planingRhino

Planing Craft Resistance plugin for Rhino3D

Manual
**(Version 1.0 / Windows Version)**

Installing *planingRhino* Plugin

1. Download your own copy here. You can try all the plugin features for 20 days for free. After the trial period you need to purchase a valid licence here.


2. After you download the installer file, double click its icon:
3. The installer's main window will appear. Follow the simple instructions presented to install your copy of planingRhino:

4. You are now ready to run planingRhino for first time. Open your Rhino3D application as usual. In case a planingRhino toolbar is not shown, you can setup the toolbar as follows: Right-click on your standard toolbar, select the 'Show Toolbar' submenu and click on rhinoPlaning. A new toolbar containing a planingRhino button will appear. You can drag and drop the new toolbar on your other toolbars in order to have it as a tab.
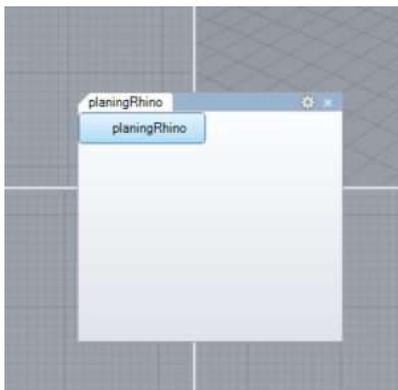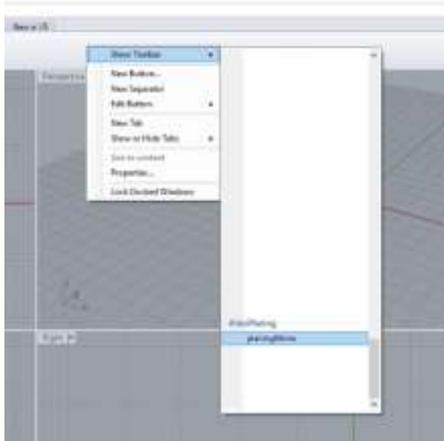

5. You can now click on the planingRhino button to view planingRhino's main window.
6. Alternatively you can type 'rhinoPlaningCommand' in the Rhino3D command line as follows (Rhino will autocomplete the command):
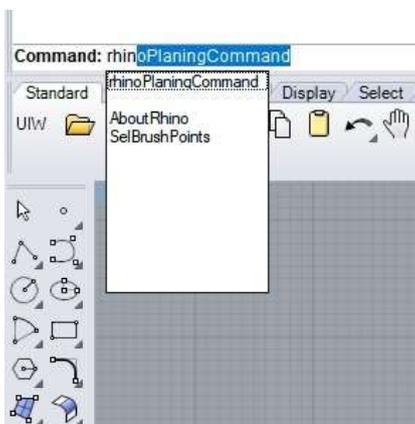
Using planingRhino Plugin

planingRhino plugin has a main window that is shown whenever the user clicks on the planingRhino button (located in the plugin's toolbar) or types rhinoPlaningCommand in the Rhino3D command line (Rhino will autocomplete the command):
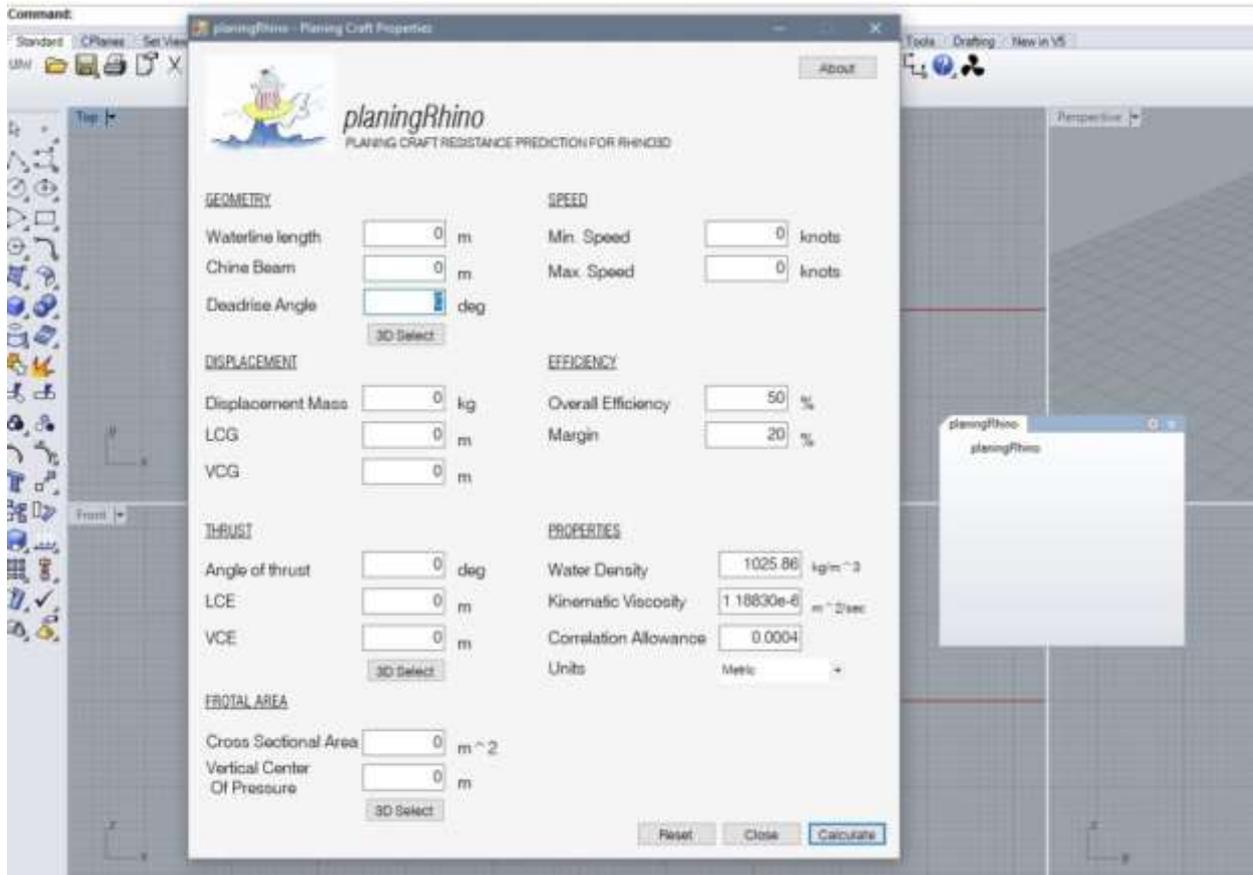

The user is required to complete the following parameters:

GEOMETRY

- *Waterline Length* (optional)
  The intersection line of the free water surface with the moulded surface of the hull. It is used to compute a Froude number for each speed to be evaluated. *rhinoPlugin* will compute resistance in case Waterline Length is not defined by the user but will not check for minimum speed validity.
- *Chine Beam* (mandatory)
  Maximum breadth over chines, excluding external spray strips.
- *Deadrise Angle* (mandatory)User can input the above values manually or let *planingRhino* to determine them from the hull geometry. In such a case, the user needs to have a 3D model of the hull loaded. By clicking on the '3D Select' button, the user is required to select the planing surface. If a valid surface is selected the Chine beam and Deadrise angle values are entered in the respective fields. The waterline length cannot be determined automatically by the geometry.

User is required to select only the planing surface (port or starboard side) excluding any external spray rails or chine flats. Model's centerline must have a transverse coordinate equal to zero (0). In other words hull's centerline must be on X world axis.
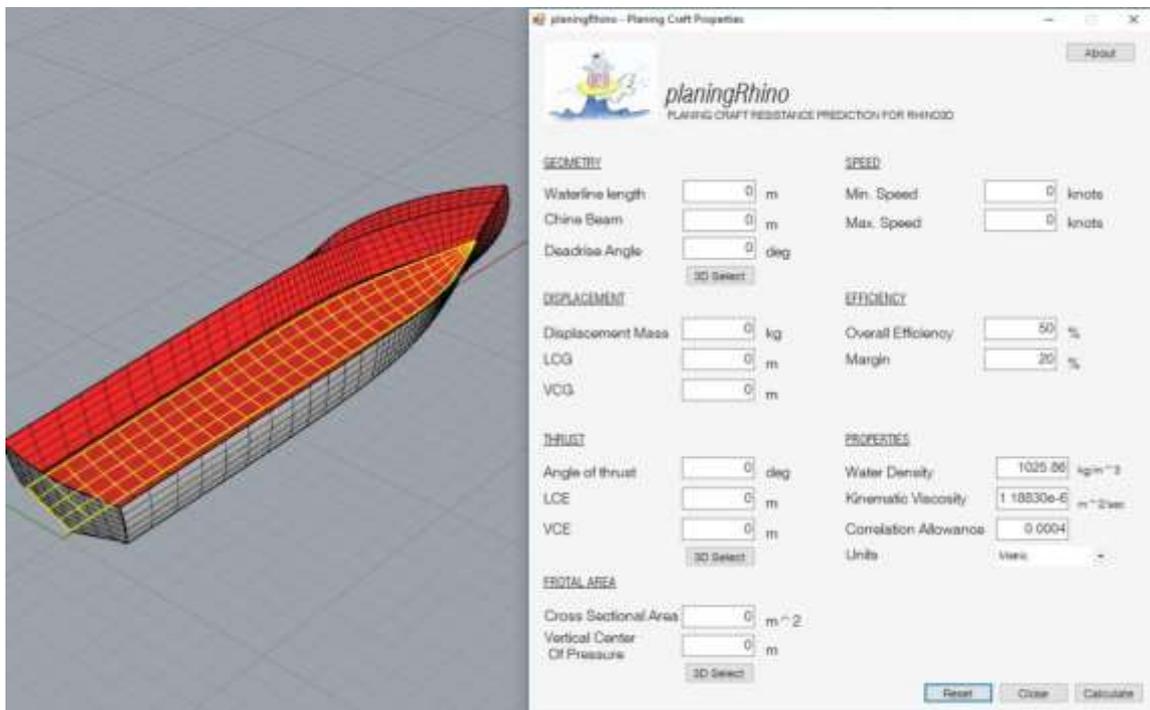

DISPLACEMENT

- *Displacement Mass* (mandatory)
  The total displacement mass of the vessel to be used for resistance calculations.
- *Longitudinal Center of Gravity - LCG (mandatory)*
  Longitudinal distance between the center of gravity of the vessel and the trailing edge of the planing surface.
- *Vertical Center of Gravity - VCG (mandatory)*
  Vertical distance between the center of gravity of the vessel and the keel.

THRUST

- *Angle of thrust (optional)*
  The angle of thrust line relative to base line or world-plane.
- *Longitudinal Center of Thrust Effort- LCG (optional)*
  Longitudinal distance between the propeller and the trailing edge of the planing surface.
- *Vertical Center of Thrust Effort- VCG (optional)*
  Vertical distance between the propeller and the keel.

User can input the above values manually or let *planingRhino* to determine them from the hull geometry. In such a case, the user needs to have a 3D model of the hull loaded and the thrust line drawn . By clicking on the '3D Select' button, the user is required to select the thrust line. If a valid line is selected the thrust angle, LCE and VCE values are entered in the respective fields.
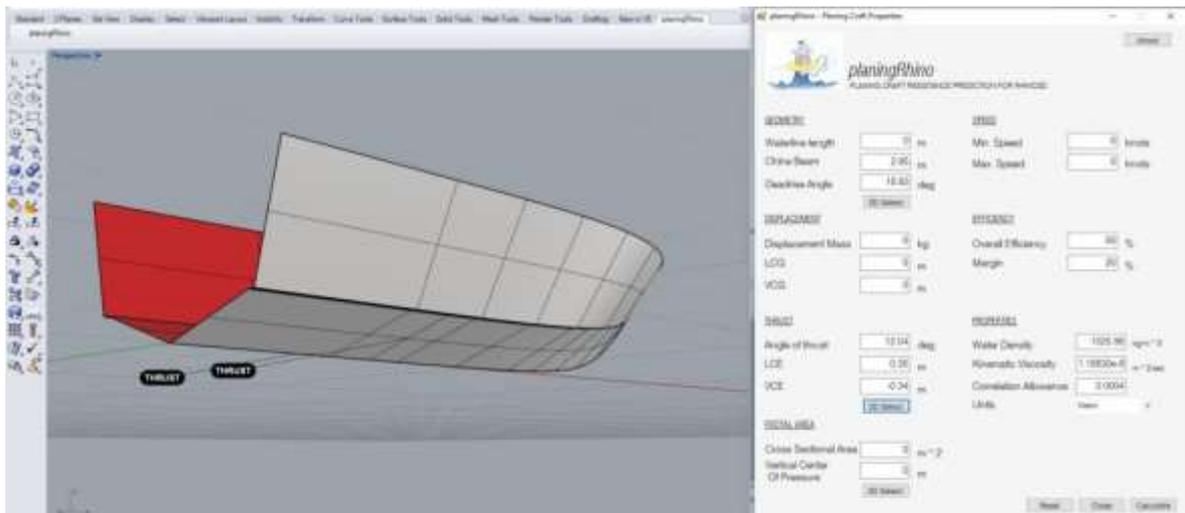
In case the thrust passes through the boat's center of gravity or the thrust angle, LCE and VCE are unknowns, the user can 'emulate' the Savitsky's short form resistance prediction method. In such a case, the user can set angle of thrust equal to zero (0), set LCE equal to LCG and VCE equal to VCG.

FRONTAL AREA

- *Cross Sectional Area* (optional)
  The cross sectional area of the superstructure and hull above waterline. When provided, *planingRhino* will estimate the aerodynamic resistance.
- *Vertical Center of pressure* (optional)
  The vertical distance of the cross sectional area's centroid (center of pressure) to keel. If a cross sectional area is provided but not a vertical center of pressure, planingRhino will add aerodynamic resistance to results but will not calculate the effect of air drag to the running trim angle.

  User can input the above values manually or let *planingRhino* to determine them from the model's geometry. In such a case, the user needs to have a 3D model of the hull and superstructure loaded defining the volume of the vessel, generally avoiding complexities. By clicking on the '3D Select' button, the user is required to select the model's surfaces. If a valid set of surfaces is selected the sectional area and vertical center of pressure values are entered in the respective fields.

SPEED

planingRhino will attempt to predict resistance for ten (10) speeds. User is required to define a minimum speed and a maximum speed to be evaluated. Minimum speed is checked so Froude number is greater that 0.5 (hull is at least at pre-planing mode). In case user defined minimum speed is less than required, minimum speed will be automatically overridden at the results. Maximum speed is the maximum speed to be evaluated. In case maximum speed is less than minimum speed, it will automatically set to be two times the minimum speed at the results.

EFFICIENCY

planignRhino will predict resistance (bare-hull and total) as well as effective power for each speed (maximum 10 speeds). The user can define the propulsive efficiency to be used for the plugin to calculate the total required power for each evaluated speeds. In addition the user can define an efficiency margin to be included in the final result. Typical values for Overall Propulsive Efficiency are within the range of 50-60%.

PROPERTIES

It is required the user to define the water density, water kinematic viscosity and friction correlation allowance. By default planignRhino will use salt water density, and typical values for kinematic viscosity and correlation allowance. User can override default values.

UNITS

planingRhino always use its own units, independently of Rhino3D model units. User can select Metric or Imperial units.

Metric
Length: Meters (m)
Area: Meters squared (m^2)
Angles: Degrees (deg)
Mass: Kilograms (kg)
Density: Kilograms per cubic meters (kg/m^3)
Kinematic Viscosity: Meters squared per seconds (m^2/sec)
Force: Kilo Newtons (kN)
Power: Kilo Watts (kW)

Imperial
Length: Feet (ft)
Area: Feet squared (ft^2)
Angles: Degrees (deg)
Mass: Pounds (lbs)
Density: Slugs per cubic feet (slug/ft^3)
Kinematic Viscosity: Feet squared per seconds (ft^2/sec)
Force: Pounds (lbs)
Power: Horsepower (hp)

Speed is always in knots (kts).

User can use either the metric or imperial system by selecting his/her preference using the drop-down menu provided. Values already provided will not be converted from one system to the other. User is responsible to check that his/her values correspond to the selected unit system. Whenever user uses the '3D Select' button to automatically calculate/estimate values from geometry, *planingRhino* will convert model-units to *planingRhino* units. If for example user has selected 'Metric' and his 3D model uses Imperial/Inches, *planingRhino* will convert inches to meters. If the user has selected 'Metric' and his 3D model uses Metric/Centimeters, *planingRhino* will convert centimeters to meters.

RESULTS

After providing all the required data, user can click on 'Calculate' button to view the results. Results are shown on a separate window. User can keep a result-window, adjust input on main window and click on 'Calculate'. In such a case a new result-window will appear.
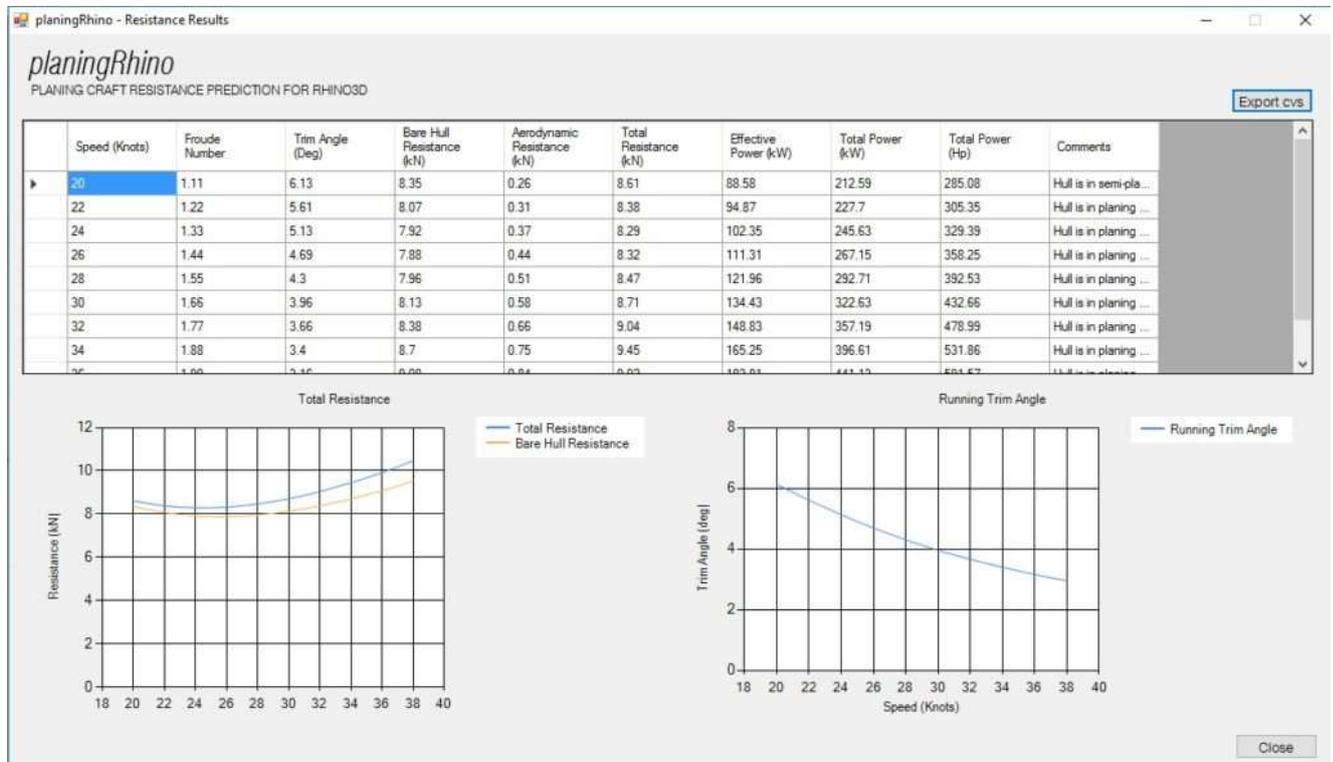
Results window contains a spreadsheet-like area where results are shown on a tabular form. User can copy and paste data to other software as usual. Results contain the following for each speed planingRhino evaluated:

- Speed in knots
- Froude number (if waterline length was provided)
- Trim Angle in deg. (Dynamic trim angle - angle of keel relative to static waterline)
- Bare Hull Resistance in kN or lbs
- Aerodynamic Resistance in kN or lbs
- Total Resistance in kN or lbs
- Effective Power in kW or Hp
- Total Power in kW or Hp (Metric results contain total power in both kW and hp)
- Comments including the 'speed mode' of the hull and warnings about the validity of the result. Generally *planingRhino* will attempt to calculate resistance with any input provided. However if input or calculated data are out of method boundary limits, a comment is shown.

Results window contains two graphs. A speed to resistance curve and a speed to trim-angle curve.

EXPORTING RESULTS

User can export results to a .cvs file to be viewed or processes in spreadsheet or other software. In order to export results, user can click on the 'Export cvs' button. A dialog will appear to save the .cvs file.

LOADING A LICENCE

You can download and use planingRhino for free for 20 days. After trial period expires, you need a valid licence to continue using planingRhino plugin. In order to check you licence status click on 'About' button located in the main window. A new window will appear with information about the version of the plugin. At the bottom of the 'About' window you can check the licence status, days left until your copy expires as well as licence information.
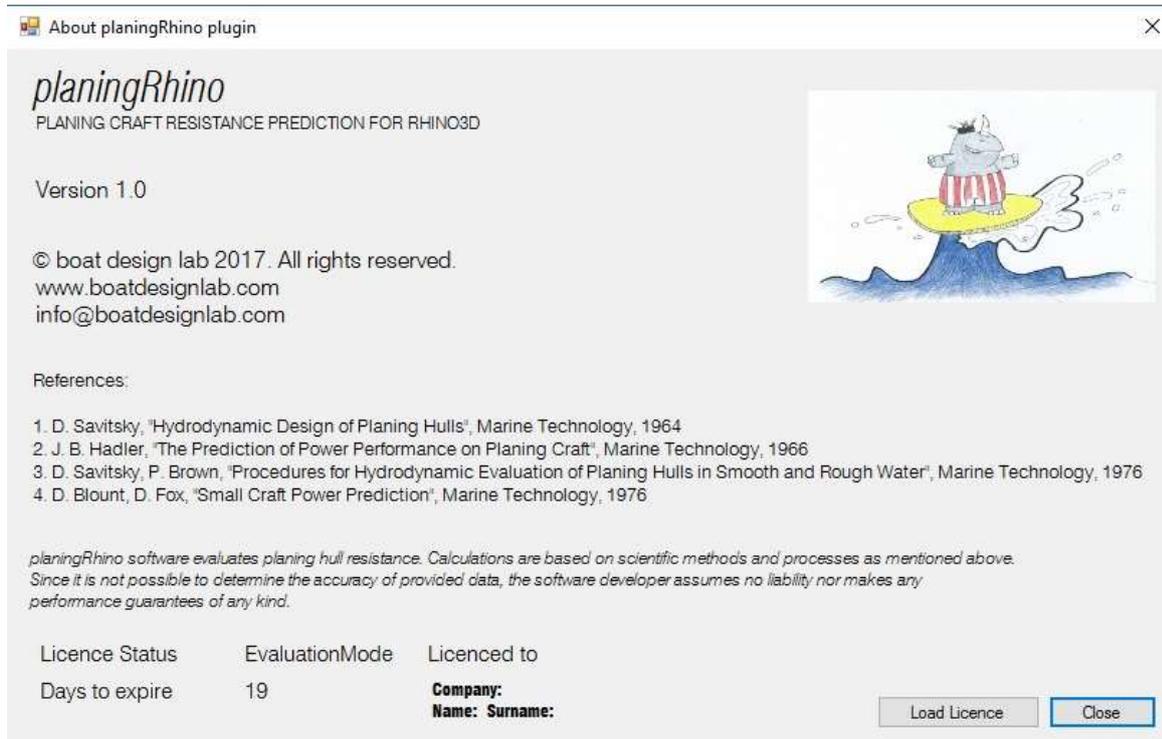
In order to licence your copy follow the following instructions:

1. Purchase a valid licence here
2. After successful purchase, a licence file will be sent to your email
3. Open Rhino3D and run planingRhino plugin as usual (from toolbar or command line)
4. Click on 'About'. A new 'About' window will appear
5. Click on 'Load Licence' button. A new Open File dialog will appear.
6. Locate and select the licence file and click open
7. Your Licence Status will change from 'Evaluation Mode' to 'Licenced'
8. Your details (company, name, surname) will appear