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Parametric transformation of Parent cruise ship

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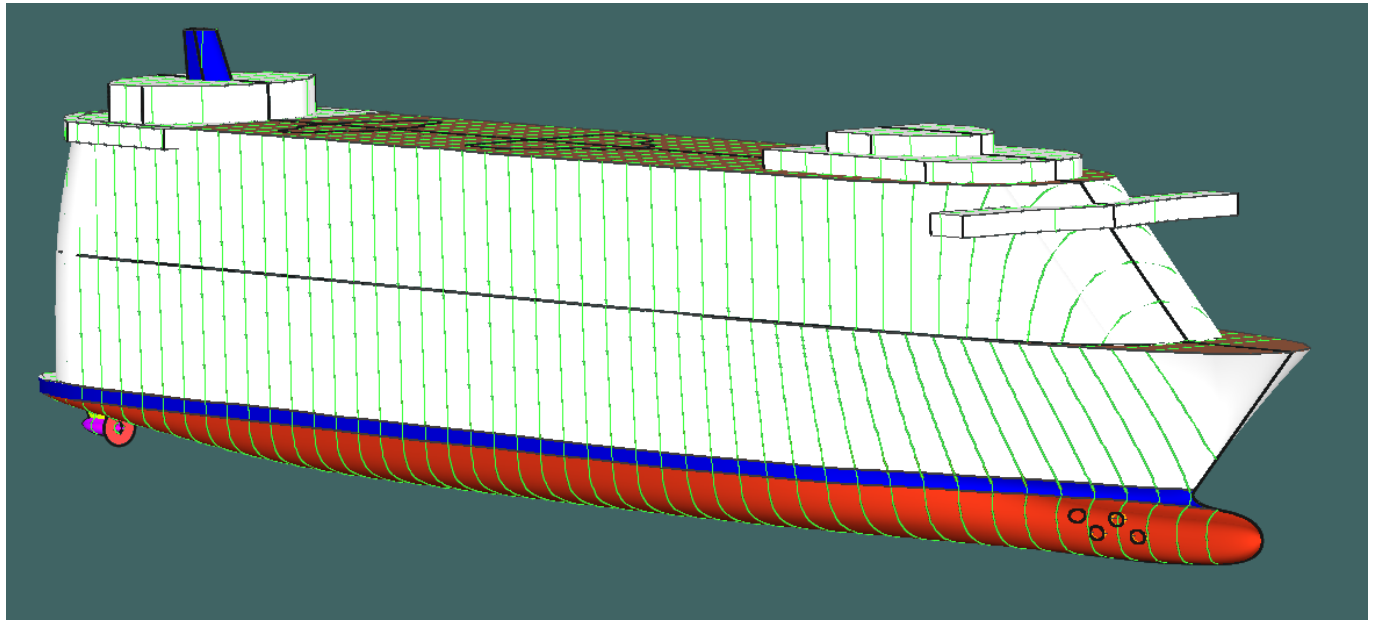
Parametric Transformation - Concept

- Modeler Advanced has the ability to perform parametric transformations of hull shapes using the Parametric Transformation command in the Data menu.
- This process involves moving the columns fore and aft, while not changing the section shapes (unless scaling them) i.e. all y-coordinates move by ratio of beams, all z by ratio of drafts etc.
- The transformation moves stations fore and aft until the required parameter(s) specifications are met.
- A key quality of this approach is that it maintains the fairness of the hull to a very high degree during the transformation process.
- In this tutorial we are going to employ this parametric transformation feature to transform a parent 3D model into a geometric similar model with new particulars.
- The parent ship model used in this tutorial is a cruise ship; you can also use other parent models, like general cargo ship, ferry, catamaran, etc.

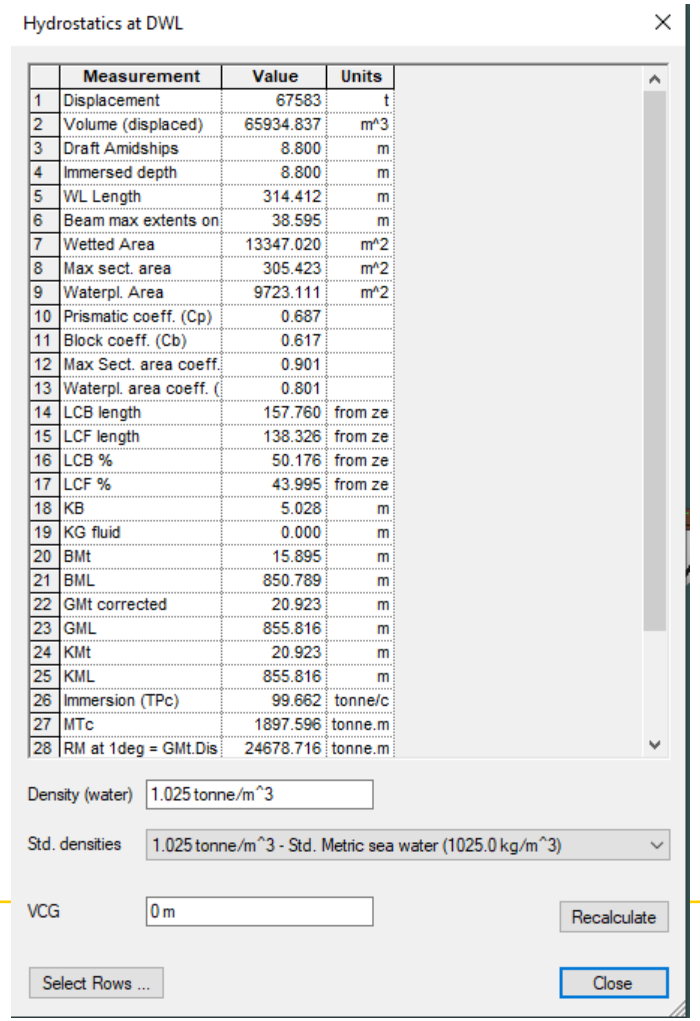
Parametric transformation of a basic ship

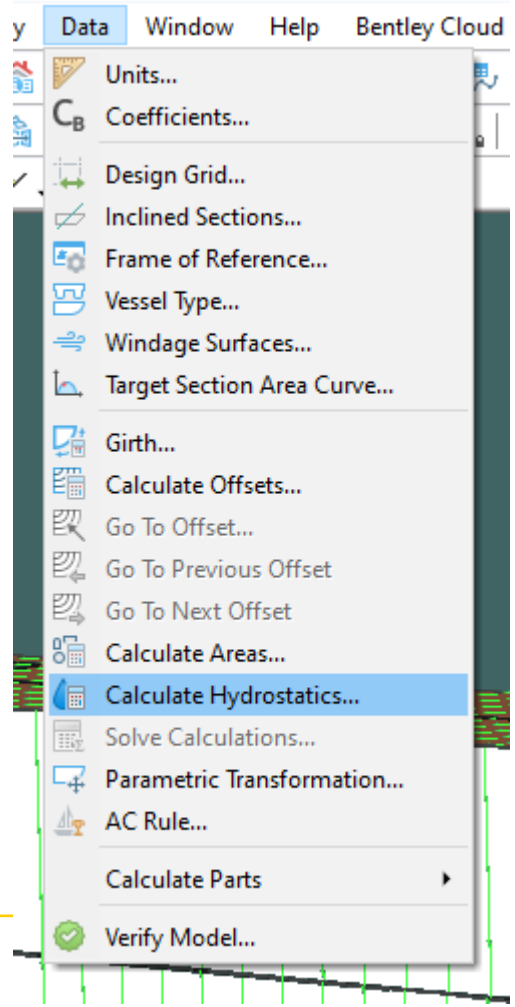
- **Maxsurf Modeler has many types of parametric ship models that can be adjusted to meet the main particulars of a new design.**
  - Go to the installation location to check the available models (C:\Program Files\Bentley\Offshore\MAXSURF CONNECT Edition V23\Sample Designs)
  - Open Cruise ship model (CruiseShip_Pro.msd)



Parametric transformation of a basic ship

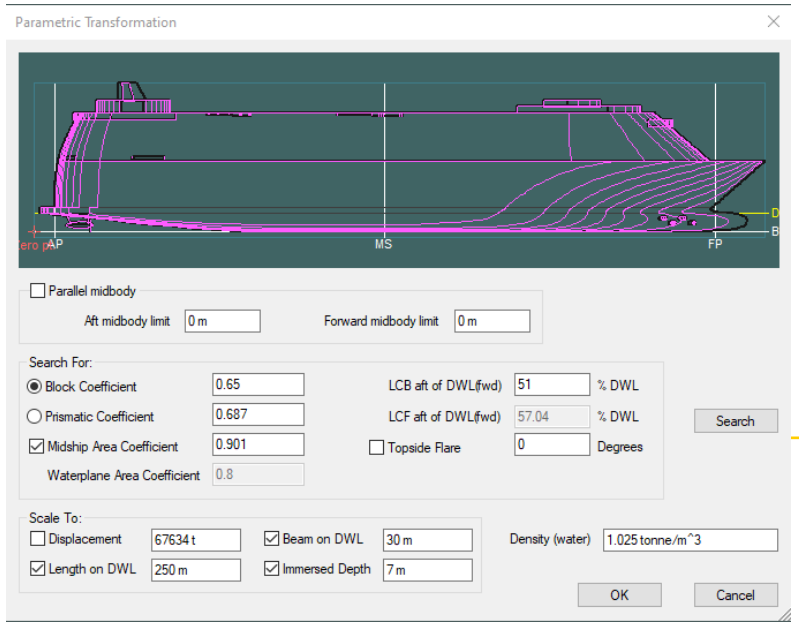
- **To show main particulars of the parent cruise ship model**
  - ✓ Make sure that the grid lines (sections, buttocks and waterlines) and datum are defined.
  - ✓ Go to Data ➛ Calculate Hydrostatics
- **Assume that Your new model has the following particulars:**
  - ✓ LWL = 250 m
  - ✓ Breadth = 30 m
  - ✓ Draft = 7 m
  - ✓ C_B = 0.65

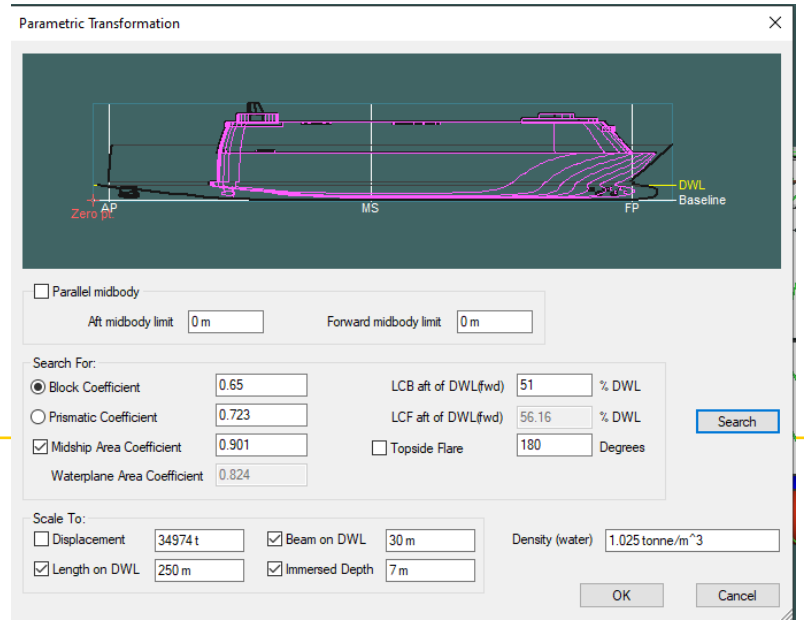


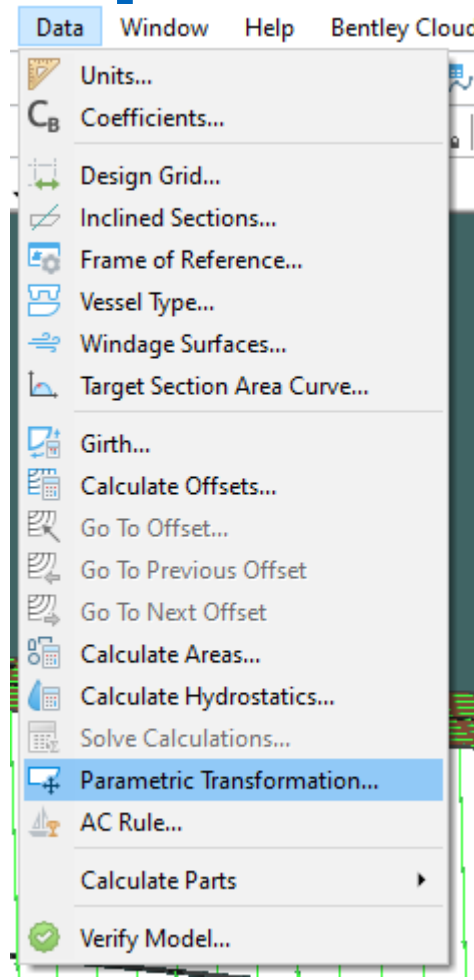


Parametric transformation of a basic ship

- **To create model with the new dimensions**
  - ✓ Unlock all surfaces (double click on the surfaces and uncheck “locked”)
  - ✓ Define the DWL and aft and forward perpendicular (refer to “Maxsurf Modeler Basics” presentation)
  - ✓ It is preferrable to do parametric transformation without superstructure
  - ✓ Go to Data ➛ Parametric Transformation ➛ Insert the new particulars (C_B or C_P, Midship area coefficient, LCB, displacement, LWL, Beam and/or immersed depth) ➛ Press Search ➛ Check the new model main parameter are defined adequately and the lines are smooth without considerable distortion ➛ Press Ok or search again to define new model.

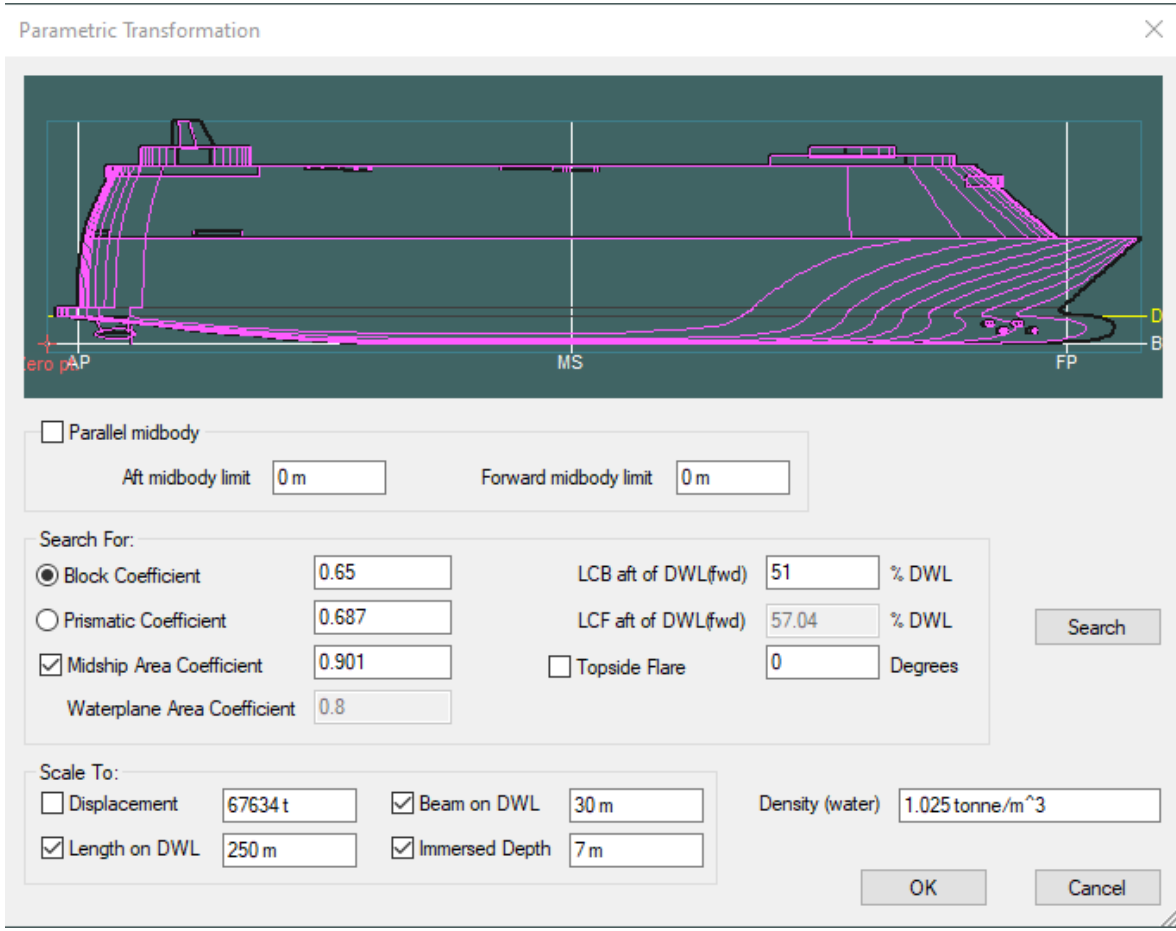






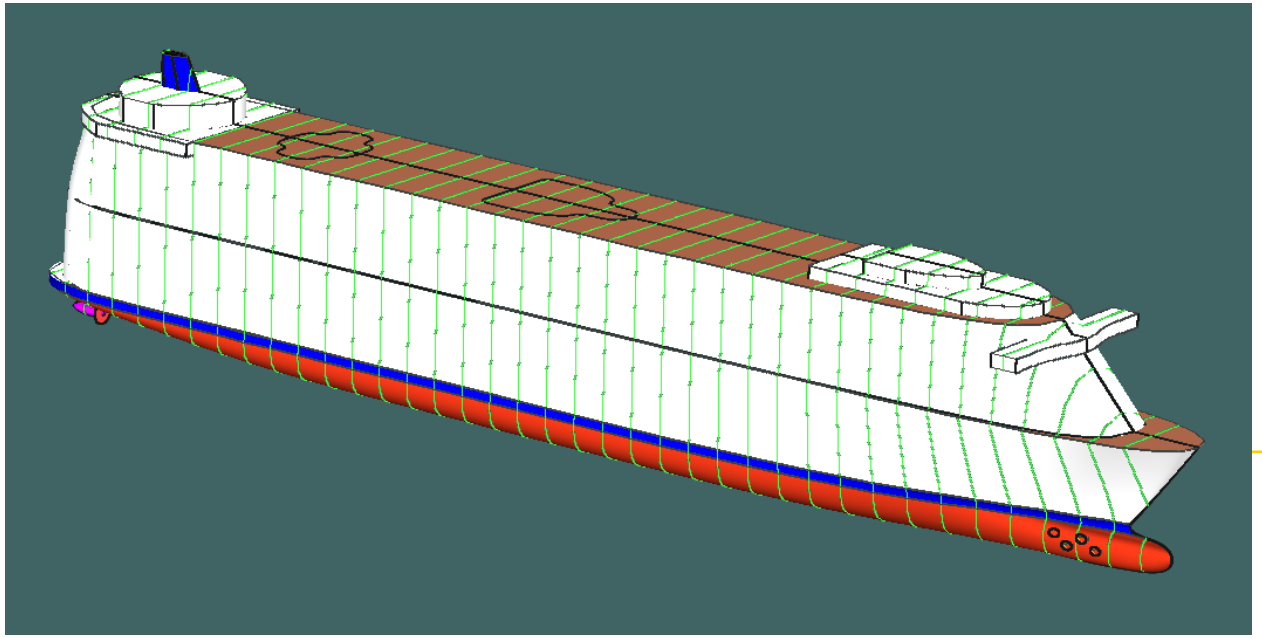
Parametric transformation of a basic ship

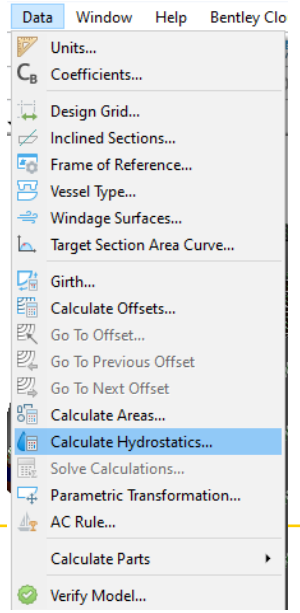
- **The parallel midbody feature is used to keep the midbody between the aft and forward limit as it is while performing parametric transformations.**
- **The parameters that can be specified are divided into two groups:**
  - **Search Parameters:** like C_B, C_P and LCB. These Parameters require a non-linear transformation of the hull shape. As there is no explicit function of these parameters, Maxsurf modeler performs an iterative search to achieve the specified values.
  - **Scaling factors:** Scaling Factors are those parameters that can be calculated directly using a linear scaling of the hull (as Displacement, LWL, B and Draft). These parameters can be constrained to particular values, or left to vary as other parameters change by selecting the appropriate check boxes and setting the required values.



Parametric transformation of a basic ship

- **The parametric variation tool is ideal for making small adjustments from a suitable parent design. It is not intended to be used for gross design modifications.**
- **The reference point and the design grid should be redefined**
- **Now you can calculate the new hydrostatics of the transformed model**
  - Go to Data ➛ Calculate Hydrostatics…





Hydrostatics at DWL

	Measurement	Value	Units
1	Displacement	34973	t
2	Volume (displaced)	34120.037	m^3
3	Draft Amidships	7.000	m
4	Immersed depth	7.000	m
5	WL Length	250.000	m
6	Beam max extents on	29.997	m
7	Wetted Area	8417.390	m^2
8	Max sect. area	188.814	m^2
9	Waterpl. Area	6196.424	m^2
10	Prismatic coeff. (Cp)	0.723	
11	Block coeff. (Cb)	0.650	
12	Max Sect. area coeff.	0.901	
13	Waterpl. area coeff. (	0.826	
14	LCB length	122.541	from ze
15	LCF length	109.246	from ze
16	LCB %	49.016	from ze
17	LCF %	43.698	from ze
18	KB	3.973	m
19	KG fluid	-1.800	m
20	BMt	11.982	m
21	BML	695.797	m
22	GMt corrected	17.754	m
23	GML	701.570	m
24	KMt	15.954	m
25	KML	699.770	m
26	Immersion (TPc)	63.513	tonne/c
27	MTc	981.450	tonne.m
28	RM at 1deg = GMt.Dis	10836.531	tonne.m

Density (water) 1.025 tonne/m^3

Std. densities 1.025 tonne/m^3 - Std. Metric sea water (1025.0 kg/m^3)

VCG -1.8 m

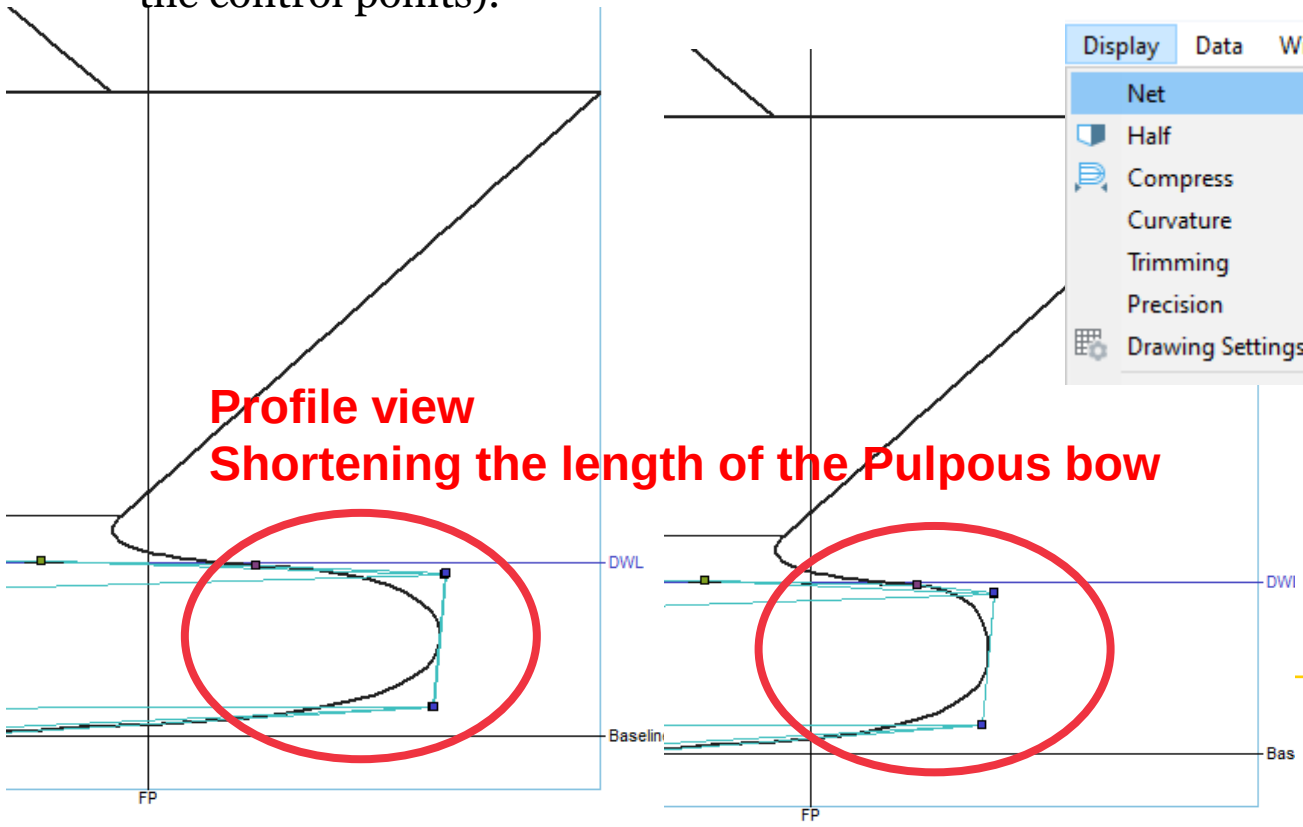
Recalculate

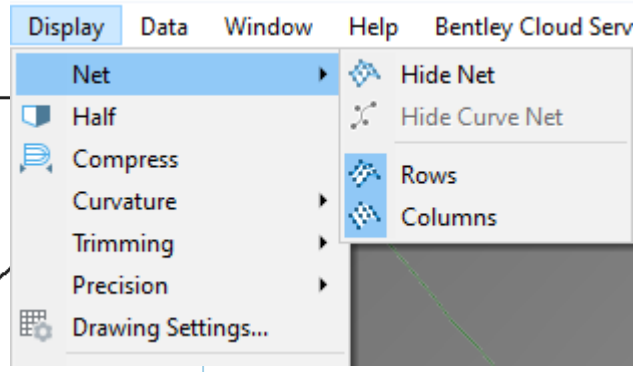
Select Rows ...

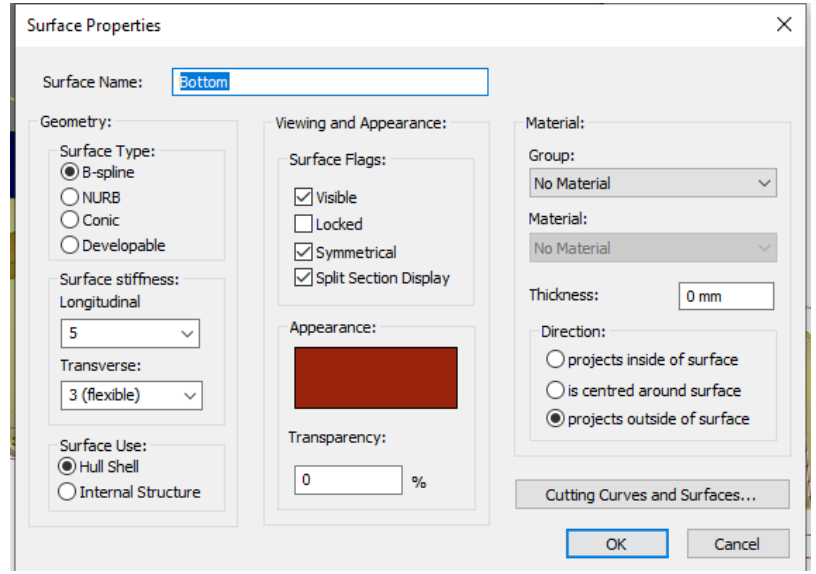
Close

Amending hull form manually

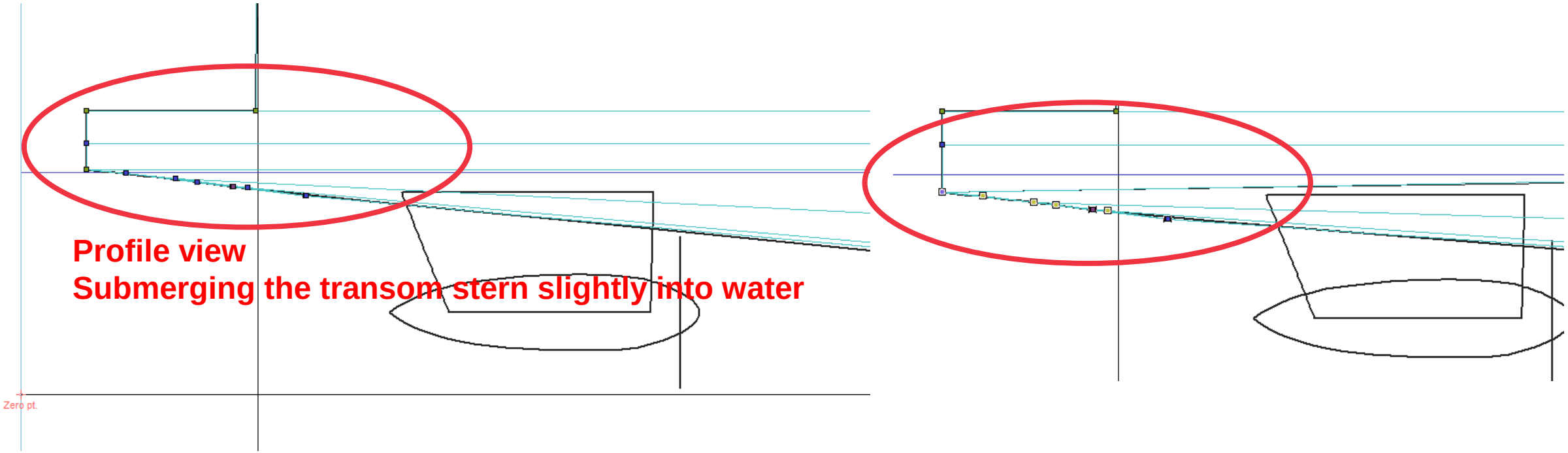
- **The shape of the hull, pulpous bow or stern can be amended easily by manipulating the position of the nearest control points**
  - Make sure that the surface is unlocked (double click on the surface and uncheck Locked)
  - Activate surface Net (Display ➛ Net ➛ activate Rows and Columns)
  - Then manipulate the control points to get the desired shape (Use the appropriate view to ease the manipulation of the control points).







Amending hull form manually

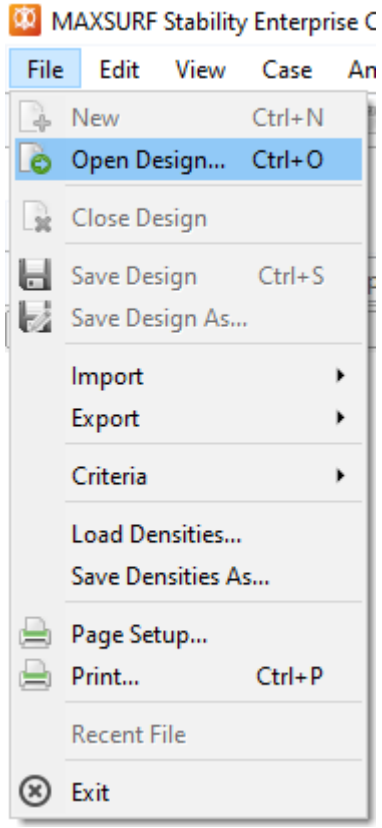


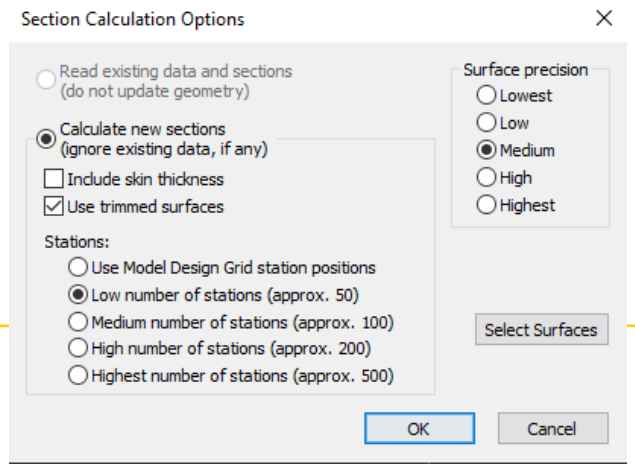
Profile view
Submerging the transom stern slightly into water

Check the presentation “Ice Breaker from lines plan” for more information about manipulating the control points and surface forming.

Hydrostatics

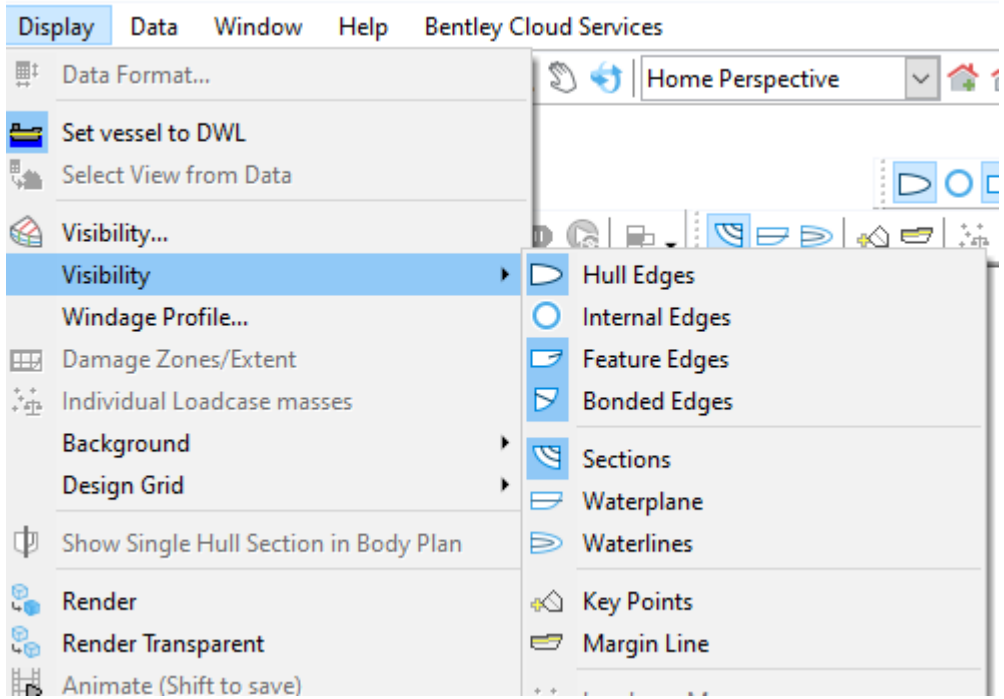
- **Maxsurf Stability can be employed, to plot hydrostatics curves.**
  - Save the model in Maxsurf modeler
  - Open Maxsurf stability
  - Go to File ➛ Open Design ➛ and open the modified model.
  - If it is the first time to open the model in Maxsurf Stability, the first option " read existing data" should not be active (Next time you can select this option to open the saved stability file)
  - From stations, select the appropriate number of stations that will be used to calculate ship hydrostatics. It depends on the ship length and the ship geometry. Increasing the number of stations will increase the required analysis time.

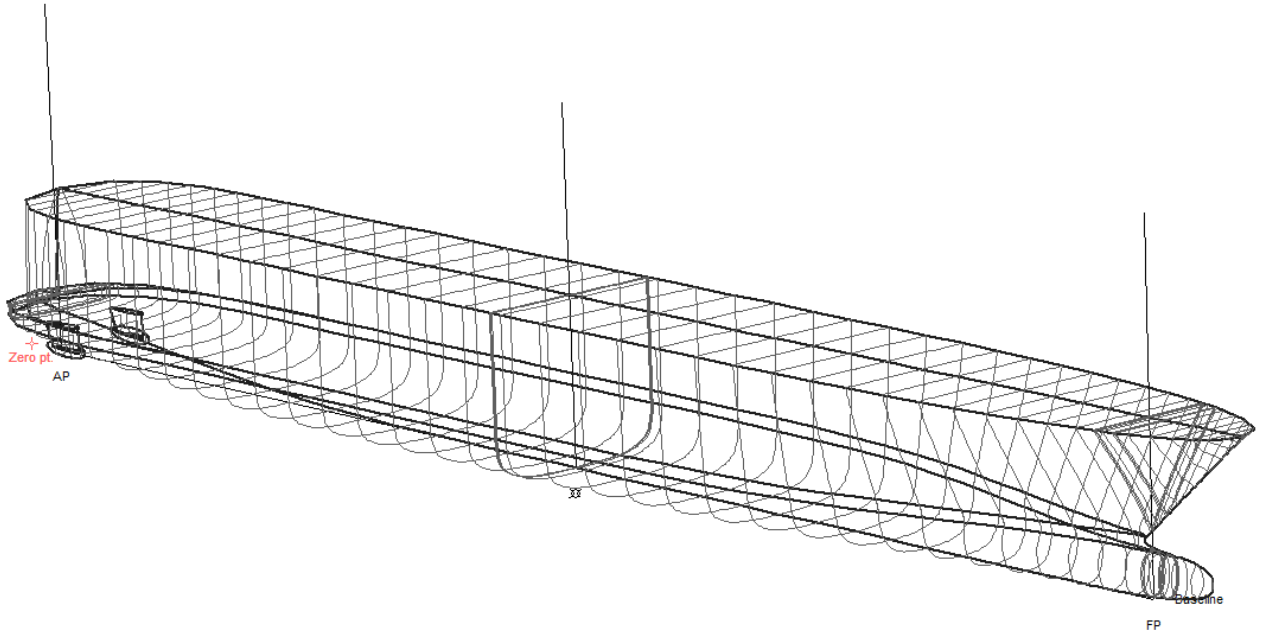




Hydrostatics

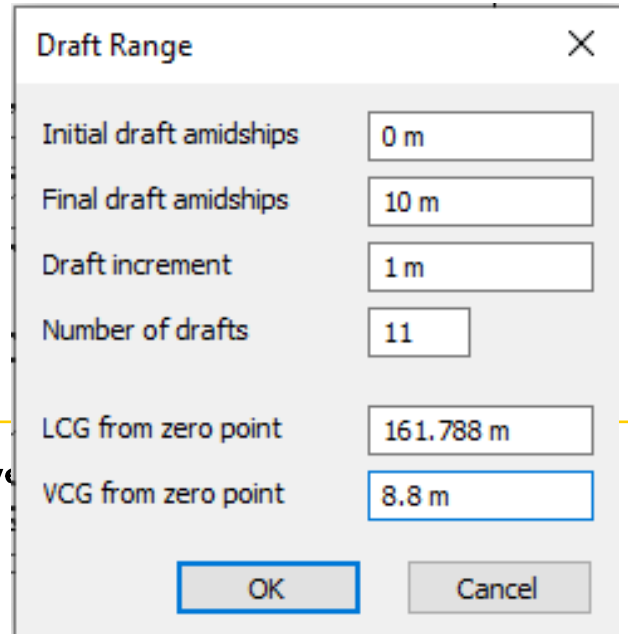
- **To show the stations that will be used in hydrostatics calculations**
  - Go to Display ➛ Visibility ➛ Sections

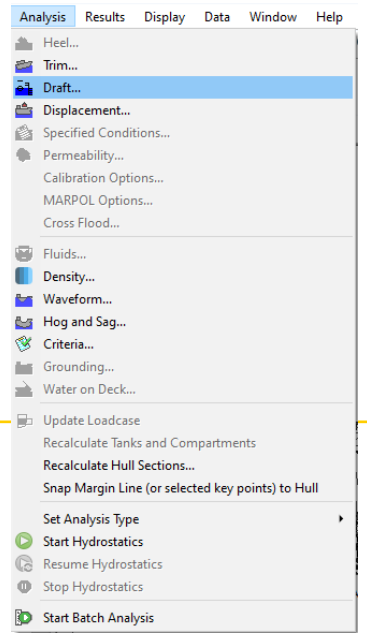


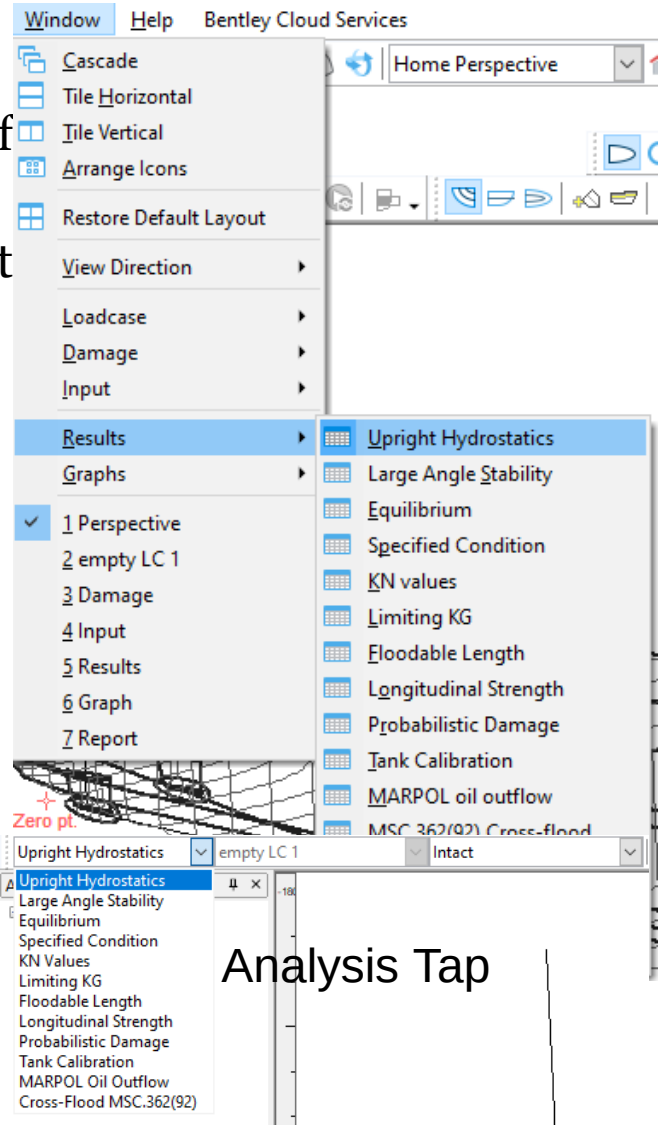


Hydrostatics

- **Now we need to define the range of draft for hydrostatics calculations:**
  - Go to window ➛ Upright Hydrostatics (Or select it from Analysis tab)
  - Go to Analysis ➛ Draft..
  - Define initial draft amidship, Final draft and draft increment or number of drafts
  - Define VCG and LCG if available unless the calculations of GM will be not accurate.
  - Press Ok
  - You can instead define range of displacement from Analysis ➛ Displacement..



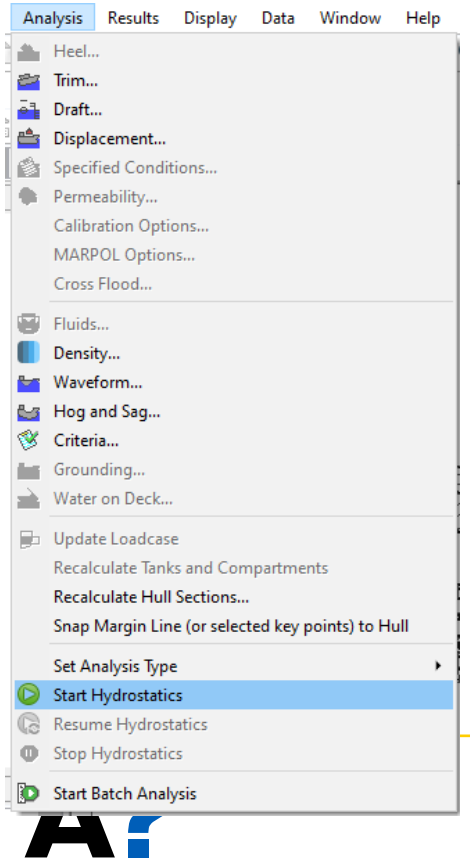


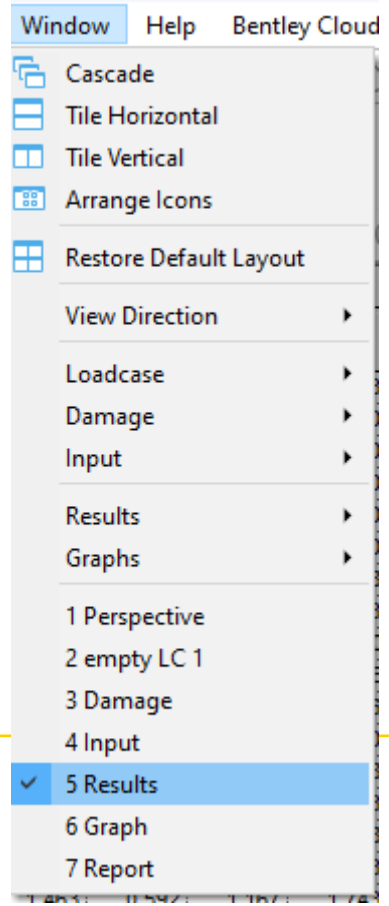


Analysis Tap

Hydrostatics (Results)

- **To Calculate the hydrostatics Go to Analysis ➛ Start Hydrostatics.**
- **To show the tabulated results at different drafts:**
  - Go to Window ➛ Results..

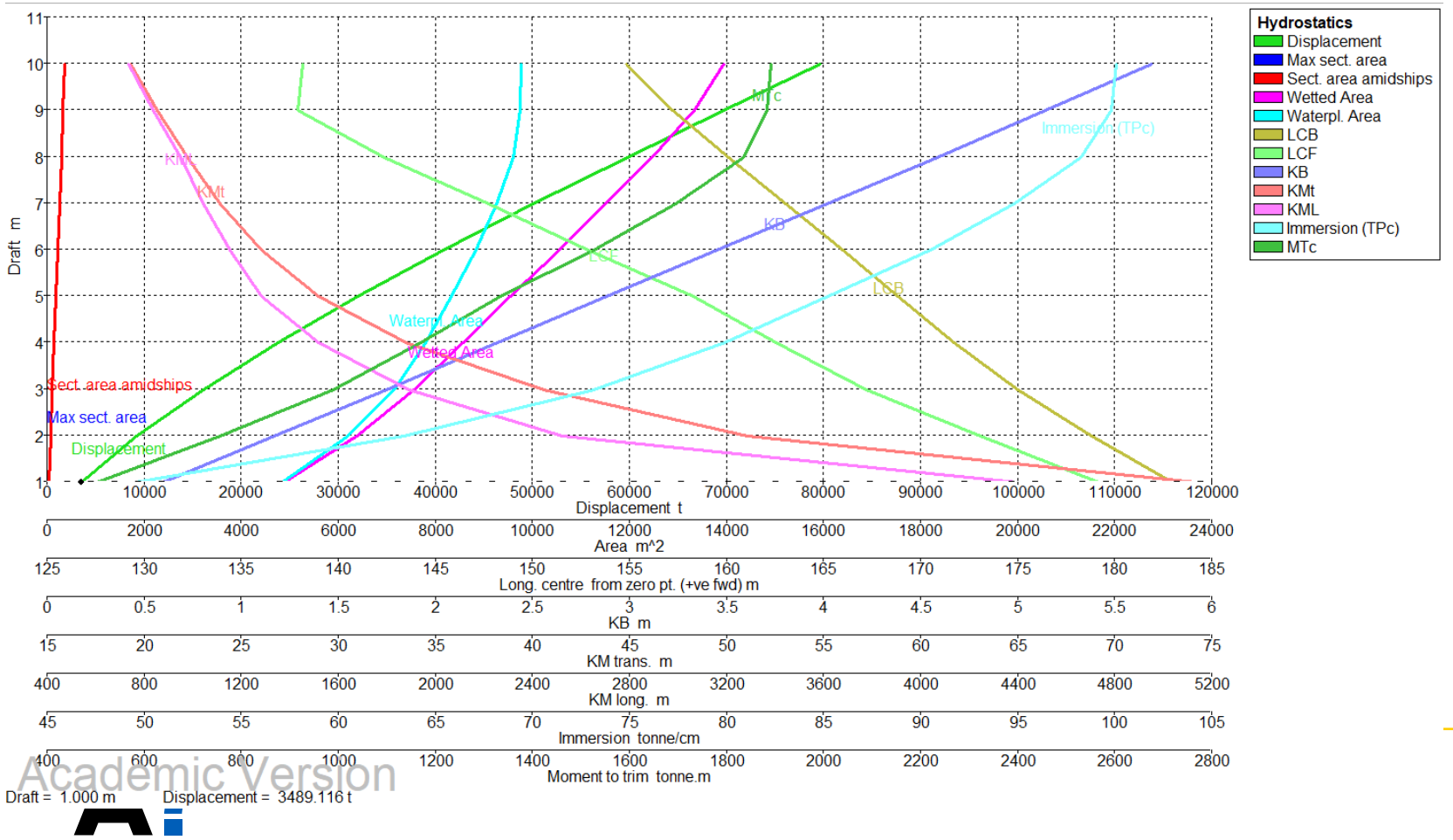


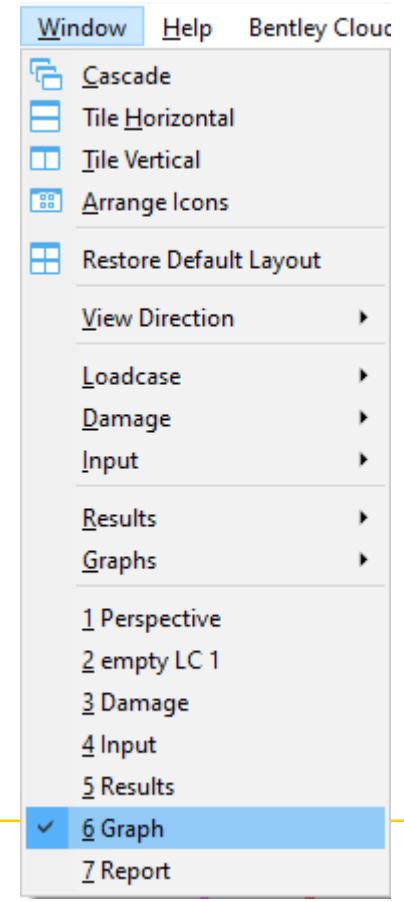


	Draft Amidships m	0.000	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000
1	Displacement t	0.0000	3489	9165	16023	23681	31932	40719	49994	59654	69578	79565
2	Heel deg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Draft at FP m	0.000	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000
4	Draft at AP m	0.000	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000
5	Draft at LCF m	0.000	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000
6	Trim (+ve by stern) m	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	WL Length m	129.202	234.244	307.279	312.778	312.800	312.768	312.923	312.327	314.670	313.547	310.088
8	Beam max extents on W	0.000	27.957	32.791	35.443	36.775	37.582	38.090	38.401	38.556	38.600	38.600
9	Wetted Area m^2	0.000	4872.989	6355.598	7540.310	8555.240	9529.181	10533.99	11500.77	12443.70	13310.06	13934.44
10	Waterpl. Area m^2	0.000	4829.380	6180.447	7132.288	7789.947	8311.736	8826.562	9244.310	9580.742	9735.837	9758.787
11	Prismatic coeff. (Cp)	0.000	0.662	0.554	0.576	0.601	0.622	0.641	0.661	0.674	0.691	0.712
12	Block coeff. (Cb)	0.000	0.520	0.444	0.470	0.502	0.530	0.555	0.581	0.600	0.623	0.649
13	Max Sect. area coeff. (	0.000	0.786	0.802	0.818	0.837	0.854	0.868	0.880	0.892	0.903	0.913
14	Waterpl. area coeff. (C	0.000	0.737	0.613	0.643	0.677	0.707	0.741	0.771	0.790	0.804	0.815
15	LCB from zero pt. (+ve f	9.734	182.913	178.779	174.958	171.690	168.794	165.935	163.008	160.089	157.194	154.778
16	LCF from zero pt. (+ve f	9.734	179.121	173.031	167.143	162.523	158.234	152.841	147.703	142.355	137.891	138.137
17	KB m	1.463	0.592	1.167	1.743	2.314	2.880	3.447	4.014	4.579	5.139	5.686
18	KG m	8.800	8.800	8.800	8.800	8.800	8.800	8.800	8.800	8.800	8.800	8.800
19	BMt m	0.000	73.537	49.854	38.776	31.145	26.051	22.539	19.860	17.591	15.474	13.588
20	BML m	0.000	4394.601	2520.782	1885.509	1510.642	1276.998	1146.923	1036.611	940.823	827.623	727.159
21	GMt m	-7.337	65.328	42.221	31.719	24.659	20.131	17.186	15.073	13.371	11.813	10.474
22	GML m	-7.337	4386.392	2513.149	1878.452	1504.155	1271.078	1141.569	1031.825	936.602	823.962	724.045
23	KMt m	1.463	74.128	51.021	40.519	33.459	28.931	25.986	23.873	22.171	20.613	19.274
24	KML m	1.463	4395.192	2521.949	1887.252	1512.955	1279.878	1150.369	1040.625	945.402	832.762	732.845
25	Immersion (TPc) tonne/c	0.000	49.501	63.350	73.106	79.847	85.195	90.472	94.754	98.203	99.792	100.028
26	MTc tonne.m	0.000	502.120	755.701	987.449	1168.626	1331.627	1525.067	1692.433	1833.063	1880.903	1890.048
27	RM at 1deg = GMt.Disp.	0.000	3978.067	6753.546	8869.543	10191.42	11218.68	12213.07	13151.92	13920.34	14344.54	14544.13
28	Max deck inclination deg	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	Trim angle (+ve by stern	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Hydrostatics (Results)

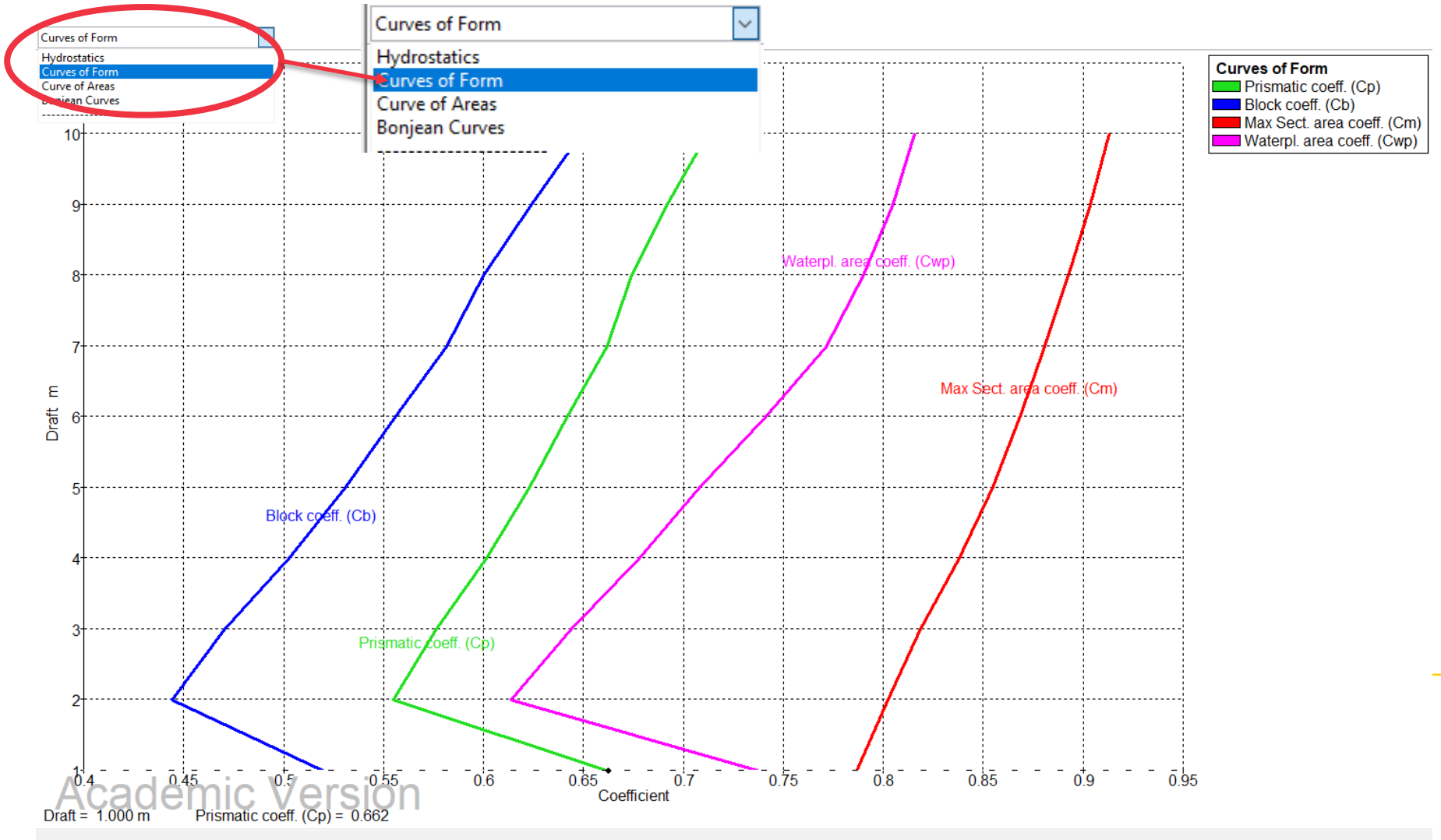
- **The graphical representation of the results can be illustrated from:**
  - Window ➛ Graph..





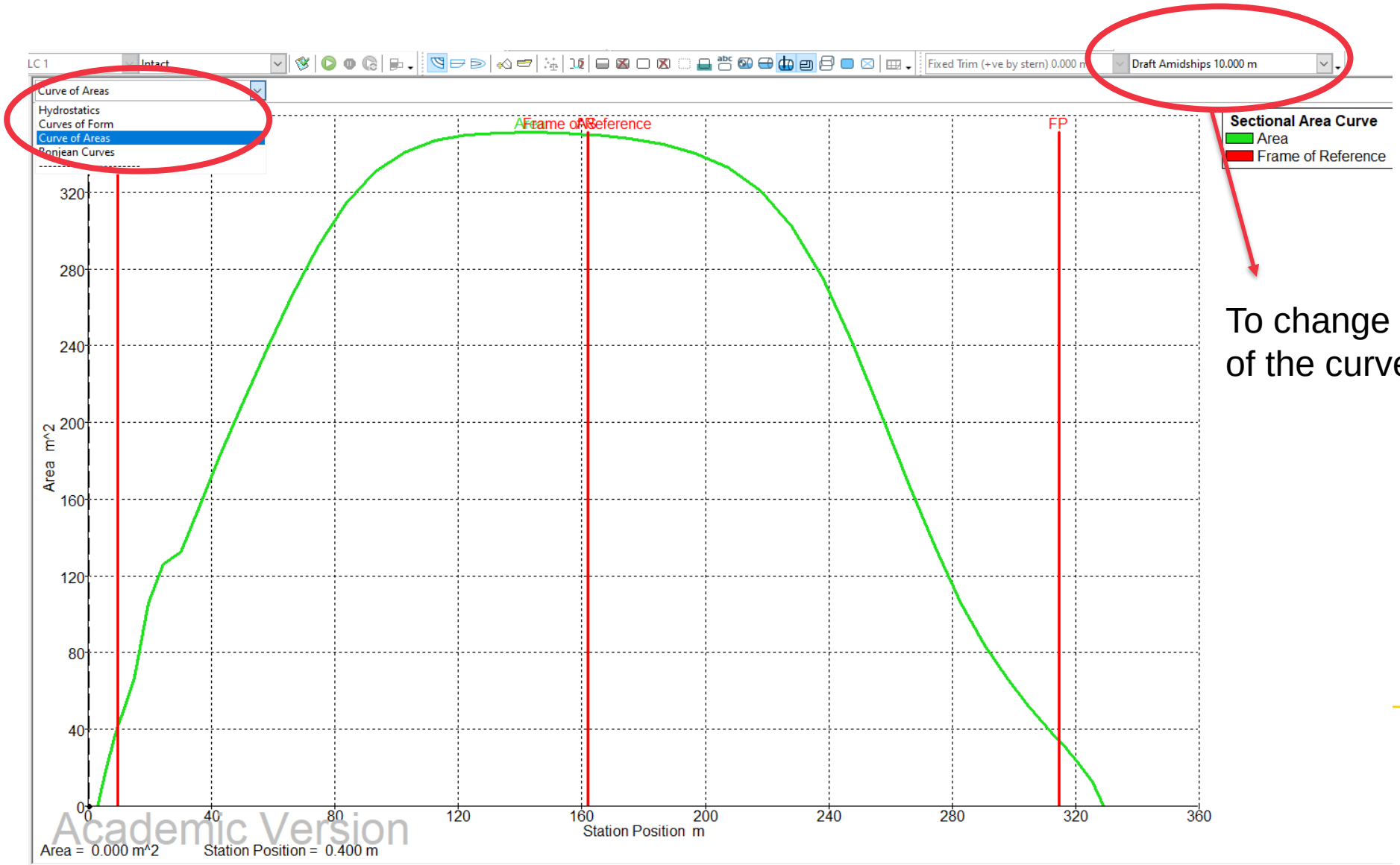
Hydrostatics (Results)

- **To show curves of form, change the type of curves from the tab above the Graph window**



Hydrostatics (Results)

- **You can also show the curves of areas and Bonjean curves from the same tab.**



To change the draft of the curve of area

Hydrostatics (Results)

- **Bonjean curves**