

## Corbin 39 – the Stability issue – as for 21 04 2020

The stability issue has been addressed by both Gene-Hull and Multisurf on the same basis :

- a displacement of **14000 kg** assumed to be the minimum weight of the existing boats
- a trim = 0° for this displacement, assuming that the owners can act on the mass repartition for this objective. This zero trim is obtained with **Xg = 4,505 m**.
- a **Zg = 0,038 m** resulting from the mass spreadsheet (with mk2 sailplan)

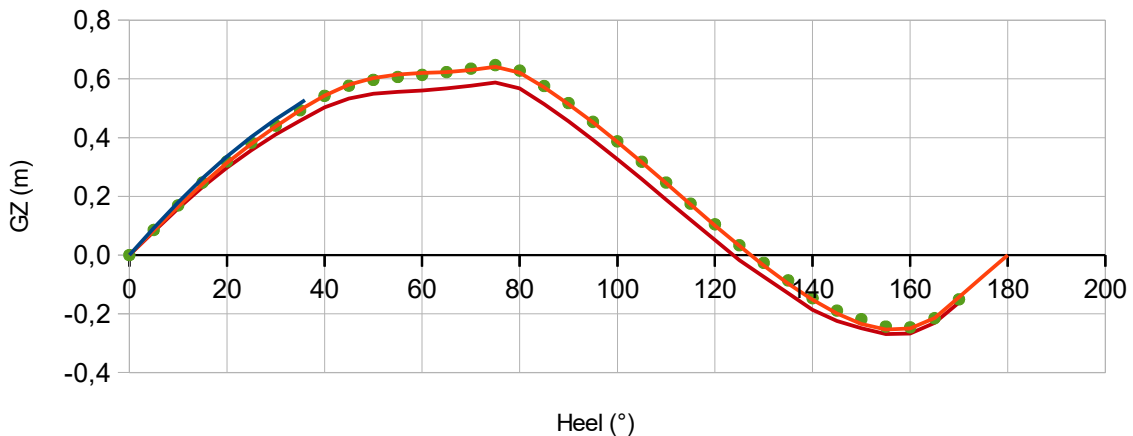
**Results** (and in Annex the output data) :

**GMt :** (as computed at 1° Heel)  
>>> 1,06 m Gene-Hull  
>>> 0,98 m Multisurf  
>>> 0,99 m Delfship-Archimede MB

**GZ curve :**

### GZ curve

Blue : Proxi 39 ; Red : Multisurf ; Green points : Delfship - Archimede MB  
(with M 14000 kg ; Xg 4,505 m ; Zg 0,038 m) - Brown , when Zg = 0,1 m



At heel angle 36° (end of the blue line) starts the immersion of the sheer line. The angle of vanished stability **AVS is 127°**. The positive area up to 127° is 51,8 deg.m. The negative area from 127° to 180° is -8,2 deg.m >>> **Area ratio is 6,3 > 5** .

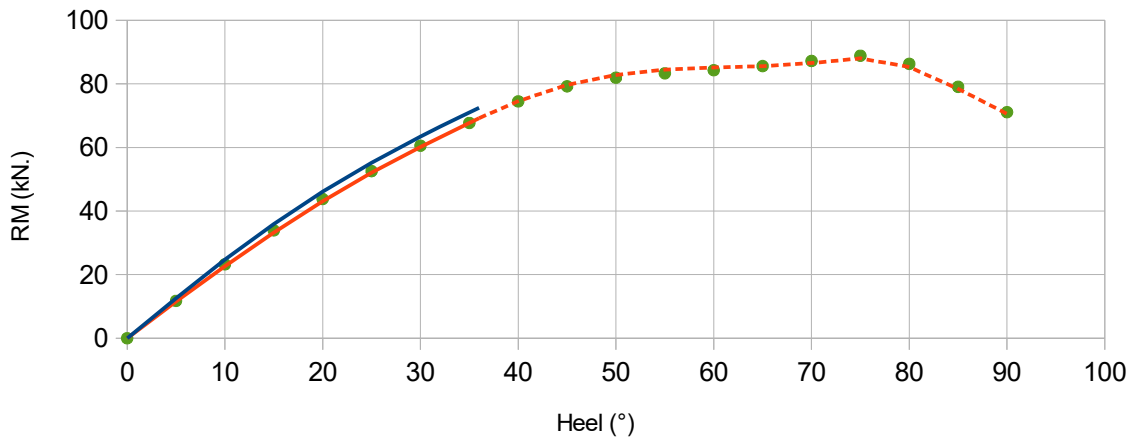
The associated video : <https://www.youtube.com/watch?v=h0AngYDBMIQ&feature=youtu.be>

When assuming Zg = 0,1m (assuming the worst), the stability is still good , with an AVS at ~ 123,7° and an areas ratio = 4,94.

>>> The Righting Moment RM : **RM30° = 60,2 kN.m (Multisurf)**  
**60,5 kN.m (Delftship – Archimede MB)**  
**63,4 kN.m (Gene-Hull)**

### RM curve

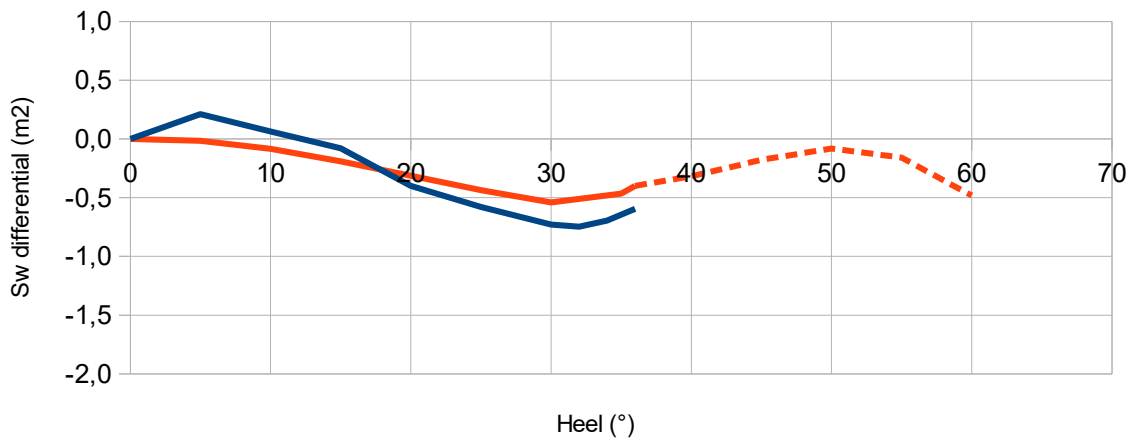
Blue : Proxi 39 ; Red : Multisurf ; Green points : Delftship - Archimede MB  
 (with M 14000 kg ; Xg 4,505 m ; Zg 0,038 m)



>>> The wetted surface Sw evolution :

### Wetted surface differential with heel

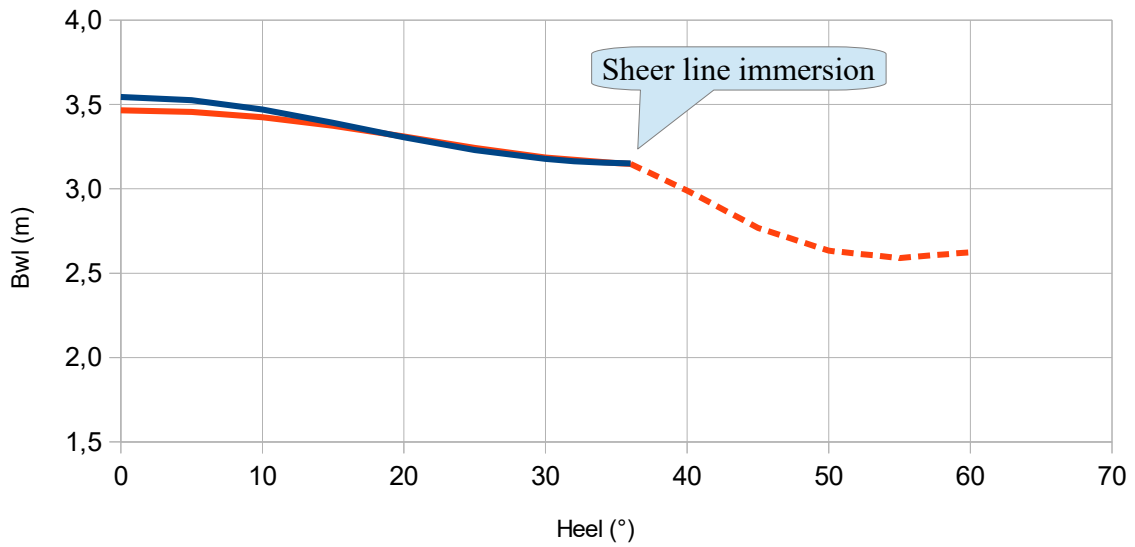
Blue : Proxi 39 ; Red : Multisurf  
 (with M 14000 kg ; Xg 4,505 m ; Zg 0,038 m)



>>> The Bwl evolution

Bwl evolution with heel

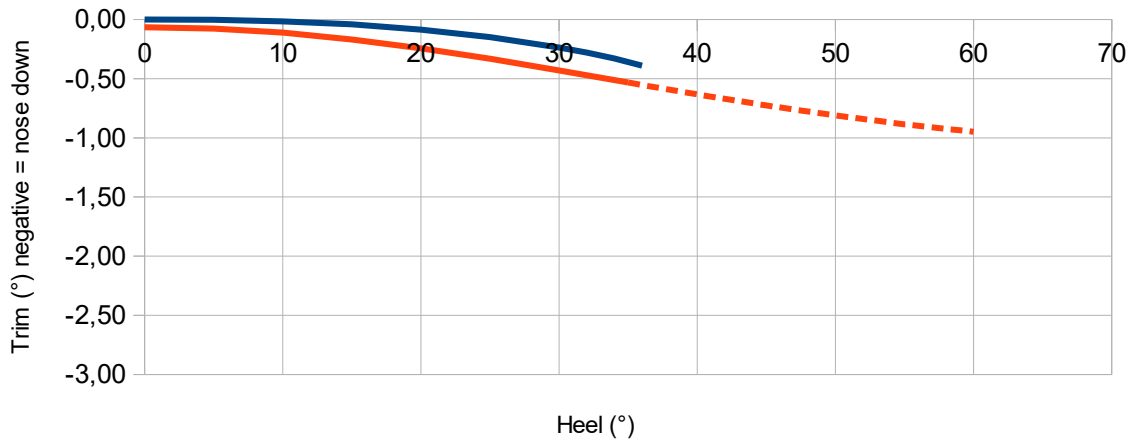
Blue : Proxi 39 ; Red : Multisurf  
(with M 14000 kg ; Xg 4,505 m ; Zg 0,038 m)



>>> The trim evolution (negative = bow down)

Trim evolution with heel

Blue : Proxi 39 ; Red : Multisurf  
(with M 14000 kg ; Xg 4,505 m ; Zg 0,038 m)



At 20° heel angle :

Data to enter : yellow cells

Heel (°) 20,0  
 Height (cm) -7,2030  
 Trim (°) -0,085

**Results**

Disp. (m3)	13,65853	/ Disp. (m3)	13,65854
Xc heel (m)	4,505	/ Xg (m)	4,505
Yc heel (m)	-0,349	Yg heel (m)	-0,013
Zc heel (m)	-0,384	> GZ (m)	0,336
Sw heel (m2)	38,93	RM (kN.m)	46,093
Bwl heel (m)	3,31	FB mini (cm)	48,4
		Obliquity (°)	1,54

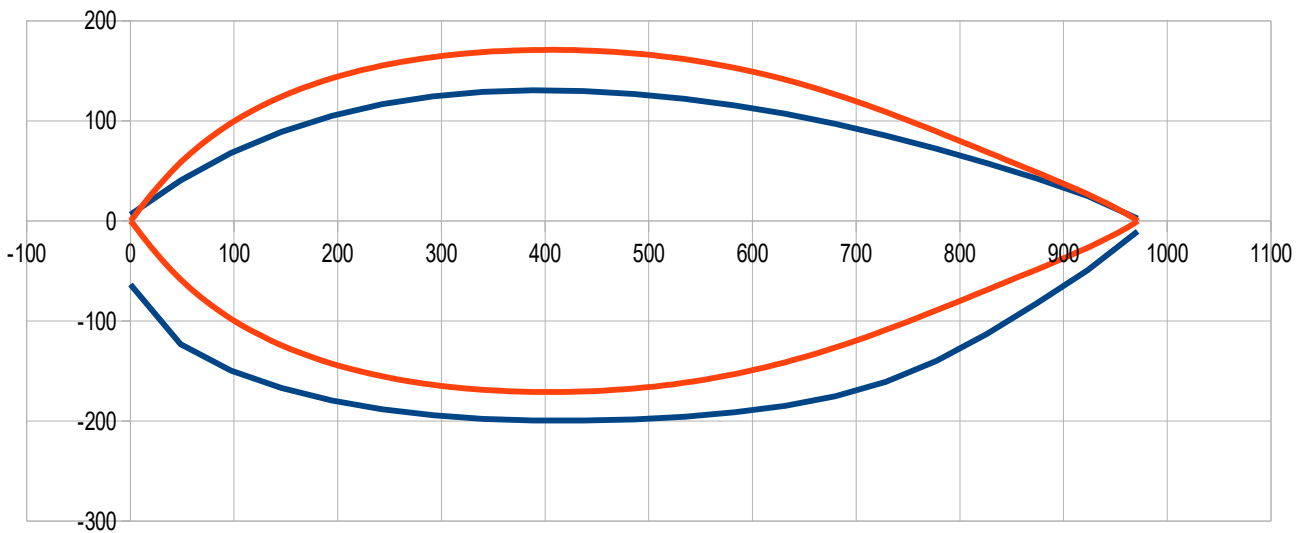
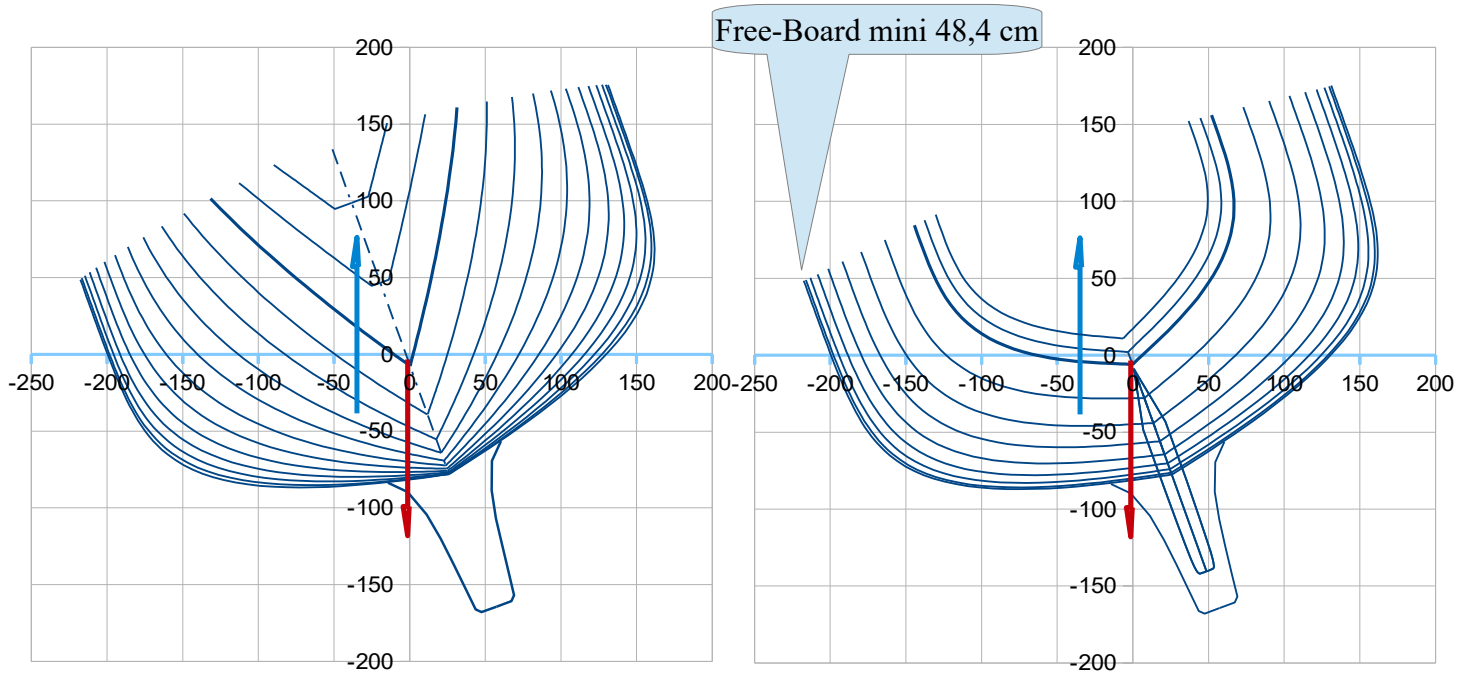
**Specific results**

Relevant only when heel = 0°

Lw (m)	9,89	Z fore (cm)	0,8
Bwl (m)	3,31	Z aft (cm)	-0,7
Trim (°)	-0,09		

Relevant only when heel = 1°  
 with crew at center

Yg heel (m)	-0,013
Gz (m)	0,336
> GM1° (m)	0,98



### At 30° heel angle

Data to enter : yellow cells

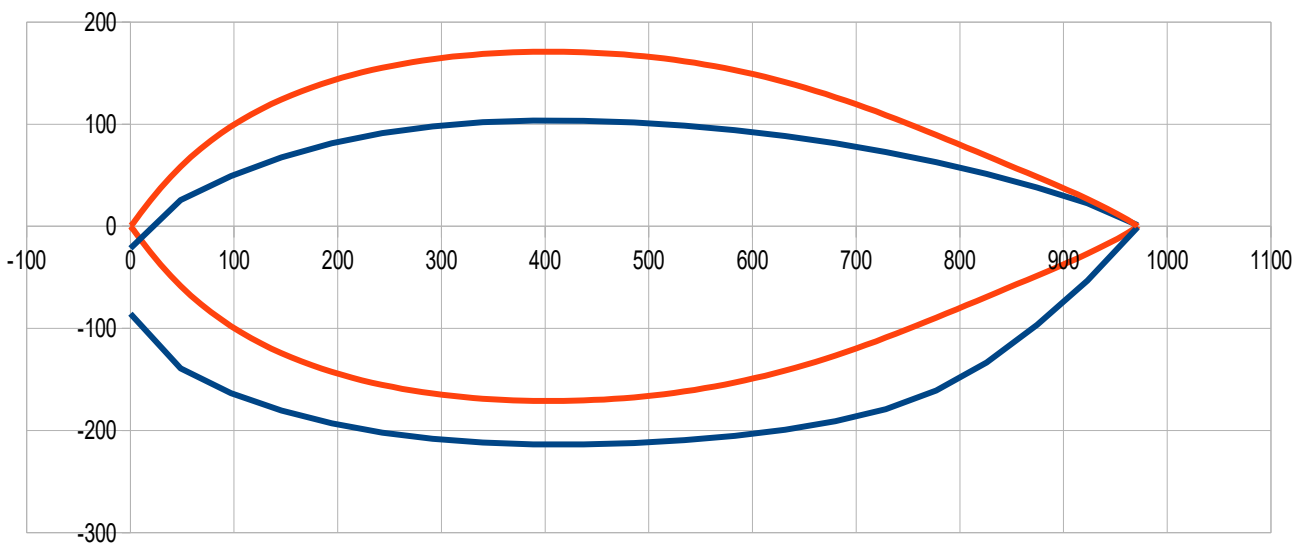
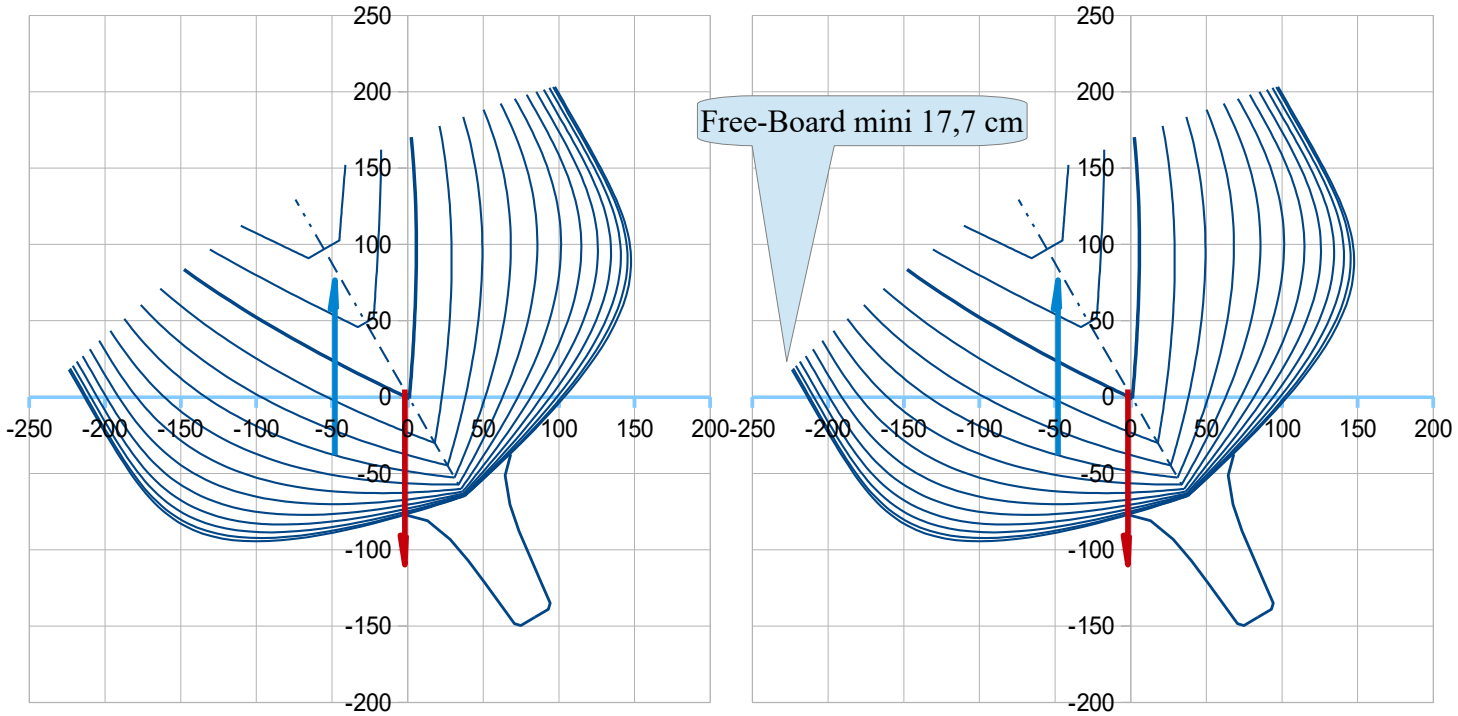
Heel (°)	30,0
Height (cm)	1,1351
Trim (°)	-0,237

Results

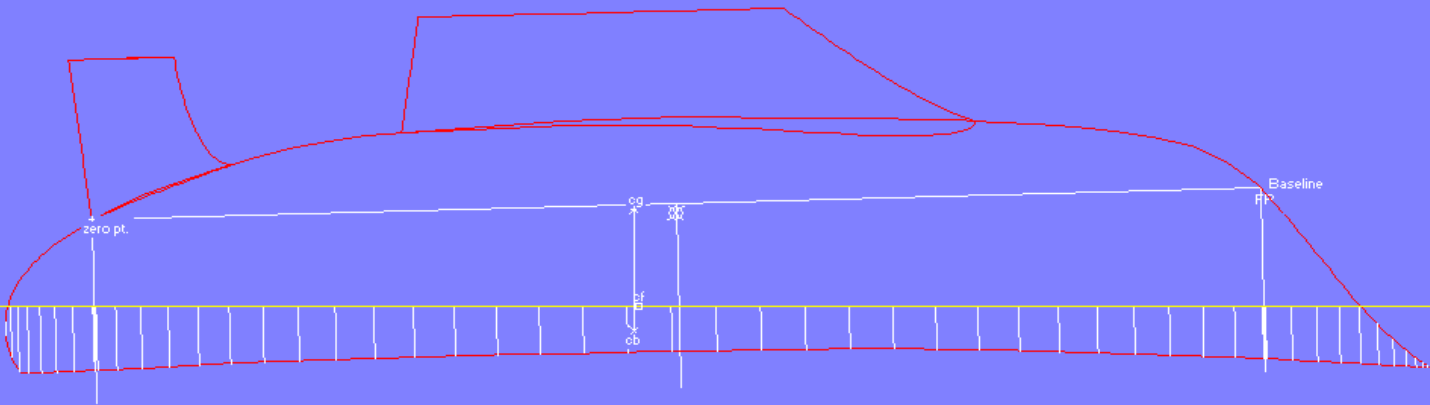
Disp. (m3)	13,65854	/ Disp. (m3)	13,65854
Xc heel (m)	4,505	/ Xg (m)	4,505
Yc heel (m)	-0,481	Yg heel (m)	-0,019
Zc heel (m)	-0,381	> GZ (m)	0,462
Sw heel (m2)	38,60	RM (kN.m)	63,433
Bwl heel (m)	3,18	FB mini (cm)	17,7
		Obliquity (°)	2,05

Specific results

Relevant only when heel = 0°			
Lwl (m)	9,67	Z fore (cm)	2,2
Bwl (m)	3,18	Z aft (cm)	-1,9
Trim (°)	-0,24		
Relevant only when heel = 1°			
Yg heel (m)	-0,019	with crew at center	
Gz (m)	0,462		
> GM1° (m)	0,92		



Upside down : <https://youtu.be/h0AngYDBMIQ>



**Annex : Output data of the computations with M 14000 kg ; X 4,505 m ; Zg 0,038 m**

Nota : Sw diff (m2) here below is the wetted surface evolution with heel, relative to the value when upright at this displacement 14000 kg and trim 0°.

**Gene-Hull results with Proxi 39 :**

Heel (°)	D 14000 kg ss loading		GM1° (m)	1,06			
	Height (cm)	Trim (°)	GZ (m)	RM (kN.m)	Sw diff. (m2)	Bwl (m)	FB mini (cm)
0	-12,8735	0,000	0,000	0,000	0,00	3,55	113,1
5	-12,5489	-0,003	0,092	12,597	0,21	3,53	97,0
10	-11,5517	-0,015	0,180	24,703	0,06	3,47	80,6
15	-9,8074	-0,040	0,262	35,934	-0,08	3,39	64,4
20	-7,2030	-0,085	0,336	46,093	-0,40	3,31	48,4
25	-3,6153	-0,150	0,402	55,212	-0,58	3,23	32,8
30	1,1351	-0,237	0,462	63,433	-0,73	3,18	17,7
32	3,4205	-0,280	0,484	66,513	-0,75	3,16	11,9
34	5,9488	-0,330	0,506	69,507	-0,69	3,15	6,1
36	8,7420	-0,390	0,527	72,438	-0,59	3,15	0,5

**Multisurf results :**

Multisurf	D 14000 kg ss loading					
Heel (°)	Trim (°)	GZ (m)	RM (kN.m)	Sw diff (m2)	Bwl (m)	
0	-0,066	0,000	0,000	0	3,466	
5	-0,077	0,084	11,537	-0,017	3,456	
10	-0,11	0,165	22,661	-0,083	3,424	
15	-0,169	0,242	33,236	-0,191	3,373	
20	-0,244	0,314	43,125	-0,313	3,31	
25	-0,332	0,379	52,052	-0,437	3,243	
30	-0,431	0,438	60,155	-0,541	3,186	
35	-0,533	0,493	67,709	-0,466	3,152	
36		0,504	69,219	-0,399	3,148	
40	-0,63	0,543	74,576	-0,318	2,99	
45	-0,73	0,58	79,657	-0,178	2,769	
50	-0,81	0,603	82,816	-0,081	2,633	
55	-0,89	0,615	84,464	-0,159	2,59	
60	-0,95	0,62	85,151	-0,482	2,624	
65	-0,98	0,623	85,563	-1,222	2,765	
70	-0,96	0,63	86,524	-2,431	3,001	
75	-0,95	0,641	88,035	-3,51	3,067	
80	-0,93	0,621	85,288	-5,783	2,102	
85	-0,86	0,571	78,421	-5,794	1,968	
90	-0,756	0,514	70,593	-5,684	1,938	
95	-0,626	0,452				
100	-0,476	0,385				
105	-0,32	0,316				
110	-0,154	0,245				
115	0,025	0,173				
120	0,215	0,101				
125	0,409	0,032				
130	0,596	-0,035				
135	0,773	-0,097				
140	0,937	-0,152				
145	1,085	-0,199				
150	1,216	-0,234				
155	1,326	-0,253				
160	1,414	-0,25				
165	1,482	-0,214				
170	1,555	-0,144				
175	1,604	-0,071				
180	1,621	0				

## Delfship – Archimede MB :

Archimede MB (Rev 6-43)		
Heel (°)	KN (m)	GZ (m)
0	0	0,000
5	0,089	0,086
10	0,176	0,169
15	0,257	0,247
20	0,332	0,319
25	0,399	0,383
30	0,460	0,441
35	0,515	0,493
40	0,567	0,542
45	0,604	0,577
50	0,626	0,597
55	0,638	0,607
60	0,647	0,614
65	0,658	0,623
70	0,671	0,635
75	0,684	0,647
80	0,666	0,628
85	0,614	0,576
90	0,556	0,518
95	0,492	0,454
100	0,425	0,387
105	0,355	0,318
110	0,283	0,247
115	0,210	0,175
120	0,138	0,105
125	0,065	0,034
130	0,003	-0,026
135	-0,059	-0,086
140	-0,122	-0,147
145	-0,167	-0,189
150	-0,199	-0,218
155	-0,227	-0,243
160	-0,233	-0,246
165	-0,205	-0,215
170	-0,144	-0,151