

Wing Helper 1.4

Tutorial

Document Version 1.4

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Change History

Date	Change	Doc. Version
2015/09/26	First release, corresponding to Wing Helper 1.0	1.0
2016/01/09	Second release, corresponding to Wing Helper 1.1	1.1
2016/06/10	Third release, corresponding to Wing Helper 1.2	1.2
2017/02/25	Fourth release, corresponding to Wing Helper 1.3	1.3
2018/02/02	Fifth release, corresponding to Wing Helper 1.4	1.4

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1 Introduction

Wing Helper is a state-of-the-art 3D CAD program for design of RC plane models, running on all popular operating systems (Windows 7 or later¹, OSX 10.8 or later, 64-bit Linux). *Wing Helper* is available in English and in German language.

In the current version 1.4, *Wing Helper* supports the creation of the main wing, the very heart of every plane. *Wing Helper* follows a mixture of parametric and visual editing modes. Parametric means that you are not drawing your plane components “free-hand”, but rather by specifying the numerical parameters defining how your plane is going to look like. The results of the changes you make to the parametric definition of your plane are instantaneously turned into a 3D visual representation, which allows you to review and fine tune your results right away, without having to switch between windows or to wait for the 3D window to refresh. This allows for a very fast work flow and greatly simplifies the design process.

In this document, we start by giving an overview of the most important functions. Then we proceed to explain in detail how these functions can be used.

For all additional information, updates, lists of errors, frequently asked questions, and so on, please visit us on our web site <https://www.winghelper.com>. For technical support, you can contact us using the form on the aforementioned web page, or directly via mail to support@winghelper.com. If you seek the contact to other Wing Helper users, there is also a [discussion forum](#) available, accessible from our web site.

In this tutorial, we are using the screen shots and videos created under the Linux operating system. While the look and feel of *Wing Helper* will be slightly different under Windows and OSX operating systems, the differences will be of purely visual nature. Everything else (functionality, commands, general windows layout, etc.) are the same.

Wing Helper e.U., the company behind this program, is a single person company located in Vienna, Austria. The “e.U.” in the name stands for “eingetragener Unternehmer” in German, or - freely translated to English - “registered independent business owner”. The name of the company is therefore the same as the name of our main product, the only difference is the “e.U.” suffix.

Despite of Wing Helper e.U. legally consisting of only one person, the *Wing Helper* product is a joint effort of a multitude of beta testers, RC pilot colleagues, friendly Internet forum members and other *Wing Helper* users from all over the world. Without their valuable input, *Wing Helper* would not be where it is today. We are looking forward to also hearing from you, and want to know what you think is good, bad, or worth improving in *Wing Helper*!

Thank you for your interest in *Wing Helper*, we hope you will like it!

¹ Please note, that Windows XP is explicitly *not* supported. Some Wing Helper customers are using the program under Windows Vista, yet we cannot guarantee that it will function correctly on anything older than Windows 7.



2 New Functions and Improvements in Version 1.4

Version 1.4 introduces the following new functionalities and improvements², such as:

- Generation of lightening holes in ribs
- Automatic generation of ailerons (new spar type "*Aileron Cutter (simple)*")
- Graphical Airfoil Designer and Manager
- 3D export in SCAD format (intermediate for STL; see OpenSCAD.org)
- ICE Export (G-Code for Styrofoam cutting machines)
- Visibility control added to ribs and sheeting strips (context menu)
- When changing the thickness of the last rib, its' position is now automatically adjusted
- Scaling of the background image in wing form editor can now also be done based on a measurement
- Airfoil import: added option to smooth-out the nose portion of the airfoil
- Airfoil spanning implemented (see *Edit* → *Airfoil Spanning*)
- Right-click now opens a spar resp. sheeting strip pop-up menu also if one doesn't click directly on an already existing spar or sheeting strip
- Option added to also include full, un-altered ribs in the DXF file (useful for "facing ribs")
- "*Help* → *About Wing Helper*" now also presents the system information which can be included in error reports
- Improved control over positioning of building tabs
- Building tabs: now also with "holes", for easier removal
- Added an option to distribute ribs in a more flexible way (right-click on the rib in the rib table)
- Additional option for the main wing view: *Show Dihedral*
- Countless further improvements, optimizations and bug fixes!

² This list only shows the most important changes. Additional improvements, including detailed information how to use them, are described in the sections below and in the referenced video tutorials.



3 Features

Wing Helper 1.4 concentrates on the definition of the main wing as a set of segments, in further text referred to as *wing panels*. For each of these panels, you can specify the following parameters:

1. Base parameters

- a) Panel length (can also be calculated automatically from the desired number of ribs and the distance between them)
- b) Length of the root chord (i.e. length of the first rib in the panel)
- c) Length of the tip chord (i.e. length of the last rib in the panel)
- d) Sweep
- e) Panel twist (separately at the root and at the tip of each panel)
- f) Dihedral angle (angle between this panel and the previous one)
- g) Airfoil
 - freely selectable from the list of approximately 1500 airfoils, including the option to import and to edit additional ones, from DAT or COR files, or as copies of existing airfoils. Starting with version 1.4, option to design own airfoils was also added.
 - optionally a separate airfoil for the tip rib (intermediate ribs will be linearly interpolated)
 - The airfoil thickness can also be modified directly in this window, instead of doing it via the “*Airfoil import*” functionality.
- h) Specification of the rib alignment (no alignment / upper side / lower side)

2. Ribs

- a) Base parameters:
 - Rib thickness
 - Number of ribs
- b) Extended settings:
 - Position and thickness
 - Add / delete / split / redistribute ribs
- c) 2D presentation of the selected rib, including the measuring tool
- d) Definition of the building tabs (placement, position, width, length)
 - Starting with version 1.4, with a plenitude of new options!

3. Spars

- a) 6 base types: round, square, webbing, round joiner, cuboid, cuboid joiner
- b) One special spar type introduced in version 1.4: “*Aileron Cutter (simple)*”, used for



automated generation of ailerons

4. Leading Edge

- a) “Standard” leading edge corresponding to the fore part of the rib
- b) Round, strip, and “diamond” leading edges can be created by means of properly placed spars.

5. Trailing Edge

- a) “Standard” trailing edge corresponding to the aft part of the rib

6. Sheeting

- a) “Standard” sheeting, which always starts at the leading edge, is still available, but is now declared obsolete and can cause issues when applied to non-trapezoid wings. Please use the “Advanced” sheeting option instead.
- b) “Advanced” sheeting, consisting of a list of *sheeting strips*, which can be freely placed anywhere on the wing.
- c) Support for *cap strips*, as a special kind of sheeting strips.

7. Construction helpers

- a) Definition of one or more *rib combs*, with a plenitude of options. A rib comb can also be utilized as a spar webbing.
- b) Definition of *rib lightening holes* (introduced in version 1.4)

Once your wing is defined, you can save it in the *Wing Helper* specific format (*whf*), you can store the resulting ribs and the wing plan as a PDF, print them, or export them in DXF format for further processing or for sending them to the cutter machines³. Starting with version 1.4, *Wing Helper* introduces the two additional export formats:

1. ICE (G-Code for Styrofoam cutters⁴), and
2. SCAD (a 3D output format understood by the free program OpenSCAD, from where you can transform it into an STL file)

Wing Helper also provides a undo / redo functionality and calculates for you the relevant wing parameters (wing span and area).

While *Wing Helper 1.4* already brings a great amount of functionality, this is not where we want to stop! Beside additional improvements for the main wing definition, future versions shall extend the focus to also comprise the fuselage, empennage, interfaces to other programs (e.g. XFLR5), and many other advanced functionalities. The road map for the future versions of *Wing Helper* can be found in the “*Future Extensions*” section of our web site <https://www.winghelper.com>.

The future development of *Wing Helper* will greatly depend on your feedback and on the interest of

³ Before cutting the wing elements, please always make sure that the wood grain is correctly oriented

⁴ ICE is not a very widely spread format, but it was an obvious first step for the *Wing Helper* due to the excellent support by the author. In future, we are planning to introduce additional G-Code output formats



the community. You are kindly invited to help us make *Wing Helper* a number one RC plane modeling tool!



Wing Helper 1.4 introduces a plenitude of new functions and improvements, which called for changes in the core parts of the already implemented functionality. For that reason, please make sure that your existing wing designs are still as you wanted them to be after import in Wing Helper 1.4 – in some cases, you might need to undertake minor modifications to make your existing designs correct again!



4 Using Wing Helper

In this section, we explain all *Wing Helper* functions in detail, providing links to video material where available.

4.1 Registering Wing Helper

The first thing you should do after installation of *Wing Helper* is to enter your purchased registration key. By entering the registration key, you make sure that the full functionality of *Wing Helper* will be available also after the expiration of the trial period.

The registration key can be entered in the “*About Wing Helper*” dialog, on the tab called “*Registration Info*”, as shown on Figure 1:

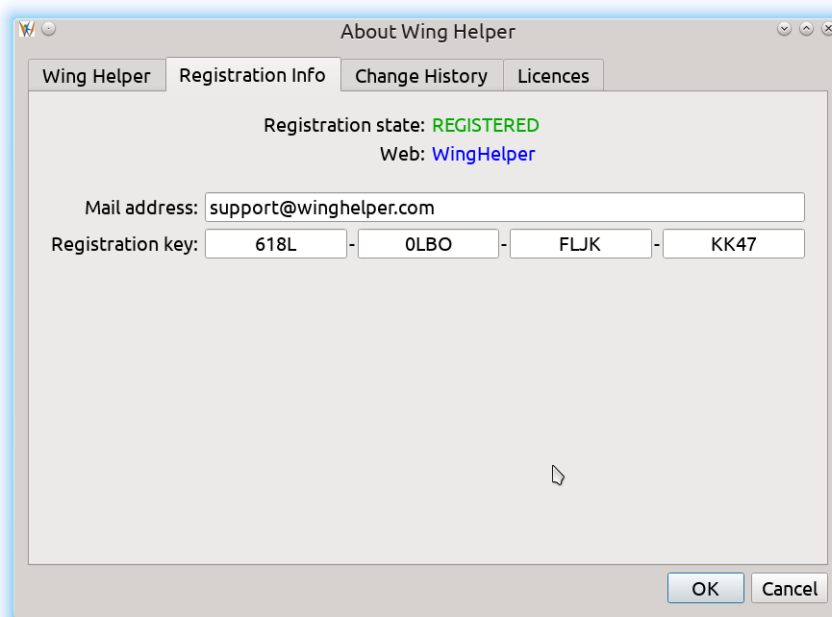


Figure 1: Entering registration information

The registration key shown here is just an example, it is not a valid *Wing Helper* registration key.



Please take good care of your registration key and don't share it with other people, publish it on the Internet, or use it in any other inappropriate way. It is also not allowed to reverse-engineer and publish the algorithm for the key creation.



Please make sure that you enter the license key exactly as you received it. It is rather easy to confuse 0 (digit) and O (letter), or – with some fonts – also 1 (digit) and I (letter). We advise you to enter the key by copy pasting it from your confirmation e-Mail.

4.2 Main Window

Figure 2 shows the *Wing Helper* main window.

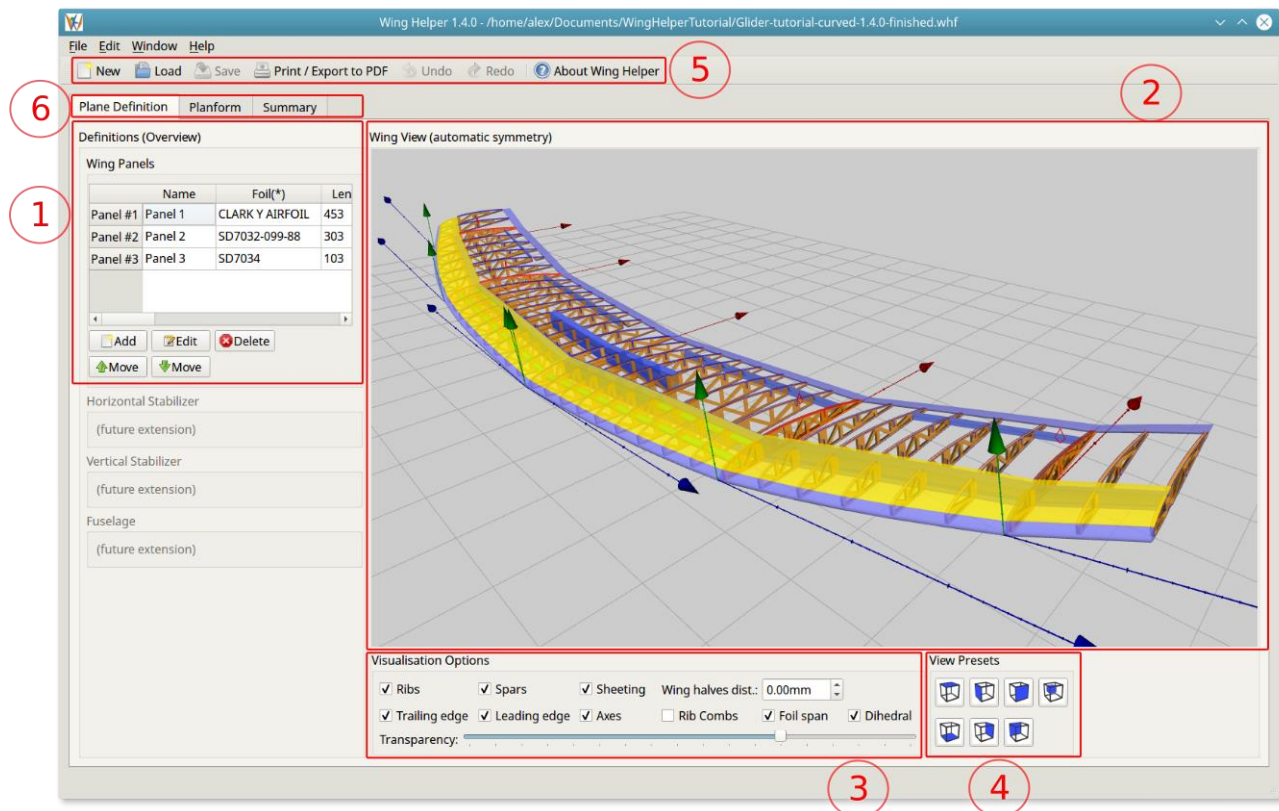


Figure 2: Main Window

The window is separated in 6 areas:

1. Panels table, listing all panels defined for this wing. As you can see, the table shows the name of each panel and the airfoil assigned to its' root rib. If you scroll the window contents to the right, you will see additional parameters, such as panel length, root chord, tip twist, etc. Some of these parameters can also be changed directly in the table, some can only be adjusted in the panel edit mode. You can enter the panel edit mode by double-clicking the appropriate row in this table, or by selecting the row and pressing the *Edit* button. Please see Section 4.3 *Panel Edit Mode* for details.



2. Main wing view, showing the 3D view of the defined wing. You can rotate, pan, and zoom this view using your mouse or touch pad. Pressing *SHIFT* or middle mouse button while moving the mouse pans the view. Mouse wheel zooms in / out of the view. Holding the *CTRL* key selects the finer (higher) resolution for zoom and rotation. Double-click resets the view to the default position.
3. Visualisation options, where you can select which parts of the wing are going to be shown in the 3D view. The “*Transparency*” slider allows you to control the opacity of the wing elements.
4. *View presets* are short-cuts to various predefined camera positions. This option is particularly useful when you are in the panel editing mode.
5. Toolbar and menu area. While the menu is fixed at the top of the screen, the toolbar can be freely positioned according to your preferences.⁵
6. Tabs for selection of different editing views:
 - *Plane Definition*: standard view
 - *Planform*: this is where you can give your wing a desired form. For detailed information about this tab, please consult Section 5 *Non-Trapezoid Wing Forms*.
 - *Summary screen*

As mentioned above, double-clicking a row in the panel table, or selecting a row and pressing *Edit*, brings you into the panel edit mode, which we describe in the following section.

4.3 Panel Edit Mode

The panel edit mode is implemented by means of a separate dialog (window). Figure 3 shows what you will see upon entering the panel edit mode.

⁵ Default toolbar position under Windows and Linux operating systems is at the top of the window. Please note, that due to an error in the underlying programming library QT under OSX, the toolbar positioning is not working perfectly in the full screen mode on Apple computers. If you experience any problems in the full screen mode, please try to maximize the window or to move the toolbar to another position.

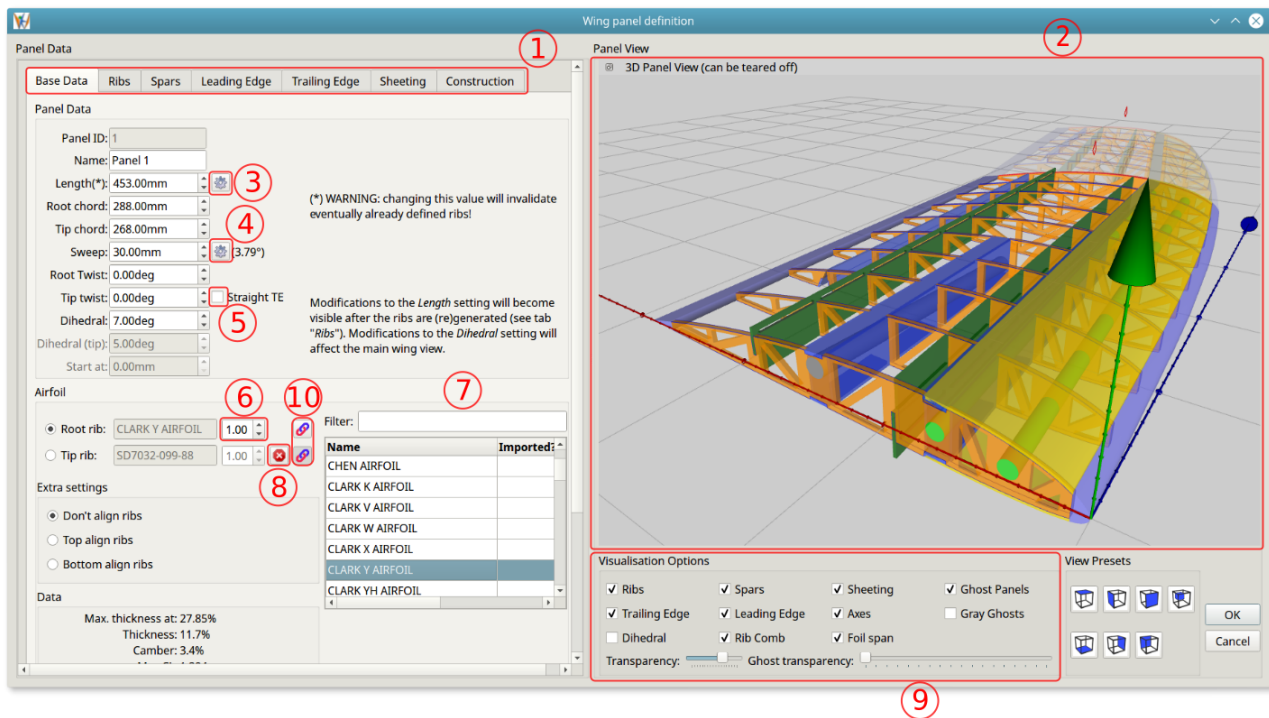


Figure 3: Panel Edit Mode - Base Data

The panel edit window comprises two sub-windows: the *data area* on the left side, and the *3D visualisation area* on the right, just like in the main window. In the data entry area on the left side of the panel edit window, you can choose among different editing areas (base data, ribs, spars, and so on – see the area marked by a red number one).

4.3.1 Base Data

In Figure 3, the *Base Data* area is selected, which is the starting point for the panel definition. Here you can specify the following data:

1. *Panel Data* – base data for this panel
 - **Panel name** (only used for visualisation purposes)
 - **Panel length**. This number is one of the parameters used for the generation of the initial set of panel ribs. For this reason, modifications to this parameter are not reflected instantly, but rather after the button *Generate Ribs* is pressed (see the area *Ribs*). Most probably, you will not want to enter this data manually, but rather by means of the *Panel Length Calculator*, which can be invoked by clicking on the button denoted with a red number 3. Panel length calculator can be seen on Figure 4. If you are using the *Panel Length Calculator*, don't forget to also press the “*Generate Ribs*” in the ribs specification area (see Section 4.3.2), because the effects will not be visible before you do so.
 - **Root chord**, or the length of the first rib in the panel.



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- **Tip chord**, or the length of the last rib in the panel.
- **Sweep**. This value specifies how far back (or forth) this wing panel shall be swept. Next to this field, you will also find a button depicted with the red number 4. Pressing this button sets the sweep value so, that the leading edge of the panel is in a straight line with the leading edge of the previous one.
- **Root twist**. This parameter allows you to set the rotation of the first rib (panel twist at the root of the panel).
- **Tip twist**. This parameter specifies the rotation of the last rib (the twist at the end of the panel). Please note that extreme panel twists (e.g. over 7 or 8 degrees) also might introduce some undesired side-effects, so please use it with care if you have such an unusual wing.
- **Straight TE**. This check-box, denoted with the red number 5, specifies how the panel twist will be propagated over the ribs. If this option is not selected, the twist of all ribs between the first and the last ones is interpolated linearly (default *Wing Helper* behavior prior to version 1.3). If this option is selected, the twist is propagated in such a way, as to guarantee a straight trailing edge instead.
- **Dihedral**, or the “V-Position”, denotes the angle between this panel and the previous one. In order to activate the visualisation of the dihedral angle in this view, please select the option “*Dihedral*” in the “Visualisation Options” area (red number 9).
- **Dihedral (Tip)**. This is just an informational field showing the dihedral angle of the *next* panel. In order to change this value, please move to the next panel and change the “*Dihedral*” parameter instead.
- **Starts at**. This is also an informational field, showing the distance of the panel from the wing root.

2. Airfoil

- Select the “*Root rib*” button, then select one of the airfoils in the list. Voilà – the default panel airfoil is replaced by the one you selected!
- If you want to have a different airfoil at the tip of the panel, select the “*Tip rib*” button, followed by the tip airfoil. All ribs between the first and the last ones are going to be interpolated. Button marked with a red number 8 removes the tip airfoil selection, making the tip airfoil the same as the root airfoil again.
- By modifying the value in the field denoted with the red number 6, you can directly influence the height of the selected airfoil.
- Buttons denoted with the red number 10 are shown as “*pressed*” if you specified the airfoil interpolation to “span” more than one panel. See Section 4.8.1 for details on airfoil



spanning.

- The field called “*filter*” is denoted by the red number 7. Entering a value into this field filters out all non-matching airfoils.
3. *Extra settings*. This is where you can specify how the ribs in your panel are aligned: (1) not at all, (2) along their upper side, or (3) along their lower side. For some wings, this can be useful in order to make sure that the aileron hinge line will be straight.
 4. *Data*. This is just a static data calculated for this airfoil. The data is obtained, with the permission of the author, from the *Airfoil Investigation Database* web site (<http://www.airfoildb.com/>). For imported or manually created airfoils, this data is not available.

On the right side of the window, you see the 3D panel visualisation area (red number 2), which can be rotated / moved / zoomed the same way as it was possible with the wing view in the main window. In the *visualisation options* area (red number 9), you see an additional option for “*ghost panels*”. Ghost panels are the panels adjacent to this panel, which are drawn with a separate transparency and color control. Ghost panels represent a very useful help for aligning the spars stretching over multiple panels. In the Figure 3, you can see one ghost panel in the background.

If you wish, you can also “tear off” the 3D visualisation area window for placement on the location of your desire. After tearing off this area, you can freely position it anywhere on the screen. Closing the panel edit dialog also docks this area back into its’ original location.

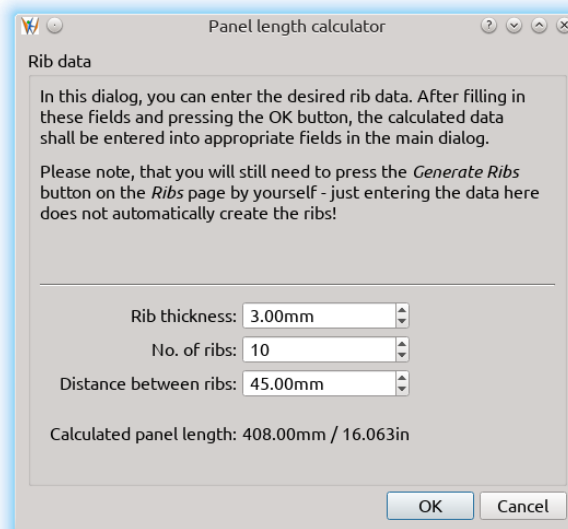


Figure 4: Panel Length Calculator



Please find the video tutorial for this Section at [You Tube \(Tutorial 1\)](#)

4.3.2 Ribs

The *Ribs* area allows you to manipulate the panel's ribs (Figure 7). Upon creation of a panel, a predefined set of default ribs is already generated in accordance to standard parameters. If you wish to modify them, you can either do so by means of the *Panel Length Calculator*, or directly in the *Ribs* area of the panel dialog. There are five ways to modify the generated ribs:

1. Modifying *Rib Thickness* and / or *No of ribs* fields and pressing *Generate Ribs* buttons. This will override all eventual manual settings you might have done to the ribs!
2. Adding / removing / modifying the ribs in the rib table. You can do so by clicking on an existing rib with the right mouse button. This action will open a context menu with options to add a rib in front of the selected one, behind the selected one, to split the rib in two, or to delete the selected rib. The selected rib is represented in red color in the 3D view window, as well as in the 2D visualisation area. The newly added rib will be located exactly half way between the surrounding ribs.
3. Modifying the position or the thickness of a rib directly in the table.
4. New in version 1.4: automatically change the distribution of ribs in accordance to the parameters specified in the corresponding dialog (Figure 6). To invoke this function, right-click into the ribs table, then select the option "*Change distribution*".
5. A rib can also be split in two adjacent ribs of 50% thickness.

Please note the following constraints:

- the first and the last rib cannot be deleted
- the position plus the thickness of the last rib must equal the panel length. This means, if you want to increase (resp. decrease) the thickness of the last rib, the rib will also need to be moved to the left (resp. right), to a new position. Starting with *Wing Helper 1.4*, this is done automatically by the program.

For example, starting from the panel we defined in the tutorial video number one, we might want to:

- Make the first rib thicker, so that there is enough material to account for the dihedral
- Add two more ribs right next to the existing ones, at the positions where the aileron will be located later on.



How this can be done is shown in the video tutorial referenced at the end of this Section.

The highlighted areas in Figure 7 show the most important other functions in this window:

- 2D rib view, where the selected rib is shown just as it will be drawn in the final DXF or PDF output. This allows for even better control of the final result than what is possible in the 3D view. Pan and zoom in this area works the same way as in the 3D view.
- Both the 2D rib view as well as the rib table can be teared-off by pressing the control button highlighted with the red asterisk (“*”). After tearing off these windows, you can freely position them anywhere on the screen. If you change into another view (e.g. “Spars”), the teared-off windows remain visible and active, as shown on Figure 8. Closing the panel edit dialog also docks these windows back into their original location.
- “Building tabs” for this panel can be created in the area highlighted with the red number 1. Please note, that the building tabs specification will only influence the DXF output, not the PDF or SCAD.

A right click into the 2D rib view brings up a context menu allowing you to take measurements of your rib, as shown in Figure 5. For details on how to use this new functionality, please consult the video tutorial at the end of this Section.

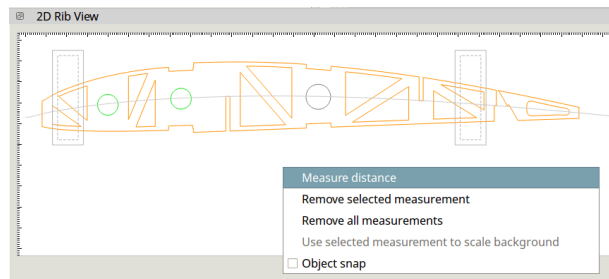


Figure 5: 2D Rib View context menu

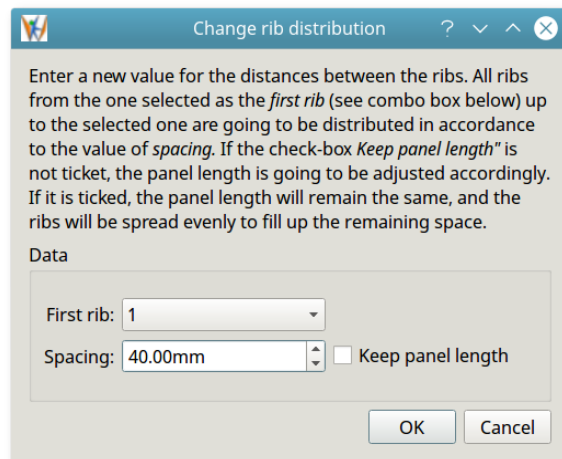


Figure 6: Changing the rib distribution within one panel



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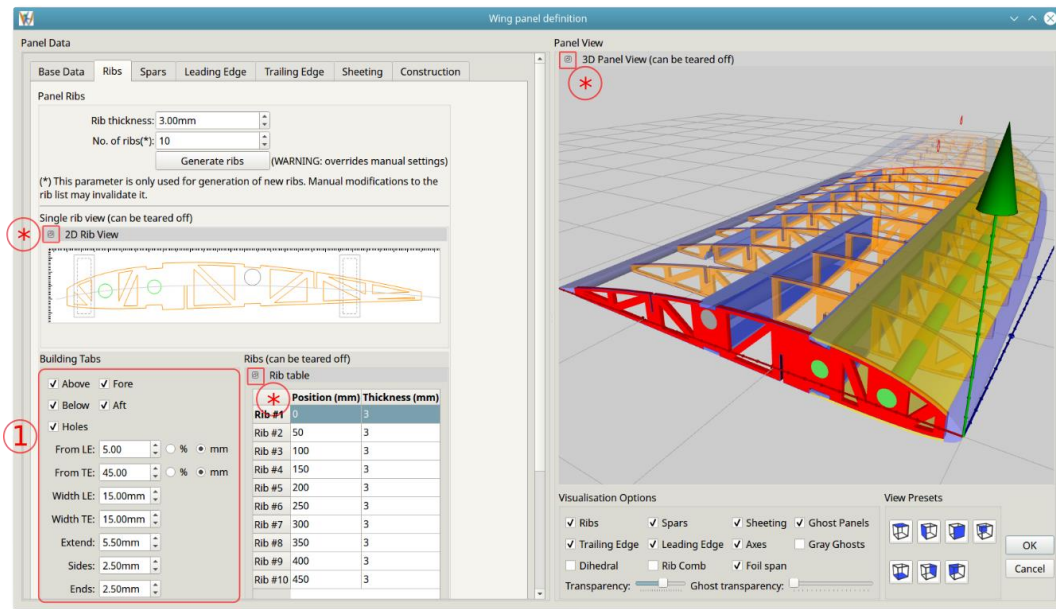


Figure 7: Generating / editing panel ribs

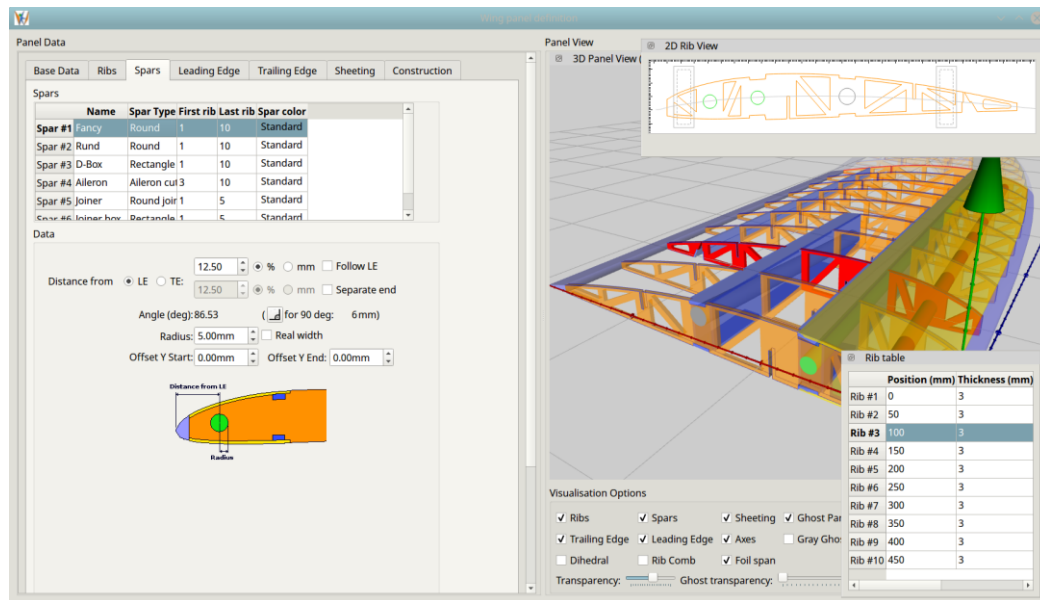


Figure 8: Teared-off 2D rib view and rib table



Please find the video tutorial for this section at [You Tube \(Tutorial 2\)](#)



4.4 Spars

The *Spars* area (Figure 10) is where you define the spars for your wing panel. The upper part of the *Spars* data area holds the list of all spars defined for this panel. In the lower part of that area, you can see the data for the currently selected spar.

At the beginning, the spars table is empty. Right mouse click into the (empty) table opens a menu with options to add a new spar. For as long as the table is empty, only the options to add a new spar are active. It is not important whether you add the first spar “*in front*” or “*behind*”, just select any of these two possibilities. “*In front*” and “*behind*” becomes important once the table is not empty.

A newly added spar is always of the type *Round*⁶, extends from the first to the last rib, and is located at 25% of the rib, measured from the leading edge. Be aware, that if you create two spars in a row, both will be located exactly in the same position, meaning that they will overlap. Don't forget to move them to their correct positions before closing the dialog.

The name of the spar, its' type, and the first and the last rib of the spar can be changed directly in the spar table. All other spar parameters are changed in the lower part of the spar data entry area. All changes are instantly reflected in the 3D panel view.

Each spar has own set of separately adjustable parameters. One of the more complex spars is a *Rectangular* spar, so let us see the parameters which can be adjusted for this spar. After that, we will describe the additional parameters specific to other spar types (e.g. “*Radius*” or “*Offset Y*” parameter of the round and cuboid spars).

Wing Helper also allows you to freely assign a color to a spar by double-clicking on the corresponding cell in the last column called “*Spar color*”, as shown in Figure 9. Selecting the color *white* resets the color to the standard color foreseen for that specific spar type. Please note, that the color *black* is used for internal purposes and has no effect on the resulting color of the spar.

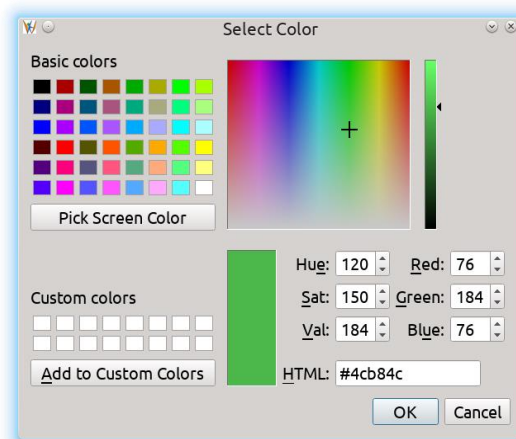


Figure 9: Spar color selection dialog

⁶ To change the type of the spar, double-click on the type cell (e.g. “*Round*”) and you will see the drop-down menu allowing you to select the desired type.

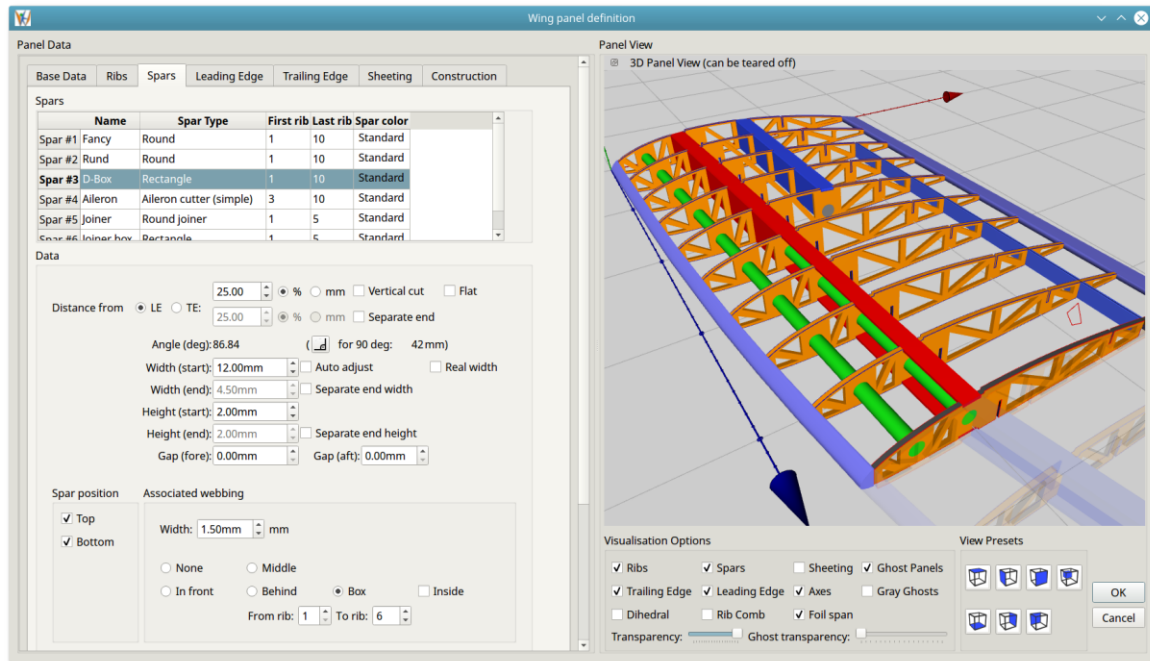


Figure 10: Rectangular Spar - Parameter

4.4.1 Rectangular Spar

Rectangle Spar is a spar consisting of a straight upper and lower parts (the spar itself) and possibly the associated interconnecting webbing. It is mainly the webbing which gives the strength to a rectangular spar. In case you wish to have a webbing on its' own, detached from a spar, you can also define spars of the explicit type *Webbing*. Wing Helper also supports so-called *rib combs*, which can be utilized as yet another kind of webbings (see Section 4.7.1), while also acting as building help.

In the order of appearance on Figure 10, the parameters of a rectangular spar are:

1. The reference point for the spar position. You can select either a LE (*Leading Edge*) or TE (*Trailing Edge*) here. The most spars will probably be positioned relative to the LE, except for e.g. spars defining the flaps or ailerons.
2. Position of the spar in percentage of the rib length or in mm. If the box *Separate end* is ticked, you can also specify a separate position for the beginning and for the end of the spar. By doing so, you are affecting the angle at which the spar is meeting the first rib. This angle is shown directly below the location data entry area. The program also displays which position in millimeter needs to be entered for the end position of a spar in order to put that spar at 90 degrees to the ribs.
3. Usually, the rib cut-out created by the spar will be perpendicular to the rib at the point where the spar is placed. If you wish to have a vertical cut-out, you can specify it by ticking the box *Vertical cut*.
4. The bottom line of the spar cut-out is always following the original rib curvature. Ticking the



option “*Flat*” makes the bottom line of the cut-out a straight line instead.

5. Width and height of the spar. This data is used for both the upper and the lower part of the rectangular spar. Ticking the box “*Auto adjust width*” makes the width automatically change with the length of the rib. For example, if the last rib of a spar is only half as long as the first rib, ticking this box will also make the spar only half as wide at the last rib than it is at the first rib.
6. The “*Width*” parameter specifies the width of the cut-out on the rib. If the spar is placed in a very acute angle to the rib, this will lead to the width of the spar itself being *less* than that number. If you want to counter that effect, you can tick the option “*Real width*”. Obviously, doing so will make the cut-out wider as well.
7. “*Separate end width*” and “*Separate end height*” allows you to specify the width and the height of the spar at the last rib.
8. Options *Gap (fore)* and *Gap (aft)* specify how much wider than the spar the cut-out shall be. This is especially useful for spars which are placed in a sharp angle, in order to allow for a tension free spar insertion.
9. *Bottom* and *Top* tick boxes. Useful for defining helper spars in the aileron hinge area.
10. Data for the associated webbing:
 - *Width*, specifying the width of the webbing
 - *Type (None, Middle, In Front, Behind, Box)*, specifying which kind of the webbing you want to have
 - Place the webbing between or outside of the spars.
 - *From Rib / To Rib*, allows you to restrict the area of spar where the webbing is generated. If “*To Rib*” is set to zero, the webbing will extend until the end of the panel.

You can change any of the above values either by explicitly specifying a numerical value, by means of the small arrow buttons at the right side of the data fields, or by clicking into the data entry field and rotating the mouse wheel.

4.4.2 Joiners (Round and Cuboid)

A *joiner* spar is a special spar defining an element used to connect the two wing halves or two outer panels. This spar is, by definition, always at 90 degrees to the first rib. It is therefore not possible to specify a separate position for the end of a joiner spar.

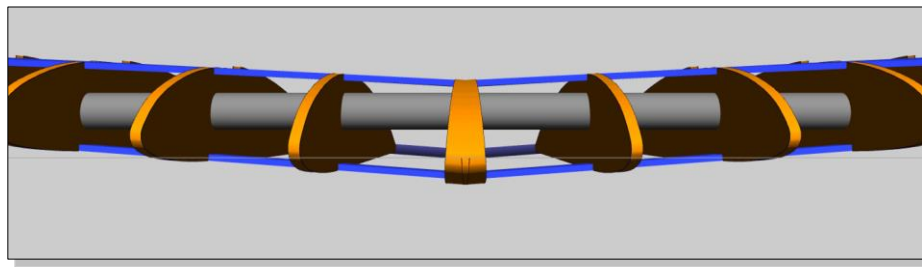


Figure 11: Straight connection between wing halves

As you can see on Figure 11, the joiner spar is angled according to the “*Dihedral*” parameter of the panel. This allows for a straight connection between the wing halves.

The dihedral angle is also considered for the joiners between the outer panels, not only for the joiners between the wing halves. To place a joiner between two outer panels, all you need to do is to define one joiner at the end of the first panel, one at the beginning of the second, and then to align them using the corresponding menu option. Fine-tuning of the joiner’s vertical position can be achieved by means of the parameter “*Offset Y Start*”. If you are using the joiner spars between outer panels, it is important to not forget to apply the corresponding modification to “*Offset Y Start*” to the joiners in both panels (Figure 12).

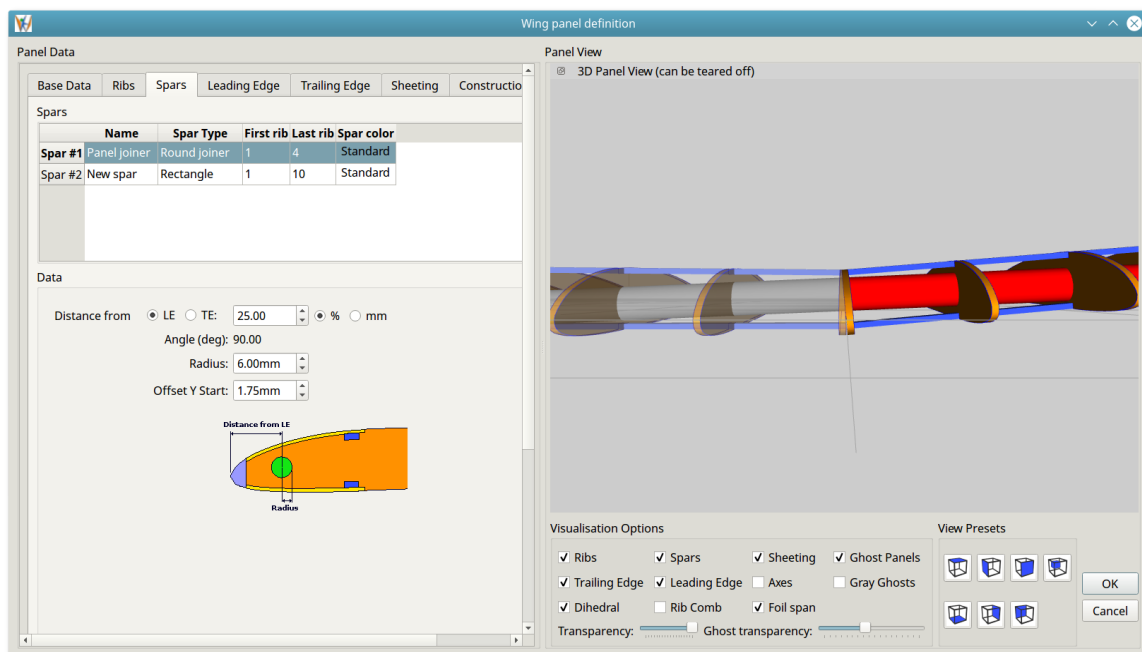


Figure 12: Joiner spar (round) between outer panels with non-zero dihedral

4.4.3 Round and Cuboid Spars

In addition to the parameters we saw in the discussion of rectangular spars, round and cuboid spars



comprise the following additional parameters:

1. *Radius* (round spar)
2. *Rotation* (cuboid spar)
3. “*Follow LE*” tick box (useful when defining the leading edge using a round or a cuboid spar for non-trapezoid wings)
4. “*Offset Y Start*” and “*Offset Y End*” for additional position adjustments at the beginning and at the end of the spar

While radius and rotation are self-explanatory, we would especially like to point out the “*Offset Y Start/End*” parameter, which supports you when defining leading edges using the round and the cuboid spars. How to do so is shown in the video tutorial linked at the end of this section.

4.4.4 Creating Ailerons

Starting with version 1.4, *Wing Helper* also supports automatic generation of ailerons. Ailerons are defined by means of as a special spar type, called “*Aileron Cutter (Simple)*”. The parameters specific to the aileron cutter spars are:

1. *Hinge above / below* specifies whether the aileron is going to be hinged at the upper or at the lower side of the rib
2. *Cut-off*: if ticked, the aileron will be shown as a separate part in the final DXF output. If this option is not ticked, the rib and the aileron will remain connected. The lines along which the aileron will need to be cut off after the panel is built will still be clearly indicated
3. *Alpha / Beta*: angles towards LE and TE at which the aileron is to be cut off
4. *Width* specifies the distance between the rib part and the aileron part at the hinging point
5. *Cut* specifies, in percentage of the rib height, how far the aileron spar webbing is to cut into the rib. This parameter is only important if *Close (LE)* or *Close (TE)* is also ticked
6. *Close (LE/TE)* and the associated parameter *Width* define the spar webbing to be applied where the aileron is cut-off.

Figure 13 depicts a panel with two automatically generated ailerons, one cut-off from the rib, one still attached to it.

4.4.5 Aligning Spars Over Multiple Panels

Right-clicking at an existing spar in the spar table opens the context sensitive menu shown in Figure 14. At this point, we especially want to point out the option to align the spar to another spar in the previous or in the next panel. This function also considers the “*Offset Y*” setting, which makes it very useful when there is a dihedral angle between outer panels.

Other options in this menu are demonstrated in the video tutorial.

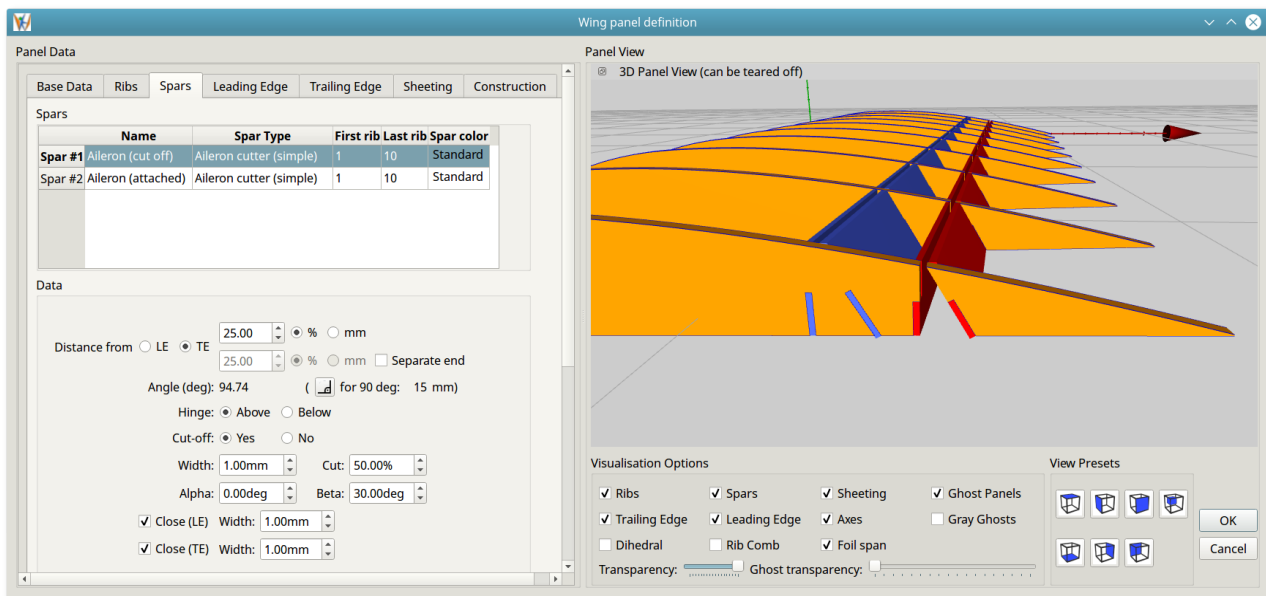


Figure 13: Automatic aileron generation

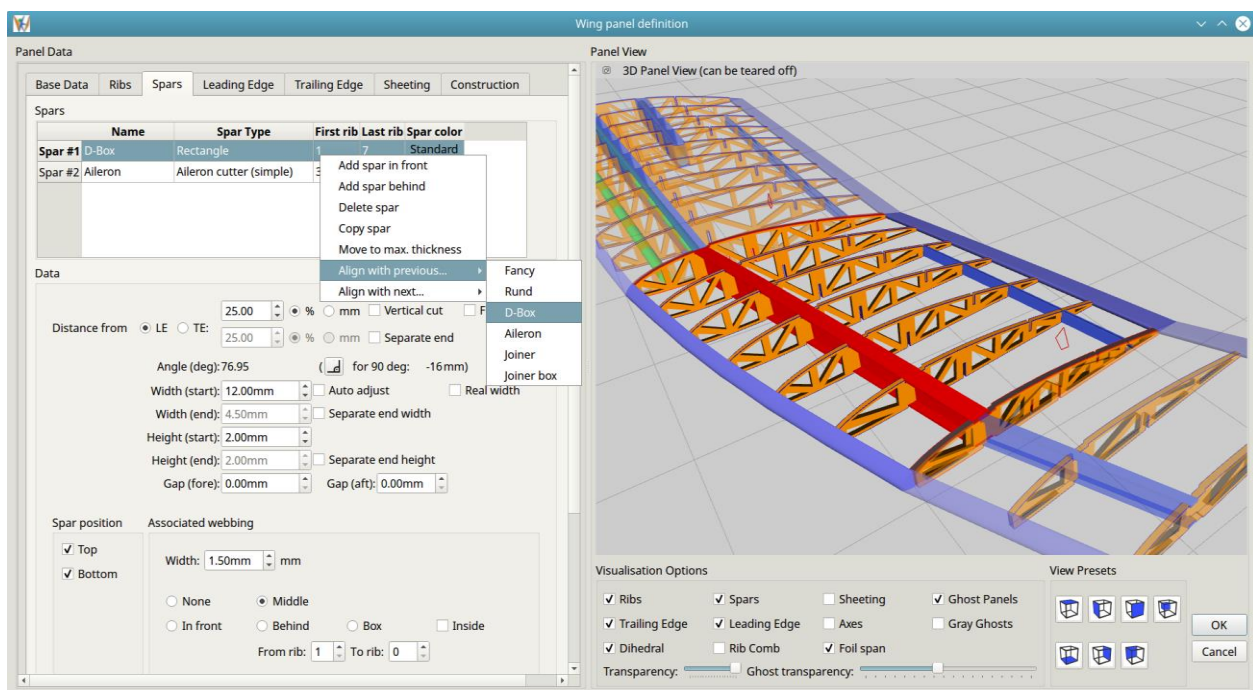


Figure 14: How to align a spar to one in another panel



Please find the video tutorial for this section at [You Tube \(Tutorial 3\)](#)



4.5 Leading and Trailing Edge

At the time being, the wing leading and trailing edges are restricted to the simple “*standard*” types. For both the leading as well as for the trailing edge, it is possible to define the depth. In addition to that, you can specify that the depth of the trailing edge shall automatically change with the rib length – just as with the spars (see option “*Auto adjust width*”).

You can also define additional types of leading edges using the properly placed round and cuboid spars:

1. Round leading edge: a round spar, correctly placed using the positioning and the “*Offset Y Start/End*” parameters,
2. Strip leading edge: a cuboid spar, correctly placed using the positioning and the “*Offset Y Start/End*” parameters, and
3. “Diamond” leading edge: like the strip leading edge, but in addition rotated at 45 degrees.

How to define a round and a diamond leading edge is shown in the following video tutorial.



Please find the video tutorial for this section at [You Tube \(Tutorial 4\)](#)

4.6 Sheeting

Wing Helper 1.4 supports two different kinds of sheeting definitions: “Standard” and “Advanced”.



Please note, that the “Standard” sheeting is deprecated and might cause undesired effects especially when applied on non-trapeziod wing forms. This option shall be removed in later versions of Wing Helper.

4.6.1 Standard Sheeting (Deprecated)

A standard sheeting starts at the leading edge, and stretches a specified distance towards the trailing edge. In addition, you can let the sheeting stretch all the way towards the trailing edge for a defined number of ribs.

The options include the following settings:

1. Length of the sheeting, measured from the leading edge. Specified in percent of the rib length



or in mm.

2. Thickness
3. The last rib until which to extend the sheeting all the way to the trailing edge
4. Tick boxes for partial sheeting (top / bottom)

4.6.2 Advanced Sheeting

Advanced sheeting is defined as a set of *sheeting strips*. Sheeting strips are defined in a table, by means of a context sensitive menu, just like the spars. Figure 15 shows all parameters which can be set for a single sheeting strip:

1. Reference point for the start of the strip. This can be either the leading or the trailing edge.
2. Distance from the reference point to the strip at the beginning of the strip (in percentage or in millimeter)
3. Distance from the reference point to the strip at the end of the strip (in percentage or in millimeter). This parameter is optional.
4. Length of the strip (in percent or in millimeter) at the beginning of the strip.
5. Length of the strip (in percent or in millimeter) at the end of the strip. This parameter is optional.
6. Thickness of the strip
7. Tick boxes for partial sheeting (top / bottom).
8. Tick box specifying whether this strip is a “normal” sheeting strip or a cap strip.



Please find the video tutorial for this section at [You Tube \(Tutorial 5\)](#)

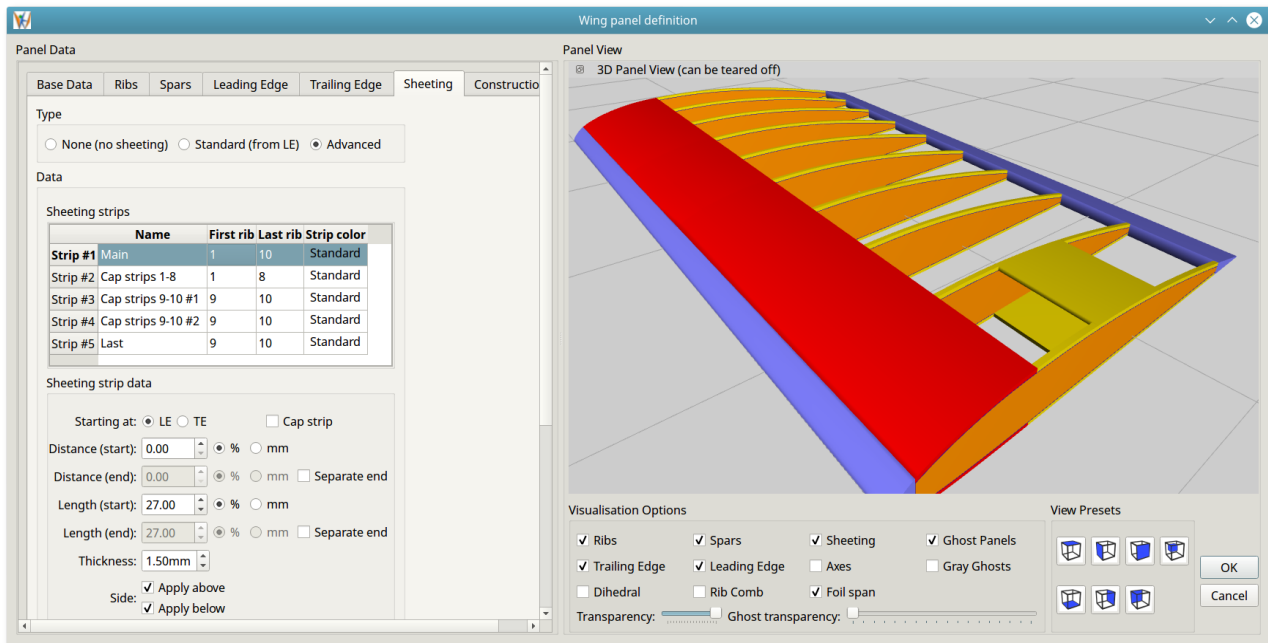


Figure 15: Advanced Sheeting

4.7 Construction Helpers

Wing Helper provides a set of construction helpers, supporting the build process and helping you reduce the weight of the final product.

4.7.1 Rib Comb

Rib combs are defined in a table, just like the spars or the sheeting strips. You will find your rib combs also in the final DXF output.

Although the rib combs are thought as elements to assist you during the construction and building of your wing, you can also use them as an additional kind of spar webbings. Rib combs also carry an adjustable “*slit*” (or “*notch*”), to help you to cut-off the extra part of the comb after the wing is built.

Figure 16 shows all available rib comb parameters:

1. Position of the comb. We already know this parameter block from the spar definition area.
2. Width of the comb.
3. Height of the comb (“*Extend*”). Here you can either specify the height yourself, or select one of the following options:
 - “*As building tabs*”, which aligns the height of the comb with the height of the building tabs. When ticked, the value entered in the “*Extend*” box is disregarded.
 - “*Leveled*”, which is like “*As building tabs*” but also respects the additional offset specified in the “*Extend*” parameter. You can use the “*Leveled*” parameter to align the rib combs



over multiple panels, provided the dihedral angle is constant.

4. *Gap (fore)* and *gap (aft)* specify how much wider than the comb the rib cut-outs need to be. This is especially useful when your comb is placed at a very sharp angle, to allow for a tension free comb insertion.
5. *Needle adjustment* specifies the width adjustment for the comb needles relative to the maximal possible width. This is also an option mainly useful when your comb is placed at a sharp angle.
6. *Slit height* defines the height of the slit.
7. *Slit adjust* defines the width of the slit.

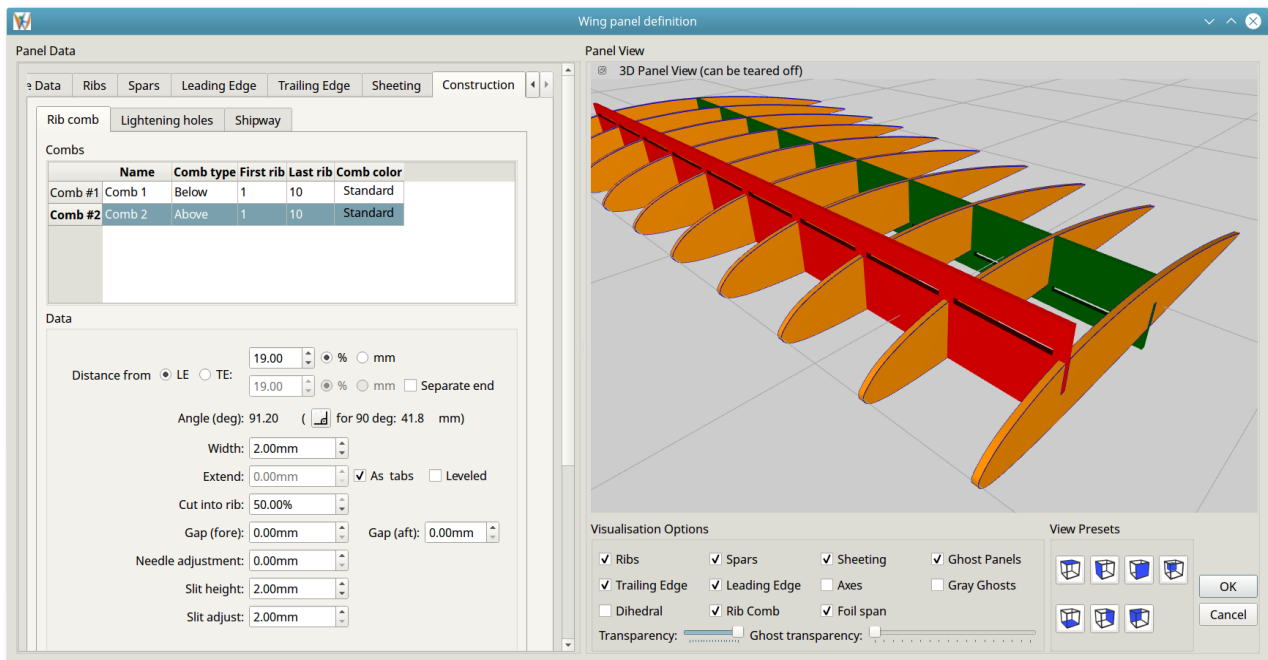


Figure 16: Rib Combs

4.7.2 Lightening Holes

New in version 1.4, *Wing Helper* also allows you to automatically add lightening holes to your ribs. The placement of the holes can be influenced by the parameters shown on Figure 17. All necessary exceptions due to spars, sheeting, leading / trailing edges, and similar, are automatically considered by the program.

Lightening holes can be either simple rib cut-outs, or they can also carry additional structural enforcement (struts) building a series of triangle-like cut-outs.

Please note, that the lightening hole parameters are only to be seen as a guidance for the program. This means, even if you define the minimal distance between lightening holes as 5mm, the actual distance can vary slightly due to the parameters specified in the “*Round corners*” section.

Rounding up the corners in triangular lightening holes is currently not supported.

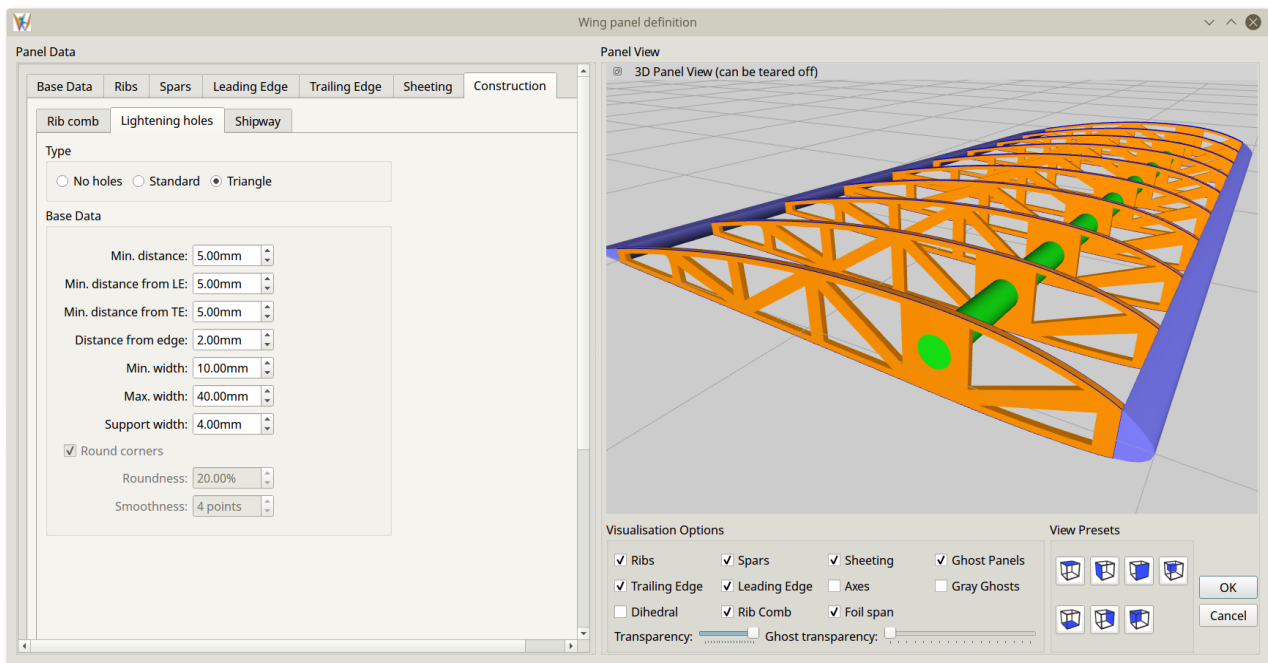


Figure 17: Lightening Holes



Please find the video tutorial for this section at [You Tube \(Tutorial 6\)](#)

4.8 Adding Further Panels

While you can let your creativity soar during the definition of the first panel, adding further panels is usually a more involved task. The root rib of the second panel will most certainly need to be of the same length and airfoil as the tip rib of the first panel, the tapering and the sweep will usually be in line with the first panel, and it is very probable, that the spars will also have similarities – the spars reaching the tip rib of the first panel will in most designs also extend into the next panel.

While all these parameters can be set manually, *Wing Helper* supports you in this tedious process by offering to create the new panel as a copy of the previous one. If you don't want to make a copy of the previous panel, the new panel will be created as a “default” panel, with predefined number of ribs, rib distance, and rib weight. The sweep parameter will be taken from the previous panel. The first rib of the new panel is automatically adapted to the last rib of the previous one (length, airfoil).

If you allow the program to create the second panel as a copy of the first one, you will be offered



additional options shown in Figure 18:

1. Direct (1:1) Copy

This option makes a direct 1:1 copy of the previous panel, with only the basic modification set described above (sweep, root and tip rib length, airfoil). All spars are copied verbatim, as they are defined in the first panel.

2. Mirror Copy (only spars at the connection rib)

This option only copies the spars from the previous panel which are extending all the way to the last rib. In other words, it mirrors the spars around the rib connecting the panels. All other parameters are handled the same way as with the option 1.

In some cases, especially if a spar has a “*Separate end*” option selected, the copied spar will be aligned properly, but it will not exactly be mirrored (i.e. the angle of the new spar will not be the same as the angle of the original spar). If you wish to have the new spar at the same angle as the original spar, you will need to adjust the end position of the new spar accordingly, either manually, or by means of the function “*Align spars*” described in Section 4.4.5. The previous and (if available) the next panel are shown as “*ghost panels*” to give you a better visual control of what you are doing.

3. Smart Copy

This option is a combination of the above two: the spars reaching the last rib of the first panel are mirrored, other spars are copied as they are. All other panel parameters are handled as in the previous two options. What was said about the option “*Mirror Copy*” also holds here.

Most probably, option 3 (Smart Copy) will be the one used most frequently.

While these options greatly simplify the design process, please bear in mind, that it is important to always carefully examine the results of the copy operation, to make sure everything is just as you need it to be – especially if you are defining a non-trapezoid wing.

If, despite all your manual adjustments, the spars are not placed exactly as you need them, *Wing Helper* also provides the function to align them automatically, including the “*Offset Y*” parameter. This function is particularly useful when defining the joiners at outer panels. Please consult Section 4.4.5 for details.

4.8.1 Airfoil Spanning Multiple Panels

If you wish your airfoil to span multiple panels, with all intermediate airfoils interpolated, you can instruct Wing Helper to do so by means of the menu item *Edit* → *Airfoil Spanning* in the main window. Selecting this menu item will open a dialog, where you can select the course of airfoil interpolation. Setting a tick mark between the two panels overrules the corresponding airfoil selections done in the panel edit dialog (see Figure 3, red number 10).

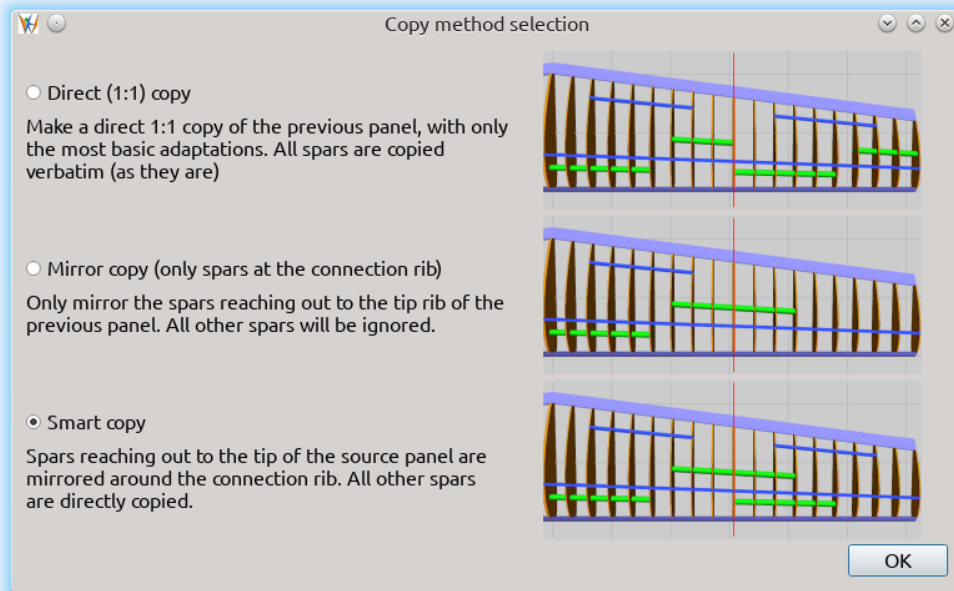


Figure 18: Copy method selection



Please find the video tutorial for this section at [You Tube \(Tutorial 7\)](#)



5 Non-Trapezoid Wing Forms

Wing Helper's base design philosophy revolves around definition of wing as a series of trapezoid panels, which allows for a very easy and straight-forward work-flow. Once the wing as a series of trapezoid panels is defined, you can also give it a nice curved look. Here is how to do it:

1. In the main window, choose the tab "*Planform*" to activate the appropriate view. Now you should see the top view of your wing, correctly considering all dihedral angles.
2. In the main window menu, choose "*Edit → Load Planform Image*". Select an image (silhouette of your wing) and press OK to load it. The silhouette must have the leading edge pointing upwards.
3. Right-click on the loaded image to activate the context menu and select "*Set background image anchor*" option. Now left-click on the foremost point (the "*nose*") of the root rib in the background image to place the "*anchor point*". This anchor point will later be used to move and scale the image to fit the position and the size of the wing.
4. Right-click again to activate the context menu, then select "*Move background image*" option. The image now follows your mouse movements. Place the image anchor point defined in the previous step at the upper left point of your wing (nose point of the first rib).
5. Zoom out to see the entire picture, then select the option "*Scale background image*". Now left-click at some point in the background image and move the mouse. You will see the image being scaled. Once the size of the background image matches the size of the wing correctly, press the left mouse button again to finish the operation. *Wing Helper 1.4* also introduces the option to scale the background image using one of the measurements placed previously. Please see the video tutorial linked at the end of this section for further details.
6. Make sure that all panels are well aligned with the image. If they are not, adjust the panel data in the corresponding panel edit dialogs accordingly⁷.
7. In the context menu, select "*Modify rib*". Now you can move the points on the leading respectively on the trailing edge of every rib so that the ribs match the background image by selecting the point to move, moving it, and finally placing it to the new location by means of a left mouse click. The command "*Modify rib*" does not need to be activated separately for each new rib; once it is activated, it stays active until either another command is issued, or the user presses the "ESC" button.

After all ribs are adjusted, we recommend that you double-check the positions and the parameters of all elements (spars, rib combs, sheeting strips, and so on) in the wing. Please bear in mind, that while trapezoid panels are perfectly straight-forward to define, non-trapezoid ones are more involved and

⁷ The panels themselves (i.e. the first and the last rib in a panel) can't be modified in this view, only the ribs within a single panel can be adjusted so that they match the background image correctly. If you need to modify the first respectively the last rib within a panel, you can do so by changing the panel parameters as described previously.



Wing Helper 1.4

might call for some planning in advance.

Figure 19 and Figure 20 are showing the top view of our example wing before and after the application of the above procedure.

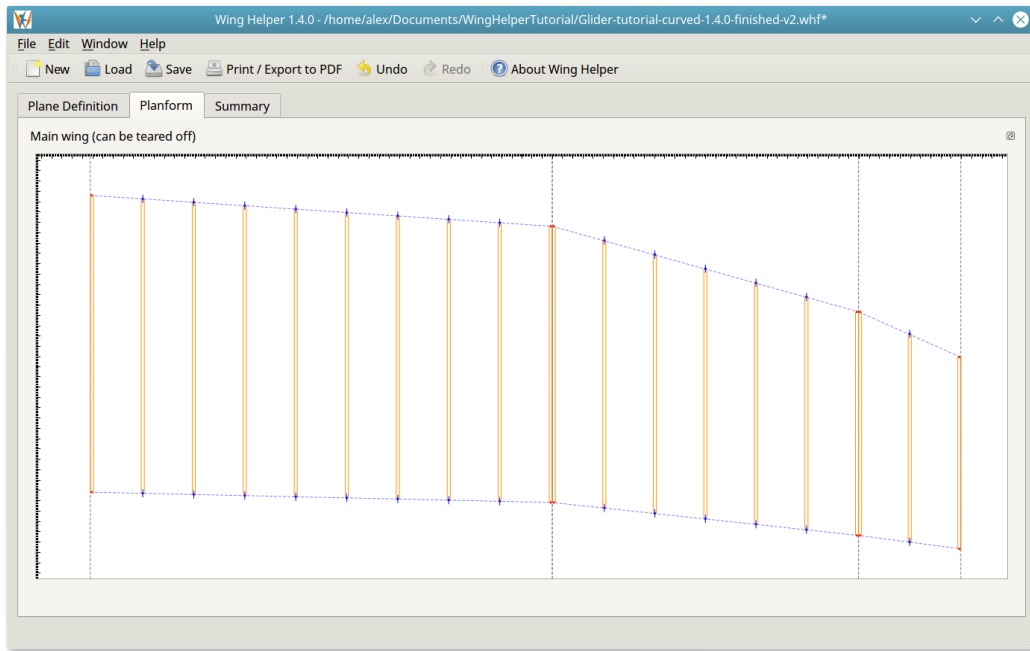


Figure 19: Wing as a series of trapezoid panels

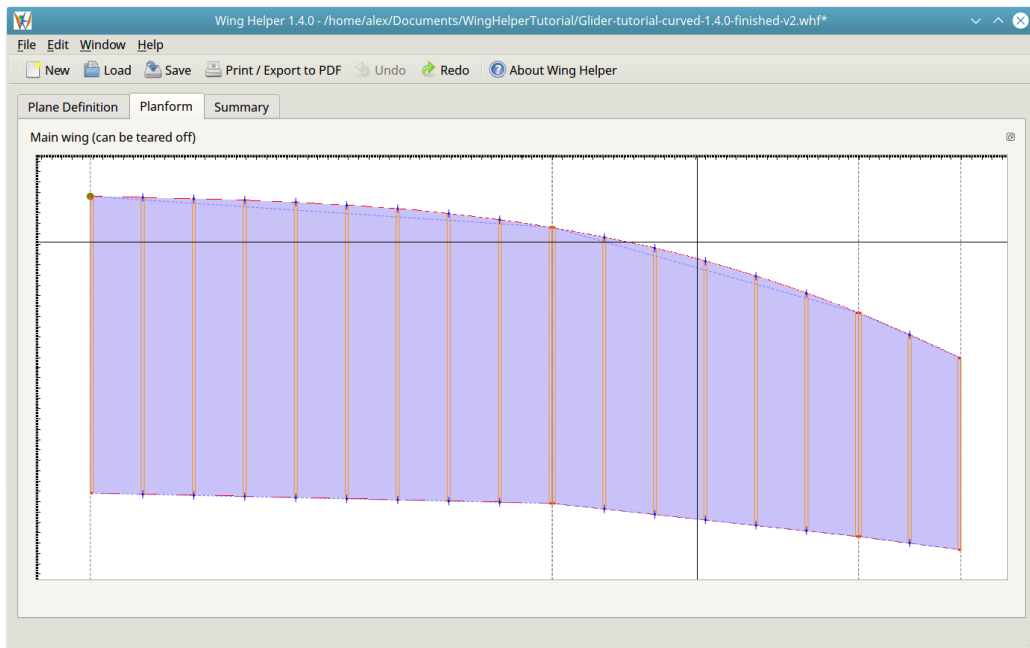


Figure 20: Curved leading edge, also showing the background image



During all the above operations, you can zoom and pan the view as usual without interrupting the command being executed.



Please find the video tutorial for this section at [You Tube \(Tutorial 8\)](#)



6 Airfoil Management

If you don't like any of the 1500+ standard airfoils included in the distribution, if you can't find exactly that one you were hoping for, or if you like experimenting with your own airfoil designs, *Wing Helper* offers you the possibility to import or manually define additional airfoils. Imported and manually defined airfoils are stored in a user specific location on your hard disk, which is different for different operating systems:

- Windows:

C:\Users\[user name]\AppData\Roaming\WingHelper\importedFoils

- Linux:

~/.local/share/WingHelper/importedFoils/

- OSX

/Users/[user name]/Library/Application Support/WingHelper/importedFoils

Each airfoil imported into the *Wing Helper* or manually created is stored into one separate file in this directory. The name of that file is specified during the import resp. during the creation of the airfoil.

If you don't want to create a completely new airfoil, but rather to modify an existing one, please start by re-importing that existing profile. By doing so, you are creating a copy of the original profile, which you can then adapt according to your needs. All standard airfoils can be found in the location where the *Wing Helper* is installed, in the sub-directory *resources/foils_v2*. The airfoils in that directory are slightly modified, so that they also include a line containing the airfoil characteristic. Despite that, the import is still going to work properly.



Please do not edit or modify the airfoils directly in the standard *resources/foils_v2* directory! If you wish to modify one of the standard airfoils, first import it using the import function described in this section, and then apply your changes to that newly imported copy.

In *Wing Helper 1.4*, airfoil management was completely revamped, offering a huge improvement in functionality. Figure 22 shows the new *Manage Airfoils* window, with the following options:

1. Create a new airfoil manually (*Wing Helper* provides a template airfoil to start from)
2. Import an existing airfoil in DAT or in COR format, with the option to automatically smooth-out the points on the front portion of the airfoil (the airfoil nose)
3. Modify an imported or manually defined airfoil's thickness in the range between 0.1 (10%) and 2 (200%)



4. Search through the list of previously imported or created airfoils and delete the ones you don't need any more

The import function supports files in the standard DAT or COR format. The first line in a DAT file contains the airfoil name, while the following lines are the same for DAT and COR files – they simply contain the (x, y) coordinate pairs, in the range [0, 1] (0 being the nose of the airfoil), starting from the airfoil tail and moving counter clock-wise:

```
CLARK Y AIRFOIL
1.000000 0.000599
0.990000 0.002969
0.980000 0.005333
[...]
0.012000 0.017858
0.008000 0.013735

0.004000 0.008924 ← The front ("nose") point
0.003552 0.008276
0.003121 0.007628
[...]
0.980000 -0.001334
0.990000 -0.000967
1.000000 -0.000599
```

If you attempt to define an airfoil with a name which is already in use, you will be prompted to enter for a new airfoil name. If you try to store the imported airfoil into a file which already exists, you will be asked whether you wish to overwrite that file.



Please note, that after you change, delete, or in some other way modify one of the airfoils directly in the airfoil directory, it is recommended to restart the *Wing Helper*, so that the airfoil list can be properly updated. If you make your changes from within the *Manage Airfoils* window only, there is no need to restart *Wing Helper*.



If you delete an airfoil which is used by another *Wing Helper* file (*whf*), you will still be able to load your file, but the deleted foil will be replaced by:

- **Default (Clark Y) airfoil if it is a root rib airfoil, respectively**
- **Empty airfoil, if the unknown airfoil is at the tip of the rib (i.e. the tip rib airfoil will become the same as the root rib airfoil)**

In the first case, the name in the *Foil* column in the panel table will be changed as shown on Figure 21.



Wing Panels			
	Name	Foil(*)	Length(*)
Panel #1	Innen	Blue-1 (not found, defaulted to CLARK Y AIRFOIL)	520
Panel #2	Neuer Abschnitt	Blue-1 (not found, defaulted to CLARK Y AIRFOIL)	482

Figure 21: Airfoil not found

Figure 22 shows the *Airfoil Management* window. The main portion of the window holds the airfoil to be modified (in this case, it's the template airfoil you receive when you press the “New” button) and the list of functions available for airfoil modification (mouse right-click). On the right side of the window, you see the list of all airfoils imported or created by you. A right-click on one of the airfoils in that list offers you the possibility to delete that airfoil.

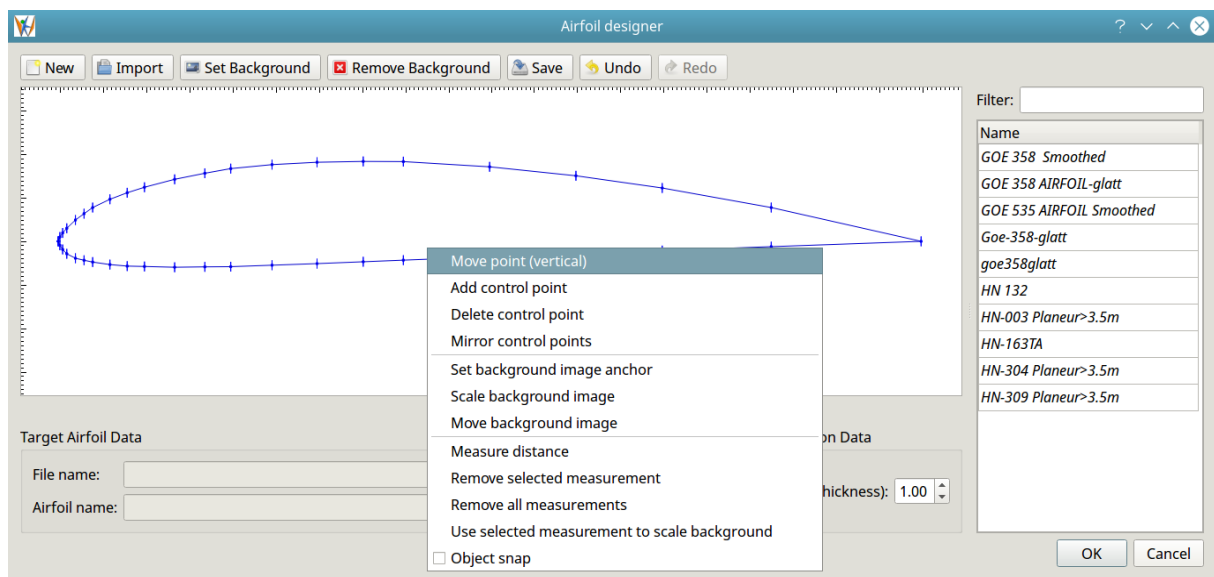


Figure 22: Airfoil management window

The main drawing area and the functions shown here work the same way as for the planform editing (see Section 5). For a detailed explanation of how to use the Airfoil Management function, please refer to the video tutorial.



Please find the video tutorial for this section at [You Tube \(Tutorial 9\)](#)



7 Exporting your design

Once you are happy with your design, you'll want to bring it to the paper, or - if you possess a milling machine or a laser cutter - into a suitable file format. *Wing Helper* offers you four export targets: PDF, DXF, SCAD and ICE. If you wish to send your creation directly to the printer, all that we say about the PDF export in the remainder of this section will also apply to printing.

The graphical formats PDF and DXF are useful for different purposes. While ribs printed on paper or exported into a PDF file will probably be more useful for modelers who want to cut them by hand, the DXF export will be important if you wish to send the ribs to some sort of a cutting machine or if you wish to introduce further modification in an external CAD program.

In addition to that, starting with the version 1.4, you can also export the data into ICE (suitable for 4-axis CNC wire cutters) and SCAD (3D) formats.

Here is the complete overview of the functionality supported for different output formats:

1. DXF⁸ export contains (Figure 23):
 - Top view of the wing
 - Ribs with all modifications applied and with building tabs.
 - Nose (leading edge) checking templates.
 - All spars of type “*Rectangle*” and “*Webbing*”, regardless if they are stand alone or associated with a rectangular spar.
 - Rib combs
 - Aileron shear webs
2. PDF export contains (Figure 25):
 - Ribs with all modifications as defined through spars, leading edge, trailing edge, rib comb and sheeting. Ribs which don't fit on a single page will be split over multiple pages. The PDF output also shows a raster of light gray lines spaced at 1cm⁹, which you can use for cutting out the building tabs. The raster will also be visible on the wing top view, which helps you to place the ribs where they belong. If building tabs are defined, they will also be indicated as properly placed red rectangles.
 - Nose (leading edge) checking templates
 - Table with all dihedral angles and tip distances. The values in this table will help you place your wing panels into the correct position before gluing them together.
 - Top wing views (left & right wing), including the ribs with the corresponding 1cm raster of helper lines, spars, leading and trailing edges.

⁸ Different element types are placed on different layers in the DXF file

⁹ Please cut the building tabs all the way down to the rib bounding box (dashed lines), to ensure all ribs within a panel will be properly aligned.



3. SCAD (Figure 24)

- 3D format supported by the open source program [OpenSCAD](#). From there, you can then further export it into STL, which is supported by a majority of 3D modelling programs, such as e.g. [Blender](#).

4. ICE (Figure 26)

- A program for control of the 4-axis CNC wire cutters.
- See [here](#) for further details (*German web page only*)

While ICE is not a very widely spread format, it was an obvious first step for the Wing Helper in the direction of G-Code export, due to the excellent support by the author and due to the popular request by *Wing Helper* users. In near future, we are planning to introduce additional G-Code output formats (NC)

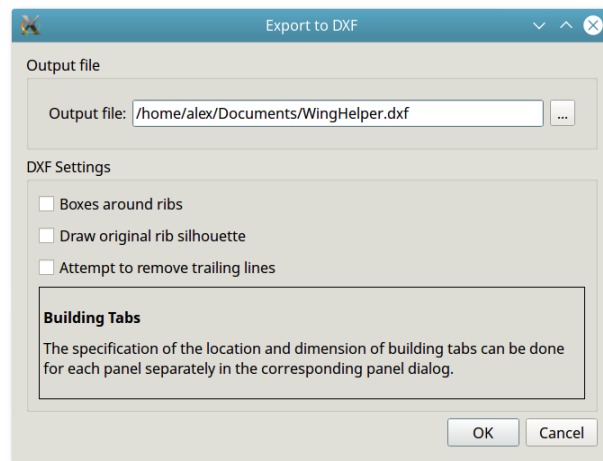


Figure 23: DXF Export

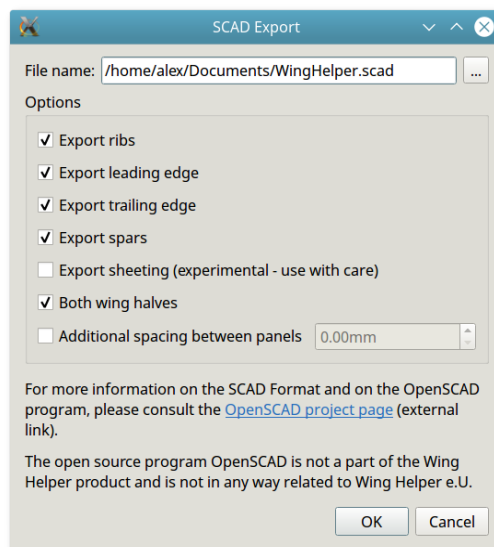


Figure 24: SCAD Export (3D)

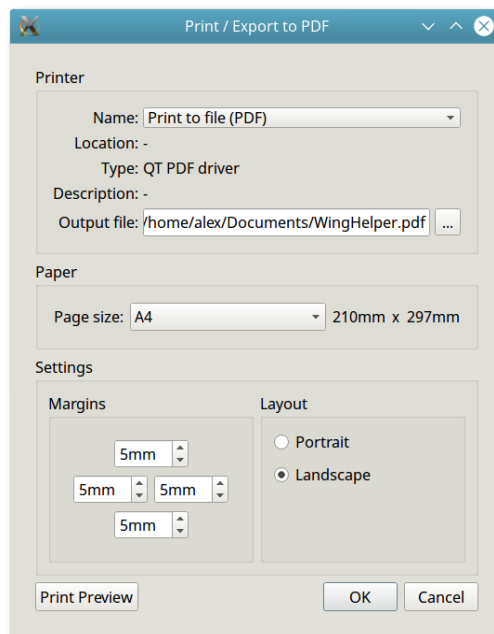


Figure 25: Printing and PDF Export

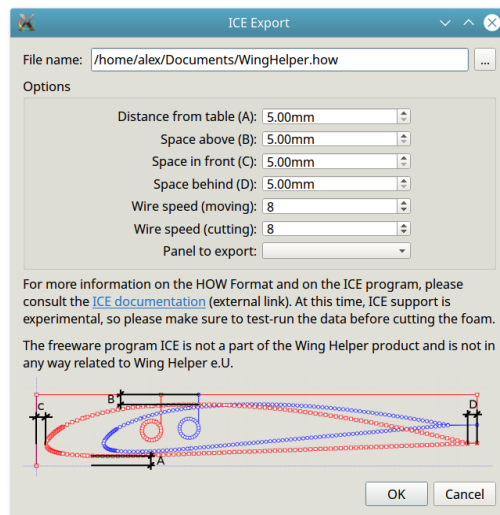


Figure 26: ICE Export



Please find the video tutorial for this section at [You Tube \(Tutorial 10\)](#)



Please make sure, that your printer margins are all set to 0 before actual printing!
The margins are specified in the Wing Helper's *Print / Export to PDF* dialog already, having them also specified in the printer settings will result in the printed output being smaller than it should be.



8 Roadmap / Future Extensions

Wing Helper aims to become a full-scale CAD program for RC planes, covering all steps in the design process. The exact roadmap will also in future strongly depend on feedback and inputs we receive from our customers. Already during the beta test phase for the version 1.0, the functionality was extended far beyond what was initially planned. This great communication has continued during the development of further versions, giving the *Wing Helper* a considerable functionality and usability boost. We are looking forward to continuing this fruitful cooperation and we invite you to let us know what you need and what you expect from *Wing Helper*!

The current plan for the evolution within the next *Wing Helper* versions includes, in order of votes received so far, the following topics¹⁰:

- Further extension of the G-Code support for 4-axis hot wire cutting machines
- Half-ribs
- Servo bays
- Attaching additional notes to wing elements
- “Settings” dialog
- Undo / Redo functionality for the panel editor
- Improvements to the planform editor (e.g. Splines)
- ... and many more!

In further future, we plan to extend the focus on airplane parts other than the main wing: fuselage, horizontal / vertical stabilizers (empennage), interface to programs for calculation of airworthiness (e.g. XFLR5), and so on.

The most recent information about the roadmap, current and future developments of *Wing Helper* will always be published on our web site <https://www.winghelper.com/>, as well as on our Facebook site <https://www.facebook.com/winghelper/>.

¹⁰ Please note, that this list is work in progress. It might change at any time at our discretion and without notice. The most recent version of this list can be found on the web page <https://www.winghelper.com/>, under the menu point “Future Extensions”



9 Tips and Tricks / Frequently Asked Questions

In this Section, we present some tips and tricks, as well as answers to the most frequently asked questions.

Multi-panel wings

Please be aware, that wing panels are meant to be built one-by-one instead of all at once. For that reason, both the building tabs as well as the combs are not guaranteed to be at the same height for different panels. In case of combs, you can manually adjust them to be at the same height over different panels provided the dihedral angle between them remains at zero (see option “*Leveled*” in the combs section). For building tabs, such an option currently does not exist.

We suggest that you split the wing into panels only when necessary because of a change in the dihedral angle or because you want to segment the wing for easier transportation.

I am missing an element in the PDF output

The PDF output only provides the basic functionality. For complete functionality, please use the DXF output instead.

Why can't I change the length of the root and tip ribs in the “Planform” view?

Being able to change the length of the root or tip ribs in the planform view would influence the basic definition of the panel (sweep, root chord tip chord) and would therefore collide with the settings done in the “*Base Data*” section of the panel editor. Besides, it would most probably also disturb the positions of the spars, combs, and other wing elements, without the user being able to notice it at once. For these reasons, we deliberately kept these settings separated: the basic definition of each panel can only be changed in the panel editor, while the editor in the planform view allows you to apply advanced modifications to the looks of each panel.

I get strange effects when wing elements overlap or touch each other

Due to the way, geometrical modifications caused by wing elements are implemented in *Wing Helper*, it is important to make sure that no elements overlap. Usually it suffices to move the touching elements a tiny bit around or to adjust their length or width accordingly. Leaving a very small gap between two elements is better than allowing them to touch each other – small gaps are recognized and eliminated by the *Wing Helper* anyway.

Wing Helper is not working under a specific Linux distribution

While Linux is *Wing Helper*'s primary development platform, it is next to impossible to make sure that all different distributions out there will be properly supported. Prior to each release, we test the *Wing Helper* under following distributions:

- Ubuntu 14.04 LTS
- Ubuntu 16.04 LTS



Wing Helper 1.4

- Mint 17.3
- Mint 18.0

Usually, it's just a question of library dependencies, therefore sometimes it will suffice to remove one or more of the libraries which came with the *Wing Helper* from the *libs* directory. If you can't get Wing Helper to run on your preferred distribution, you might consider running it in a VM under one of the distributions mentioned above.

Please note, that as of Wing Helper 1.4, if you are using K Desktop Environment under Linux, the function *Print Preview* might not work properly.

I can rescale but I can't move the teared-off window under Linux

This is a known issue in the version of QT used for Wing Helper. A work-around is to press and hold the ALT key prior to trying to move the teared-off window around. We are planning to update the QT libraries in the next release of *Wing Helper*.

When will the support for fuselage be available?

We plan to start the design work in 2018. The date for the first version of Wing Helper supporting design of fuselage is not yet set, but we don't expect it to be earlier than 2019.



10 External Licenses and Programs

Airfoil data obtained with permission of the author from the site [Airfoil Investigation Database](#). The data on that site is, for the most part, obtained from the *UIUC Applied Aerodynamics Group*.

The Wing Helper application is implemented using the [QT application framework](#), licensed under the *GNU Lesser General Public License (LGPL)*. As required by the license, the libraries are linked dynamically and can be found in the *Wing Helper* installation directory.

Icons used in Wing Helper are provided as public domain by the [Tango Desktop Project](#)

Wing Helper includes software developed by the *OpenSSL Project* for use in the *OpenSSL Toolkit* (<https://www.openssl.org>). Please find the license [here](#).

Programs [ICE](#), [OpenSCAD](#), und [Blender](#), referenced in this document as export targets, are not a part of the Wing Helper product, and are in no way related to or associated with Wing Helper e.U.