

MAAT Hydro
Hydrostatic Calculation
Reference Guide
Rev. 7.4

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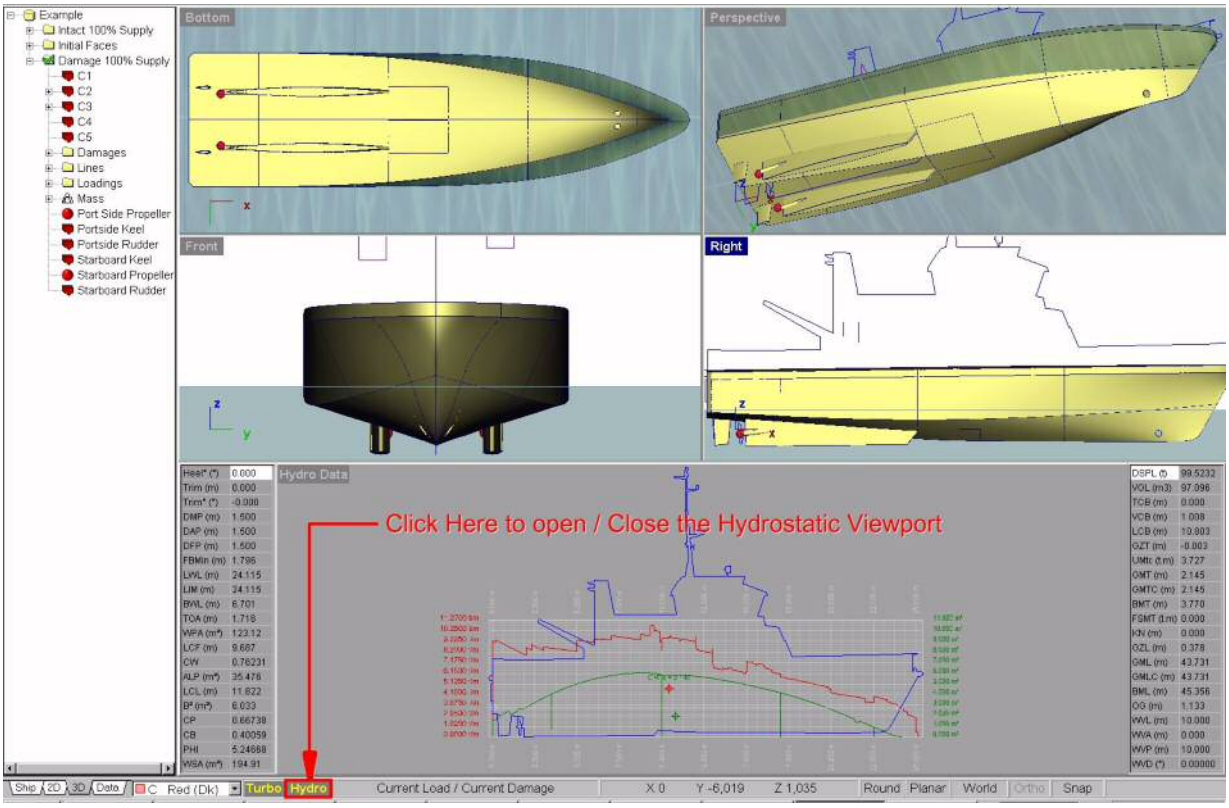
1 Hydrostatic Calculations with MAAT Hydro:

After having read the previous parts I and II, you are now supposed to have become familiar with MAAT Hydro's user interface and understood how to create a virtual ship corresponding to your project.

This part III will therefore show you, function by function, how to use MAAT Hydro for analyzing the hydrostatic behavior of this virtual ship.

As seen previously, MAAT Hydro provides two complementary approaches:

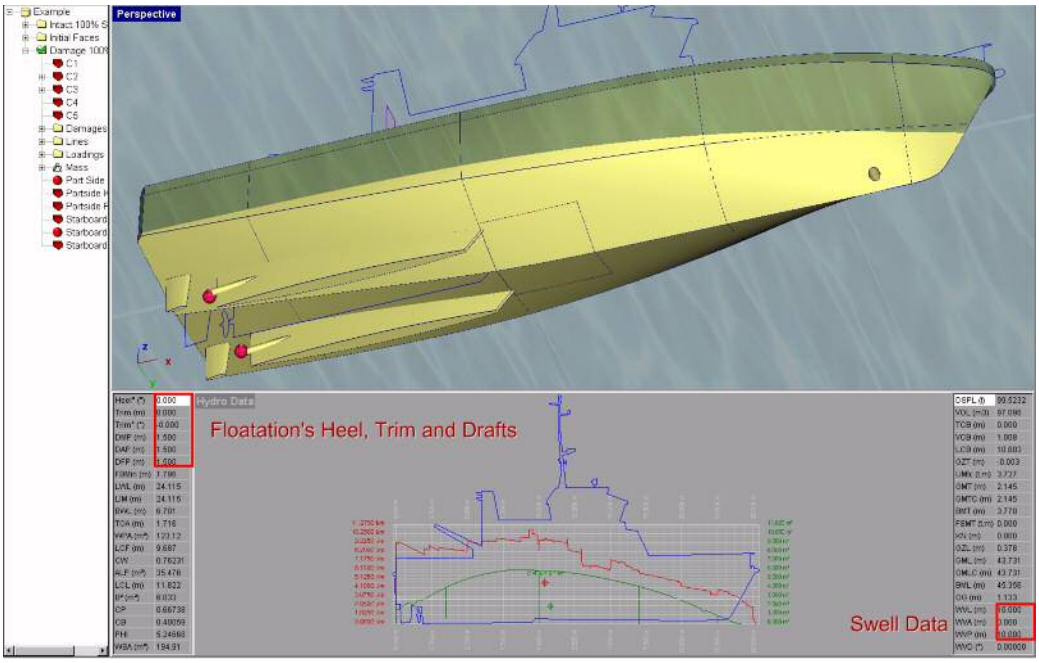
- Real time hydrostatic analysis allowing simulating ship's hydrostatic behavior in a visual and almost 'lifelike' way. MAAT Hydro's real time hydrostatic simulator, which can be seen as the virtual tank in which your virtual ship will be able to float virtually, can be used at any time, by clicking on the [Hydro] button located at the bottom of MAAT Hydro's window. Although it doesn't correspond to any specific requirement, this operation mode is extremely helpful for simulating various situations, allowing to check immediately freeboards, downflooding risks, heads of water, etc… (see 2 below for more details)



- Offline calculations providing the reports required by the classification societies in order to check your project's compliance with the current rules. Most of these offline functions can be accessed from menu bar's 'Tools' menu.

2 Real-time Hydrostatic Simulation with the Hydrostatic Viewport:

Assuming that the virtual ship has been created in MAAT Hydro, as explained in previous parts, and that it has been selected by double clicking on its folder, clicking on the [Hydro] button located at the bottom of the window opens the hydrostatic viewport:



This viewport displays the main hydrostatic data corresponding to the current floatation:

- **[Heel (°)]:** Allows displaying and entering floatation's heel angle.

- **[Trim (m)]:** Allows displaying and entering floatation's trim in current length unit.

- **[Trim (°)]:** Allows displaying and entering floatation's trim angle in degrees.

- **[DMP]:** Allows displaying and entering floatation's draft at MP in current length unit.

- **[DAP]:** Allows displaying and entering floatation's draft at AP in current length unit.

- **[DFP]:** Allows displaying and entering floatation's draft at FP in current length unit.

You can enter different values in these fields and notice that ship's SAC, hydrostatic data and 3D display are reacting in real-time, as well as tank's weight and C.G.on the [Data] page.

Moreover, an optional sinusoidal swell can also be added to this mean floatation plane by specifying its definition data:

- **[WVL]:** Allows displaying and entering swell's wave length in current length unit.

- **[WVA]:** Allows displaying and entering swell's height in current length unit (It is important to stress that this height corresponds to swell's total height:.1 m height = 0.5 m amplitude)

- **[WVP]:** Allows displaying and entering swell's phase (location of swell's crest) in current length unit.

- **[WVD]:** Allows displaying swell's direction (0°)

Additionally, several useful shortcuts also allow calculating ship's balance data whenever necessary, provided that the hydrostatic viewport has the focus (in this case, its upper left title is highlighted; just click in the viewport if not) and that ship's weight and buoyancy are realistic:

- **[↑]**: Increases Draft at MP (keep **[Shift]** key simultaneously pressed for larger increments or **[Ctrl]** key for smaller increments).

- **[↓]**: Decreases Draft at MP (keep **[Shift]** key simultaneously pressed for larger increments or **[Ctrl]** key for smaller increments).

- **[→]**: Increases Trim (keep **[Shift]** key simultaneously pressed for larger increments, **[Ctrl]** key for smaller increments, **[Alt]** key for keeping displacement unchanged).

- **[←]**: Decreases Trim (keep **[Shift]** key simultaneously pressed for larger increments, **[Ctrl]** key for smaller increments, **[Alt]** key for keeping displacement unchanged).

- **[Page Up]**: Increases Heel angle (keep **[Shift]** key simultaneously pressed for larger increments, **[Ctrl]** key for smaller increments, **[Alt]** key for keeping displacement unchanged).

- **[Page Down]**: Decreases Heel angle (keep **[Shift]** key simultaneously pressed for larger increments, **[Ctrl]** key for smaller increments, **[Alt]** key for keeping displacement unchanged).

- **[BackSpace]**: Resets the waterplane to the reference Dwl (heel = trim = 0°).

- **[Home]**: Calculate ship's balance by freeing its immersion, trim and heel (if possible).

- **[End]**: Calculate ship's balance by freeing its immersion and trim for current heel (if possible).

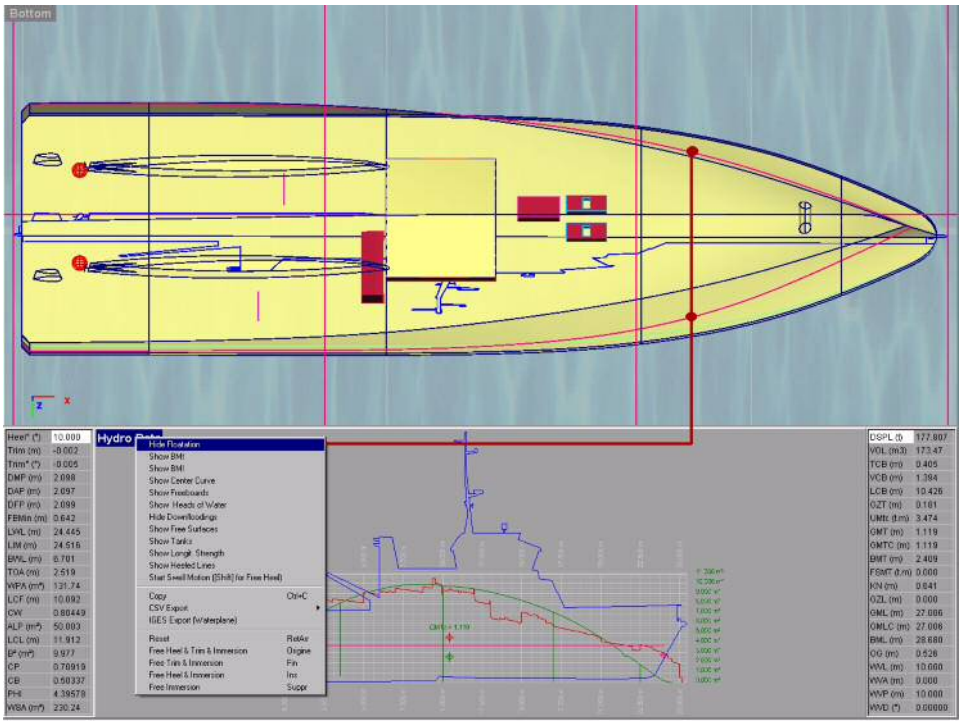
- **[Insert]**: Calculate ship's balance by freeing its immersion and heel (if possible).

- **[Delete]**: Calculate ship's balance by freeing its immersion for current heel and trims (if possible).

The effect of these shortcuts is replicated in hydrostatic viewport's menu (right click in the upper left "Hydro Data" title to display it), which also provides several useful high level display options (but don't forget that they may significantly slow down MAAT Hydro's response time):

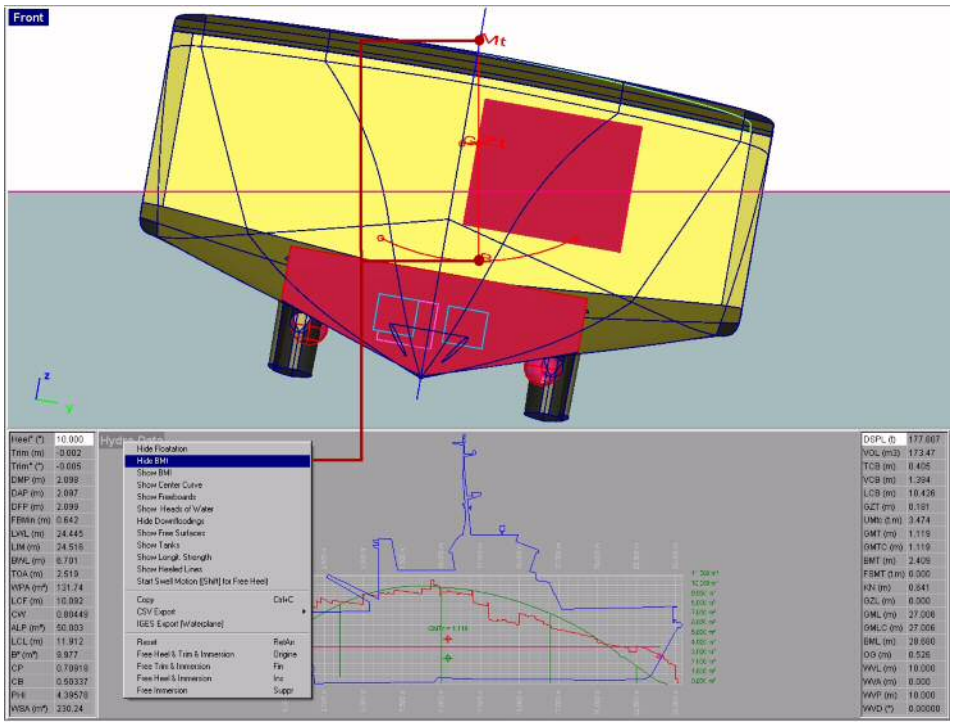
2.1 ***Show Floatation / Hide Floatation:***

Allows displaying / hiding float's intersection with current floatation (best when combined with "Show Center Curve" option).



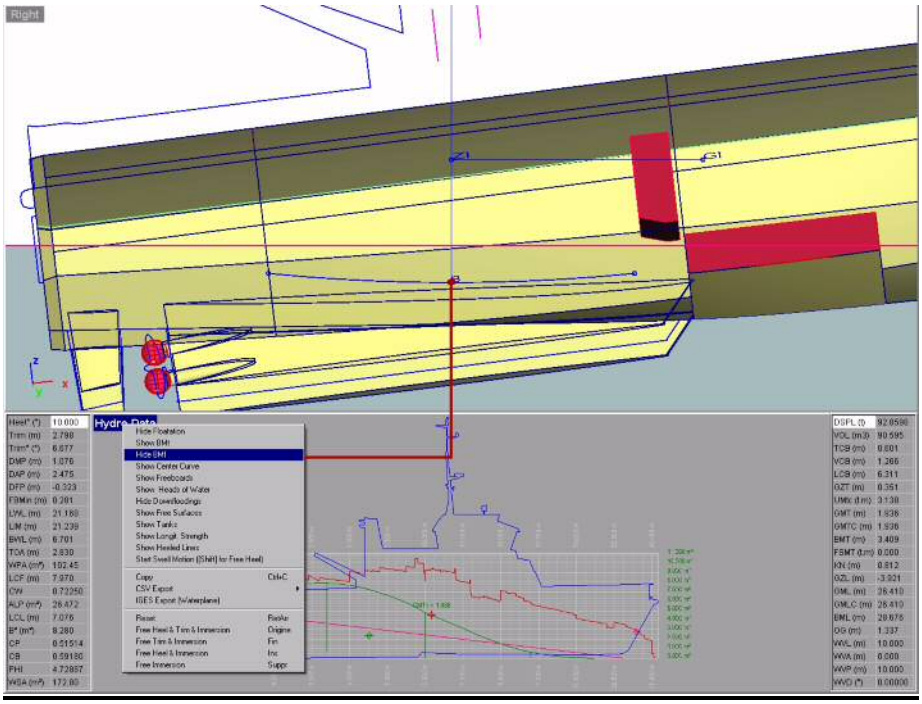
2.2 ***Show BMT / Hide BMT:***

Allows displaying / hiding the transverse Metacentric radius and the local CB arc (may be hidden when rendered in the "opaque" mode.



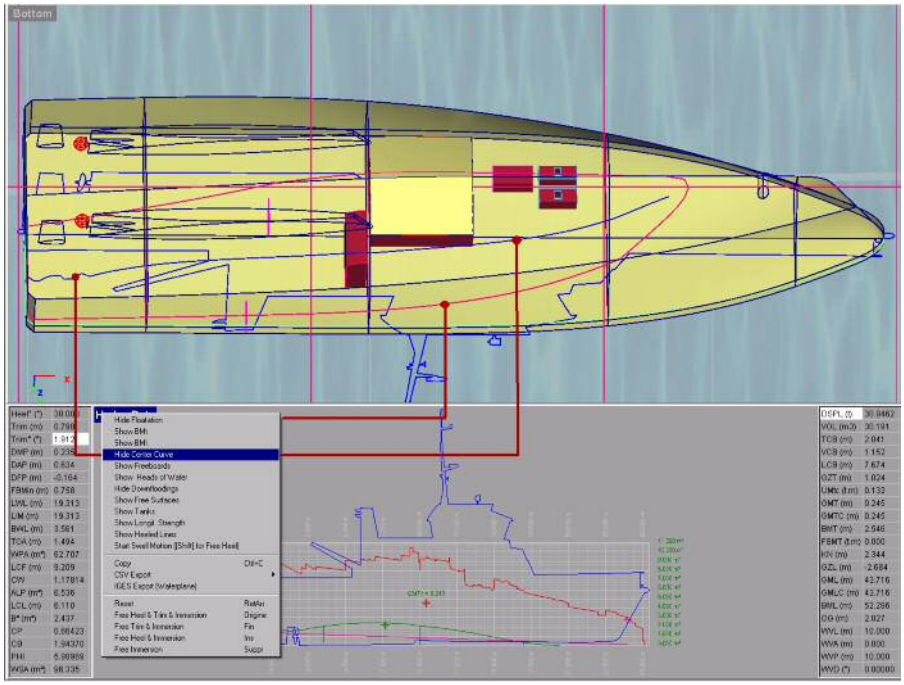
2.3 ***Show BML / Hide BML:***

Allows displaying / hiding the longitudinal Metacentric radius and the local CB arc (may be hidden when rendered in the “opaque” mode.



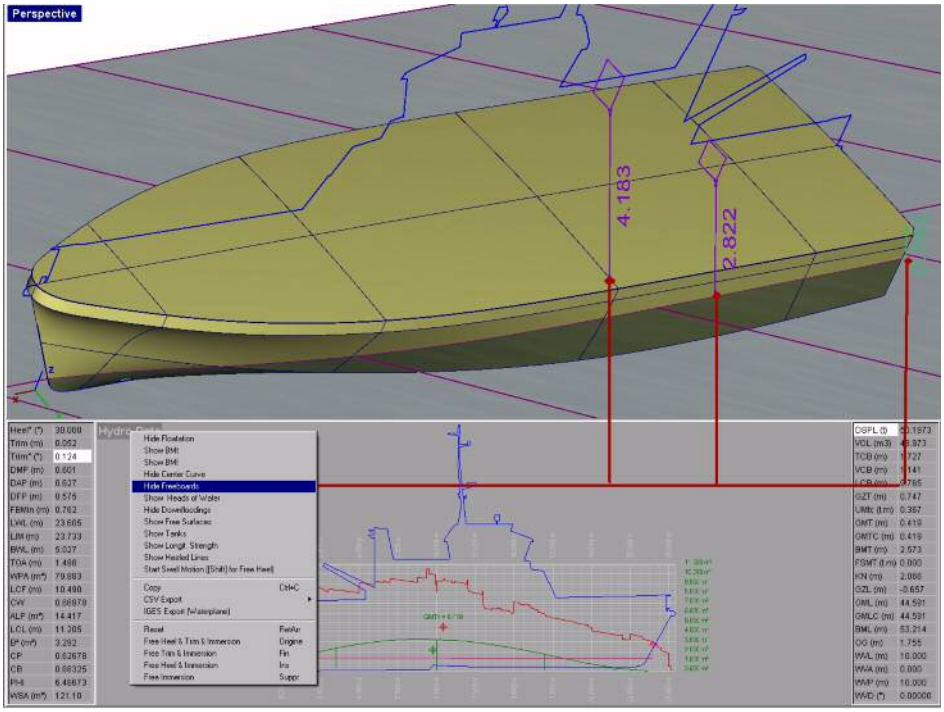
2.4 ***Show Center Curve / Hide Center Curve:***

Allows displaying / hiding the center curve (i.e. curve joining centers of immersed stations). This option is best when combined with “Show Floatation” or “Show Heeled Lines”.



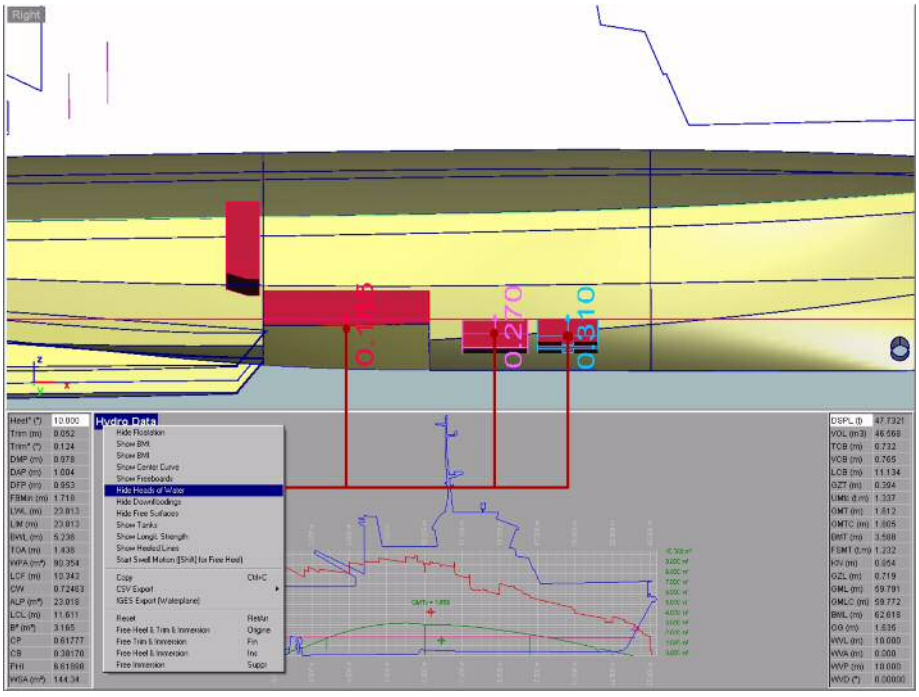
2.5 ***Show Freeboards / Hide Freeboards:***

Allows displaying / hiding the minimum freeboard of all the freeboard and opening lines according to current floatation:



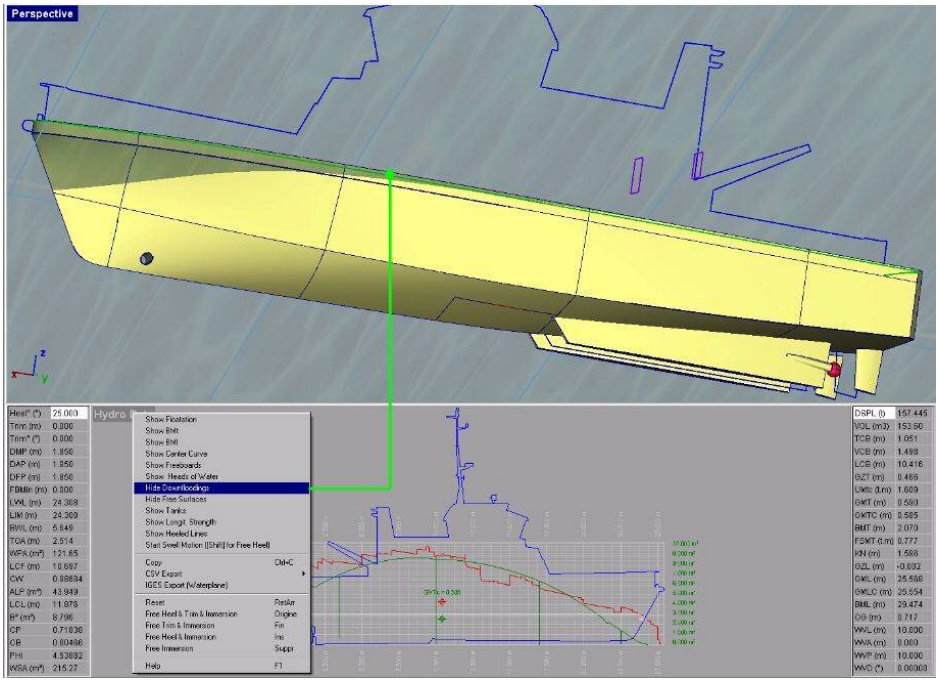
2.6 ***Show Heads of Water / Hide Heads of Water:***

Allows displaying / hiding tank's heads of water (i.e. depth of their free surface according to the current floatation). This option is best when combined with "Show Free Surfaces":



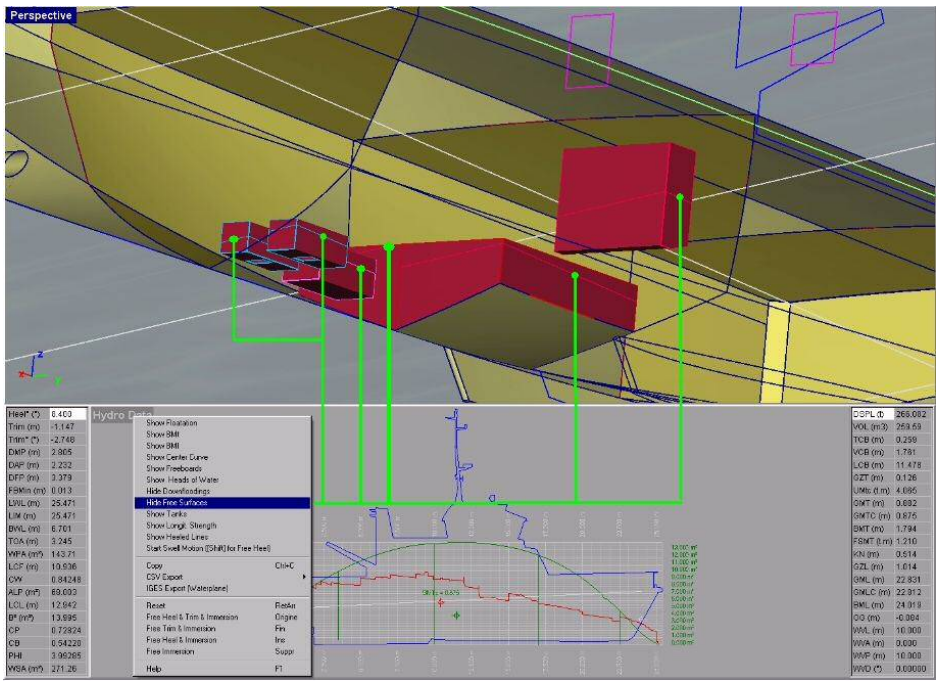
2.7 ***Show Downfloodings / Hide downfloodings:***

Allows highlighting the downflooded compartments (i.e. compartments whose opening is immersed):



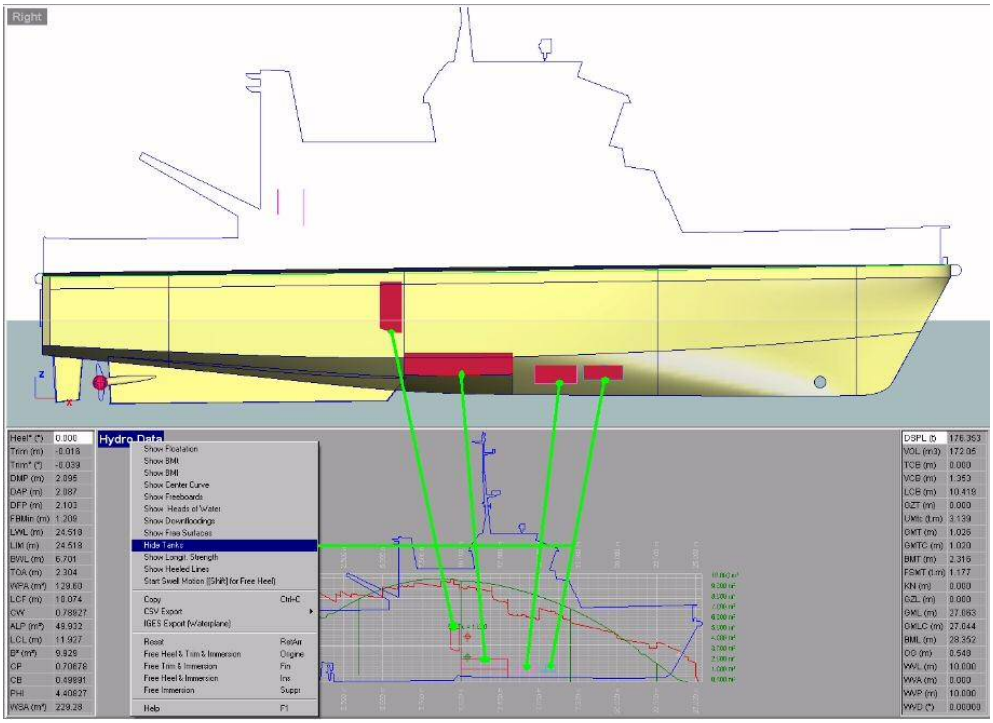
2.8 ***Show Free Surfaces / Hide Free surfaces:***

Allows displaying / hiding current tank's free surface.



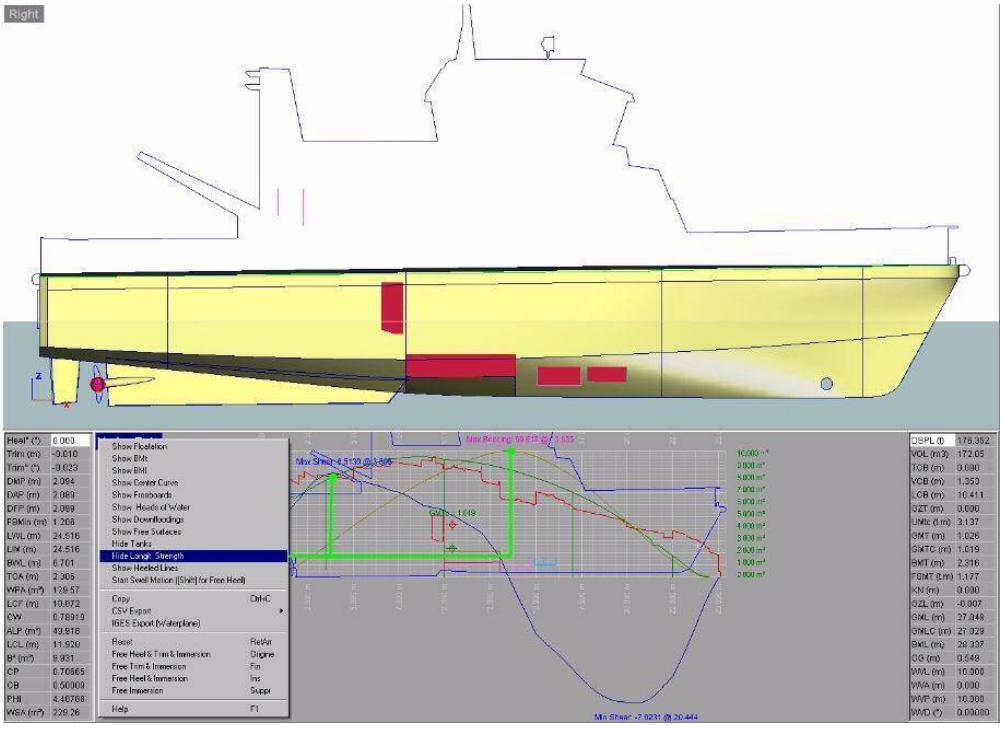
2.9 ***Show Tanks / Hide Tanks:***

Allows showing / hiding tank's silhouettes in the hydrostatic window:



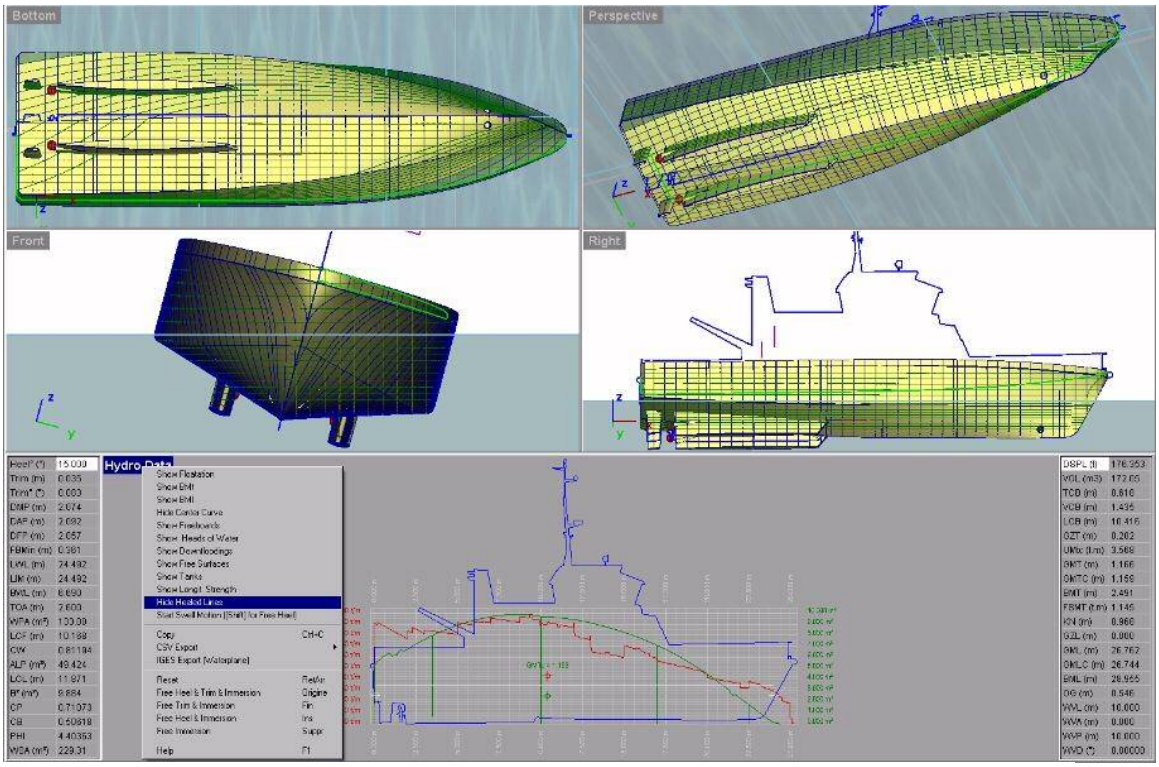
2.10 ***Show Longitudinal Strength / Hide Longitudinal Strength:***

Allows displaying / hiding the current longitudinal strength in the ship beam. This option is meaningless when no realistic mass distribution is available and / or when ship's floatation doesn't correspond to a longitudinal balance.



2.11 *Show Heeled Lines / Hide Heeled Lines:*

Allows displaying / hiding the heeled and trimmed ship lines (best when combined with "Show Center Curve" option).



2.12 *Start Swell Motions / Stop Swell Motions:*

Allows calculating and displaying quasi-static ship's motions on a sinusoidal swell corresponding to the current wavelength and amplitude (only reacts for non-zero amplitudes and wave lengths). Longitudinal strengths are also animated when displayed.

MAAT Hydro first calculates ship balances for each wave position and, then, displays a looped animation of the results (just click on 'Stop Swell Motion' in the menu or hit [Esc] key to stop).

A typical animation can be seen on Sistre's home page (www.sistre.eu).

Please notice that clicking on 'Start Swell Motion' with the [Shift] key pressed will calculate ship's balance with a free heel (only possible when GM is positive) while a simple click only starts the calculation for the current heel.

More details on this function can be read in MAAT Hydro's FAQ ('Results' page): http://www.sistre-shipdesign-software.com/faq/maat-hydro-faq/results/#animation

2.13 ***Copy:***

Allows transferring current hydrostatic display to other applications like “MS Word”, thanks to Windows clipboard.

2.14 ***CSV Export:***

Allows exporting the current data to EXCEL thanks to the CSV format.

2.15 ***IGES Export (waterplane):***

Allows exporting the current floatation’s geometry in an IGES file whenever needed by your 3D modeler.

2.16 ***Help:***

Displays online Help on the Hydrostatic Viewport.

3 MAAT Hydro's Offline Hydrostatic Tools:

MAAT Hydro's real-time hydrostatic analysis tools are especially useful during the design process for answering current designer's questions and solving a lot of more or less informal problems.

But ship's final approval by a classification society usually requires numerous calculation reports which can also be automatically provided by MAAT Hydro as soon as virtual ship's final version is ready.

Most of these offline calculations operate on the current ship, in its current status, and can be accessed from menu bar's 'Tool' submenu:

- **Floatation Analysis / Fix Imm. + Trim + Heel:** Calculates current ship's features (SAC, main hydrostatic data, etc…) for a given floatation defined by its height, trim and heel.

- **Floatation Analysis / Fix Displ. + Trim + Heel:** Calculates current ship's features (SAC, main hydrostatic data, etc…) for the floatation defined by the specified displacement, trim and heel (balance floatation's height is calculated according to the entered displacement, if possible).

- **Floatation Analysis / Fix Load + Heel:** Calculates current ship's features (SAC, main hydrostatic data, etc…) for the floatation defined by the specified displacement, center of gravity and heel (balance floatation's height and trim are calculated according to the entered displacement and C.G., if possible).

- **Floatation Analysis / Fix Load:** Calculates current ship's features (SAC, main hydrostatic data, etc…) for the floatation defined by the specified displacement and center of gravity (balance floatation's height, trim and heel are calculated according to the entered displacement and C.G., if possible).

- **Silhouette Analysis:** Calculates current ship silhouette's features (windage / lateral plane data, etc…) when a silhouette descriptor (i.e.closed line(s) in the 'Silhouette' layer) is included in the model.

- **Compartments List (Full / Lite):** Provides a set of reports describing all the ship compartments (geometry and properties) currently present (the 'Full' option allows adding a set stations on compartment's description leaf).

- **Float Analysis:** Lists virtual ship's current components and status (solid loads, liquid loads and buoyant components).

- **Weight Analysis:** Lists virtual ship's current solid and liquid loadss.

- **Hydro Curves:** Calculates current ship's hydrostatic curves and tables.

- **Tank Capacities:** Provides a set of reports describing the ship tanks geometry and properties.

- **Floodable Lengths:** Calculates virtual ship's floodable lengths for the current load. For obvious reasons, ship must be in the intact state.

- **Grounding:** Calculates virtual ship's grounding data for various intermediate floatations according to a given grounding point and the current load.

- **Transverse Stability:** Calculates virtual ship's transverse stability in its current status. Many options allow customizing the reports after calculation (including stability criterion selection) and the calculation can be automatically repeated for all the current Loading / Damage combinations, in order to automate the stability calculations as soon as they become numerous (also see 'Deterministic Stability' and 'Probabilistic Stability' below).

- **Deterministic Stability:** Calculates virtual ship's max KGs / min GMs for all the current damages in a given draft / trim range and automatically checks the compliance of all the current loading conditions with the calculated results.

- **Probabilistic Stability / Make Damage System:** Automatically scans virtual ship's transverse, longitudinal and horizontal bulkheads in order to create the complete damage system needed for probabilistic damage stability calculations.

- **Probabilistic Stability / Calculate Damage System:** Automatically calculates ship's probabilistic stability for the damages selected in the 3D browser (depending on the amount of data, the number of damages and the heel range, this calculation can be very long).

- **Probabilistic Stability / Show Damage Analysis:** Automatically calculates and displays the detailed reports concerning a set of calculated damages.

- **Dredge Stability:** Calculates virtual ship's transverse stability in the sense of dredge stability (manages cargo spilling and water inflow in dredger's hopper decks according to the scripted criterion).

- **Interm. Flood. Stages:** Calculates virtual ship's transverse stability for intermediate flooding stages.

- **Cross Curves:** Calculates virtual ship's cross curves (fix or free trim).

- **Max KGs:** Calculates virtual ship's Max KGs for the current load and damage.

- **Lines Presentation Plan:** Calculates virtual ship's line presentation plan (including ship's SAC, main dimensions and features).

- **Lines Presentation Leaf:** Calculates virtual ship's lines presentation report (including ship's SAC, main dimensions and features).

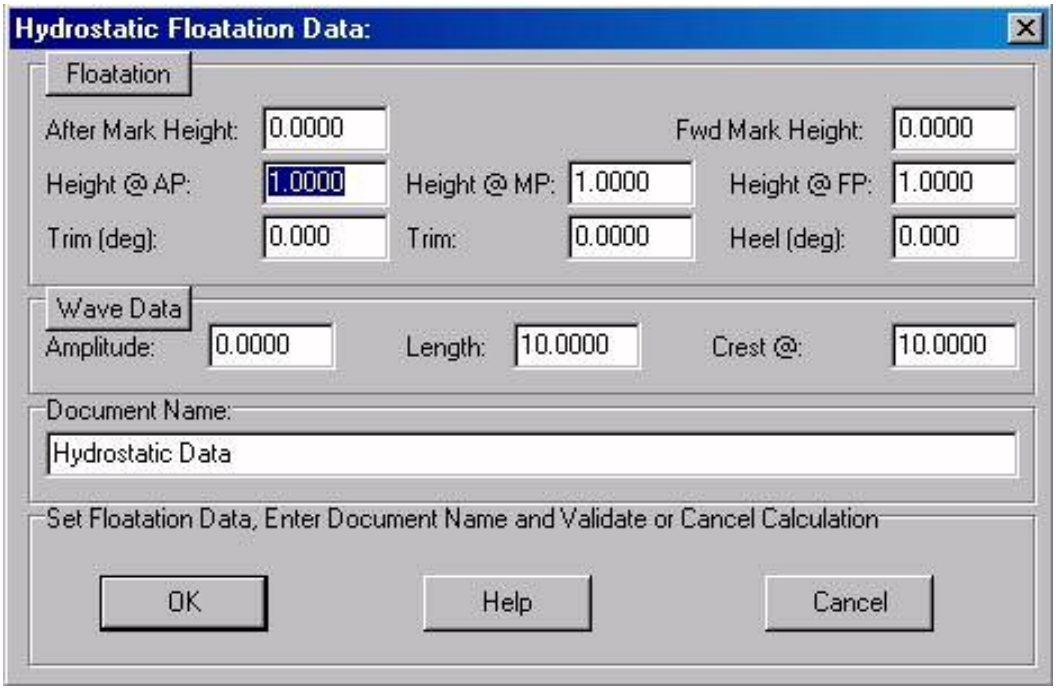
3.1 ***Floatation Analysis / Fix Imm. + Trim + Heel:***

3.1.a Purpose:

Calculates current ship's features (SAC, main hydrostatic data, etc…) for a given floatation defined as follows:

3.1.b Inputs:

The following dialog box pops up when the function is selected:



The upper **[Floatation]** button allows resetting the floatation data to the Dwl ones, declared on [Ship] tab's [Hydro] page.

The heights defining specific floatation's trim can be entered as follows (current Hydro Viewport's data are displayed by default):

- In absolute coordinates (i.e. by reference to designer's Z origin or K point. Don't forget that the resulting trim also depends on AP an FP's position on [Ship] tab's [Hydro] page), in the '**Height @ AP**' / '**Height @ FP**' fields. This mode is the usual one for designers who need entering design offsets.

- In relative coordinates (i.e. by reference to the Aft and Forward marks located on [Ship] tab's [Hydro] page) in the '**After Mark Height**' / **Fwd Mark Height**' fields. This input mode is only useful when the heights are directly measured at sea, provided that the AP and FP marks are accurately located.

The floatation can also be defined by entering its height at Middle Perpendicular in the '**Height @ MP**' field and its trim in the '**Trim (deg)**' or '**Trim**' fields.

Setting these data will automatically update the associated fields in real time.

Moreover, floatation's heel can be specified in the '**Heel (deg)**' field and an optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the created hydrostatic report among the 2D data listed in the 2D browser if necessary and, finally:

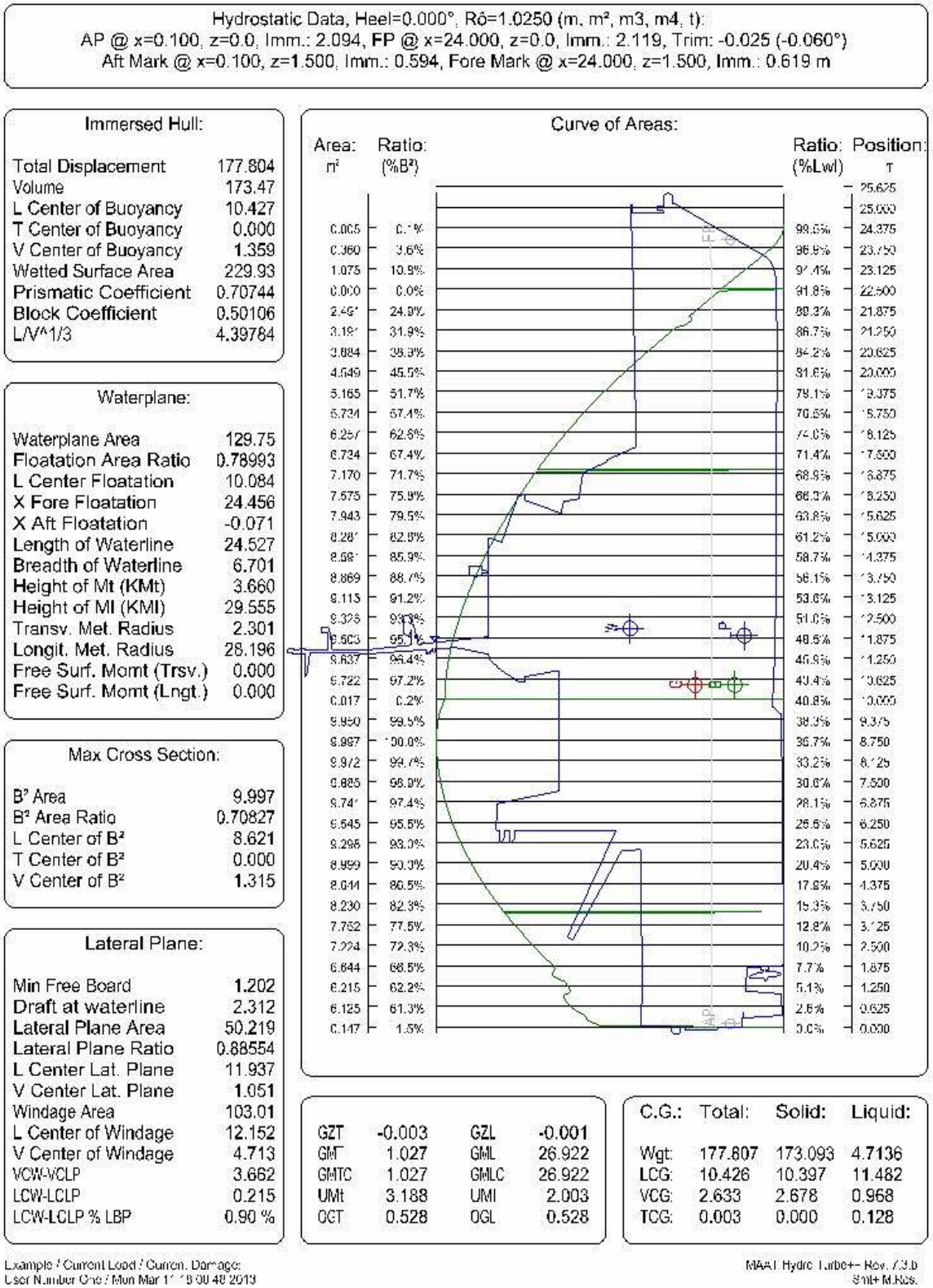
The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.1.c Outputs:

After clicking on the **[OK]** button, an hydrostatic report corresponding to the entered data is created and displayed in the **[2D]** tab:



3.1.d Limitations:

The data obtained in the report depend on the entities available in the virtual ship:

- At least one solid must be present to allow any buoyancy calculation.

- Faces whose outline is in the 'Wetted Surface Layer' must be present to allow wetted surface calculation (see MAAT Hydro's FAQ/Results/Why is the wetted surface value erroneous?' for more details).

- Stations or lines must be present in the midship area to allow an calculating Bwl and the depending coefficients accurately (see 'MAAT Hydro's FAQ/Results/Why may the Bwl value be erroneous ?' for more details).

- At least one silhouette outline (i.e. in the 'Silhouette Layer') is necessary to allow windage and lateral plane area calculation.

- At least one freeboard line (i.e. in the 'Freeboard Layer') is necessary to calculate the freeboard.

- At least one mass is necessary to define the center of gravity allowing to calculate G, GZ, GM, etc…

3.1.e Typical use:

Calculating ship's upright or specific hydrostatic data corresponding to current ship's status.

3.1.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "**/Tools/Floatation Analysis/Fix Imm + Trim + Heel"** in the menu bar.

- Click on the **[Floatation]** button to reset the floatation to Dwl.

- Click on the **[OK]** button directly to calculate ship's hydrostatic data for its default floatation: The corresponding report will be created and displayed among the 2D data. You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

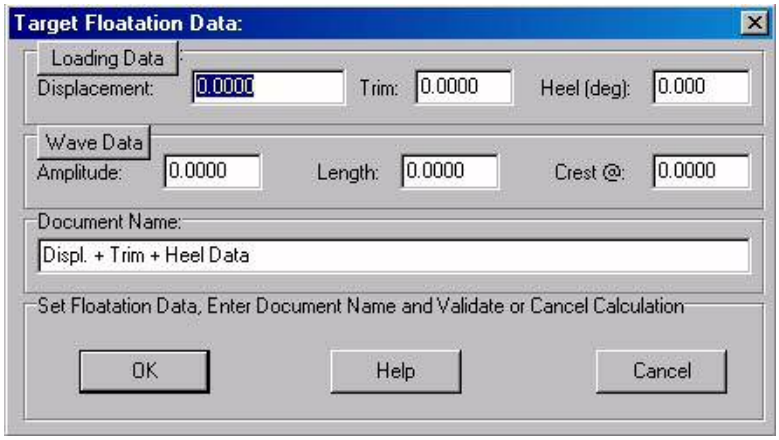
3.2 *Floatation Analysis / Fix Displ. + Trim + Heel:*

3.2.a Purpose:

Calculates current ship's hydrostatic features (SAC, main hydrostatic data, etc…) for a given displacement, trim and heel (keep in mind that no equilibrium can be found when displacement exceeds ship's buoyancy):

3.2.b Inputs:

The following dialog box pops up when the function is selected:



The upper **[Loading Data]** button allows resetting the displacement to its current value (corresponding to the present masses and /or liquids in the tanks).

The target displacement can also be specified in the '**Displacement**' field, floatation's trim in the '**Trim**' field and its heel angle in the '**Heel (deg)**' field.

An optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the created hydrostatic report among the 2D data listed in the 2D browser if necessary and, finally:

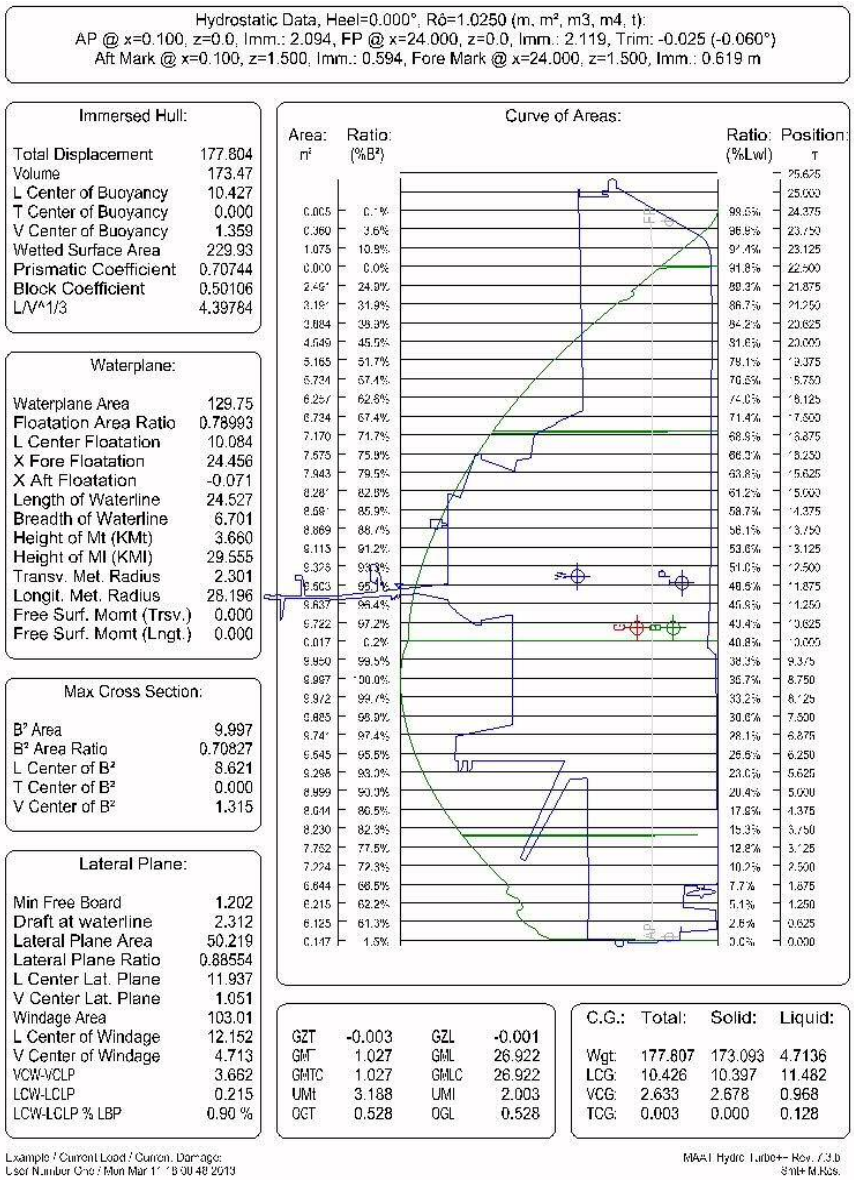
The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.2.c Outputs:

After clicking on the **[OK]** button, an hydrostatic report corresponding to the entered data is created and displayed in the **[2D]** tab:



3.2.d Limitations:

The data obtained in the report depend on the entities available in the virtual ship:

- At least one solid must be present to allow any buoyancy calculation.

- The entered displacement must be correlated to ship's buoyancy, otherwise no equilibrium can be found.

- Faces whose outline is in the 'Wetted Surface Layer' must be present to allow wetted surface calculation (see MAAT Hydro's FAQ/Results/Why is the wetted surface value erroneous?' for more details).

- Stations or lines must be present in the midship area to allow an calculating Bwl and the depending coefficients accurately (see 'MAAT Hydro's FAQ/Results/Why may the Bwl value be erroneous ?' for more details).

- At least one silhouette outline (i.e. in the 'Silhouette Layer') is necessary to allow windage and lateral plane area calculation.

- At least one freeboard line (i.e. in the 'Freeboard Layer') is necessary to calculate the freeboard.

- At least one mass and or filled tank is necessary to define the center of gravity allowing to calculate G, GZ, GM, etc…

- For obvious reasons, displacement must not exceed ship's buoyancy.

- When child openings are affiliated to compartments, a special attention must be paid to the possible effect of the corresponding buoyancy losses (the virtual ship may suddenly sink).

3.2.e Typical use:

Calculating ship's hydrostatic data, in its current status, for the floatation corresponding to a given load and heel angle.

3.2.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select **"/Tools/Floatation Analysis/Fix Displ. + Trim + Heel"** in the menu bar.

- Click on the **[Loading Data]** button to reset the floatation to Dwl.

- Click on the **[OK]** button directly to calculate ship's floatation and hydrostatic data: The corresponding report will be created and displayed among the 2D data. You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

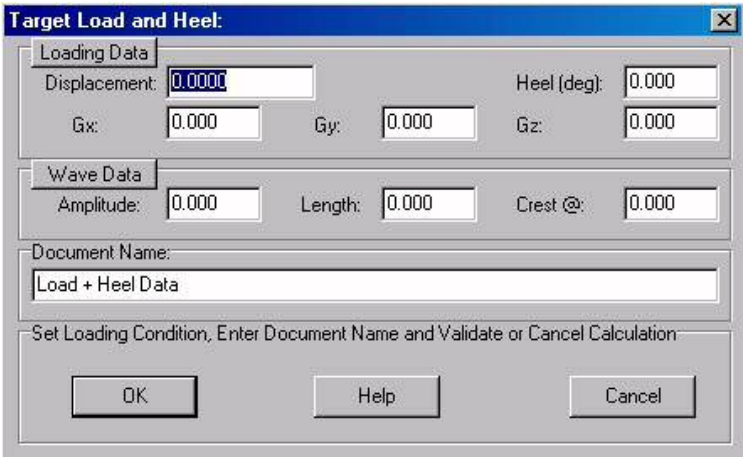
3.3 ***Floatation Analysis / Fix Load + Heel:***

3.3.a Purpose:

Calculates current ship's hydrostatic features (SAC, main hydrostatic data, etc…) for a given load (i.e. displacement and centre of gravity) and heel, equilibrium's immersion and trim being automatically calculated for the entered heel (keep in mind that no equilibrium can be found when longitudinal GM is negative or displacement exceeds ship's buoyancy).

3.3.b Inputs:

The following dialog box pops up when the function is selected:



The upper **[Loading Data]** button allows resetting the displacement and CG coordinates to their current values, corresponding to the present masses and /or liquids in the tanks (.

The target displacement can also be specified in the '**Displacement**' field, C.G.'s coordinates in the '**Gx**', '**Gy**', '**Gz**' fields and heel angle in the '**Heel (deg)**' field.

An optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the created hydrostatic report among the 2D data listed in the 2D browser if necessary and, finally:

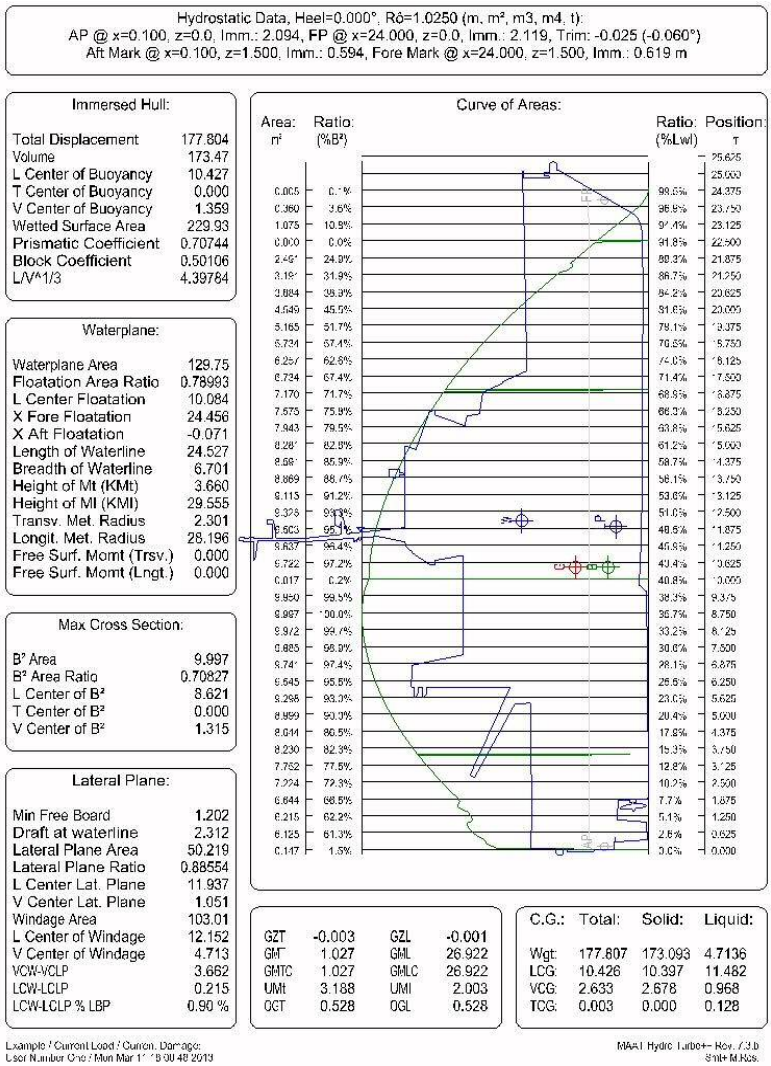
The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.3.c Outputs:

After clicking on the **[OK]** button, an hydrostatic report corresponding to the entered data is created and displayed in the **[2D]** tab:



3.3.d Limitations:

The data obtained in the report depend on the entities available in the virtual ship:

- At least one solid must be present to allow any buoyancy calculation.

- Current ship's load (i.e. masses and tanks load) must be correlated to its buoyancy, otherwise no equilibrium can be found.

- Faces whose outline is in the 'Wetted Surface Layer' must be present to allow wetted surface calculation (see MAAT Hydro's FAQ/Results/Why is the wetted surface value erroneous?' for more details).

- Stations or lines must be present in the midship area to allow an calculating Bwl and the depending coefficients accurately (see 'MAAT Hydro's FAQ/Results/Why may the Bwl value be erroneous ?' for more details).

- At least one silhouette outline (i.e. in the 'Silhouette Layer') is necessary to allow windage and lateral plane area calculation.

- At least one freeboard line (i.e. in the 'Freeboard Layer') is necessary to calculate the freeboard.

- At least one mass is necessary to define the center of gravity allowing to calculate G, GZ, GM, etc…

- Displacement must not exceed ship's buoyancy and induce a negative GM.

- When child openings are affiliated to compartments, a special attention must be paid to the possible effect of the corresponding buoyancy losses (the virtual ship may suddenly sink).

3.3.e Typical use:

Calculating ship's hydrostatic data, in its current status, for the floatation corresponding to a given loading condition (i.e. masses and tanks load) for a given heel angle.

3.3.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "**/Tools/Floatation Analysis/Fix Load + Heel"** in the menu bar.

- Click on the **[Loading Data]** button to reset the loading Data (i.e. displacement and C.G.'s position) to their current value.

- Click on the **[OK]** button directly to calculate ship's floatation and hydrostatic data: The corresponding report will be created and displayed among the 2D data. You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

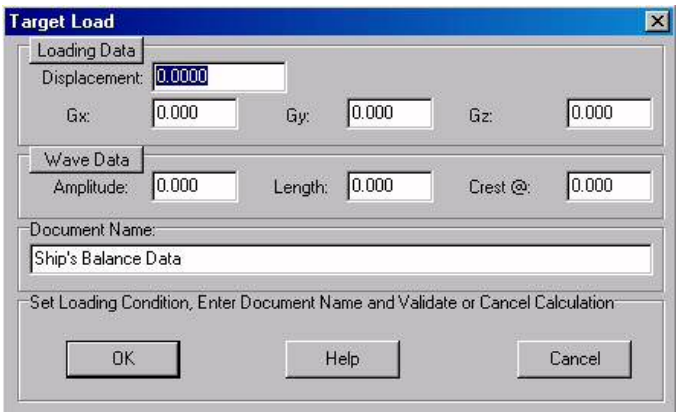
3.4 ***Floatation Analysis / Fix Load:***

3.4.a Purpose:

Calculates current ship's hydrostatic features (SAC, main hydrostatic data, etc…) for a given load (i.e. displacement and centre of gravity), equilibrium's immersion, trim and heel being automatically obtained (but keep in mind that no equilibrium can be found when transverse / longitudinal GM is negative or displacement exceeds ship's buoyancy):

3.4.b Inputs:

The following dialog box pops up when the function is selected:



The upper **[Loading Data]** button allows resetting the displacement and CG coordinates to their current values, corresponding to the present masses and /or liquids in the tanks (.

The target displacement can also be specified in the '**Displacement**' field and C.G.'s coordinates in the '**Gx**', '**Gy**', '**Gz**' fields.

An optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the created hydrostatic report among the 2D data listed in the 2D browser if necessary and, finally:

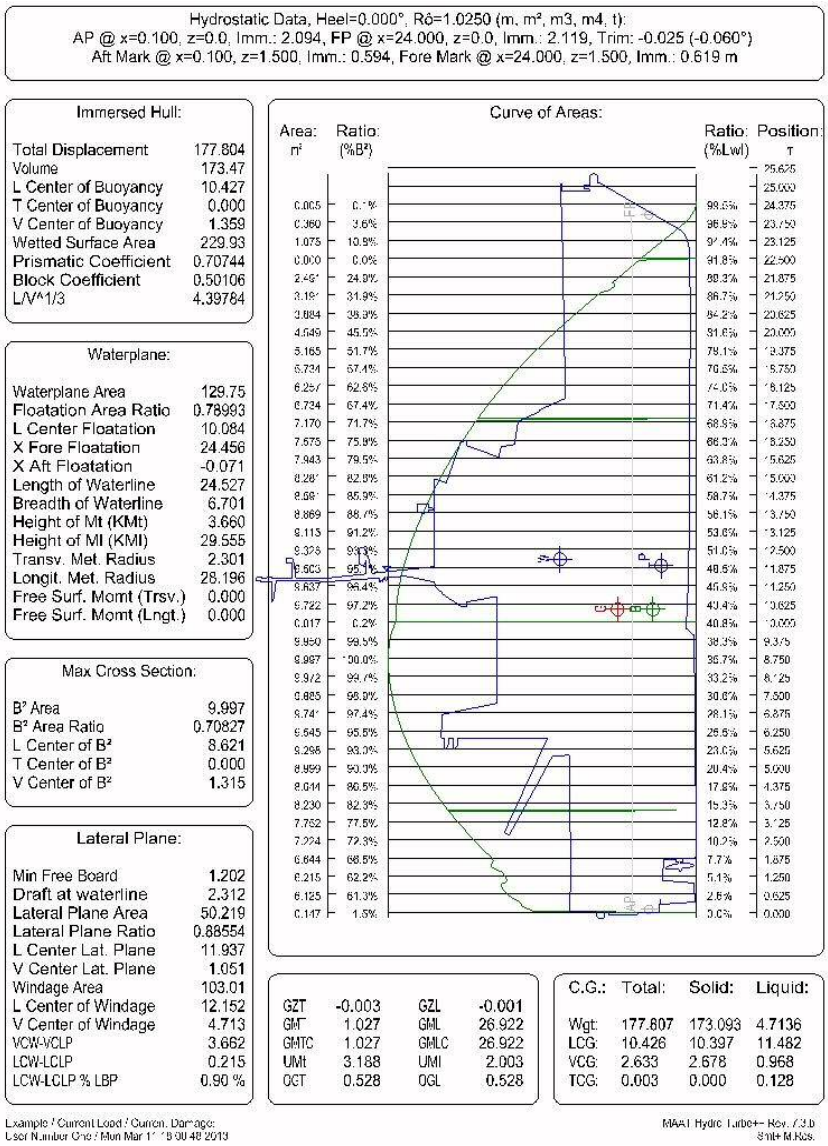
The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.4.c Outputs:

After clicking on the **[OK]** button, an hydrostatic report corresponding to the entered data is created and displayed in the **[2D]** tab:



3.4.d Limitations:

The data obtained in the report depend on the entities available in the virtual ship:

- At least one solid must be present to allow any buoyancy calculation.

- Current ship's load (i.e. masses and tanks load) must be correlated to its buoyancy, otherwise no equilibrium can be found.

- Faces whose outline is in the 'Wetted Surface Layer' must be present to allow wetted surface calculation (see MAAT Hydro's FAQ/Results/Why is the wetted surface value erroneous?' for more details).

- Stations or lines must be present in the midship area to allow an calculating Bwl and the depending coefficients accurately (see 'MAAT Hydro's FAQ/Results/Why may the Bwl value be erroneous ?' for more details).

- At least one silhouette outline (i.e. in the 'Silhouette Layer') is necessary to allow windage and lateral plane area calculation.

- At least one freeboard line (i.e. in the 'Freeboard Layer') is necessary to calculate the freeboard.

- At least one mass is necessary to define the center of gravity allowing to calculate G, GZ, GM, etc…

- Displacement must not exceed ship's buoyancy and induce a negative GMs.

- When child openings are affiliated to compartments, a special attention must be paid to the possible effect of the corresponding buoyancy losses (the virtual ship may suddenly sink).

3.4.e Typical use:

Calculating ship's hydrostatic data, in its current status, for the floatation corresponding to a given loading condition (i.e. masses and tanks load).

3.4.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "**/Tools/Floatation Analysis/Fix Load"** in the menu bar.

- Click on the **[Loading Data]** button to reset the loading Data (i.e. displacement and C.G.'s position) to their current value.

- Click on the **[OK]** button directly to calculate ship's equilibrium floatation and hydrostatic data: The corresponding report will be created and displayed among the 2D data. You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

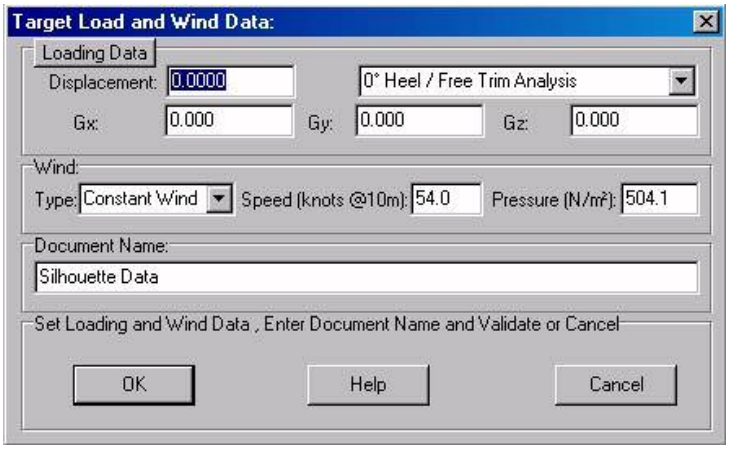
3.5 ***Silhouette Analysis:***

3.5.a Purpose:

Calculates current ship's silhouette data (i.e. windage and lateral plane data) for a given load (i.e. displacement and center of gravity) for ship's equilibrium floatation for a free or 0° heel angle (keep in mind that no equilibrium can be found when transverse / longitudinal GM is negative or displacement exceeds ship's buoyancy).

3.5.b Inputs:

The following dialog box pops up when the function is selected:



The upper **[Loading Data]** button allows resetting the displacement and CG coordinates to their current values, corresponding to the present masses and /or liquids in the tanks (.

The target displacement can also be specified in the '**Displacement**' field and C.G.'s coordinates in the '**Gx**', '**Gy**', '**Gz**' fields.

The upper right selector allows selecting whether ship's equilibrium will be calculated for a free or a 0° heel angle.

The 'Wind' frame allows defining the wind characteristics to be used for silhouette integration:

- The '**Type**' selector allows selecting the wind gradient:
  - '**No Wind**' for a constant 0 knot wind.
  - '**Constant**' for a constant wind velocity according to Z
  - '**FR**' for a French variable gradient.
  - '**US**' for a US variable gradient.

Silhouette's vertical center of windage is usually higher for a variable gradient than for a constant one, as the wind speed increases according to Z.

- The '**Speed (knots @ 10m**) field allows defining wind's speed in knots at z = 10 m. The corresponding unitary pressure is updated in real time according to gradient's associated density.

- The '**Pressure (N/m²)**' field allows defining wind's unitary pressure. The corresponding speed is updated in real time according to gradient's associated density.

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the created hydrostatic report among the 2D data listed in the 2D browser if necessary and, finally:

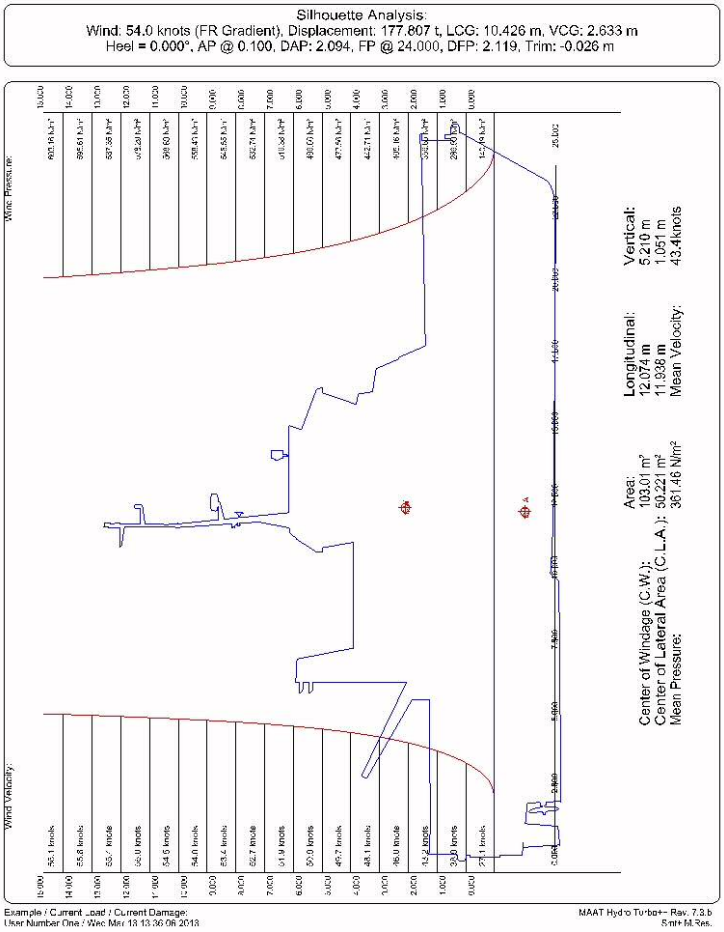
The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.5.c Outputs:

After clicking on the **[OK]** button, an hydrostatic report corresponding to the entered data is created and displayed in the **[2D]** tab:



3.5.d Limitations:

This report can only be obtained when one or more silhouette descriptors (i.e. outlines or closed lines in the ‘Silhouette Layer’ selected on [Ship] tab’s [Hydro] page) are included in the current ship model. It is hereby recalled that holes in the silhouette outline can be represented by affiliating their corresponding outline to the outer silhouette outline by dragging and dropping it in the 3D browser.

- At least one solid must be present to allow any buoyancy calculation.

- Displacement must not exceed ship’s buoyancy and induce a negative GMs.

3.5.e Typical use:

Calculating ship’s silhouette properties, in its current status, for given load and wind.

3.5.f Example:

Open the ‘Example Ship.m2a’ file and double click on ‘Damage 100% Supply’ in the 3D browser to select this virtual ship:

- Select **"/Tools/Floatation Analysis/Silhouette Analysis"** in the menu bar.

- Click on the **[Loading Data]** button to reset the loading Data (i.e. displacement and C.G.’s position) to their current value.

- Select a **[US]** wind gradient in the ‘**Type**’ selector.

- Set a 50 knots velocity in the corresponding field (see the unitary pressure changes).

- Click on the **[OK]** button directly to calculate ship's equilibrium floatation and hydrostatic data: The corresponding report will be created and displayed among the 2D data.

- Repeat this example for a constant gradient and compare the obtained heights of the center of windage (VCW).

You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

3.6 ***Compartments List:***

3.6.a Purpose:

Creates a set of reports analyzing the main features of all the ship compartments (in 'full' or 'light' format).

The volume of the affiliated tanks is automatically subtracted to parent compartment's volume.

3.6.b Inputs:

The Output format must be selected in function's submenu:

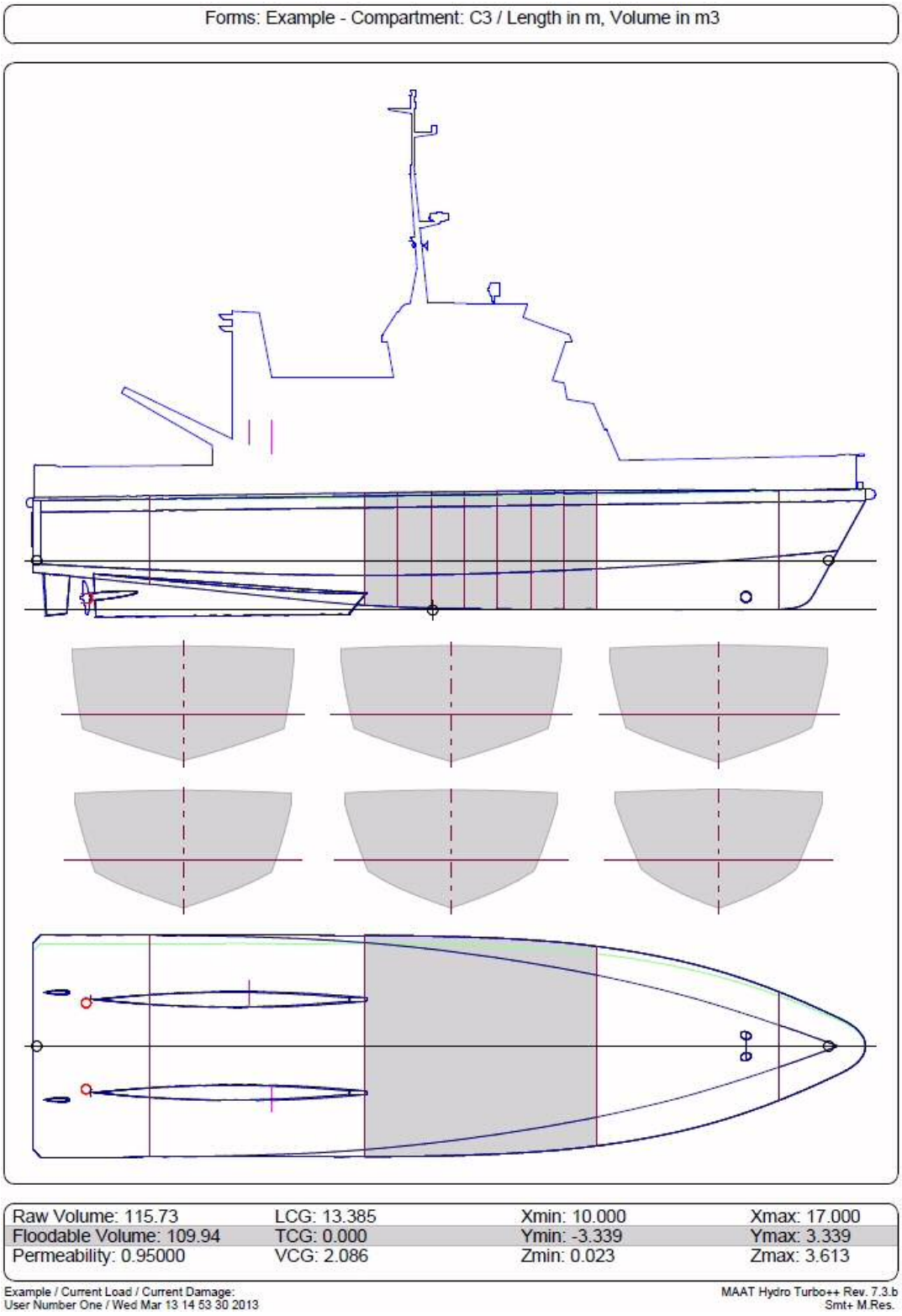
- '**Full**': Selects a full report (i.e. including compartment stations).

- '**Lite**': Selects a light report (i.e. without compartment stations).

3.6.c Outputs:

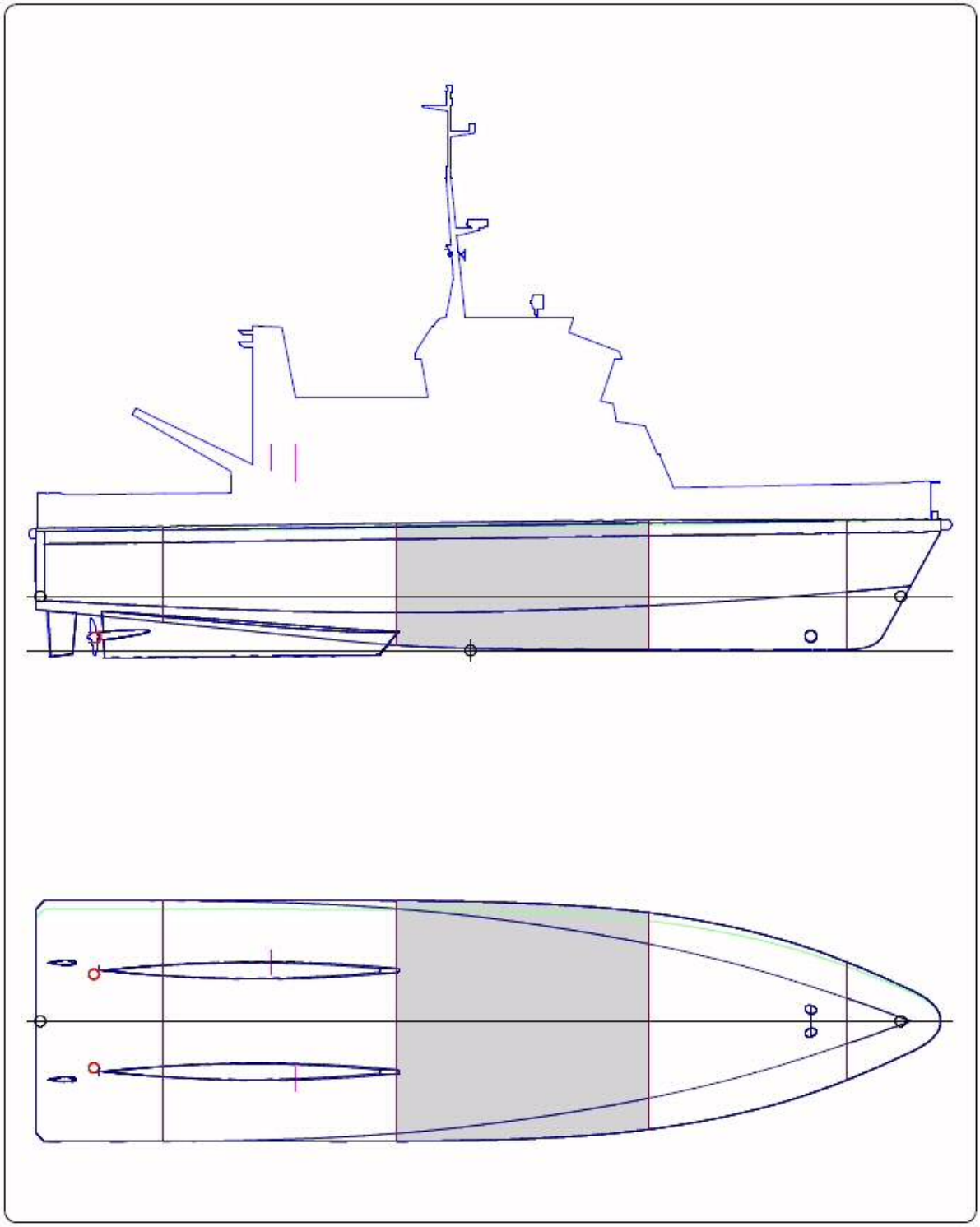
After having selected the output format, a set of reports analyzing all the ship compartments is created and displayed in the **[2D]** tab:

- 3.6.c.1: Full Report:



- 3.6.c.2: Light Report:

Forms: Example - Compartment: C3 / Length in m, Volume in m3



Raw Volume: 115.73	LCG: 13.385	Xmin: 10.000	Xmax: 17.000
Floodable Volume: 109.94	TCG: 0.000	Ymin: -3.339	Ymax: 3.339
Permeability: 0.95000	VCG: 2.086	Zmin: 0.023	Zmax: 3.613

Example / Current Load / Current Damage:
User Number One / Wed Mar 13 14 59 09 2013

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3.6.d Limitations:

The current model must contain one or more compartments.

3.6.e Typical use:

Presenting ship's subdivision and main compartment properties.

3.6.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "**/Tools/Compartments List/Full"** in the menu bar to Create the compartment reports and display them among the 2D data.

You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

3.7 ***Float Analysis:***

3.7.a Purpose:

Reports current virtual ship's component status and features:

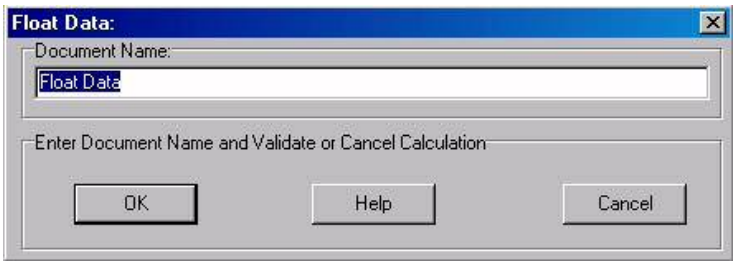
- Masses
- Tanks
- Compartments

When masses are sorted in a tree, the listed tree branches will correspond to 3D browser's tree branches (see examples below).

Moreover, it is important to notice that the heaviest mass is considered as the 'Light Ship' and listed apart.

3.7.b Inputs:

The following dialog box pops up when the function is selected:



The '**Document Name**' input field allows naming the created report among the data listed in the 2D browser.

The **[OK]** button can be clicked creating the 'Float Analysis' report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the function.

3.7.c Outputs:

After having entered report's name, a set of reports analyzing virtual ship's components status is created and displayed in the **[2D]** tab:

Ship Status / BIM / DCC* 10%

Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
02_marge M3	3.9800		100.0%	3.9800	10.8730	0.0000	2.8340
03_équipage PS (3 p)	0.2250		100.0%	0.2250	14.5000	0.0000	6.9500
04_pers. spécial PS (7 p)	0.5250		100.0%	0.5250	13.0000	0.0000	6.9500
05a_pers. spécial PP (13 p)	0.9750		100.0%	0.9750	14.0000	0.0000	4.6000
05b_pers. spécial PP (3 p)	0.2250		0.0%				
06_marge M4	4.6750		100.0%	4.6750	10.9780	0.0000	2.7280
Solid Load Subtotal:				10.3800	11.4002	0.0000	3.2495
01_lège				79.6000	10.8730	0.0000	2.8340
Total (Solid):				89.9800	10.9338	0.0000	2.8819

Tank:	Raw Volume: (m3)	Muin:	Quantity:	FSM: (t.m)	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
caisse ED	0.3400	100.0%	10.0%	0.1421	0.0340	15.5000	0.0000	1.5600
Freshwater Subtotal (rô=1., 10.0% of total capacity):				0.1421	0.0340	15.5000	0.0000	1.5600
caisse GO Bd	4.2423	95.0%	10.0%	0.1753	0.3365	11.5983	0.3238	0.2781
caisse GO journalière	1.4056	95.0%	10.0%	0.2091	0.1115	9.6770	1.0450	1.8585
caisse GO Td	4.2423	95.0%	10.0%	0.1753	0.3365	11.5983	-0.3238	0.2781
Gasoil Subtotal (rô=0.835, 10.0% of total capacity):				0.5597	0.7845	11.3252	0.1485	0.5027
caisse EU	0.3525	95.0%	100.0%		0.3359	14.1875	-0.2500	0.6610
Greywater Subtotal (rô=1.003, 100.0% of total capacity):				0.0000	0.3359	14.1875	-0.2500	0.6610
Total (Liquid):				0.7017	1.1544	12.2810	0.0282	0.5799
Total (Liquid + Solid):				0.7017	91.1344	10.9509	0.0004	2.8528

Buoyant Component:	Raw Volume: (m3)	Mu:	Quantity:	Hydro Volume: (m3)	LCG: (m)	TCG: (m)	VCG: (m)
safran Td	0.0706	95.0%	Unfloodable	0.0706	0.7204	-1.5000	0.5138
safran Bd	0.0706	95.0%	Unfloodable	0.0706	0.7204	1.5000	0.5138
dérive Td	2.1803	95.0%	Unfloodable	2.1803	5.6733	-1.3025	0.3181
dérive Bd	2.1803	95.0%	Unfloodable	2.1803	5.6733	1.3025	0.3181
caisse ED	0.3400	100.0%	Intact Tank	0.3400	15.5000	0.0000	1.7400
caisse EU	0.3525	95.0%	Intact Tank	0.3525	14.1875	-0.2500	0.6610
caisse GO Bd	4.2423	95.0%	Intact Tank	4.2423	11.5098	0.7410	0.7584
caisse GO journalière	1.4056	95.0%	Intact Tank	1.4056	9.6348	1.0450	2.4760
caisse GO Td	4.2423	95.0%	Intact Tank	4.2423	11.5098	-0.7410	0.7584
coque	(320.428)	95.0%	Unfloodable	320.428	10.7710	0.0000	2.1374
Total Volume:	335.512						

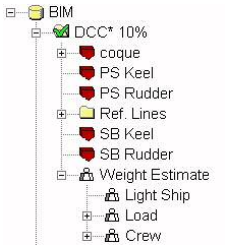
BIM / Current Load / Current Damage:
User Number One / Sun Apr 07 11 22 29 2013

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Cert. M.Res.

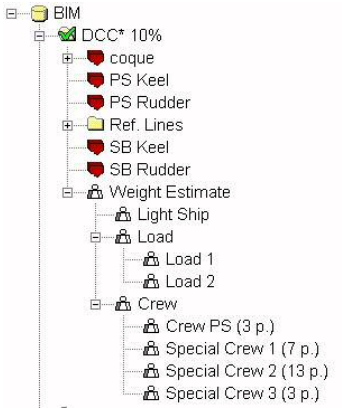
3.7.d Limitations:

When the masses are sorted in a tree, 3D browser's tree status must be set according to the details to list in the weight report.

Moreover, it is important to notice that the heaviest mass encountered is considered as the Light Ship and listed apart:



Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
Load	8.6550		100.0%	8.6550	10.9297	0.0000	2.7767
Crew	1.7250		100.0%	1.7250	13.7609	0.0000	5.6217
Solid Load Subtotal:				10.3800	11.4002	0.0000	3.2495
Light Ship				79.6000	10.8730	0.0000	2.8340
Total (Solid):				89.9800	10.9338	0.0000	2.8819



Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
Load 2	4.6750		100.0%	4.6750	10.9780	0.0000	2.7280
Load 1	3.9800		100.0%	3.9800	10.8730	0.0000	2.8340
Special Crew 3 (3 p.)	0.2250		0.0%				
Special Crew 2 (13 p.)	0.9750		100.0%	0.9750	14.0000	0.0000	4.6000
Special Crew 1 (7 p.)	0.5250		100.0%	0.5250	13.0000	0.0000	6.9500
Crew PS (3 p.)	0.2250		100.0%	0.2250	14.5000	0.0000	6.9500
Solid Load Subtotal:				10.3800	11.4002	0.0000	3.2495
Light Ship				79.6000	10.8730	0.0000	2.8340
Total (Solid):				89.9800	10.9338	0.0000	2.8819

3.7.e Typical use:

Presenting the calculated ship components (weight estimate, tanks and compartments), and their current status.

3.7.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "/Tools/Float Analysis" in the menu bar to create the 'Float Analysis' reports and display them among the 2D data.

You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

3.8 ***Weight Analysis:***

3.8.a Purpose:

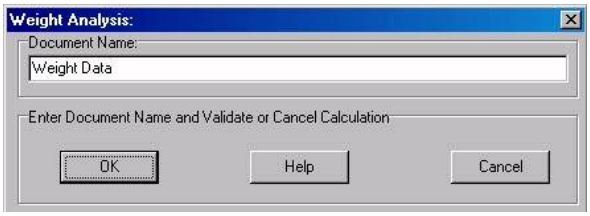
Reports current virtual ship's weight estimate (masses + tanks):

When masses are sorted in a tree, the listed tree branches will correspond to 3D browser's tree branches (see examples below).

Similarly, when tanks are affiliated to parent compartments, they must be expanded in the 3D browser in order to allow detailing their weight data in the report (collapsed parent compartment contents won't be detailed).

3.8.b Inputs:

The following dialog box pops up when the function is selected:



The '**Document Name**' input field allows naming the created report among the data listed in the 2D browser.

The **[OK]** button can be clicked creating the 'Weight Analysis' report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the function.

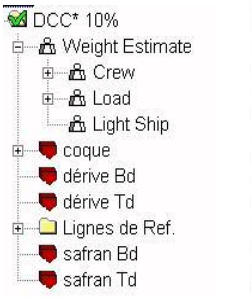
3.8.c Outputs:

After having entered report's name, virtual ship's component weights are reported and displayed in the **[2D]** tab, according to 3D browser's model status:

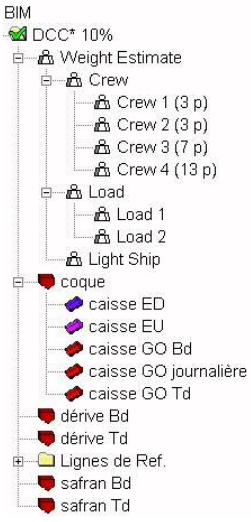
3.8.d Limitations:

When the masses are sorted in a tree, 3D browser's tree status must be set according to the details to list in the weight report.

Similarly, when tanks are affiliated to parent compartments, they must also be expanded in the 3D browser in order to allow detailing their weight data in the report (collapsed parent compartment contents won't be detailed).



Item:	Material:	Quantity:	Mass:	LCG:	TCG:	VCG:
DCC* 10%			(91.1344)	(10.9509)	(0.0004)	(2.8528)
Weight Estimate	Default	100% Weighed	(89.9800)	(10.9338)	(0.0000)	(2.8819)
Light Ship	Default	100% Weighed	79.6000	10.8730	0.0000	2.8340
Load	Default	100% Weighed	8.6550	10.9297	0.0000	2.7767
Crew	Default	100% Weighed	1.7250	13.7609	0.0000	5.6217
coque	Compartment (µ=95%)	Intact (0%)	1.1544	12.2810	0.0282	0.5799



Item:	Material:	Quantity:	Mass:	LCG:	TCG:	VCG:
DCC* 10%			(91.1344)	(10.9509)	(0.0004)	(2.8528)
Weight Estimate	Default	100% Weighed	(89.9800)	(10.9338)	(0.0000)	(2.8819)
Light Ship	Default	100% Weighed	79.6000	10.8730	0.0000	2.8340
Load	Default	100% Weighed	(8.6550)	(10.9297)	(0.0000)	(2.7767)
Load 2	Default	100% Weighed	3.9800	10.8730	0.0000	2.8340
Load 1	Default	100% Weighed	4.6750	10.9780	0.0000	2.7280
Crew	Default	100% Weighed	(1.7250)	(13.7609)	(0.0000)	(5.6217)
Crew 4 (13 p)	Default	100% Weighed	0.9750	14.0000	0.0000	4.6000
Crew 3 (7 p)	Default	100% Weighed	0.5250	13.0000	0.0000	6.9500
Crew 2 (3 p)	Default	100% Weighed	0.2250	14.5000	0.0000	6.9500
Crew 1 (3 p)	Default	0% Weighed				
coque	Compartment (µ=95%)	Intact (0%)	(1.1544)	(12.2810)	(0.0282)	(0.5799)
caisse ED	Tank (µin=100%)	0.00 % Filled	0.0340	15.5000	0.0000	1.5600
caisse EU	Tank (µin=95%)	Full (100%)	0.3359	14.1875	-0.2500	0.6610
caisse GO Bd	Tank (µin=95%)	0.00 % Filled	0.3365	11.5983	0.3238	0.2781
caisse GO journalière	Tank (µin=95%)	0.00 % Filled	0.1115	9.6770	1.0450	1.8585
caisse GO Td	Tank (µin=95%)	0.00 % Filled	0.3365	11.5983	-0.3238	0.2781

3.8.e Typical use:

Presenting ship's weight estimate corresponding to a given loading condition.

3.8.f Example:

- Open the ‘Example Ship.m2a’ file and double click on ‘Damage 100% Supply’ in the 3D browser to select this virtual ship:

- Select "/Tools/Weight Analysis" in the menu bar to create the ‘Weight Analysis’ report and display it among the 2D data.

You can exit the 2D display page by clicking the [Ship], [3D] or [Data] tab.

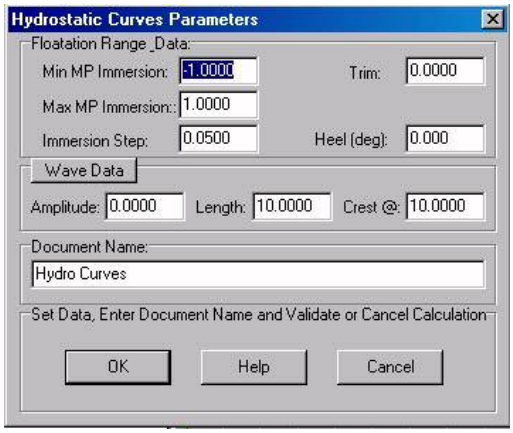
3.9 ***Hydrostatic Curves:***

3.9.a Purpose:

Automatically calculates current ship’s Hydrostatic Curves and Tables for a given floatation range (heel, trim can be defined by user if necessary, as well as an optional sinusoidal swell).

3.9.b Inputs:

The following dialog box pops up when the function is selected:



The ‘**Min MP Immersion**’ input field allows entering the minimum floatation’s height at middle perpendicular (MP).

The ‘**Max MP Immersion**’ input field allows entering the maximum floatation’s height at middle perpendicular (MP).

The ‘**Immersion Step**’ input field allows entering the floatation height increment at middle perpendicular (MP).

The '**Trim**' input field allows entering floatation's trim, in current length units, if not zero.

The '**Heel (deg)**' input field allows entering floatation's heel angle, in degrees, if not zero.

An optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the 2D folder in which the resulting reports will be created created in the 2D browser.

The **[OK]** button can be clicked for calculating the hydrostatic curves according to the current data.

The **[Help]** button allows displaying the online help (Internet access necessary).

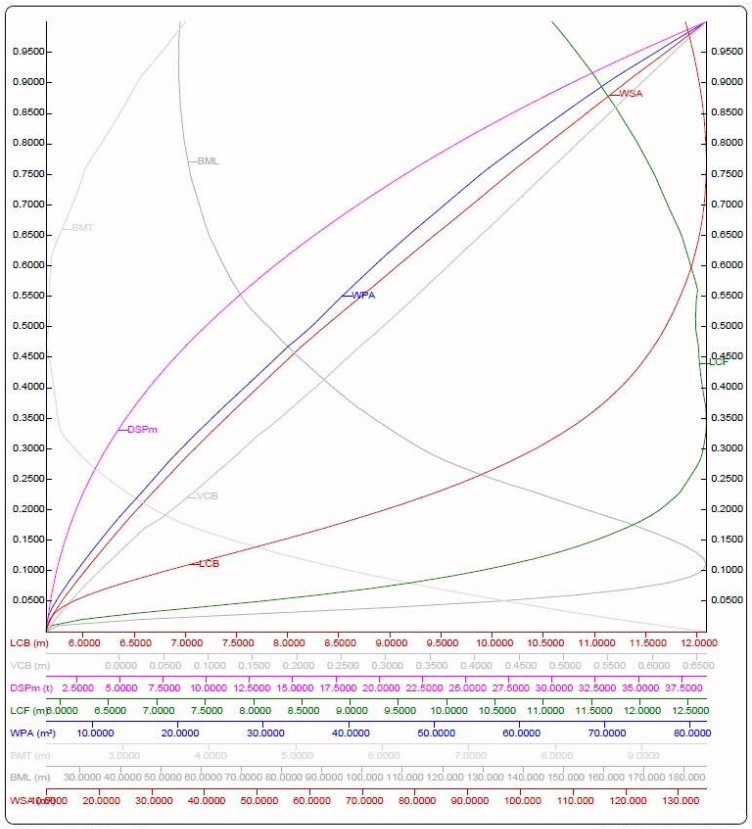
The **[Cancel]** button allows cancelling the calculation.

3.9.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the hydrostatic curves and tables corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created:

Hydrostatic Curves Forms: DCC* 10%
VCG: 0.4224, Density: 1.025, Trim: 0.0000, Heel: 0.000°
AP @ 0.8920, FP @ 24.8880, Length in m, Areas in m², Volumes in m3, Inertias in m4 and Weights in t



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Hydrostatic Curves Forms: DCC* 10%
VCG: 0.4224, Density: 1.025, Trim: 0.0000, Heel: 0.000°
AP @ 0.8920, FP @ 24.8880, Length in m, Areas in m², Volumes in m3, Inertias in m4 and Weights in t

	MP Draft	AP Draft	FP Draft	DSPL	VOL	LCB	TCB	VCB	LCB/F(%)	W.S. Area
1	0.0000	0.0000	0.0000	0.8208	0.8008	5.6407	0.0000	-0.0823	58.18	9.9330
2	0.0100	0.0100	0.0100	0.8702	0.8489	5.6533	0.0000	-0.0771	74.73	10.2949
3	0.0200	0.0200	0.0200	0.9211	0.8986	5.6759	0.0000	-0.0718	75.54	10.7665
4	0.0300	0.0300	0.0300	0.9747	0.9509	5.7204	0.0000	-0.0665	75.92	11.3712
5	0.0400	0.0400	0.0400	1.0322	1.0070	5.7968	0.0000	-0.0609	75.71	12.1018
6	0.0500	0.0500	0.0500	1.0942	1.0675	5.9075	0.0000	-0.0550	75.31	12.9114
7	0.0600	0.0600	0.0600	1.1609	1.1326	6.0490	0.0000	-0.0488	74.75	13.7523
8	0.0700	0.0700	0.0700	1.2328	1.2027	6.2165	0.0000	-0.0424	74.06	14.6355
9	0.0800	0.0800	0.0800	1.3097	1.2777	6.4044	0.0000	-0.0357	73.28	15.5197
10	0.0900	0.0900	0.0900	1.3918	1.3578	6.6073	0.0000	-0.0289	72.43	16.4286

	MP Draft	B² area	WPA	LCF	TPC	MCT	BMT	BML	T Inertia	L Inertia
1	0.0000	0.1477	4.5586	5.8527	0.04673	0.0065	9.7416	21.5506	7.1234	15.7586
2	0.0100	0.1548	4.5855	5.9089	0.04700	0.0079	9.2104	24.5169	7.1552	19.0463
3	0.0200	0.1573	4.7026	6.2223	0.04820	0.0156	8.7246	45.0172	7.1825	37.0604
4	0.0300	0.1585	4.9341	6.7712	0.05057	0.0282	8.2716	76.3733	7.2073	66.5461
5	0.0400	0.1606	5.2804	7.4369	0.05412	0.0424	7.8420	108.099	7.2327	99.7005
6	0.0500	0.1642	5.6998	8.0870	0.05842	0.0557	7.4305	133.975	7.2607	130.9124
7	0.0600	0.1688	6.1480	8.6651	0.06302	0.0675	7.0360	153.164	7.2918	158.7317
8	0.0700	0.1748	6.6361	9.1790	0.06802	0.0781	6.6585	166.825	7.3262	183.5528
9	0.0800	0.1814	7.1244	9.6229	0.07302	0.0876	6.2984	175.965	7.3633	205.7159
10	0.0900	0.1891	7.6364	10.0115	0.07827	0.0961	5.9568	181.602	7.4032	225.6980

	MP Draft	Cb	Cp	L/V^1/3	CW	CB2	CWS	LWL	BWL	TOA
1	0.0000	0.00000	0.39137	13.62177	0.12013	0.00000	3.00101	12.6494	3.1050	0.2163
2	0.0100	1.19211	0.23917	22.16579	0.07283	4.98438	2.99159	20.9881	3.1050	0.2263
3	0.0200	0.60870	0.24025	22.56936	0.07197	2.53359	3.01219	21.7793	3.1050	0.2363
4	0.0300	0.41939	0.24647	22.68168	0.07374	1.70155	3.06362	22.3044	3.1050	0.2463
5	0.0400	0.33100	0.25594	22.38311	0.07845	1.29326	3.13823	22.4353	3.1050	0.2563
6	0.0500	0.27950	0.26432	22.03360	0.08437	1.05744	3.22044	22.5188	3.1050	0.2663
7	0.0600	0.24634	0.27186	21.66397	0.09075	0.90612	3.29745	22.5822	3.1050	0.2763
8	0.0700	0.22366	0.27811	21.28312	0.09773	0.80422	3.37150	22.6338	3.1050	0.2863
9	0.0800	0.20753	0.28417	20.89905	0.10472	0.73031	3.43390	22.6780	3.1050	0.2963
10	0.0900	0.19578	0.28929	20.51478	0.11205	0.67676	3.49059	22.7168	3.1050	0.3063

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3.9.d Limitations:

For obvious reasons, this function only operates when buoyant components are included in ship's model.

3.9.e Typical use:

Calculating ship's Hydrostatic Curves and Tables.

3.9.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Hydro Curves**' in the menu bar.
- Set the '**Min MP Immersion**' input field to 0.
- Click on the **[OK]** button to start the calculation.
- Notice that the first report (Hydrostatic Curves) is displayed in red in the 2D browser, which means that you can export its CSV content if necessary (a right click on its display menu provides CSV export options, but these options are not available for the other reports).

3.10 ***Tank Calibration:***

3.10.a Purpose:

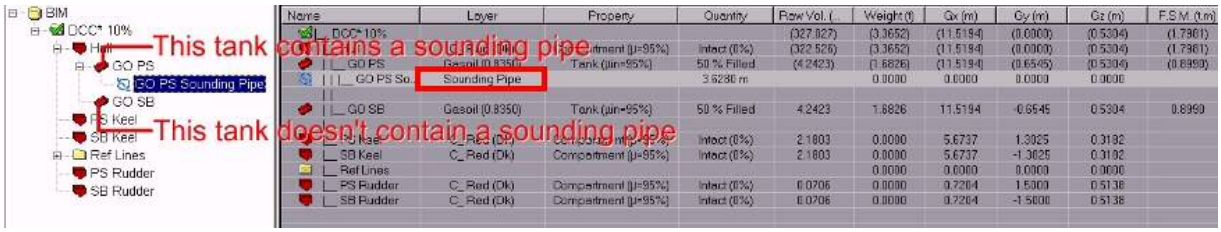
Automatically calibrates current ship's tanks and creates for each tank:

- Tank location / presentation plan.
- Tank calibration diagram showing volume, weight, LCG, VCG, VCGt, FS area and FSM curves according to sounding / ullage.

- Tank calibration table displaying volume, weight, LCG, TCG, VCG, VCGt, FS area and FSM.

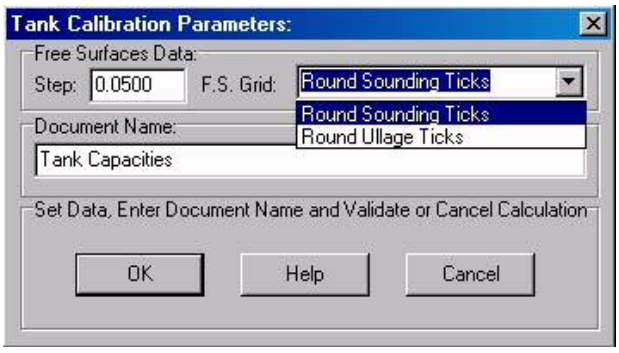
- Tank Pipe Data table (if current tank contains a sounding pipe) displaying tank and pipe's sounding / ullages, volumes, weights, and corresponding pipe coordinates.

It is recalled that when tanks contain a sounding pipe (i.e. an affiliated line in the 'Sounding Pipe Layer'), the reports automatically include the corresponding sounding pipe data and the 'Sounding Tables' function detailed below becomes usable.



3.11.b Inputs:

The following dialog box pops up when the function is selected:



The '**Step**' input field allows entering the free surface increment, provided that heel and trim are fixed to 0°. .

The '**F.S. Incrementation**' selector allows selecting whether table's tank fillings are calculated for round sounding or ullage ticks.

The input field located in the '**Document Name**' frame allows naming the 2D folder in which the reports will be created.

Finally, when the input data are set:

The **[OK]** button can be clicked for starting the tank calibration.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

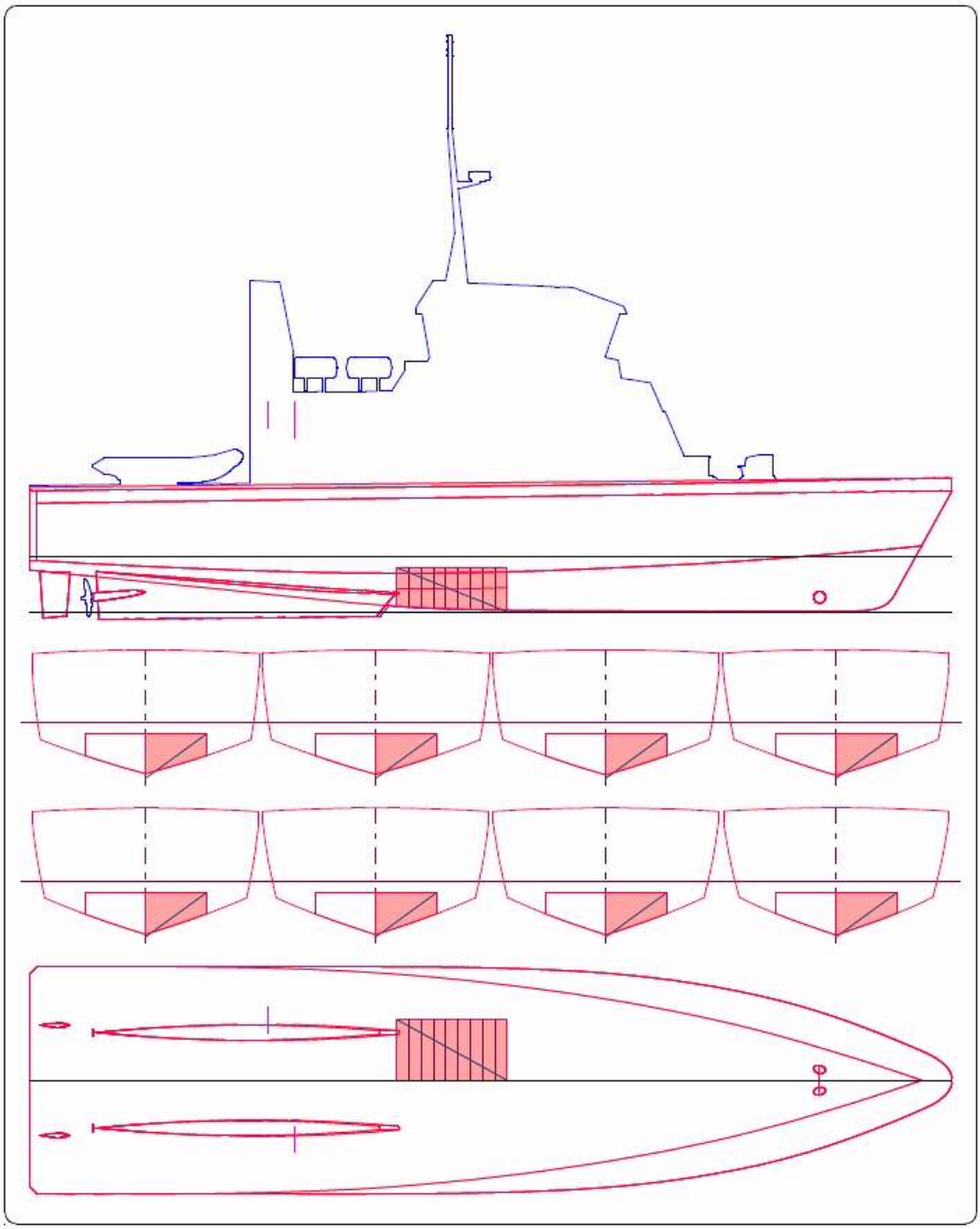
3.10.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the tank calibration reports corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created for each tank:

3.10.c.1: Tank Location / Presentation Plan:

Forms: BIM - Tank: caisse GO Bd (Tank Pipe: Sonde GO Bd) / Length in m, Volume in m3, Weight in t



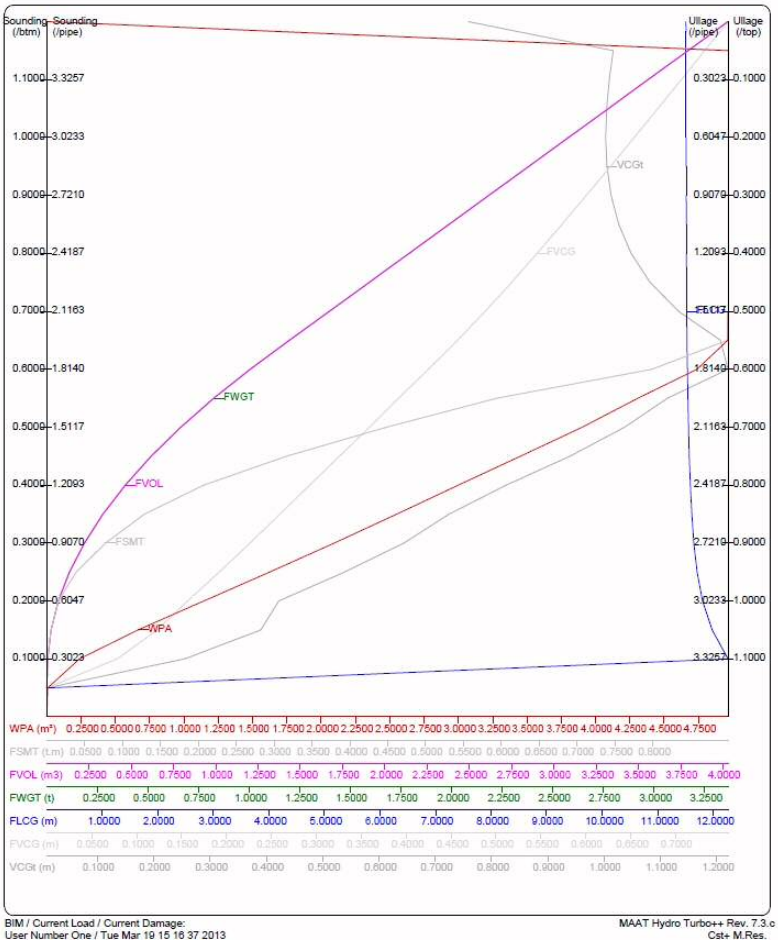
Content: Gasoil	Raw Vol.: 4.2423	LCG: 11.5098	Xmin: 10.0000	Xmax: 13.0000
Density: 0.83500	Weight: 3.3652	TCG: 0.7410	Ymin: 0.0000	Ymax: 1.6550
Permeability: 0.95000	Max FSMt: 0.8990	VCG: 0.7584	Zmin: 0.0449	Zmax: 1.2000

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3.10.c.2: Tank Calibration Diagram:

Tank Capacity of 'caisse GO Bd' (Tank Pipe: Sonde GO Bd)
Trim = 0.0000, Heel = 0.000°, Length in m, Volumes in m3, Inertias in m4, Weights in t
Raw Volume: 4.2423, Content: Gasoil (0.8350), Sounding / Z = 0.0449, Ullage / Z = 1.2000
Net Volume: 4.0302, Permeability: 95%, Max Weight: 3.3652, LCG: 11.5098 m, TCG: 0.7410 m, VCG 0.7584



3.10.c.3: Tank Calibration Table:

Tank Capacity of 'GO PS', Content: Gasoil (0.8350), Raw Volume: 4.2422 m3, Capacity: 4.0301 m3
Trim = Heel = 0°, Permeability: 95%, Max Weight: 3.3651 t, LCG: 11.5098 m, TCG: 0.7397 m, VCG 0.7582 m
Tank Pipe: Sonde desc longue, Pipe Length = 1.1500 m, Pipe Bottom @ Z=0.0500 m, Pipe Top @ Z=1.2000 m

Filling (%)	Sounding (m)	Ullage (m)	Volume (m3)	Weight (t)	LCG (m)	TCG (m)	VCG (m)	VCGt (m)	FSMt (t.m)
0.00	?	?	0.0000	0.0000	0.0000	0.0000	0.0000	0.0100	0.0000
0.00	0.0000	1.1500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0100	0.0000
0.11	0.0500	1.1000	0.0045	0.0037	12.3231	0.0502	0.0858	0.1837	0.0004
0.62	0.1000	1.0500	0.0249	0.0208	12.0154	0.0918	0.1216	0.2879	0.0035
1.68	0.1500	1.0000	0.0678	0.0566	11.8195	0.1378	0.1569	0.3902	0.0132
3.31	0.2000	0.9500	0.1335	0.1115	11.7159	0.1872	0.1912	0.4944	0.0338
5.50	0.2500	0.9000	0.2218	0.1852	11.6556	0.2377	0.2250	0.5991	0.0693
8.24	0.3000	0.8500	0.3322	0.2774	11.6167	0.2884	0.2586	0.7071	0.1244
10.00	0.3268	0.8232	0.4030	0.3365	11.6023	0.3154	0.2764	0.7623	0.1654
11.52	0.3500	0.8000	0.4644	0.3878	11.5898	0.3388	0.2919	0.8102	0.2010
15.33	0.4000	0.7500	0.6179	0.5160	11.5702	0.3888	0.3251	0.9149	0.3043
19.66	0.4500	0.7000	0.7925	0.6617	11.5553	0.4383	0.3583	1.0142	0.4341
24.51	0.5000	0.6500	0.9877	0.8247	11.5437	0.4872	0.3913	1.1135	0.5956
29.85	0.5500	0.6000	1.2031	1.0046	11.5343	0.5355	0.4243	1.2080	0.7873
35.63	0.6000	0.5500	1.4359	1.1990	11.5276	0.5811	0.4568	1.2065	0.8988
41.48	0.6500	0.5000	1.6717	1.3959	11.5237	0.6159	0.4876	1.1316	0.8990
47.33	0.7000	0.4500	1.9076	1.5928	11.5208	0.6420	0.5170	1.0814	0.8990
50.00	0.7228	0.4272	2.0151	1.6826	11.5197	0.6513	0.5299	1.0660	0.8990
53.18	0.7500	0.4000	2.1434	1.7897	11.5185	0.6625	0.5454	1.0477	0.8990
59.04	0.8000	0.3500	2.3792	1.9867	11.5167	0.6788	0.5731	1.0256	0.8990
64.89	0.8500	0.3000	2.6151	2.1836	11.5152	0.6922	0.6003	1.0120	0.8990
70.74	0.9000	0.2500	2.8509	2.3805	11.5139	0.7034	0.6272	1.0048	0.8990
76.59	0.9500	0.2000	3.0868	2.5774	11.5128	0.7129	0.6537	1.0025	0.8990
82.44	1.0000	0.1500	3.3226	2.7744	11.5119	0.7210	0.6801	1.0041	0.8990
88.30	1.0500	0.1000	3.5584	2.9713	11.5111	0.7281	0.7063	1.0088	0.8990
94.15	1.1000	0.0500	3.7943	3.1682	11.5104	0.7343	0.7323	1.0160	0.8990
98.00	1.1329	0.0171	3.9495	3.2978	11.5100	0.7379	0.7493	1.0222	0.8990
100.00	1.1500	0.0000	4.0301	3.3651	11.5098	0.7397	0.7582	1.0253	0.8990

3.10.c.4: Tank Pipe Data Table:

Tank Pipe Data of 'GO PS', Content: Gasoil (0.8350), Raw Volume: 4.2422 m3, Capacity: 4.0301 m3
Trim = Heel = 0°, Permeability: 95%, Max Weight: 3.3651 t, Tank Bottom @: 0.0449 m, Tank Top @ 1.2000 m
Tank Pipe: Sonde desc longue, Pipe Length = 1.1500 m, Pipe Bottom @ Z=0.0500 m, Pipe Top @ Z=1.2000 m

Filling (%)	Volume (m3)	Weight (t)	Sounding (m)	Ullage (m)	H/Botm (m)	H/Top (m)	Pipe X (m)	Pipe Y (m)	Z (m)
0.00	0.0000	0.0000	?	?	0.0051	1.1551	?	?	0.0449
0.00	0.0000	0.0000	0.0000	1.1500	0.0000	1.1500	13.0000	0.0000	0.0500
0.11	0.0045	0.0037	0.0500	1.1000	0.0500	1.1000	13.0000	0.0000	0.1000
0.62	0.0249	0.0208	0.1000	1.0500	0.1000	1.0500	13.0000	0.0000	0.1500
1.68	0.0678	0.0566	0.1500	1.0000	0.1500	1.0000	13.0000	0.0000	0.2000
3.31	0.1335	0.1115	0.2000	0.9500	0.2000	0.9500	13.0000	0.0000	0.2500
5.50	0.2218	0.1852	0.2500	0.9000	0.2500	0.9000	13.0000	0.0000	0.3000
8.24	0.3322	0.2774	0.3000	0.8500	0.3000	0.8500	13.0000	0.0000	0.3500
10.00	0.4030	0.3365	0.3268	0.8232	0.3268	0.8232	13.0000	0.0000	0.3768
11.52	0.4644	0.3878	0.3500	0.8000	0.3500	0.8000	13.0000	0.0000	0.4000
15.33	0.6179	0.5160	0.4000	0.7500	0.4000	0.7500	13.0000	0.0000	0.4500
19.66	0.7925	0.6617	0.4500	0.7000	0.4500	0.7000	13.0000	0.0000	0.5000
24.51	0.9877	0.8247	0.5000	0.6500	0.5000	0.6500	13.0000	0.0000	0.5500
29.85	1.2031	1.0046	0.5500	0.6000	0.5500	0.6000	13.0000	0.0000	0.6000
35.63	1.4359	1.1990	0.6000	0.5500	0.6000	0.5500	13.0000	0.0000	0.6500
41.48	1.6717	1.3959	0.6500	0.5000	0.6500	0.5000	13.0000	0.0000	0.7000
47.33	1.9076	1.5928	0.7000	0.4500	0.7000	0.4500	13.0000	0.0000	0.7500
50.00	2.0151	1.6826	0.7228	0.4272	0.7228	0.4272	13.0000	0.0000	0.7728
53.18	2.1434	1.7897	0.7500	0.4000	0.7500	0.4000	13.0000	0.0000	0.8000
59.04	2.3792	1.9867	0.8000	0.3500	0.8000	0.3500	13.0000	0.0000	0.8500
64.89	2.6151	2.1836	0.8500	0.3000	0.8500	0.3000	13.0000	0.0000	0.9000
70.74	2.8509	2.3805	0.9000	0.2500	0.9000	0.2500	13.0000	0.0000	0.9500
76.59	3.0868	2.5774	0.9500	0.2000	0.9500	0.2000	13.0000	0.0000	1.0000
82.44	3.3226	2.7744	1.0000	0.1500	1.0000	0.1500	13.0000	0.0000	1.0500
88.30	3.5584	2.9713	1.0500	0.1000	1.0500	0.1000	13.0000	0.0000	1.1000
94.15	3.7943	3.1682	1.1000	0.0500	1.1000	0.0500	13.0000	0.0000	1.1500
98.00	3.9495	3.2978	1.1329	0.0171	1.1329	0.0171	13.0000	0.0000	1.1829
100.00	4.0301	3.3651	1.1500	0.0000	1.1500	0.0000	13.0000	0.0000	1.2000

3.10.d Limitations:

For obvious reasons, this function only operates when tanks are included in ship's model.

Tank pipes must be affiliated to the tanks if you want to calculate the tank pipe data.

Tank's permeability and density must be set to realistic values.

3.10.e Typical use:

Calibrating ship's tanks for designer's purpose (use the 'Sounding Tables' function for getting ship tank's onboard data).

3.10.f Example:

Open the ‘Example Ship.m2a’ file and double click on ‘Damage 100% Supply’ in the 3D browser to select this virtual ship:

Select "**/Curve/Line/Line"** in the menu bar.

Type '12.9,0.1,0.1[Return]' to input tank pipe's bottom.

Type '12.9,0.1,1.2[Return]' to input tank pipe's top.

Check the 'Tank Pipe Layer' on [Ship] tab's [Hydro] page.

Click on the [Data] tab to display the corresponding page.

Rename the created line 'GO PS Tank Pipe' in the 3D browser

Set 'GO PS Tank Pipe' line's layer to the current 'Tank Pipe Layer'.

Drag the 'GO PS Tank Pipe' line with the 3D browser to drop it in the 'GO PS' tank.

Select '/Tools/Tank Calibration' and validate directly.

Compare the results obtained with and without affiliating a tank pipe.

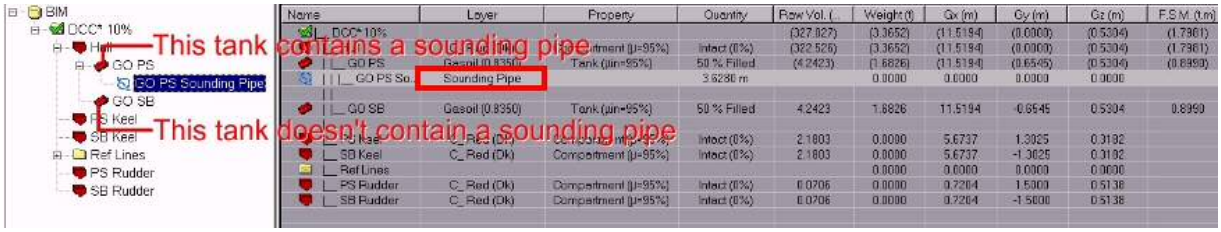
Compare these results with the 'Sounding Tables' results (see below).

3.11 ***Sounding Tables:***

3.11.a Purpose:

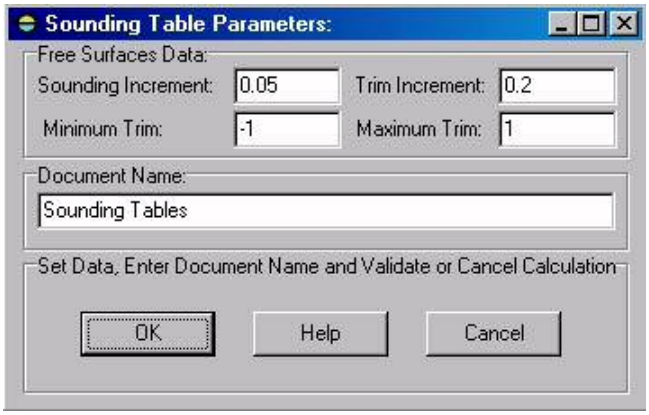
Automatically calculates current tank's sounding tables (i.e. tank capacity table according to sounding / ullages in a given trim range) as soon the tanks can be sounded.

It is recalled that tanks can only be sounded when they contain a sounding pipe (i.e. an affiliated line in the ‘Sounding Pipe Layer’ declared on [Ship] tab's [Hydro] page). See FAQ for more details.



3.11.b Inputs:

The following dialog box pops up when the function is selected:



The '**Sounding Increment**' input field allows entering the free surface increment (heel = 0°).

The '**Trim Increment**' input field allows entering the trim increment in current length unit. As 11 (0 to 10) trims are automatically calculated for each sounding, this increment must be correlated to trim range's limits

The '**Minimum Trim**' input field allows entering the trim range's minimum value. According to the current **Trim Increment** value, the '**Maximum Trim**' value is automatically updated accordingly (maximum trim = minimum trim + 10* trim increment).

The '**Maximum Trim**' input field allows entering the trim range's maximum value. According to the current **Trim Increment** value, the '**Minimum Trim**' value is automatically updated accordingly (minimum trim = maximum trim - 10* trim increment).

The input field located in the '**Document Name**' frame allows naming the 2D folder in which the reports will be created.

Finally, when the input data are set:

The **[OK]** button can be clicked for starting the tank calibration.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

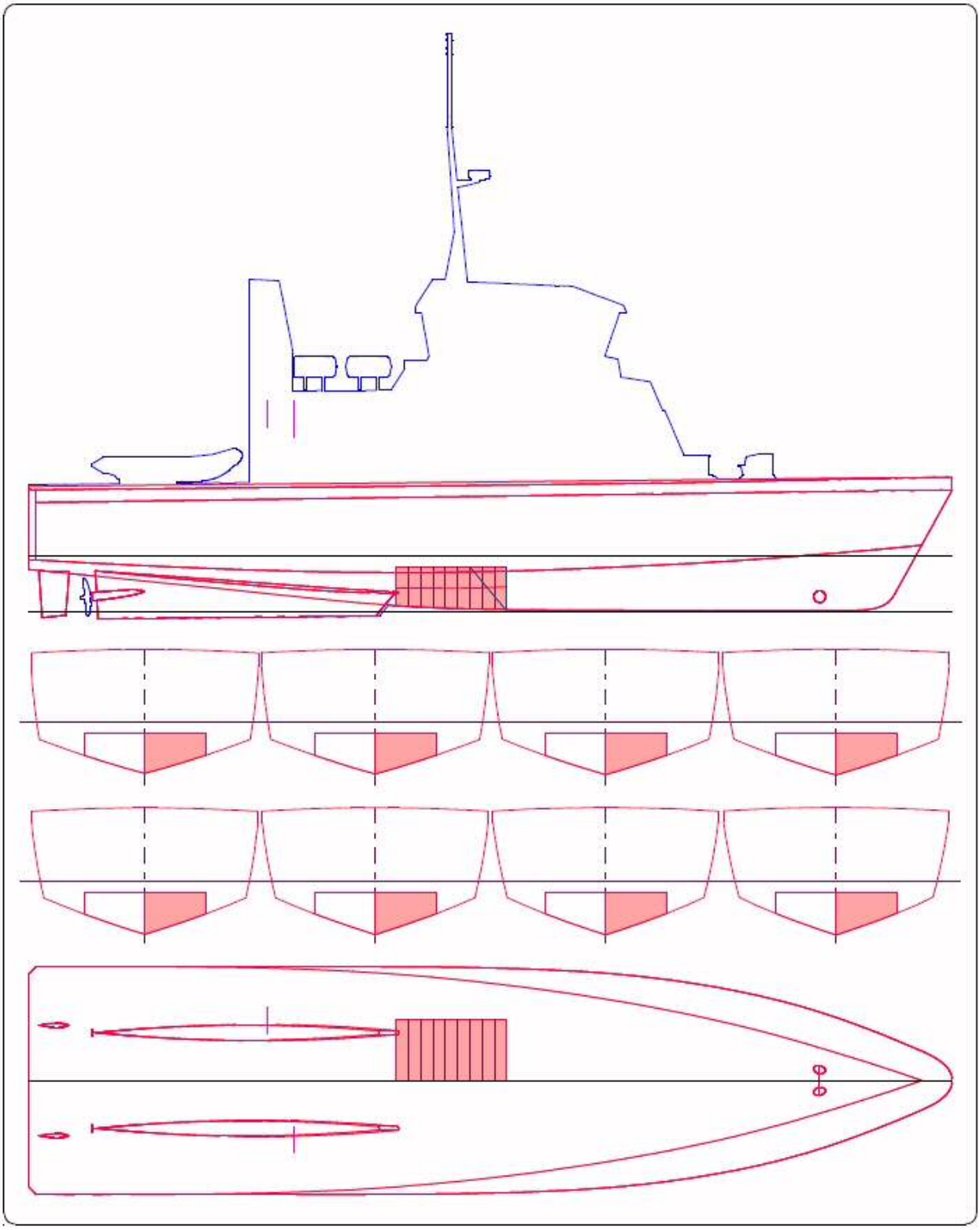
3.11.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the sounding tables corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created for each soundable tank:

3.11.c.1: Tank Location / Presentation Plan:

Forms: BIM - Tank: GO PS (Tank Pipe: Oblique) / Length in m, Volume in m3, Weight in t



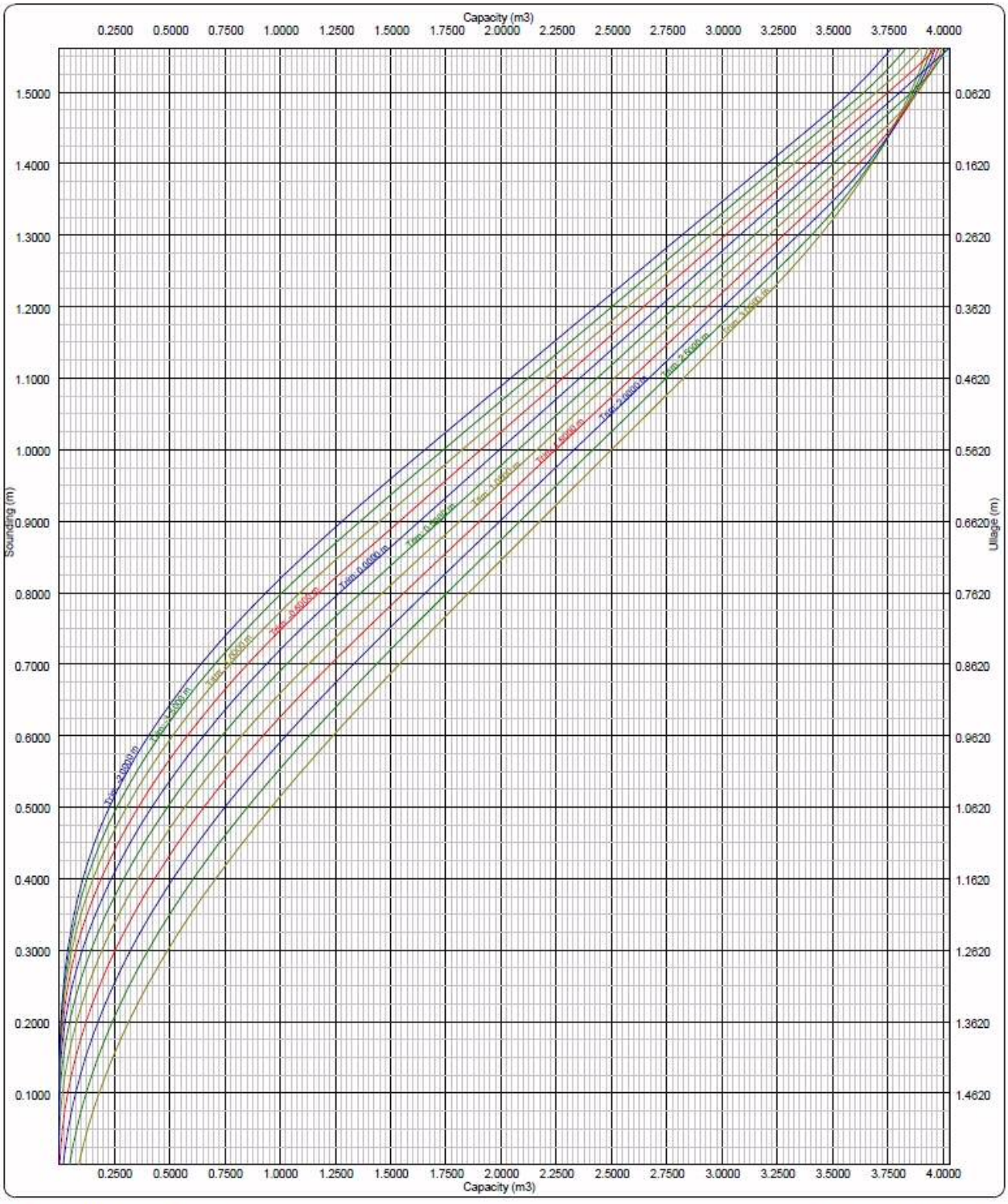
Content: Gasoil	Raw Vol.: 4.2422	LCG: 11.5098	Xmin: 10.0000	Xmax: 13.0000
Density: 0.83500	Weight: 3.3651	TCG: 0.7397	Ymin: 0.0000	Ymax: 1.6550
Permeability: 0.95000	Max FSMt: 1.0803	VCG: 0.7582	Zmin: 0.0449	Zmax: 1.2000

BIM / Current Load / Current Damage:
User Number One / Tue Apr 02 18 13 04 2013

MAAT Hydro Turbo++ Rev. 7.4
Smt+ V.H.Res.

3.11.c.2: Sounding Curves:

Capacities of 'GO PS', Content: Gasoil (0.8350), Raw Volume: 4.2422, Max Capacity: 4.0301
Permeability: 95%, Tank Pipe: Oblique (Length = 1.5620 m)



BIM / Current Load / Current Damage:
User Number One / Tue Apr 02 18 13 04 2013

MAAT Hydro Turbo++ Rev. 7.4
Smt+ V.H.Res.

3.11.c.3: Sounding Table:

Sounding / Trim Capacity Table of 'GO PS', Content: Gasoil (0.8350), Raw Volume: 4.2422 m3, Maximum Capacity: 4.0301 m3
Tank Pipe: Oblique (Length = 1.5620 m), Permeability: 95%, Maximum Weight: 3.3651 t

Capacities in m3												
Sounding: (m)	Ullage: (m)	Trim(m): -2.0000	Trim(m): -1.5000	Trim(m): -1.0000	Trim(m): -0.5000	Trim(m): 0.0000	Trim(m): 0.5000	Trim(m): 1.0000	Trim(m): 1.5000	Trim(m): 2.0000	Trim(m): 2.5000	Trim(m): 3.0000
0.0000	1.5620	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0033	0.0189	0.0472	0.0880
0.0250	1.5370	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0081	0.0288	0.0620	0.1075
0.0500	1.5120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0154	0.0412	0.0793	0.1294
0.0750	1.4870	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0070	0.0256	0.0565	0.0993	0.1539
0.1000	1.4620	0.0003	0.0003	0.0004	0.0005	0.0010	0.0036	0.0152	0.0390	0.0747	0.1221	0.1810
0.1250	1.4370	0.0010	0.0011	0.0014	0.0020	0.0036	0.0096	0.0265	0.0553	0.0958	0.1477	0.2108
0.1500	1.4120	0.0024	0.0028	0.0035	0.0050	0.0086	0.0190	0.0411	0.0748	0.1198	0.1760	0.2432
0.1750	1.3870	0.0047	0.0056	0.0070	0.0099	0.0163	0.0318	0.0588	0.0972	0.1467	0.2071	0.2782
0.2000	1.3620	0.0083	0.0098	0.0124	0.0171	0.0273	0.0478	0.0797	0.1227	0.1765	0.2409	0.3158
0.2250	1.3370	0.0133	0.0158	0.0198	0.0271	0.0416	0.0671	0.1037	0.1511	0.2090	0.2774	0.3560
0.2500	1.3120	0.0200	0.0237	0.0296	0.0400	0.0594	0.0897	0.1308	0.1825	0.2445	0.3166	0.3987
0.2750	1.2870	0.0286	0.0338	0.0421	0.0563	0.0806	0.1155	0.1610	0.2168	0.2827	0.3585	0.4440
0.3000	1.2620	0.0394	0.0464	0.0575	0.0761	0.1051	0.1446	0.1943	0.2541	0.3237	0.4030	0.4918
0.3250	1.2370	0.0524	0.0617	0.0761	0.0994	0.1330	0.1768	0.2306	0.2942	0.3675	0.4502	0.5422
0.3500	1.2120	0.0681	0.0800	0.0982	0.1262	0.1642	0.2122	0.2700	0.3373	0.4140	0.5000	0.5950
0.3750	1.1870	0.0865	0.1014	0.1239	0.1564	0.1987	0.2508	0.3123	0.3832	0.4633	0.5524	0.6503
0.4000	1.1620	0.1079	0.1262	0.1532	0.1901	0.2365	0.2925	0.3577	0.4320	0.5153	0.6074	0.7081
0.4250	1.1370	0.1324	0.1546	0.1861	0.2271	0.2776	0.3373	0.4060	0.4836	0.5700	0.6650	0.7680
0.4500	1.1120	0.1603	0.1867	0.2225	0.2676	0.3219	0.3851	0.4573	0.5381	0.6274	0.7251	0.8301
0.4750	1.0870	0.1918	0.2224	0.2624	0.3114	0.3694	0.4361	0.5115	0.5953	0.6875	0.7878	0.8942
0.5000	1.0620	0.2269	0.2618	0.3058	0.3586	0.4201	0.4901	0.5686	0.6553	0.7502	0.8528	0.9601
0.5250	1.0370	0.2659	0.3049	0.3526	0.4090	0.4739	0.5472	0.6286	0.7181	0.8156	0.9199	1.0278
0.5500	1.0120	0.3086	0.3515	0.4029	0.4628	0.5309	0.6072	0.6915	0.7837	0.8836	0.9889	1.0970
0.5750	0.9870	0.3551	0.4017	0.4566	0.5198	0.5911	0.6703	0.7573	0.8520	0.9539	1.0598	1.1678
0.6000	0.9620	0.4052	0.4554	0.5138	0.5801	0.6543	0.7363	0.8259	0.9230	1.0263	1.1324	1.2399
0.6250	0.9370	0.4590	0.5126	0.5742	0.6436	0.7206	0.8053	0.8973	0.9966	1.1006	1.2065	1.3133
0.6500	0.9120	0.5164	0.5734	0.6380	0.7103	0.7900	0.8772	0.9716	1.0726	1.1767	1.2819	1.3879
0.6750	0.8870	0.5775	0.6376	0.7052	0.7802	0.8625	0.9520	1.0486	1.1505	1.2542	1.3587	1.4635
0.7000	0.8620	0.6421	0.7052	0.7756	0.8532	0.9380	1.0297	1.1283	1.2302	1.3331	1.4365	1.5401
0.7250	0.8370	0.7103	0.7762	0.8493	0.9294	1.0164	1.1104	1.2100	1.3114	1.4132	1.5153	1.6176
0.7500	0.8120	0.7820	0.8507	0.9262	1.0087	1.0979	1.1938	1.2935	1.3938	1.4944	1.5951	1.6958
0.7750	0.7870	0.8573	0.9284	1.0064	1.0911	1.1823	1.2796	1.3783	1.4773	1.5764	1.6755	1.7747
0.8000	0.7620	0.9360	1.0096	1.0898	1.1765	1.2697	1.3669	1.4642	1.5616	1.6591	1.7566	1.8542
0.8250	0.7370	1.0180	1.0940	1.1763	1.2650	1.3595	1.4551	1.5508	1.6466	1.7424	1.8383	1.9342
0.8500	0.7120	1.1030	1.1813	1.2657	1.3562	1.4500	1.5439	1.6380	1.7320	1.8261	1.9203	2.0146
0.8750	0.6870	1.1907	1.2710	1.3571	1.4482	1.5406	1.6329	1.7253	1.8177	1.9102	2.0027	2.0952
0.9000	0.6620	1.2806	1.3626	1.4498	1.5403	1.6312	1.7220	1.8128	1.9036	1.9944	2.0853	2.1762
0.9250	0.6370	1.3724	1.4557	1.5433	1.6325	1.7217	1.8110	1.9002	1.9895	2.0787	2.1680	2.2572
0.9500	0.6120	1.4658	1.5498	1.6370	1.7247	1.8123	1.9000	1.9877	2.0753	2.1630	2.2507	2.3384
0.9750	0.5870	1.5605	1.6447	1.7307	1.8168	1.9029	1.9890	2.0751	2.1612	2.2473	2.3334	2.4195
1.0000	0.5620	1.6561	1.7400	1.8245	1.9090	1.9935	2.0780	2.1626	2.2471	2.3316	2.4162	2.5007
1.0250	0.5370	1.7525	1.8353	1.9182	2.0011	2.0841	2.1670	2.2500	2.3330	2.4159	2.4989	2.5819
1.0500	0.5120	1.8492	1.9306	2.0119	2.0933	2.1747	2.2561	2.3374	2.4188	2.5002	2.5816	2.6630
1.0750	0.4870	1.9461	2.0259	2.1057	2.1855	2.2653	2.3451	2.4249	2.5047	2.5845	2.6643	2.7442
1.1000	0.4620	2.0430	2.1212	2.1994	2.2776	2.3559	2.4341	2.5123	2.5906	2.6688	2.7471	2.8253
1.1250	0.4370	2.1398	2.2165	2.2931	2.3698	2.4464	2.5231	2.5998	2.6764	2.7531	2.8298	2.9065
1.1500	0.4120	2.2367	2.3118	2.3869	2.4619	2.5370	2.6121	2.6872	2.7623	2.8374	2.9125	2.9876
1.1750	0.3870	2.3336	2.4071	2.4806	2.5541	2.6276	2.7011	2.7747	2.8482	2.9217	2.9952	3.0688
1.2000	0.3620	2.4305	2.5024	2.5743	2.6463	2.7182	2.7902	2.8621	2.9341	3.0060	3.0780	3.1499
1.2250	0.3370	2.5273	2.5977	2.6681	2.7384	2.8088	2.8792	2.9495	3.0199	3.0903	3.1607	3.2290
1.2500	0.3120	2.6242	2.6930	2.7618	2.8306	2.8994	2.9682	3.0370	3.1058	3.1746	3.2434	3.3044
1.2750	0.2870	2.7211	2.7883	2.8555	2.9227	2.9900	3.0572	3.1244	3.1917	3.2589	3.3258	3.3761
1.3000	0.2620	2.8180	2.8836	2.9493	3.0149	3.0806	3.1462	3.2119	3.2775	3.3432	3.4043	3.4440
1.3250	0.2370	2.9148	2.9789	3.0430	3.1071	3.1712	3.2352	3.2993	3.3634	3.4275	3.4782	3.5082
1.3500	0.2120	3.0117	3.0742	3.1367	3.1992	3.2617	3.3243	3.3868	3.4493	3.5097	3.5475	3.5687
1.3750	0.1870	3.1086	3.1695	3.2305	3.2914	3.3523	3.4133	3.4742	3.5352	3.5859	3.6121	3.6255
1.4000	0.1620	3.2055	3.2648	3.3242	3.3836	3.4429	3.5023	3.5617	3.6204	3.6560	3.6721	3.6785
1.4250	0.1370	3.3024	3.3601	3.4179	3.4757	3.5335	3.5913	3.6491	3.6989	3.7202	3.7275	3.7278
1.4500	0.1120	3.3992	3.4554	3.5117	3.5679	3.6241	3.6803	3.7365	3.7691	3.7783	3.7782	3.7734
1.4750	0.0870	3.4948	3.5507	3.6054	3.6600	3.7147	3.7693	3.8173	3.8309	3.8304	3.8242	3.8153
1.5000	0.0620	3.5831	3.6441	3.6991	3.7522	3.8053	3.8583	3.8851	3.8844	3.8764	3.8657	3.8535

3.11.d Limitations:

For obvious reasons, the sounding curves and tables can only be calculated for the soundable tanks, i.e. tanks containing a tank pipe (See FAQ for more details).

3.10.e Typical use:

Calculating ship tank's sounding tables for onboard use (use '/Tools/Tank Calibration' for getting ship tank's design data).

3.10.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select "**/Curve/Line/Line"** in the menu bar.
- Type '12.9,0.1,0.1[Return]' to input tank pipe's bottom.
- Type '12.9,0.1,1.2[Return]' to input tank pipe's top.
- Check the 'Tank Pipe Layer' on [Ship] tab's [Hydro] page.
- Click on the [Data] tab to display the corresponding page.
- Rename the created line 'GO PS Tank Pipe' in the 3D browser
- Set 'GO PS Tank Pipe' line's layer to the current 'Tank Pipe Layer'.
- Drag the 'GO PS Tank Pipe' line with the 3D browser to drop it in the 'GO PS' tank.
- Select '/Tools/Sounding Tables' and validate directly.

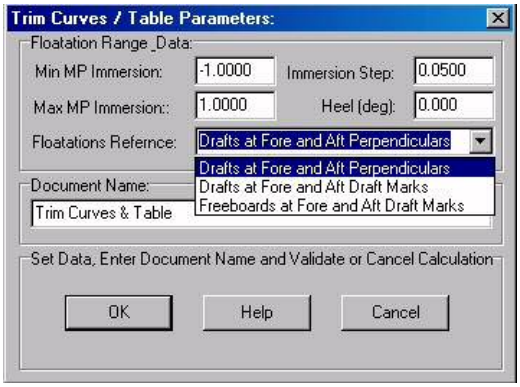
3.12 *Trim Curves / Tables:*

3.12.a Purpose:

Automatically calculates current ship's Trim Curves and Tables for a given immersion / trim range (trim range results from the immersion range at perpendiculars / draft marks).

3.12.b Inputs:

The following dialog box pops up when the function is selected:



The '**Min MP Immersion**' input field allows entering the minimum floatation's height at middle perpendicular (MP).

The '**Max MP Immersion**' input field allows entering the maximum floatation's height at middle perpendicular (MP).

The '**Immersion Step**' input field allows entering the floatation height increment at middle perpendicular (MP).

The '**Heel (deg)**' input field allows entering floatation's heel angle, in degrees, if not zero.

The '**Floatations Reference**' selector allows selecting to which references the floatation range will refer:

- '**Drafts at Fore and Aft Perpendiculars**' allows fixing the calculated floatations according to designer's perpendiculars. The corresponding reports are therefore rather intended for the designer.

- '**Drafts at Fore and Aft Draft Marks**' allows fixing the calculated floatations according to the draft marks (whose coordinates can be fixed on [Ship] tab's [Hydro] page), assuming that drafts are positive when marks are submerged. The corresponding reports are therefore rather intended for the crew.

- '**Freeboards at Fore and Aft Draft Marks**' allows fixing the calculated floatations according to the draft marks (whose coordinates can be fixed on [Ship] tab's [Hydro] page), assuming that freeboards are positive when marks are emerged. The corresponding reports are therefore rather intended for the crew.

At last, when all these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the 2D folder in which the resulting reports will be created created in the 2D browser.

The **[OK]** button can be clicked for calculating the hydrostatic curves according to the current data.

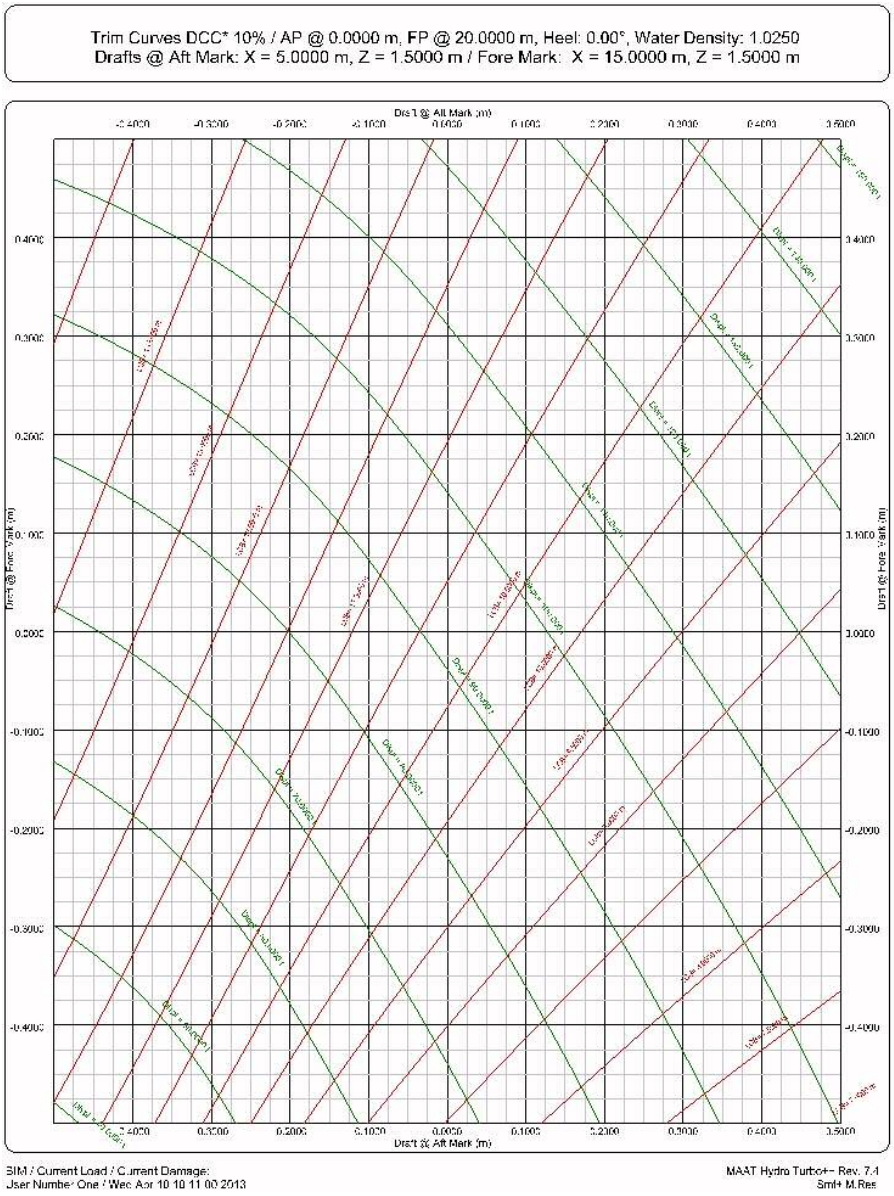
The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

3.12.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the trim curves and tables corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created:



Trim Table DCC* 10% /AP @ 0.0000 m, FP @ 20.0000 m, Heel: 0.00°, Water Density: 1.0250
Drafts @ Aft Mark X = 5.0000 m, Z = 1.5000 m / Fore Mark X = 15.0000 m, Z = 1.5000 m (VCG=VCB)

AM Draft: (m)	FM Draft: (m)	MP Draft: (m)	Trim: (m)	DSPL: (t)	LCB: (m)	TPC: (t/cm)	MCT: (t.m/cm)	BMT: (m)	FBMin: (m)
-0.5000	-0.5000	1.0000	0.0000	38.9029	11.9022	0.83880	1.0892	3.7750	2.2957
-0.4500	-0.5000	1.0250	0.1000	40.6732	11.5759	0.88959	1.2145	4.0995	2.2217
-0.4000	-0.5000	1.0500	0.2000	42.7721	11.2176	0.95199	1.3820	4.4939	2.1477
-0.3500	-0.5000	1.0750	0.3000	45.2586	10.8233	1.01023	1.5460	4.8458	2.0736
-0.3000	-0.5000	1.1000	0.4000	48.0944	10.4109	1.05597	1.6770	5.1341	1.9995
-0.2500	-0.5000	1.1250	0.5000	51.1984	10.0015	1.08289	1.7590	5.2416	1.9253
-0.2000	-0.5000	1.1500	0.6000	54.4083	9.6241	1.08371	1.7536	4.9738	1.8511
-0.1500	-0.5000	1.1750	0.7000	57.6276	9.2896	1.08247	1.7405	4.7044	1.7769
-0.1000	-0.5000	1.2000	0.8000	60.8543	8.9917	1.08109	1.7272	4.4617	1.7027
-0.0500	-0.5000	1.2250	0.9000	64.0884	8.7249	1.07972	1.7139	4.2432	1.6285
0.0000	-0.5000	1.2500	1.0000	67.3302	8.4849	1.07826	1.7005	4.0445	1.5542
0.0500	-0.5000	1.2750	1.1000	70.5792	8.2680	1.07674	1.6869	3.8633	1.4790
0.1000	-0.5000	1.3000	1.2000	73.8357	8.0712	1.07516	1.6731	3.6973	1.4037
0.1500	-0.5000	1.3250	1.3000	77.0997	7.8920	1.07358	1.6593	3.5451	1.3284
0.2000	-0.5000	1.3500	1.4000	80.3714	7.7286	1.07104	1.6380	3.4047	1.2531
0.2500	-0.5000	1.3750	1.5000	83.6546	7.5795	1.06863	1.6177	3.2748	1.1779
0.3000	-0.5000	1.4000	1.6000	86.9471	7.4430	1.06667	1.6008	3.1546	1.1027
0.3500	-0.5000	1.4250	1.7000	90.2476	7.3174	1.06485	1.5854	3.0427	1.0275
0.4000	-0.5000	1.4500	1.8000	93.5557	7.2017	1.06314	1.5708	2.9385	0.9524
0.4500	-0.5000	1.4750	1.9000	96.8712	7.0947	1.06153	1.5568	2.8413	0.8773
0.5000	-0.5000	1.5000	2.0000	100.194	6.9957	1.05996	1.5432	2.7505	0.8022
-0.5000	-0.4500	1.0250	-0.1000	41.5184	12.1198	0.85506	1.1030	3.7660	2.3196
-0.4500	-0.4500	1.0500	0.0000	43.2552	11.8086	0.90364	1.2244	4.0618	2.2457
-0.4000	-0.4500	1.0750	0.1000	45.2929	11.4692	0.95753	1.3762	4.3451	2.1717
-0.3500	-0.4500	1.1000	0.2000	47.6908	11.0954	1.01363	1.5484	4.6184	2.0977
-0.3000	-0.4500	1.1250	0.3000	50.4374	10.6985	1.05979	1.6888	4.8660	2.0236
-0.2500	-0.4500	1.1500	0.4000	53.4674	10.2977	1.09120	1.7880	5.0163	1.9495
-0.2000	-0.4500	1.1750	0.5000	56.6519	9.9175	1.09738	1.8041	4.8518	1.8753
-0.1500	-0.4500	1.2000	0.6000	59.8561	9.5768	1.09589	1.7912	4.5968	1.8011
-0.1000	-0.4500	1.2250	0.7000	63.0674	9.2717	1.09437	1.7783	4.3670	1.7270
-0.0500	-0.4500	1.2500	0.8000	66.2857	8.9973	1.09282	1.7654	4.1588	1.6527
0.0000	-0.4500	1.2750	0.9000	69.5112	8.7493	1.09125	1.7523	3.9695	1.5785
0.0500	-0.4500	1.3000	1.0000	72.7440	8.5242	1.08966	1.7392	3.7965	1.5043
0.1000	-0.4500	1.3250	1.1000	75.9837	8.3193	1.08807	1.7261	3.6380	1.4290
0.1500	-0.4500	1.3500	1.2000	79.2309	8.1321	1.08644	1.7128	3.4920	1.3538
0.2000	-0.4500	1.3750	1.3000	82.4850	7.9605	1.08480	1.6994	3.3572	1.2785
0.2500	-0.4500	1.4000	1.4000	85.7461	7.8029	1.08316	1.6859	3.2325	1.2033
0.3000	-0.4500	1.4250	1.5000	89.0148	7.6578	1.08151	1.6723	3.1168	1.1280
0.3500	-0.4500	1.4500	1.6000	92.2929	7.5242	1.07847	1.6477	3.0088	1.0528
0.4000	-0.4500	1.4750	1.7000	95.5816	7.4010	1.07630	1.6299	2.9080	0.9777
0.4500	-0.4500	1.5000	1.8000	98.8786	7.2871	1.07440	1.6142	2.8138	0.9026
0.5000	-0.4500	1.5250	1.9000	102.183	7.1814	1.07264	1.5995	2.7255	0.8275
-0.5000	-0.4000	1.0500	-0.2000	44.2383	12.3196	0.87077	1.1170	3.7434	2.3434
-0.4500	-0.4000	1.0750	-0.1000	45.9423	12.0226	0.91355	1.2310	3.9611	2.2696
-0.4000	-0.4000	1.1000	0.0000	47.9191	11.7006	0.96102	1.3702	4.1731	2.1957
-0.3500	-0.4000	1.1250	0.1000	50.2264	11.3476	1.01488	1.5448	4.3960	2.1217
-0.3000	-0.4000	1.1500	0.2000	52.8819	10.9677	1.06169	1.6948	4.6105	2.0477
-0.2500	-0.4000	1.1750	0.3000	55.8315	10.5782	1.09612	1.8071	4.7731	1.9736
-0.2000	-0.4000	1.2000	0.4000	58.9757	10.1992	1.10955	1.8513	4.7227	1.8995
-0.1500	-0.4000	1.2250	0.5000	62.1643	9.8540	1.10795	1.8387	4.4833	1.8253
-0.1000	-0.4000	1.2500	0.6000	65.3600	9.5433	1.10635	1.8261	4.2667	1.7512

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3.12.d Limitations:

Depending on the selected option, perpendiculars or draft marks must be previously fixed on [Ship] tab's [Hydro] page.

Immersion step must be large enough to avoid too copious results.

3.12.e Typical use:

Calculating a trim table immediately providing ship's displacement and LCB according to its drafts or freeboards.

3.12.f Example:

Open the ‘Example Ship.m2a’ file and double click on ‘Damage 100% Supply’ in the 3D browser to select this virtual ship:

- Select '**/Tools/Trim Curves / Tables**' in the menu bar.
- Set the ‘**Min MP Immersion**’ input field to 1.
- Set the ‘**Max MP Immersion**’ input field to 2.
- Click on the **[OK]** button to start the calculation.
- Notice that the first report (‘Trim Curves & Table 1’) is displayed in red in the 2D browser, which means that you can export its CSV content if necessary (a right click on its display menu provides CSV export options, but these options are not available for the other reports).

3.13 ***Floodable Length:***

3.13.a Purpose:

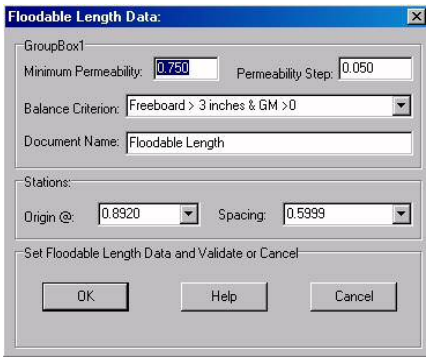
Automatically calculates current ship’s Floodable Length according to a given stability criterion and a permeability range.

As this calculation usually doesn’t take tanks into account, a confirmation box pops up if tanks are encountered in the current model.

At last, this calculation will be refused as long as no freeboard line is present in the model to allow calculating the critical floatations network.

3.13.b Inputs:

The following dialog box pops up when the function is selected:



The '**Minimum Permeability**' input field allows entering the minimum permeability of the calculation range.

The '**Permeability Step**' input field allows entering the permeability step of the calculation range, a permeability of 1 being assumed to be the maximum.

The '**Balance Criterion**' selector allows selecting according to which criterion the Floodable Length must be calculated. Only 2 criteria are available for the moment (STC criteria will be accepted in the future):

- '**Freeboard > 3 inches and GM > 0**'.

- '**Freeboard > 3 inches**'.

- '**GM > 0**'.

The '**Stations**' frame allows defining Floodable Length's station grid to use for the reports, being assumed that the stations are equidistant and automatically distributed along ship's length according to the entered origin and spacing:

- The '**Origin @**' input field allows entering the position of a station.

- The '**Spacing**' input field allows entering the station spacing.

At last, when these floatation data are set, the input field located in the '**Document Name**' frame will allow naming the 2D folder in which the resulting reports will be created created in the 2D browser.

The **[OK]** button can be clicked for calculating the Floodable Length according to the current data.

The **[Help]** button allows displaying the online help (Internet access necessary).

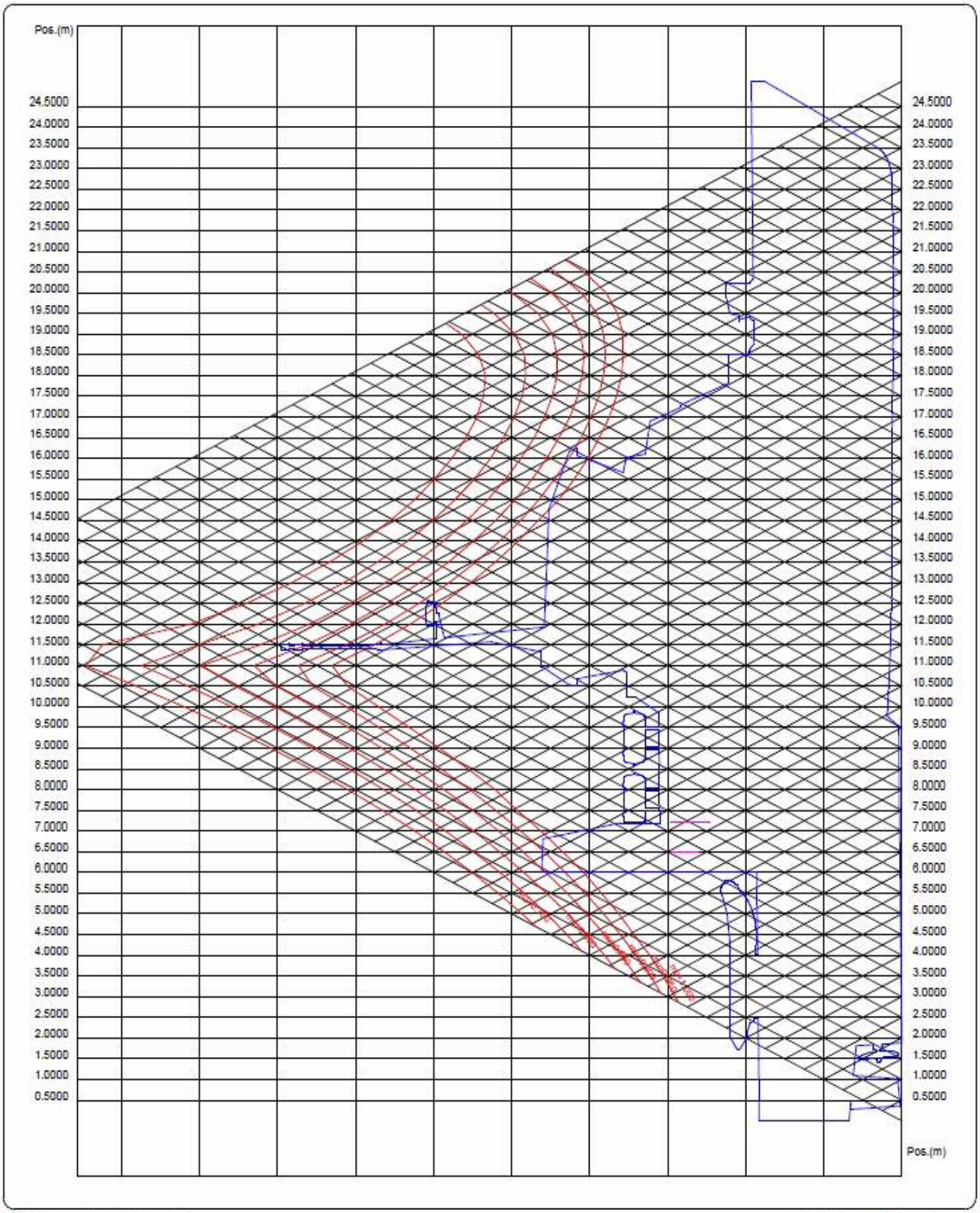
The **[Cancel]** button allows cancelling the calculation.

3.13.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the Floodable Length reports corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created:

Floodable Length Forms BIM / DCC* 10%, Criterion: Freeboard > 3" and GM > 0
Length in m, Weights in t, Water Density: 1.0250, Displ. 91.1344, LCGc 10.9537, VCGc 2.8614, Heel 0°



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Floodable Length Forms BIM / DCC* 10%, Criterion: Freeboard > 3" and GM > 0
Length in m, Weights in t, AP @0.8920, FP @24.8880, Water Density: 1.0250
Displacement 91.1344, LCGc 10.9537, VCGc 2.8614, Heel 0°

Sta. Pos.	Mu	Floodable L.	F. Volume	F. LCB	DAP	DFP	Freeboard	GM0
3.0000	1.000	5.8082	68.9867	2.9703	3.1323	0.2645	0.0668	0.3387
3.5000	0.900	6.8122	72.4828	3.4539	3.1310	0.3577	0.0717	0.3257
	0.950	6.4340	72.4023	3.4614	3.1278	0.3616	0.0751	0.3267
	1.000	6.1128	72.4880	3.4686	3.1284	0.3626	0.0745	0.3308
4.0000	0.850	7.6188	76.3500	3.9338	3.1312	0.4562	0.0751	0.3066
	0.900	7.1873	76.6967	3.9444	3.1368	0.4547	0.0693	0.3105
	0.950	6.8167	76.6413	3.9590	3.1328	0.4605	0.0736	0.3099
	1.000	6.4643	76.5885	3.9574	3.1320	0.4608	0.0745	0.3100
4.5000	0.800	8.5803	80.7432	4.4050	3.1360	0.5579	0.0739	0.2788
	0.850	8.0721	80.9939	4.4213	3.1380	0.5605	0.0720	0.2892
	0.900	7.6168	81.1228	4.4350	3.1380	0.5638	0.0721	0.2879
	0.950	7.2149	81.2015	4.4422	3.1382	0.5654	0.0719	0.2902
	1.000	6.8624	81.3439	4.4520	3.1392	0.5671	0.0709	0.2916
5.0000	0.750	9.7320	85.3845	4.8572	3.1408	0.6643	0.0729	0.2489
	0.800	9.1029	85.6059	4.8824	3.1400	0.6712	0.0740	0.2566
	0.850	8.5567	85.8095	4.9020	3.1400	0.6762	0.0742	0.2626
	0.900	8.0857	86.0729	4.9164	3.1421	0.6788	0.0721	0.2655
	0.950	7.6445	86.0658	4.9268	3.1399	0.6827	0.0746	0.2657
	1.000	7.2533	86.2771	4.9350	3.1423	0.6836	0.0722	0.2785
5.5000	0.750	10.3414	90.6382	5.3147	3.1465	0.7824	0.0715	0.2191
	0.800	9.6816	90.9920	5.3537	3.1449	0.7938	0.0736	0.2266
	0.850	9.1046	91.2566	5.3732	3.1459	0.7985	0.0727	0.2365
	0.900	8.5778	91.4180	5.3903	3.1451	0.8036	0.0737	0.2390
	0.950	8.1133	91.7572	5.4050	3.1481	0.8065	0.0707	0.2487
	1.000	7.6983	91.9524	5.4212	3.1482	0.8111	0.0708	0.2565
6.0000	0.750	11.0136	96.3288	5.7772	3.1488	0.9149	0.0740	0.1907
	0.800	10.2985	96.9088	5.8163	3.1502	0.9263	0.0730	0.1981
	0.850	9.6899	97.2238	5.8380	3.1509	0.9326	0.0725	0.2031
	0.900	9.1249	97.5521	5.8581	3.1522	0.9381	0.0714	0.2145
	0.950	8.6292	97.8882	5.8820	3.1528	0.9451	0.0711	0.2235
	1.000	8.1590	97.7626	5.8866	3.1520	0.9434	0.0718	0.2379
6.5000	0.750	11.7324	102.802	6.2325	3.1554	1.0564	0.0725	0.1604
	0.800	10.9782	103.369	6.2781	3.1537	1.0726	0.0748	0.1687
	0.850	10.3068	103.812	6.3002	3.1556	1.0797	0.0732	0.1797
	0.900	9.7107	104.165	6.3299	3.1543	1.0902	0.0749	0.1872
	0.950	9.1670	104.540	6.3460	3.1566	1.0950	0.0727	0.1990
	1.000	8.6968	104.607	6.3589	3.1570	1.0959	0.0723	0.2112
7.0000	0.750	12.4825	109.773	6.6820	3.1597	1.2109	0.0738	0.1371
	0.800	11.6969	110.744	6.7322	3.1619	1.2296	0.0723	0.1428
	0.850	10.9708	111.178	6.7635	3.1602	1.2425	0.0745	0.1556
	0.900	10.3359	111.895	6.7959	3.1626	1.2548	0.0724	0.1686
	0.950	9.7686	112.080	6.8154	3.1603	1.2629	0.0751	0.1760
	1.000	9.2505	112.315	6.8269	3.1632	1.2634	0.0722	0.1874
7.5000	0.750	13.3111	117.808	7.1325	3.1662	1.3833	0.0735	0.1197
	0.800	12.4519	118.711	7.1851	3.1654	1.4051	0.0751	0.1304
	0.850	11.6973	119.603	7.2272	3.1670	1.4225	0.0741	0.1410
	0.900	10.9996	120.326	7.2584	3.1689	1.4357	0.0727	0.1546
	0.950	10.4096	120.824	7.2841	3.1679	1.4484	0.0741	0.1594
	1.000	9.8601	121.168	7.3032	3.1693	1.4539	0.0729	0.1741

3.13.d Limitations:

At least one freeboard line (i.e. a line set in the ‘Freeboard Layer’ declared on [Ship] tab’s [Hydro] page) is necessary to allow calculating the critical floatations.

Calculation’s duration mainly depends on the number of stations.

3.13.e Typical use:

Calculating ship’s Floodable Length allowing to preset ship’s transverse bulkheads.

3.13.f Example:

Open the ‘Example Ship.m2a’ file and double click on ‘Damage 100% Supply’ in the 3D browser to select this virtual ship:

- Select '**/Tools/Floodable Length**' in the menu bar.
- Click on the **[OK]** button directly to start the calculation.

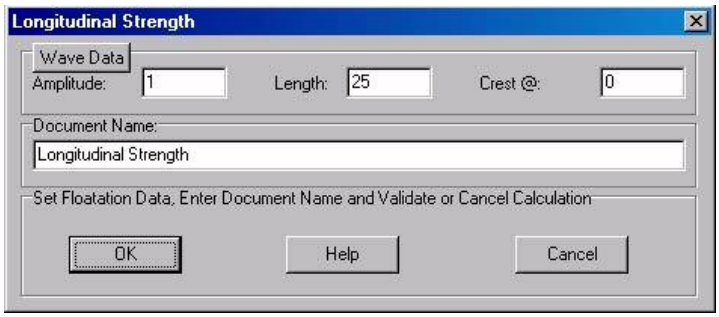
3.14 *Longitudinal Strength:*

3.14.a Purpose:

Automatically calculates current ship's Longitudinal Strength corresponding to current ship's status (damage and load) according to a given swell.

3.14.b Inputs:

The following dialog box pops up when the function is selected:



An optional sinusoidal swell can be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the current state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

The '**Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

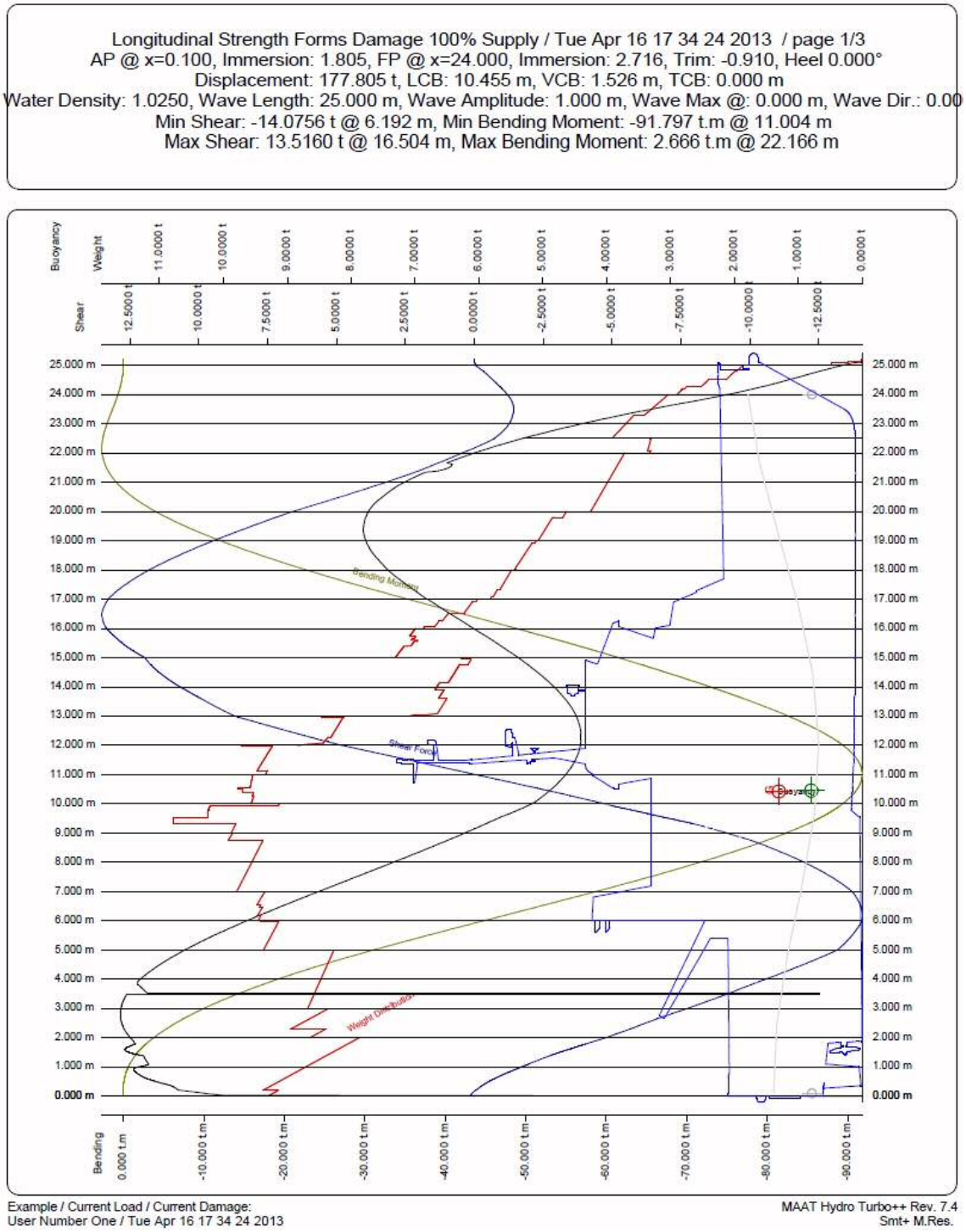
The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.14.c Outputs:

After clicking on the **[OK]** button, a 2D folder is created, containing the Longitudinal Strength reports corresponding to the entered data and displayed in the **[2D]** tab.

The following reports are automatically created:



Longitudinal Strength Forms Damage 100% Supply / Tue Apr 16 17 34 24 2013 / page 2/3
Length in m, Weight and Buoyancy in t, Moments in t.m

From:	To:	Weight:	Wcg @:	Buoyancy:	Bcg @:	Shear Force:	Bending Moment:
0.000	0.500	4.5859	0.249	5.1399	0.262	-0.5196	-0.068
0.500	1.000	4.4622	0.748	5.6463	0.751	-1.7038	-0.608
1.000	1.500	4.2525	1.248	5.6277	1.251	-3.0789	-1.792
1.500	2.000	4.0428	1.748	5.7299	1.749	-4.7661	-3.747
2.000	2.500	4.1595	2.255	5.7675	2.250	-6.2039	-6.495
2.500	3.000	4.2842	2.748	5.8039	2.750	-7.7234	-9.967
3.000	3.500	4.2340	3.251	5.7832	3.250	-9.1920	-14.196
3.500	4.000	4.2636	3.750	5.2924	3.766	-10.5601	-19.126
4.000	4.500	4.2125	4.249	5.5796	4.249	-11.9272	-24.752
4.500	5.000	4.1615	4.749	5.4046	4.748	-13.1700	-31.032
5.000	5.500	4.3809	5.255	5.1921	5.248	-13.7060	-37.759
5.500	6.000	4.5968	5.750	4.9487	5.748	-14.0567	-44.708
6.000	6.500	4.7024	6.250	4.6827	6.248	-14.0240	-51.739
6.500	7.000	4.6922	6.750	4.4009	6.747	-13.7187	-58.684
7.000	7.500	4.7561	7.251	4.1097	7.247	-12.9625	-65.364
7.500	8.000	4.8075	7.749	3.8173	7.747	-11.9719	-71.607
8.000	8.500	4.7488	8.249	3.5283	8.247	-10.7517	-77.298
8.500	9.000	4.7572	8.752	3.2488	8.746	-9.1751	-82.306
9.000	9.500	5.0698	9.255	2.9831	9.246	-7.0820	-86.406
9.500	10.000	5.0916	9.747	2.7159	9.746	-4.7463	-89.354
10.000	10.500	4.7633	10.252	2.3193	10.265	-2.4648	-91.165
10.500	11.000	4.7886	10.749	2.3743	10.748	-0.0516	-91.797
11.000	11.500	4.6995	11.250	2.2799	11.249	2.3661	-91.222
11.500	12.000	4.6534	11.750	2.2220	11.749	4.8031	-89.431
12.000	12.500	4.1955	12.248	2.2014	12.250	6.7958	-86.523
12.500	13.000	4.0956	12.749	2.2178	12.751	8.6774	-82.652
13.000	13.500	3.3517	13.246	2.2705	13.251	9.7274	-78.040
13.500	14.000	3.2946	13.751	2.3577	13.752	10.6658	-72.941
14.000	14.500	3.2456	14.248	2.4735	14.252	11.4373	-67.403
14.500	15.000	3.1420	14.749	2.6145	14.752	11.9541	-61.543
15.000	15.500	3.5978	15.249	2.7759	15.253	12.7791	-55.347
15.500	16.000	3.5131	15.750	2.9507	15.753	13.3416	-48.810
16.000	16.500	3.3288	16.247	3.1331	16.252	13.5157	-42.081
16.500	17.000	3.1248	16.747	3.3116	16.752	13.2848	-35.369
17.000	17.500	2.8714	17.248	3.2945	17.266	12.6632	-28.870
17.500	18.000	2.7781	17.749	3.6419	17.752	11.7994	-22.746
18.000	18.500	2.6800	18.249	3.7661	18.251	10.7192	-17.109
18.500	19.000	2.6078	18.749	3.8558	18.751	9.4690	-12.055
19.000	19.500	2.5083	19.249	3.8992	19.250	8.0711	-7.666
19.500	20.000	2.4137	19.748	3.8879	19.750	6.5808	-3.997
20.000	20.500	2.1862	20.245	3.8169	20.249	4.8553	-1.140
20.500	21.000	2.0250	20.749	3.6757	20.748	3.2046	0.871
21.000	21.500	1.9586	21.249	3.4393	21.246	1.7238	2.091
21.500	22.000	1.8922	21.749	3.1702	21.747	0.4457	2.628
22.000	22.500	1.6708	22.248	2.8503	22.244	-0.7379	2.539
22.500	23.000	1.7561	22.754	2.3596	22.749	-1.2635	2.025
23.000	23.500	1.7769	23.246	1.9284	23.238	-1.4324	1.338
23.500	24.000	1.5838	23.747	1.3473	23.731	-1.1959	0.661

Example / Current Load / Current Damage:
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3.14.d Limitations:

The calculated model must contain buoyant components and a sufficient number of masses representing ship's weight curve / load distribution to allow calculating longitudinal strength accurately. For more details on weight curve modeling, see item 9 (Mass Modelling) in 'MAAT Hydro's Quick Hydrostatic Modelling Guide' on MAAT Hydro's resource page and see FAQ's Modelling page).

3.14.e Typical use:

Calculating ship's Longitudinal Strength for given ship status (damage and load) and an optional sinusoidal swell.

3.14.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Longitudinal Strength**' in the menu bar.
- Set swell's amplitude to 1m (i.e. swell's height = 2 m).
- Set swell's wave length to 25 m.
- Click on the **[OK]** button directly to start the calculation.
- Check the obtained reports.
- Return to the [3D] page and click on the [Hydro] pane to open the Hydro viewport.
- Right click on viewport's upper left title to select 'Show Longitudinal Strength' in the hydro viewport menu.
- Set a 1 m swell amplitude in the lower right 'WVA' field and a 25 m wave length in the lower right WVL field.
- Press [End] key to calculate ship's equilibrium for this load and swell.
- Check the obtained results.

3.15 ***Grounding:***

3.15.a Purpose:

3.16 ***Transverse Stability:***

3.16.A Transverse Stability Inputs:

3.16.A.a Purpose:

The Transverse Stability Input dialog box allows entering the transverse stability calculation parameters.

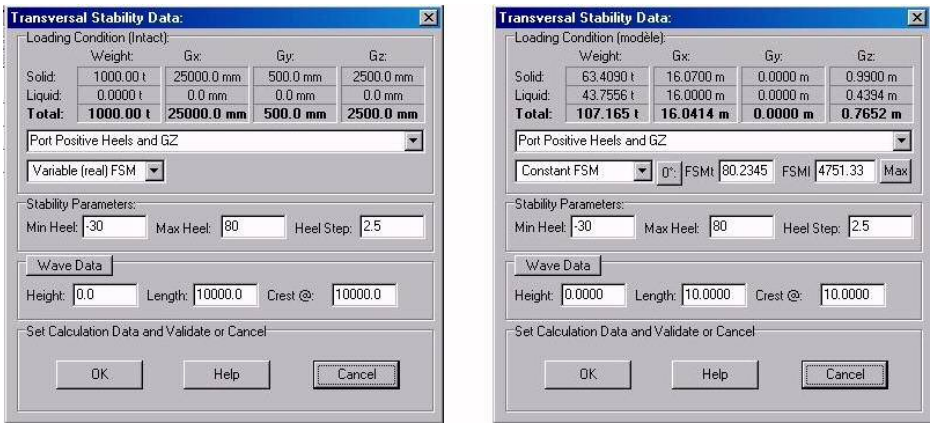
At the end of the stability calculation, a Transverse Stability Results dialog box, described below, will provide numerous options allowing to set the stability criterion and layout options as well as the various reports to be associated to the results.

If necessary, the Transverse Stability Results dialog box allows repeating the current stability calculation automatically for all the present loading conditions / damage conditions.

When the hydrostatic viewport is opened during the stability calculation, all the intermediary data are displayed in real-time, although the response time significantly slows down.

3.16.A.b Inputs:

This Dialog Box allows entering the transverse stability calculation data (as shown below, its layout may change slightly, depending on the selected FSM option):



The '**Port Positive Heels**' / 'S Positive Heels' selector allows selecting whether the transverse stability has to be calculated on portside (by default) or starboard.

The FSM selector allows selecting how to process tank's free surface effect:

- '**Variable (real) FSM**' (default setting) allows calculating the real free surface moments automatically.

- '**Constant FSM**' allows using the constant transverse and longitudinal FSMs entered in the corresponding input fields (see the right dialog box above). A **[0°]** button allows presetting automatically these FSMs to their 0° values and a **[Max]** button allows presetting them to their maximum value by scanning / summing tanks max FSMs individually.

The '**Min Heel**' input field allows entering the minimum heel angle to calculate.

The '**Max Heel**' input field allows entering the maximum heel angle to calculate.

The '**Heel Step**' input field allows entering the heel angle calculation increment.

A special attention must be paid to this heel range, as the minimum / maximum heels must be large enough to allow calculating all the angles needed by the criterion and heel increment must be small enough to insure accurate results (maximum GZ calculation, positive GZ arc, etc…)

Moreover, if necessary, an optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.16.A.c Outputs:

After clicking on the **[OK]** button, the transverse stability calculation starts according to the entered data and the Transverse Stability Results dialog box, detailed below, finally pops up, allowing to control result's layout accurately.

3.16.A.d Limitations:

As explained above, the heel range must be decided according to the expected criterion and ship's behavior.

The calculated model must have realistic buoyancy and load for the calculated heels, otherwise the calculation will abort. A special attention must therefore be paid to the buoyancy losses controlled by compartment's child openings.

Moreover, for obvious reasons, 'Transverse Stability' must not be used for calculating special stabilities like Dredge stability, WoD (Stockholm) stability, Probabilistic stability, etc…, as dedicated functions are provided in the 'Tools' menu for these special processes.

3.16.A.e Typical use:

Calculating ship's Transverse Stability (intact or damaged, depending on virtual ship's current status) for current loading and damage condition as well as for all the present loading condition / damage condition combinations (see MAAT Hydro's FAQ).

3.16.A.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Transverse Stability**' in the menu bar.
- Click on the **[OK]** button directly to validate the default settings and start the calculation.
- Control and set the calculated data in the Transverse Stability Results dialog box (described below).

3.16.B Transverse Stability Results:

3.16.B.a Purpose:

The Transverse Stability Results dialog box allows setting the stability criterion to apply to the calculated data as well as setting various layout options.

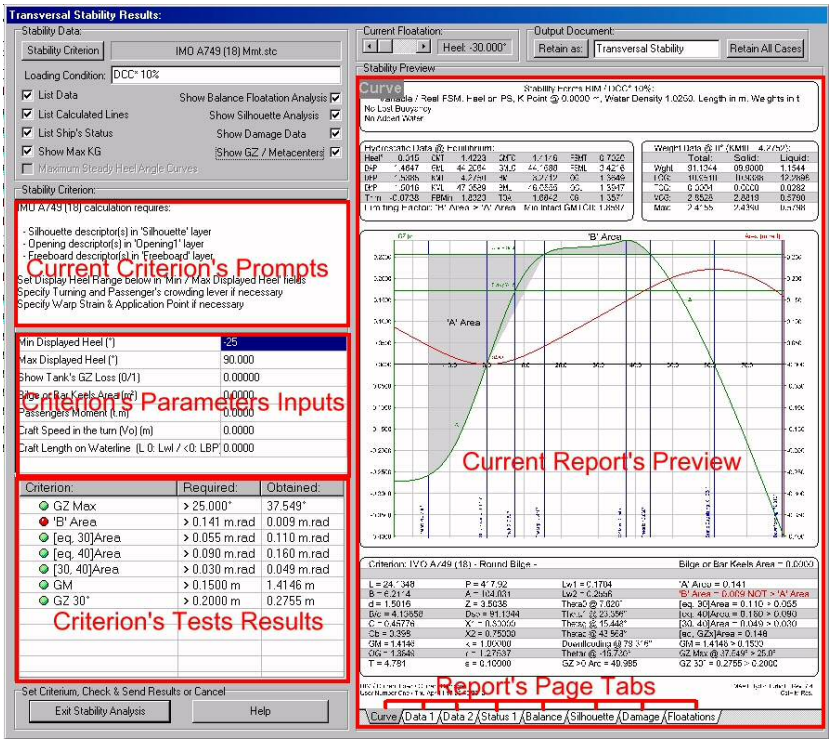
Moreover, this dialog box also allows repeating the current stability calculation automatically for all the present loading conditions / damage conditions (see FAQ concerning loading and damage conditions management).

All the reports created with this dialog box can be retained among the [2D] data by clicking on the [Retain] / [Retain All] buttons, otherwise they will be lost after closing the dialog box.

3.16.B.b Inputs:

This Dialog Box allows selecting the stability criterion and setting in real-time various options controlling the content and layout of the calculated reports.

The top of the dialog box contains the setting controls and the rest contains 4 display Areas (like for any MAAT Hydro viewport, the current report can be panned by shifting mouse with right button pressed and zoomed by pressing the [Ctrl] key):



The **[Stability Criterion]** button allows selecting a criterion among the various STC scripts available in the '/ProgData/StabCriteria' directory (download / see 'MAAT Hydro's Scripting Reference Guide' for more details about criterion scripting: http://sistre-marinesoftware.com/MH+CriterionScriptingReference.pdf). As soon as a criterion (i.e. an STC script file) is selected, MAAT Hydro applies it to the current stability data and immediately displays the resulting report, if possible. If not, a warning box pops up, detailing the problem (script's constraints are recalled in the upper left display box). The 'Basic.stc' criterion is initially selected by default.

The '**Loading Condition**' input field allows renaming report's current loading condition if necessary.

The '**List Data**' check box allows including / removing the stability data listing associated to the diagram (see 3.16.c.2 below).

The '**List Calculated Lines**' check box allows including / removing the information (dimensions, freeboard at equilibrium, angle of immersion) concerning the current freeboard and openings descriptors (see 3.16.c.3 below).

The '**List Ship's Status**' check box allows including / removing the weight, tank and compartment status in / from the current stability report (see 3.16.c.4 below). These data correspond to '/Tools/Float Status' report.

The '**Show Max KG**' check box allows including / removing the Max KG corresponding to the selected criterion in stability diagram's header (see 3.16.c.5 below).

The '**Maximum Steady Heel Angle Curves**' check box allows including / removing the Maximum Steady Heel diagram in / from the current stability report (see 3.16.c.6 below). This option is greyed when the selected STC script doesn't include the Maximum Steady Heel statement '*SetMaxSteadyHeelData*' (by example, see the 'MCA Intact Sail (Mono).stc' script; see also MAAT Hydro's Calculation FAQ dedicated item).

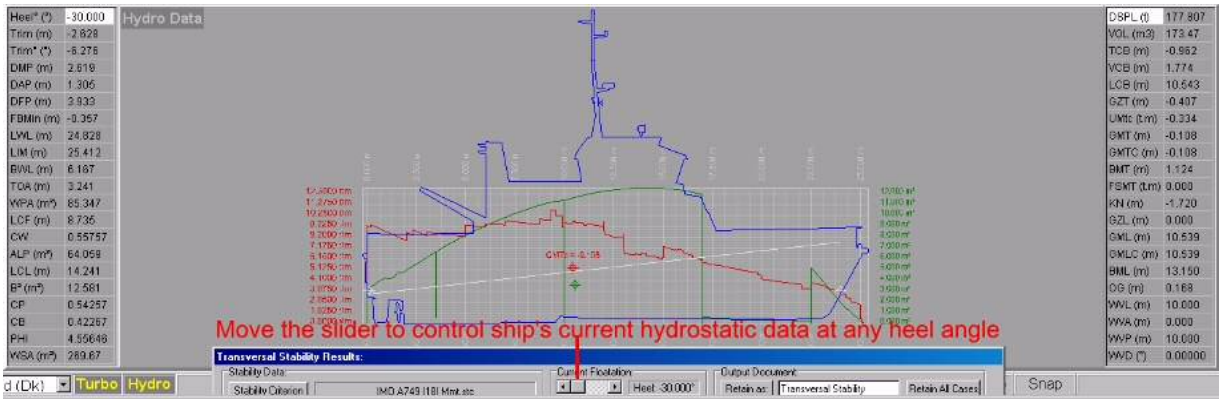
The '**Show Equilibrium Floatation Analysis**' check box allows including / removing the SAC / hydrostatic analysis diagram at equilibrium (see 3.16.c.7 below). These data correspond to '/Tools/Floatation Analysis' report.

The '**Show Silhouette Analysis**' check box allows including / removing the Silhouette analysis diagram at equilibrium (see 3.16.c.8 below). These data correspond to '/Tools/Silhouette Analysis' report.

The '**Show Damage Data**' check box allows including / removing the Damage presentation page (see 3.16.c.9 below). These data correspond to '/Tools/Silhouette Analysis' report.

The '**Show GZ / Metacenters**' check box allows including / removing the Body plan / GZ polar / Metacenters curves (see 3.16.c.10 below).

The '**Current Floatation**' slider allows exploring ship's behavior in the calculated heel range and displaying ship's associated SAC and most important data in the hydrostatic viewport. For an optimal use, don't hesitate to move the Transverse Stability Results dialog box completely down:



The [**Retain**] button allows including the current reports among the 2D Data (if not clicked, the previewed results will be lost).

The [**Retain All Cases**] button allows repeating the current calculation for all the loading condition / Damage condition combinations, the current results being therefore simply used as a preview.

The **[OK]** button can be clicked to exit the Transverse Stability Results dialog box (the current results will ten be lost if not retained among the [2D] thanks to the [Retain] / [Retain all Cases] buttons).

The **[Help]** button allows displaying the online help (Internet access necessary).

3.16.B.c Outputs:

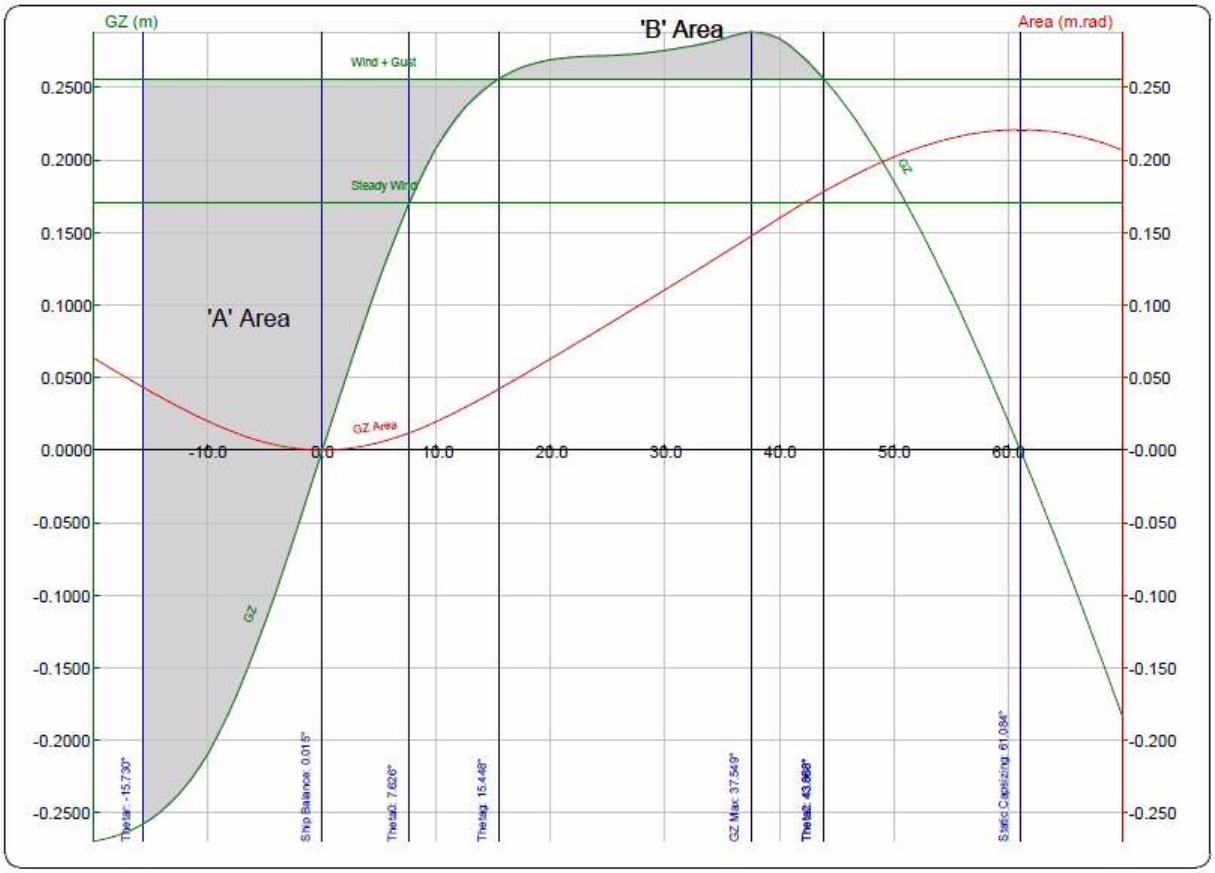
Depending on the checked options (see above), the following outputs can be obtained:

3.16.B.c.1: Stability Curve:

Stability Forms BIM / DCC* 10%:
Variable / Real FSM, Heel on PS, K Point @ 0.0000 m, Water Density 1.0250, Length in m, Weights in t
No Lost Buoyancy
No Added Water

Hydrostatic Data @ Equilibrium:							
Heel°	0.015	GMT	1.4223	GMTC	1.4146	FSMT	0.7020
DAP	1.4647	GML	44.2064	GMLC	44.1688	FSML	3.4216
DFP	1.5385	KMT	4.2750	BMT	3.2712	OGT	1.3649
DMP	1.5016	KML	47.0589	BML	46.0555	OGL	1.3947
Trim	-0.0738	FBMin	1.8323	TOA	1.6842	OG	1.3571

Weight Data @ 0°(KMt0 = 4.2752):			
	Total:	Solid:	Liquid:
Wght:	91.1344	89.9800	1.1544
LCG:	10.9510	10.9338	12.2898
TCG:	0.0004	0.0000	0.0282
VCG:	2.8528	2.8819	0.5798



Criterion: IMO A749 (18) - Round Bilge -			Bilge or Bar Keels Area = 0.0000
L = 24.1348	P = 417.92	Lw1 = 0.1704	'A' Area = 0.141
B = 6.2114	A = 104.031	Lw2 = 0.2556	'B' Area = 0.009 NOT > 'A' Area
d = 1.5016	Z = 3.5038	Theta0 @ 7.626°	[eq, 30]Area = 0.110 > 0.055
B/d = 4.13658	Dsp = 91.1344	Theta1 @ 23.356°	[eq, 40]Area = 0.160 > 0.090
C = 0.45776	X1 = 0.80000	Thetag @ 15.448°	[30, 40]Area = 0.049 > 0.030
Cb = 0.398	X2 = 0.75000	Thetac @ 43.868°	[eq, GZx]Area = 0.148
GM = 1.4146	k = 1.00000	Downflooding @ 79.316°	GM = 1.4146 > 0.1500
OG = 1.3649	r = 1.27537	Thetar @ -15.730°	GZ Max @ 37.549°> 25.0°
T = 4.781	s = 0.10000	GZ >0 Arc = 49.985	GZ 30°= 0.2755 > 0.2000

3.16.B.c.2: Stability Listing:

Stability Forms BIM / DCC* 10%:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Status:	Heel:	AP Draft:	FP Draft:	TCB:	VCB:	LCB:	KN:	MS:	GZ:	Area:
	-30.000	1.0124	1.5417	-1.2241	1.2939	10.9886	-1.7071	0.4354	-0.2761	0.111
	-27.500	1.0854	1.5538	-1.1470	1.2516	10.9849	-1.5954	0.3833	-0.2738	0.099
	-25.000	1.1521	1.5620	-1.0695	1.2135	10.9813	-1.4822	0.3288	-0.2726	0.087
	-22.500	1.2136	1.5664	-0.9913	1.1791	10.9775	-1.3670	0.2728	-0.2718	0.075
	-20.000	1.2695	1.5675	-0.9107	1.1480	10.9737	-1.2484	0.2171	-0.2697	0.063
	-17.500	1.3198	1.5656	-0.8265	1.1195	10.9698	-1.1249	0.1634	-0.2646	0.052
Thetar	-15.730	1.3510	1.5626	-0.7630	1.1011	10.9673	-1.0327	0.1285	-0.2574	0.044
	-15.000	1.3639	1.5614	-0.7368	1.0935	10.9662	-0.9947	0.1140	-0.2544	0.040
	-12.500	1.4007	1.5555	-0.6393	1.0698	10.9630	-0.8557	0.0713	-0.2369	0.030
	-10.000	1.4296	1.5487	-0.5316	1.0485	10.9602	-0.7056	0.0381	-0.2093	0.020
	-7.500	1.4495	1.5420	-0.4111	1.0302	10.9581	-0.5420	0.0169	-0.1691	0.012
	-5.000	1.4605	1.5381	-0.2802	1.0160	10.9570	-0.3677	0.0056	-0.1187	0.005
	-2.500	1.4645	1.5377	-0.1419	1.0070	10.9566	-0.1857	0.0011	-0.0613	0.001
	0.000	1.4647	1.5385	0.0000	1.0039	10.9567	0.0000	0.0000	-0.0004	-0.000
Ship Balance	0.015	1.4647	1.5385	0.0008	1.0039	10.9567	0.0011	0.0000	0.0000	0.000
	2.500	1.4644	1.5377	0.1419	1.0070	10.9566	0.1857	-0.0011	0.0606	0.001
	5.000	1.4605	1.5381	0.2802	1.0160	10.9570	0.3677	-0.0056	0.1180	0.005
	7.500	1.4495	1.5420	0.4111	1.0302	10.9581	0.5420	-0.0169	0.1684	0.011
Theta0	7.626	1.4485	1.5423	0.4171	1.0311	10.9582	0.5503	-0.0180	0.1704	0.012
	10.000	1.4296	1.5487	0.5316	1.0485	10.9602	0.7056	-0.0380	0.2086	0.020
	12.500	1.4007	1.5555	0.6393	1.0698	10.9630	0.8557	-0.0713	0.2362	0.029
	15.000	1.3639	1.5614	0.7368	1.0935	10.9662	0.9947	-0.1140	0.2538	0.040
Thetag	15.448	1.3560	1.5621	0.7529	1.0982	10.9669	1.0181	-0.1229	0.2556	0.042
	17.500	1.3198	1.5656	0.8265	1.1195	10.9699	1.1249	-0.1634	0.2639	0.051
	20.000	1.2695	1.5675	0.9107	1.1480	10.9737	1.2484	-0.2171	0.2690	0.063
	22.500	1.2136	1.5664	0.9913	1.1791	10.9775	1.3670	-0.2728	0.2711	0.075
	25.000	1.1521	1.5621	1.0695	1.2135	10.9813	1.4822	-0.3288	0.2719	0.087
	27.500	1.0854	1.5538	1.1470	1.2516	10.9850	1.5954	-0.3833	0.2731	0.099
	30.000	1.0124	1.5417	1.2241	1.2939	10.9886	1.7071	-0.4354	0.2755	0.110
	32.500	0.9314	1.5255	1.3005	1.3402	10.9924	1.8169	-0.4851	0.2788	0.123
	35.000	0.8417	1.5046	1.3762	1.3907	10.9961	1.9250	-0.5323	0.2832	0.135
	37.500	0.7411	1.4792	1.4504	1.4452	10.9999	2.0305	-0.5773	0.2883	0.147
GZ Max	37.549	0.7388	1.4787	1.4517	1.4462	11.0000	2.0323	-0.5783	0.2882	0.148
	40.000	0.6222	1.4539	1.5152	1.4969	11.0046	2.1229	-0.6303	0.2836	0.160
	42.500	0.4872	1.4284	1.5694	1.5446	11.0097	2.2006	-0.6929	0.2677	0.172
Thetac	43.868	0.4073	1.4131	1.5957	1.5698	11.0125	2.2377	-0.7295	0.2556	0.178
	45.000	0.3411	1.4004	1.6174	1.5906	11.0147	2.2684	-0.7599	0.2456	0.183
	47.500	0.1820	1.3697	1.6600	1.6350	11.0196	2.3270	-0.8303	0.2181	0.193
	50.000	0.0070	1.3361	1.6977	1.6781	11.0244	2.3767	-0.9035	0.1858	0.202
	52.500	-0.1872	1.2993	1.7311	1.7198	11.0290	2.4183	-0.9787	0.1494	0.209
	55.000	-0.4050	1.2588	1.7608	1.7603	11.0336	2.4519	-1.0553	0.1095	0.215
	57.500	-0.6523	1.2139	1.7870	1.7997	11.0379	2.4780	-1.1328	0.0665	0.219
	60.000	-0.9366	1.1632	1.8101	1.8380	11.0422	2.4968	-1.2107	0.0208	0.221
Static Capsizing	61.084	-1.0804	1.1378	1.8190	1.8541	11.0439	2.5019	-1.2445	0.0000	0.221
	62.500	-1.2682	1.1046	1.8305	1.8753	11.0462	2.5086	-1.2886	-0.0272	0.220
	65.000	-1.6619	1.0357	1.8483	1.9114	11.0500	2.5134	-1.3662	-0.0773	0.218
	67.500	-2.1382	0.9521	1.8637	1.9465	11.0535	2.5115	-1.4431	-0.1293	0.214
	70.000	-2.7277	0.8480	1.8769	1.9805	11.0567	2.5030	-1.5192	-0.1828	0.207
	72.500	-3.4754	0.7114	1.8882	2.0138	11.0594	2.4884	-1.5937	-0.2373	0.198
	75.000	-4.4538	0.5204	1.8978	2.0467	11.0612	2.4682	-1.6661	-0.2924	0.186
	77.500	-5.7918	0.2289	1.9057	2.0788	11.0618	2.4420	-1.7365	-0.3480	0.172
Downflooding	79.316	-7.2149	-0.1127	1.9105	2.1024	11.0613	2.4197	-1.7852	-0.3879	0.160

3.16.B.c.3: Calculated Lines Features:

Stability Forms BIM / DCC* 10%:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Calculation Lines:

Name	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax	Fbd Eq.	Ximm	Yimm	Zimm	Imm°
Freeboard:							1.8323				37.059
livet	0.0000	25.1056	0.0000	3.1004	3.2957	3.6411	1.8323	12.6790	3.0561	3.4231	37.059
Downfloodable Opening 1:							3.2302				?
Ventilation Bd	6.5000	6.5000	1.2800	1.9800	5.0140	5.7140	3.5315				
Ventilation Td	7.2000	7.2000	-1.9600	-1.2600	4.7140	5.7140	3.2302				

3.16.B.c.4: Ship's Status Report:

Ship Status / BIM / DCC* 10%

Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
02_marge M3	3.9800		100.0%	3.9800	10.8730	0.0000	2.8340
03_équipage PS (3 p)	0.2250		100.0%	0.2250	14.5000	0.0000	6.9500
04_pers. spécial PS (7 p)	0.5250		100.0%	0.5250	13.0000	0.0000	6.9500
05a_pers. spécial PP (13 p)	0.9750		100.0%	0.9750	14.0000	0.0000	4.6000
05b_pers. spécial PP (3 p)	0.2250		0.0%				
06_marge M4	4.6750		100.0%	4.6750	10.9780	0.0000	2.7280
Solid Load Subtotal:				10.3800	11.4002	0.0000	3.2495
01_lège				79.6000	10.8730	0.0000	2.8340
Total (Solid):				89.9800	10.9338	0.0000	2.8819

Tank:	Raw Volume: (m3)	Muin:	Quantity:	FSM: (t.m)	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
caisse ED	0.3400	100.0%	10.0%	0.1421	0.0340	15.5000	0.0000	1.5600
Freshwater Subtotal (rô=1., 10.0% of total capacity):				0.1421	0.0340	15.5000	0.0000	1.5600
caisse GO Bd	4.2423	95.0%	10.0%	0.1753	0.3365	11.5983	0.3238	0.2781
caisse GO journalière	1.4056	95.0%	10.0%	0.2091	0.1115	9.6770	1.0450	1.8585
caisse GO Td	4.2423	95.0%	10.0%	0.1753	0.3365	11.5983	-0.3238	0.2781
Gasoil Subtotal (rô=0.835, 10.0% of total capacity):				0.5597	0.7845	11.3252	0.1485	0.5027
caisse EU	0.3525	95.0%	100.0%		0.3359	14.1875	-0.2500	0.6610
Greywater Subtotal (rô=1.003, 100.0% of total capacity):				0.0000	0.3359	14.1875	-0.2500	0.6610
Total (Liquid):				0.7017	1.1544	12.2810	0.0282	0.5799
Total (Liquid + Solid):				0.7017	91.1344	10.9509	0.0004	2.8528

Buoyant Component:	Raw Volume: (m3)	Mu:	Quantity:	Hydro Volume: (m3)	LCV: (m)	TCV: (m)	VCV: (m)
safran Td	0.0706	95.0%	Unfloodable	0.0706	0.7204	-1.5000	0.5142
safran Bd	0.0706	95.0%	Unfloodable	0.0706	0.7204	1.5000	0.5142
dérive Td	2.1803	95.0%	Unfloodable	2.1803	5.6737	-1.3025	0.3182
dérive Bd	2.1803	95.0%	Unfloodable	2.1803	5.6737	1.3025	0.3182
caisse ED	0.3400	100.0%	Intact Tank	0.3400	15.5000	0.0000	1.7400
caisse EU	0.3525	95.0%	Intact Tank	0.3525	14.1875	-0.2500	0.6610
caisse GO Bd	4.2423	95.0%	Intact Tank	4.2423	11.5098	0.7410	0.7584
caisse GO journalière	1.4056	95.0%	Intact Tank	1.4056	9.6348	1.0450	2.4760
caisse GO Td	4.2423	95.0%	Intact Tank	4.2423	11.5098	-0.7410	0.7584
coque	320.428	95.0%	Unfloodable	320.428	10.7710	0.0000	2.1374
Total Volume:	335.512						

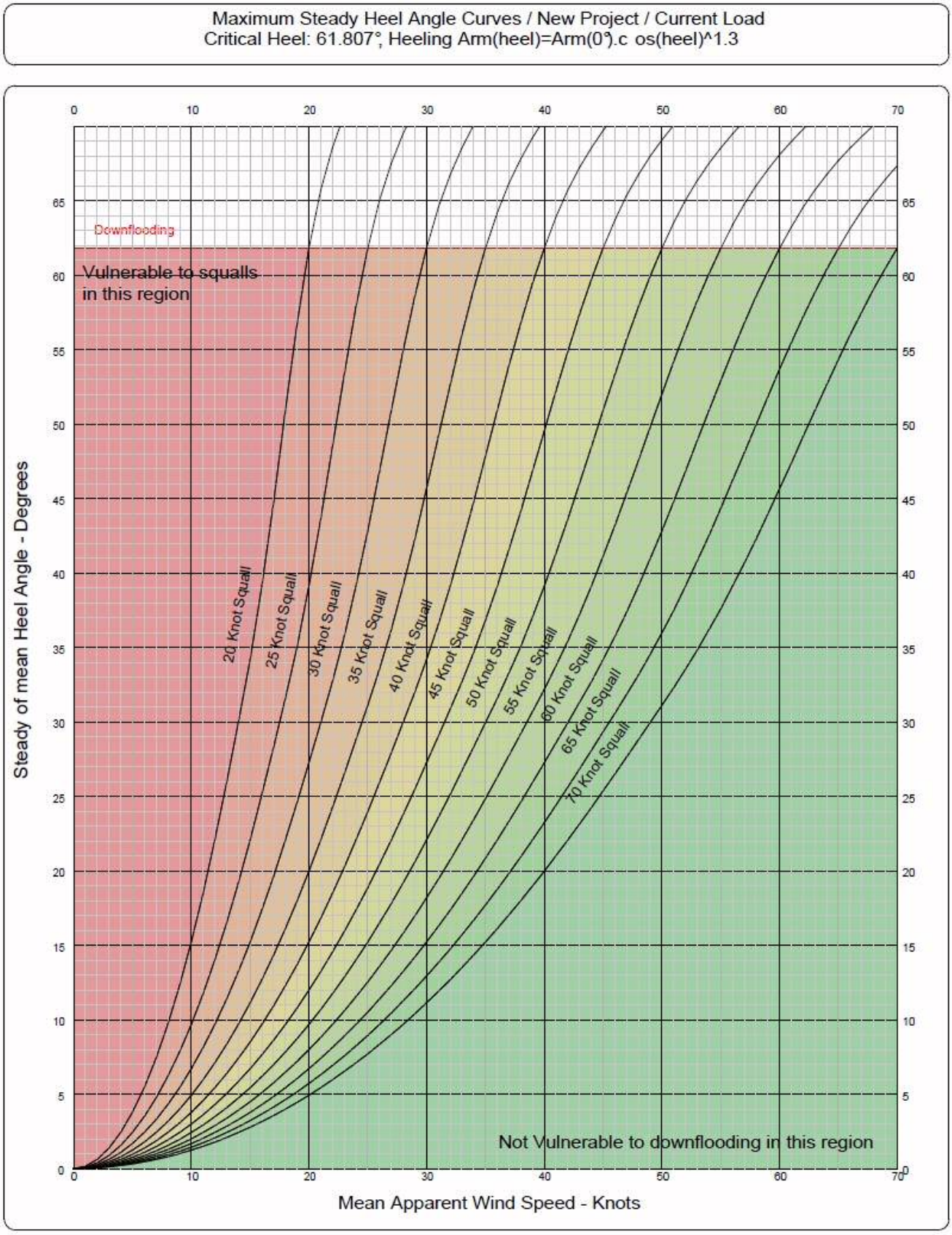
3.16.B.c.5: Calculated Max KG:

Stability Forms BIM / DCC* 10%:
Variable / Real FSM, Heel on PS, K Point @ 0.0000 m, Water Density 1.0250, Length in m, Weights in t
No Lost Buoyancy
No Added Water

Hydrostatic Data @ Equilibrium:							
Heel°	0.015	GMT	1.4223	GMTC	1.4146	FSMT	0.7020
DAP	1.4647	GML	44.2064	GMLC	44.1688	FSML	3.4216
DFP	1.5385	KMT	4.2750	BMT	3.2712	OGT	1.3649
DMP	1.5016	KML	47.0590	BML	46.0555	OGL	1.3947
Trim	-0.0738	FBMin	1.8323	TOA	1.6842	OG	1.3571
Limiting Factor: 'B' Area > 'A' Area				Min Intact GMTC0:			1.8597

Weight Data @ 0°(KMt0 = 4.2752):			
	Total:	Solid:	Liquid:
Wght:	91.1344	89.9800	1.1544
LCG:	10.9510	10.9338	12.2898
TCG:	0.0004	0.0000	0.0282
VCG:	2.8528	2.8819	0.5798
Max:	2.4155	2.4390	0.5798

3.16.B.c.6: Maximum Steady Heel Angle Diagram:



3.16.B.c.7: Equilibrium Floatation Analysis:

Hydrostatic Data, Heel=0.015°, Rô=1.025(Sélection et zoom 4, t):
AP @ x=0.8920, z=0.0, Imm.: 1.4647, FP @ x=24.8880, z=0.0, Imm.: 1.4565, Trim: -0.0738 (-0.176°)
Aft Mark @ x=0.0000, z=0.0000, Imm.: 1.4619, Fore Mark @ x=0.0000, z=0.0000, Imm.: 1.4619 m

Immersed Hull:

Total Displacement	91.1338
Volume	88.9110
L Center of Buoyancy	10.9567
T Center of Buoyancy	0.0008
V Center of Buoyancy	1.0039
Wetted Surface Area	0.0000
Prismatic Coefficient	0.66840
Block Coefficient	0.39542
L/V^1/3	5.40744

Waterplane:

Waterplane Area	114.149
Floatation Area Ratio	0.76268
L Center Floatation	9.7017
X Fore Floatation	24.1348
X Aft Floatation	0.0000
Length of Waterline	24.1348
Breadth of Waterline	6.2044
Height of Mt (KMt)	4.2752
Height of Ml (KMl)	47.0606
Trsv Met. Radius (BMt)	3.2713
Lng Met. Radius (BMl)	46.0572
Free Surf. Momt (Trsv.)	0.7019
Free Surf. Momt (Lngt.)	3.4216

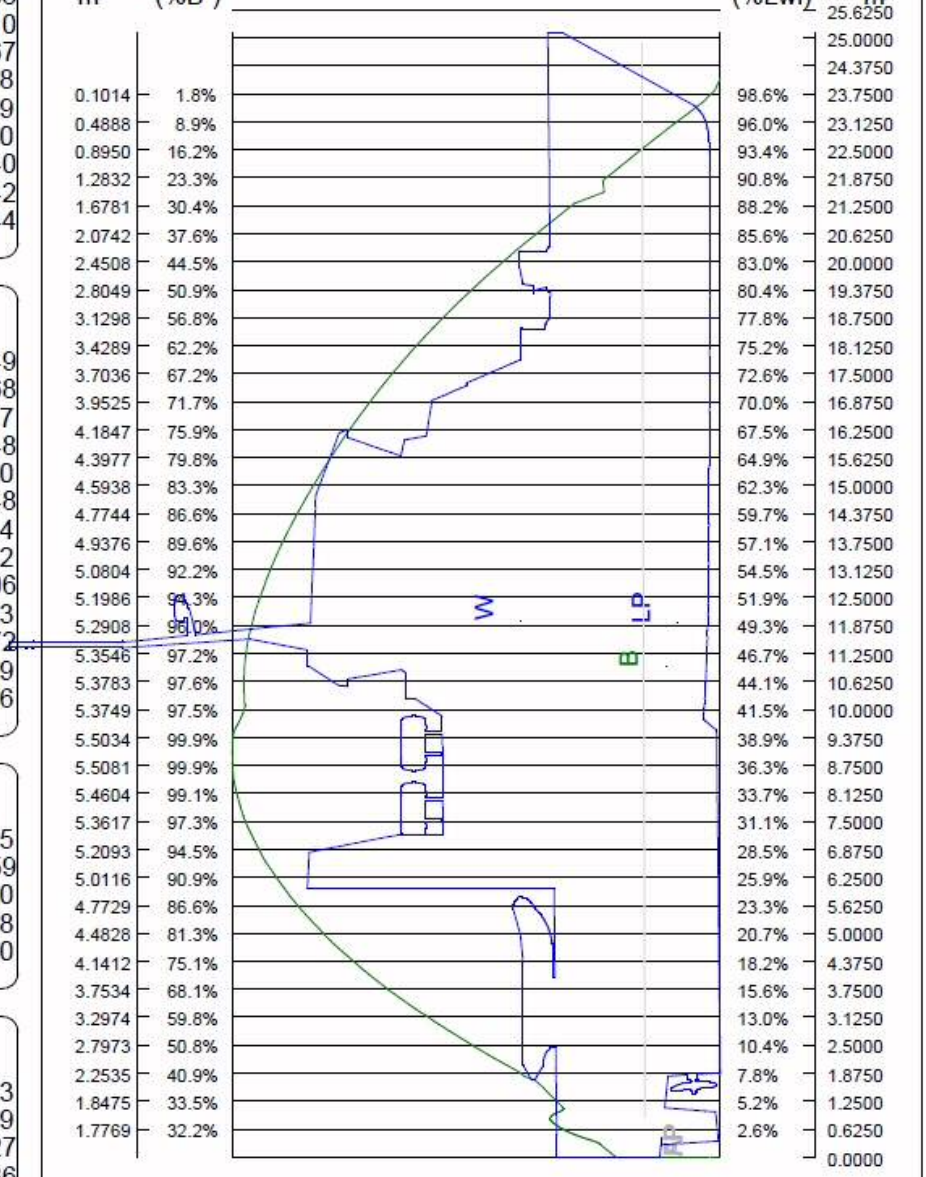
Max Cross Section:

B² Area	5.5115
B² Area Ratio	0.59159
L Center of B²	9.0610
T Center of B²	0.0008
V Center of B²	0.9760

Lateral Plane:

Min Free Board	1.8323
Draft at waterline	1.6839
Lateral Plane Area	35.4527
Lateral Plane Ratio	0.87236
L Center Lat. Plane	11.9232
V Center Lat. Plane	0.7373
Windage Area	104.030
L Center of Windage	11.9897
V Center of Windage	4.2411
VCW-VCLP	3.5038
LCW-LCLP	0.0665
LCW-LCLP % LBP	0.28 %

Curve of Areas:

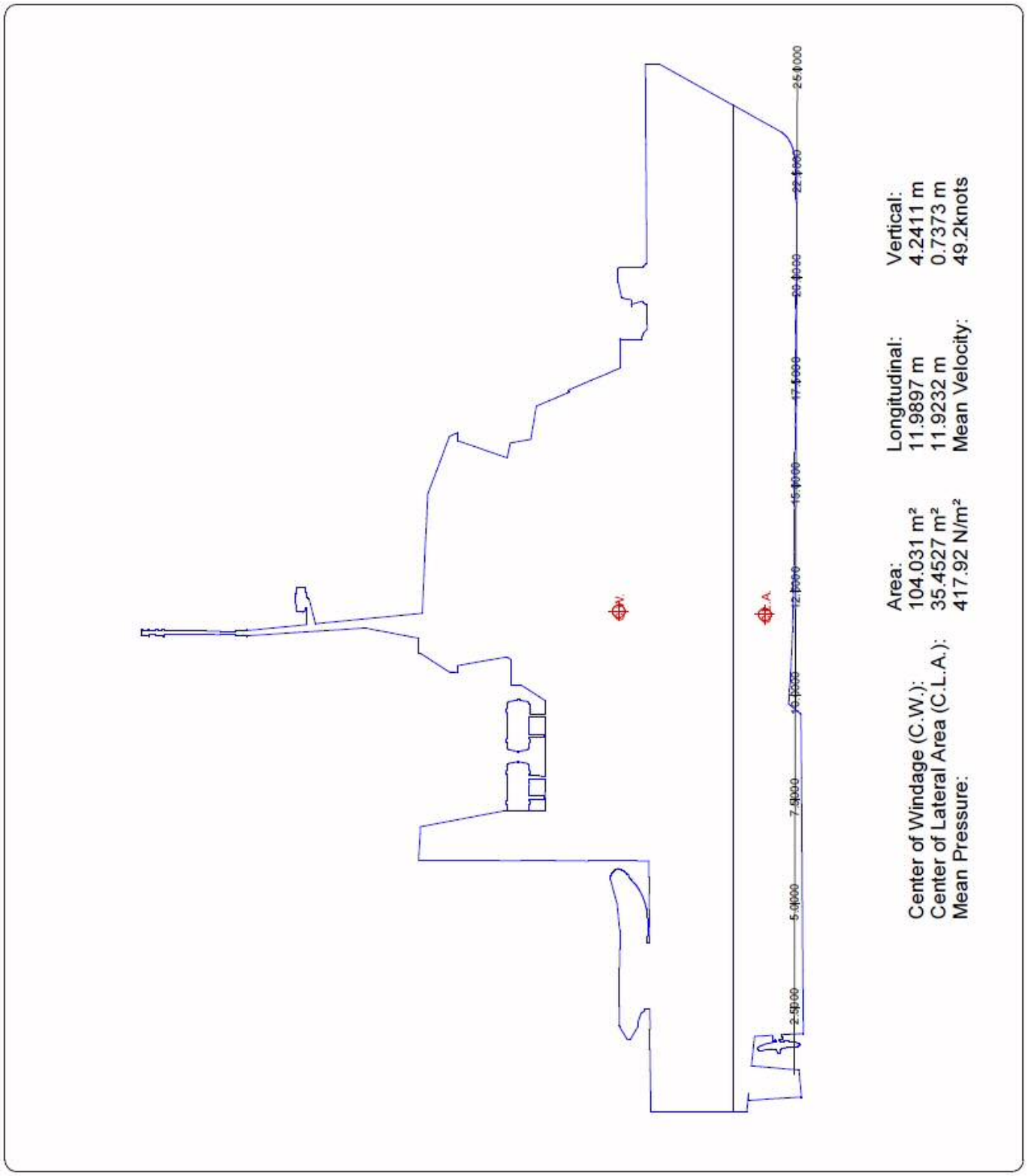


GZT	0.0000	GZL	0.0000
GMT	1.4224	GML	44.2081
GMTC	1.4147	GMLC	44.1705
UMt	2.2501	UMl	1.6775
OGT	1.3648	OGL	1.3947

C.G.:	Total:	Solid:	Liquid:
Wgt:	91.1344	89.9800	1.1544
LCG:	10.9510	10.9338	12.2898
VCG:	2.8528	2.8819	0.5798
TCG:	0.0004	0.0000	0.0283

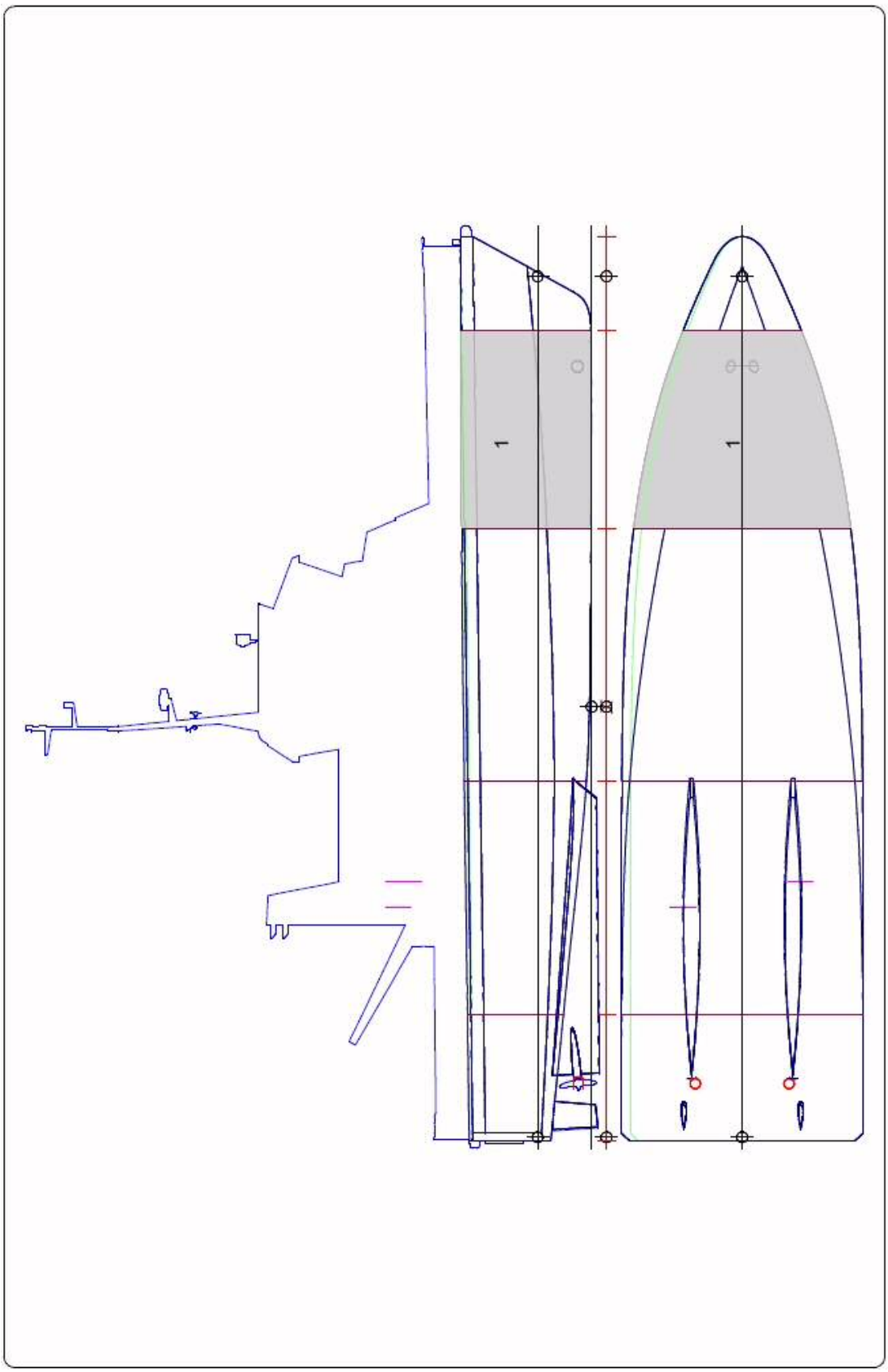
3.16.B.c.8:Silhouette Analysis:

Silhouette Analysis:
Wind: 49.2 knots (constant), Displacement: 91.1344 t, LCG: 10.9510 m, VCG: 2.8528 m
Heel = 0.000°, AP @ 0.8920, DAP: 1.4647, FP @ 24.88 80, DFP: 1.5385, Trim: -0.0738 m



3.16.B.c.9:Damage Analysis:

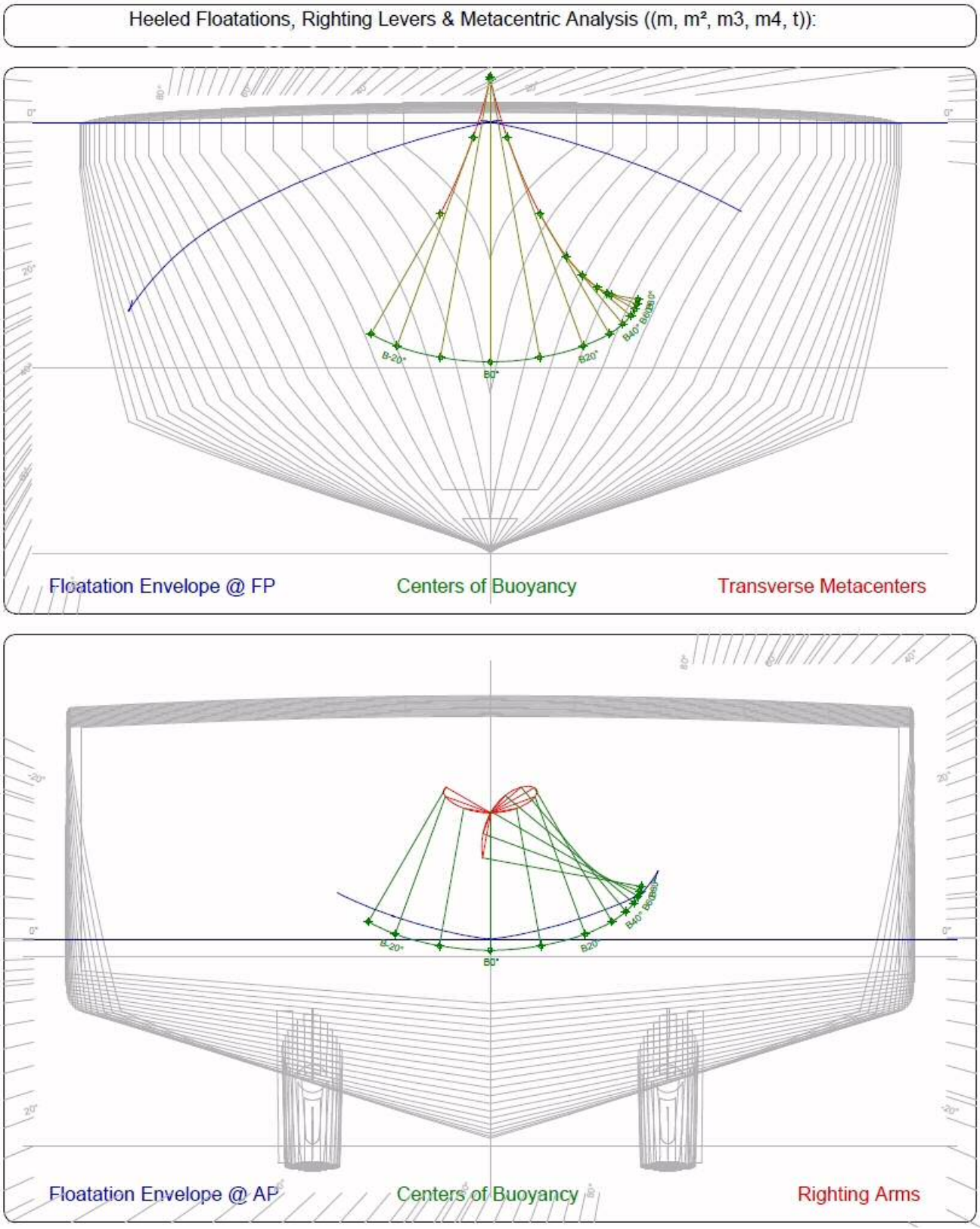
Damage Data Forms Example / C4 Damaged:



Damage: C4 Damaged, Ship Balance: Heel= 0.159°, Tri m= -1.8578, Mean Draft= 2.5640, (Data in m, m3, t.m.):

#	Name:	Status:	Raw Vol.	Wat. Vol.	Wat. x	Wat. y	Wat. z	FSMt	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax
1	C4	100%x0.950	61.4833	46.5666	19.3995	0.0031	1.9671	53.2593	17.0000	22.5001	-3.0094	3.0094	0.0054	3.6349

3.16.B.c.10: GZ Metacenters Page:



3.16.B.d Limitations:

Depending on the entities contained in the calculated model, its hydrostatic behavior and the calculated heel range, certain criteria may not be usable (by example a criterion calculating a downflooding angle when no opening is defined, or calculating windage data when no silhouette is present, etc…).

When the [**Retain all Cases**] must be used, don't forget that certain loading condition / damage condition combinations may not fit with the current heel range, criterion and/or output parameters.

At last, special criteria like Dredge stability, WoD (Stockholm) stability, etc… are not designed to be used here, as dedicated functions are provided in the 'Tools' menu for these special processes.

3.16.B.e Typical use:

Calculating ship's Transverse Stability (intact or damaged, depending on virtual ship's current status) for current loading and damage condition as well as for all the present loading condition / damage condition combinations (see MAAT Hydro's FAQ).

3.16.B.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:
- Select '**/Tools/Transverse Stability**' in the menu bar.
- Click on the **[OK]** button directly to validate the default settings and start the calculation.
- Click on the **[Criterion]** button to select the 'IMO A749 (18).stc' criterion.
- Check and uncheck various options.
- Click on the **[Retain]** button to conserve the current report among the 2D data.
- Click on the **[OK]** button to exit.
- Click on the **[2D]** tab, at the bottom left of MAAT Hydro's window, to view the 'retained' reports.

3.17 ***Deterministic Stability:***

3.17.a Purpose:

This function is intended to automate the deterministic damaged stability calculations in order to process them like the probabilistic ones. Like for a probabilistic calculation, this automation is made possible thanks to the preliminary definition of the concerned damages (see the FAQ for more details) and loading conditions.

Trim and draft ranges must be defined, according ton which intact centers of buoyancy will be calculated in order to allow scanning the corresponding critical KGs for the selected criterion and all the present damages.

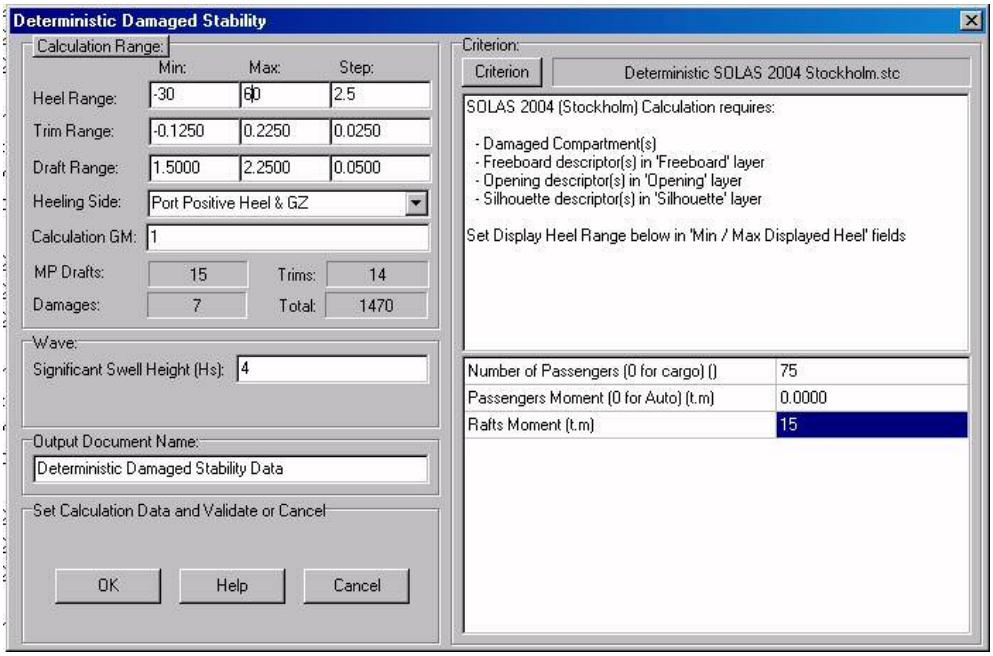
Among its numerous results, this function provides complete Max KG and Min GM tables for the entered trim and draft ranges, allowing to check immediately the safety of all the present loading conditions according to the selected criterion (see outputs below). The present loading conditions are, therefore, not directly used for the calculations, but they are simply located in the Max KGs / Min GM diagrams in order to make their safety obvious.

Depending on model's weight, attention must be paid to the total amount of calculations when damage - trim – draft – heel combinations are numerous.

When the selected criterion refers uses water on deck (Stockholm Agreement), damage's longitudinal extents must be preliminarily defined on the [Data] page, in their Xmin / Xmax fields (see FAQ).

3.17.b Inputs:

The following dialog box pops up when the function is selected:



- The [**Criterion]** button allows selecting the deterministic stability criterion among the available STC scripts (the associated data must be set after this selection).

- The [**Calculation Range]** button allows resetting the heel, trim and draft ranges to their default values.

- The '**Heel Range**' 'Min', 'Max' and 'Step' fields allow defining the stability heel range to calculate. This range must be thought in order to allow calculating the selected criterion for <u>all</u> the damage / trim / draft combinations.

- The '**Trim Range**' 'Min', 'Max' and 'Step' fields allow defining the intact trim range in which the stability criterion will be calculated, in combination with the draft range (see below), for all the present damages. The smaller the step will be, the sharper will be the Max KG scanning, but the heavier will be the calculations and the amount of results. The 4 panes at the bottom of the 'Calculation Range' frame allow controlling in real-time the total amount of stability calculations resulting from the current ranges and damages.

- The '**Draft Range**' 'Min', 'Max' and 'Step' fields allow defining the intact draft range in which the stability criterion will be calculated, in combination with the trim range (see above), for all the present damages. The smaller the step will be, the sharper will be the Max KG scanning, but the heavier will be the calculations and the amount of results. The 4 panes at the bottom of the 'Calculation Range' frame allow controlling in real-time the total amount of stability calculations resulting from the current ranges and damages.

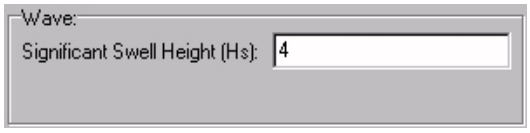
- The '**Heeling Side**' selector allows defining on which side the stability has to be calculated.

- The '**Calculation GM**' input field allows initializing the VCG before scanning its critical value. The closer this initial value is from the critical one, the faster the Max KG calculation is. Moreover, when the criterion uses Water on Deck, a realistic initial

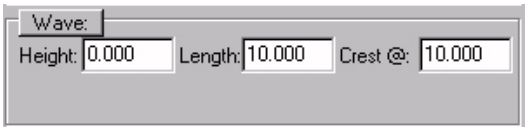
GM value provides more accurate Max KGs (as water on deck causes displacement variations during the stability calculations, Max KG can only be approximated in this case and a realistic initial GM provides better results).

- The content of the '**Wave**' frame depends on the selected criterion:

- If the criterion contains Water on Deck calculations (Stockholm Agreement, …), a '**Significant Swell Height (Hs)**' field is displayed, allowing to input this data:



- In all the other cases, the classical swell parameter fields are displayed (generally useless):



The '**Output Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report. Nevertheless, as this calculation may be time consuming, a confirmation box recalls the number of stability calculations before starting.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.17.c Outputs:

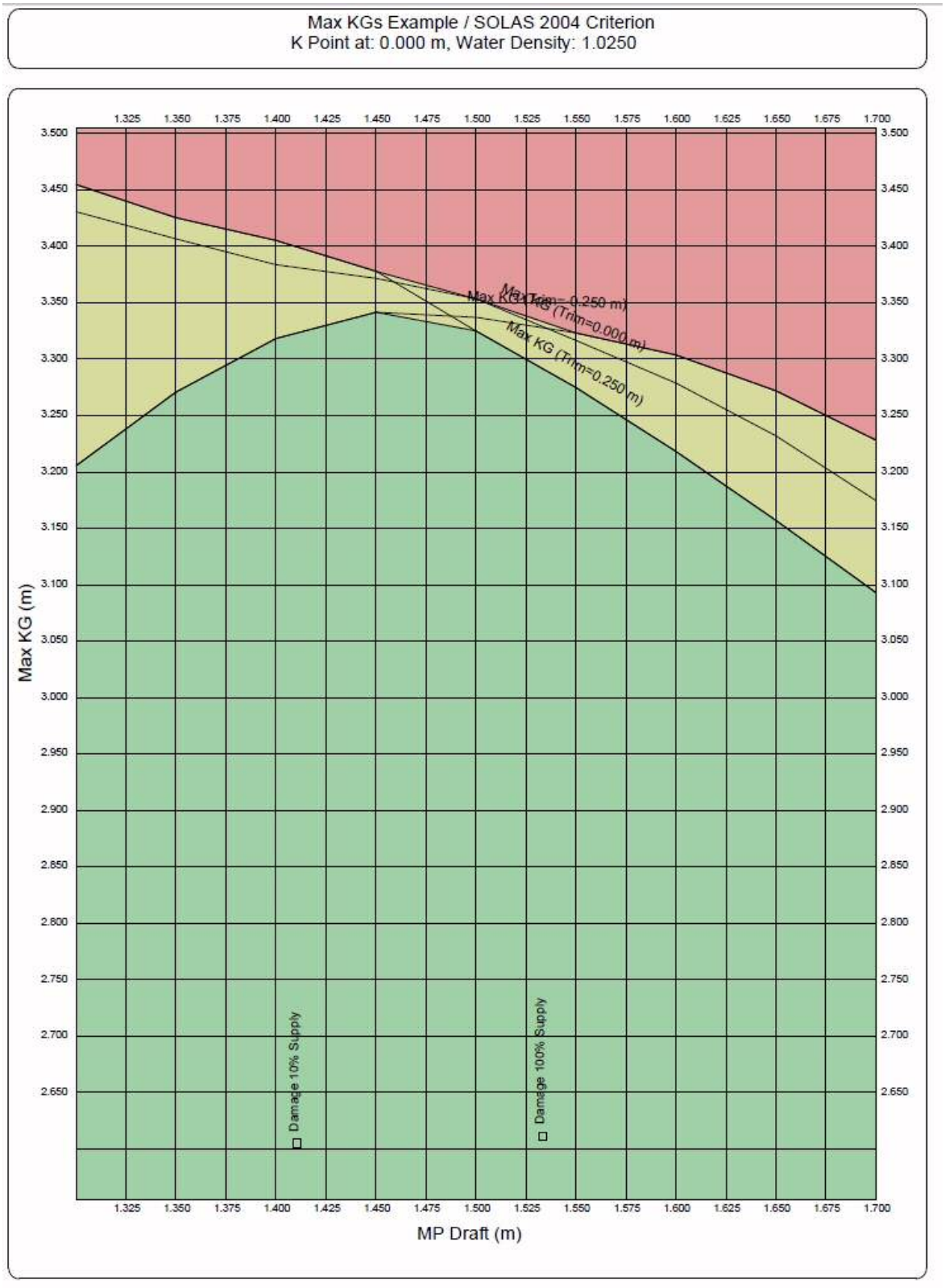
After clicking on the **[OK]** button, a 2D folder is created in the 2D browser, containing:

- A ‘General’ subfolder containing the general data (Max KGs diagram, Min GMs diagram, initial ship status and hydrostatic features for each intact floatation, damage / compartment list, compartment / damage list, line features and damage description for each damage, …).

- One subfolder for each trim of the entered range, containing trim’s detailed data (Max KGs diagram, Min GMs diagram, detailed data table for each draft, …).

The following reports are automatically created in the ‘General’ subfolder:

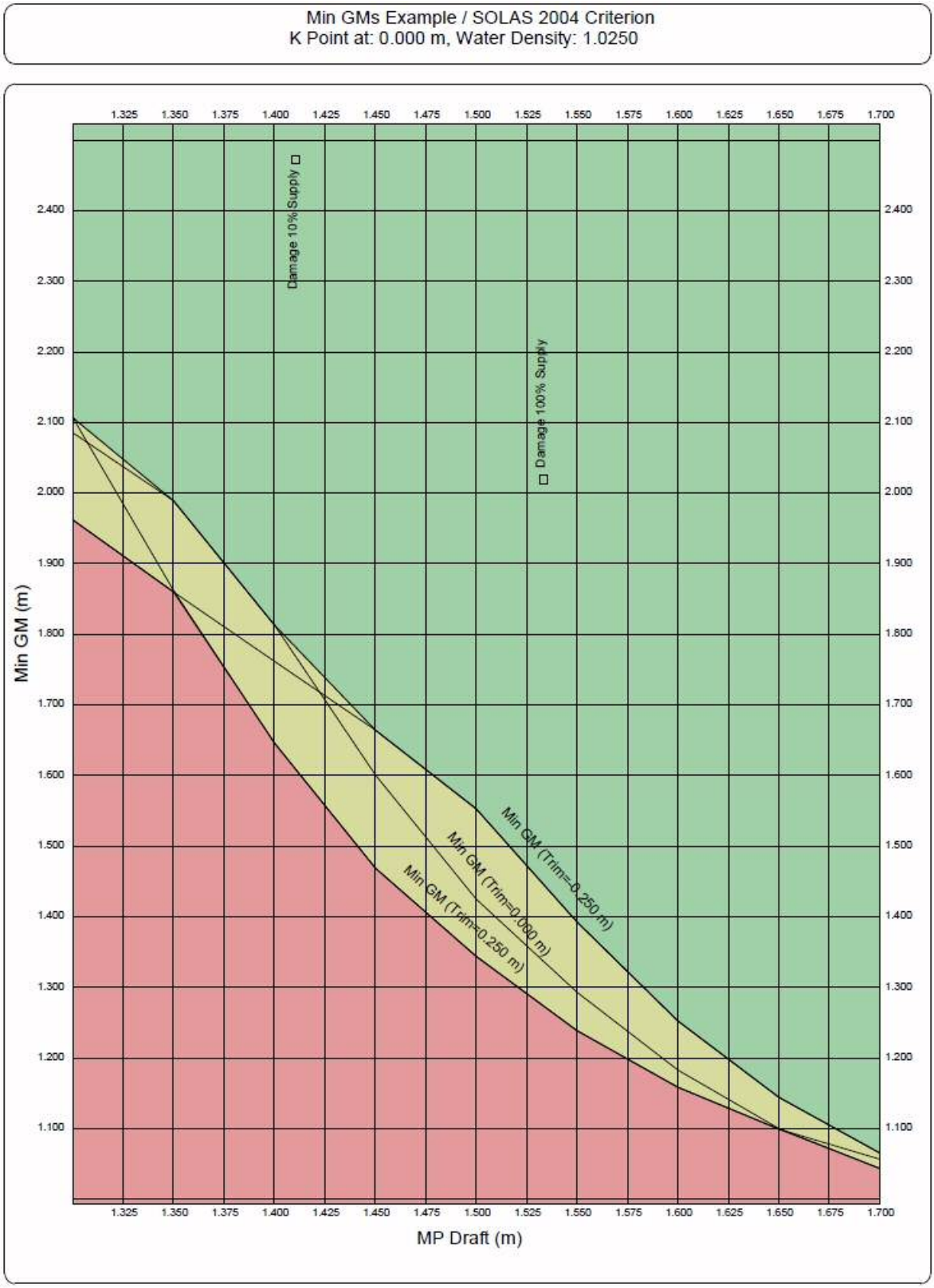
3.17.c.G1: Max KGs:



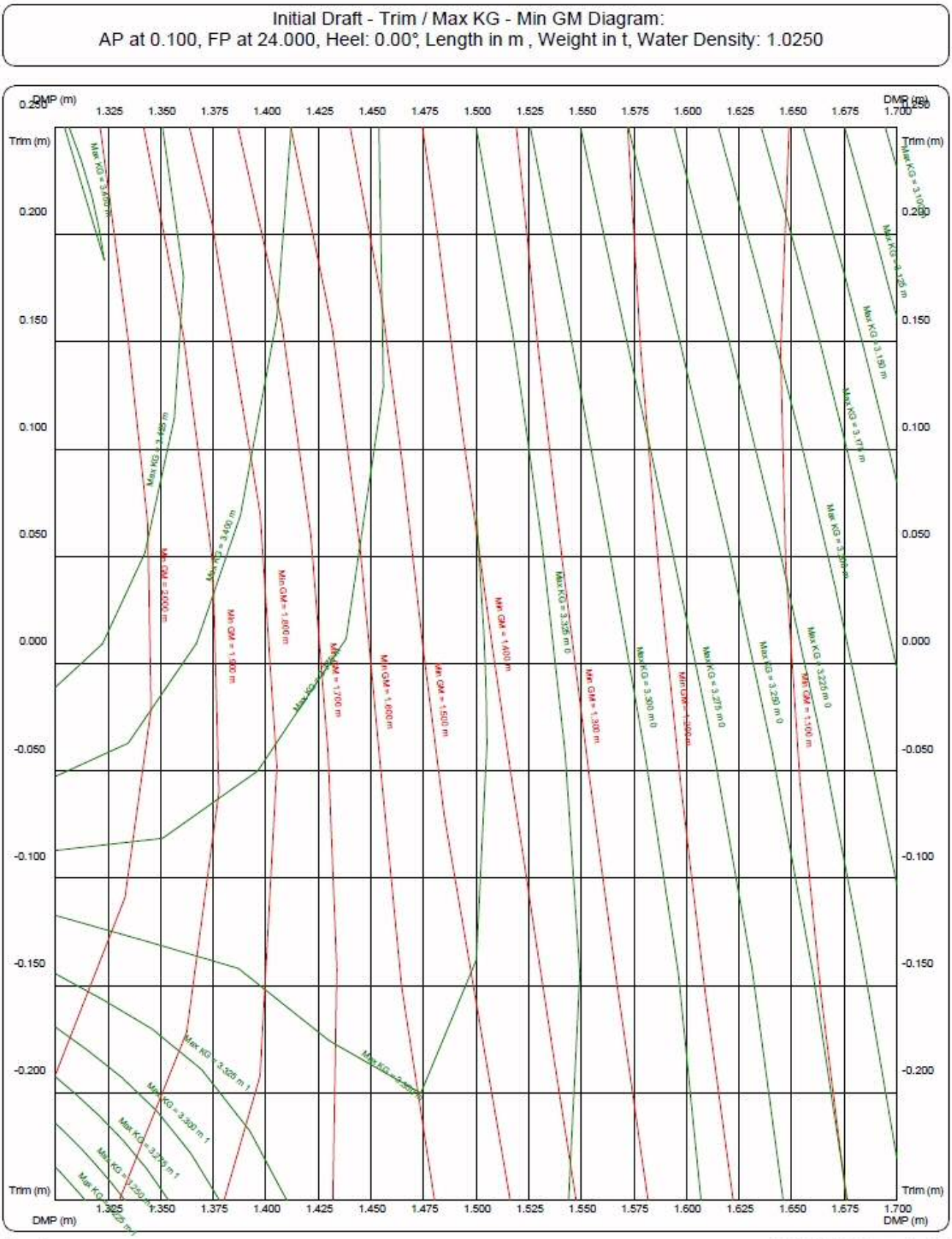
Example:
User Number One / Thu Apr 18 15 12 19 2013

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3.17.c.G2: Min GMs:



3.17.c.G3: Max KGs / Min GMs Diagram:



Example:
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3.17.c.G4: Max KG / Min GM Report:

Critical Initial Conditions calculated for Damaged Stability Analysis (SOLAS 2004 Criterion)
K Point at: 0.000 m, Water Density: 1.0250

MP Draft:	Trim:	Displ:	LCG:	Max KG:	Min GM:	Worst Damage:	Limiting Criterion:
1.300	-0.250	71.958	11.791	3.205	1.962	C3 Damaged	GZmax > Max(psg, rft, wnd)
1.300	0.000	74.583	11.191	3.431	2.085	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.300	0.250	77.789	10.578	3.455	2.107	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.350	-0.250	77.856	11.662	3.271	1.860	C3 Damaged	GZmax > Max(psg, rft, wnd)
1.350	0.000	80.729	11.074	3.407	1.989	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.350	0.250	83.961	10.501	3.425	1.862	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.400	-0.250	83.925	11.536	3.318	1.761	C3 Damaged	GZmax > Max(psg, rft, wnd)
1.400	0.000	86.960	10.969	3.384	1.813	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.400	0.250	90.166	10.436	3.405	1.646	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.450	-0.250	90.130	11.417	3.341	1.664	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.450	0.000	93.227	10.880	3.372	1.601	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.450	0.250	96.402	10.382	3.378	1.469	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.500	-0.250	96.430	11.307	3.337	1.553	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.500	0.000	99.523	10.803	3.353	1.425	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.500	0.250	102.67	10.336	3.325	1.344	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.550	-0.250	102.78	11.210	3.323	1.392	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.550	0.000	105.85	10.738	3.317	1.293	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.550	0.250	108.96	10.297	3.275	1.238	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.600	-0.250	109.16	11.126	3.304	1.252	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.600	0.000	112.20	10.681	3.279	1.183	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.600	0.250	115.28	10.264	3.218	1.158	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.650	-0.250	115.57	11.052	3.272	1.144	C2 Damaged	[Eq-22'] Area > 0.015
1.650	0.000	118.58	10.632	3.232	1.100	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.650	0.250	121.63	10.236	3.157	1.099	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.700	-0.250	122.00	10.988	3.228	1.065	C2 Damaged	[Eq-22'] Area > 0.015
1.700	0.000	124.98	10.589	3.174	1.043	C2 Damaged	GZmax > Max(psg, rft, wnd)
1.700	0.250	128.01	10.212	3.093	1.056	C2 Damaged	GZmax > Max(psg, rft, wnd)

3.17.c.G5: Loading Condition Report:

Ship Status / Example / Damage 100% Supply

Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
Specific Fittings	1.5500		100.0%	1.5500	4.762	0.000	4.424
Piping	2.6620		100.0%	2.6620	9.644	0.000	1.875
Painting	1.6070		100.0%	1.6070	11.000	0.000	2.000
Movable Equipments	3.8020		100.0%	3.8020	18.168	0.000	2.655
Machinery	6.7880		100.0%	6.7880	6.122	0.000	1.479
Electrical Installation	3.1630		100.0%	3.1630	9.899	0.000	4.268
Deck Fittings	5.9980		100.0%	5.9980	12.000	0.000	4.000
Crew	0.2250		100.0%	0.2250	10.900	0.000	4.000
Ballast - Liquids - Reserves	3.4770		100.0%	3.4770	9.893	0.000	2.484
Arrangement	7.9490		100.0%	7.9490	11.790	0.000	4.117
100% Supply	16.5730		100.0%	16.5730	10.158	0.002	2.664
Solid Load Subtotal:				53.7940	10.476	0.001	2.957
Structure				46.2007	10.682	-0.004	2.375
Total (Solid):				99.9947	10.571	-0.002	2.688

Tank:	Raw Volume: (m3)	Muin:	Quantity:	FSM: (t.m)	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
Freshwater Tank	0.340	95.0%	100.0%		0.1486	15.500	0.000	0.656
Freshwater Subtotal (rô=0.46, 100.0% of total capacity):				0.000	0.1486	15.500	0.000	0.656
Daily GO Tank	1.406	95.0%	100.0%		0.6142	9.635	1.045	2.476
Portside GO Tank	4.341	95.0%	100.0%		1.8969	11.513	0.750	0.750
Starboard GO Tank	4.347	95.0%	100.0%		1.8998	11.513	-0.749	0.750
Gasoil Subtotal (rô=0.46, 100.0% of total capacity):				0.000	4.4110	11.252	0.146	0.991
Greywater Tank	0.353	95.0%	100.0%		0.1540	14.187	-0.250	0.606
Greywater Subtotal (rô=0.46, 100.0% of total capacity):				0.000	0.1540	14.187	-0.250	0.606
Total (Liquid):				0.000	4.7136	11.482	0.128	0.968
Total (Liquid + Solid):				0.000	104.708	10.612	0.004	2.611

3.17.c.G6: Associated Intact Hydrostatic Analysis:

Hydrostatic Data, Heel=0.000°, Rô=1.0250 (m, m², m3 , m4, t):
AP @ x=0.100, z=0.0, Imm.: 1.572, FP @ x=24.000, z=0.0, Imm.: 1.494, Trim: 0.078 (0.187°)
Aft Mark @ x=0.100, z=1.500, Imm.: 0.072, Fore Mark @ x=24.000, z=1.500, Imm.: -0.006 m

Immersed Hull:

Total Displacement	104.708
Volume	102.15
L Center of Buoyancy	10.607
T Center of Buoyancy	0.000
V Center of Buoyancy	1.033
Wetted Surface Area	197.02
Prismatic Coefficient	0.67022
Block Coefficient	0.41236
L/V^1/3	5.15788

Waterplane:

Waterplane Area	123.30
Floatation Area Ratio	0.76355
L Center Floatation	9.693
X Fore Floatation	24.111
X Aft Floatation	0.000
Length of Waterline	24.111
Breadth of Waterline	6.701
Height of Mt (KMt)	4.630
Height of Ml (KMl)	44.194
Trsv Met. Radius (BMt)	3.597
Lng Met. Radius (BMl)	43.161
Free Surf. Momt (Trsv.)	0.000
Free Surf. Momt (Lngt.)	0.000

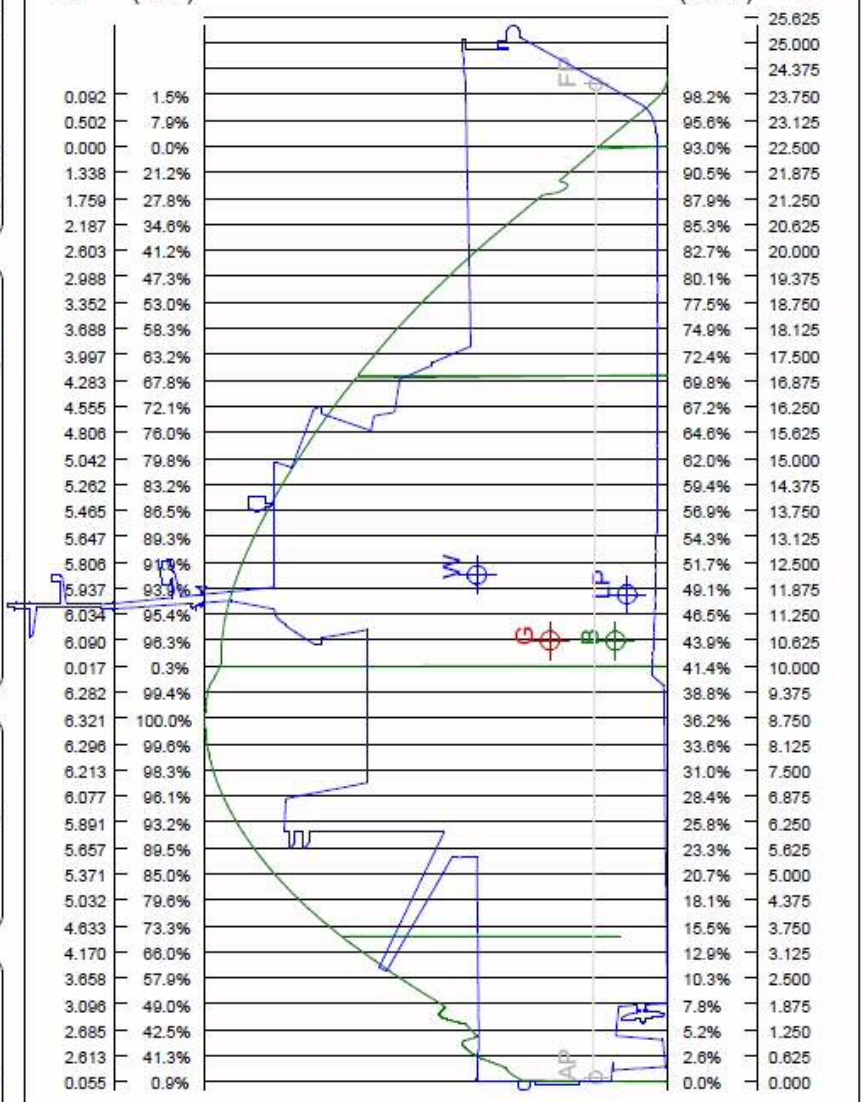
Max Cross Section:

B² Area	6.321
B² Area Ratio	0.61526
L Center of B²	8.752
T Center of B²	0.000
V Center of B²	1.013

Lateral Plane:

Min Free Board	1.724
Draft at waterline	1.783
Lateral Plane Area	36.280
Lateral Plane Ratio	0.84391
L Center Lat. Plane	11.722
V Center Lat. Plane	0.755
Windage Area	116.95
L Center of Windage	12.193
V Center of Windage	4.368
VCW-VCLP	3.613
LCW-LCLP	0.471
LCW-LCLP % LBP	1.97 %

Curve of Areas:



GZT	-0.004	GZL	0.000
GMT	2.019	GML	41.584
GMTC	2.019	GMLC	41.584
UMt	3.690	UMl	1.822
OGT	1.073	OGL	1.073

C.G.:	Total:	Solid:	Liquid:
Wgt:	104.708	99.9947	4.7136
LCG:	10.612	10.571	11.482
VCG:	2.611	2.688	0.968
TCG:	0.004	-0.002	0.128

Example / Damage 100% Supply / Intact Ship:
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3.17.c.G7: Damage / Compartment List:

Ship: Example - Damage/Compartments List (PS):

Damage 'C1 Damaged' Floods: C1

Damage 'C2 Damaged' Floods: C2

Damage 'C3 Damaged' Floods: C3

Damage 'C4 Damaged' Floods: C4

Damage 'C5 Damaged' Floods: C5

Damage 'Intact' Floods: Nothing

3.17.c.G8: Compartment / Damage List:

Ship: Example - Compartment/Damages List (PS):

Compartment 'C1' Flooded in Damages: C1 Damaged

Compartment 'C2' Flooded in Damages: C2 Damaged

Compartment 'C3' Flooded in Damages: C3 Damaged

Compartment 'C4' Flooded in Damages: C4 Damaged

Compartment 'C5' Flooded in Damages: C5 Damaged

Compartment 'Daily GO Tank' Never Damaged.

Compartment 'Freshwater Tank' Never Damaged.

Compartment 'Greywater Tank' Never Damaged.

Compartment 'Port Side Propeller' Never Damaged.

Compartment 'Portside GO Tank' Never Damaged.

Compartment 'Portside Keel' Never Damaged.

Compartment 'Portside Rudder' Never Damaged.

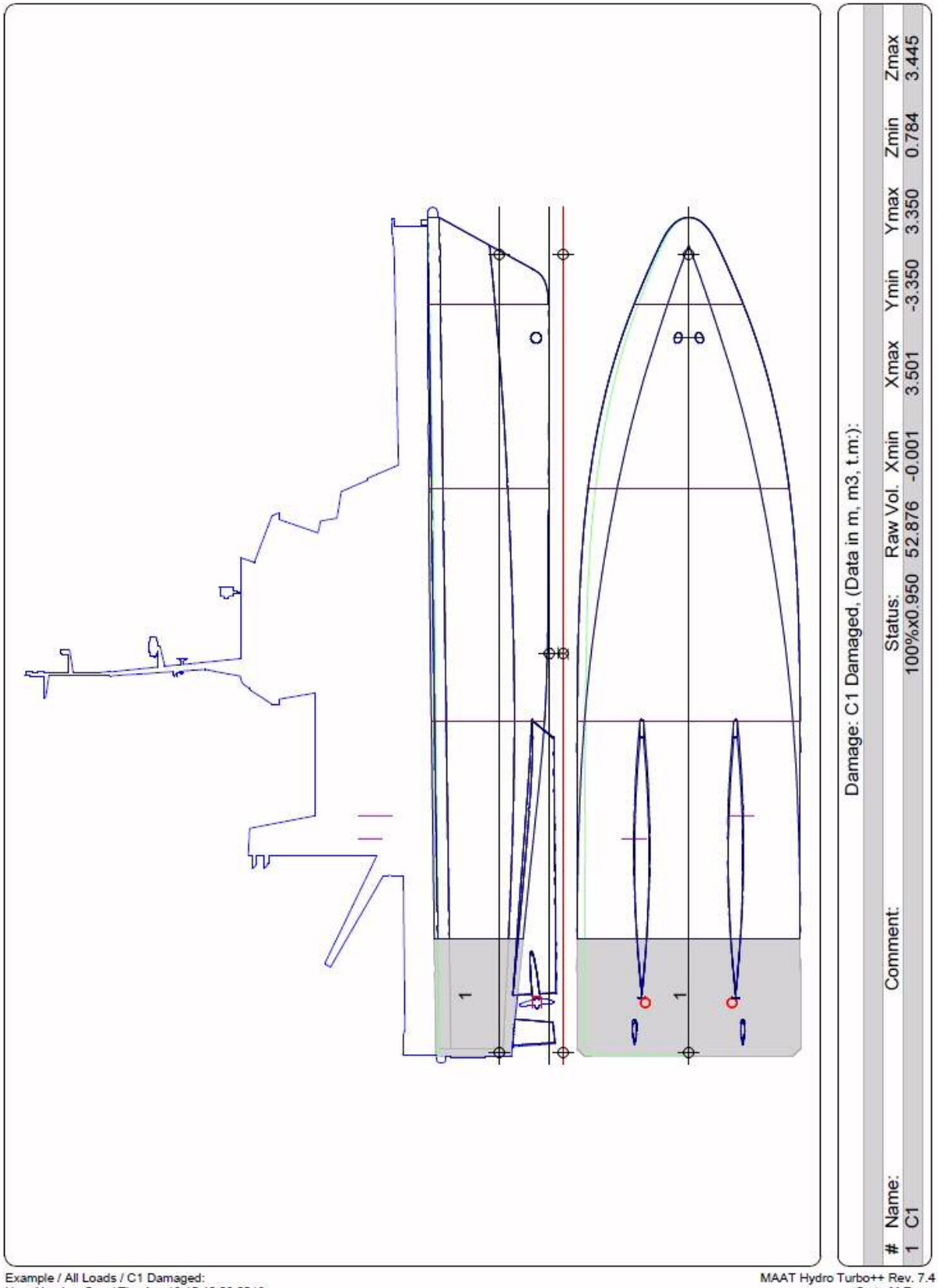
Compartment 'Starboard GO Tank' Never Damaged.

Compartment 'Starboard Keel' Never Damaged.

Compartment 'Starboard Propeller' Never Damaged.

Compartment 'Starboard Rudder' Never Damaged.

3.17.c.G9: Damage Presentation:



Damage: C1 Damaged, (Data in m, m3, t.m:):

#	Name:	Comment:	Status:	Raw Vol.	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax
1	C1		100%x0.950	52.876	-0.001	3.501	-3.350	3.350	0.784	3.445

Example / All Loads / C1 Damaged:
User Number One / Thu Apr 18 15 12 08 2013

MAAT Hydro Turbo++ Rev. 7.4
Smt+ M.Res.

3.17.c.G10: Damage's Associated Line Data:

Ship: Example / Lines Data (PS Heel, KG = Max KG) / Damage: C1 Damaged

Freeboard Lines:

Deck Line (xmin=0.000, xmax=25.106, ymin=0.000, ymax=3.100, zmin=3.296, zmax=3.641):

Intact Draft:	Intact Trim:	Damage Draft:	Damage Trim:	Damage Heel:	Fbd @ Equ.:	Imm. Heel:
1.300 m	-0.250 m	1.315 m	-0.067 m	0.451 °	1.988 m	42.705 °
1.350 m	-0.250 m	1.371 m	0.006 m	0.482 °	1.894 m	41.133 °
1.400 m	-0.250 m	1.428 m	0.093 m	0.535 °	1.792 m	39.370 °
1.450 m	-0.250 m	1.486 m	0.189 m	0.609 °	1.682 m	36.966 °
1.500 m	-0.250 m	1.544 m	0.291 m	0.714 °	1.567 m	33.365 °
1.550 m	-0.250 m	1.603 m	0.394 m	0.801 °	1.453 m	30.112 °
1.600 m	-0.250 m	1.661 m	0.494 m	0.931 °	1.337 m	26.891 °
1.650 m	-0.250 m	1.720 m	0.593 m	1.074 °	1.221 m	23.870 °
1.700 m	-0.250 m	1.779 m	0.691 m	1.303 °	1.101 m	21.239 °
1.300 m	0.000 m	1.327 m	0.370 m	0.496 °	1.757 m	41.637 °
1.350 m	0.000 m	1.385 m	0.473 m	0.560 °	1.645 m	36.854 °
1.400 m	0.000 m	1.443 m	0.579 m	0.640 °	1.530 m	32.930 °
1.450 m	0.000 m	1.501 m	0.683 m	0.751 °	1.413 m	29.529 °
1.500 m	0.000 m	1.560 m	0.786 m	0.830 °	1.299 m	26.212 °
1.550 m	0.000 m	1.618 m	0.888 m	0.954 °	1.184 m	23.124 °
1.600 m	0.000 m	1.677 m	0.988 m	1.101 °	1.067 m	20.418 °
1.650 m	0.000 m	1.736 m	1.087 m	1.332 °	0.947 m	18.238 °
1.700 m	0.000 m	1.795 m	1.184 m	1.515 °	0.830 m	16.293 °
1.300 m	0.250 m	1.340 m	0.874 m	0.592 °	1.488 m	32.324 °
1.350 m	0.250 m	1.398 m	0.981 m	0.672 °	1.372 m	28.795 °
1.400 m	0.250 m	1.457 m	1.087 m	0.770 °	1.256 m	25.389 °
1.450 m	0.250 m	1.515 m	1.190 m	0.853 °	1.142 m	22.247 °
1.500 m	0.250 m	1.574 m	1.292 m	0.972 °	1.026 m	19.541 °
1.550 m	0.250 m	1.632 m	1.393 m	1.115 °	0.910 m	17.379 °
1.600 m	0.250 m	1.691 m	1.492 m	1.331 °	0.791 m	15.414 °
1.650 m	0.250 m	1.750 m	1.589 m	1.465 °	0.676 m	13.587 °
1.700 m	0.250 m	1.809 m	1.685 m	1.480 °	0.569 m	11.762 °

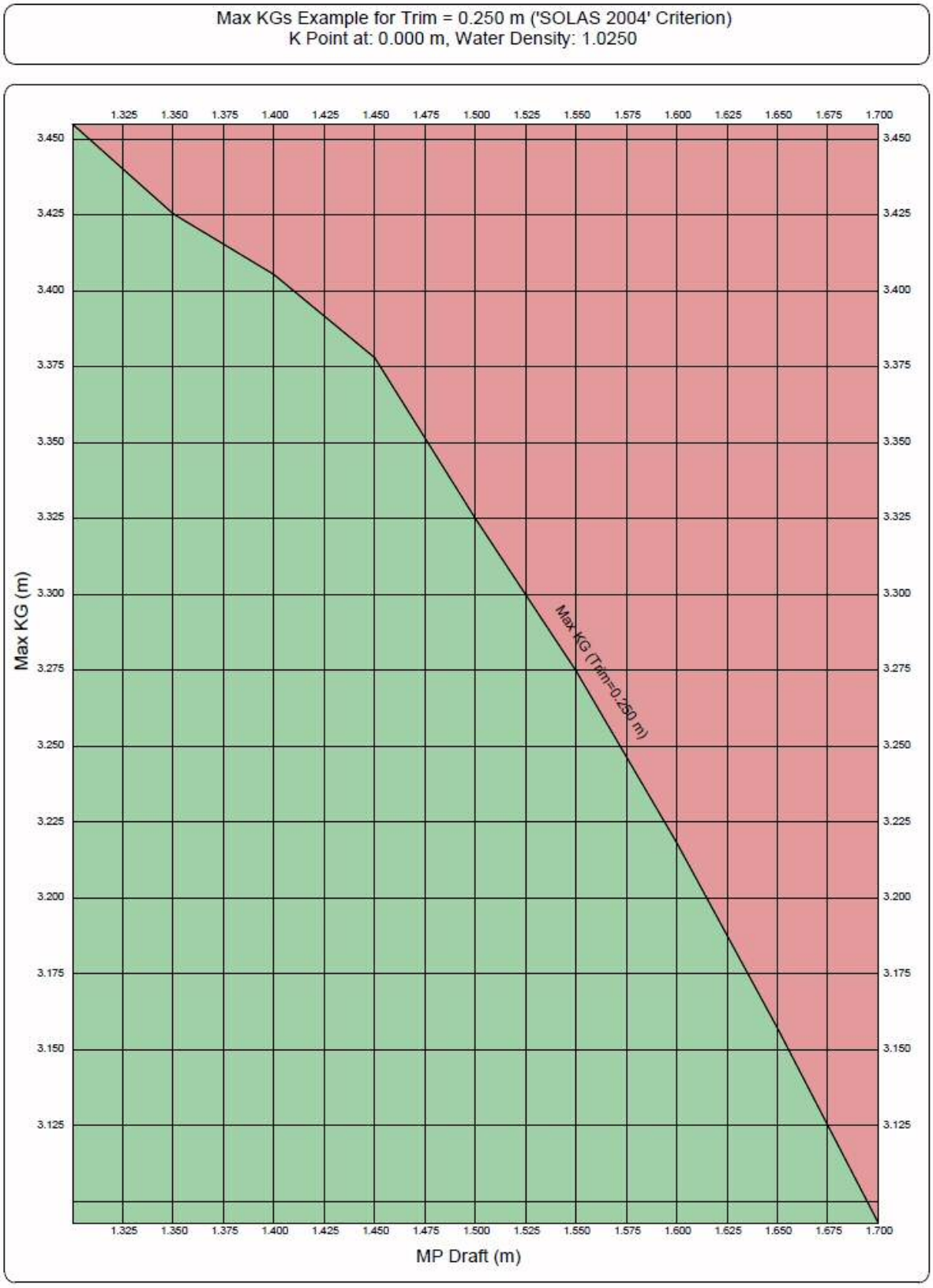
Downfloodable Opening 1 Lines:

Starboard opening (xmin=7.200, xmax=7.200, ymin=-1.960, ymax=-1.260, zmin=4.714, zmax=5.714):

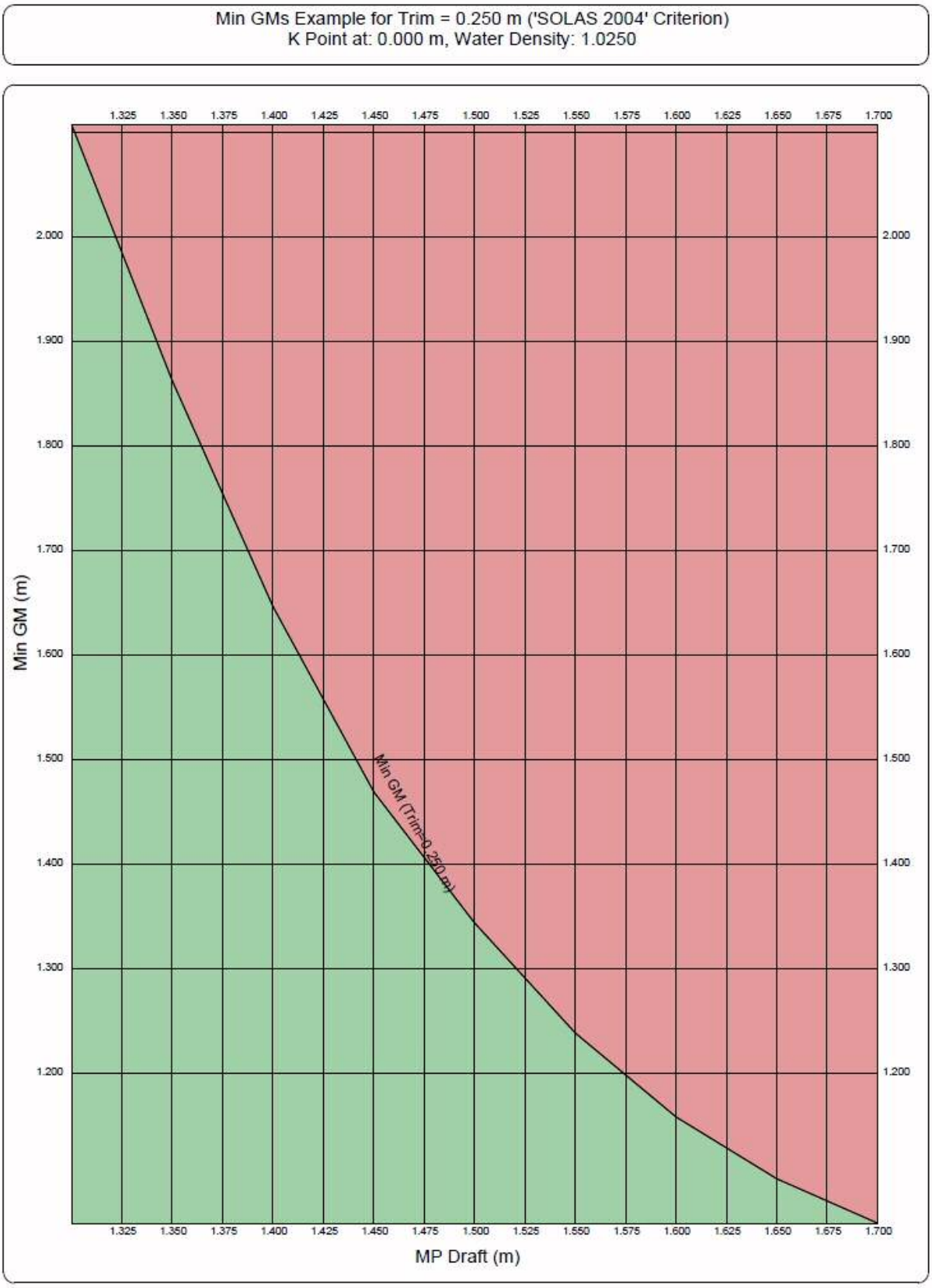
Intact Draft:	Intact Trim:	Damage Draft:	Damage Trim:	Damage Heel:	Fbd @ Equ.:	Imm. Heel:
1.300 m	-0.250 m	1.315 m	-0.067 m	0.451 °	3.421 m	?
1.350 m	-0.250 m	1.371 m	0.006 m	0.482 °	3.351 m	?
1.400 m	-0.250 m	1.428 m	0.093 m	0.535 °	3.277 m	?
1.450 m	-0.250 m	1.486 m	0.189 m	0.609 °	3.201 m	?
1.500 m	-0.250 m	1.544 m	0.291 m	0.714 °	3.124 m	?
1.550 m	-0.250 m	1.603 m	0.394 m	0.801 °	3.046 m	?
1.600 m	-0.250 m	1.661 m	0.494 m	0.931 °	2.969 m	?
1.650 m	-0.250 m	1.720 m	0.593 m	1.074 °	2.893 m	?
1.700 m	-0.250 m	1.779 m	0.691 m	1.303 °	2.818 m	?
1.300 m	0.000 m	1.327 m	0.370 m	0.496 °	3.321 m	?
1.350 m	0.000 m	1.385 m	0.473 m	0.560 °	3.243 m	?
1.400 m	0.000 m	1.443 m	0.579 m	0.640 °	3.165 m	?
1.450 m	0.000 m	1.501 m	0.683 m	0.751 °	3.087 m	?
1.500 m	0.000 m	1.560 m	0.786 m	0.830 °	3.009 m	?
1.550 m	0.000 m	1.618 m	0.888 m	0.954 °	2.932 m	?
1.600 m	0.000 m	1.677 m	0.988 m	1.101 °	2.855 m	?
1.650 m	0.000 m	1.736 m	1.087 m	1.332 °	2.781 m	?

The following reports are automatically created in the individual trim subfolders:

3.17.c.T1: Individual Trim's Max KGs:



3.17.c.T2: Individual Trim's Min GMs:



3.17.c.T3: Individual Trim's Max KGs / Min GMs:

Damaged Stability Analysis (Initial MP Draft = 1.350 / Trim = 0.250 / Displ = 83.961 / KMt = 5.287)
Criterion: SOLAS 2004, K Point at: 0.000 m, Water Density: 1.0250

Damage:	Displ:	LCG:	TCG:	VCG:	Max KG:	Min GM:	Limiting Criterion:
C1 Damaged	79.247	10.445	0.000	4.287	3.684	1.604	GZmax > Max(psg, rft, wnd)
C2 Damaged	79.247	10.442	0.000	4.287	3.425	1.862	GZmax > Max(psg, rft, wnd)
C3 Damaged	79.247	10.443	0.000	4.287	3.478	1.809	GZmax > Max(psg, rft, wnd)
C4 Damaged	79.247	10.449	0.000	4.287	3.991	1.296	GZmax > Max(psg, rft, wnd)
C5 Damaged	79.247	10.450	0.000	4.287	4.142	1.145	GZmax > Max(psg, rft, wnd)
Intact	79.247	10.450	0.000	4.287	4.142	1.145	GZmax > Max(psg, rft, wnd)

3.17.d Limitations:

The calculated model must be realistic in terms of weight and buoyancy and it may be interesting to calculate first several transverse stabilities individually in order to determine the best calculation parameters before starting this automated calculation.

The calculation range must be thought according to the calculated damages in order to maintain positive buoyancy in any case (i.e. intact displacement associated to current draft and trim must never exceed damaged ship's buoyancy).

Depending on model's complexity, and on the amount of damages to process, heavy draft, trim and heel ranges may cause long calculations.

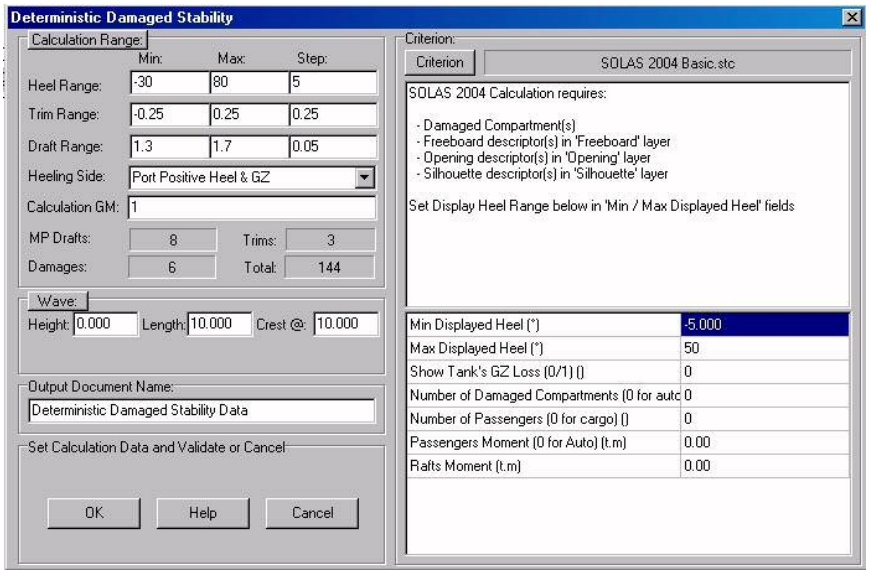
3.17.e Typical use:

Calculating ship's deterministic damaged stability and global Max KGs automatically.

3.17.f Example:

Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Deterministic Stability**' in the menu bar.
- Set the following parameters in the Deterministic Stability dialog box, validate them on the [OK] button and confirm the resulting 144 stability calculations:



- Check the obtained reports.

3.18 ***Probabilistic Stability:***

3.18.A Make Damage System:

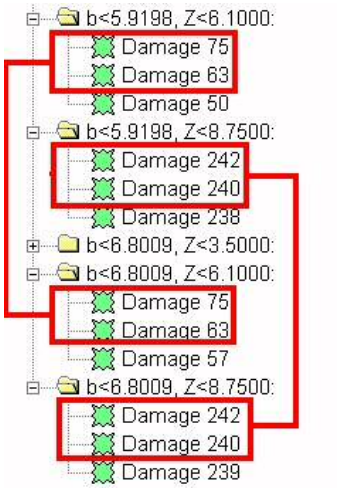
3.18.A.a Purpose:

A probabilistic stability calculation is achieved in 3 steps, as explained in MAAT Hydro's FAQ:

- Ship's subdivision (compartments and tanks) modelling.
- Damage System's automatic generation.
- Damage System's stability calculation (usually time consuming, but automatic).

As soon as the current ship is subdivided, according to the rules detailed in MAAT Hydro's FAQ, this function allows creating automatically a complete SOLAS 2009 compliant damage system and a complete report on ship's scanned subdivision (if necessary, ship's subdivision can be preliminarily controlled thanks to 3D viewport's 'Bulkheads' display option).

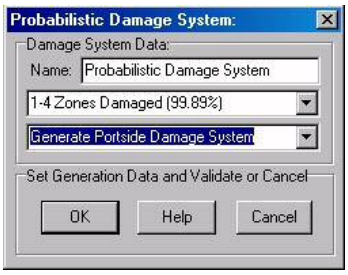
It is important to notice that the same damage can be repeated in different branches corresponding to different breach dimensions.



Nevertheless, for obvious optimization reasons, the corresponding stability curve will only be calculated once and its features automatically duplicated in the identical damage nodes.

3.18.A.b Inputs:

The following dialog box pops up when the function is selected:



The '**Name**' input field allows naming the damage system created among the 3D data.

The '**1-N Zones Damaged**' selector allows selecting the maximum number of contiguous zones to damage. The greater this number is, the most exhaustive the damage system will be (the associated ratio is displayed for information), but the longer it will take to be calculated, often for a poor profit on the resulting index (large damages usually have a poor survivability). Depending on ship's subdivision, the default '1-4 Zones Damaged' setting may therefore be reduced for speeding up the calculations or increased for trying to improve the attained index if not compliant.

The '**Side**' selector allows defining on which side the damaged system has to be calculated is ship is not symmetric.

At last, when all the probabilistic damage system generation data are set:

The **[OK]** button can be clicked for creating the damage system..

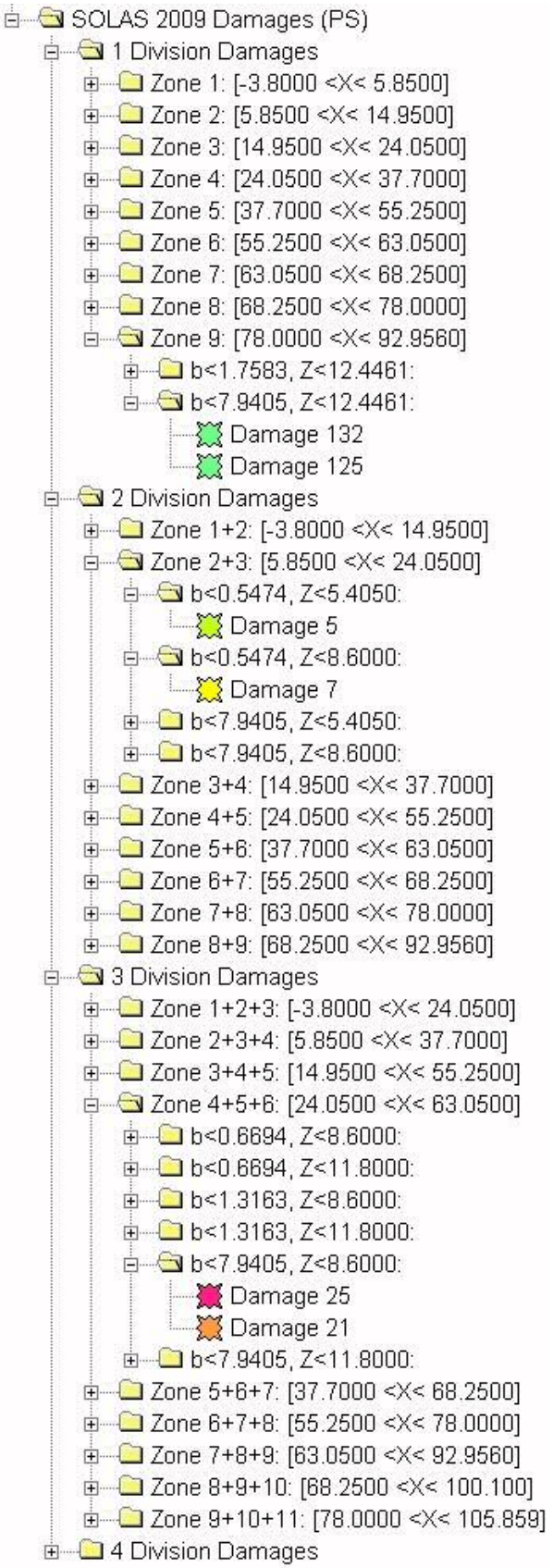
The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the function.

3.18.A.c Outputs:

After clicking on the **[OK]** button, the damage system tree is created among the current 3D Data (the created damages are initially white, but become colored according to a red=0 / green=1 scale as soon as they are calculated, in order to make their survivability visible in the 3D browser:

3.18.A.c.1: Damage System Tree:



3.18.A.c.2: Subdivision Analysis 1:

X1 = -3.8000:					
	p(x1,x2) = 0.06159				
X2 = 5.8500	p(x1,x3) = 0.13871	p1,3 = 0.04547			
	p(x2,x3) = 0.03165		p(x1,x4) = 0.22037	p1,4 = 0.01157	
X3 = 14.9500	p(x2,x4) = 0.10174	p2,4 = 0.03844		p(x1,x4) = 0.34478	p1,4 = 0.00304
	p(x3,x4) = 0.03165		p(x2,x5) = 0.22311	p2,5 = 0.01184	
X4 = 24.0500	p(x3,x5) = 0.14118	p3,5 = 0.04531		p(x2,x5) = 0.38315	p2,5 = 0.00105
	p(x4,x5) = 0.06422		p(x3,x6) = 0.30016	p3,6 = 0.00602	
X5 = 37.7000	p(x4,x6) = 0.21719	p4,6 = 0.05673		p(x3,x6) = 0.37129	p3,6 = 0.00001
	p(x5,x6) = 0.09624		p(x4,x7) = 0.28831	p4,7 = 0.00308	
X6 = 55.2500	p(x5,x7) = 0.16428	p5,7 = 0.04413		p(x4,x7) = 0.33573	p4,7 = 0.00043
	p(x6,x7) = 0.02391		p(x5,x8) = 0.21127	p5,8 = 0.01174	
X7 = 63.0500	p(x6,x8) = 0.05915	p6,8 = 0.02404		p(x5,x8) = 0.30016	p5,8 = 0.00687
	p(x7,x8) = 0.01121		p(x6,x9) = 0.14118	p6,9 = 0.01860	
X8 = 68.2500	p(x7,x9) = 0.07463	p7,9 = 0.02760		p(x6,x9) = 0.27651	p6,9 = 0.00455
	p(x8,x9) = 0.03583		p(x7,x10) = 0.20541	p7,10 = 0.00808	
X9 = 78.0000	p(x8,x10) = 0.15853	p8,10 = 0.04802		p(x7,x10) = 0.27053	p7,10 = 0.00053
	p(x9,x10) = 0.07468		p(x8,x11) = 0.22311	p8,11 = 0.00380	
X10 = 92.9560	p(x9,x11) = 0.13546	p9,11 = 0.04045		p(x8,x11) = 0.30929	p8,11 = 0.00119
	p(x10,x11) = 0.02033		p(x9,x12) = 0.22045	p9,12 = 0.01729	
X11 = 100.100	p(x10,x12) = 0.08804	p10,12 = 0.03465			
	p(x11,x12) = 0.03305				
X12 = 105.859					
Sum(p1): 0.48435		Sum(p2): 0.40484		Sum(p3): 0.09202	Sum(p4): 0.01768
Total: 0.99888764					

3.18.A.c.3: Subdivision Analysis 2:

X(0): -3.8000, Y(0): 0.0000
Y1(0, k): 0.0000, 3.9696, 0.8099, -0.2136,
Y(0, k): 7.7269, 7.8520, 4.6923, -0.2136,
Y2(0, k): 7.7648, 11.7344, 8.5747, -0.2136,
b1(0, k): 0.0000, -3.9696, -0.8099, 0.2136,
b(0, k): 0.0000, -0.1251, 3.0346, 7.9405,
b2(0, k): 0.0000, -3.9696, -0.8099, 7.9785,
Z(0, m): 0.0000, 5.4050, 8.6000,
X(1): 5.8500, Y(1): 7.7648
Y1(1, k): 7.7648, 7.1449, -0.1258,
Y(1, k): 7.8148, 7.2674, -0.1258,
Y2(1, k): 7.8592, 7.3899, -0.1258,
b1(1, k): 0.0000, 0.6199, 7.8906,
b(1, k): 0.0000, 0.5474, 7.9405,
b2(1, k): 0.0000, 0.4693, 7.9849,
Z(1, m): 0.0000, 5.4050, 8.6000,
X(2): 14.9500, Y(2): 7.8592
Y1(2, k): 7.8592, -0.0549,
Y(2, k): 7.8856, -0.0549,
Y2(2, k): 7.8955, -0.0549,
b1(2, k): 0.0000, 7.9141,
b(2, k): 0.0000, 7.9405,
b2(2, k): 0.0000, 7.9505,
Z(2, m): 0.0000, 8.6000,
X(3): 24.0500, Y(3): 7.8955
Y1(3, k): 7.8955, -0.0459,
Y(3, k): 7.8946, -0.0459,
Y2(3, k): 7.8995, -0.0459,
b1(3, k): 0.0000, 7.9414,
b(3, k): 0.0000, 7.9405,
b2(3, k): 0.0000, 7.9454,
Z(3, m): 0.0000, 8.6000,
X(4): 37.7000, Y(4): 7.8995
Y1(4, k): 7.8995, 7.3489, -0.0691,
Y(4, k): 7.8714, 7.2020, -0.0691,
Y2(4, k): 7.6457, 7.0551, -0.0691,
b1(4, k): 0.0000, 0.5506, 7.9686,
b(4, k): 0.0000, 0.6694, 7.9405,
b2(4, k): 0.0000, 0.5906, 7.7148,
Z(4, m): -0.0011, 1.5000, 11.8000,
X(5): 55.2500, Y(5): 7.6457
Y1(5, k): 7.6457, 6.6037, -0.4986,
Y(5, k): 7.4419, 6.1256, -0.4986,
Y2(5, k): 7.1535, 5.6475, -0.4986,
b1(5, k): 0.0000, 1.0420, 8.1443,
b(5, k): 0.0000, 1.3163, 7.9405,
b2(5, k): 0.0000, 1.5060, 7.6522,
Z(5, m): -0.0005, 1.5000, 11.8000,
X(6): 63.0500, Y(6): 7.1535
Y1(6, k): 7.1535, 5.8894, -1.0294,
Y(6, k): 6.9111, 5.3518, -1.0294,
Y2(6, k): 6.6290, 4.8141, -1.0294,
b1(6, k): 0.0000, 1.2641, 8.1830,
b(6, k): 0.0000, 1.5594, 7.9405,
b2(6, k): 0.0000, 1.8149, 7.6584,
Z(6, m): -0.0005, 1.5000, 11.8000,
X7: 68.2500,

3.18.A.d Limitations:

The calculated model must comply with the subdivision rules detailed in MAAT Hydro's FAQ.

3.18.A.e Typical use:

Creating the complete probabilistic damage system needed for a probabilistic stability calculation.

3.18.A.f Example:

Open a probabilistic project complying with the subdivision rules detailed in MAAT Hydro's FAQ.

- Select '**/Tools/Probabilistic Stability/Make Damage System**' in the menu bar.

- Click directly on the **[OK]** button and check the obtained subdivision analysis reports on the **[2D]** page.

- Check the obtained damage system in the **[3D]** / **[Data]** pages and notice that the created damages are white (not calculated yet).

3.18.B Calculate Damage System:

3.18.B.a Purpose:

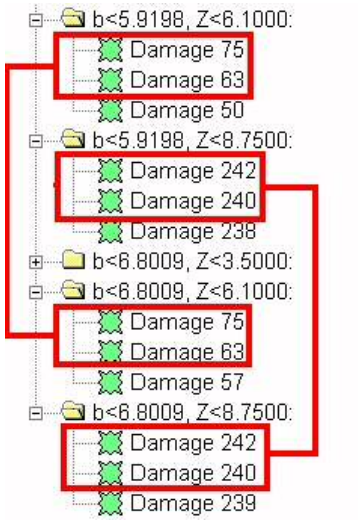
As recalled previously (and in MAAT Hydro's FAQ), a probabilistic stability calculation is achieved in 3 steps:

- Ship's subdivision (compartments and tanks) modelling.
- Probabilistic Damage System's automatic generation.
- Damage System's stability calculation (usually time consuming, but automatic).

As soon as ship's probabilistic damage system is generated, the 'Service Load', 'Partial Service Load' and 'Light Service Load' Loading Conditions must be created according to the probabilistic regulation, in order to allow starting the probabilistic stability calculations.

When the previously created damage system is selected and the corresponding calculation parameters are validated, MAAT Hydro starts repeating automatically the probabilistic stability calculations for all the present Damage Condition / Loading Condition combinations (currently processed damage is highlighted on the [3D] page), till the final global results can be reported in the [2D] section. Depending on the amount of damage / loading combinations and on model's complexity, this automatic calculation can be time consuming.

As the same damage can be repeated in different damage system branches corresponding to different breach dimensions, the corresponding stability curve is, nevertheless, only calculated once and its features are automatically duplicated in the identical damage nodes:



Moreover, the stability results corresponding to any damage are encapsulated in it after calculation, so that the initially white (empty) damage node becomes colored according to damage's mean survivability Si (according to a red=0 / green=1 color scale, fatal damages including a green exclamation mark).

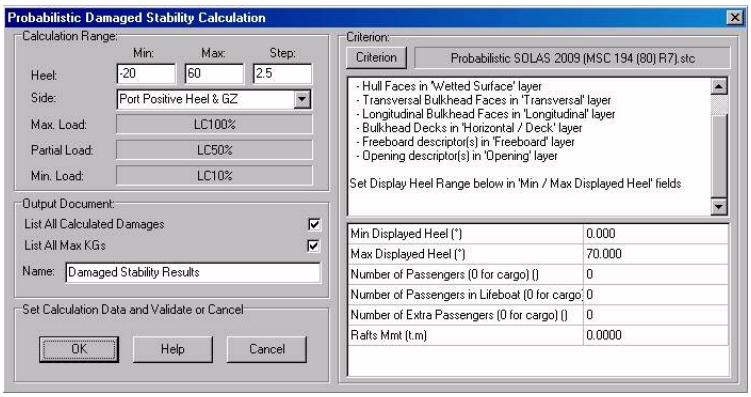
When all the damage system nodes have already been calculated (i.e. all the damage nodes are colored), the 'Calculate Damage System' function will, therefore, immediately provide the corresponding reports without any new calculation.

Moreover, in addition to the global reports provided by the 'Calculate Damage System' function, the 'Show Damage Analysis' function detailed below also allows providing the detailed stability reports corresponding to each damage whenever necessary, especially when sharp controls are necessary.

At last, damage system branches can also be calculated one by one, provided that the final global results will be immediately obtained by selecting the complete damage system, as soon as all its branches will be calculated.

3.18.B.b Inputs:

The following dialog box pops up when the function is selected:



- The [**Criterion]** button allows selecting the probabilistic stability criterion (i.e. including the statements needed by probabilistic calculations) among the available STC scripts (the associated data must be set after this selection).

- The '**Min Heel**' input field allows entering the minimum heel angle.

- The '**Max Heel**' input field allows entering the maximum heel angle.

- The '**Heel Step**' input field allows entering the heel angle calculation increment.

A special attention must be paid to this heel range, as the minimum / maximum heels must be large enough to allow calculating all the angles needed by the probabilistic criterion and heel increment must be small enough to insure accurate results (maximum GZ calculation, positive GZ arc, etc…). On the contrary, a heavy heel range will slow down the calculations for nothing.

The '**Side**' selector allows defining on which side ship's damaged stability has to be calculated. The default selection is automatically set to damage system's side.

The '**Max. Load**', '**Partial Load**' and '**Min. Load**' fields recall the 3 required loading conditions identified in current model for the probabilistic calculations.

The '**List All Calculated Damages**' checkbox allows displaying the index summation in a detailed form or in a compact form.

When unchecked, this option provides the following compact format (only the worst calculated damages are displayed):

Zone 3: [14.4000 <X< 19.8000]											
b<1.4998, Z<3.5000:	27	0.01087	0.00000	1.00000	0.00000	0.15427	3.7737	0.0749	2.255	33.006	0.6549
b<1.4998, Z<6.1000:	7	0.01087	0.24086	1.00000	0.00262	0.15688	3.8244	0.2249	4.549	29.497	0.5092
b<1.4998, Z<8.7500:	43	0.01087	0.75914	1.00000	0.00825	0.16513	3.8244	0.2249	4.549	28.716	0.3313
b<5.9198, Z<3.5000:	28	0.01146	0.00000	1.00000	0.00000	0.16513	3.9454	0.6528	2.899	31.312	0.6761
b<5.9198, Z<6.1000:	8	0.01146	0.24086	1.00000	0.00276	0.16789	4.0431	0.9341	5.494	27.330	0.5271
b<5.9198, Z<8.7500:	44	0.01146	0.75914	1.00000	0.00870	0.17659	4.0431	0.9341	5.494	25.798	0.2585
b<6.8010, Z<3.5000:	29	0.00041	0.00000	1.00000	0.00000	0.17659	3.9608	0.6963	2.852	31.219	0.6932
b<6.8010, Z<6.1000:	9	0.00041	0.24086	1.00000	0.00010	0.17669	4.0627	0.9887	5.339	27.323	0.5421
b<6.8010, Z<8.7500:	45	0.00041	0.75914	1.00000	0.00031	0.17700	4.0627	0.9887	5.339	25.410	0.2592

When checked, this option provides the following detailed format (all the calculated damages are displayed):

Zone 3: [14.4000 <X< 19.8000]										
b<1.4998, Z<3.5000:	27	0.01087	0.00000	1.00000	0.00000	0.15427	3.7737	0.0749	2.255	33.006	0.6549
	56	0.01087	0.00000	1.00000	0.00000		3.7631	0.0342	1.168	34.184	0.6645
b<1.4998, Z<6.1000:	7	0.01087	0.24086	1.00000	0.00262	0.15688	3.8244	0.2249	4.549	29.497	0.5092
	11	0.01087	0.24086	1.00000	0.00262		3.8092	0.1708	2.643	31.494	0.5180
b<1.4998, Z<8.7500:	43	0.01087	0.75914	1.00000	0.00825	0.16513	3.8244	0.2249	4.549	28.716	0.3313
	47	0.01087	0.75914	1.00000	0.00825		3.8092	0.1708	2.643	30.740	0.3534
b<5.9198, Z<3.5000:	28	0.01146	0.00000	1.00000	0.00000	0.16513	3.9454	0.6528	2.899	31.312	0.6761
	30	0.01146	0.00000	1.00000	0.00000		3.9263	0.5810	2.042	32.333	0.6707
	57	0.01146	0.00000	1.00000	0.00000		3.9158	0.5418	1.056	33.409	0.6792
b<5.9198, Z<6.1000:	8	0.01146	0.24086	1.00000	0.00276	0.16789	4.0431	0.9341	5.494	27.330	0.5271
	10	0.01146	0.24086	1.00000	0.00276		4.0188	0.8478	4.014	29.007	0.5243
	12	0.01146	0.24086	1.00000	0.00276		4.0059	0.8016	2.123	31.003	0.5338
b<5.9198, Z<8.7500:	44	0.01146	0.75914	1.00000	0.00870	0.17659	4.0431	0.9341	5.494	25.798	0.2585
	46	0.01146	0.75914	1.00000	0.00870		4.0188	0.8478	4.014	27.746	0.2789
	48	0.01146	0.75914	1.00000	0.00870		4.0059	0.8016	2.123	29.837	0.3018
b<6.8010, Z<3.5000:	29	0.00041	0.00000	1.00000	0.00000	0.17659	3.9608	0.6963	2.852	31.219	0.6932
	30	0.00041	0.00000	1.00000	0.00000		3.9263	0.5810	2.042	32.333	0.6707
	57	0.00041	0.00000	1.00000	0.00000		3.9158	0.5418	1.056	33.409	0.6792
b<6.8010, Z<6.1000:	9	0.00041	0.24086	1.00000	0.00010	0.17669	4.0627	0.9887	5.339	27.323	0.5421
	10	0.00041	0.24086	1.00000	0.00010		4.0188	0.8478	4.014	29.007	0.5243
	12	0.00041	0.24086	1.00000	0.00010		4.0059	0.8016	2.123	31.003	0.5338
b<6.8010, Z<8.7500:	45	0.00041	0.75914	1.00000	0.00031	0.17700	4.0627	0.9887	5.339	25.410	0.2592
	46	0.00041	0.75914	1.00000	0.00031		4.0188	0.8478	4.014	27.746	0.2789
	48	0.00041	0.75914	1.00000	0.00031		4.0059	0.8016	2.123	29.837	0.3018

The '**List All Max KGs**' checkbox allows calculating and including the Max intact KGs in the damage list report:

Damage / Load Conditions	S	DMP	Trim	Thetae	Freebd	Range	GZmax	KGmax
Damage 240: WB 4 prt, WB 4 stb, skeg								
Deepest subdivision draught:	1.00000	3.8004	0.5617	-0.002	2.1139	35.348	0.6519	6.0796
Partial subdivision draught:	1.00000	3.2393	0.3315	-0.002	2.7102	42.102	0.7081	6.5334
Light subdivision draught:	1.00000	2.3771	0.4066	-0.001	3.5608	50.001	0.9080	27.7333
Damage 241: Main deck accommodation, WB 4 prt, WB 4 stb, skeg								
Deepest subdivision draught:	1.00000	3.8004	0.5617	-0.002	2.1139	34.425	0.4766	6.2173
Partial subdivision draught:	1.00000	3.2393	0.3315	-0.002	2.7102	41.124	0.6532	6.5334
Light subdivision draught:	1.00000	2.3771	0.4066	-0.001	3.5608	50.001	0.9079	27.7333
Damage 353: WB 4 prt								
Deepest subdivision draught:	1.00000	3.7714	0.2219	1.372	2.0308	33.992	0.6386	6.5234
Partial subdivision draught:	1.00000	3.2211	0.1340	0.642	2.6816	41.482	0.6979	6.6452
Light subdivision draught:	1.00000	2.3683	0.3144	0.065	3.5757	49.935	0.8988	27.7333
Damage 354: Main deck accommodation, WB 4 prt								
Deepest subdivision draught:	1.00000	3.7714	0.2219	1.372	2.0308	33.177	0.4759	6.5227
Partial subdivision draught:	1.00000	3.2211	0.1340	0.642	2.6816	40.574	0.6493	6.6452
Light subdivision draught:	1.00000	2.3683	0.3144	0.065	3.5757	49.935	0.8988	27.7333

At last, when all the probabilistic stability calculation data are set:

The **[OK]** button can be clicked for creating the damage system..

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the function.

3.18.B.c Outputs:

After clicking on the **[OK]** button, the selected 'empty' probabilistic damages are combined with the standard loading conditions required by regulation in order to calculate all the stability data needed by the global probabilistic reports.

When this calculation is finished, a folder is created in the 2D section, containing 4 subfolders (a 'General' folder containing the global results and one folder for each loading condition results).

3.18.B.c.1: 'General' Reports:

3.18.B.c.1.1: Global Report:

Damaged Stability Forms Ship - Criterion: MSC194(80) Reg. 7 / PS Heel / PS Damages
Salvable Passengers: 25, Extra Passengers: 0 - Length in m, Area in m², Volume in m3, Weight in t

Deepest subdivision draught		Partial subdivision draught		Light subdivision draught	
Total Load:	2916.00	Total Load:	2444.00	Total Load:	1734.00
LCG:	33.2000	LCG:	33.4960	LCG:	33.3460
TCG:	0.0000	TCG:	0.0000	TCG:	0.0000
VCG:	5.0230	VCG:	5.3110	VCG:	5.6210
Solid Load:	2916.00	Solid Load:	2444.00	Solid Load:	1734.00
LCG:	33.2000	LCG:	33.4960	LCG:	33.3460
TCG:	0.0000	TCG:	0.0000	TCG:	0.0000
VCG:	5.0230	VCG:	5.3110	VCG:	5.6210
Liquid Load:	0.0000	Liquid Load:	0.0000	Liquid Load:	0.0000
LCG:	0.0000	LCG:	0.0000	LCG:	0.0000
TCG:	0.0000	TCG:	0.0000	TCG:	0.0000
VCG:	0.0000	VCG:	0.0000	VCG:	0.0000
FSMt:	0.0000	FSMt:	0.0000	FSMt:	0.0000
DAP:	3.7516	DAP:	3.2233	DAP:	2.5162
DMP:	3.7516	DMP:	3.2110	DMP:	2.3664
DFP:	3.7516	DFP:	3.1987	DFP:	2.2167
Trim:	0.0000	Trim:	0.0245	Trim:	0.2996
Heel:	0.000	Heel:	0.000	Heel:	0.000
GMt:	1.2949	GMt:	1.4064	GMt:	2.3573
Freeboard:	2.2484	Freeboard:	2.7852	Freeboard:	3.5877
Min. Critical KG:	5.0253	Min. Critical KG:	5.3147	Min. Critical KG:	5.6271
Critical Damage:	Damage 205	Critical Damage:	Damage 294	Critical Damage:	Damage 95
1 Zone Damages:	117	1 Zone Damages:	117	1 Zone Damages:	117
Sum(pi.vj)	0.48489	Sum(pi.vj)	0.48489	Sum(pi.vj)	0.48489
Mean Survivability:	0.99879	Mean Survivability:	0.98678	Mean Survivability:	0.97833
Attained Index A1:	0.48431	Attained Index A1:	0.47848	Attained Index A1:	0.47439
2 Zones Damages:	204	2 Zones Damages:	204	2 Zones Damages:	204
Sum(pi.vj)	0.31928	Sum(pi.vj)	0.31928	Sum(pi.vj)	0.31928
Mean Survivability:	0.53717	Mean Survivability:	0.68989	Mean Survivability:	0.83698
Attained Index A2:	0.17151	Attained Index A2:	0.22027	Attained Index A2:	0.26723
3 Zones Damages:	317	3 Zones Damages:	317	3 Zones Damages:	317
Sum(pi.vj)	0.12865	Sum(pi.vj)	0.12924	Sum(pi.vj)	0.13016
Mean Survivability:	0.41315	Mean Survivability:	0.47460	Mean Survivability:	0.70623
Attained Index A3:	0.05315	Attained Index A3:	0.06134	Attained Index A3:	0.09193
4 Zones Damages:	393	4 Zones Damages:	393	4 Zones Damages:	393
Sum(pi.vj)	0.03762	Sum(pi.vj)	0.03765	Sum(pi.vj)	0.03803
Mean Survivability:	0.08754	Mean Survivability:	0.10699	Mean Survivability:	0.41865
Attained Index A4:	0.00329	Attained Index A4:	0.00403	Attained Index A4:	0.01592
Total Calculated Damages:	1031	Total Calculated Damages:	1031	Total Calculated Damages:	1031
Total Sum(pi.vj):	0.97045	Total Sum(pi.vj):	0.97106	Total Sum(pi.vj):	0.97236
Mean Survivability:	0.73395	Mean Survivability:	0.78689	Mean Survivability:	0.87361
As = Sum(Asi):	0.71226	Ap = Sum(Api):	0.76412	Al = Sum(Ali):	0.84946

Ship's Damaged Stability Complies with MSC194(80) Reg. 7 Criterion

Attained Subdivision Index A=0.4.As+0.4.Ap+0.2.Al:	0.76044			Required Subdivision Index R:	0.67460
As (>0.9.R):	0.71226	Ap (>0.9.R):	0.76412	Al (>0.9.R):	0.84946

Ship / Current Load / Current Damage:
User Number One / Wed May 01 18 48 41 2013

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3.18.B.c.1.2: Damaged Stability Results:

The data listed in this report and its layout are specified in the STC script (see *ReportDamageData* command in 'MAAT Hydro's STC Scripting Reference Guide').

Ship: Ship / PS Heel / Damage System: Probabilistic Damage System

Damage / Load Conditions	S	DMP	Trim	Thetae	Freebd	Range	GZmax	KGmax
Damage 1: Bow thruster comp.								
Deepest subdivision draught:	1.00000	3.8330	-0.4013	-0.003	2.1303	34.285	0.6629	6.3283
Partial subdivision draught:	1.00000	3.2771	-0.3153	-0.003	2.6941	41.143	0.7443	6.7136
Light subdivision draught:	1.00000	2.4081	0.0660	-0.001	3.5820	50.001	0.9471	27.7333
Damage 2: Hold 1, Bow thruster comp.								
Deepest subdivision draught:	1.00000	4.0994	-1.5777	-0.005	1.7550	30.028	0.5110	6.3225
Partial subdivision draught:	1.00000	3.5428	-1.5690	-0.005	2.3122	36.156	0.5942	6.5544
Light subdivision draught:	1.00000	2.5841	-0.8190	-0.002	3.3402	50.002	0.8567	27.7333
Damage 3: Hold 1, Bow thruster comp., FW prt								
Deepest subdivision draught:	1.00000	4.2196	-2.0591	5.334	0.9505	22.901	0.3590	5.8311
Partial subdivision draught:	1.00000	3.6618	-2.0910	5.743	1.4526	28.372	0.4364	6.1219
Light subdivision draught:	1.00000	2.6840	-1.2834	3.705	2.7488	43.421	0.6771	7.0725
Damage 4: Hold 1, Bow thruster comp., FW prt, Hold 2								
Deepest subdivision draught:	0.53346	5.1068	-4.9164	9.870	-0.7314	7.344	0.0515	5.1915
Partial subdivision draught:	0.85269	4.4024	-4.6587	9.090	0.0780	15.496	0.1515	5.6126
Light subdivision draught:	1.00000	3.2363	-3.4540	6.831	1.6153	30.571	0.4308	6.4442
Damage 5: WB 1 prt, Hold 1, Bow thruster comp.								
Deepest subdivision draught:	1.00000	4.1383	-1.7538	0.536	1.6349	28.947	0.4965	6.2947
Partial subdivision draught:	1.00000	3.5840	-1.7693	0.623	2.1770	34.895	0.5838	6.7868
Light subdivision draught:	1.00000	2.6287	-1.0508	0.536	3.2091	48.645	0.8540	7.6950
Damage 6: WB 1 prt, Hold 1, Bow thruster comp., WB 2F prt tronque, Nouveau void port, FW prt								
Deepest subdivision draught:	0.95063	4.3481	-2.5835	7.770	0.4802	18.756	0.2918	5.6313
Partial subdivision draught:	0.88503	3.7989	-2.7055	8.734	0.8947	23.545	0.3870	5.9203
Light subdivision draught:	0.99432	2.8549	-2.1195	7.091	2.0846	37.294	0.6385	6.7246
Damage 7: WB 1 prt, Hold 1, Bow thruster comp., WB 2F prt tronque, FW prt								
Deepest subdivision draught:	0.97376	4.3405	-2.5536	7.414	0.5334	19.212	0.3004	5.6628
Partial subdivision draught:	0.91454	3.7909	-2.6698	8.309	0.9577	24.076	0.3949	5.9549
Light subdivision draught:	1.00000	2.8453	-2.0710	6.677	2.1500	37.862	0.6479	6.7763
Damage 8: WB 1 prt, Hold 1, Bow thruster comp., WB 2F prt tronque, Nouveau void port, FW prt, Hold 2								
Deepest subdivision draught:	0(opg1)		No Positive Stability					
Partial subdivision draught:	0.25215	4.6220	-5.5754	14.063	-0.8124	8.075	0.0700	5.3605
Light subdivision draught:	0.73476	3.4581	-4.5008	10.681	0.8271	23.942	0.3772	6.1027
Damage 9: WB 1 prt, Hold 1, Bow thruster comp., WB 2F prt tronque, FW prt, Hold 2								
Deepest subdivision draught:	0(opg1)		No Positive Stability					
Partial subdivision draught:	0.35726	4.6053	-5.5055	13.335	-0.7035	8.945	0.0807	5.3983
Light subdivision draught:	0.77445	3.4459	-4.4360	10.202	0.9042	24.577	0.3875	6.1539
Damage 10: WB 1 stb, WB 1 prt, Hold 1, Bow thruster comp.								
Deepest subdivision draught:	1.00000	4.1772	-1.9259	-0.003	1.6447	28.952	0.5018	6.2776
Partial subdivision draught:	1.00000	3.6254	-1.9646	-0.003	2.1927	34.907	0.5973	6.5970
Light subdivision draught:	1.00000	2.6741	-1.2811	-0.002	3.2073	48.571	0.8826	7.7800

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Ship / Light subdivision draught:

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3.18.B.c.1.3: Compartment / Damage List:

Ship: Ship - Compartment/Damages List (PS):

Compartment 'Boatswain stores' Flooded in Damages: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252

Compartment 'Bow thruster comp.' Flooded in Damages: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375,

Compartment 'Chain locker' Flooded in Damages: 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375

Compartment 'Crew accommodation' Flooded in Damages: 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 90, 91, 96, 97, 100, 101, 102, 103, 105, 106, 108, 110, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 134, 135, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 160, 161, 218, 221, 222, 224, 225, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 254, 255, 257, 258, 260, 261, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 284, 285, 290, 291, 292, 293, 294, 298, 303, 307, 308, 316, 320, 324, 325, 329, 330, 335, 336, 345, 348, 350, 351

Compartment 'ER F 2 8' Flooded in Damages: 47, 48, 49, 51, 52, 53, 54, 55, 56, 58, 59, 60, 61, 62, 64, 65, 66, 67, 68, 69, 71, 72, 73, 74, 76, 77, 78, 79, 80, 81, 84, 85, 86, 87, 88, 117, 118, 119, 120, 121, 122, 124, 125, 126, 127, 128, 129, 131, 132, 133, 137, 138, 139, 142, 143, 144, 145, 146, 147, 149, 150, 151, 152, 154, 155, 156, 158, 159, 178, 179, 181, 182, 183, 185, 186, 188, 189, 190, 239, 264, 265, 267, 268, 269, 272, 273, 274, 275, 277, 278, 279, 280, 282, 283, 287, 288, 291, 292, 293, 294, 296, 297

Compartment 'FO 1 prt' Flooded in Damages: 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 169, 171, 212, 302, 303, 304, 306, 307, 308, 309, 310, 311, 312, 323, 324, 325, 326, 328, 329, 330, 331, 332, 333, 334, 335, 336, 339,

Compartment 'FO 1 stb' Never Damaged.

Compartment 'FO 2 prt' Flooded in Damages: 43, 44, 45, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 307, 308, 309, 310, 311, 312, 316, 317, 318, 329, 330, 331, 332, 333, 334, 335, 336, 345, 346, 347, 348

Compartment 'FO 2 stb' Never Damaged.

Compartment 'FO 3 prt' Flooded in Damages: 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 96, 97, 98, 99, 100, 101, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 180, 181, 182, 183, 184, 185, 186, 232, 233

Compartment 'FO 3 stb' Never Damaged.

3.18.B.c.1.4: Line / Damage Analysis:

Ship: Ship / PS Heel / Damage System: Light subdivision draught

Freeboard Lines:

Sheer line: xmin=-4.7000, xmax=43.0070, ymin=0.0000, ymax=6.8007, zmin=6.0000, zmax=8.7501

Damage	Deepest subdivision draught		Partial subdivision draught		Light subdivision draught	
Number:	Fbd @ Equil.:	Immers. Heel:	Fbd @ Equil.:	Immers. Heel:	Fbd @ Equil.:	Immers. Heel:
1	2.1301 m	17.567 °	2.6942 m	21.879 °	3.5822 m	29.600 °
2	1.0343 m	14.495 °	2.3123 m	18.824 °	3.3405 m	26.866 °
3	0.8038 m	13.026 °	1.5031 m	17.307 °	2.4860 m	25.055 °
4	-0.3132 m	4.214 °	-0.0198 m	9.712 °	1.3236 m	19.176 °
5	1.6993 m	14.044 °	2.1867 m	18.350 °	3.1977 m	26.297 °
6	0.2874 m	11.635 °	1.0123 m	15.884 °	1.8736 m	23.365 °
7	0.9851 m	11.714 °	1.0668 m	15.963 °	1.9399 m	23.460 °
8	-0.6208 m	2.108 °	-7.6669 m	7.768 °	0.3949 m	17.116 °
9	-0.5722 m	2.230 °	-6.0186 m	7.877 °	0.5025 m	17.231 °
10	1.5797 m	13.595 °	2.1927 m	17.883 °	3.2075 m	25.741 °
11	-1.2728 m	1.424 °	-7.9316 m	7.160 °	0.4352 m	16.465 °
12	-1.1809 m	1.547 °	-6.1912 m	7.269 °	0.5423 m	16.581 °
13	-1.3880 m	-0.044 °	-6.6294 m	5.866 °	0.7749 m	15.090 °
14	-1.2853 m	0.081 °	-1.0600 m	5.974 °	0.8669 m	15.206 °
15	2.1293 m	17.499 °	2.6942 m	21.861 °	3.5822 m	29.600 °
16	2.1293 m	17.499 °	2.6942 m	21.861 °	3.5822 m	29.600 °
17	1.6540 m	14.156 °	2.3030 m	18.658 °	3.3405 m	26.853 °
18	0.7295 m	12.533 °	1.4562 m	17.010 °	2.4693 m	25.007 °
19	-1.2329 m	1.403 °	-6.4787 m	7.937 °	0.8332 m	18.485 °
20	1.6581 m	13.654 °	2.1705 m	18.145 °	3.1968 m	26.275 °
21	0.4893 m	11.007 °	0.9293 m	15.450 °	1.8427 m	23.238 °
22	0.9153 m	11.092 °	0.9873 m	15.537 °	1.9108 m	23.338 °
23	-1.9633 m	-2.443 °	-7.1933 m	5.577 °	-7.1933 m	16.045 °
24	-1.2074 m	-1.935 °	-9.7656 m	5.711 °	-4.5311 m	16.183 °
25	1.5978 m	13.156 °	2.1715 m	17.636 °	3.2075 m	25.708 °
26	-2.2699 m	-7.575 °	-7.4510 m	4.801 °	-7.4510 m	15.254 °
27	-2.0855 m	-6.229 °	-7.4022 m	4.945 °	-7.4022 m	15.392 °
28	-3.3953 m	?	-8.0916 m	3.065 °	-5.0481 m	13.559 °
29	-3.0586 m	?	-8.0277 m	3.213 °	-5.0144 m	13.699 °
30	1.6540 m	14.156 °	2.3030 m	18.658 °	3.3405 m	26.853 °
31	0.7299 m	12.538 °	1.4562 m	17.012 °	2.4693 m	25.007 °
32	-0.9370 m	2.865 °	-0.4737 m	8.457 °	1.1444 m	18.516 °
33	1.6581 m	13.654 °	2.1705 m	18.145 °	3.1968 m	26.275 °
34	0.4899 m	11.025 °	0.9303 m	15.454 °	1.8427 m	23.238 °
35	0.9153 m	11.109 °	0.9880 m	15.541 °	1.9108 m	23.338 °
36	-1.2785 m	0.722 °	-6.4190 m	6.536 °	0.0351 m	16.172 °
37	-0.7806 m	0.844 °	-6.3838 m	6.645 °	0.2104 m	16.302 °
38	1.5978 m	13.157 °	2.1715 m	17.636 °	3.2075 m	25.708 °
39	-1.2764 m	0.041 °	-8.6044 m	5.932 °	0.1147 m	15.435 °
40	-1.1823 m	0.163 °	-6.5800 m	6.040 °	0.2365 m	15.564 °
41	-1.0973 m	-1.825 °	-7.0803 m	4.626 °	0.5294 m	13.901 °
42	-0.9909 m	-1.605 °	-9.4863 m	4.739 °	0.6245 m	14.027 °
43	1.2573 m	14.325 °	1.8342 m	19.370 °	2.6946 m	27.072 °
44	1.3155 m	14.256 °	1.7403 m	19.300 °	2.5970 m	26.984 °
45	1.2278 m	14.036 °	1.7295 m	19.078 °	2.5819 m	26.703 °
46	2.0946 m	17.200 °	2.2014 m	21.810 °	3.2264 m	29.452 °
47	0.7264 m	8.030 °	1.2278 m	14.529 °	1.7043 m	23.048 °
48	-0.0238 m	5.561 °	0.3974 m	11.826 °	0.8240 m	20.755 °
49	-3.6599 m	?	-16.6617 m	9.661 °	-4.8001 m	20.066 °
50	1.5873 m	14.925 °	1.7923 m	19.848 °	2.7218 m	27.630 °

3.18.B.c.2: Loading Condition Reports:

3.18.B.c.2.1: Calculated Elements:

Ship Status / Ship / Deepest subdivision draught

Weight:	Ref. Weight: (t)	Property:	Quantity:	Weight: (t)	LCG: (m)	TCG: (m)	VCG: (m)
Deepest subdivision draught				2916.00	33.2000	0.0000	5.0230
Total (Solid):				2916.00	33.2000	0.0000	5.0230

Buoyant Component:	Raw Volume: (m3)	Mu:	Quantity:	Hydro Volume: (m3)	LCV: (m)	TCV: (m)	VCV: (m)
skeg	8.4147	95.0%	Intact (0%)	8.4147	2.4716	0.0000	1.5520
WB 4 stb	115.274	95.0%	Intact (0%)	115.274	0.9733	-3.0465	4.5709
WB 4 prt	115.254	95.0%	Intact (0%)	115.254	0.9733	3.0471	4.5709
WB 2A prt	35.1168	95.0%	Intact (0%)	35.1168	43.6429	3.1509	0.5397
WB 2A stb	35.1271	95.0%	Intact (0%)	35.1271	43.6428	-3.1501	0.5397
WB 2F stb	52.9062	95.0%	Intact (0%)	52.9062	51.1481	-2.7923	0.5523
WB 3 prt	42.6193	95.0%	Intact (0%)	42.6193	43.6484	6.0492	3.5076
WB 3 stb	42.6193	95.0%	Intact (0%)	42.6193	43.6484	-6.0492	3.5076
Void space hold2 stb	26.5276	95.0%	Intact (0%)	26.5276	48.2924	-6.0394	3.5332
Hold 2	746.710	70.0%	Intact (0%)	746.710	48.1116	0.0000	3.6363
FW stb	77.8974	95.0%	Intact (0%)	77.8974	53.1203	-4.9938	2.9830
FW prt	77.8975	95.0%	Intact (0%)	77.8975	53.1203	4.9938	2.9830
Void space hold2 prt	26.5275	95.0%	Intact (0%)	26.5275	48.2924	6.0394	3.5332
Nouveau void port	4.4511	95.0%	Intact (0%)	4.4511	49.4200	5.7549	0.6838
WB 2F prt tronque	48.4404	95.0%	Intact (0%)	48.4404	51.3079	2.5215	0.5403
Main deck accommodation	977.786	95.0%	Intact (0%)	977.786	9.8163	0.0000	7.4392
Technical room	70.0284	95.0%	Intact (0%)	70.0284	68.8440	0.0000	7.4985
WB 5	53.9361	95.0%	Intact (0%)	53.9361	68.4884	0.0000	3.1889
Chain locker	37.6701	95.0%	Intact (0%)	37.6701	64.9731	0.0000	5.1366
Bow thruster comp.	47.7651	95.0%	Intact (0%)	47.7651	64.9723	0.0000	2.1910
Boatswain stores	65.2963	95.0%	Intact (0%)	65.2963	65.0767	0.0000	7.3126
Hold 1	342.137	70.0%	Intact (0%)	342.137	59.6283	0.0000	3.6684
WB 1 prt	20.6233	95.0%	Intact (0%)	20.6233	59.4968	1.6671	0.5929
WB 1 stb	20.6349	95.0%	Intact (0%)	20.6349	59.4934	-1.6678	0.5929
FO 1 prt	96.5528	70.0%	Intact (0%)	96.5528	33.0000	3.1593	0.5393
FO 1 stb	96.3951	70.0%	Intact (0%)	96.3951	33.0001	-3.1644	0.5394
Hold 3	825.144	70.0%	Intact (0%)	825.144	33.0000	0.0000	3.5050
Void hold 3 prt equ	233.345	95.0%	Intact (0%)	233.345	33.0000	0.0000	3.5066
Crew accommodation	382.030	95.0%	Intact (0%)	382.030	19.8001	0.0000	4.8005
GW prt	12.5070	95.0%	Intact (0%)	12.5070	17.1446	5.9790	1.1013
Void space 8 11 prt	12.9593	95.0%	Intact (0%)	12.9593	17.1003	6.0500	2.6999
GW stb	12.5070	95.0%	Intact (0%)	12.5070	17.1446	-5.9790	1.1013
Void space 8 11 stb	12.9593	95.0%	Intact (0%)	12.9593	17.1003	-6.0500	2.6999
FO 3 prt	22.8241	95.0%	Intact (0%)	22.8241	17.1134	3.0539	0.5315
FO 3 stb	22.8241	95.0%	Intact (0%)	22.8241	17.1134	-3.0539	0.5315
FO 2 stb	68.4733	95.0%	Intact (0%)	68.4733	22.5000	-2.7869	1.3768
FO 2 prt	68.4733	95.0%	Intact (0%)	68.4733	22.5000	2.7869	1.3768
tunnel 8 14	19.1806	85.0%	Intact (0%)	19.1806	19.8002	0.0000	0.5055
Pump room	194.043	85.0%	Intact (0%)	194.043	18.5336	0.0000	2.4661
Total Volume:	6004.02						

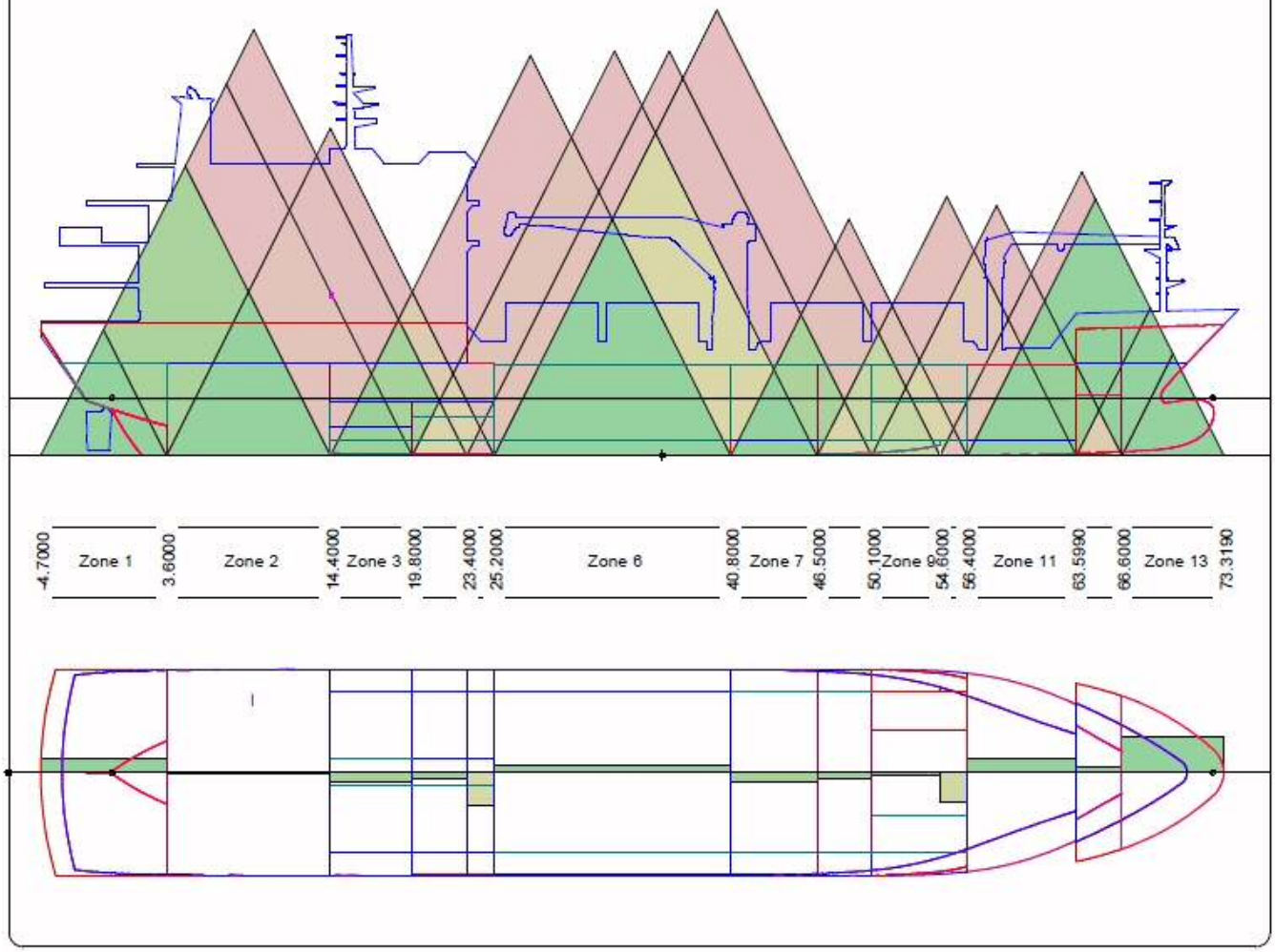
3.18.B.c.2.2: Damage Survivability Diagram:

Damaged Stability / Ship / Deepest subdivision draught (PS Heel / PS Damages):
K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Ship Balance:							
Heel°	0.000	GMT	1.2945	GMTC	1.2945	FSMT	0.0000
TA	3.7482	GML	101.088	GMLC	101.088	FSML	0.0000
TF	3.7561	KMT	6.3175	BMT	4.3096	OGT	1.2712
TM	3.7521	KML	106.111	BML	104.103	OGL	1.2712
Trim	-0.0080	Fbd	2.2471	TOA	3.7540	OG	1.2712

C.G.:	Total:	Solid:	Liquid:
Wght:	2916.00	2916.00	0.0000
LCG:	33.2000	33.2000	0.0000
TCG:	0.0000	0.0000	0.0000
VCG:	5.0230	5.0230	0.0000

Subdivision Index Distribution:



Criterion: SOLAS 2009							
Lsmin:	-4.7000	Lsmax:	73.3190	Ls:	78.0190	B:	13.6021	Ds:	3.7516
Min Heel:	-20.000	Max Heel:	60.000	Heel Step:	2.500			R:	0.67460

Divisions:	1	2	3	4	Total:
Damages:	117	204	317	393	1031
Sum(dA):	0.48431	0.17151	0.05315	0.00329	0.71226
Sum(pi.vj):	0.48489	0.31928	0.12865	0.03762	0.97045
Mean smin:	0.99879	0.53717	0.41315	0.08754	0.73395

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Ship / Deepest subdivision draught:

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3.18.B.c.2.3: Detailed Index Calculation:

The ‘List All Calculated Damages’ checkbox, presented above, allows selecting a compact or detailed format. The meaning of the optional mnemonics displayed in the ‘smin’ column is detailed in the FAQ.

Damaged Stability / Ship / Deepest subdivision draught (PS Heel / PS Damages):
K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Damaged Divisions:	Damg	Pi	Vi	smin	dA	Sum(dA)	DMP	Trim	Thetae	Range	GZmax
	210	0.00001	1.00000	1.00000	0.00001		4.3908	-1.9655	5.875	20.554	0.3227
Zone 10: [54.6000 <X< 56.4000]											
b<1.1409, Z<3.5000:	176	0.00162	0.00000	1.00000	0.00000	0.37579	3.9169	-0.6127	6.066	26.811	0.5329
	162	0.00162	0.00000	1.00000	0.00000		3.8449	-0.3560	4.404	29.421	0.5532
b<1.1409, Z<6.0000:	176	0.00162	1.00000	1.00000	0.00162	0.37741	3.9169	-0.6127	6.066	26.811	0.5329
	162	0.00162	1.00000	1.00000	0.00162		3.8449	-0.3560	4.404	29.421	0.5532
b<6.4399, Z<3.5000:	214	0.00117	0.00000	0.96145	0.00000	0.37741	4.4807	-2.2753	7.605	17.660	0.2949
	210	0.00117	0.00000	1.00000	0.00000		4.3908	-1.9655	5.875	20.554	0.3227
b<6.4399, Z<6.0000:	214	0.00117	1.00000	0.96145	0.00113	0.37854	4.4807	-2.2753	7.605	17.660	0.2949
	210	0.00117	1.00000	1.00000	0.00117		4.3908	-1.9655	5.875	20.554	0.3227
b<6.8010, Z<3.5000:	341	0.00000	0.00000	1.00000	0.00000	0.37854	4.5743	-2.5474	4.998	18.948	0.3358
	210	0.00000	0.00000	1.00000	0.00000		4.3908	-1.9655	5.875	20.554	0.3227
b<6.8010, Z<6.0000:	341	0.00000	1.00000	1.00000	0.00000	0.37854	4.5743	-2.5474	4.998	18.948	0.3358
	210	0.00000	1.00000	1.00000	0.00000		4.3908	-1.9655	5.875	20.554	0.3227
Zone 11: [56.4000 <X< 63.5990]											
b<4.7658, Z<6.0000:	196	0.03499	1.00000	1.00000	0.03499	0.41353	4.0411	-1.2737	0.548	30.302	0.5347
	191	0.03499	1.00000	1.00000	0.03499		4.0014	-1.0957	-0.005	31.404	0.5433
b<6.8010, Z<6.0000:	203	0.00328	1.00000	1.00000	0.00328	0.41681	4.0809	-1.4480	-0.003	30.312	0.5441
	191	0.00328	1.00000	1.00000	0.00328		4.0014	-1.0957	-0.005	31.404	0.5433
Zone 12: [63.5990 <X< 66.6000]											
b<4.3427, Z<3.9700:	1	0.00752	0.02240	1.00000	0.00017	0.41698	3.8330	-0.4013	-0.003	34.285	0.6632
b<4.3427, Z<6.1000:	15	0.00752	0.21846	1.00000	0.00164	0.41862	3.8335	-0.4039	-0.004	33.922	0.6433
b<4.3427, Z<8.3499:	16	0.00752	0.75913	1.00000	0.00571	0.42433	3.8335	-0.4039	-0.004	33.765	0.6313
Zone 13: [66.6000 <X< 73.3190]											
b<1.3687, Z<6.1000:	355	0.05998	0.24087	1.00000	0.01445	0.43878	3.8162	-0.3411	-0.003	34.366	0.6592
b<1.3687, Z<8.4353:	242	0.05998	0.75913	1.00000	0.04553	0.48431	3.8162	-0.3411	-0.003	34.354	0.6578
2 Division Damages											
Zone 1+2: [-4.7000 <X< 14.4000]											
b<1.5851, Z<6.1000:	87	0.01961	0.24087	1.00000	0.00472	0.48903	4.2677	3.8016	5.404	17.059	0.6188
b<1.5851, Z<8.7491:	88	0.01961	0.75913	0.48257	0.00718	0.49621	4.3121	4.2133	8.429	4.128	0.0513
b<6.8010, Z<6.1000:	85	0.03739	0.24087	0.96357	0.00868	0.50489	4.3710	4.7577	-0.001	13.793	0.6523
b<6.8010, Z<8.7491:	86	0.03739	0.75913	0(opg1)	0.00000	0.50489	4.5276	6.1858	-0.002	20.157	0.0552
Zone 2+3: [3.6000 <X< 19.8000]											
b<1.4998, Z<3.5000:	178	0.01382	0.00000	1.00000	0.00000	0.50489	4.1933	2.9444	2.660	27.491	0.6544
	264	0.01382	0.00000	1.00000	0.00000		4.1800	2.8890	1.385	29.299	0.6662
b<1.4998, Z<6.1000:	47	0.01382	0.24087	0.96516	0.00321	0.50810	4.4835	3.8959	4.285	13.884	0.4671
	71	0.01382	0.24087	1.00000	0.00333		4.4729	3.8691	2.365	16.855	0.4800
b<1.4998, Z<8.7500:	62	0.01382	0.75913	0(opg1)	0.00000	0.50810	4.6829	13.5675	50.000	0.000	0.0000
	74	0.01382	0.75913	0(opg1)	0.00000		4.6345	13.0835	50.000	0.000	0.0000
b<5.9198, Z<3.5000:	181	0.02593	0.00000	1.00000	0.00000	0.50810	4.4042	3.7165	2.957	16.491	0.6824
	188	0.02593	0.00000	1.00000	0.00000		4.3815	3.6314	2.136	18.718	0.6833
	267	0.02593	0.00000	1.00000	0.00000		4.3694	3.5860	1.121	20.514	0.6950
b<5.9198, Z<6.1000:	51	0.02593	0.24087	0(opg1)	0.00000	0.50810	4.7158	4.5827	3.054	0.000	0.4827
	64	0.02593	0.24087	0.27926	0.00174		4.6939	4.5182	2.250	0.717	0.4882
	76	0.02593	0.24087	0.52097	0.00325		4.6835	4.4891	1.198	2.546	0.5025
b<5.9198, Z<8.7500:	56	0.02593	0.75913	0(opg1)	0.00000	0.50810	5.8984	35.1587	50.000	0.000	0.0000
	69	0.02593	0.75913	0(opg1)	0.00000		5.5823	28.9434	50.000	0.000	0.0000
	81	0.02593	0.75913	0(opg1)	0.00000		5.4558	26.7306	50.000	0.000	0.0000
b<6.8010, Z<3.5000:	185	0.00235	0.00000	0.99405	0.00000	0.50810	4.4223	3.7725	2.854	15.623	0.6949
	188	0.00235	0.00000	1.00000	0.00000		4.3815	3.6314	2.136	18.718	0.6833
	267	0.00235	0.00000	1.00000	0.00000		4.3694	3.5860	1.121	20.514	0.6950
b<6.8010, Z<6.1000:	58	0.00235	0.24087	0(opg1)	0.00000	0.50810	4.7346	4.6273	2.917	0.000	0.4926
	64	0.00235	0.24087	0.27926	0.00016		4.6939	4.5182	2.250	0.717	0.4882
	76	0.00235	0.24087	0.52097	0.00030		4.6835	4.4891	1.198	2.546	0.5025
b<6.8010, Z<8.7500:	61	0.00235	0.75913	0(opg1)	0.00000	0.50810	6.2500	44.5398	50.000	0.000	0.0000
	69	0.00235	0.75913	0(opg1)	0.00000		5.5823	28.9434	50.000	0.000	0.0000
	81	0.00235	0.75913	0(opg1)	0.00000		5.4558	26.7306	50.000	0.000	0.0000

Ship / Current Load / Current Damage:
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3.18.B.d Limitations:

The calculated model must comply with the probabilistic modelling rules detailed in MAAT Hydro's FAQ.

Although MAAT Hydro would be able to do it, including liquid effect in a probabilistic stability calculation is unusual. Probabilistic ship models therefore generally exclude tanks or only include empty ones.

3.18.B.e Typical use:

Calculating the probabilistic damaged stability reports after having generated ship's probabilistic damage system (see above).

3.18.A.f Example:

Open a probabilistic project complying with the subdivision rules detailed in MAAT Hydro's FAQ.

- Select '**/Tools/Probabilistic Stability/Make Damage System**' in the menu bar.
- Click directly on the **[OK]** button and check the obtained subdivision analysis reports on the **[2D]** page.
- Select an appropriate 'Computation Accuracy' on [Ship] tab's [Hydro] page if not done yet.
- Select '**/Tools/Probabilistic Stability/Calculate Damage System**' in the menu bar and click on the root (or any branch) of the damage system tree in the 3D browser.
- Select the 'Probabilistic SOLAS 2009 (MSC 194 (80) R7).stc' criterion and enter the associated parameters.
- Enter a realistic heel range allowing to calculate the stability criterion for any damage / loading combination.
- Wait for the end of the calculation (or press the [Esc] key to abort).
- Control the results in the obtained 2D folder and subfolders.

3.18.C Show Damage Analysis:

3.18.C.a Purpose:

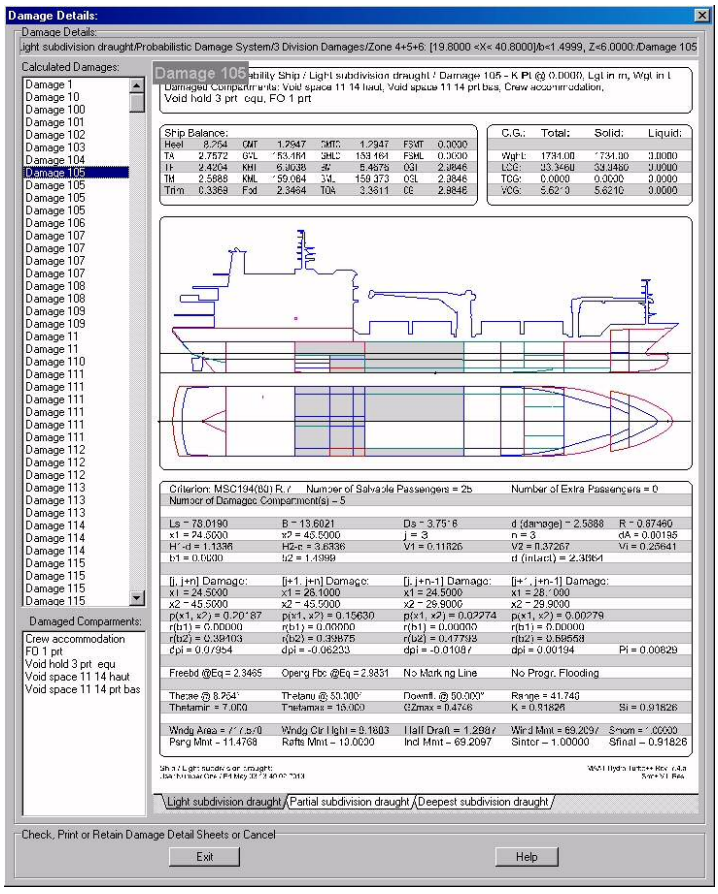
According to its exhaustive nature, a probabilistic stability calculation operates on a large number of damages, so that the damage system must be created automatically (see 'Make Damage System' above) and that its calculation results must be processed for providing an understandable synthesis (see 'Calculate Damage System' above).

Nevertheless, as checking probabilistic calculation details is often necessary, the 'Show Damage Analysis' function is provided to allow this sharp 'post process' control whenever necessary, without overloading the 2D section with all the reports potentially available.

The 'Show Damage Analysis' function therefore allows viewing, printing and exporting all the stability calculation details contained in the damage nodes as soon as they are calculated (i.e. have got a red – green color) without retaining them in the 2D section.

3.18.C.b Inputs:

The following dialog box pops up when a preliminarily created and calculated damage system tree or branch has been selected in the 3D browser:



The '**Damage Details**' box display's the currently reported loading condition / damage condition combination.

The '**Calculated Damages**' List contains all the calculated damages found in the selected damage system tree or branch, allowing to select the currently displayed one. As soon as a damage is selected, the corresponding damaged compartments are listed in the bottom list and the report corresponding to the currently selected load (see below) is displayed on the right (the data displayed in report's lower frame are totally defined and controlled by the selected STC script) .

The tabs displayed at the bottom of the report allow selecting the load associated to the current damage.

Right clicking on report's title box allows setting various display and export options, as well as printing it.

At last, it is important to recall that, as the same damage may result from different probabilistic breaches, therefore corresponding to different probabilistic coefficients, the same damage may appear more than once in the left upper damage list, the associated reports only differing by their $p_i.nu_j$ calculations.

When the required calculation details are pll the probabilistic damage system generation data are set:

The **[Exit]** button allows ending the function.

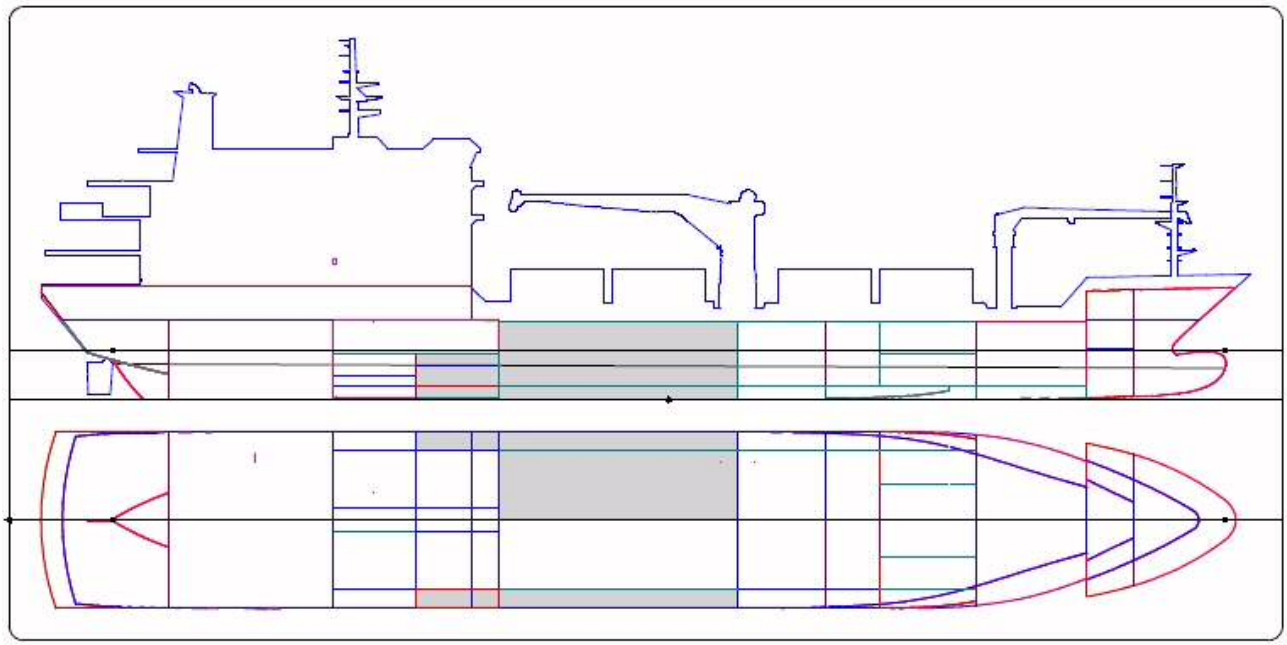
The **[Help]** button allows displaying the online help (Internet access necessary).

3.18.A.c Outputs:

Damaged Stability Ship / Light subdivision draught / Damage 107 - K Pt @ 0.0000, Lgt in m, Wgt in t
Damaged Compartments: Void space 11 14 haut, Void space 11 14 prt bas, Void hold 3 prt equ, FO 1 prt

Ship Balance:							
Heel°	7.937	GMT	1.5359	GMTC	1.5359	FSMT	0.0000
TA	2.7524	GML	154.851	GMLC	154.851	FSML	0.0000
TF	2.4213	KMT	7.1428	BMT	5.7091	OGT	2.9889
TM	2.5869	KML	160.470	BML	160.666	OGL	2.9889
Trim	0.3311	Fbd	2.3890	TOA	3.3282	OG	2.9889

C.G.:	Total:	Solid:	Liquid:
Wght:	1734.00	1734.00	0.0000
LCG:	33.3460	33.3460	0.0000
TCG:	0.0000	0.0000	0.0000
VCG:	5.6210	5.6210	0.0000



Criterion: MSC194(80) R.7	Number of Salvable Passengers = 25		Number of Extra Passengers = 0	
Number of Damaged Compartment(s) = 4				
Ls = 78.0190	B = 13.6021	Ds = 3.7516	d (damage) = 2.5869	R = 0.67460
x1 = 28.1000	x2 = 45.5000	j = 4	n = 2	dA = 0.00015
H1-d = -1.3564	H2-d = 0.2336	V1 = 0.00000	V2 = 0.02396	Vi = 0.02396
b1 = 0.0000	b2 = 1.4999		d (intact) = 2.3664	
[j, j+n] Damage:	[j+1, j+n] Damage:	[j, j+n-1] Damage:		
x1 = 28.1000	x1 = 29.9000	x1 = 28.1000		
x2 = 45.5000	x2 = 45.5000	x2 = 29.9000		
p(x1, x2) = 0.15630	p(x1, x2) = 0.13394	p(x1, x2) = 0.00279		
r(b1) = 0.00000	r(b1) = 0.00000	r(b1) = 0.00000		
r(b2) = 0.39875	r(b2) = 0.40208	r(b2) = 0.69558		
dpi = 0.06233	dpi = -0.05385	dpi = -0.00194		Pi = 0.00653
Freebd @Eq = 2.3890	Openg Fbd @Eq = 3.0004	No Marking Line	No Progr. Flooding	
Thetae @ 7.937°	Thetanu @ 50.000°	Downfl. @ 50.000°	Range = 42.063	
Thetamin = 7.000	Thetamax = 15.000	GZmax = 0.6299	K = 0.93963	Si = 0.93963
Wndg Area = 717.570	Wndg Ctr Hght = 9.1803	Half Draft = 1.2987	Wind Mmt = 69.2097	Smom = 1.00000
Psng Mmt = 11.4768	Rafts Mmt = 10.0000	Incl Mmt = 69.2097	Sinter = 1.00000	Sfinal = 0.93963

Ship / Light subdivision draught:
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3.18.C.d Limitations:

A damage system must be preliminarily created and the selected tree or branch must be preliminarily calculated.

3.18.A.e Typical use:

Controlling calculation details sharply, in addition to the standard global results generated in the 2D section.

3.18.C.f Example:

- Open a probabilistic project complying with the probabilistic calculation rules detailed in MAAT Hydro's FAQ.
- Select '**/Tools/Probabilistic Stability/Make Damage System**' in the menu bar.
- Click directly on the **[OK]** button and check the obtained subdivision analysis reports on the **[2D]** page.
- Select an appropriate 'Computation Accuracy' on [Ship] tab's [Hydro] page if not done yet.
- Select '**/Tools/Probabilistic Stability/Calculate Damage System**' in the menu bar and click on the root (or any branch) of the damage system tree in the 3D browser.
- Select the 'Probabilistic SOLAS 2009 (MSC 194 (80) R7).stc' criterion and enter the associated parameters.
- Enter a realistic heel range allowing to calculate the stability criterion for any damage / loading combination.
- Click on the [OK] button and select a tree or a simple branch of the damage system created in the 3D browser.
- Wait for the end of the calculation and return to the [3D] page.
- Select '**/Tools/Probabilistic Stability/Show Damage Analysis**' in the menu bar and select a calculated damage system branch in the 3D browser.
- Select various damage / loading combinations as explained above, print or export them and click on **[Exit]** when finished.

3.19 *Dredge Stability:*

3.19.a Purpose:

Dredge stability calculation is based on 3 simultaneous phenomenons:

- Cargo shifting, whose free surface is not parallel to floatation (cargo's heel is defined according to its density and floatation's heel in criterion script's header).

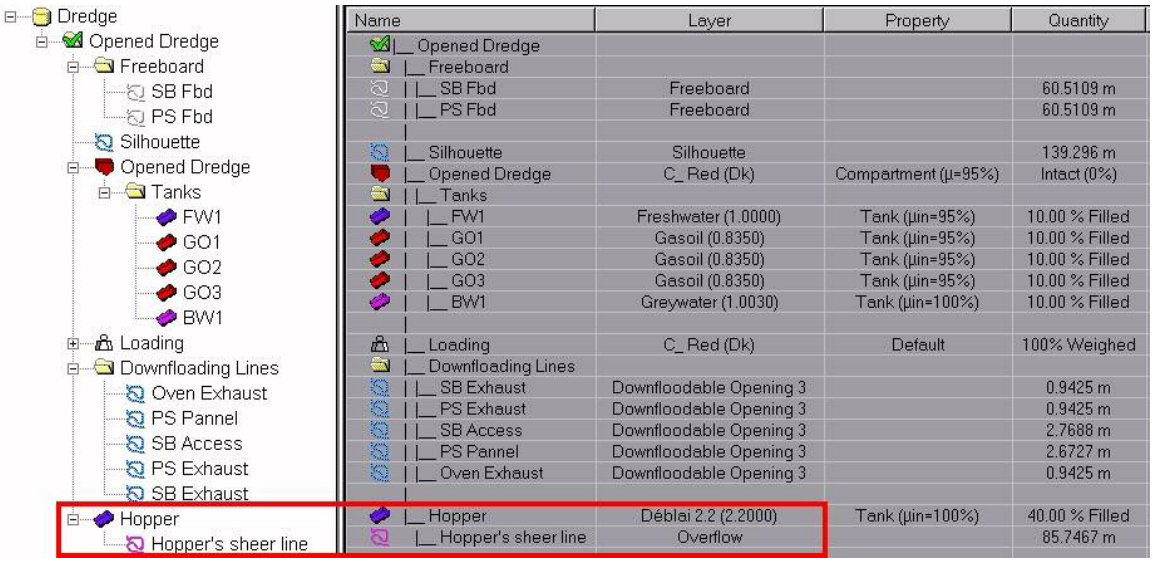
- Cargo's progressive spilling out of hopper, depending on heel and hopper's spilling / inflow line.

- Hopper's partial inflow, depending on cargo's free surface, permeability and hopper's spilling / inflow line.

The dedicated 'Dredge Stability' function automatically processes these 3 phenomenons, which are not supported by the standard 'Transverse Stability' function (so, don't try calculating dredge's stability with the 'Transverse Stability' function and don't try calculating a standard stability with the 'Dredge Stability' function).

In order to make this automatic process possible, a few simple modelling rules must be respected (see the FAQ for more details) and the selected criterion must include a special header specifying cargo's properties (see the the 'D231.stc' header criterion for example).

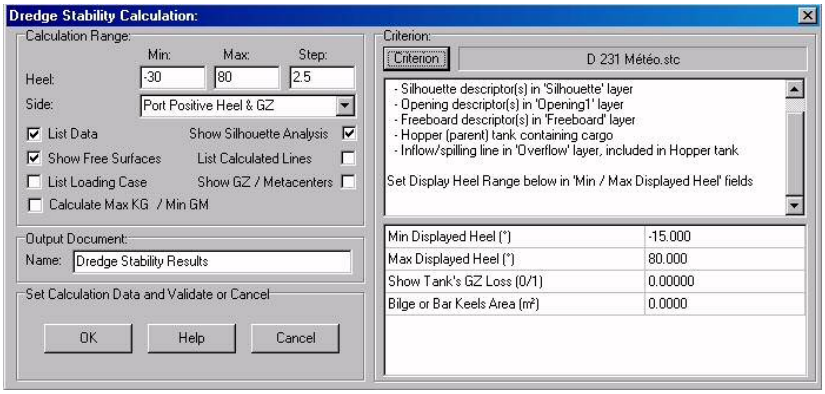
Dredge stability calculation is refused if current ship doesn't comply with the required modelling rules (i.e doesn't contain a 'hopper tank' set in the 'Dredge Cargo Layer' and an affiliated hopper inflow / spilling sheer line set in the 'Overflow Layer', as shown below).



Name	Layer	Property	Quantity
|__ Opened Dredge			
| |__ Freeboard			
| | |__ SB Fbd	Freeboard		60.5109 m
| | |__ PS Fbd	Freeboard		60.5109 m
|			
| |__ Silhouette	Silhouette		139.296 m
| |__ Opened Dredge	C_Red (Dk)	Compartment (µ=95%)	Intact (0%)
| | |__ Tanks			
| | | |__ FW1	Freshwater (1.0000)	Tank (µin=95%)	10.00 % Filled
| | | |__ GO1	Gasoil (0.8350)	Tank (µin=95%)	10.00 % Filled
| | | |__ GO2	Gasoil (0.8350)	Tank (µin=95%)	10.00 % Filled
| | | |__ GO3	Gasoil (0.8350)	Tank (µin=95%)	10.00 % Filled
| | | |__ BW1	Greywater (1.0030)	Tank (µin=100%)	10.00 % Filled
| |			
| |__ Loading	C_Red (Dk)	Default	100% Weighed
| |__ Downfloading Lines			
| | |__ SB Exhaust	Downfloodable Opening 3		0.9425 m
| | |__ PS Exhaust	Downfloodable Opening 3		0.9425 m
| | |__ SB Access	Downfloodable Opening 3		2.7688 m
| | |__ PS Pannel	Downfloodable Opening 3		2.6727 m
| | |__ Oven Exhaust	Downfloodable Opening 3		0.9425 m
| |			
| |__ Hopper	Déblai 2.2 (2.2000)	Tank (µin=100%)	40.00 % Filled
| |__ Hopper's sheer line	Overflow		85.7467 m

3.19.b Inputs:

The following dialog box pops up when the function is selected:



The **[Criterion]** button allows selecting the dredge stability criterion among the available STC scripts (the associated data must be set after this selection). As explained above, the selected criterion must include a special header specifying cargo's properties (see the 'D231.stc' header criterion for example).

The '**Heel Range**' 'Min', 'Max' and 'Step' fields allow defining the stability heel range to calculate. This range must, of course, be thought in order to allow calculating the selected criterion.

The '**Side**' selector allows defining on which side the stability has to be calculated.

The '**List Data**' check box allows including / removing the stability data listing associated to the diagram (see 3.19.c.2 below).

The '**Show Free Surfaces**' check box allows including / removing the Cargo / Floatation free surface report (see 3.19.c.4 below).

The '**List Loading Case**' check box allows including / removing current loading condition's analysis (see 3.19.c.3 below).

The '**Calculate Max KG / Min GM**' check box allows including / removing the Max KG corresponding to the selected criterion in stability diagram's header (see 3.19.c.1 below).

The '**Show Silhouette Analysis**' check box allows including / removing the Silhouette analysis diagram at equilibrium (see 3.19.c.5 below). These data correspond to '/Tools/Silhouette Analysis' report.

The '**List Calculated Lines**' check box allows including / removing the information (dimensions, freeboard at equilibrium, angle of immersion) concerning the current freeboard and openings descriptors (see 3.19.c.3 below).

The '**Show GZ / Metacenters**' check box allows including / removing the Body plan / GZ polar / Metacenters curves (see 3.19.c.6 below).

The '**Output Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report. Nevertheless, as this calculation may be time consuming, a confirmation box recalls the number of stability calculations before starting.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.19.c Outputs:

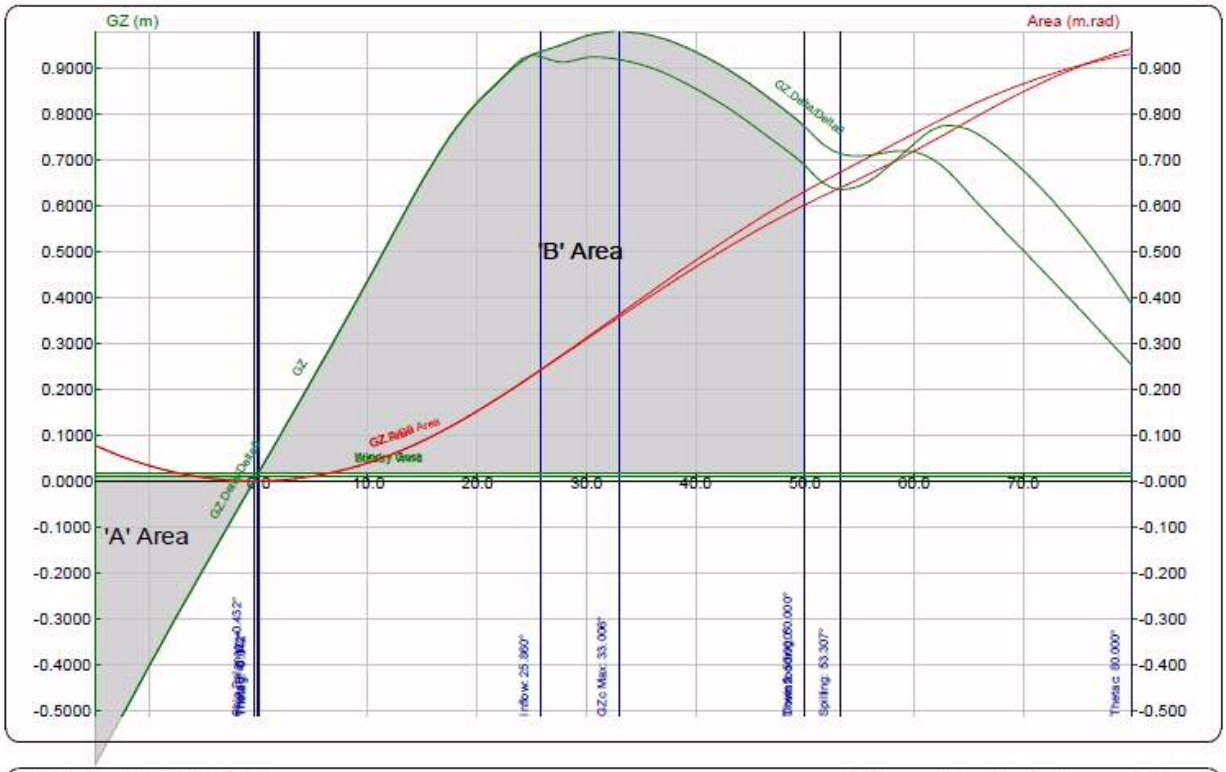
After clicking on the **[OK]** button, a 2D folder is created in the 2D browser, containing the following reports, depending on the checked options:

3.19.c.1: Dredge Stability Curve:

Stability Forms Dredge / Opened Dredge:
Variable / Real FSM, Heel on PS, K Point @ 0.0000 m, Water Density 1.0250, Length in m, Weights in t
No Lost Buoyancy
No Added Water
Hopper(s) : Hopper (40%),

Hydrostatic Data @ Equilibrium:							
Heel°	-0.432	GMT	2.8499	GMTC	2.0365	FSMT	456.508
DAP	2.4173	GML	115.885	GMLC	83.9158	FSML	18844.7
DFP	1.6714	WPA	454.716	BMT	3.6105	OGT	0.5892
DMP	2.0444	WSA	889.767	BML	116.664	OGL	31.7528
Trim	0.7459	FBMin	0.9147	TOA	2.3425	OG	-0.2155
Limiting Factor: GZc Max > 25.0°				Min Intact GMTC0: 2 .8250			

Weight Data @ 0°(KMt0 = 4.6944):	Total:	Solid:	Liquid:
Wght:	876.891	395.832	481.059
LCG:	26.1557	24.7320	27.3273
TCG:	-0.0175	-0.0342	-0.0038
VCG:	1.8460	1.9473	1.7627
Max:	1.8694	1.9991	1.7628



Criterion: D 231 - 2.02			Bilge or Bar Keels Area = 0.0000
Lambda = 2.2	Lambdaf = 0.88	Cargo Heel°@eq = -0.173	Cargo Trim°@eq = 0.312
Cargo W = 478.154	Cargo X: = 27.4733	Cargo Y = 0.0015	Cargo Z = 1.7643
L = 52.9077	P = 351.44	Lw1 = 0.0107	'A' Area = 0.243
B = 9.1683	A = 104.015	Lw2 = 0.0161	'B' Area = 0.616 > 'A' Area
d = 2.0444	Z = 2.5296	Theta0 @ -0.172°	[eq, 30]Area = 0.312 > 0.055
B/d = 4.48462	Dsp = 876.892	Theta1 @ 26.202°	[eq, 40]Area = 0.480 > 0.090
C = 0.45340	X1 = 0.80000	Thetag @ -0.042°	[30, 40]Area = 0.169 > 0.030
Cb = 0.825	X2 = 1.00000	Thetac @ 80.000°	[eq, GZx]Area = 0.363
GM = 2.0365	k = 1.00000	No Opening	GM = 2.0365 > 0.1500
OG = 0.5892	r = 0.90291	Thetar @ -26.375°	GZc Max @ 33.006°> 25.0°
T = 5.826	s = 0.10000	Min GZ >0 Arc = 50.432	GZc 30°= 0.9702 > 0.2000

Dredge / Current Load / Current Damage:
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3.19.c.2: Dredge Stability Listing:

Stability Forms Dredge / Opened Dredge:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Status:	Thetar°	AP Draft	FP Draft	Thetag°	Cargo	Inflow	FSM	GZ	GZc	GZc Area
	-30.000	2.7843	1.6913	-12.000	478.154	44.1216	413.644	-0.8920	-0.9380	0.2936
	-27.500	2.6893	1.6779	-11.000	478.154	33.2990	421.039	-0.8810	-0.9153	0.2532
Thetar	-26.375	2.6072	1.6583	-10.550	478.154	18.3088	424.667	-0.8877	-0.9065	0.2354
	-25.000	2.5069	1.6343	-10.000	478.154	0.0000	429.097	-0.8959	-0.8959	0.2137
	-22.500	2.4694	1.6428	-9.000	478.154	0.0000	438.397	-0.8491	-0.8491	0.1756
	-20.000	2.4371	1.6514	-8.000	478.154	0.0000	448.733	-0.7909	-0.7909	0.1398
	-17.500	2.4149	1.6590	-7.000	478.154	0.0000	457.977	-0.7157	-0.7157	0.1070
	-15.000	2.4054	1.6661	-6.000	478.154	0.0000	463.284	-0.6199	-0.6199	0.0778
	-12.500	2.4056	1.6701	-5.000	478.154	0.0000	465.087	-0.5116	-0.5116	0.0531
	-10.000	2.4096	1.6710	-4.000	478.154	0.0000	463.031	-0.4017	-0.4017	0.0332
	-7.500	2.4128	1.6715	-3.000	478.154	0.0000	459.802	-0.2944	-0.2944	0.0180
	-5.000	2.4154	1.6716	-2.000	478.154	0.0000	458.470	-0.1893	-0.1893	0.0075
	-2.500	2.4171	1.6714	-1.000	478.154	0.0000	456.742	-0.0854	-0.0854	0.0015
Ship Balance	-0.432	2.4173	1.6714	-0.173	478.154	0.0000	456.508	0.0000	0.0000	0.0003
Theta0	-0.172	2.4174	1.6714	-0.069	478.154	0.0000	456.479	0.0107	0.0107	0.0001
Thetag	-0.042	2.4174	1.6714	-0.017	478.154	0.0000	456.464	0.0161	0.0161	0.0000
	0.000	2.4174	1.6714	0.000	478.154	0.0000	456.460	0.0179	0.0179	0.0000
	2.500	2.4170	1.6714	1.000	478.154	0.0000	457.653	0.1210	0.1210	0.0030
	5.000	2.4155	1.6715	2.000	478.154	0.0000	458.443	0.2247	0.2247	0.0106
	7.500	2.4130	1.6712	3.000	478.154	0.0000	461.167	0.3298	0.3298	0.0227
	10.000	2.4098	1.6708	4.000	478.154	0.0000	463.649	0.4368	0.4368	0.0394
	12.500	2.4056	1.6701	5.000	478.154	0.0000	464.879	0.5463	0.5463	0.0608
	15.000	2.4052	1.6662	6.000	478.154	0.0000	461.388	0.6542	0.6542	0.0870
	17.500	2.4148	1.6591	7.000	478.154	0.0000	455.268	0.7497	0.7497	0.1177
	20.000	2.4370	1.6515	8.000	478.154	0.0000	446.891	0.8244	0.8244	0.1520
	22.500	2.4695	1.6428	9.000	478.154	0.0000	437.236	0.8821	0.8821	0.1892
	25.000	2.5070	1.6343	10.000	478.154	0.0000	429.407	0.9282	0.9282	0.2287
Inflow	25.860	2.5697	1.6493	10.344	478.154	11.4474	426.956	0.9228	0.9350	0.2428
	27.500	2.6893	1.6779	11.000	478.154	33.2870	422.280	0.9125	0.9480	0.2697
	30.000	2.7851	1.6900	12.000	478.154	44.0460	415.583	0.9227	0.9702	0.3115
	32.500	2.8968	1.7001	13.000	478.154	54.7605	408.764	0.9203	0.9792	0.3540
GZc Max	33.006	2.9220	1.7009	13.203	478.154	56.6080	407.536	0.9177	0.9784	0.3627
	35.000	3.0212	1.7039	14.000	478.154	63.8829	402.701	0.9076	0.9754	0.3967
	37.500	3.1605	1.7048	15.000	478.154	72.3681	397.159	0.8854	0.9603	0.4389
	40.000	3.3189	1.7020	16.000	478.154	80.5200	392.494	0.8549	0.9353	0.4803
	42.500	3.4919	1.6867	17.000	478.154	86.8649	388.516	0.8201	0.9034	0.5204
	45.000	3.6881	1.6691	18.000	478.154	93.4101	385.037	0.7796	0.8648	0.5590
	47.500	3.9114	1.6417	19.000	478.154	99.4884	381.533	0.7353	0.8207	0.5957
Downflooding	50.000	4.1674	1.5984	20.000	478.154	104.850	378.506	0.6881	0.7725	0.6305
	52.500	4.4655	1.5332	21.000	478.154	109.624	376.371	0.6387	0.7206	0.6631
Spilling	53.307	4.5277	1.4286	21.323	469.319	111.160	371.493	0.6399	0.7165	0.6731
	55.000	4.6583	1.2092	22.000	450.780	114.382	361.259	0.6422	0.7080	0.6942
	57.500	4.7666	0.5622	23.000	402.129	117.438	336.611	0.6816	0.7161	0.7253
	60.000	4.8524	-0.5239	24.000	340.075	115.250	300.504	0.7342	0.7175	0.7566
	62.500	4.8850	-2.0220	25.000	273.134	106.279	252.173	0.7729	0.6882	0.7872
	65.000	4.8785	-3.5101	26.000	221.117	96.4368	214.758	0.7657	0.6276	0.8159
	67.500	4.8188	-4.7603	27.000	187.347	90.6201	185.544	0.7290	0.5645	0.8420
	70.000	4.7293	-6.0033	28.000	161.588	88.2470	164.930	0.6778	0.5030	0.8652
	72.500	4.5931	-7.4482	29.000	139.601	86.5187	146.538	0.6167	0.4410	0.8858
	75.000	4.4032	-9.2034	30.000	120.334	86.4953	128.664	0.5476	0.3795	0.9037
	77.500	4.0993	-11.5650	31.000	102.871	85.9723	114.514	0.4697	0.3159	0.9189
	80.000	3.6484	-14.9645	32.000	86.8875	86.4805	98.8893	0.3844	0.2517	0.9313

3.19.c.3: Line and Load Analysis:

Stability Forms Dredge / Opened Dredge:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Calculation Lines:

Name	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax	Fbd Eq.	Ximm	Yimm	Zimm	Imm°
Freeboard:							0.9146				11.846
SB Fbd	0.0000	54.7885	-4.5791	-0.0750	3.2000	3.8590	0.9146	0.0000	-0.0750	3.8433	-11.846
PS Fbd	0.0000	54.7885	0.0750	4.5791	3.2000	3.8590	0.9836	12.2500	4.5670	3.2000	11.846
Downfloodable Opening 3:							2.0337				38.735
SB Exhaust	3.3500	3.6500	1.7000	2.0000	6.1000	6.1000	3.7409	3.4980	1.9999	6.1000	48.380
PS Exhaust	3.3500	3.6500	-2.0000	-1.7000	6.1000	6.1000	3.7130				
SB Access	3.1761	3.8824	-1.1300	-0.5000	4.4169	4.6818	2.0337				
PS Pannel	3.1761	3.8824	0.5000	1.1300	4.5400	4.5400	2.1690	3.1761	1.1300	4.5400	43.579
Oven Exhaust	5.2000	5.5000	3.5800	3.8800	6.2000	6.2000	3.8802	5.3500	3.8800	6.2000	38.735
Overflow:							1.6152				-25.860
Hopper's sheer line	0.0000	46.0000	-3.1500	3.1500	3.8900	4.5355	1.6152	12.2500	3.1500	3.8900	-25.860

Load Analysis: Opened Dredge

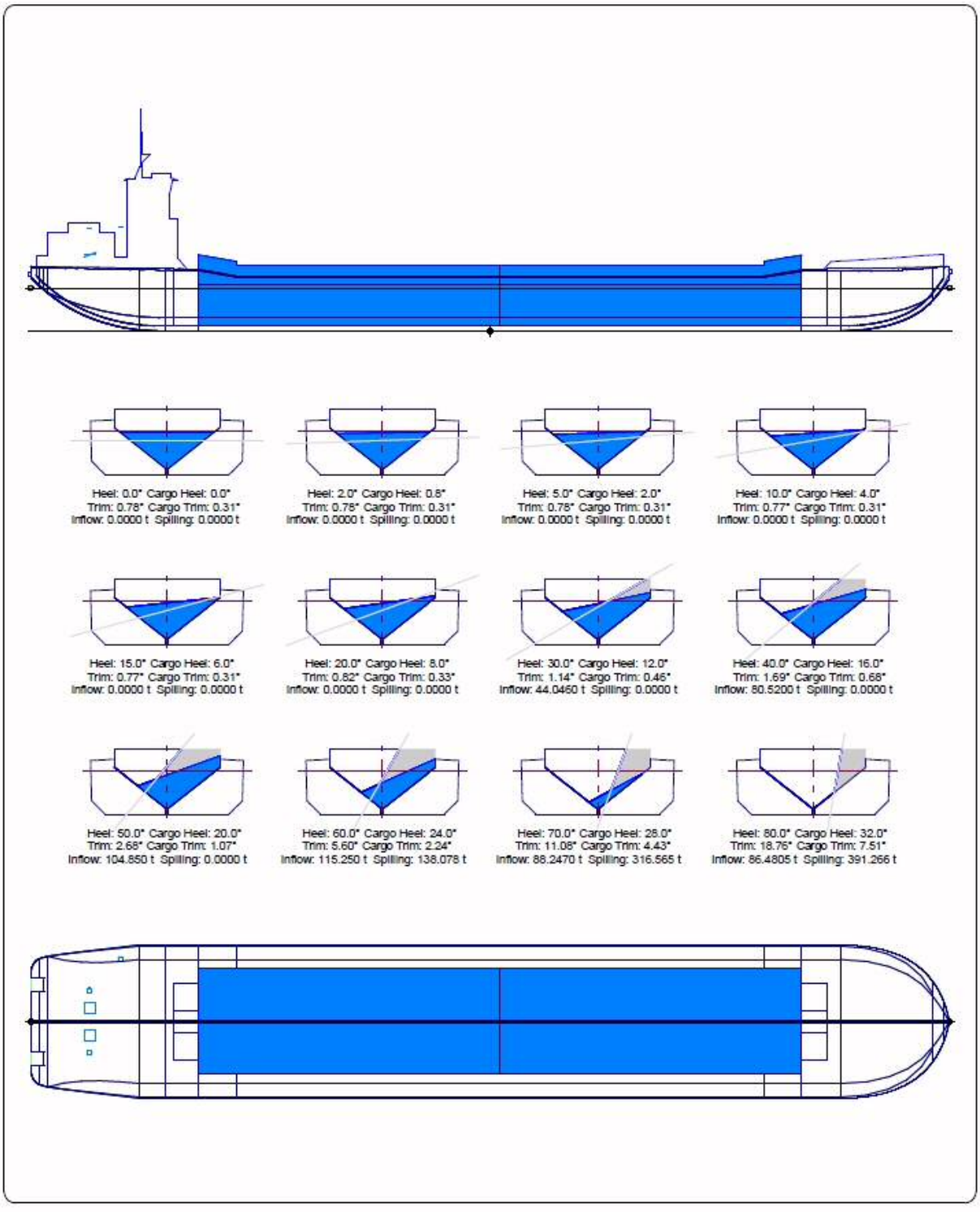
Name:	Pct:	Mu:	Rô:	Xmin:	Xmax:	Weight:	VCG:	LCG:	TCG:	FSMt:
BW1	10%	100%	1.003	7.0999	8.0999	0.5534	0.5310	7.5999	-1.6250	1.0169
FW1	10%	95%	1.000	0.0000	2.5060	1.5139	1.7201	2.1244	-1.9797	5.5034
GO1	10%	95%	0.835	0.0000	2.5000	0.4287	1.7358	2.1196	3.2526	0.2037
GO2	10%	95%	0.835	2.5000	3.5001	0.2047	1.7750	3.0001	0.9489	0.3364
GO3	10%	95%	0.835	2.5000	3.5001	0.2047	1.7750	3.0001	-0.9489	0.3364
Hopper	40%	100%	2.200	(10.0000)	(46.0000)	(411.668)	(1.9758)	(28.0000)	(1.1430)	(342.729)
Total (Liquid Load):						414.573	1.9725	27.8269	1.1289	350.126
Total Dead Weight:						414.573	1.9725	27.8269	1.1289	350.126
Light Ship:						395.832	1.9473	24.7320	-0.0342	
Total Weight:						810.405	1.9602	26.3152	0.5608	350.126

Dredge / Current Load / Current Damage:
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3.19.c.4: Free Surfaces Analysis:

Forms: Dredge - Tank: Hopper / Length in m, Volume in m3, Weight in t



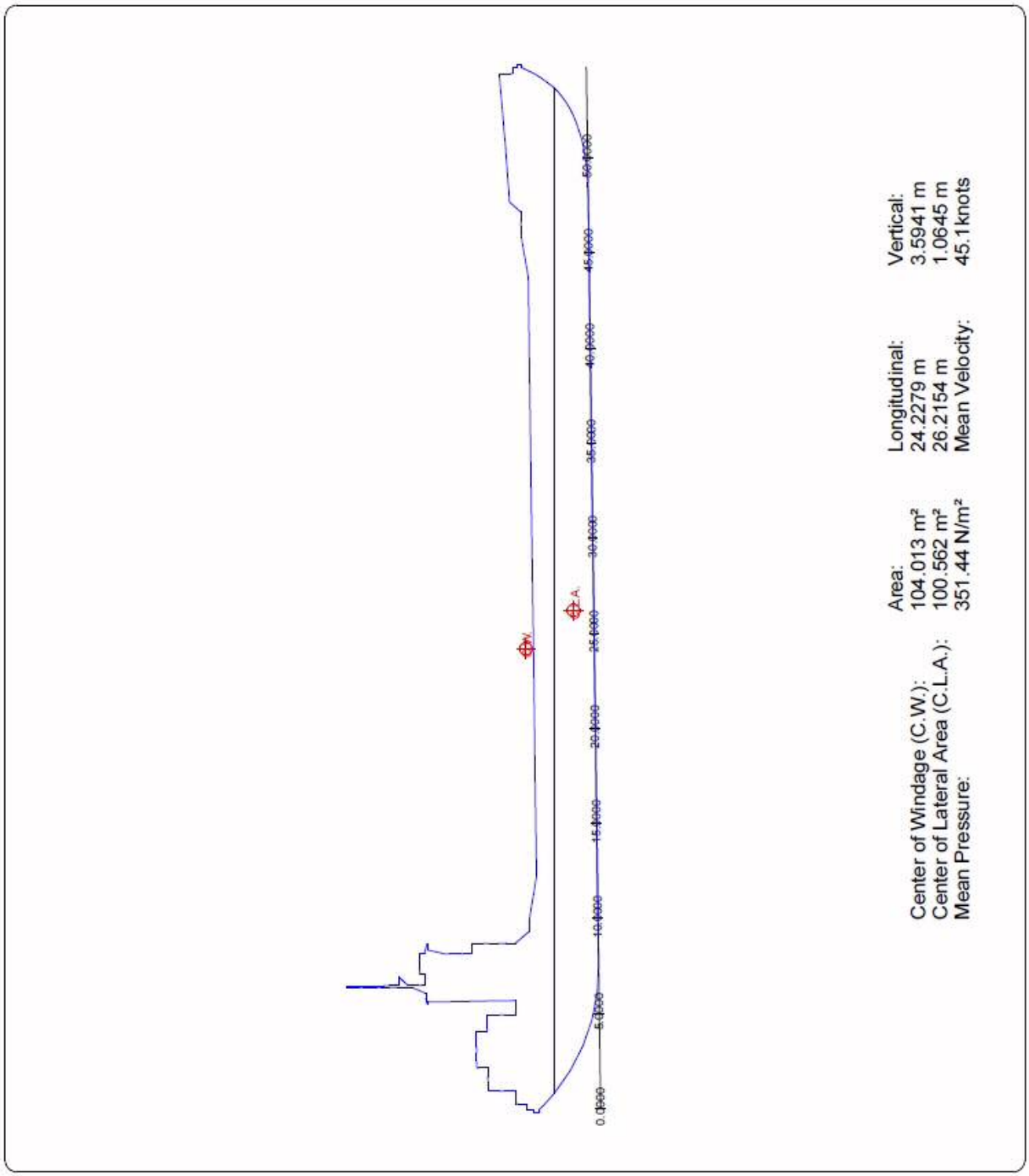
Name: Hopper	Raw Vol.: 543.356	LCG: 27.9984	Xmin: 10.0000	Xmax: 46.0000
Permeability: 1.00000	Weight: 1195.38	TCG: 0.0007	Ymin: -3.1500	Ymax: 3.1500
	Max FSMt: 465.087	VCG: 2.6460	Zmin: 0.3000	Zmax: 4.5355
Content: Déblai 2.2	Filling: 40.0%	Density: 2.20000	FSM Density: 0.88000	Permeability: 0.0%

Dredge / Current Load / Current Damage:
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3.19.c.5: Silhouette Analysis:

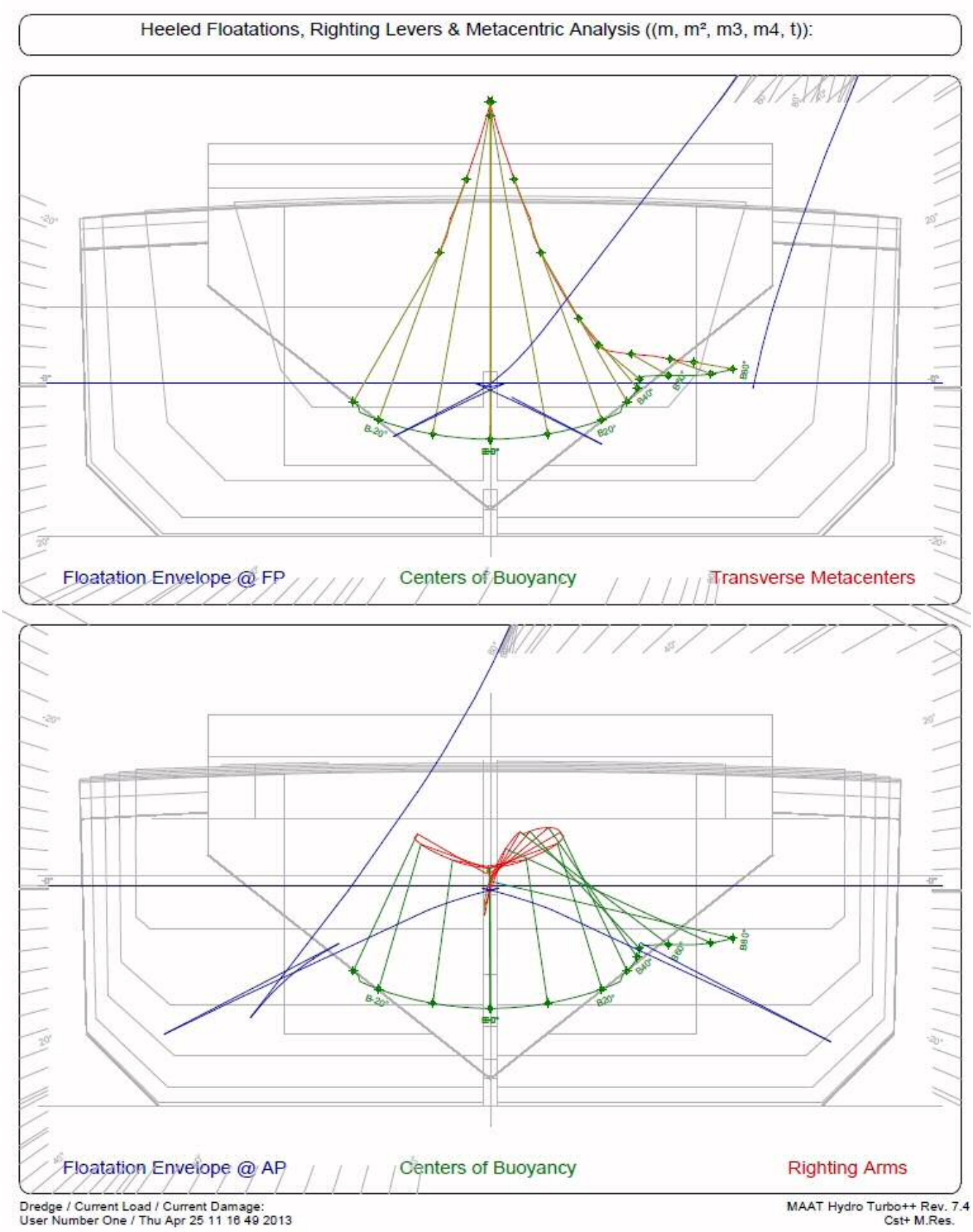
Silhouette Analysis:
Wind: 45.1 knots (constant), Displacement: 876.891 t, LCG: 25.7273 m, VCG: 1.8499 m
Heel = -0.432°, AP @ 0.0000, DAP: 2.4174, FP @ 54.8 000, DFP: 1.6715, Trim: 0.7459 m



Dredge / Current Load / Current Damage:
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3.19.c.6: GZ / Metacenters Diagram:



3.19.d Limitations:

The calculated model must comply with the dredge modeling rules respected (see the FAQ for more details) and be realistic in terms of weight and buoyancy.

3.19.e Typical use:

Calculating dredge's stability.

3.19.f Example:

Open a dredge file complying with the dredge modeling rules and select it to calculate its stability data:

- Select '**/Tools/Dredge Stability**' in the menu bar.
- Click on the [Criterion] button, select the 'D231 Météo' dredge criterion and validate it.
- Click on the [OK] button and check the obtained reports.

3.20 *WoD Stability:*

3.20.a Purpose:

Stability calculations with water on deck (Stockholm Agreement) assume that the car deck may be flooded by waves according to its residuary freeboard, calculated with reference to their significant height Hs.

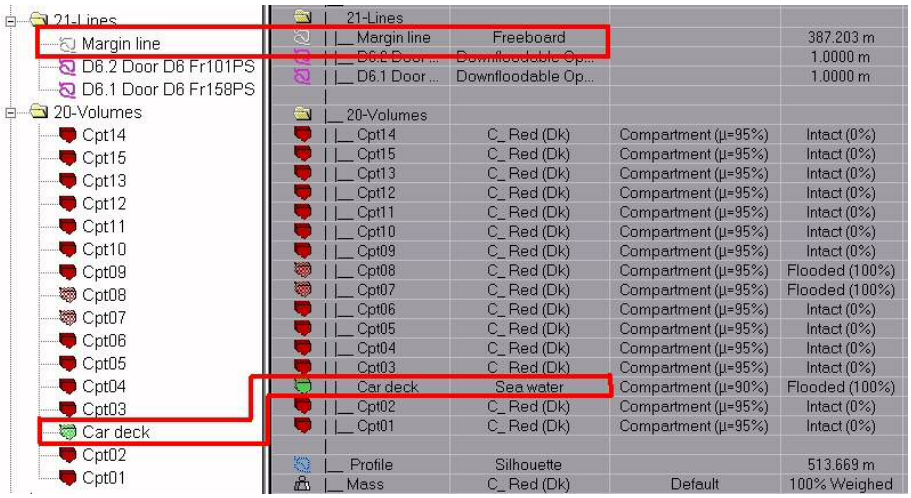
In order to achieve this special stability calculation, the dedicated 'WoD Stability' function automatically adds the necessary water on the car deck, according to the entered data and selected script. As this special process is not supported by the standard 'Transverse Stability' function, don't try calculating WoD stability with the 'Transverse Stability' function (no water will be added on car deck) and don't try calculating a standard stability with the 'WoD Stability' function.

In order to make this automatic process possible, a few simple modelling rules must be respected (see the FAQ for more details) and the selected criterion must include a special header specifying the car deck flooding rule (i.e. the *DefineSubmersionRange* / *DefineSwellRange* commands. See 'STC Scriping Manual' for more details and the 'SOLAS 2004 Stockholm.stc' criterion for example).

If necessary, the WoD stability can be automatically calculated for all the present damage cases thanks to the 'Deterministic Stability' function, provided that the calculated damages comply with the WoD modelling rules.

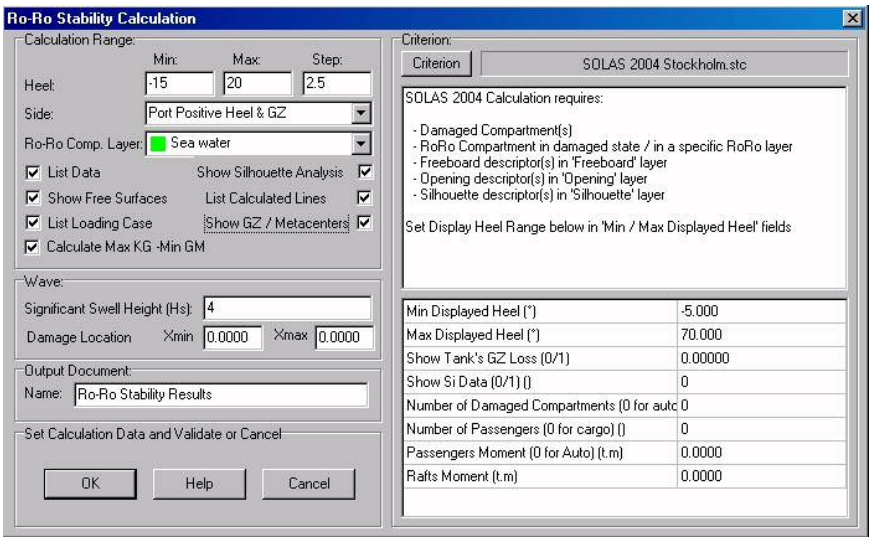
In this case, attention must be paid to the fact that the damage longitudinal extents must preliminarily be set individually in their 'Xmin' /'Xmax' fields on the [Data] page.

WoD stability calculation is refused if current ship doesn't comply with the required modelling rules (i.e doesn't contain a 'car deck compartment' set in the 'Water on Deck Layer' and a car deck margin line set in the 'Freeboard Layer', as shown below). It is important to notice that car deck's margin line(s) doesn't need to be affiliated to it and that the selected 'Water on Deck Layer' must have flooding water's density, as it specifies water on deck's properties.



3.20.b Inputs:

The following dialog box pops up when the function is selected:



The [**Criterion]** button allows selecting the WoD stability criterion among the available STC scripts (the associated data must be set after this selection). As explained above, the selected criterion must include a special header specifying the car deck flooding rule (see the 'SOLAS 2004 Stockholm.stc' header criterion for example).

The '**Heel Range**' 'Min', 'Max' and 'Step' fields allow defining the stability heel range to calculate. This range must, of course, be thought in order to allow calculating the selected criterion.

The '**Side**' selector allows defining on which side the stability has to be calculated.

The '**List Data**' check box allows including / removing the stability data listing associated to the diagram (see 3.20.c.2 below).

The '**Show Free Surfaces**' check box allows including / removing the Cargo / Floatation free surface report (see 3.20.c.4 below).

The '**List Loading Case**' check box allows including / removing current loading condition's analysis (see 3.20.c.3 below).

The '**Calculate Max KG / Min GM**' check box allows including / removing the Max KG corresponding to the selected criterion in stability diagram's header (see 3.20.c.1 below).

The '**Show Silhouette Analysis**' check box allows including / removing the Silhouette analysis diagram at equilibrium (see 3.20.c.5 below). These data correspond to '/Tools/Silhouette Analysis' report.

The '**List Calculated Lines**' check box allows including / removing the information (dimensions, freeboard at equilibrium, angle of immersion) concerning the current freeboard and openings descriptors (see 3.20.c.3 below).

The '**Show GZ / Metacenters**' check box allows including / removing the Body plan / GZ polar / Metacenters curves (see 3.20.c.6 below).

- The '**Significant Swell Height (Hs)**' field allows entering significant swell's height, according to its Stockholm Agreement definition.

- Damage's longitudinal extent is defined by its **'Xmin**' and **'Xmax**' limits (according to the regulation, car deck's minimum freeboard is only calculated between these limits).

The '**Output Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report. Nevertheless, as this calculation may be time consuming, a confirmation box recalls the number of stability calculations before starting.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.20.c Outputs:

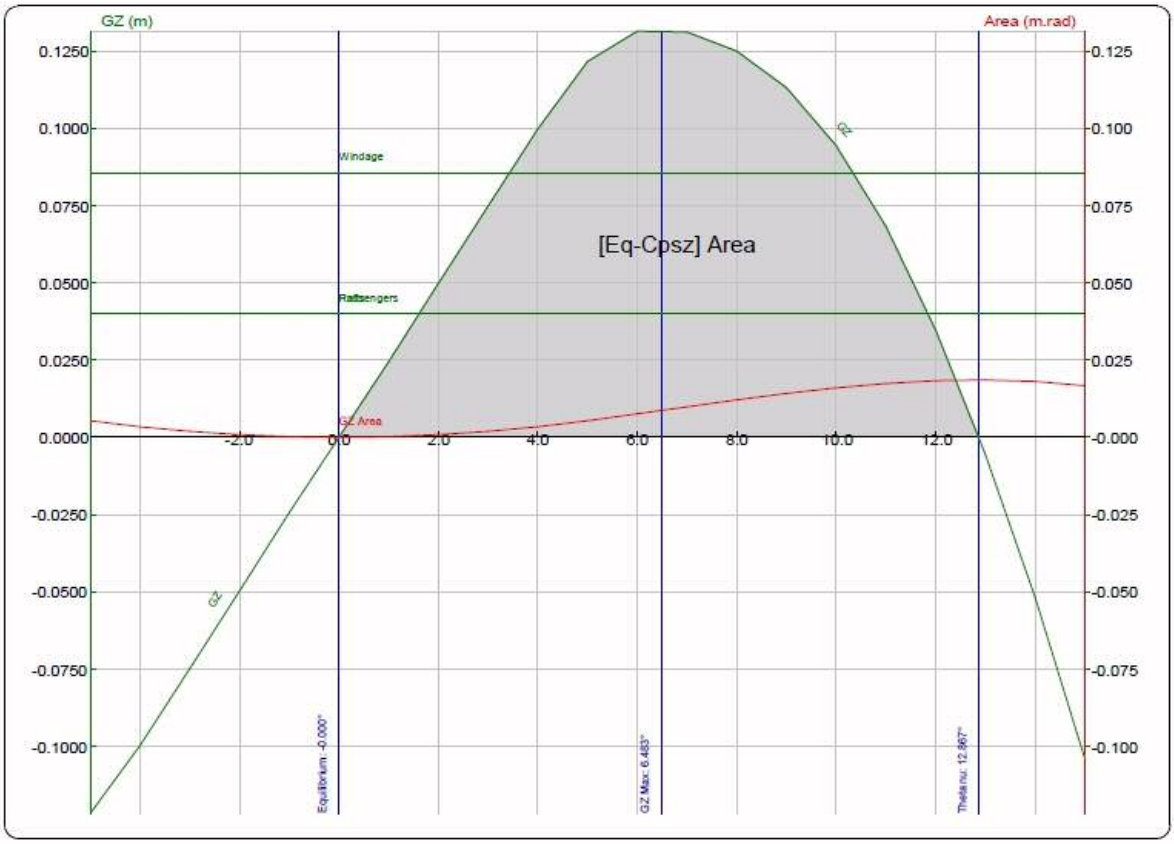
After clicking on the **[OK]** button, a 2D folder is created in the 2D browser, containing the following reports, depending on the checked options:

3.20.c.1: WoD Stability Curve:

Stability Forms RoRo / Damaged:
Variable / Real FSM, Heel on PS, K Point @ 0.0000 m, Water Density 1.0250, Length in m, Weights in t
Lost Buoyancy in: Cpt08 (100%), Cpt07 (100%),
No Added Water
Water on Deck in: Car deck,

Hydrostatic Data @ Equilibrium:							
Heel°	-0.000	GMT	1.3825	GMTC	1.1591	FSMT	4384.27
DAP	6.0310	GML	388.031	GMLC	387.999	FSML	630.274
DFP	9.3853	KMT	16.6873	BMT	12.2902	OGT	7.9023
DMP	7.7082	KML	403.261	BML	398.938	OGL	7.7109
Trim	-3.3543	FBMin	-1.8691	TOA	9.3287	OG	7.6788
Limiting Factor: [Eq-Cpsz] Area > A.15/Min Intact GMTC0: 1.9522							

Weight Data @ 0°(KMt0 = 17.2926):	Total:	Solid:	Liquid:
Wght:	19620.9	19611.3	9.5598
LCG:	81.1403	81.1071	149.208
TCG:	0.0000	0.0000	-0.0002
VCG:	15.3048	15.3075	9.7487
Max:	15.3404	15.3431	9.7487



Criterion: SOLAS 2004 / Stockholm			Number of Damaged Compartment(s) = 2
Dmg from Xmin = 84.3000	Dmg to Xmax = 110.700		Height of Swell (hs) = 4.0000
	RoRo Res. Fbd (fr) = 1.5005		Height of Added Water (hw) = 0.1469
Passengers Moment = 0.0000	Rafts Moment = 0.0000		Windage Moment = 896.099
Windage Area = 4386.65	Windage Ctr Hght = 20.5471		Half Draft = 3.8541
R8 / 2.3.1: Equilibrium @ -0.000°	Thetanu @ 12.867°	Thetaf @ 30.000°	[Eq-Cpsz] Rge = 12.867 > 10.000
R8 / 2.3.2: Nb of Dmg Compts = 2	Limit @ 27.000°	Thetaf @ 30.000°	[Eq-Cpsz] Area = 0.019 > A.15/rg
R8 / 2.3.3: GZpsg = 0.0400	GZrft = 0.0400	GZwnd = 0.0857	GZmax = 0.1313 > Max(p., r., w.)

RoRo / Current Load / Current Damage:
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3.20.c.2: WoD Stability Listing:

Stability Forms RoRo / Damaged:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Status:	Heel:	TAP:	TFP:	KN:	Inflow W	Inflow X	Inflow Y	Inflow Z	FS Diff.	FSM	GZ
	-15.000	5.4909	10.0221	-4.4373	1282.42	108.003	-11.0313	10.5984	0.1583	14760.2	0.1037
	-14.000	5.5334	9.9440	-4.1427	1061.28	110.180	-11.0601	10.5062	0.1580	12986.5	0.0518
	-13.000	5.5813	9.8643	-3.8456	859.307	112.405	-11.0949	10.4158	0.1576	11213.1	0.0054
	-12.000	5.6330	9.7852	-3.5464	677.195	114.709	-11.1354	10.3251	0.1569	9470.65	-0.0348
	-11.000	5.6870	9.7083	-3.2454	515.608	117.127	-11.1793	10.2362	0.1562	7790.70	-0.0682
	-10.000	5.7417	9.6357	-2.9433	375.370	119.689	-11.2242	10.1502	0.1558	6212.86	-0.0944
	-9.000	5.7958	9.5685	-2.6412	257.073	122.410	-11.2686	10.0648	0.1561	4770.60	-0.1131
	-8.000	5.8474	9.5083	-2.3406	161.279	125.301	-11.3061	9.9794	0.1565	3369.25	-0.1249
	-7.000	5.8949	9.4557	-2.0440	88.0636	128.473	-11.3124	9.8927	0.1546	2100.47	-0.1312
	-6.000	5.9365	9.4133	-1.7517	37.6135	132.150	-11.2246	9.8129	0.1567	1189.59	-0.1314
	-5.000	5.9708	9.3857	-1.4607	9.3704	136.928	-10.8077	9.7069	0.1556	345.995	-0.1217
	-4.000	5.9952	9.3782	-1.1688	2.6726	142.114	-9.8840	9.6786	0.2489	116.477	-0.0997
	-3.000	6.0126	9.3768	-0.8768	1.8290	145.712	-9.0881	9.7080	0.4018	82.1334	-0.0748
	-2.000	6.0249	9.3761	-0.5846	1.5303	148.023	-8.3422	9.7269	0.5479	81.4397	-0.0497
	-1.000	6.0320	9.3764	-0.2923	1.9851	149.243	-7.1374	9.7358	0.6944	239.110	-0.0244
Equilibrium	-0.000	6.0310	9.3853	0.0000	9.5589	149.208	-0.0002	9.7487	0.8355	4384.27	0.0000
	0.000	6.0310	9.3853	0.0000	9.5591	149.208	0.0000	9.7487	0.8355	4384.38	0.0000
	1.000	6.0320	9.3764	0.2923	1.9852	149.243	7.1374	9.7358	0.6944	239.110	0.0244
	2.000	6.0249	9.3761	0.5846	1.5303	148.023	8.3422	9.7269	0.5479	81.4400	0.0497
	3.000	6.0126	9.3768	0.8768	1.8290	145.712	9.0881	9.7080	0.4018	82.1377	0.0748
	4.000	5.9952	9.3782	1.1688	2.6726	142.114	9.8840	9.6786	0.2489	116.479	0.0997
	5.000	5.9708	9.3857	1.4607	9.3701	136.928	10.8077	9.7069	0.1555	345.575	0.1217
	6.000	5.9365	9.4132	1.7517	37.6046	132.150	11.2247	9.8128	0.1567	1188.21	0.1314
GZ Max	6.483	5.9165	9.4337	1.8928	61.9582	130.375	11.2671	9.8514	0.1557	1628.00	0.1313
	7.000	5.8949	9.4556	2.0440	88.0559	128.473	11.3125	9.8927	0.1546	2099.29	0.1312
	8.000	5.8475	9.5081	2.3406	161.241	125.301	11.3065	9.9793	0.1565	3365.61	0.1250
	9.000	5.7958	9.5684	2.6412	257.049	122.410	11.2688	10.0647	0.1561	4768.56	0.1132
	10.000	5.7418	9.6355	2.9433	375.313	119.688	11.2245	10.1502	0.1558	6208.99	0.0944
	11.000	5.6870	9.7082	3.2454	515.546	117.127	11.1795	10.2362	0.1562	7787.21	0.0683
	12.000	5.6330	9.7850	3.5464	677.135	114.709	11.1356	10.3251	0.1569	9467.21	0.0348
	13.000	5.5814	9.8640	3.8457	859.204	112.404	11.0951	10.4158	0.1576	11207.6	-0.0053
	14.000	5.5335	9.9436	4.1428	1061.14	110.179	11.0604	10.5062	0.1581	12980.7	-0.0517
	15.000	5.4909	10.0220	4.4373	1282.41	108.004	11.0313	10.5984	0.1583	14760.0	-0.1037
	16.000	5.4546	10.0979	4.7291	1522.34	105.884	11.0082	10.6907	0.1572	16492.1	-0.1608
	17.000	5.4246	10.1704	5.0178	1779.44	103.874	10.9887	10.7844	0.1565	18185.2	-0.2218
	18.000	5.4008	10.2392	5.3035	2052.34	102.000	10.9704	10.8804	0.1567	19831.2	-0.2855
	19.000	5.3827	10.3042	5.5861	2339.62	100.266	10.9517	10.9792	0.1565	21420.3	-0.3510
	20.000	5.3698	10.3654	5.8652	2640.24	98.6685	10.9320	11.0804	0.1573	22973.7	-0.4175
	21.000	5.3619	10.4228	6.1411	2953.56	97.1978	10.9122	11.1815	0.1573	24528.3	-0.4845
	22.000	5.3587	10.4765	6.4137	3278.94	95.8420	10.8919	11.2846	0.1564	26099.0	-0.5512
	23.000	5.3600	10.5262	6.6832	3615.89	94.5884	10.8715	11.3904	0.1558	27710.7	-0.6175
	24.000	5.3656	10.5721	6.9494	3964.09	93.4260	10.8514	11.4981	0.1560	29374.8	-0.6830
	25.000	5.3748	10.6141	7.2124	4322.86	92.3477	10.8317	11.6089	0.1562	31103.3	-0.7476
	26.000	5.3871	10.6525	7.4721	4691.99	91.3445	10.8126	11.7215	0.1560	32881.7	-0.8109
	27.000	5.4018	10.6872	7.7286	5070.76	90.4123	10.7939	11.8370	0.1565	34756.9	-0.8730
	28.000	5.4182	10.7187	7.9816	5459.24	89.5466	10.7756	11.9550	0.1572	36733.1	-0.9338
	29.000	5.4357	10.7481	8.2314	5857.54	88.7462	10.7582	12.0752	0.1570	38824.0	-0.9934
Thetaf	30.000	5.4541	10.7749	8.4779	6265.51	88.0013	10.7416	12.1974	0.1568	41000.1	-1.0516

3.20.c.3: Line and Load Analysis:

Stability Forms RoRo / Damaged:
Variable / Real FSM, Heel on PS, K Point at: 0.0000 m, Water Density: 1.0250, Length in m, Weights in t

Calculation Lines:

Name	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax	Fbd Eq.	Ximm	Yimm	Zimm	Imm°
Freeboard:							-1.8691				?
Margin line	-4.5780	171.061	15.4372	15.4372	7.5210	9.7000	-1.8691				
Downfloodable Opening 1:							10.4670				?
Door 1	80.5000	81.5000	9.8000	9.8000	19.0000	19.0000	11.3663				
Door 2	126.300	127.300	13.5000	13.5000	19.0000	19.0000	10.4670				

Load Analysis: Damaged

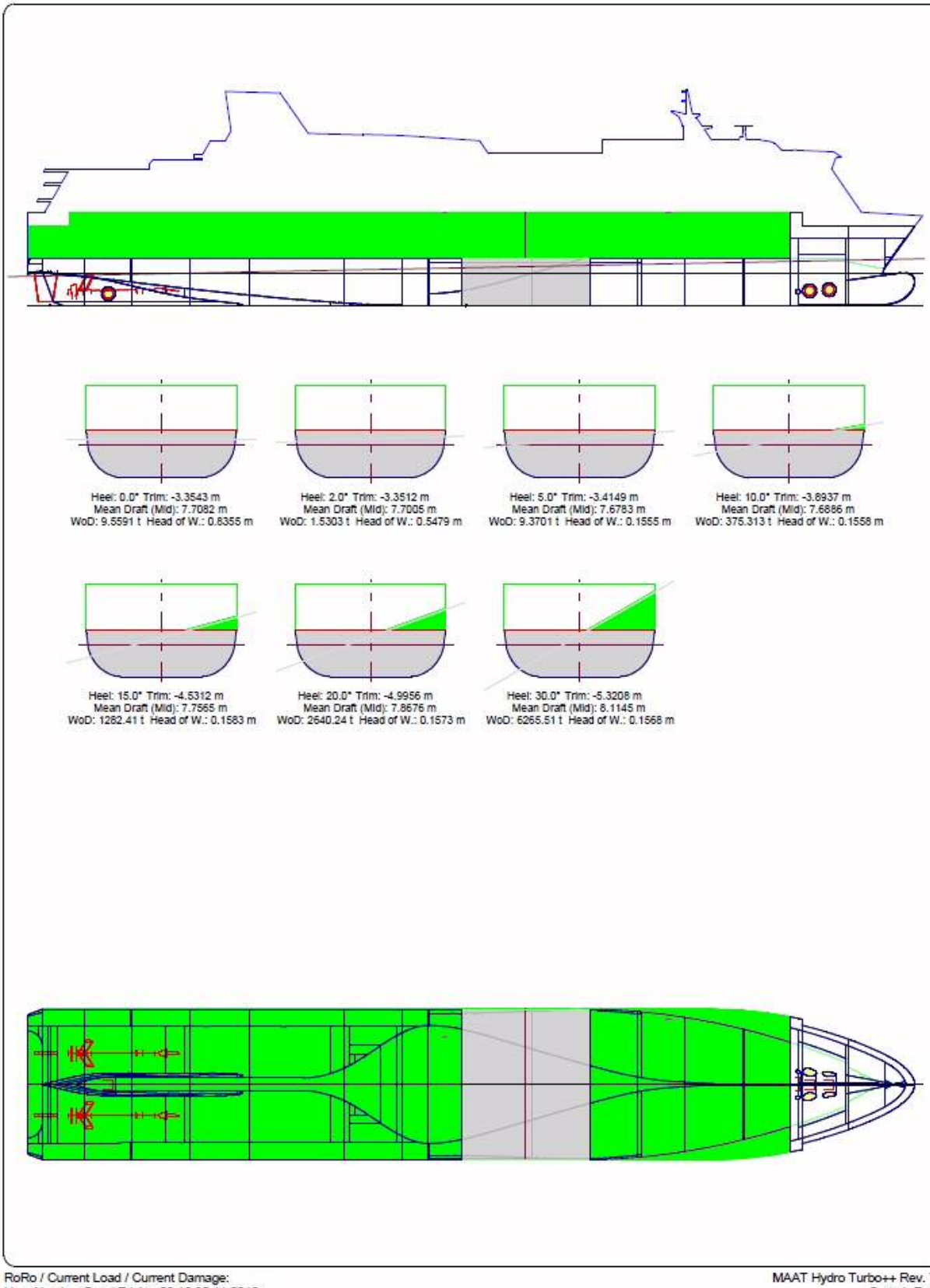
Name:	Pct:	Mu:	Rô:	Xmin:	Xmax:	Weight:	VCG:	LCG:	TCG:	FSMt:
Car deck	0%	90%	1.025	-4.5780	151.800	9.5585	9.7487	149.208	-0.0002	4383.68
Total (Liquid Load):						9.5585	9.7487	149.208	-0.0002	4383.68
Total Dead Weight:						9.5585	9.7487	149.208	-0.0002	4383.68
Light Ship:						19611.3	15.3075	81.1071	0.0000	
Total Weight:						19620.9	15.3048	81.1403	0.0000	4383.68

RoRo / Current Load / Current Damage:
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3.20.c.4: Free Surfaces Analysis:

Forms: RoRo - Damaged RoRo Compartment: Car deck / Length in m, Volume in m3, Weight in t
Raw Vol.: 43434.5 LCG: 73.7302 TCG: 0.0000 VCG: 14.3228 Max FSMt: 38824.0

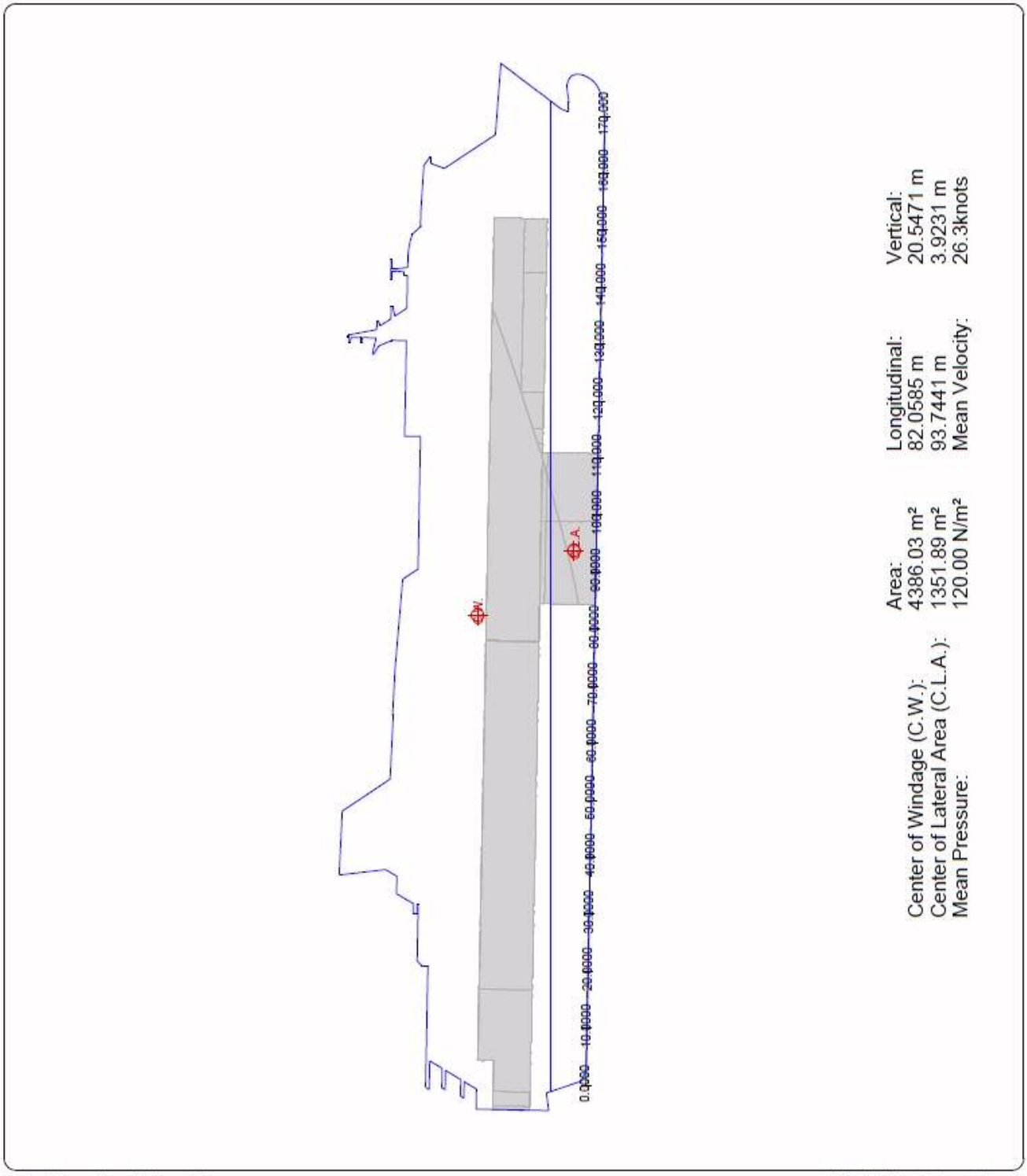


RoRo / Current Load / Current Damage:
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3.20.c.5: Silhouette Analysis:

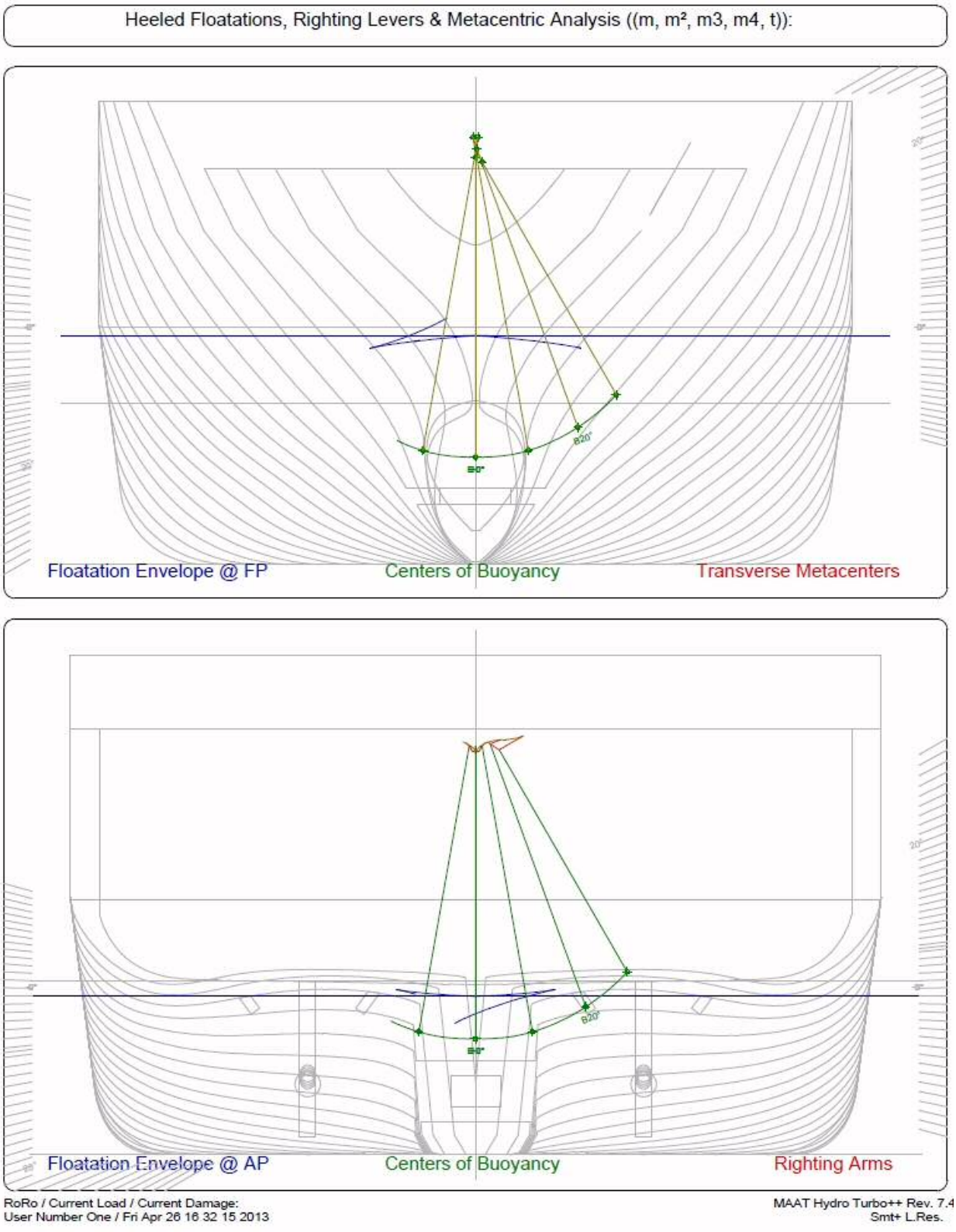
Silhouette Analysis:
Wind: 26.3 knots (constant), Displacement: 19620.9 t, LCG: 81.1403 m, VCG: 15.3048 m
Heel = -0.000°, AP @ 0.0000, DAP: 6.0310, FP @ 170. 800, DFP: 9.3853, Trim: -3.3543 m



RoRo / Current Load / Current Damage:
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3.20.c.6: GZ / Metacenters Diagram:



3.20.d Limitations:

The calculated model must comply with the Water on Deck modeling rules (see the FAQ for more details) and be realistic in terms of weight and buoyancy.

3.20.e Typical use:

Calculating stability with water on deck (typically SOLAS 2004 / Stockholm Agreement).

3.20.f Example:

Open a project complying with the Water on Deck modeling rules and select it to calculate its stability data:

- Select '**/Tools/WoD Stability**' in the menu bar.
- Click on the **[Criterion]** button, select the 'SOLAS 2004 Stockholm' criterion, and validate it.
- Input criterion's associated data in the right grid.
- Input a realistic heel range in the '**Min**', '**Max**' and '**Step**' fields.
- Set the damage extent in the '**Xmin'** / '**Xmax**' fields.
- Click on the **[OK]** button and check the obtained reports.

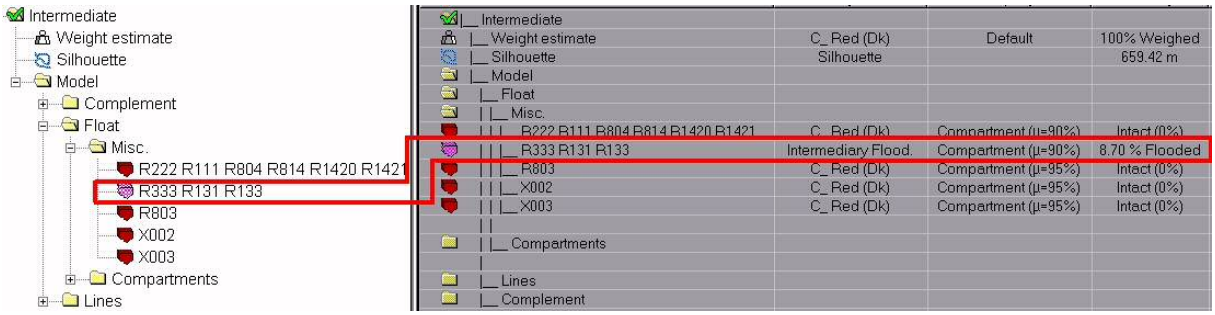
3.21 ***Intermediate Flooding Stages:***

3.21.a Purpose:

Intermediate Flooding Stage calculations allow calculating ship's stability when certain compartments are flooded progressively. Such progressive floodings usually result from a primary damage, through openings, pipes, leaks, etc…

In order to process such secondary damages accurately, their liquid effect must be taken into account at different intermediate stages, as the inflow is assumed to remain in the flooded compartment(s) like in tank(s).

As the lost buoyancy approximation is therefore no longer sufficient (see the FAQ about this) for these calculations, such compartments must be identified by setting their layer to the 'Intermediate Flooding Layer' declared in [Ship] tab's [Hydro] page to allow their special process (i.e. converting them into tanks before calculation, and calculating their content automatically, according to final equilibrium's floatation and their intermediate flooding ratio):



MAAT Hydro's 'Intermediate Flooding Stages' function therefore allows repeating this special stability calculation automatically by setting incrementally the intermediate damaged compartments (i.e. compartments identified by setting their

layer to the ‘Intermediate Flooding Layer’) from the intact state (flooding ratio = 0%) to the final state (flooding ratio = 100%).

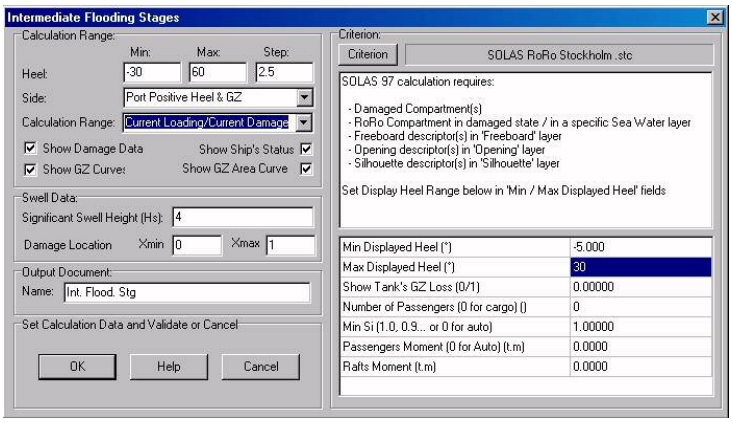
Please, notice that the ‘Transverse Stability’ function also processes the intermediate damaged compartments automatically (i.e. converts them into tanks whose content will be calculated according to final equilibrium’s floatation and intermediate flooding ratio), but only for their current flooding ratio, instead of providing a complete stability analysis in the 0% - 100% flooding range.

Moreover, it is also important to notice that MAAT Hydro’s stability calculation functions (including ‘Dredge Stability’ and ‘WoD stability’) are the only ones providing this automatic conversion, and that the other functions simply process such intermediate damages as ordinary lost buoyancy damages (by example, see Hydrostatic Viewport).

At last, the ‘Intermediate Flooding Stage’ calculation is refused if current ship doesn’t contain any intermediate damaged compartment and, as the intermediate damaged compartments are automatically converted into tanks before the stability calculation, their ‘Intermediate Flooding Layer’ must be declared with the same density than the flooding water on [Ship] tab’s [Layers] page (usually ‘Sea Water’).

3.21.b Inputs:

This Dialog Box allows setting the cross curve calculation options:



The [**Criterion]** button allows selecting the stability criterion among the available STC scripts (the associated data must be set after this selection). It is recalled that the data listed in the reports correspond to criterion’s ‘Print’ and ‘Test’ statements.

The ‘**Heel**’ ‘**Min**’, ‘**Max**’ and ‘**Step**’ fields allow defining the stability heel range to calculate. This range must, of course, be thought in order to allow calculating the selected criterion for all the selected damages and loads.

The ‘**Side**’ selector allows defining on which side the stability has to be calculated.

The '**Calculation Range**' selector allows selecting for which conditions the Intermediate Flooding Calculations will be repeated:

- **'Current Loading / Current Damage**': Calculates the Intermediate Flooding reports for the current load and damage only.

- **'All Loadings / Current Damage**': Calculates the Intermediate Flooding reports obtained by combining all the present 'Loading Conditions' with the current damage.

- **'Current Loading / All Damages**': Calculates the Intermediate Flooding reports obtained by combining all the present 'Damage Conditions' with the current loading.

- **'All Loadings / All Damages**': Calculates the Intermediate Flooding reports obtained by combining all the present 'Loading Conditions' with all the present damages.

The '**Show Damage Data**' check box allows including / removing a damage detailed list in the results (see 3.21.c.3 below).

The '**Show Ship's Status**' check box allows including / removing a ship status report in the results (see 3.21.c.4 below).

The '**Show GZ Curve**' check box allows including / removing the GZ curve in/from the stability diagram (see 3.21.c.1 below).

The '**Show GZ Area Curve**' check box allows including / removing the GZ Area curve in/from the stability diagram (see 3.21.c.1 below).

The '**Swell Data**' frame only activates when a WoD criterion is selected, allowing to specify swell's height *Hs* and current damage's '**Xmin**' and '**Xmax**' limits (when the calculations must be repeated for all the current damages, attention must be paid to the fact that the damage limits must preliminarily be set individually in their 'Xmin' /'Xmax' fields on the [Data] page).

The '**Output Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report. Nevertheless, as this calculation may be time consuming, a confirmation box recalls the number of stability calculations before starting.

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.21.c Outputs:

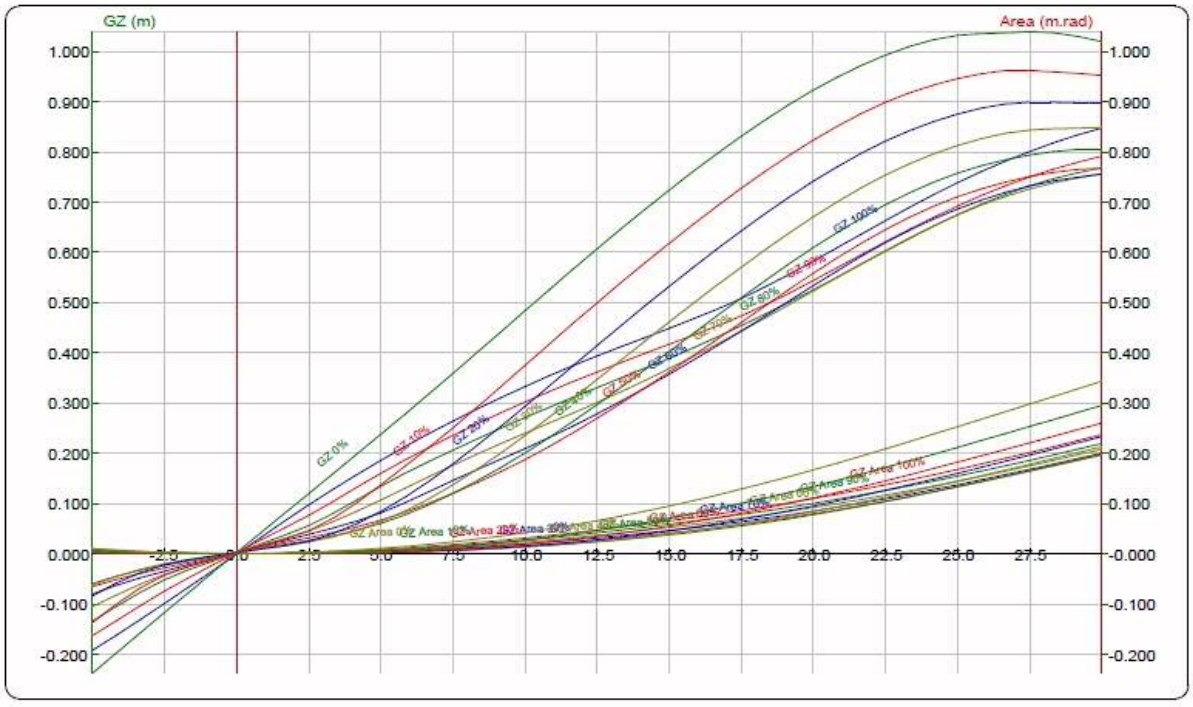
The Intermediate Flooding Stages outputs are the followings:

3.21.c.1: Intermediate Flooding Stability Curves:

Criterion's *Test*ed results are listed in a table at the bottom of this report:

Intermediate Flooding Stages (individual inflows) Forms Ship / Intermediate:
Variable / Real FSM, Heel on PS, K Point at: 0.000 m, Water Density: 1.0250, Length in m, Weights in t
No Lost Buoyancy
Added Sea Water in: R333 R131 R133, R511 R513 R521 R523, R601, R602, R603, R604, R609, R611,
No Water on Deck

Ship Data @ Equilibrium:			Solid Weight:	13216	LCGs:	87.978	TCGs:	0.007	VCGs:	12.000
Flooding:	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Heel °	-0.043	-0.127	-0.256	-0.286	-0.248	-0.200	-0.162	-0.134	-0.106	-0.073	0.027
MP Draft	5.012	5.067	5.121	5.175	5.227	5.279	5.331	5.381	5.431	5.480	5.529
Trim	-0.012	0.166	0.337	0.504	0.665	0.819	0.966	1.106	1.240	1.367	1.486
GMtc	2.688	0.665	0.451	0.475	0.593	0.711	0.857	1.015	1.194	1.375	2.163
Min FBd	4.073	3.917	3.744	3.596	3.466	3.343	3.223	3.104	2.990	2.880	2.779
Total Wgt	13216	13429	13642	13855	14068	14281	14495	14708	14921	15134	15347
LCGt	87.978	87.515	87.061	86.619	86.190	85.772	85.367	84.973	84.590	84.217	83.857
TCGt	0.007	0.003	-0.004	-0.007	-0.005	-0.003	-0.001	0.000	0.002	0.003	0.010
VCGt	12.000	11.837	11.687	11.547	11.416	11.295	11.183	11.079	10.983	10.895	10.815
F.S.M. t.	0.00	29294	34811	37719	38720	39710	40295	40719	40672	40760	31472



Criterion: SOLAS 2004

Flooding:	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
[Eq-Dfl] Range > 15.000	48.933	47.026	47.162	47.198	47.164	47.117	47.077	47.051	47.025	46.995	46.898
[Eq-27] Area > 0.015	0.289	0.245	0.213	0.189	0.171	0.159	0.158	0.161	0.169	0.179	0.194
GZmax > Max(psg, rft) 0.067		0.959	0.894	0.837	0.786	0.742	0.723	0.716	0.721	0.738	0.788
GM0c > 0.050	2.688	0.665	0.451	0.475	0.593	0.711	0.857	1.015	1.194	1.375	2.163
Ship balance < 12.000	0.043	0.127	0.256	0.286	0.248	0.200	0.162	0.134	0.106	0.073	0.027
Res. Fbd > 0.076	4.073	3.917	3.744	3.596	3.466	3.343	3.223	3.104	2.990	2.880	2.779

Ship / Current Load / Current Damage:
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3.21.c.2: Intermediate Flooding Stability Results:

This report lists criterion's *Print*ed results in a table for the intermediate flooding stages:

Intermediate Flooding Stages Forms Ship / Intermediate:
Variable / Real FSM, Heel on PS, K Point at: 0.000 m, Water Density: 1.0250, Length in m, Weights in t

Flooding:	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Passengers Moment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windage Area	4866.4	4855.9	4845.7	4835.5	4825.6	4815.7	4806.0	4796.4	4786.9	4777.5	4768.2
Equilibrium	-0.043	-0.127	-0.256	-0.286	-0.248	-0.200	-0.162	-0.134	-0.106	-0.073	0.027
Nb of Dmg Compts	0	0	0	0	0	0	0	0	0	0	0
GZpsg	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Rafts Moment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Windage Ctr Hght	18.474	18.503	18.531	18.559	18.586	18.613	18.640	18.666	18.691	18.717	18.742
Thetanu	58.456	58.778	59.005	59.281	59.655	60.000	60.000	60.000	60.000	60.000	60.000
Limit	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000
GZrft	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Downfl.	46.891	46.899	46.907	46.912	46.916	46.917	46.915	46.917	46.919	46.923	46.925
Downfl.	46.891	46.899	46.907	46.912	46.916	46.917	46.915	46.917	46.919	46.923	46.925
GZwnd	0.112	0.111	0.109	0.108	0.107	0.106	0.105	0.104	0.103	0.102	0.101
Number of Damaged Compartment(s)	8	8	8	8	8	8	8	8	8	8	8
Windage Moment	950.9	949.0	947.0	945.1	943.2	941.3	939.5	937.7	935.8	934.1	932.3
Half Draft	2.506	2.534	2.561	2.588	2.614	2.640	2.665	2.691	2.716	2.740	2.764

Ship / Current Load / Current Damage:
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3.21.c.3: Damage Data:

Ship Status / Ship / Intermediate

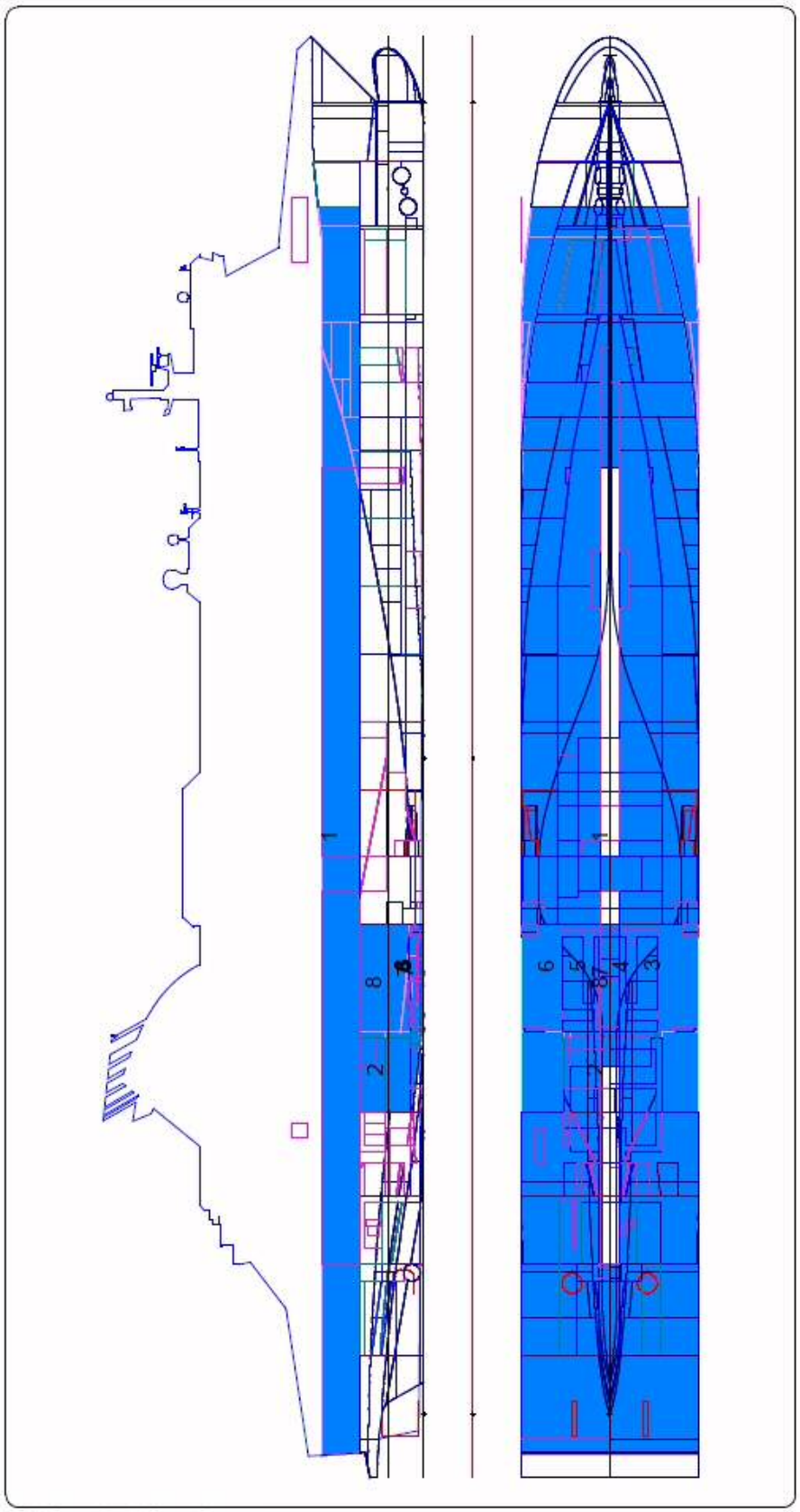
Buoyant Component:	Raw Volume: (m3)	Mu:	Quantity:	Hydro Volume: (m3)	LCV: (m)	TCV: (m)	VCV: (m)
R506	10.325	95.0%	Intact (0%)	10.325	52.803	1.103	0.981
R507	17.503	95.0%	Intact (0%)	17.503	52.821	4.302	1.106
R508	12.592	95.0%	Intact (0%)	12.592	44.516	3.859	1.397
R509	10.325	95.0%	Intact (0%)	10.325	52.803	-1.103	0.981
R511 R513 R521 R523	989.24	95.0%	0%-100% of Final	Intermediary			
X500	1298.8	95.0%	Intact (0%)	1298.8	45.146	-0.678	5.514
X501	7.408	95.0%	Intact (0%)	7.408	46.400	-2.724	1.180
X502	0.608	95.0%	Intact (0%)	0.608	43.690	-6.129	1.719
X503	0.608	95.0%	Intact (0%)	0.608	43.690	6.129	1.719
R601	21.265	95.0%	0%-100% of Final	Intermediary			
R602	21.800	95.0%	0%-100% of Final	Intermediary			
R603	21.800	95.0%	0%-100% of Final	Intermediary			
R604	21.800	95.0%	0%-100% of Final	Intermediary			
R605	37.076	95.0%	Intact (0%)	37.076	57.990	0.000	1.012
R606	15.210	95.0%	Intact (0%)	15.210	63.212	-0.001	1.062
R608	20.921	95.0%	Intact (0%)	20.921	66.010	0.001	1.089
R609	228.38	95.0%	0%-100% of Final	Intermediary			
R611	2869.4	85.0%	0%-100% of Final	Intermediary			
R6019	265.58	95.0%	Intact (0%)	265.58	61.295	0.000	0.966
X601	1.787	95.0%	Intact (0%)	1.787	54.405	10.207	1.508
X602	1.787	95.0%	Intact (0%)	1.787	54.405	-10.207	1.508
X603	4.274	95.0%	Intact (0%)	4.274	68.358	11.230	1.074
X604	4.274	95.0%	Intact (0%)	4.274	68.358	-11.230	1.074
R701	54.915	95.0%	Intact (0%)	54.915	76.400	-3.001	0.650
R702	60.540	95.0%	Intact (0%)	60.540	75.026	4.136	0.650
R703	46.231	95.0%	Intact (0%)	46.231	71.599	-3.703	0.650
R704	23.088	95.0%	Intact (0%)	23.088	70.400	3.700	0.650
R709 R710	93.596	95.0%	Intact (0%)	93.596	74.550	0.000	0.676
R711 R721 R722	1665.0	85.0%	Intact (0%)	1665.0	73.803	0.041	5.026
X701	1.483	95.0%	Intact (0%)	1.483	72.000	10.461	0.991
X702	1.483	95.0%	Intact (0%)	1.483	72.000	-10.461	0.991
R814.1	17.400	95.0%	Intact (0%)	17.400	80.000	2.650	2.750
R814.2	24.360	95.0%	Intact (0%)	24.360	80.000	5.650	2.750
R7011	261.80	95.0%	Intact (0%)	261.80	89.158	-4.341	1.154
R7012	261.77	95.0%	Intact (0%)	261.77	89.157	4.340	1.154
R812	869.82	95.0%	Intact (0%)	869.82	84.255	-0.211	3.537
R822	1444.9	60.0%	Intact (0%)	1444.9	85.226	-0.712	7.108
R7019	50.646	95.0%	Intact (0%)	50.646	83.660	-9.486	0.680
R7020	50.639	95.0%	Intact (0%)	50.639	83.659	9.486	0.680
R809 R810	203.34	95.0%	Intact (0%)	203.34	93.043	0.000	1.432
R815	320.52	95.0%	Intact (0%)	320.52	93.199	-9.949	5.826
R816	320.52	95.0%	Intact (0%)	320.52	93.199	9.949	5.826
R801	254.12	95.0%	Intact (0%)	254.12	107.06	-4.387	1.369
R802	254.12	95.0%	Intact (0%)	254.12	107.06	4.387	1.369
R909 R910	148.28	95.0%	Intact (0%)	148.28	102.44	0.000	1.619
R911 R912	637.47	95.0%	Intact (0%)	637.47	102.78	0.000	5.841
R1019 R1020	698.67	95.0%	Intact (0%)	698.67	112.29	0.000	5.451

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3.21.c.4: Ship's Status:

Damage Data Forms Ship / Current Damage:



Damage: Current Damage, (Data in m, m3, t.m.):

#	Name:	Status:	Raw Vol.	Wat. Vol.	Wat. x	Wat. y	Wat. z	FSMt	Xmin	Xmax	Ymin	Ymax	Zmin	Zmax
1	R333 R131 R133	Variable	21825	0%-100% of Final					-5.871	170.80	-12.500	12.500	9.100	14.950
2	R511 R513 R521 R523	Variable	989.24	0%-100% of Final					42.800	54.000	-12.500	12.500	0.438	9.100
3	R601	Variable	21.265	0%-100% of Final					58.000	68.400	-8.350	-6.720	0.650	2.208
4	R602	Variable	21.800	0%-100% of Final					58.000	68.400	-3.850	-2.220	0.650	2.208
5	R603	Variable	21.800	0%-100% of Final					58.000	68.400	2.220	3.850	0.650	2.208
6	R604	Variable	21.800	0%-100% of Final					58.000	68.400	6.720	8.350	0.650	2.208
7	R609	Variable	228.38	0%-100% of Final					54.000	69.200	-12.500	12.500	0.000	2.208
8	R611	Variable	2869.4	0%-100% of Final					49.200	69.200	-12.500	12.500	1.250	9.100
	Total:		25999						-5.871	170.80	-12.500	12.500	0.000	14.950

Ship / Current Load / Current Damage:
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3.21.d Limitations:

- For layout reasons, the intermediate flooding range is fixed to 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%.

- The damage and loading condition(s) must be realistic.

3.21.e Typical use:

Calculating ship's Intermediate flooding Stages for current load / damage conditions or for the combinations of the present Loading Conditions and Damage Conditions.

3.22.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship.

- Click on the [Hydro] lower button to display the hydrostatic viewport and notice compartment 'C4''s buoyancy loss on the green S.A.C.

- Click on the lower [Data] tab and expand 'Damage 100% Supply' in the 3D browser to display its content.

- Set compartment 'C4''s flooding to 50% with the 'Quantity' selector.

- Select '/Tools/Transverse Stability' in the menu bar, press [Enter] to validate the default parameters and notice the incidence of the 50% buoyancy loss on the current SAC.

- Close the stability results dialog box and set compartment 'C4''s layer to 'Intermediary Flood.' with [Data] page's 'Layer' selector.

- Select '/Tools/Transverse Stability' again in the menu bar, press [Enter] to validate the default parameters and now, notice the incidence of compartment 'C4''s inflow on the red weight curve during the calculation, while SAC's buoyancy loss simultaneously disappears. Notice that both SAC and weight curves return to their initial state when the calculation is finished.

- Compare these stability results with the previous ones.

- Close the stability results dialog box and select '/Tools/Intermediate Flooding Stages' in the menu bar.

- Click on the [Criterion] button, select the 'SOLAS 2004 Basic.stc' criterion, and directly click on the [OK] button to start the calculation with the default

parameters (as the hydrostatic viewport is not updated during this calculation, controlling SAC and weight curves is useless).

- Check the 'Intermediate Flooding Stages' reports when they are displayed on the [2D] pages.

- Set compartment 'C4''s layer to its initial layer with [Data] page's 'Layer' selector and try re-starting '/Tools/Intermediate Flooding Stages' in the menu bar: The function is now refused, as no intermediate damaged compartment is present (the same result would be obtained with a 0% flooding).

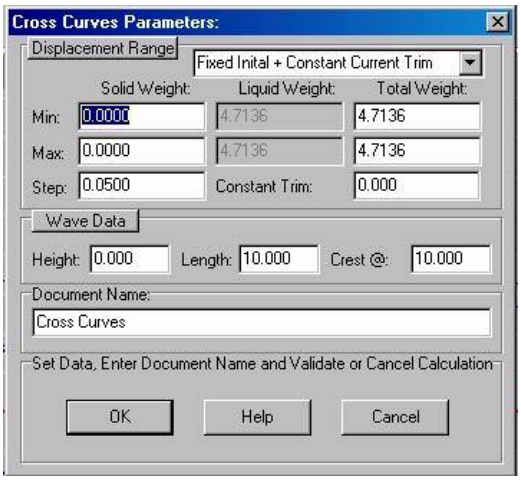
3.22 *Cross Curves:*

3.22.a Purpose:

This function allows calculating ship's cross curves according to current ship's status and load, with a fixed or free trim.

3.22.b Inputs:

This Dialog Box allows setting the cross curve calculation options:



The [**Displacement Range]** button allows presetting the displacement range automatically, according to its current value.

The upper selector allows selecting the equilibrium calculation mode among the followings:

- '**Fixed Initial + Constant Current Trim**': This option allows calculating fixed trim cross curves with a fixed initial trim, which means that the trim specified in the '**Constant Trim**' input field will be conserved at any heel angle. In this case, Ship's immersion is the only equilibrium parameter used for the cross curves calculations.

- '**Fixed Initial + Free Current Trim**': This option allows calculating free trim cross curves with a fixed initial trim, which means that the current center of gravity will be assumed to be the center of buoyancy obtained for the current displacement and the trim specified in the '**Initial Trim**' input field. In this case, Ship's trim and immersion are the equilibrium parameters used for the cross curves calculations.

- '**Free Initial + Free Current Trim**': This option allows calculating free trim cross curves with a free initial trim, which means that current load's center of gravity will be assumed to be the calculation center of gravity for all the displacement range. In this case, Ship's trim and immersion are the equilibrium parameters used for the cross curves calculations.

The '**Min**', '**Max**' and '**Step**' input fields allow defining the displacement range, the minimum and maximum displacements being displayed with and without current tank's weight.

The '**Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

Moreover, although generally unused, an optional sinusoidal swell can also be defined in the 'Wave Data' frame:

- The [**Wave Data]** button allows resetting the wave data to the 'flat' state.

- The '**Amplitude**' field allows defining swell's amplitude, which corresponds to the half-height (i.e. amplitude = 0.5 m when swell is 1 m high).

- The **'Length**' field allows defining swell's wave length (i.e. crest to crest distance).

- The '**Crest @**' field allows defining swell's phase (i.e. locating one of its crests in ship's referential).

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's data and creating the corresponding report.

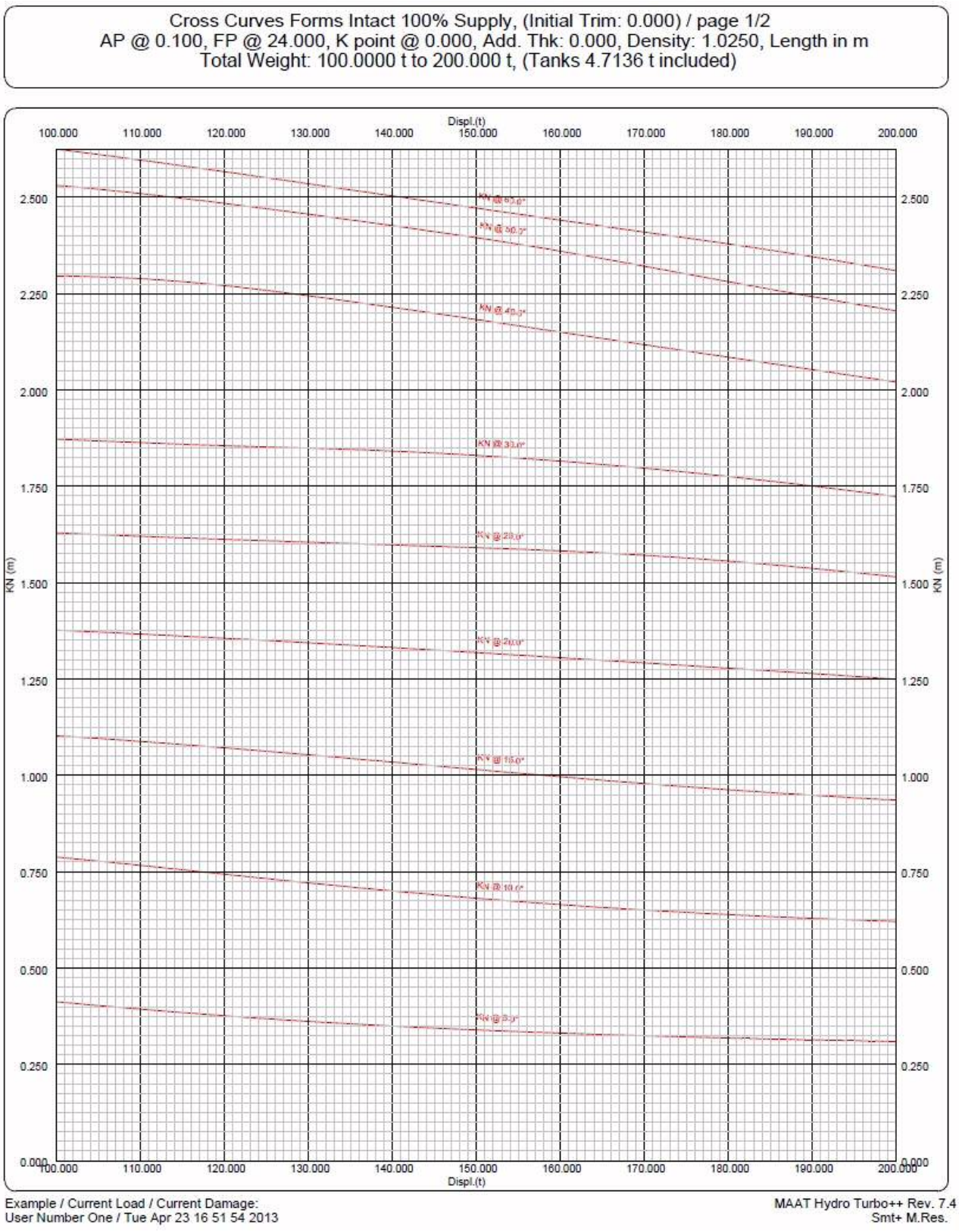
The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.22.c Outputs:

The Cross Curve outputs are the followings:



Cross Curves Forms Intact 100% Supply (Initial Trim: 0.000) page 2/2
AP @ 0.100, FP @ 24.000, K point @ 0.000, Add. Thk: 0.000, Density: 1.0250, Length in m, Weight in t
Total Load: 100.000 to 200.000, (Tanks 4.7136 t included)

Displ.Mld	DAP	DFP	DMP	KN 5°	KN 10°	KN 15°	KN 20°	KN 25°	KN 30°	KN 40°	KN 50°	KN 60°
100.0000	1.497	1.514	1.505	0.412	0.788	1.103	1.377	1.629	1.872	2.296	2.531	2.624
102.500	1.516	1.534	1.525	0.407	0.782	1.099	1.374	1.627	1.870	2.295	2.526	2.618
105.000	1.536	1.554	1.545	0.402	0.777	1.095	1.372	1.624	1.867	2.293	2.520	2.611
107.500	1.555	1.574	1.565	0.398	0.772	1.092	1.369	1.622	1.865	2.291	2.515	2.603
110.000	1.575	1.594	1.585	0.393	0.766	1.088	1.366	1.620	1.863	2.288	2.509	2.596
112.500	1.594	1.614	1.604	0.389	0.761	1.084	1.364	1.618	1.861	2.285	2.503	2.589
115.000	1.614	1.634	1.624	0.384	0.755	1.080	1.361	1.616	1.859	2.281	2.497	2.581
117.500	1.633	1.654	1.643	0.380	0.749	1.075	1.358	1.614	1.857	2.276	2.490	2.573
120.000	1.653	1.673	1.663	0.376	0.743	1.071	1.355	1.612	1.855	2.270	2.484	2.566
122.500	1.672	1.693	1.683	0.372	0.738	1.067	1.353	1.610	1.853	2.264	2.477	2.558
125.000	1.691	1.713	1.702	0.368	0.732	1.062	1.350	1.608	1.852	2.258	2.470	2.550
127.500	1.711	1.732	1.722	0.365	0.726	1.058	1.347	1.607	1.850	2.251	2.463	2.542
130.000	1.730	1.752	1.741	0.361	0.721	1.053	1.344	1.605	1.849	2.244	2.456	2.535
132.500	1.749	1.772	1.760	0.358	0.715	1.048	1.341	1.603	1.847	2.237	2.448	2.527
135.000	1.769	1.791	1.780	0.355	0.710	1.044	1.338	1.601	1.845	2.229	2.441	2.519
137.500	1.788	1.811	1.799	0.352	0.705	1.039	1.334	1.599	1.843	2.222	2.433	2.511
140.000	1.807	1.830	1.818	0.349	0.700	1.034	1.331	1.598	1.841	2.214	2.426	2.503
142.500	1.826	1.849	1.838	0.347	0.695	1.029	1.328	1.596	1.839	2.206	2.418	2.495
145.000	1.845	1.869	1.857	0.344	0.690	1.024	1.325	1.594	1.836	2.198	2.410	2.487
147.500	1.864	1.888	1.876	0.342	0.685	1.020	1.322	1.592	1.833	2.191	2.403	2.479
150.000	1.884	1.907	1.895	0.339	0.681	1.015	1.318	1.590	1.830	2.182	2.395	2.472
152.500	1.903	1.926	1.914	0.337	0.677	1.010	1.315	1.589	1.826	2.174	2.386	2.464
155.000	1.922	1.945	1.934	0.335	0.672	1.005	1.312	1.587	1.823	2.166	2.378	2.456
157.500	1.941	1.965	1.953	0.333	0.668	1.001	1.308	1.584	1.819	2.158	2.369	2.448
160.000	1.960	1.984	1.972	0.331	0.664	0.996	1.305	1.582	1.815	2.150	2.360	2.440
162.500	1.979	2.003	1.991	0.329	0.661	0.992	1.302	1.580	1.811	2.141	2.350	2.432
165.000	1.998	2.022	2.010	0.327	0.657	0.987	1.298	1.577	1.806	2.133	2.341	2.425
167.500	2.017	2.041	2.029	0.326	0.654	0.983	1.295	1.574	1.802	2.125	2.331	2.417
170.000	2.035	2.060	2.048	0.324	0.650	0.979	1.291	1.571	1.797	2.117	2.321	2.409
172.500	2.054	2.079	2.066	0.323	0.647	0.974	1.288	1.567	1.792	2.109	2.311	2.402
175.000	2.073	2.097	2.085	0.321	0.644	0.970	1.285	1.564	1.786	2.101	2.301	2.394
177.500	2.092	2.116	2.104	0.320	0.641	0.966	1.281	1.560	1.781	2.093	2.291	2.386
180.000	2.111	2.135	2.123	0.318	0.639	0.962	1.278	1.556	1.775	2.085	2.281	2.379
182.500	2.129	2.154	2.142	0.317	0.636	0.959	1.274	1.551	1.769	2.077	2.271	2.371
185.000	2.148	2.173	2.160	0.316	0.633	0.955	1.271	1.547	1.763	2.069	2.261	2.362
187.500	2.167	2.191	2.179	0.315	0.631	0.952	1.267	1.542	1.757	2.061	2.251	2.354
190.000	2.186	2.210	2.198	0.313	0.629	0.948	1.264	1.537	1.750	2.053	2.242	2.345
192.500	2.204	2.229	2.216	0.312	0.627	0.945	1.260	1.532	1.744	2.044	2.232	2.337
195.000	2.223	2.247	2.235	0.311	0.625	0.942	1.257	1.526	1.737	2.036	2.223	2.327
197.500	2.241	2.266	2.254	0.310	0.623	0.939	1.253	1.520	1.730	2.028	2.214	2.318
200.000	2.260	2.284	2.272	0.309	0.621	0.936	1.249	1.515	1.723	2.020	2.205	2.309

Example / Current Load / Current Damage:
User Number One / Tue Apr 23 16 51 55 2013

MAAT Hydro Turbo++ Rev. 7.4
Smt+ M.Res.

3.22.d Limitations:

For layout reasons, heel range is fixed to 5°, 10°, 15°, 20°, 25°, 30°, 40°, 50°, 50°.

The displacement range must be realistic.

3.22.e Typical use:

Calculating ship's Cross Curves.

3.22.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Damage 100% Supply' in the 3D browser to select this virtual ship:
- Select '**/Tools/Cross Curves**' in the menu bar.
- Click on the **[Displacement Range]** button preset a default range.
- Select ' **Constant Inital + Free Current Trim**' in the calculation mode selector.
- Click on the **[OK]** button directly to validate the default settings and start the calculation.
- Check the obtained reports.

3.23 ***Max KGs:***

3.23.a Purpose:

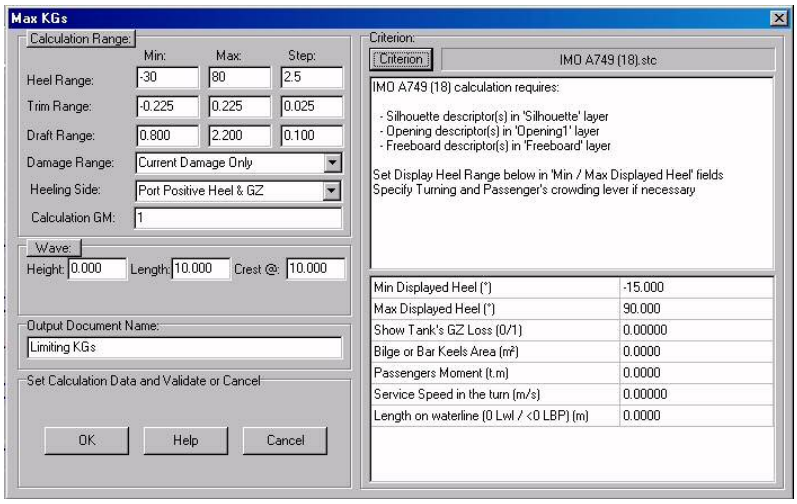
This function allows calculating ship's Max allowable KGs for a given stability criterion, according to current ship's status and loading condition.

When no mass is present in the calculated ship, MAAT Hydro assumes that the center of gravity is located above the intact center of buoyancy corresponding to the current draft and trim and calculates its corresponding critical KG.

When masses are present in the calculated ship, they are considered as its deadweight and a complementary cargo calculation (cargo's maximum allowable weight and KG) is automatically included in the reports.

3.23.b Inputs:

This Dialog Box allows setting the cross curve calculation options:



- The right [**Criterion]** button allows selecting the stability criterion among the available STC scripts (the associated criterion data, displayed below, must be set after this selection).

- The [**Calculation Range]** button allows resetting the heel, trim and draft ranges to their default values.

- The '**Heel Range**' 'Min', 'Max' and 'Step' fields allow defining the stability heel range to calculate. This range must be thought in order to allow calculating the selected criterion for <u>all</u> the damage / trim / draft combinations.

- The '**Trim Range**' 'Min', 'Max' and 'Step' fields allow defining the intact trim range in which the stability criterion will be calculated, in combination with the draft range (see below), for the damages selected in the '**Damage Range**' selector. The smaller the step will be, the sharper will be the Max KG scanning, but the heavier will be the calculations and the amount of results.

- The '**Draft Range**' 'Min', 'Max' and 'Step' fields allow defining the intact draft range in which the stability criterion will be calculated, in combination with the trim range (see above), for all the present damages. The smaller the step will be, the sharper will be the Max KG scanning, but the heavier will be the calculations and the amount of results.

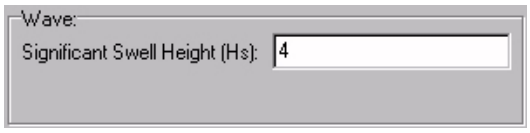
- The '**Damage Range**' selector allows selecting the damage range in which the Max KG calculation will be repeated ('Current Damage Only' is the only available choice for the moment. For automated Max KGs calculations, see '**Deterministic Stability**').

- The '**Heeling Side**' selector allows defining on which side the stability has to be calculated.

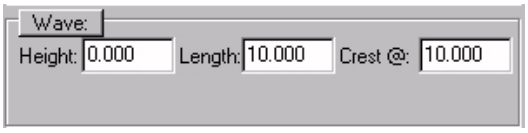
- The '**Calculation GM**' input field allows initializing the VCG before scanning its critical value. The closer this initial value is from the critical one, the faster the Max KG calculation is. Moreover, when the criterion uses Water on Deck, a realistic initial GM value provides more accurate Max KGs (as water on deck causes displacement variations during the stability calculations, Max KG can only be approximated in this case and a realistic initial GM provides better results).

- The content of the '**Wave**' frame depends on the selected criterion:

- If the criterion contains Water on Deck calculations (Stockholm Agreement, …), a '**Significant Swell Height (Hs)**' field is displayed, allowing to input this data:



- In all the other cases, the classical swell parameter fields are displayed (generally useless):



The '**Output Document Name**' input field allows naming the 2D folder in which the resulting reports will be created in the 2D browser.

At last, when all the stability input data are set:

The **[OK]** button can be clicked for calculating ship's Max KG data and creating the corresponding reports. Depending on the presence of masses, a warning box may popup for recalling that cargo calculations may be included in the results. Moreover, as this calculation may be time consuming, a confirmation box recalls the number of stability calculations before starting when it seems critical.

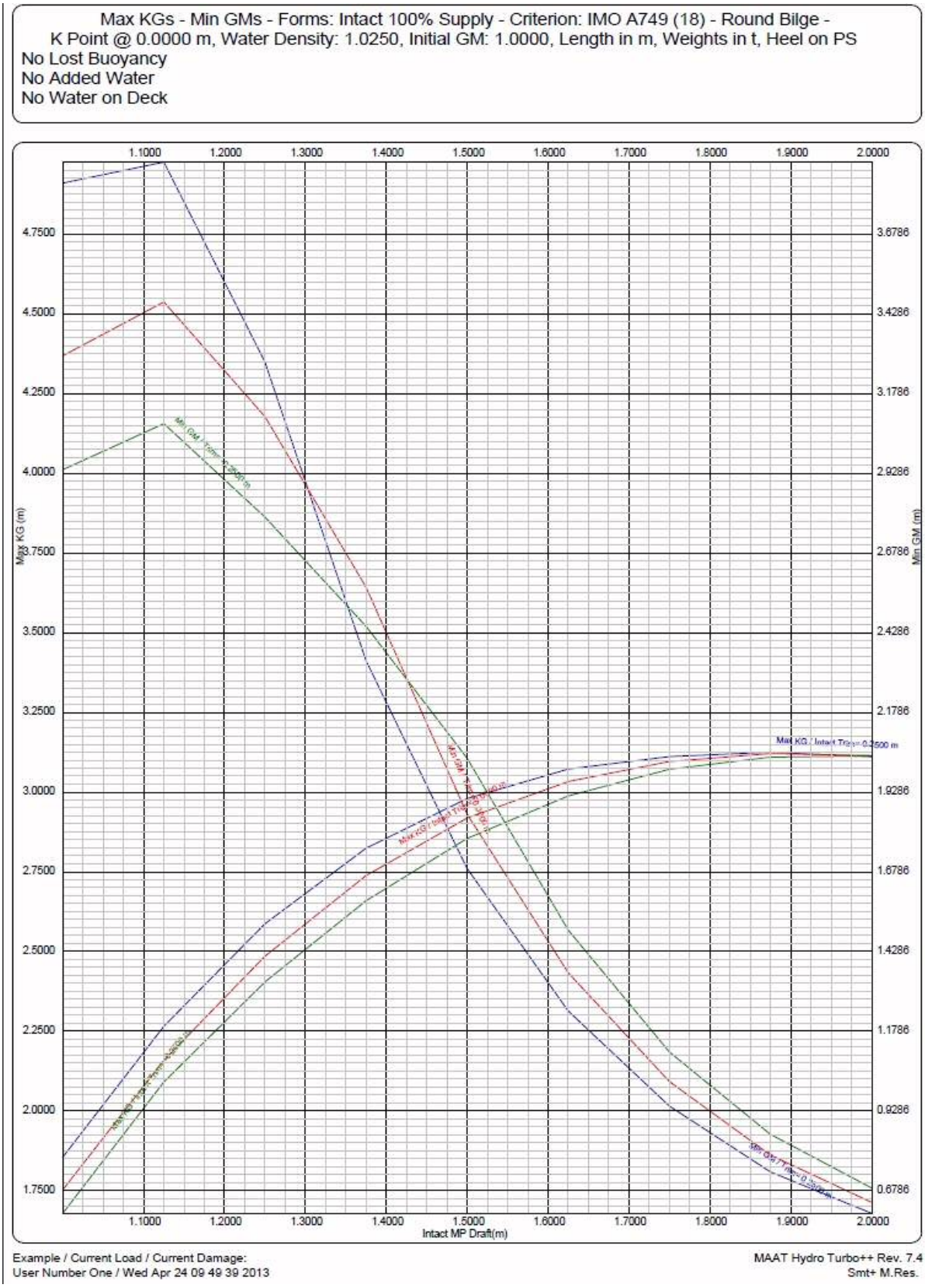
The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the calculation.

Pressing the [Escape] key when calculation is started allows aborting it.

3.23.c Outputs:

The Max KGs outputs are the followings:



Max KGs - Min GMs - Forms: Intact 100% Supply - Criterion: IMO A749 (18) - Round Bilge -
K Point @ 0.0000 m, Water Density: 1.0250, Initial GM: 1.0000, Length in m, Weights in t, Heel on PS
Deadweight: 83.4217, @ x= 10.6536, y= -0.0024, z= 2.6934

Intact Data:

DAP	DFP	DMP	Trim	Displ	LCG	Max KG	Min GM	Cargo	KG Cargo	Limiting Factor
0.8750	1.1250	1.0000	-0.2500	36.7803	12.5657	1.6788	2.9393			'B' Area > 'A' Area
1.0000	1.0000	1.0000	0.0000	37.3600	11.9417	1.7523	3.2970			'B' Area > 'A' Area
1.1250	0.8750	1.0000	0.2500	38.6543	11.2241	1.8550	3.8387			'B' Area > 'A' Area
1.0000	1.2500	1.1250	-0.2500	48.3631	12.2835	2.0905	3.0842			'B' Area > 'A' Area
1.1250	1.1250	1.1250	0.0000	49.7277	11.6480	2.1590	3.4660			'B' Area > 'A' Area
1.2500	1.0000	1.1250	0.2500	52.0684	10.9057	2.2655	3.9042			'B' Area > 'A' Area
1.1250	1.3750	1.2500	-0.2500	61.5621	11.9599	2.4043	2.7911			'B' Area > 'A' Area
1.2500	1.2500	1.2500	0.0000	63.8651	11.3041	2.4845	3.1066			'B' Area > 'A' Area
1.3750	1.1250	1.2500	0.2500	66.9460	10.6048	2.5866	3.2779			'B' Area > 'A' Area
1.2500	1.5000	1.3750	-0.2500	76.1654	11.6143	2.6592	2.4486			'B' Area > 'A' Area
1.3750	1.3750	1.3750	0.0000	79.1304	10.9929	2.7381	2.5714			'B' Area > 'A' Area
1.5000	1.2500	1.3750	0.2500	82.3517	10.4018	2.8237	2.3410			'B' Area > 'A' Area
1.3750	1.6250	1.5000	-0.2500	91.7233	11.3048	2.8545	2.0346	8.3016	4.4733	'B' Area > 'A' Area
1.5000	1.5000	1.5000	0.0000	94.8163	10.7701	2.9186	1.8592	11.3946	4.5673	'B' Area > 'A' Area
1.6250	1.3750	1.5000	0.2500	97.9606	10.2767	2.9799	1.6885	14.5389	4.6233	'B' Area > 'A' Area
1.5000	1.7500	1.6250	-0.2500	107.654	11.0751	2.9882	1.4953	24.2324	4.0029	'B' Area > 'A' Area
1.6250	1.6250	1.6250	0.0000	110.676	10.6207	3.0330	1.3614	27.2546	4.0724	'B' Area > 'A' Area
1.7500	1.5000	1.6250	0.2500	113.749	10.1967	3.0723	1.2416	30.3272	4.1145	'B' Area > 'A' Area
1.6250	1.8750	1.7500	-0.2500	123.758	10.9135	3.0715	1.1130	40.3368	3.8533	'B' Area > 'A' Area
1.7500	1.7500	1.7500	0.0000	126.707	10.5175	3.0956	1.0206	43.2849	3.8706	'B' Area > 'A' Area
1.8750	1.6250	1.7500	0.2500	129.707	10.1448	3.1114	0.9433	46.2853	3.8647	'B' Area > 'A' Area
1.7500	2.0000	1.8750	-0.2500	140.037	10.7979	3.1093	0.8550	56.6158	3.7221	'B' Area > 'A' Area
1.8750	1.8750	1.8750	0.0000	142.907	10.4457	3.1205	0.7898	59.4855	3.7193	'B' Area > 'A' Area
2.0000	1.7500	1.8750	0.2500	145.833	10.1121	3.1251	0.7368	62.4114	3.7022	'B' Area > 'A' Area
1.8750	2.1250	2.0000	-0.2500	156.496	10.7146	3.1135	0.6867	73.0744	3.5930	'B' Area > 'A' Area
2.0000	2.0000	2.0000	0.0000	159.282	10.3963	3.1147	0.6418	75.8599	3.5781	'B' Area > 'A' Area
2.1250	1.8750	2.0000	0.2500	162.127	10.0933	3.1104	0.6074	78.7056	3.5524	'B' Area > 'A' Area

3.23.d Limitations:

The calculated model must be realistic in terms of weight and buoyancy.

The calculation ranges must be thought according to the calculated damage(s) in order to maintain positive buoyancy in any case (i.e. intact displacement associated to current draft and trim must never exceed damaged ship's buoyancy).

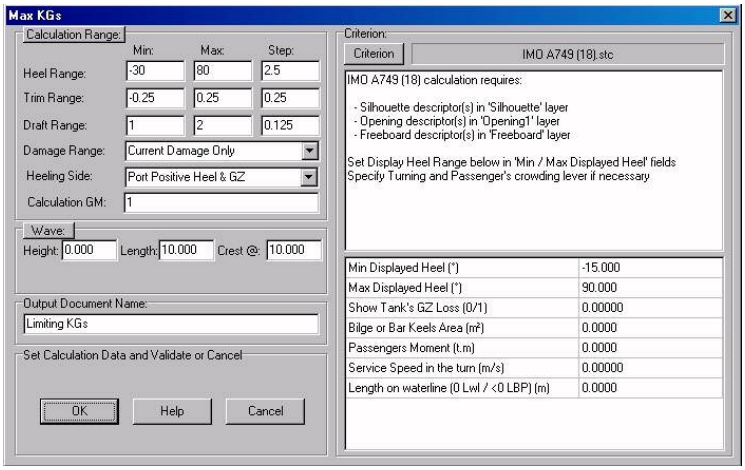
Depending on model's complexity, heavy draft, trim and heel ranges may cause long calculations.

3.23.e Typical use:

Calculating ship's Max KGs.

3.23.f Example:

- Open the 'Example Ship.m2a' file and double click on 'Intact 100% Supply' in the 3D browser to select this virtual ship.
- Delete ship's parent mass in the 3D browser.
- Select '**/Tools/Max KGs**' in the menu bar.
- Set the input parameters as follows:



- Click on the **[OK]** button directly to validate the default settings and confirm your choice to start the calculation.
- Check the obtained reports and notice that the 'Cargo' columns are blank.

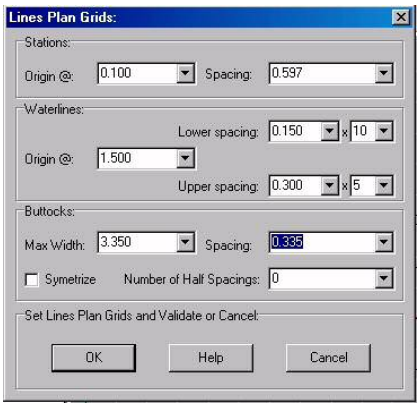
3.24 *Lines Plan Grid:*

3.24.a Purpose:

This function is intended to provide ship's lines presentation plan and main features automatically, according to given sectioning grids. When the grid data are validated, the lines plan is calculated and a 'Lines Presentation Plan Results' dialog box is displayed, allowing to set various layout options in real-time before printing, exporting and/or retaining it among project's 2D data (see 'Lines Presentation Plan Results' below).

3.24.b Inputs:

This Dialog Box allows entering lines plan's sectioning grids:



The '**Stations**' frame allows defining the stations grid:

- The '**Origin @**' input field allows fixing stations grid origin, understood that station's spacing is constant (see 'Spacing' below) and that the grid automatically covers ship's longitudinal extent. The associated selector allows pre-setting this origin from a set of predefined values (x=0, x= AP, x=MP, x=FP), as well as typing any specific value.

- The '**Spacing**' input field allows fixing stations grid's constant spacing, understood that the number of stations is automatically set to cover ship's longitudinal extent. The associated selector allows pre-setting this spacing from a set of predefined values (LBP/10, LBP/20, LBP/40, LBP/50, LBP/80, LBP/100), as well as typing any specific value.

The '**Waterlines**' frame allows defining the waterlines grids:

- The '**Origin @**' input field allows fixing waterline grid's vertical origin, understood that different spacings can be specified independently below and above this origin (see below). The associated selector allows pre-setting directly this origin to the current Dwl height if necessary.

- The '**Lower Spacing**' input field allows fixing waterlines constant spacing below the vertical origin, understood that the number of these lower waterlines can be specified in the 'x' input field located beside. The associated selector allows pre-setting this spacing from a set of predefined values (Draft/5, Draft /10, Draft /20), as well as typing any specific value.

- The '**x**' input field allows specifying the number of immersed waterlines. The associated selector allows pre-setting this number from a set of predefined values (0, 5, 10, to reach K point, to reach ship's lowest point), as well as typing any specific value.

- The '**Upper Spacing**' input field allows fixing waterlines constant spacing above the vertical origin, understood that the number of these topside waterlines can be specified in the 'x' input field located beside. The associated selector allows pre-setting this spacing from a set of predefined values (Draft/5, Draft /10, Draft /20), as well as typing any specific value.

- The '**x**' input field allows specifying the number of topside waterlines. The associated selector allows pre-setting this number from a set of predefined values (0, 5, 10, to reach ship's highest point), as well as typing any specific value.

The '**Buttocks**' frame allows defining the buttocks grid:

- The '**Max Width**' input field allows locating the buttocks grid limit and the associated selector allows pre-setting this width automatically to current model's Bmax if necessary, as well as typing any specific value.

- The '**Spacing**' input field allows fixing buttock grid's constant spacing, understood that the number of buttocks is automatically set to reach the specified 'Max Width' (see above) and that a certain number of additional 'half-spacing' buttocks can be added beside the Centreline (see below). The associated selector allows pre-setting this spacing from a set of predefined values (Bmax/5, Bmax/10, Bmax/20), as well as typing any specific value.

- The '**Number of Half-Spacing**' input field allows specifying the number of addition 'half-spacing' buttocks to insert in the grid beside the centreline. By default, no half spacing buttock is added, but the associated selector allows pre-setting this number from a set of predefined values (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10), as well as typing any specific value.

- By default, the buttocks are created on portside (Y>0) but, if necessary, the '**Symmetrize**' check box allows setting the buttocks symmetrically on both sides.

At last, when all the sectioning grids are defined:

The **[OK]** button can be clicked for calculating ship's lines plan and displaying it in the Lines Plan Results dialog box (see below).

The **[Help]** button allows displaying the online help (Internet access necessary).

The **[Cancel]** button allows cancelling the function.

3.24.c Outputs:

After clicking on the **[OK]** button, the lines plan calculation starts according to the entered data and the Lines Plan Results dialog box, detailed below, finally pops up, allowing to control lines plan's layout accurately.

3.24.d Limitations:

The sectioning grid parameters must be set with care and the spacings must be large enough to avoid calculating too many lines.

For obvious reasons, zero spacings are refused.

3.24.e Typical use:

Calculating ship's Lines Presentation Plan and main features.

3.24.f Example:

Open the 'Example Ship.m2a' file and double click on 'Intact 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Presentation Plan**' in the menu bar.

- Click on the **[OK]** button directly to validate the default settings and start the lines plan calculation.
- The Lines Presentation Plan Results dialog box then pops up, allowing to set lines plan layout options (see below).

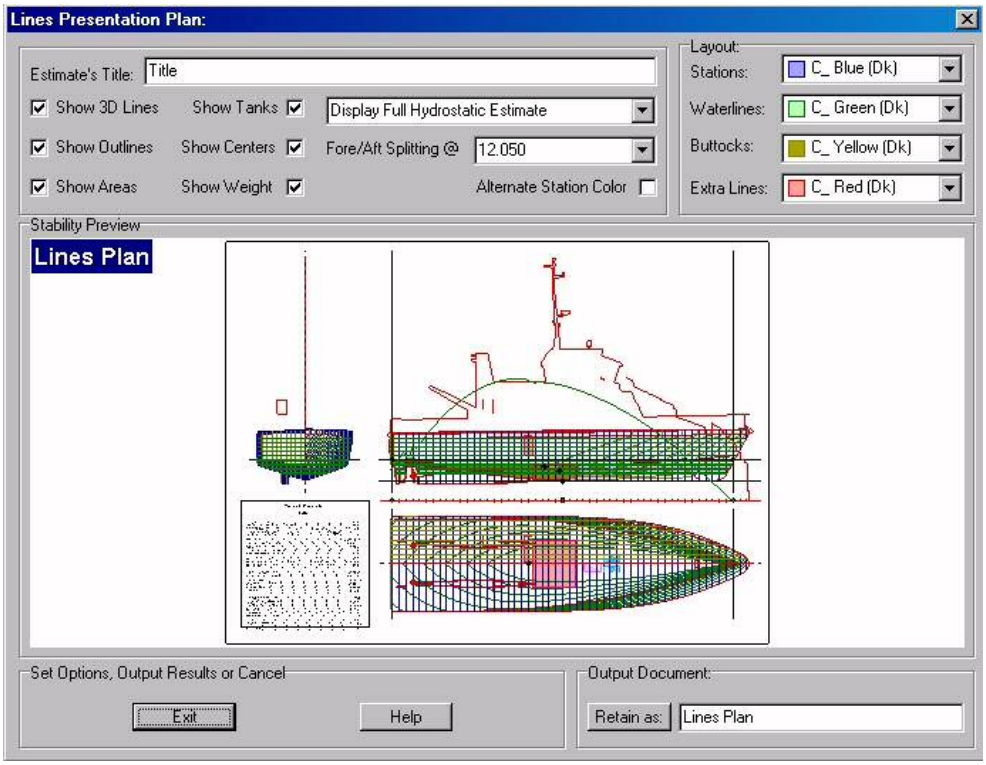
3.25 *Lines Presentation Plan:*

3.25.a Purpose:

This function is intended to provide ship's lines presentation plan automatically, according to the sectioning grids defined in the above described 'Lines Plan Grid' dialog box. When the lines plan is calculated, the 'Lines Presentation Plan' dialog box is displayed, allowing to set various layout options in real-time before printing, exporting and/or retaining it among project's 2D data.

3.25.b Inputs:

This 'Lines Presentation Plan' dialog box is the following:



The '**Show 3D Lines**' checkbox allows displaying or hiding the virtual ship's complementary lines (silhouette, sheer, openings, …).

The '**Show Outlines**' checkbox allows displaying or hiding solid's face outlines.

The '**Show Areas**' checkbox allows displaying or hiding ship's SAC.

The '**Show Tanks**' checkbox allows displaying or hiding ship's tanks.

The '**Show Centers**' checkbox allows displaying or hiding ship's centers (center of buoyancy, center of gravity, …).

The '**Show Weight**' checkbox allows displaying or hiding ship's weight curve.

The '**Estimate Title**' input field allows specifying hydrostatic estimate 's optional title.

The '**Hydrostatic Estimate**' selector allows selecting which kind of hydrostatic estimate must be inserted in the lines plan (default is 'Display Short Hydrostatic Estimate', but 'No Hydrostatic Estimate' is also possible, as well as 'Display Full Hydrostatic Estimate' for a complete estimate).

The '**Fore / Aft Splitting @**' input field allows locating the transverse plane according to which the body plan stations are considered as fore stations (displayed on the right) or after stations (displayed on the left).

The '**Alternate Stations Color**' checkbox allows alternating station's color in order to make their identification easier, especially around the midship area.

The '**Layout**' frame contains the following color selectors:

- The '**Stations**' selector allows selecting the stations color (except if the 'Alternate Stations Color' is checked).

- The '**Waterlines**' selector allows selecting the waterlines color.

- The '**Buttocks**' selector allows selecting the buttocks color.

- The '**Extra Lines**' selector allows selecting the complementary lines (silhouette, sheer, openings, …).

The '**Output Document**' frame allows retaining the current lines presentation plan among the 2D reports by clicking on the **[Retain]** button (the associated input field allows naming the retained report).

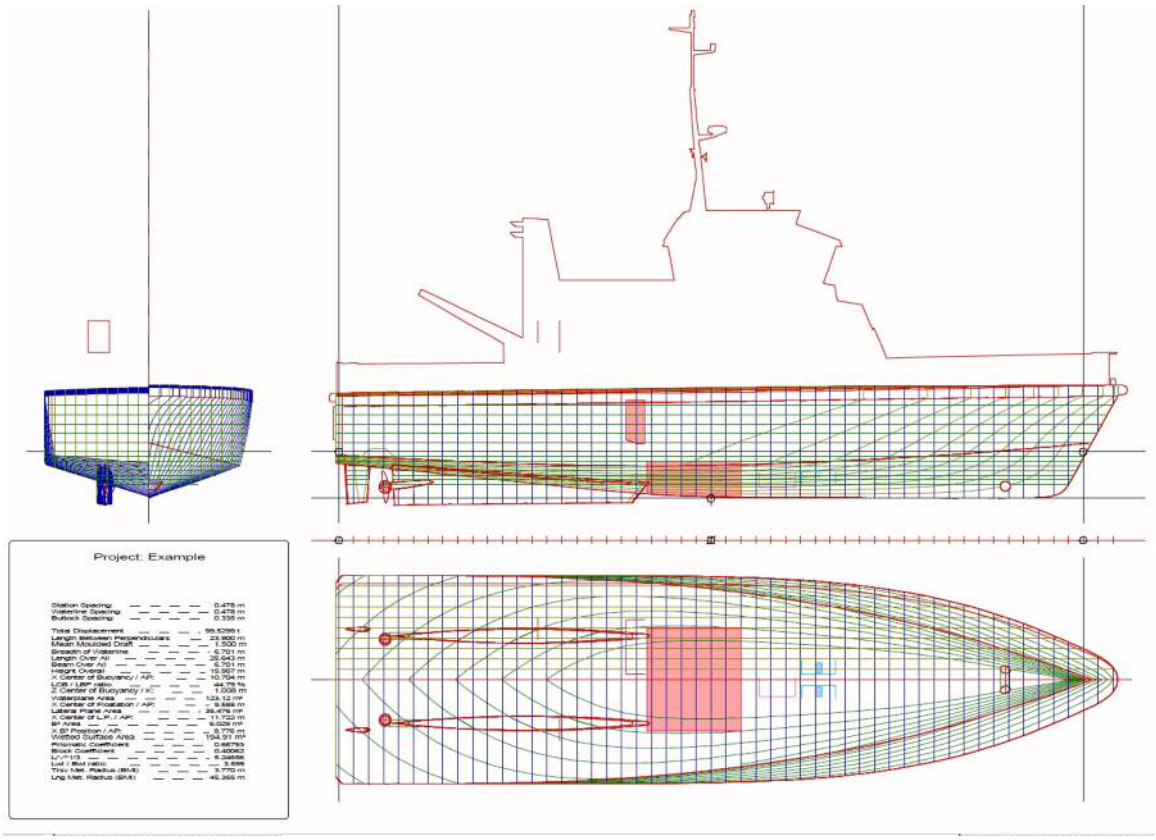
At last, the following buttons are also available:

The **[Exit]** button can be clicked for exiting the 'Lines Presentation Plan' dialog box (the current lines plan will then be lost if it has not been previously printed , exported or retained among the 2D data).

The **[Help]** button allows displaying the online help (Internet access necessary).

3.25.c Outputs:

After clicking on the **[Retain]** button, the current lines plan is retained among the 2D reports, with its current layout options:



3.25.d Limitations:

The only limitation concerns the lines plan sectioning grids.

3.25.e Typical use:

Calculating ship’s Lines Presentation Plan.

3.25.f Example:

Open the ‘Example Ship.m2a’ file and double click on ‘Intact 100% Supply’ in the 3D browser to select this virtual ship:

- Select '**/Tools/Presentation Plan**' in the menu bar.
- Click on the **[OK]** button directly to validate the default Lines Plan Grid settings and start the lines plan calculation.
- The Lines Presentation Plan dialog box then pops up, allowing to set lines plan layout options (see below).
- Try various display options and click on the **[Retain]** button to retain the lines presentation plan among the 2D data.
- Click on the **[Exit]** button and on the **[2D]** tab to display the retained plan.

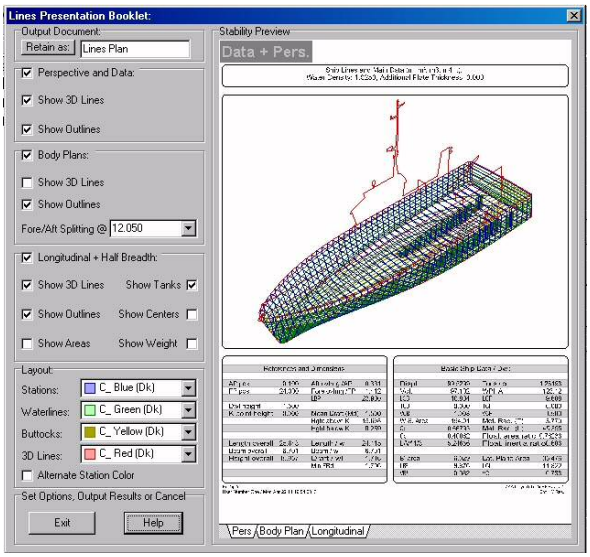
3.26 ***Lines Presentation Booklet:***

3.26.a Purpose:

This function is intended to provide a presentation booklet of ship’s lines, according to the sectioning grids defined in the ‘Lines Plan Grid’ dialog box. When the lines plan is calculated, the 'Lines Presentation Booklet' dialog box is displayed, allowing to set various layout options in real-time before printing, exporting and/or retaining it among project’s 2D data.

3.26.b Inputs:

This 'Lines Presentation Booklet' dialog box is the following:



The '**Output Document**' frame allows retaining the current booklet among the 2D reports by clicking on the **[Retain]** button (the associated input field allows naming the retained report).

The lower right tabs allow selecting the displayed booklet page:

- The **[Pers]** tab allows displaying the perspective view with ship's main features according to the current '**Perspective and Data**' layout options (see 'Outputs' below for a sample).

- The **[Body Plan]** tab allows displaying ship's body plan features according to the current '**Body Plan**' layout options (see 'Outputs' below for a sample).

- The **[Longitudinal]** tab allows displaying ship's profile and half-breadth views features according to the current '**Longitudinal + Half-breadth**' layout options (see 'Outputs' below for a sample).

The '**Perspective and Data**' frame allows setting the perpective and Data layout options:

- The '**Perspective and Data**' checkbox allows including this page in the booklet or not.

- The '**Show 3D Lines**' checkbox allows showing or hiding ship's additional lines (silhouette, sheer line, openings, …) in the perspective view.

- The '**Outlines**' checkbox allows showing or hiding ship face's outlines in the perspective view or not.

The '**Body Plan**' frame allows setting the Body Plan layout options:

- The '**Body Plan**' checkbox allows including this page in the booklet or not.

- The '**Show 3D Lines**' checkbox allows showing or hiding ship's additional lines (silhouette, sheer line, openings, …) in the body plan view.

- The '**Outlines**' checkbox allows showing or hiding ship face's outlines in the body plan view or not.

- The '**Fore / Aft Splitting @**' input field allows locating the transverse plane according to which the body plan stations are considered as fore stations (displayed on the right) or after stations (displayed on the left).

The ‘**Longitudinal + Half Breadth**’ frame allows setting the Longitudinal and Half breadth layout options:

- The ‘**Longitudinal + Half Breadth**’ checkbox allows including this page in the booklet or not.

- The ‘**Show 3D Lines**’ checkbox allows showing or hiding ship’s additional lines (silhouette, sheer line, openings, …) in the longitudinal and half breadth views.

- The ‘**Outlines**’ checkbox allows showing or hiding ship face’s outlines in the longitudinal and half breadth views.

- The ‘**Show Areas**’ checkbox allows displaying or hiding ship’s SAC.

- The ‘**Show Tanks**’ checkbox allows displaying or hiding ship’s tanks.

- The ‘**Show Centers**’ checkbox allows displaying or hiding ship’s centers (center of buoyancy, center of gravity, …).

- The ‘**Show Weight**’ checkbox allows displaying or hiding ship’s weight curve.

The ‘L**ayout**’ frame allows setting the line colors:

- The ‘**Stations**’ selector allows selecting the stations color (except if the ‘Alternate Stations Color’ is checked).

- The ‘**Waterlines**’ selector allows selecting the waterlines color.

- The ‘**Buttocks**’ selector allows selecting the buttocks color.

- The ‘**3D Lines**’ selector allows selecting the complementary line colors (silhouette, sheer, openings, etc…).

- The ‘**Alternate Stations Color**’ checkbox allows alternating station’s color in order to make their identification easier, especially around the midship area.

At last, the following buttons are also available:

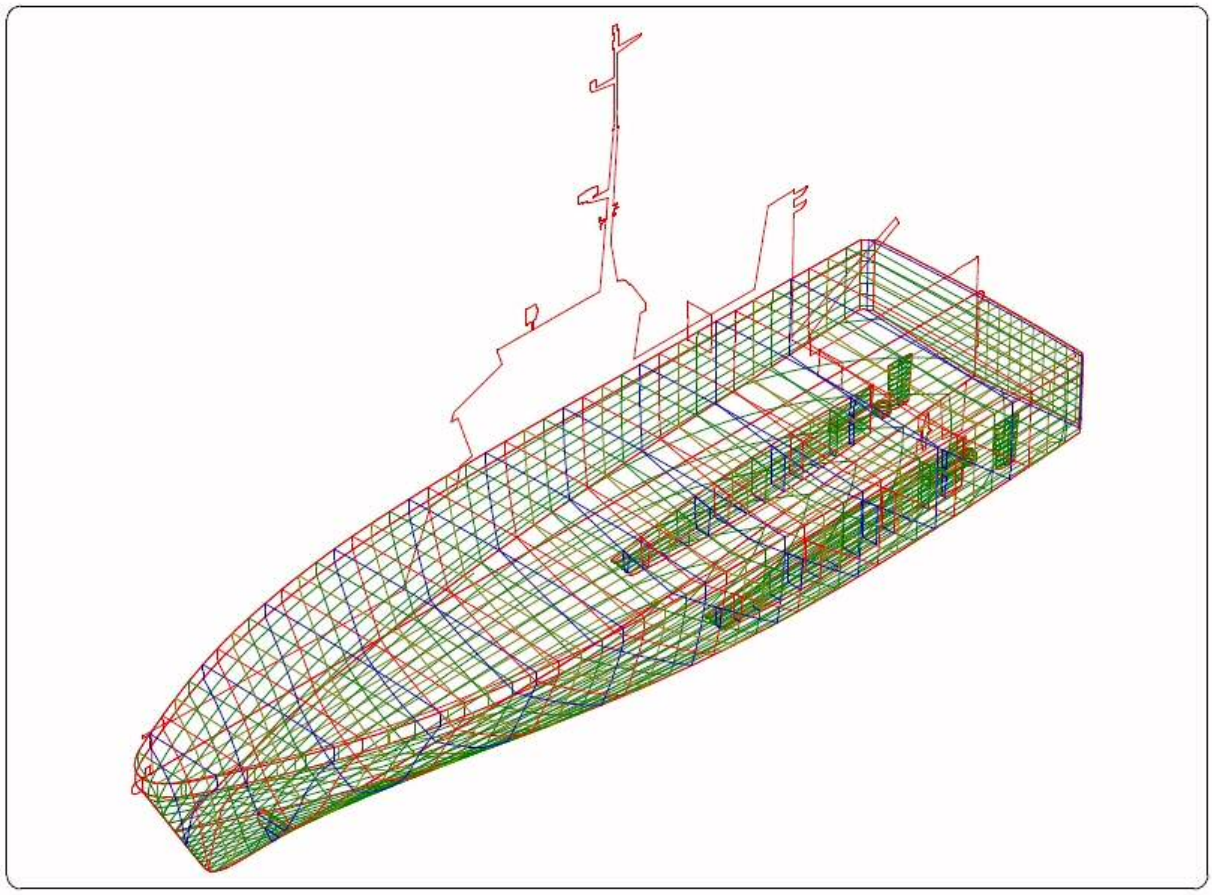
The **[Exit]** button can be clicked for exiting the ‘Lines Presentation Booklet’ dialog box (the current lines plan will then be lost if it has not been previously printed, exported or retained among the 2D data).

The **[Help]** button allows displaying the online help (Internet access necessary).

3.26.c Outputs:

After clicking on the [Retain] button, the current booklet is retained among the 2D reports, with its current layout options:

Ship Lines and Main Data (m, m², m3, m4, t):
Water Density: 1.0250, Additional Plate Thickness: 0.000



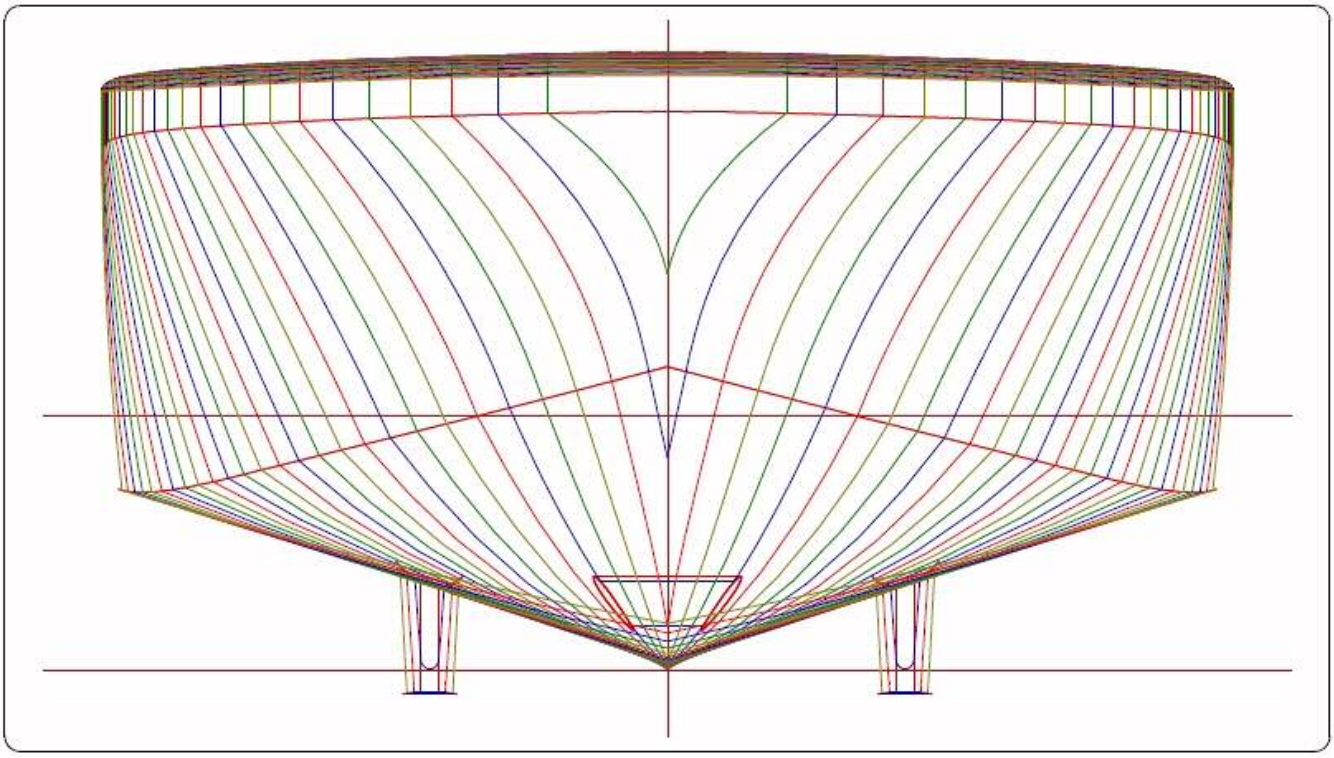
References and Dimensions:			
AP pos.	0.100	Aft ovhng /AP	0.331
FP pos.	24.000	Fore ovhng /FP	1.412
		LBP	23.900
Dwl height	1.500		
K point height	0.000	Mean Draft (Md)	1.500
		Hght above K	15.698
		Hght below K	0.259
Length overall	25.643	Length / wl	24.115
Beam overall	6.701	Beam / wl	6.701
Height overall	15.957	Draft / wl	1.716
		Min FBd	1.796

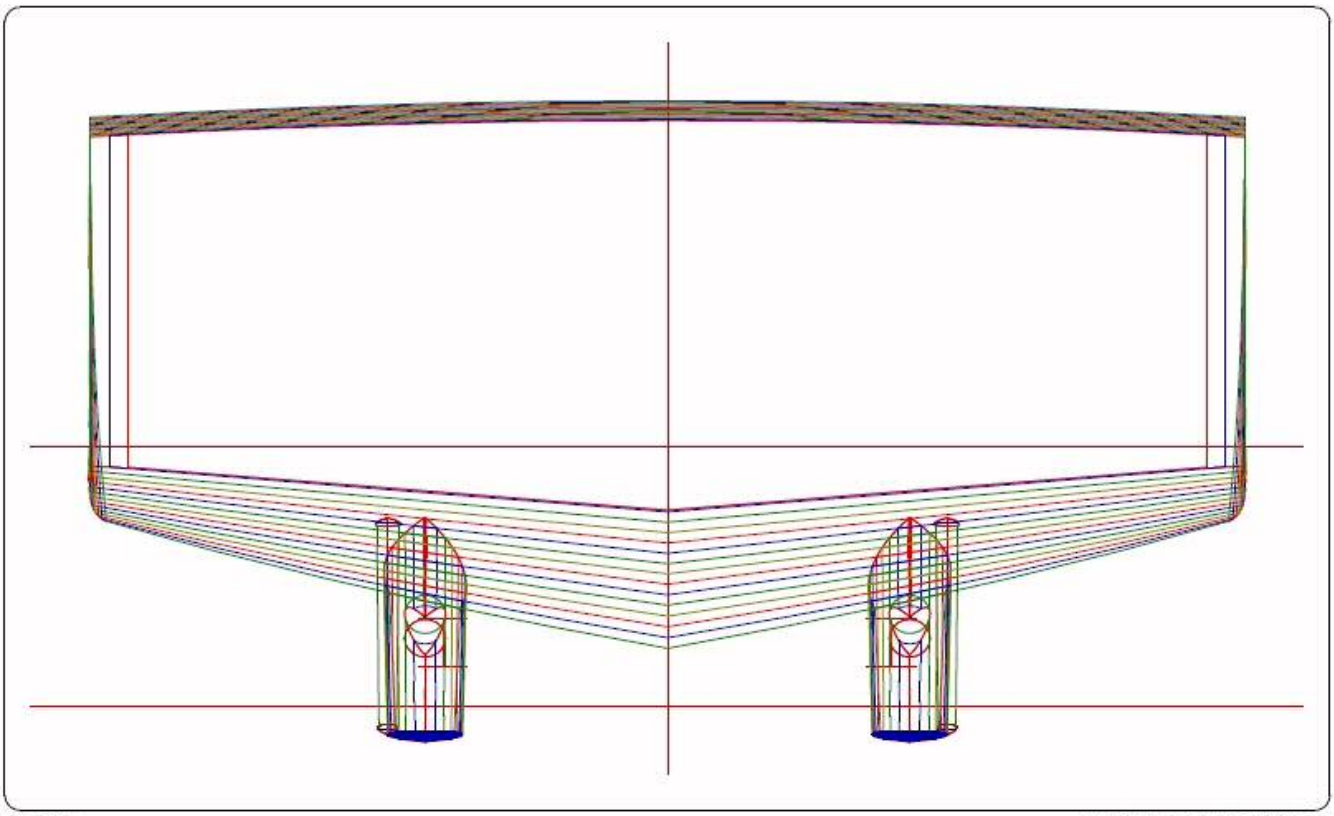
Basic Ship Data / Dwl:			
Displ.	99.5299	Tons / cm	1.26198
Vol.	97.102	WPl. A.	123.12
LCB	10.804	LCF	9.688
TCB	0.000	TCF	0.000
VCB	1.008	VCF	1.500
W.S. Area	194.91	Met. Rad. (T)	3.770
Cp	0.66793	Met. Rad. (L)	45.355
Cb	0.40062	Float. area ratio	0.76233
L/V^1/3	5.24656	Float. inertia ratio	0.606
B² area	6.029	Lat. Plane Area	35.476
LB²	8.876	LCL	11.822
VB²	0.982	VCL	0.738

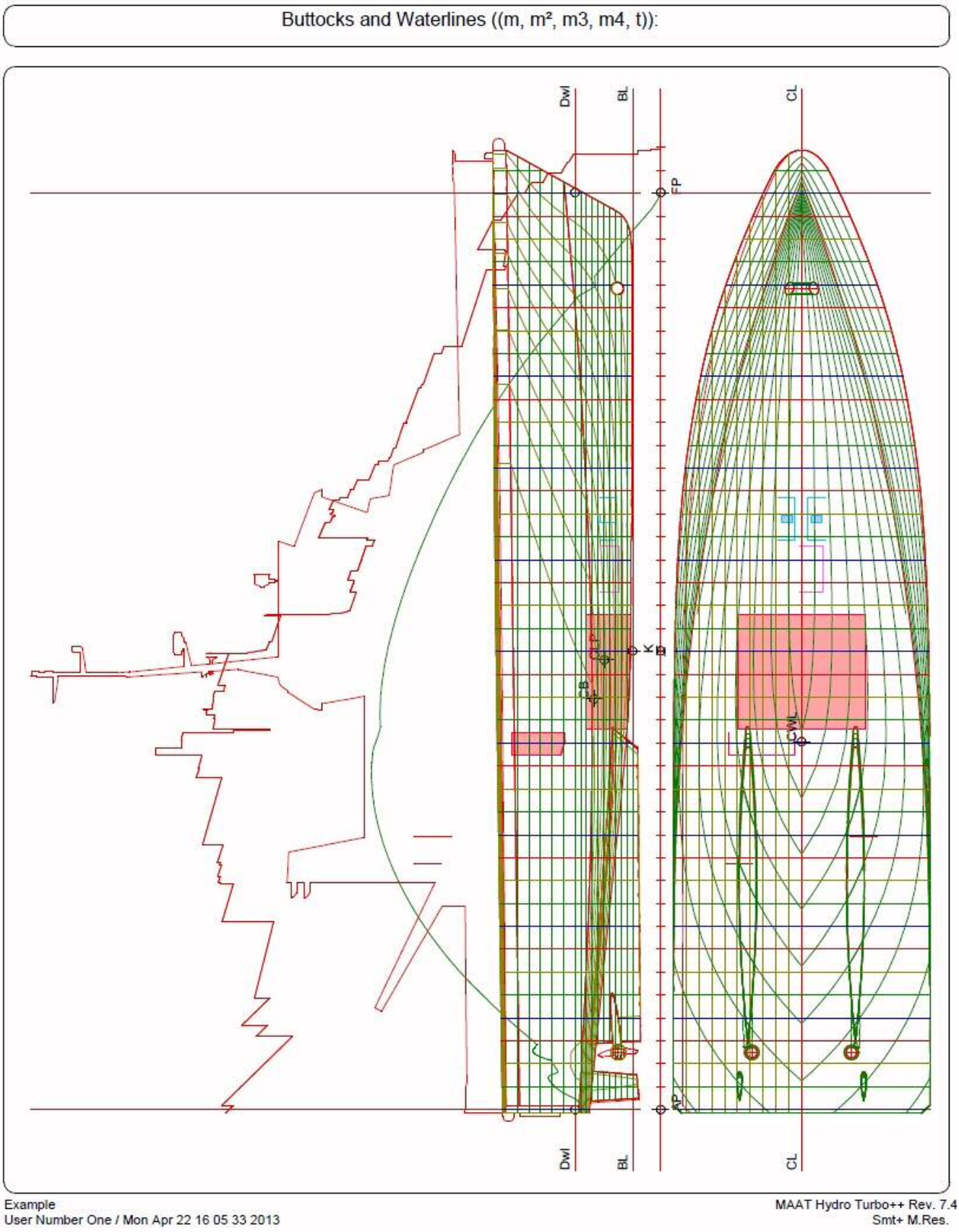
Example
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Fore and Aft Stations ((m, m², m3, m4, t)):







3.26.d Limitations:

The only limitation concerns the lines plan sectioning grids

3.26.e Typical use:

Calculating ship's Lines Presentation Booklet.

3.26.f Example:

Open the 'Example Ship.m2a' file and double click on 'Intact 100% Supply' in the 3D browser to select this virtual ship:

- Select '**/Tools/Lines Presentation Booklet**' in the menu bar.
- Click on the **[OK]** button directly to validate the default Lines Plan Grid settings and start the lines plan calculation.
- The Lines Presentation Booklet dialog box then pops up, allowing to set lines plan layout options (see above).
- Try various display options and click on the **[Retain]** button to retain the lines presentation plan among the 2D data.
- Click on the **[Exit]** button and on the **[2D]** tab to display the retained plan.