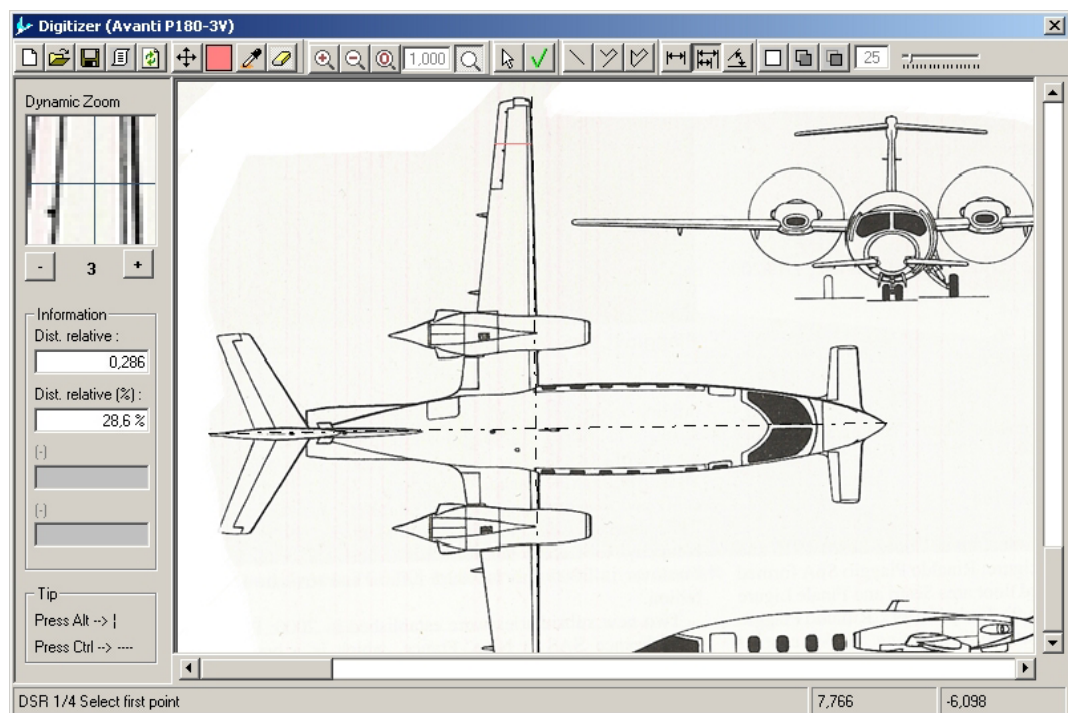


Figure 12.15 : Calculation of a distance ratio

#### 12.8.4 Measure of an angle

To measure an angle (in this case the wing dihedral):

1. **Click** on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (ANG ...).

2. ANG 1/3 **Select** the first point
3. ANG 2/3 **Select** the second point
4. ANG 3/3 **Select** the third point

Once three points have been selected, the value of the measure is displayed in the area allocated to it on the left of the image.

The value of the angle is displayed as well as the value of the complementary angle.

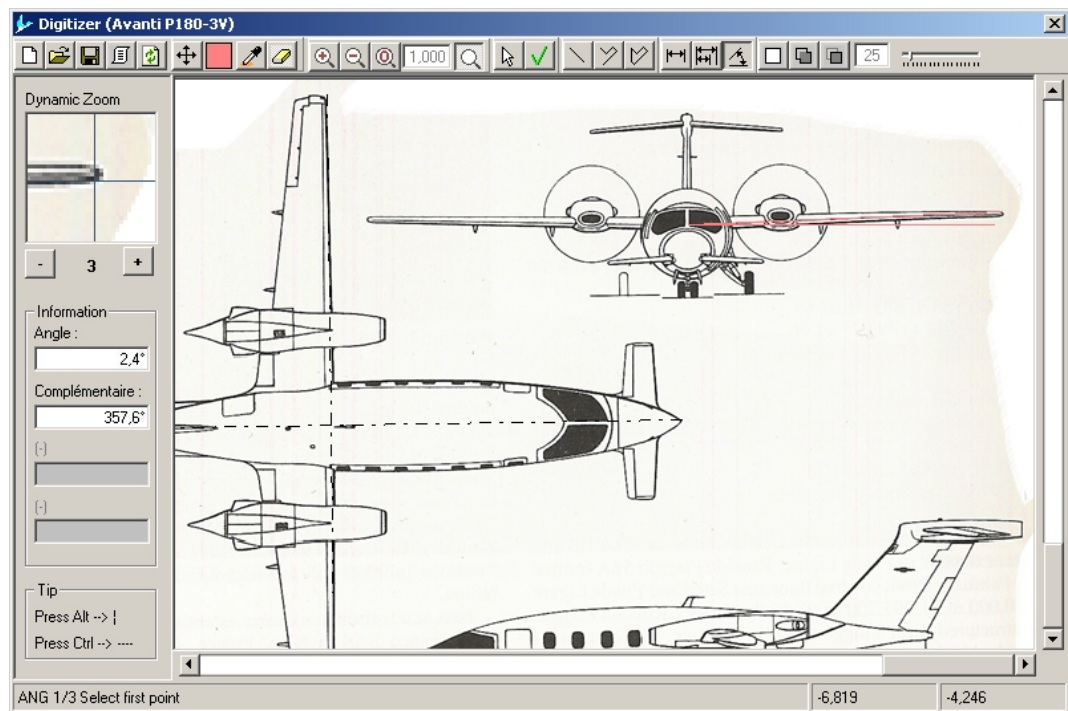



Figure 12.16 : Measure of an angle



### 12.8.5 Measure of a surface

In order to measure a surface (in this case the surface of the aileron):

1. Click on  in the toolbar in the **Digitizer** window.


Follow then the instructions that appear in the status bar (ARE...).

2. ARE **Select** a point inside the shape for which you wish to know the surface

Once the selected surface has been completely put in color, the value of the measure is displayed in the area allocated to it on the left of the image.

Additional information is also displayed, i.e.:

- The value of the largest horizontal dimension (**DeltaX**)
- The value of the largest vertical dimension (**DeltaY**)
- The shape coefficient (**Shape factor**). This coefficient is the ratio between the value of the surface measured and the value of the calculated surface by multiplying the value of the largest dimension in X by the value of the largest dimension in Y.

The color of the selection is determined or modified by clicking on  in the toolbar in the **Digitizer** window.

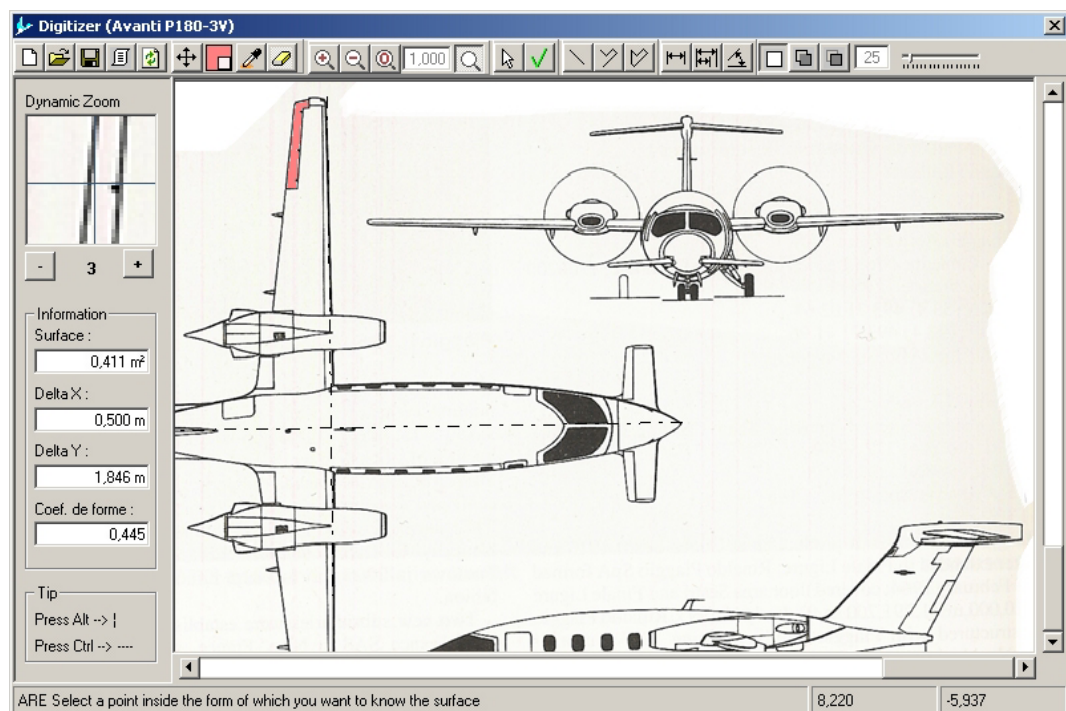



Figure 12.17 : Measure of a surface



**The initial color of the surface** is determined by the color of the point that is at the right of the pointer at the time of the selection.

A point is part of a surface if its color corresponds to the one of the surface, except for one tolerance value. By default, this tolerance equals **25**.

**The tolerance value** can be modified by moving the cursor 

#### **BEWARE**

If that tolerance is too high, the edges of the shape risk not to be recognized and the selection will go beyond the selected area. If that happens, running the function can be interrupted by clicking on the **Esc** (Escape) key.

In the same way, if the selected area is not closed, the selection will go beyond the desired area. In that case, it is necessary to interrupt the function by clicking on the **Esc** (Escape) key.





### Calculation of a complex area


The precision of the measure of a surface depends mainly on the quality of the image. If the lines are clean, the results will be good. On the other hand, if the lines represent an important shaded area, the risk is that the result is moderate. That is why we advise to « rebuild » systematically the shape for which we wish to know the surface.

By proceeding in that way, the measure of the surface should be done in the following way:

1. To erase the existing edges
2. To draw a polygon that is supported by the existing outline
3. To measure the surface

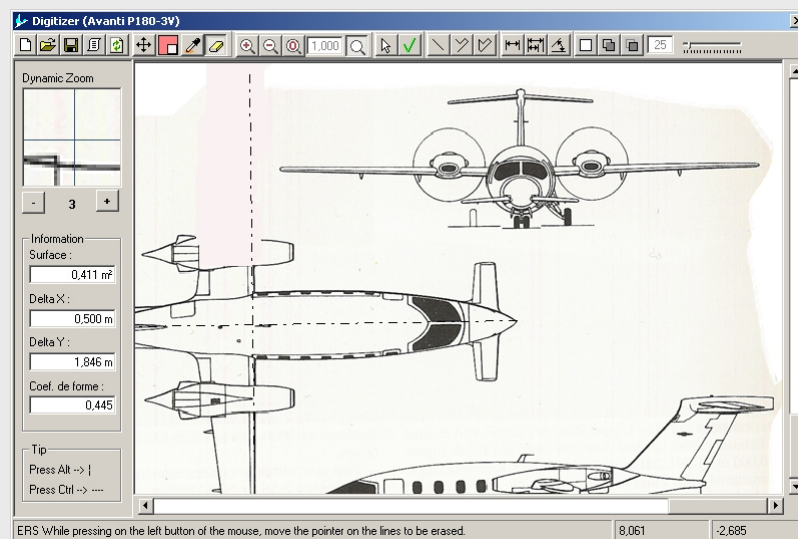
### The first step consists in erasing the existing edges (1/3)

To erase part of the drawing:



1. Click on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (ERS...).

2. ERS While pressing the left button of the mouse, **move** the pointer on the lines to be erase.



### Remarks


- a) The size of the eraser can be determined by 
- b) An erased line remains visible with the dynamic magnifying glass
- c) The function  makes it possible to reset the image



### The second step consists in drawing a polygon that is supported by the existing edges (2/3)

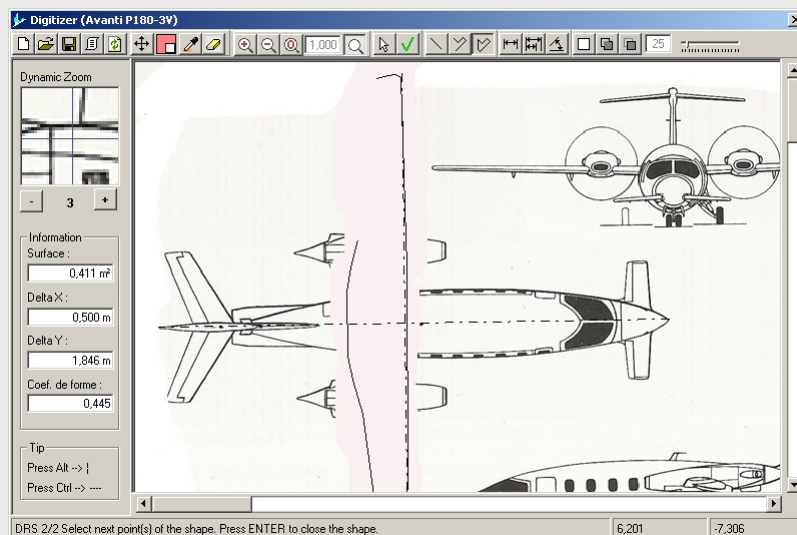
Use the dynamic magnifying glass to find the lines that have become invisible

In order to draw a polygon:


1. Click on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (DRS...).

2. DRS 1/2 **Select** the first outline point
3. DRS 2/2 **Select** the following point(s) in the outline. Press **ENTER** to close the outline




### Remarks

- a) A line which is erased remains visible with the dynamic magnifying glass
- b) The function  makes it possible to reset the image



The third step consists in measuring the surface of the new shape that has been created (3/3)

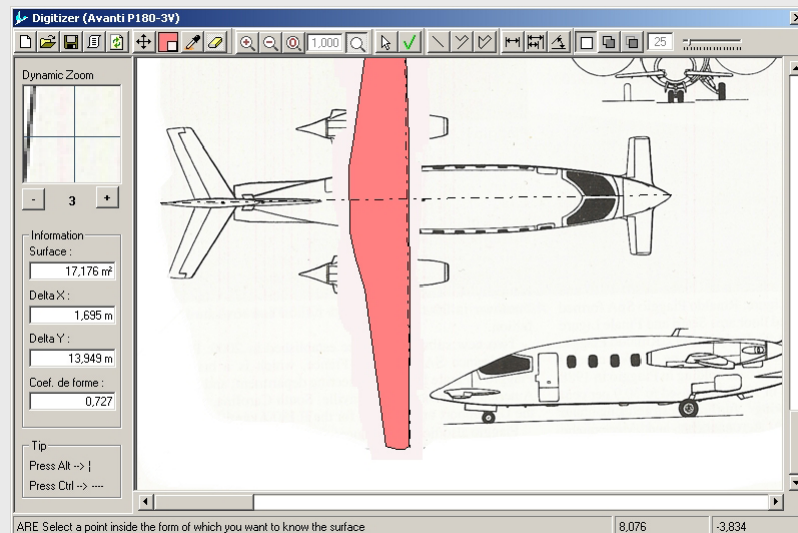
In order to measure the surface:

1. Click on  in the toolbar in the **Digitizer** window.


Follow then the instructions that appear in the status bar (ARE...).

2. ARE **Select** a point inside the shape for which you wish to know the surface

Once the selected area has been entirely colored, the value of the measure is displayed in the area that has been allocated to it to the left of the image.




## Remarks

The function  makes it possible to reset the image

### 12.8.6 To add an area to the current selection

In order to add an area to the current selection:

1. Click on  in the toolbar in the **Digitizer** window.


Follow then the instructions that appear in the status bar (ADD)

2. ADD **Select** a point inside the area that you wish to add to the selection

Once the selected area has been completely colored, the value that corresponds to the sum of the selected surfaces is displayed in the area that is allocated to it located on the left of the image.

Additional information is displayed, i.e.:

- The value of the largest horizontal dimension (**DeltaX**)
- The value of the largest vertical dimension (**DeltaY**)
- The shape coefficient (**Shape factor**). This coefficient is the ratio between the value of the surface measured and the value of the calculated surface by multiplying the value of the largest dimension in X by the value largest dimension in Y.

The color of the selection is determined or modified by clicking on  in the toolbar in the **Digitizer** window.

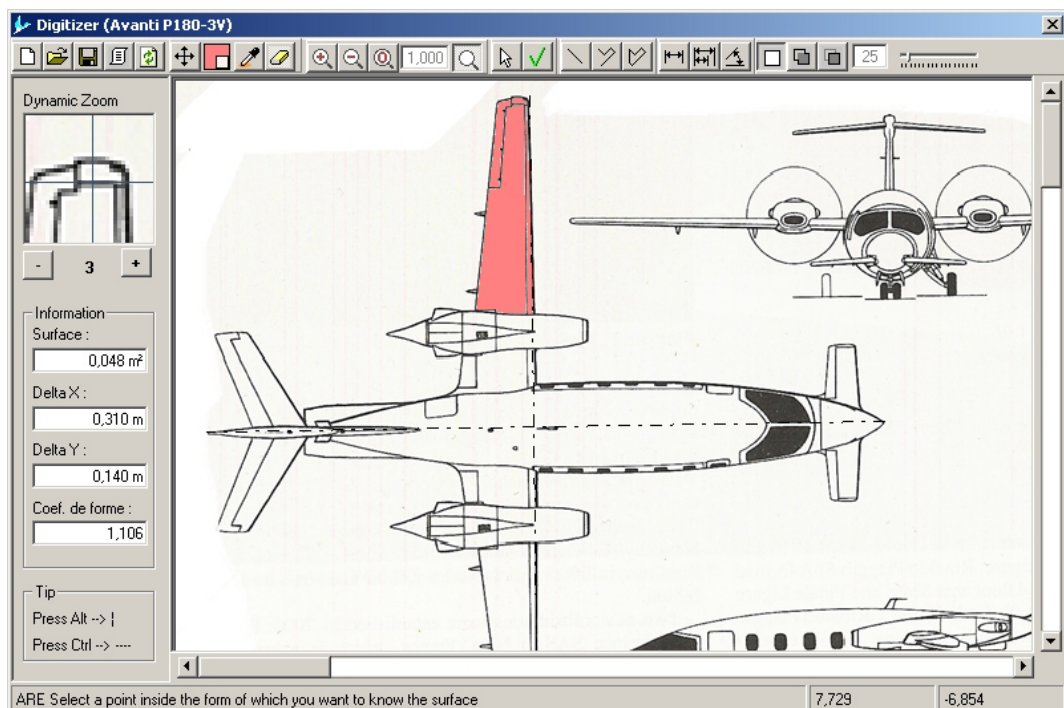



Figure 12.18 : To add an area to the current selection

### 12.8.7 To withdraw an area from the current selection

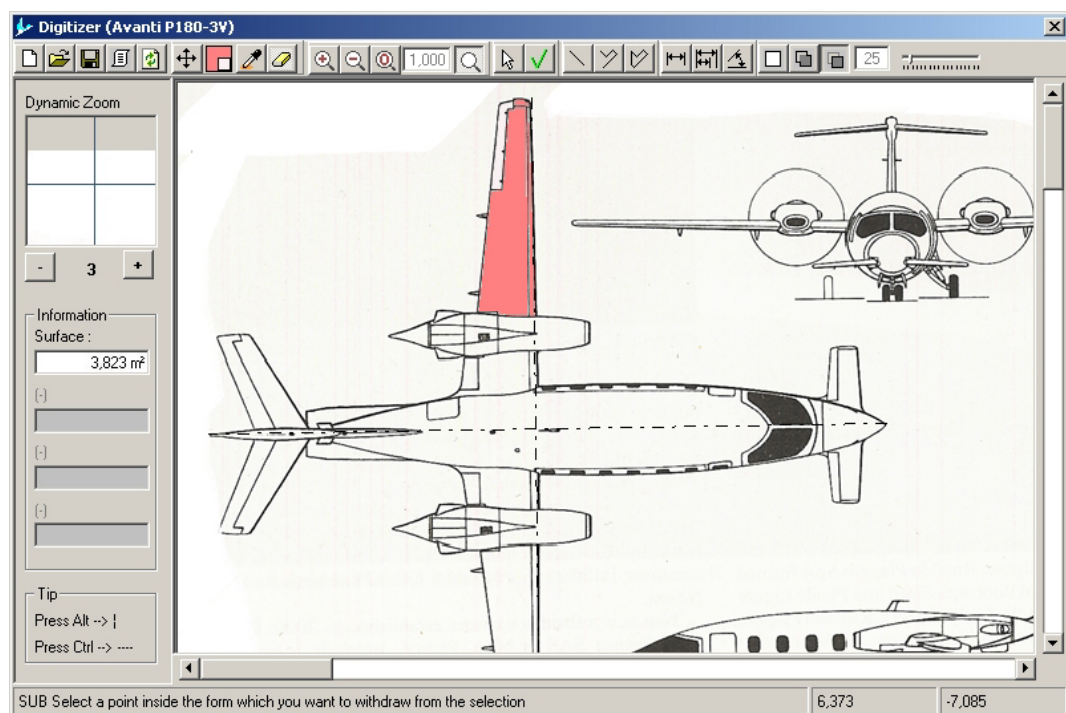
In order to withdraw an area from the current selection:

1. **Click** on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (SUB)

2. SUB **Select** a point inside the area that you wish to withdraw from the selection

Once the selected area has been completely colored, the value that corresponds to the sum of the remaining selected surfaces is displayed in the area located on the left of the image that is allocated to it.



**Figure 12.19 : To withdraw an area from the current selection**

## 12.9 To digitalize a curve

### 12.9.1 Introduction

The **Digitizer** module makes it possible to digitalize quickly a curve that will have been scanned previously such as the polar of a glider for example

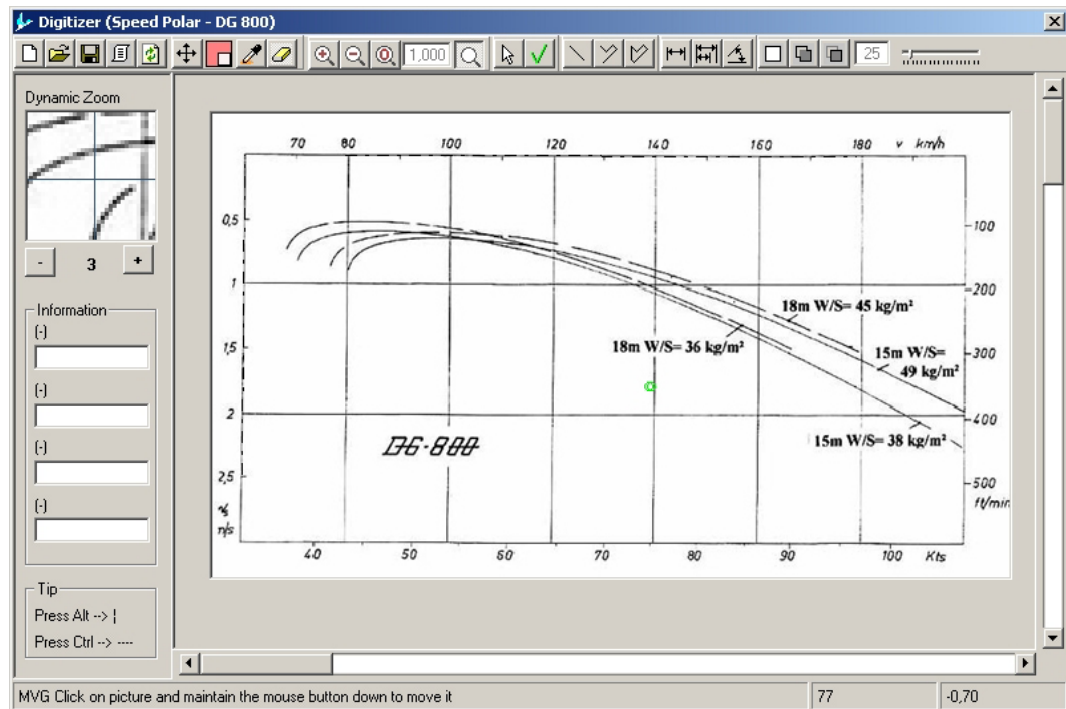



Figure 12.20 : Digitalization of a curve



## 12.9.2 To digitalize a curve

Once you have georeferenced an image (cf. 12.5) or downloaded a georeferenced image (cf. 12.7), you can use it and select the points in the curve that you wish to digitalize. In order to do that:

1. **Click** on  in the toolbar in the **Digitizer** window.

Follow then the instructions that appear in the status bar (DGT)

2. DGT **Select** the points in the image

Once you move the mouse pointer on the drawing, the position of the pointer is displayed permanently on the status bar.

Once you find a point on the image, its coordinates are automatically displayed in the table located on the right edge of the main window.

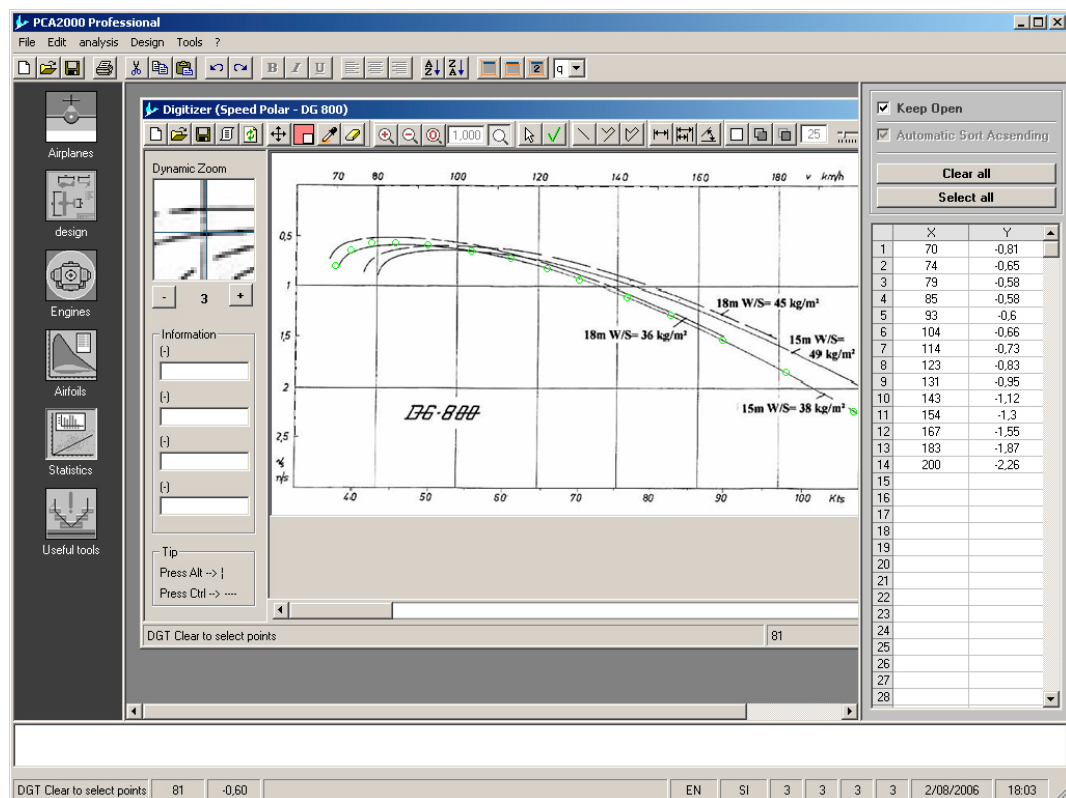




Figure 12.21 : To digitalize a curve

### 12.9.3 Validation of the selection

Once you think you have determined a curve with a sufficient number of points, you can do a **control** by clicking on  in the toolbar in the **Digitizer** window.

If the control points stick to the curve that means that you have determined the curve with a sufficient number of points. Otherwise, you have to add some.

Adding points is done simply by clicking on the curve where you think it is advisable to add some.

In order **to make the marking easier**, it is often necessary to erase the control points before going on with the digitalization of the curve. In order to do that, click on  in the toolbar in the **Digitizer** window.

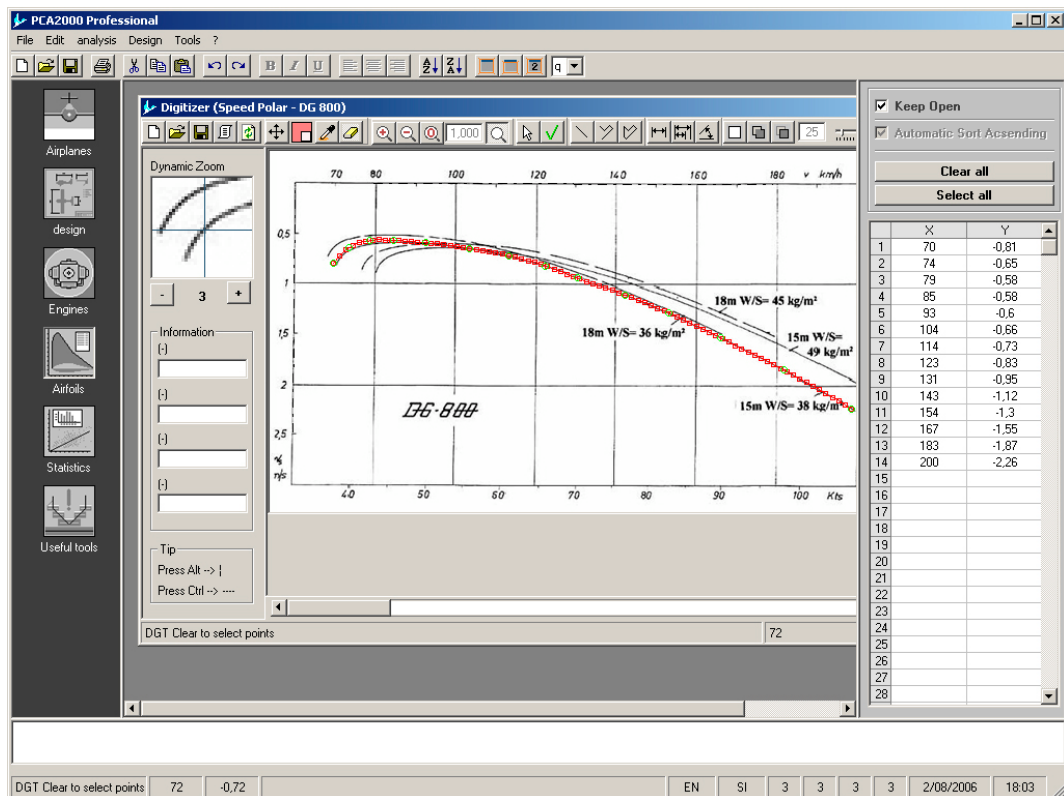


Figure 12.22 : Validation of the selection



### 12.9.4 Management of the selection


a) Erase a point in the selection

1. **Select** the cells in the table that correspond to the coordinates X and Y of the point
2. **Press** the **Delete** key

b) Erase the content of the table and all the points in the image:

**Click** on 

c) Select the content of the table

1. **Click** on 
2. **Click** then on the **right button of the mouse** to copy the selection in the paper-weight.

In that way, you can use again those texts in another **PCA2000** table or in another application such as **Excel** for example.

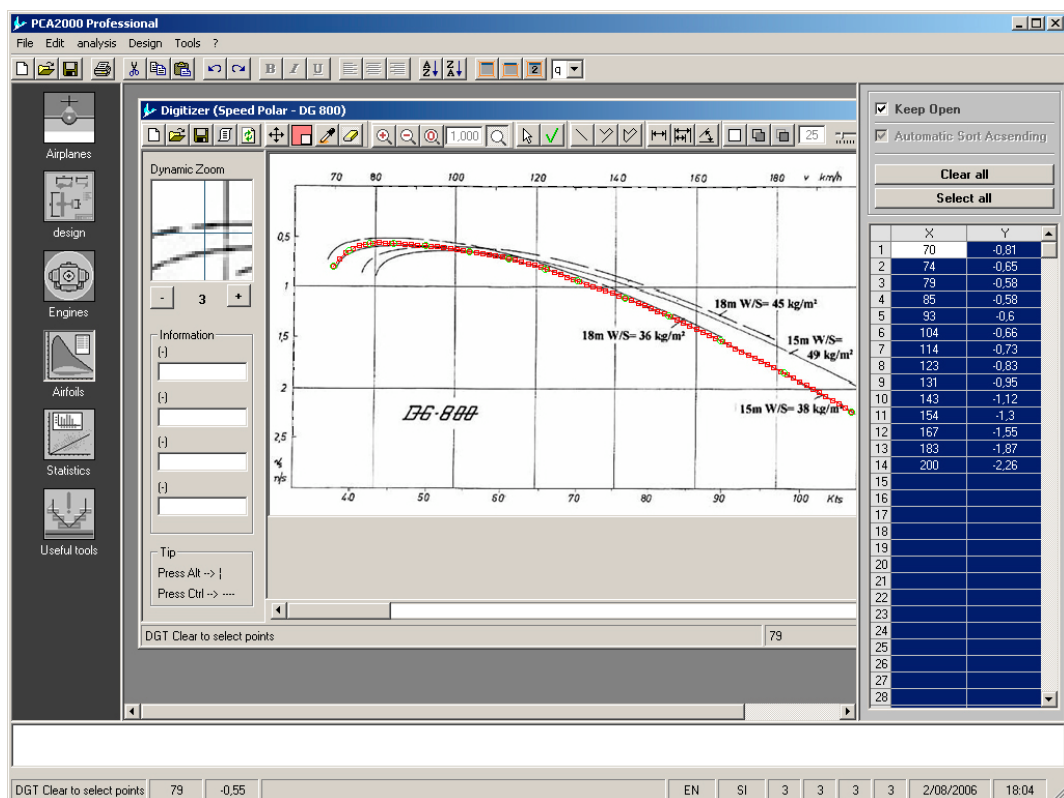


Figure 12.23 : Management of a selection