Examples with Gene-Hull VE Canoe 3.0

Jean-François Masset - May 2022 jfcmasset@outook.fr

The use of Gene-Hull VE Canoe, in its upgraded version 3.0, is illustrated through the generation of various hulls to cover the 3 types of small boats : Canoe, Peapod, Pointu.

Summary :

C1 : Tandem Canoe

C2 : variant of C1 with tumblehome shape sections

C3 : variant of C1 with flare shape sections

P1 : Peapod 14'

P1,1 : Peapod 15'

P1,2 : Peapod 16', inspired by the historical « Cape Split »

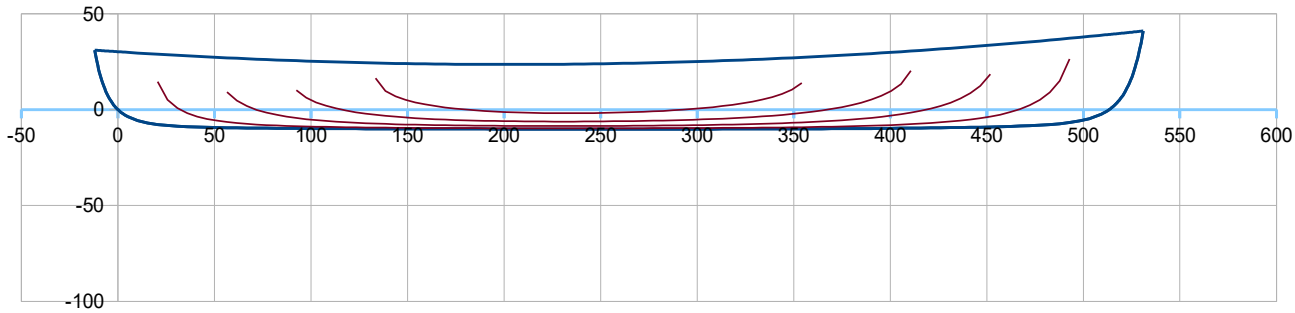
P2 : Pointu with a rowing-sailing programme

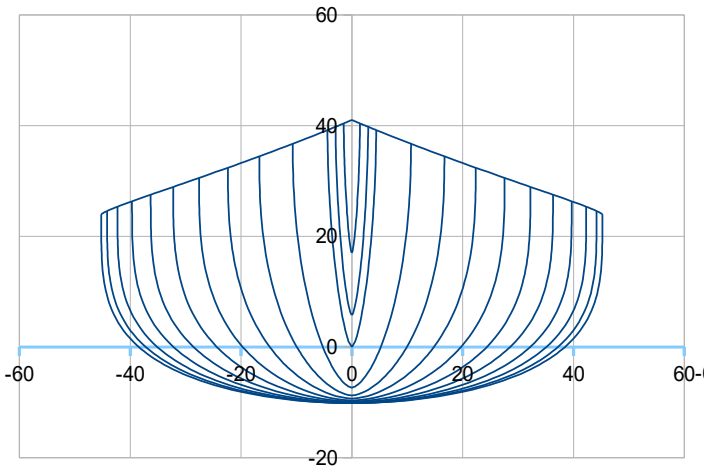
The input data for each example are in the hulls storage sheet.

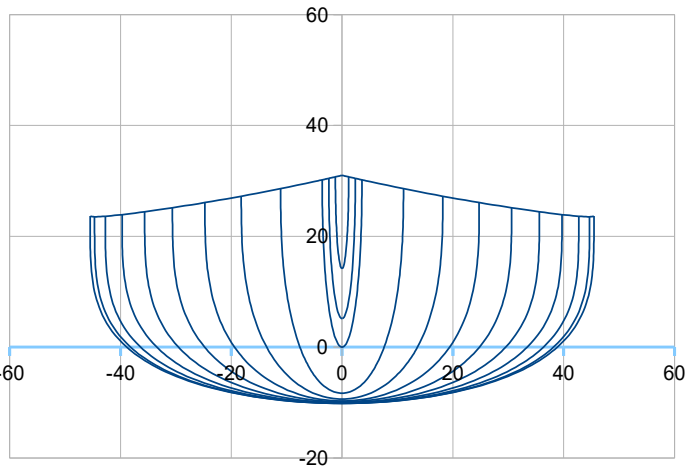
My warmest thanks to Alain Lebeau for the 3D views which illustrate the Peapod examples, done from the data provided by the offsets sheet

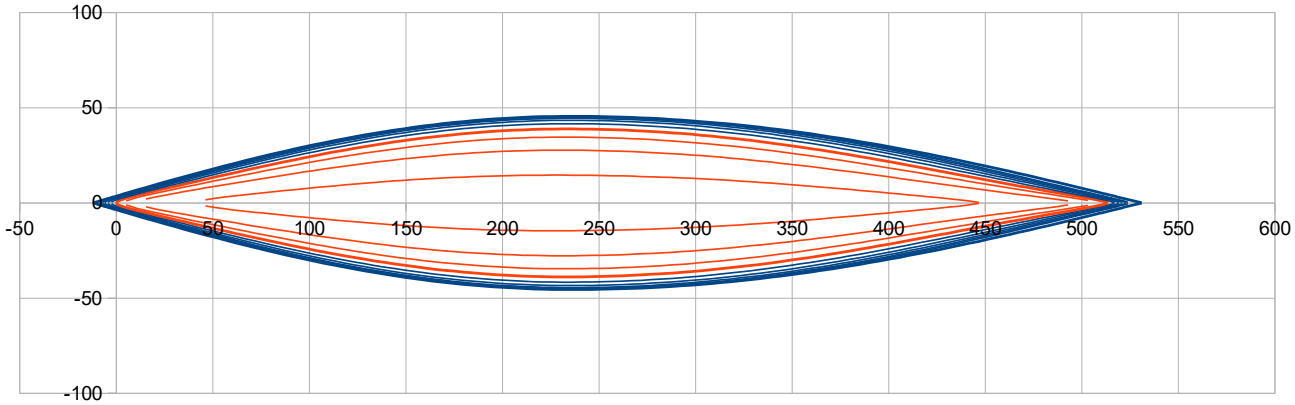
C1 Tandem Canoe

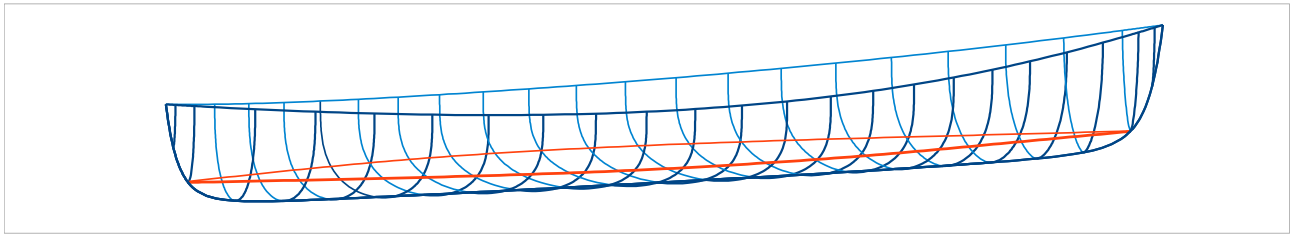
Loa : 5,43 m (17,81 ft) ; Lwl : 5,13 m (16,84 ft) ; Bsheer : 0,91 m (35,8'') = Boa (no tumblehome)
Bwl : 0,777 m (30,6'') ; Tc : 0,102 m (4'') ; Displacement : 180,3 kg (398 lbs)











C1 Hydrostatics data with the displacement 180,3 kg (i.e. with a loading of 150 kg)

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	5,43	L body (m)	5,43	Lwl body(m)	5,13	> Lwl/D^(1/3)	9,16	
>> ft	17,81	>> ft	16,84					
Bsheer (m)	0,91	at X (% Lwl)	46,0	Bmax (m)	0,91	at X (% Lwl)	46,0	
>> inch	35,83			>> inch	35,83			
Bwl (m)	0,777	at X (% Lwl)	45,0	> Bwl / Bmax	0,854	> Lwl / Bwl	6,01	
>> inch	30,60					Freeboards (m) >	Aft	Minimum	Fore
Tc (m)	0,102	at X (%Lwl)	50	Draft oa (m)	0,102		0,31	0,24	0,41
>> inch	4,00				>> inch		12,20	9,26	16,14
Displacement at H0 (m3)		0,17595	at Xc (m)	2,445	Xc (%Lwl)		47,63	Zc (m)	-0,041
(kg)		180,3	>> ft	8,02				>> inch	-1,60
>> lbs		397,6	with water mass / vol. of		1025	kg/m3			
Cp	0,600								
Sf (m2)	2,51	at Xf (m)	2,471	Xf (%Lwl)	48,12	>>> Xc – Xf (%Lwl)			-0,50
>> ft2	27,03	>> ft	8,11						
Angle immersed sheer (°)		27,9	at midship (50% Lwl)			Entry half angle (°)		10,1	
Sw (m2)	2,77	>Sw/D^(2/3)	8,83						
>> ft2	29,84								
Shull (m2)	5,88	at X (m)	2,610	Z (m)	0,041				
>> ft2	63,25	>> ft	8,56	>> inch	1,61				

B1.2 Daggerboard (if any)

Volume (m3)	0,00000	at X (m)	0,000	X (%Lwl)	0,00	Z (m)	0,000	
		>> ft	0,00			>> ft	0,00	
Draft oa (m)	0,00		Sw (m2)	0,00		Sxz (m2)	0,00	
>> ft	0,00		>> ft2	0,00		>> ft2	0,00	
CLR (m)	0,00	CLR (%Lwl)	0,00	*CLR = Center of Lateral Resistance*				
>> ft	0,00	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

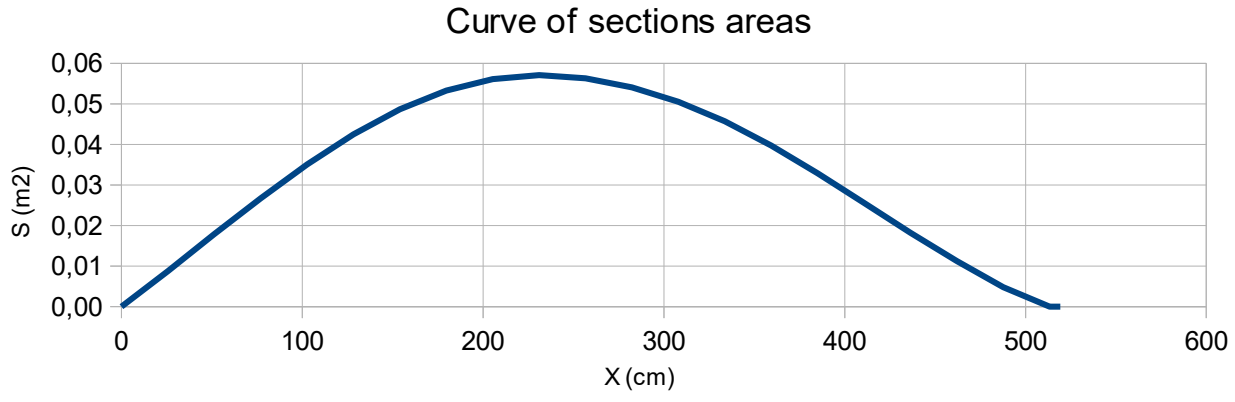
Volume (m3)	0,00000	at X (m)	0,00	X (%Lwl)	0,00	Z (m)	0,00	
Sw (m2)	0,00	>> ft	0,00			Sxz (m2)	0,00	
>> ft2	0,00					>> ft2	0,00	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	0,17595	at LCB (m)	2,445	LCB (%Lwl)	47,63	at ZCB (m)	-0,041	
(kg)	180,3	>> ft	8,02			>> ft	-0,13	
>> lbs	398							
Sw (m2)	2,77	>Sw/D^(2/3)	8,83	Lwl/D^(1/3)	9,16			
>> ft2	29,84			DLR	37	M(lbs/2240)/(Lwl(ft)/100)^3		

B1.5 Data from the mass spreadsheet

Dinghy with payload M(kg)	180,3	at Xg (m)	2,434	Xg (%Lwl)	47,40	at Zg (m)	0,259
Light boat	30,3		2,601				0,059



C1 – Mass spreadsheet

D – Mass spreadsheet – Preliminary

Eléments	L m	S m2	V m3	Mass units to enter	Masse (kg)	X (m)	M X	Z (m)	M Z
Hull :									
at unit mass assuming kg/m2		5,88		**4,00**	23,51	2,610	61,361	0,041	0,962
Benches - Deck if any									
mass assuming kg				**5,00**	5,00	2,567	12,835	0,120	0,600
Daggerboard, ballast if any :									
Daggerboard, mass assuming kg				**0,00**	0,00	1,990	0,000	0,425	0,000
Lead ballast, mass assuming kg				**0,00**	0,00	2,567	0,000	-0,122	0,000
Rudder helm system, if any :									
mass assuming kg				**0,00**	0,00	0,000	0,000	0,000	0,000
Rig and sails, if any :									
mass assuming kg				**0,00**	0,00	0,000	0,000	0,000	0,000
Various equipment or fittings :									
mass assuming kg				**1,80**	1,80	2,567	4,621	0,120	0,216
Light weight >>>					**30,3**	**2,60**	78,817	**0,059**	1,778

The mass units for the following examples C2 and C3 are unchanged

C1 - Initial stability , with the loading 150 kg (typically 2 paddlers) at Z 0,30 m

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*30,31*	*2,601*	*0,059*	*0*	*from the mass spreadsheet*
Load (kg)	**150,00**	**2,400**	**0,30**	**0,00**	Crew at center
(lbs)			**0,30**	**0,00**	Crew at windward
Total >>> Mass (kg)	**180,31**	**2,434**	**0,259**	**0,000**	**Crew at center**
Disp. (m3)	**0,17591**		**0,259**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

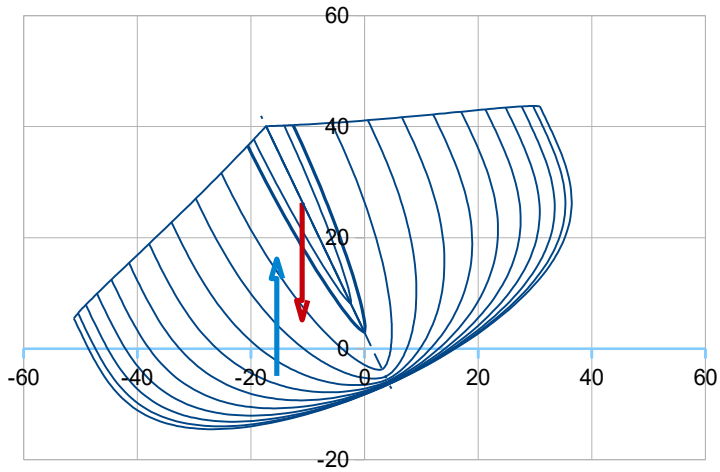
Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**1**	**> Disp. (m3)**	**0,17591**	**/ Disp. (m3)**	**0,17591**	Relevant only when heel = 0°			
Height (cm)	**0,0057**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,134	Z fore (cm)	0,2
Trim (°)	**0,0360**	Yc (m)	-0,008	Yg heel (m)	-0,005	Bwl (m)	0,777	Z aft (cm)	-0,1
		Zc (m)	-0,041	**> GZ (m)**	**0,003**	Draft (m)	0,102		
		Sw heel (m2)	**2,77**	**> RM (kN.m)**	**0,005**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,67**	**FB mini (cm)**	**22,7**	> Yg (m)	-0,005		
				Bwl (m)	**0,78**	**> GM1° (m)**	**0,17**		

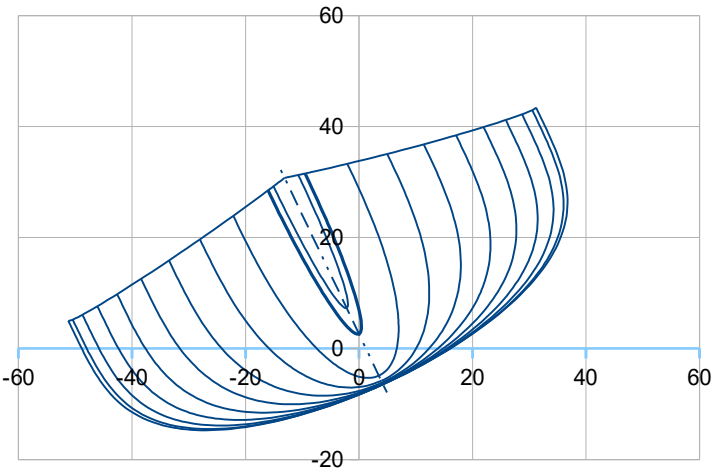
>>> GM1° = 0,17 m

C1 - Check of the freeboard mini and of the stability at heel 25° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**25**	**> Disp. (m3)**	**0,17591**	**/ Disp. (m3)**	**0,17591**	Relevant only when heel = 0°			
Height (cm)	**2,7838**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,053	Z fore (cm)	2,9
Trim (°)	**0,0280**	Yc (m)	-0,154	Yg heel (m)	-0,110	Bwl (m)	0,701	Z aft (cm)	2,7
		Zc (m)	-0,050	**> GZ (m)**	**0,045**	Draft (m)	0,074		
		Sw heel (m2)	**2,52**	**> RM (kN.m)**	**0,079**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,87**	**FB mini (cm)**	**5,0**	> Yg (m)	-0,110		
				Bwl (m)	**0,65**	**> GM1° (m)**	**0,11**		



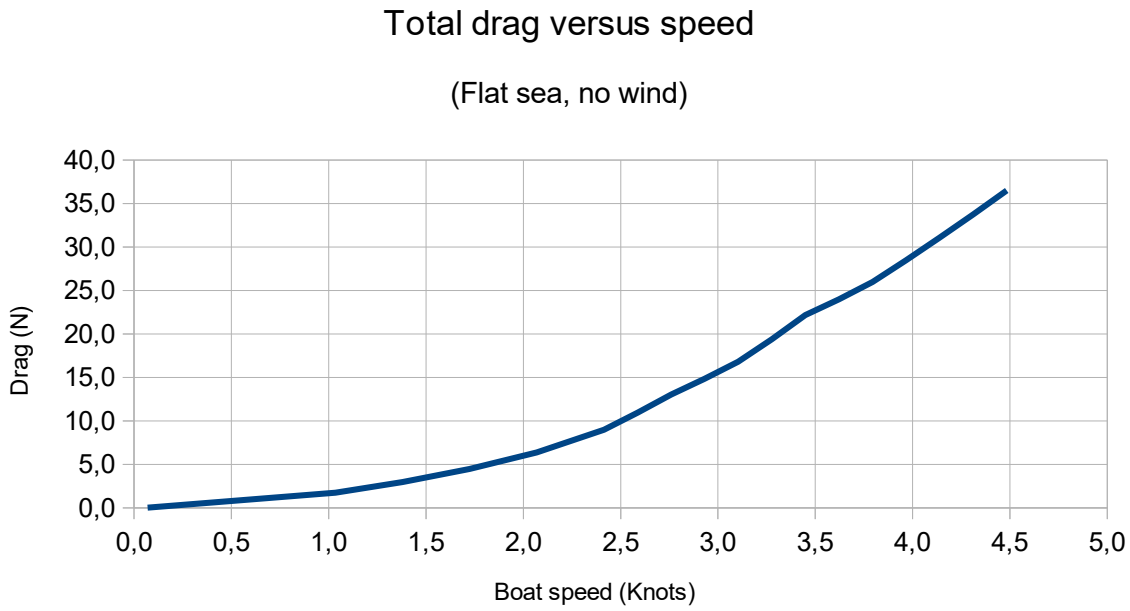


>>> The righting moment is still positive RM25° = 0,079 kN.m

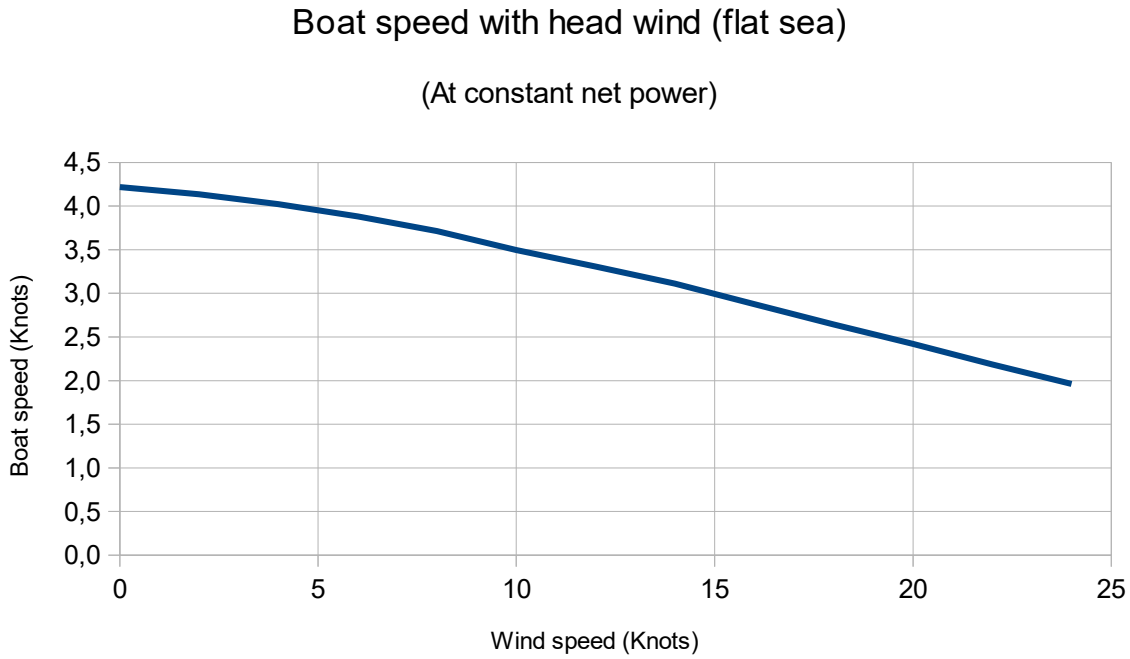
>>> The minimum freeboard is 5 cm

C1 - VPP Output :

Drag curve :

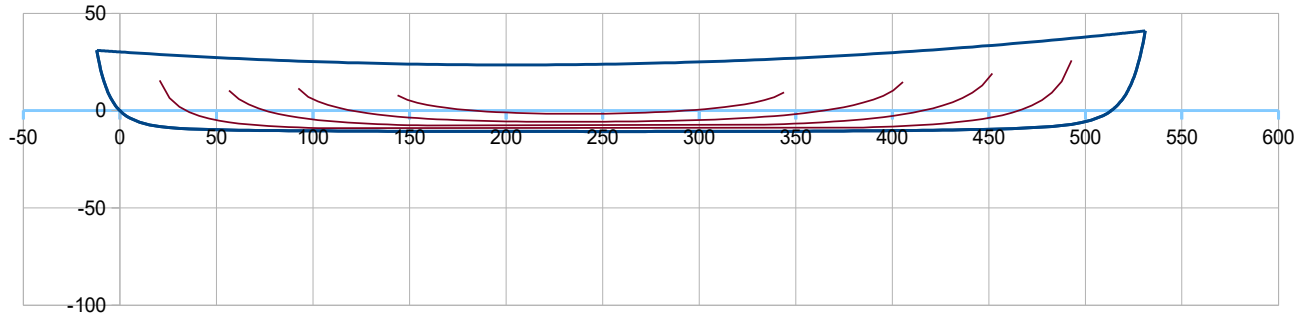


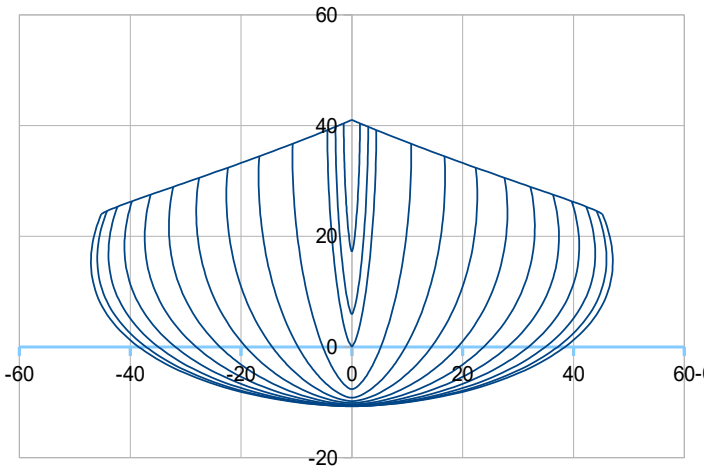
Speed estimation with a net propulsion power of 70 W :

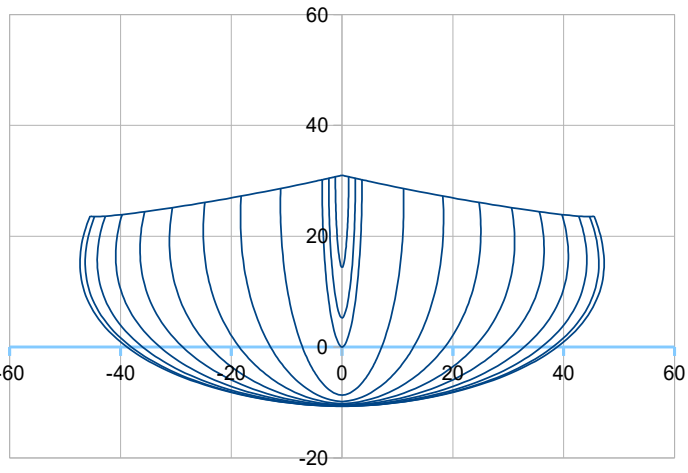


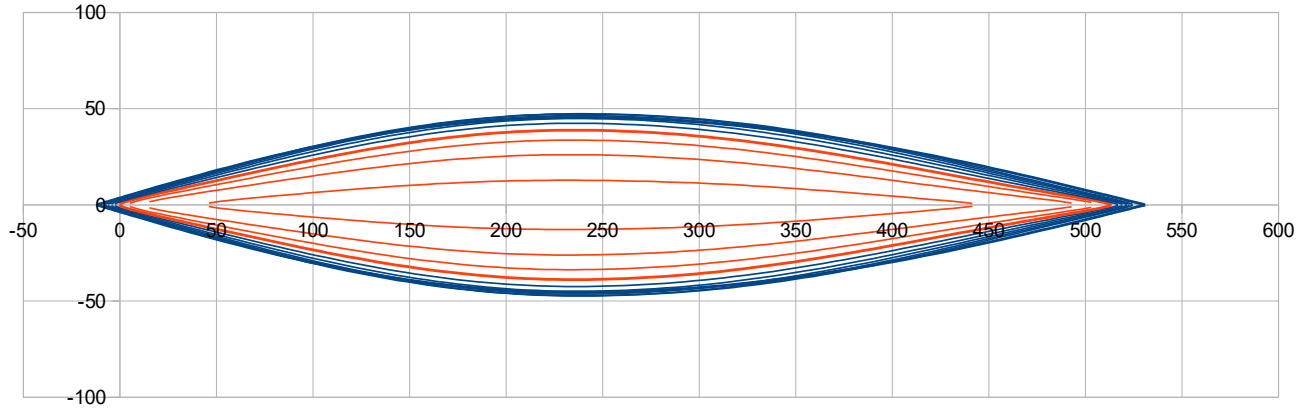
C2 - Tandem Canoe with tumblehome shape sections

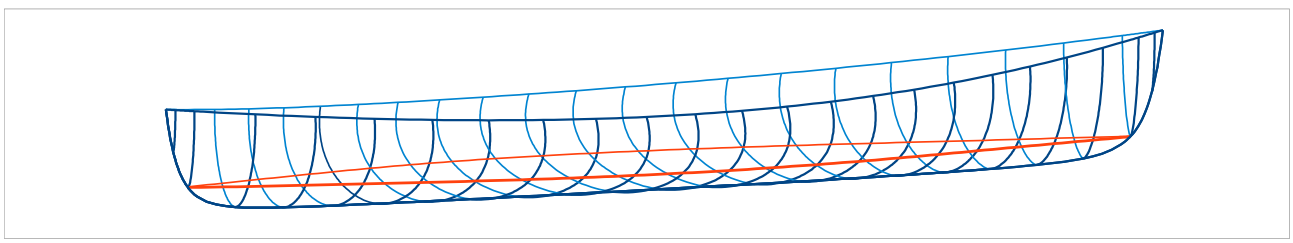
Loa : 5,43 m (17,81 ft) ; Lwl : 5,13 m (16,84 ft) ; Bsheer : 0,91 m (35,8'') ; Boa : 0,95 m (37,3'')
Bwl : 0,777 m (30,59'') ; Tc : 0,107 m (4,2'') ; Displacement : 179,9 kg (397 lbs)











C2 - Hydrostatics data at the displacement 179,9 kg (i.e. with a loading of 150 kg)

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	5,43	L body (m)	5,43	Lwl body(m)	5,13	> Lwl/D^(1/3)	9,17	
>> ft	17,81	>> ft	16,84					
Bsheer (m)	0,91	at X (% Lwl)	46,0	Bmax (m)	0,95	at X (% Lwl)	45,0	
>> inch	35,83			>> inch	37,25			
Bwl (m)	0,777	at X (% Lwl)	46,0	> Bwl / Bmax	0,821	> Lwl / Bwl	6,25	
>> inch	30,59				Freeboards (m) >	Aft	Minimum	Fore
Tc (m)	0,107	at X (%Lwl)	50	Draft oa (m)	0,107	0,31	0,24	0,41
>> inch	4,22				>> inch	12,20	9,26	16,14

Displacement at H0 (m3)	0,17547	at Xc (m)	2,457	Xc (%Lwl)	47,86	Zc (m)	-0,042
(kg)	179,9	>> ft	8,06			>> inch	-1,66
>> lbs	396,5	with water mass / vol. of		1025	kg/m3		

Cp	0,594						
Sf (m2)	2,47	at Xf (m)	2,477	Xf (%Lwl)	48,26	>>> Xc – Xf (%Lwl)	-0,40
>> ft2	26,61	>> ft	8,13				
Angle immersed sheer (°)	27,9	at midship (50% Lwl)				Entry half angle (°)	9,8
Sw (m2)	2,74	>Sw/D^(2/3)	8,76				
>> ft2	29,54						
Shull (m2)	5,92	at X (m)	2,613	Z (m)	0,041		
>> ft2	63,72	>> ft	8,57	>> inch	1,63		

B1.2 Daggerboard (if any)

Volume (m3)	0,00000	at X (m)	0,000	X (%Lwl)	0,00	Z (m)	0,000	
		>> ft	0,00			>> ft	0,00	
Draft oa (m)	0,00		Sw (m2)	0,00		Sxz (m2)	0,00	
>> ft	0,00		>> ft2	0,00		>> ft2	0,00	
CLR (m)	0,00	CLR (%Lwl)	0,00	*CLR = Center of Lateral Resistance*				
>> ft	0,00	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

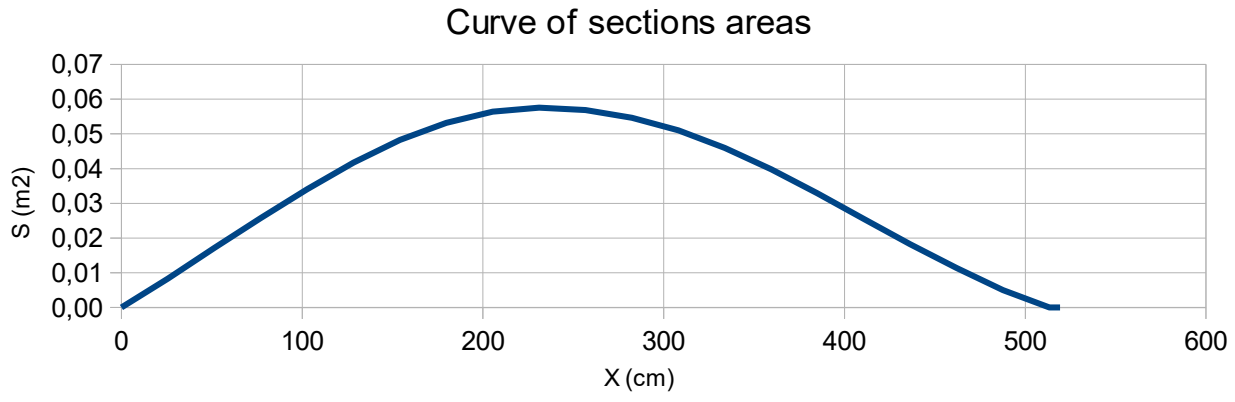
Volume (m3)	0,00000	at X (m)	0,00	X (%Lwl)	0,00	Z (m)	0,00
Sw (m2)	0,00	>> ft	0,00			Sxz (m2)	0,00
>> ft2	0,00					>> ft2	0,00

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	0,17547	at LCB (m)	2,457	LCB (%Lwl)	47,86	at ZCB (m)	-0,042
(kg)	179,9	>> ft	8,06			>> ft	-0,14
>> lbs	397						
Sw (m2)	2,74	>Sw/D^(2/3)	8,76	Lwl/D^(1/3)	9,17		
>> ft2	29,54			DLR	37	M(lbs/2240)/(Lwl(ft)/100)^3	

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	180,5	at Xg (m)	2,434	Xg (%Lwl)	47,41	at Zg (m)	0,259
Light boat	30,5		2,603				0,059



C2 - Initial stability , with the loading 150 kg (typically 2 paddlers) at Z 0,30 m

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*30,48*	*2,603*	*0,059*	*0*	*from the mass spreadsheet*
Load (kg)	**150,00**	**2,400**	**0,30**	**0,00**	Crew at center
(lbs)			**0,30**	**0,00**	Crew at windward
Total >>> Mass (kg)	**180,48**	**2,434**	**0,259**	**0,000**	**Crew at center**
Disp. (m3)	**0,17608**		**0,259**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

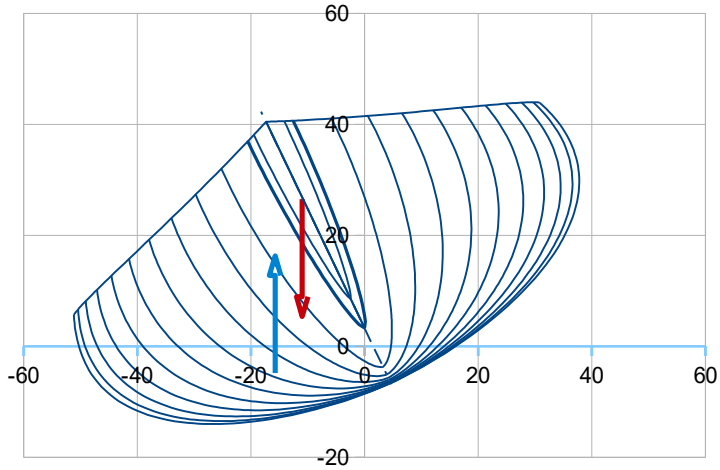
Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**1**	**> Disp. (m3)**	**0,17608**	**/ Disp. (m3)**	**0,17608**	Relevant only when heel = 0°			
Height (cm)	**-0,0208**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,134	Z fore (cm)	0,3
Trim (°)	**0,0770**	Yc (m)	-0,007	Yg heel (m)	-0,005	Bwl (m)	0,778	Z aft (cm)	-0,4
		Zc (m)	-0,042	**> GZ (m)**	**0,003**	Draft (m)	0,107		
		Sw heel (m2)	**2,75**	**> RM (kN.m)**	**0,005**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,70**	**FB mini (cm)**	**22,7**	> Yg (m)	-0,005		
				Bwl (m)	**0,78**	**> GM1° (m)**	**0,16**		

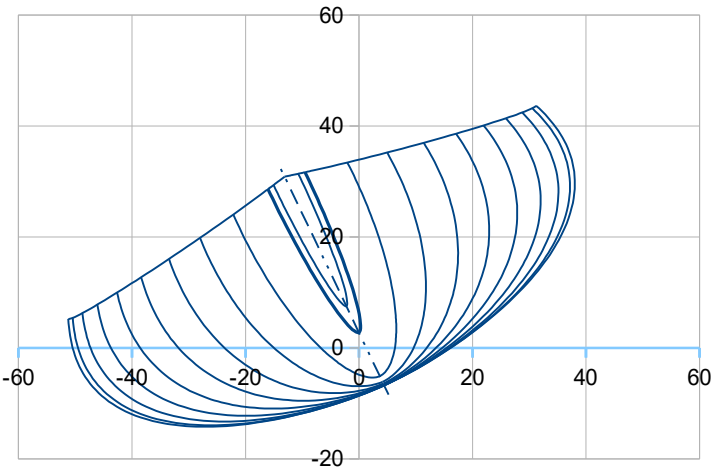
>>> GM1° = 0,16 m

C2 - Check of the freeboard mini and of the stability at heel 25° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**25**	**> Disp. (m3)**	**0,17608**	**/ Disp. (m3)**	**0,17608**	Relevant only when heel = 0°			
Height (cm)	**3,0110**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,048	Z fore (cm)	3,3
Trim (°)	**0,0570**	Yc (m)	-0,157	Yg heel (m)	-0,110	Bwl (m)	0,682	Z aft (cm)	2,8
		Zc (m)	-0,048	**> GZ (m)**	**0,048**	Draft (m)	0,077		
		Sw heel (m2)	**2,53**	**> RM (kN.m)**	**0,085**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,88**	**FB mini (cm)**	**5,2**	> Yg (m)	-0,110		
				Bwl (m)	**0,67**	**> GM1° (m)**	**0,11**		



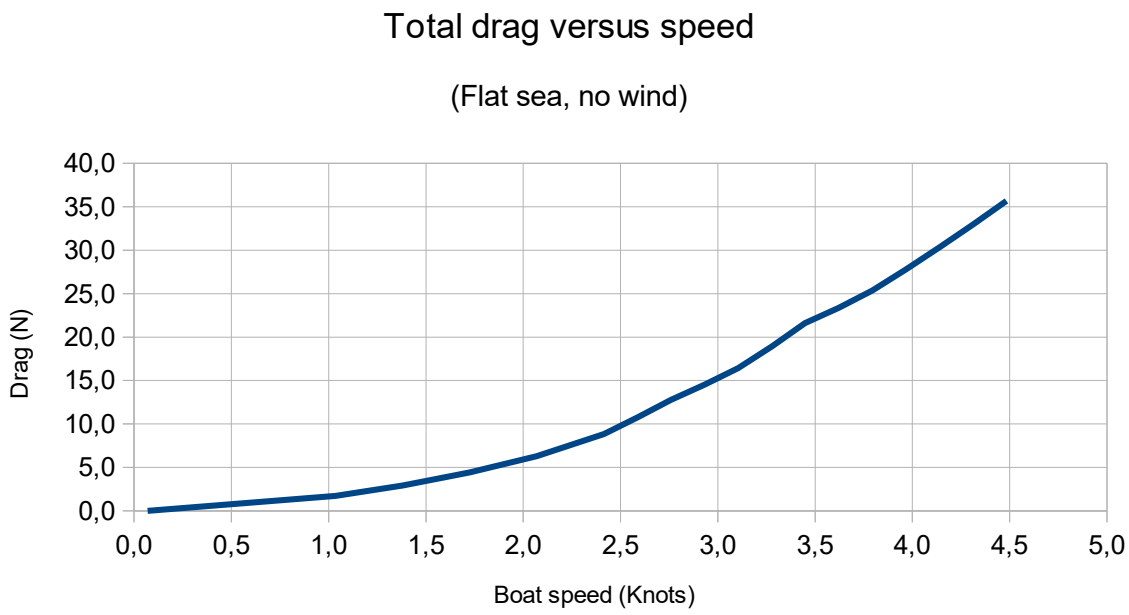


>>> The righting moment is still positive : RM25° = 0,085 kN.m

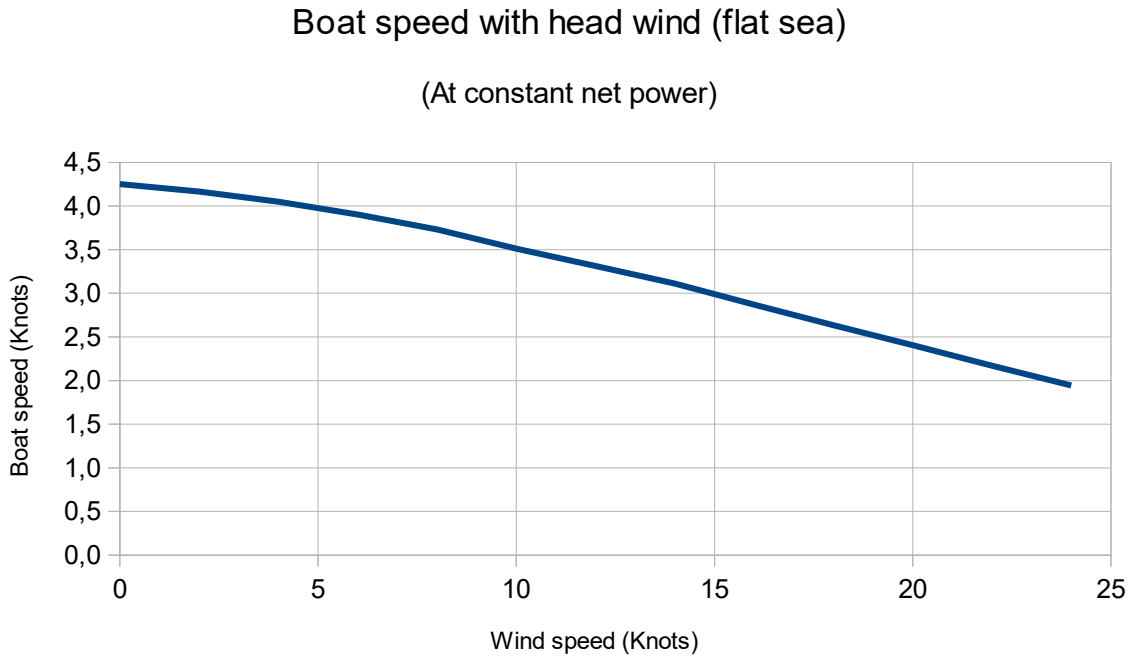
>>> The minimum freeboard is 5,2 cm

C2 - VPP Output :

Drag curve :



Speed estimation with a net propulsion power of 70 W :



What are the input data differences to evolve from C1 to C2 :

The change are only about the sections parameters and the hull draft Tc :

C1 canoe	
1.1 Hull data	metric
Lenght of waterline :	
Lwl (m)	5,134
Maximum draft of the hull body	
Tc (m)	0,1016
Keel line front part :	
Xbow (m)	5,310
Zbow (m)	0,410
Pokl fore	3,30
Cet fore	10,0
Keel line, rear part :	
Xar (m)	-0,120
Zar (m)	0,31
Pokl aft	3,30
Cet aft	10,0
Keel	
Type	0
Sheer line, in horizontal projec	
Bmax (m)	0,9100
at Xb (% Lwl)	46,0
Posh fore	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Posh aft	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Freeboard at midship	
Zsh mid (m)	0,240

Sections			
	PE1	C PE1	PE2
Fore	1,500	1,000	1,500
Mid	3,700	1,000	1,950
Aft	2,000	1,000	2,000

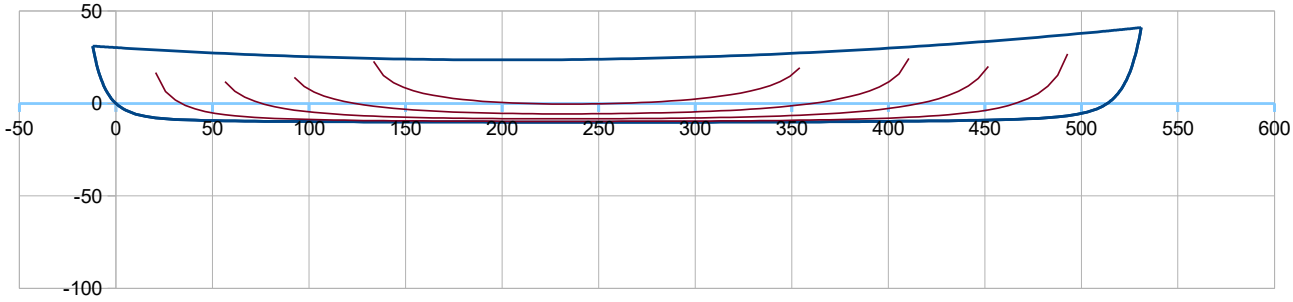
C2 canoe tumblehome	
1.1 Hull data	metric
Lenght of waterline :	
Lwl (m)	5,134
Maximum draft of the hull b	
Tc (m)	0,1071
Keel line front part :	
Xbow (m)	5,310
Zbow (m)	0,410
Pokl fore	3,30
Cet fore	10,0
Keel line, rear part :	
Xar (m)	-0,120
Zar (m)	0,31
Pokl aft	3,30
Cet aft	10,0
Keel	
Type	0
Sheer line, in horizontal pr	
Bmax (m)	0,9100
at Xb (% Lwl)	46,0
Posh fore	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Posh aft	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Freeboard at midship	
Zsh mid (m)	0,240

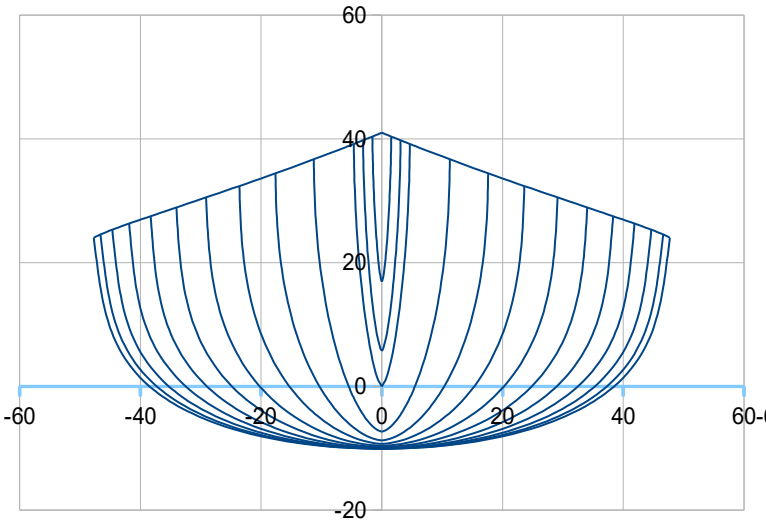
Sections			
	PE1	C PE1	PE2
Fore	1,500	0,900	1,500
Mid	2,000	0,760	1,810
Aft	1,800	0,950	1,800

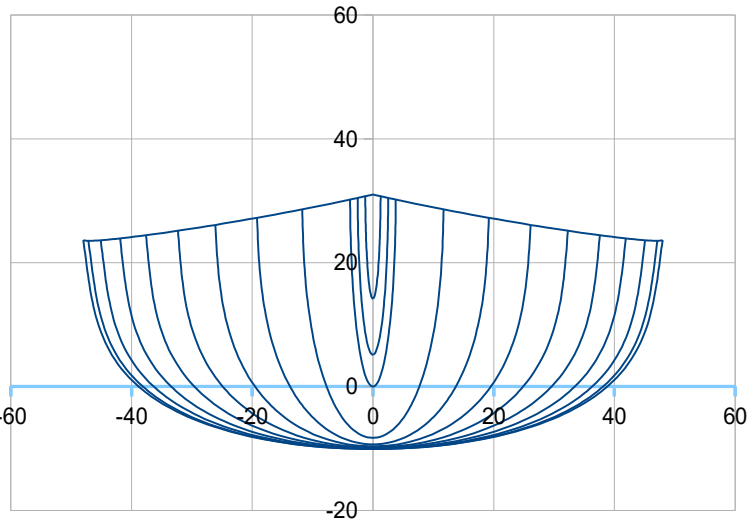
Especially, it is the C PE1 < 1 which trigger such tumblehome effect.

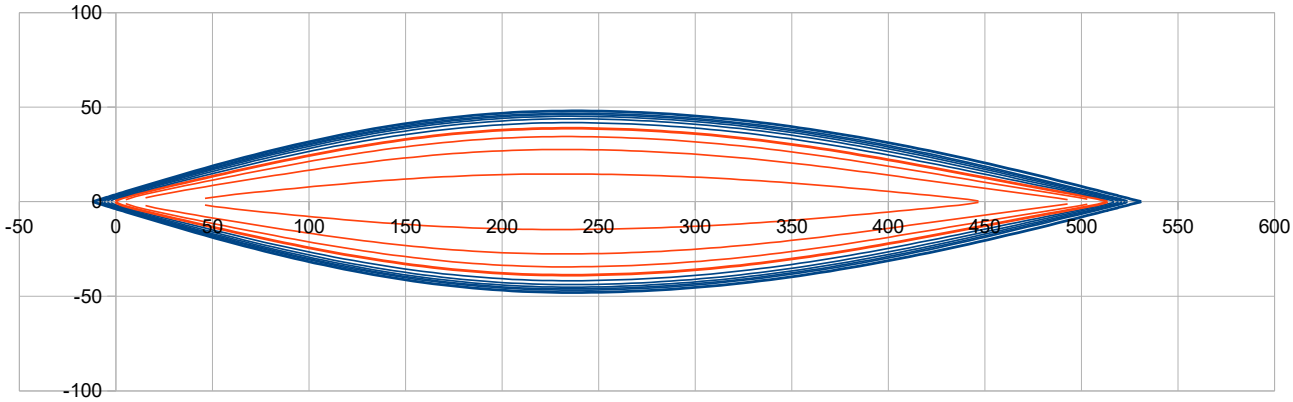
C3 - Tandem Canoe with flare shape sections

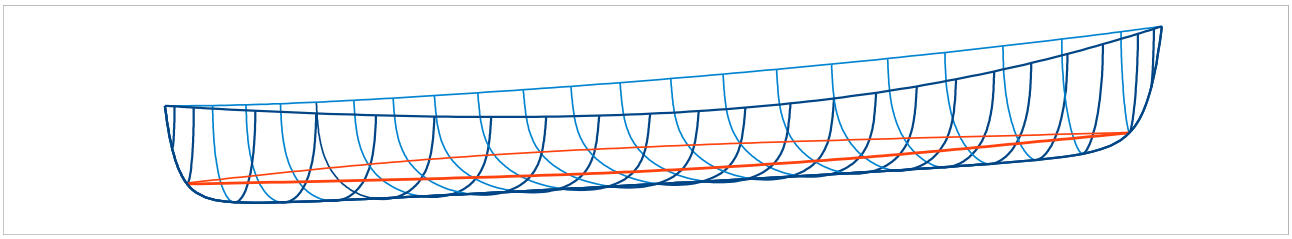
Loa : 5,43 m (17,81 ft) ; Lwl : 5,13 m (16,84 ft) ; Boa = Bsheer = 0,96 m (37,8'') ; Bwl : 0,777 m (30,59'') ; Tc : 0,101 m (3,98'') ; Displacement : 180,3 kg (397 lbs)











C3 - Hydrostatics data with the displacement 180,3 kg (i.e. with a loading of 150 kg)

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	5,43	L body (m)	5,43	Lwl body(m)	5,13	> Lwl/D^(1/3)	9,16	
>> ft	17,81	>> ft	16,84					
Bsheer (m)	0,96	at X (% Lwl)	46,0	Bmax (m)	0,96	at X (% Lwl)	46,0	
>> inch	37,80			>> inch	37,80			
Bwl (m)	0,777	at X (% Lwl)	46,0	> Bwl / Bmax	0,809	> Lwl / Bwl	6,35	
>> inch	30,58					Freeboards (m) >	Aft	Minimum	Fore
Tc (m)	0,101	at X (%Lwl)	50	Draft oa (m)	0,101		0,31	0,24	0,41
>> inch	3,98				>> inch		12,20	9,26	16,14

Displacement at H0 (m3)	0,17590	at Xc (m)	2,454	Xc (%Lwl)	47,81	Zc (m)	-0,041
(kg)	180,3	>> ft	8,05			>> inch	-1,60
>> lbs	397,5	with water mass / vol. of		1025	kg/m3		

Cp	0,605						
Sf (m2)	2,53	at Xf (m)	2,479	Xf (%Lwl)	48,28	>>> Xc – Xf (%Lwl)	-0,48
>> ft2	27,23	>> ft	8,13				

Angle immersed sheer (°)	26,7	at midship (50% Lwl)		Entry half angle (°)	10,4
Sw (m2)	2,78	>Sw/D^(2/3)	8,87		
>> ft2	29,97				
Shull (m2)	5,92	at X (m)	2,612	Z (m)	0,041
>> ft2	63,75	>> ft	8,57	>> inch	1,62

B1.2 Daggerboard (if any)

Volume (m3)	0,00000	at X (m)	0,000	X (%Lwl)	0,00	Z (m)	0,000	
		>> ft	0,00			>> ft	0,00	
Draft oa (m)	0,00		Sw (m2)	0,00		Sxz (m2)	0,00	
>> ft	0,00		>> ft2	0,00		>> ft2	0,00	
CLR (m)	0,00	CLR (%Lwl)	0,00	*CLR = Center of Lateral Resistance*				
>> ft	0,00	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

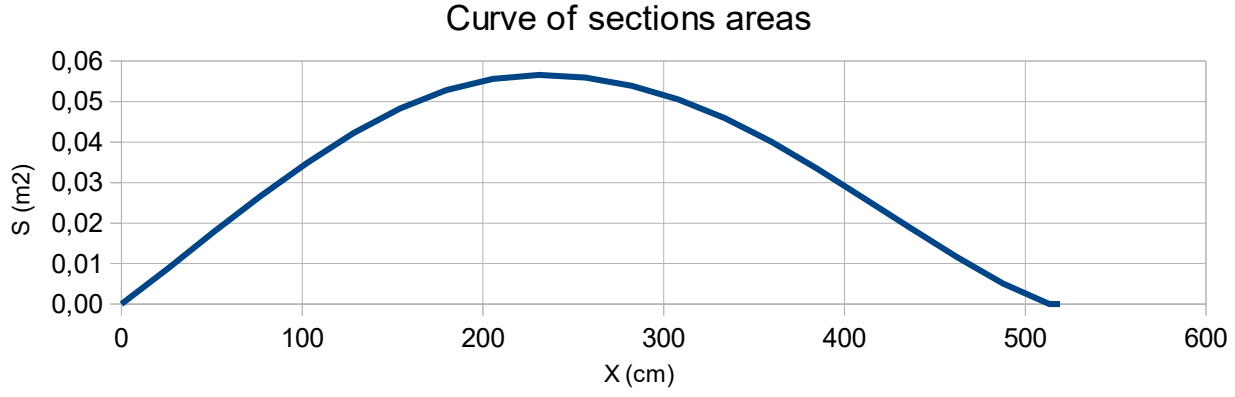
Volume (m3)	0,00000	at X (m)	0,00	X (%Lwl)	0,00	Z (m)	0,00	
Sw (m2)	0,00	>> ft	0,00			Sxz (m2)	0,00	
>> ft2	0,00					>> ft2	0,00	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	0,17590	at LCB (m)	2,454	LCB (%Lwl)	47,81	at ZCB (m)	-0,041
(kg)	180,3	>> ft	8,05			>> ft	-0,13
>> lbs	397						
Sw (m2)	2,78	>Sw/D^(2/3)	8,87	Lwl/D^(1/3)	9,16		
>> ft2	29,97			DLR	37	M(lbs/2240)/(Lwl(ft)/100)^3	

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	180,5	at Xg (m)	2,434	Xg (%Lwl)	47,41	at Zg (m)	0,259
Light boat	30,5		2,602				0,059



C3 - Initial stability , with the loading 150 kg (typically 2 paddlers) at Z 0,30 m

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*30,49*	*2,602*	*0,059*	*0*	*from the mass spreadsheet*
Load (kg)	**150,00**	**2,400**	**0,30**	**0,00**	Crew at center
(lbs)			**0,30**	**0,00**	Crew at windward
Total >>> Mass (kg)	**180,49**	**2,434**	**0,259**	**0,000**	**Crew at center**
Disp. (m3)	**0,17609**		**0,259**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

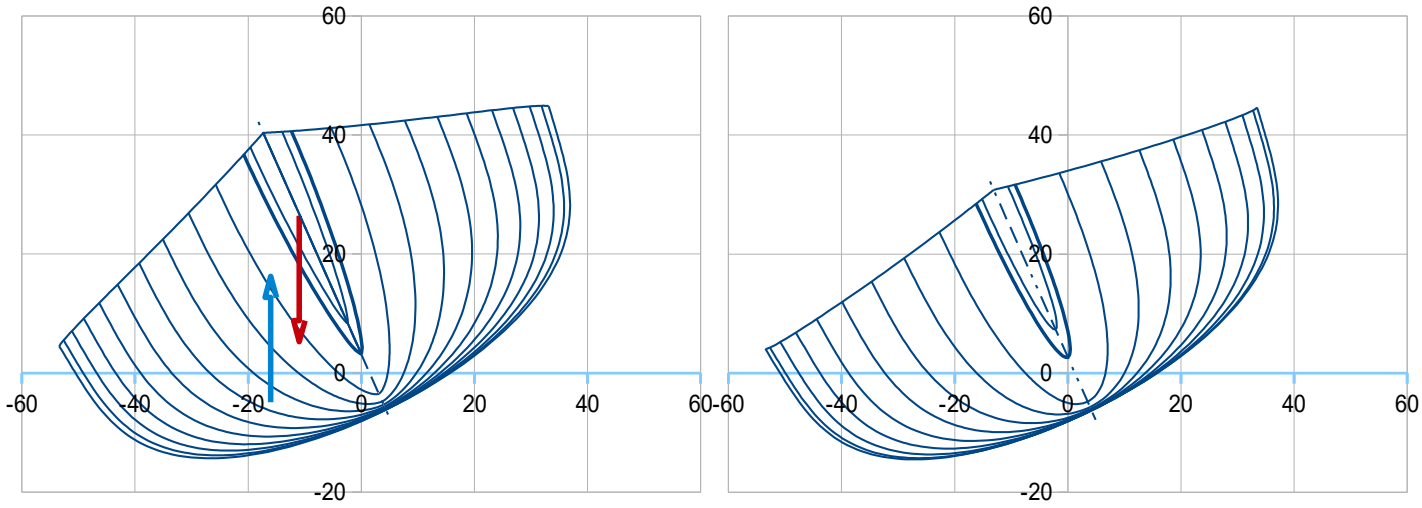
Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**1**	**> Disp. (m3)**	**0,17609**	**/ Disp. (m3)**	**0,17609**	Relevant only when heel = 0°			
Height (cm)	**-0,0043**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,134	Z fore (cm)	0,3
Trim (°)	**0,0670**	Yc (m)	-0,008	Yg heel (m)	-0,005	Bwl (m)	0,777	Z aft (cm)	-0,3
		Zc (m)	-0,040	**> GZ (m)**	**0,003**	Draft (m)	0,101		
		Sw heel (m2)	**2,78**	**> RM (kN.m)**	**0,005**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,77**	**FB mini (cm)**	**22,7**	> Yg (m)	-0,005		
				Bwl (m)	**0,78**	**> GM1° (m)**	**0,18**		

>>> GM1° = 0,18 m

C3 - Check of the freeboard mini and of the stability at heel 25° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**25**	**> Disp. (m3)**	**0,17609**	**/ Disp. (m3)**	**0,17609**	Relevant only when heel = 0°			
Height (cm)	**2,9265**	**Xc (m)**	**2,434**	**/ Xg (m)**	**2,434**	Lwl (m)	5,048	Z fore (cm)	3,2
Trim (°)	**0,0530**	Yc (m)	-0,160	Yg heel (m)	-0,110	Bwl (m)	0,693	Z aft (cm)	2,7
		Zc (m)	-0,049	**> GZ (m)**	**0,050**	Draft (m)	0,072		
		Sw heel (m2)	**2,54**	**> RM (kN.m)**	**0,089**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,89**	**FB mini (cm)**	**4,1**	> Yg (m)	-0,110		
				Bwl (m)	**0,67**	**> GM1° (m)**	**0,12**		

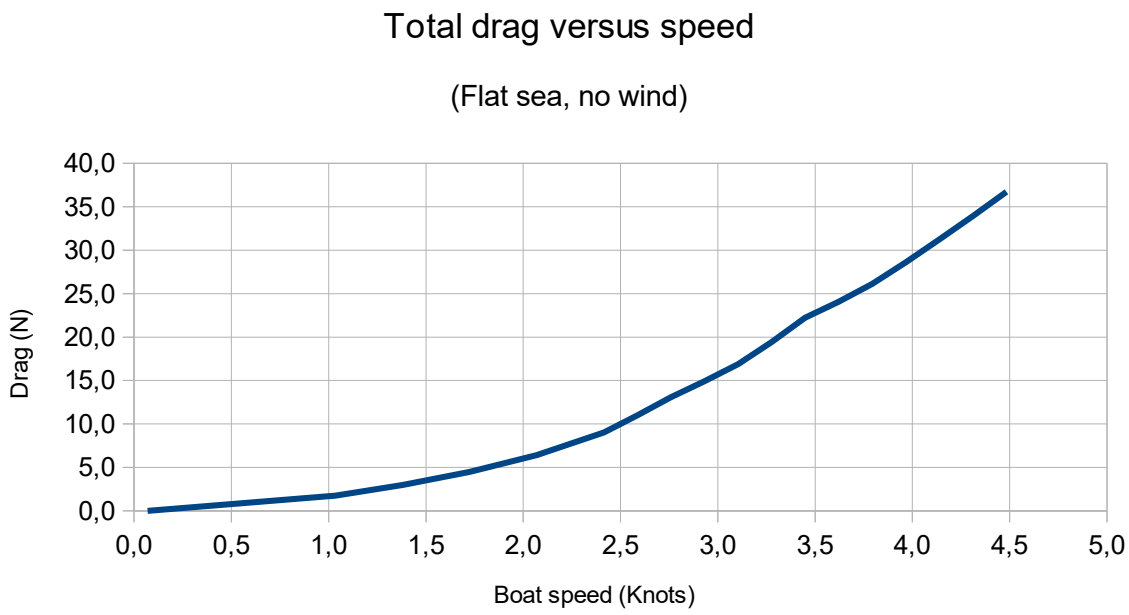


>>> The righting moment is still positive : RM25° = 0,089 kN.m

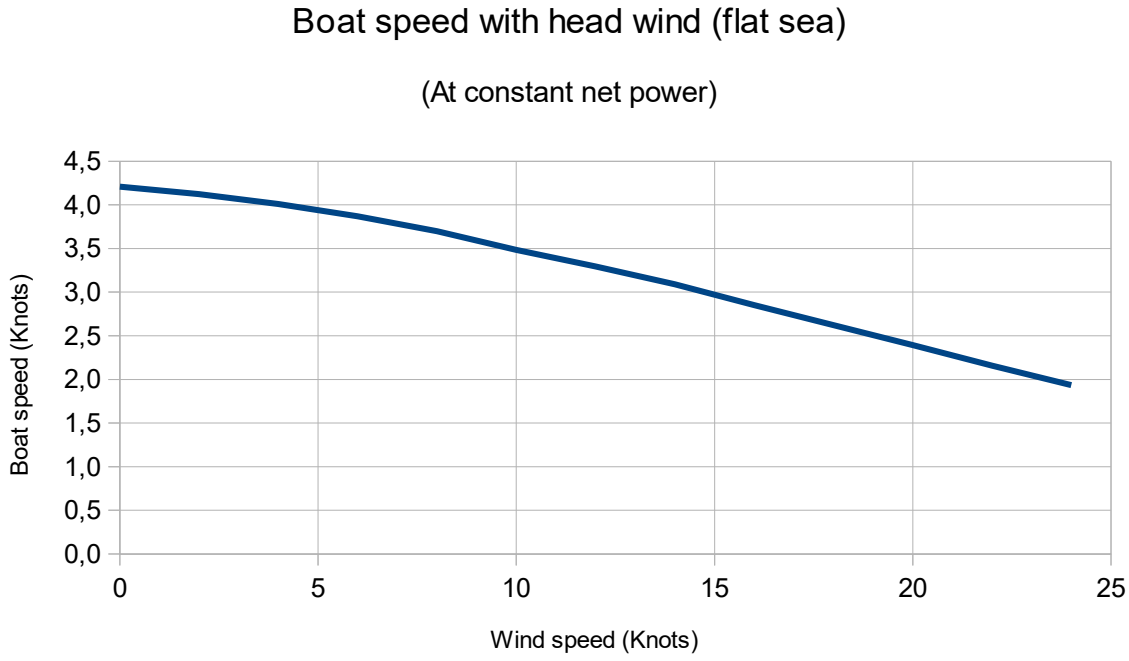
>>> The minimum freeboard is 4,1 cm

C3 - VPP Output :

Drag curve :



Speed estimation with a net propulsion power of 70 W :



What are the input data differences to evolve from C1 to C3 :

The change are only about the sections parameters and the hull draft Tc :

C1 canoe	
1.1 Hull data	metric
Lenght of waterline :	
Lwl (m)	5,134
Maximum draft of the hull body	
Tc (m)	0,1016
Keel line front part :	
Xbow (m)	5,310
Zbow (m)	0,410
Pokl fore	3,30
Cet fore	10,0
Keel line, rear part :	
Xar (m)	-0,120
Zar (m)	0,31
Pokl aft	3,30
Cet aft	10,0
Keel	
Type	0
Sheer line, in horizontal projec	
Bmax (m)	0,9100
at Xb (% Lwl)	46,0
Posh fore	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Posh aft	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Freeboard at midship	
Zsh mid (m)	0,240

Sections			
	PE1	C PE1	PE2
Fore	1,500	1,000	1,500
Mid	3,700	1,000	1,950
Aft	2,000	1,000	2,000

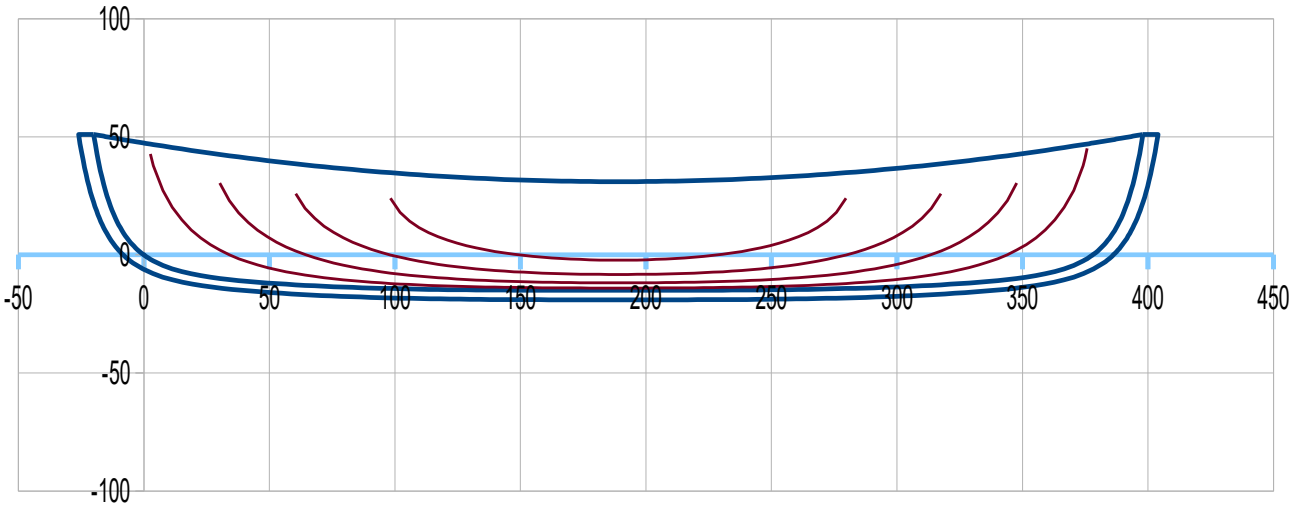
C3 canoe flare	
1.1 Hull data	metric
Lenght of waterline :	
Lwl (m)	5,134
Maximum draft of the hull b	
Tc (m)	0,1010
Keel line front part :	
Xbow (m)	5,310
Zbow (m)	0,410
Pokl fore	3,30
Cet fore	10,0
Keel line, rear part :	
Xar (m)	-0,120
Zar (m)	0,31
Pokl aft	3,30
Cet aft	10,0
Keel	
Type	0
Sheer line, in horizontal pr	
Bmax (m)	0,9600
at Xb (% Lwl)	46,0
Posh fore	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Posh aft	2,00
Cor Posh	0,030
Po Cor Posh	2,00
Freeboard at midship	
Zsh mid (m)	0,240

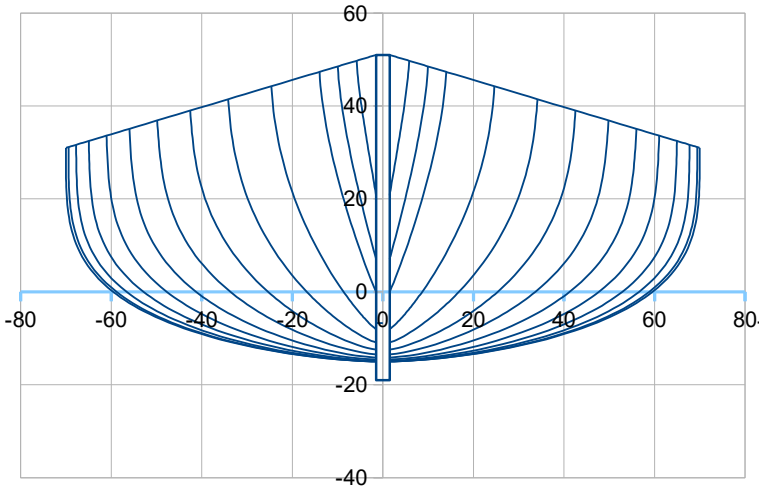
Sections			
	PE1	C PE1	PE2
Fore	1,500	1,000	1,500
Mid	3,860	1,100	2,000
Aft	2,000	1,050	2,000

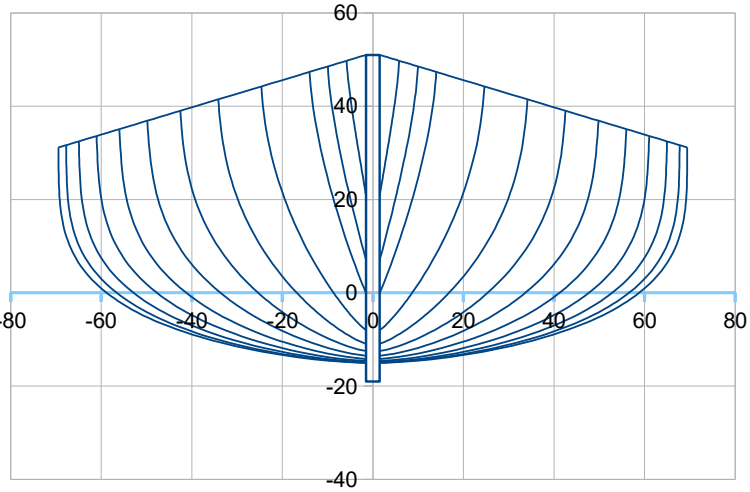
Especially, it is the C PE1 > 1 which trigger such flare effect.

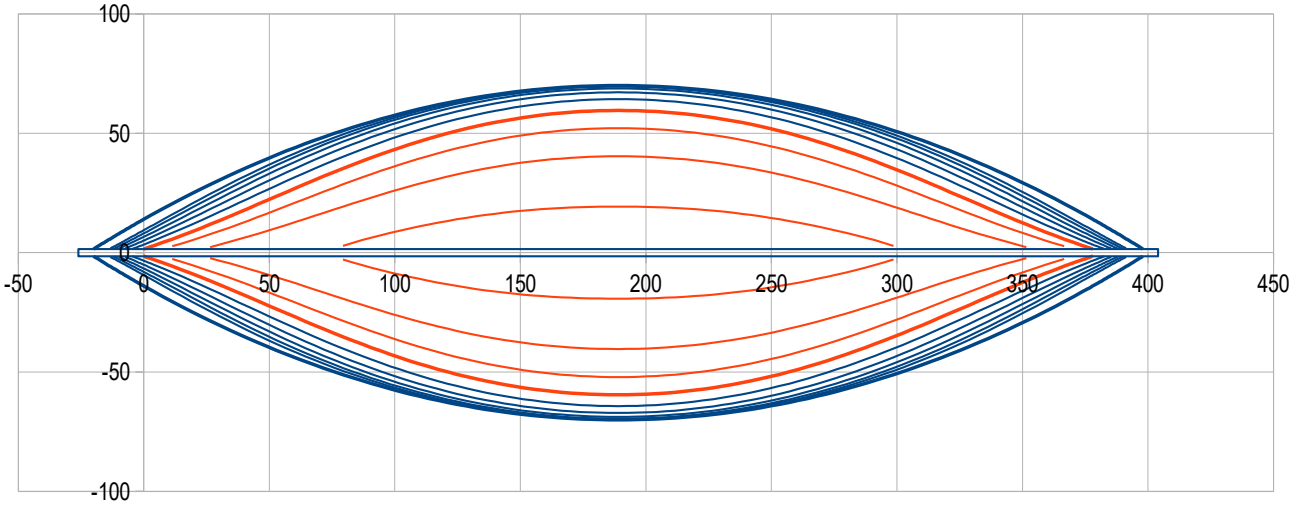
P1 – Peapod 14'

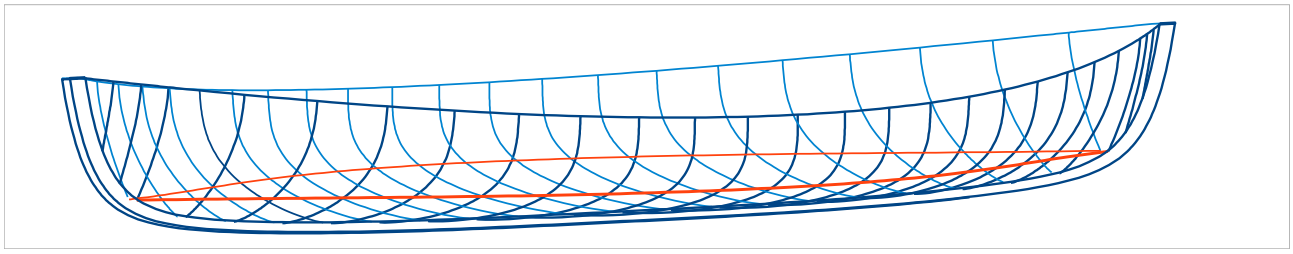
Loa : 4,30 m (14,1 ft) ; Lwl body : 3,78 m (12,4 ft) ; Boa : 1,40 m (55,1'') ; Bwl : 1,19 m (46,9'') ; Tc body : 0,150 m (5,9'') ; Displacement : 278,3 kg (613 lbs)











P1 - Hydrostatics data with the displacement 278,3 kg (i.e. with a load of 150 kg).

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	**4,30**	**L body (m)**	**4,18**	**Lwl body(m)**	**3,78**	> Lwl/D^(1/3)	5,84		
>> ft	***14,11***	***>> ft***	***12,40***						
Bsheer (m)	**1,40**	**at X (% Lwl)**	**50,0**	**Bmax (m)**	**1,40**	**at X (% Lwl)**	**50,0**		
>> inch	***55,12***			***>> inch***	***55,12***				
Bwl (m)	**1,191**	**at X (% Lwl)**	**50,0**	> Bwl / Bmax	0,851	> Lwl / Bwl	4,44		
>> inch	***46,91***					**Freeboards (m) >**	**Aft**	**Minimum**	**Fore**
Tc (m)	**0,150**	**at X (%Lwl)**	**50**	**Draft oa (m)**	**0,190**		**0,51**	**0,31**	**0,51**
>> inch	***5,91***				***>> inch***		***20,08***	***12,20***	***20,08***
Displacement at H0 (m3)		**0,27148**	**at Xc (m)**	**1,890**	**Xc (%Lwl)**		**50,00**	**Zc (m)**	**-0,058**
(kg)		**278,3**	*>> ft*	*6,20*				*>> inch*	*-2,30*
>> lbs		***613,5***	*with water mass / vol. of*		*1025*	*kg/m3*			
Cp	**0,572**								
Sf (m2)	**2,82**	**at Xf (m)**	**1,890**	**Xf (%Lwl)**	**50,00**	>>> Xc – Xf (%Lwl)			0,00
>> ft2	*30,34*	*>> ft*	*6,20*						
Angle immersed sheer (°)		**24,3**	at midship (50% Lwl)			**Entry half angle (°)**	**19,7**		
Sw (m2)	**3,32**	>Sw/D^(2/3)	7,91						
>> ft2	*35,72*								
Shull (m2)	**6,72**	**at X (m)**	**1,880**	**Z (m)**	**0,038**				
>> ft2	*72,30*	*>> ft*	*6,17*	*>> inch*	*1,48*				

B1.2 Daggerboard (if any)

Volume (m3)	**0,00000**	**at X (m)**	**0,000**	**X (%Lwl)**	**0,00**	**Z (m)**	**0,000**	
		>> ft	*0,00*			*>> ft*	*0,00*	
Draft oa (m)	**0,00**		**Sw (m2)**	**0,00**		**Sxz (m2)**	**0,00**	
>> ft	*0,00*		*>> ft2*	*0,00*		*>> ft2*	*0,00*	
CLR (m)	**0,00**	**CLR (%Lwl)**	**0,00**	*CLR = Center of Lateral Resistance*				
>> ft	*0,00*	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

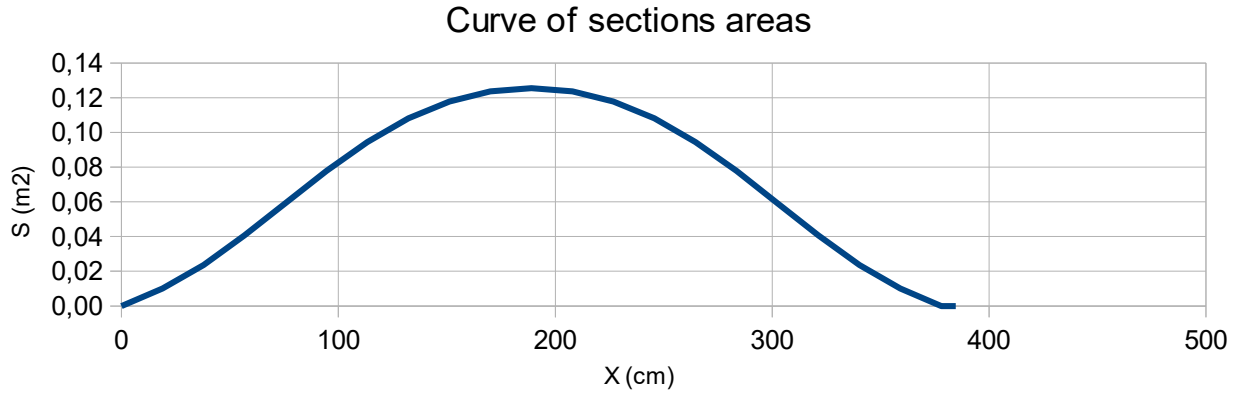
Volume (m3)	**0,00000**	**at X (m)**	**0,00**	**X (%Lwl)**	**0,00**	**Z (m)**	**0,00**	
Sw (m2)	**0,00**	*>> ft*	*0,00*			**Sxz (m2)**	**0,00**	
>> ft2	*0,00*					*>> ft2*	*0,00*	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	**0,27148**	**at LCB (m)**	**1,890**	**LCB (%Lwl)**	**50,00**		**at ZCB (m)**	**-0,058**
(kg)	**278,3**	*>> ft*	*6,20*				*>> ft*	*-0,19*
>> lbs	*613*							
Sw (m2)	**3,32**	>Sw/D^(2/3)	7,91	Lwl/D^(1/3)	5,84			
>> ft2	*35,72*			***DLR***	***144***	*M(lbs/2240)/(Lwl(ft)/100)^3*		

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	**278,3**	**at Xg (m)**	**1,886**	**Xg (%Lwl)**	**49,91**	**at Zg (m)**	**0,194**
Light boat	128,3		1,882				0,063



P1 – Mass spreadsheet

D – Mass spreadsheet – Preliminary

Eléments	L m	S m2	V m3	Mass units to enter	Masse (kg)	X (m)	M X	Z (m)	M Z
Hull :									
at unit mass assuming kg/m2		6,72		**15,00**	100,75	1,880	189,437	0,038	3,780
Benches - Deck if any									
mass assuming kg				**20,00**	20,00	1,890	37,800	0,155	3,100
Daggerboard, ballast if any :									
Daggerboard, mass assuming kg				**0,00**	0,00	1,990	0,000	0,425	0,000
Lead ballast, mass assuming kg				**0,00**	0,00	1,890	0,000	-0,170	0,000
Rudder helm system, if any :									
mass assuming kg				**0,00**	0,00	0,000	0,000	0,000	0,000
Rig and sails, if any :									
mass assuming kg				**0,00**	0,00	0,000	0,000	0,000	0,000
Various equipment or fittings :									
mass assuming kg				**7,60**	7,60	1,890	14,364	0,155	1,178
Light weight >>>					**128,3**	**1,88**	241,601	**0,063**	8,058

P1 - Initial stability , with the loading 150 kg (typically 2 rowers) at Z 0,307 m (i.e. 18'' above the rabbet line)

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*128,35*	*1,882*	*0,063*	*0*	*from the mass spreadsheet*
Load (kg)	**150,00**	**1,89**	**0,307**	**0,00**	Crew at center
(lbs)			**0,307**	**0,00**	Crew at windward
Total >>> Mass (kg)	**278,35**	**1,886**	**0,194**	**0,000**	**Crew at center**
Disp. (m3)	**0,27156**		**0,194**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

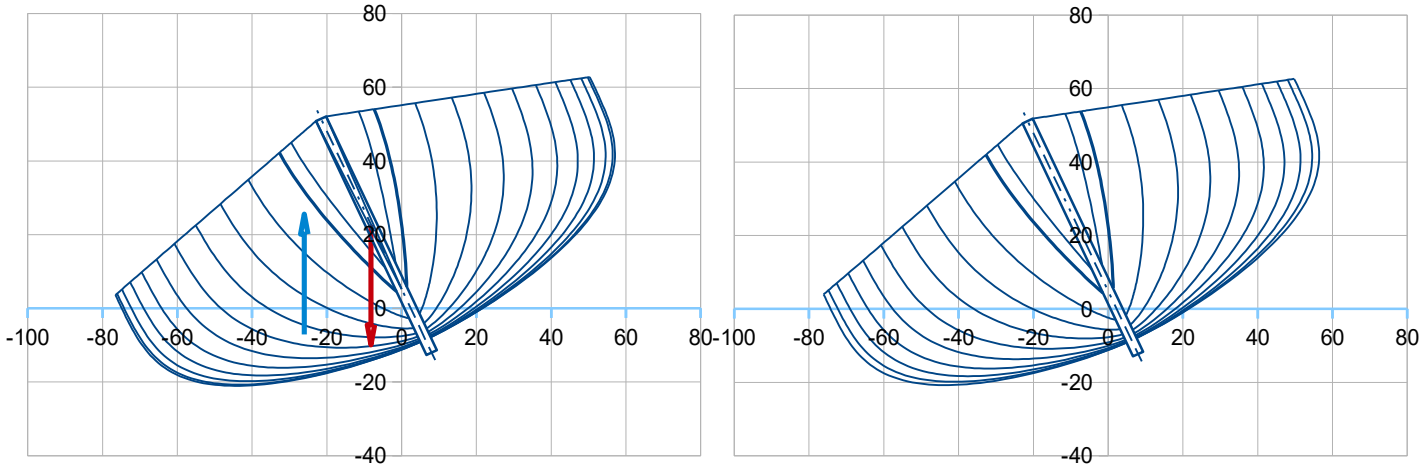
Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**1**	**> Disp. (m3)**	**0,27156**	**/ Disp. (m3)**	**0,27156**	Relevant only when heel = 0°			
Height (cm)	**0,0277**	**Xc (m)**	**1,886**	**/ Xg (m)**	**1,886**	Lwl (m)	3,779	Z fore (cm)	-6,6
Trim (°)	**0,0300**	Yc (m)	-0,013	Yg heel (m)	-0,003	Bwl (m)	1,191	Z aft (cm)	-6,9
		Zc (m)	-0,058	**> GZ (m)**	**0,010**	Draft (m)	0,150		
		Sw heel (m2)	**3,36**	**> RM (kN.m)**	**0,026**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**0,01**	**FB mini (cm)**	**29,8**	> Yg (m)	-0,003		
				Bwl (m)	**1,19**	**> GM1° (m)**	**0,56**		

>>> GM1° = 0,56 m

P1 - Check of the freeboard mini and of the stability at heel 25° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**25**	**> Disp. (m3)**	**0,27156**	**/ Disp. (m3)**	**0,27156**	Relevant only when heel = 0°			
Height (cm)	**5,0843**	**Xc (m)**	**1,886**	**/ Xg (m)**	**1,886**	Lwl (m)	3,614	Z fore (cm)	-0,9
Trim (°)	**0,0400**	Yc (m)	-0,260	Yg heel (m)	-0,082	Bwl (m)	1,018	Z aft (cm)	-1,2
		Zc (m)	-0,070	**> GZ (m)**	**0,178**	Draft (m)	0,099		
		Sw heel (m2)	**3,00**	**> RM (kN.m)**	**0,486**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,04**	**FB mini (cm)**	**3,6**	> Yg (m)	-0,082		
				Bwl (m)	**0,96**	**> GM1° (m)**	**0,42**		

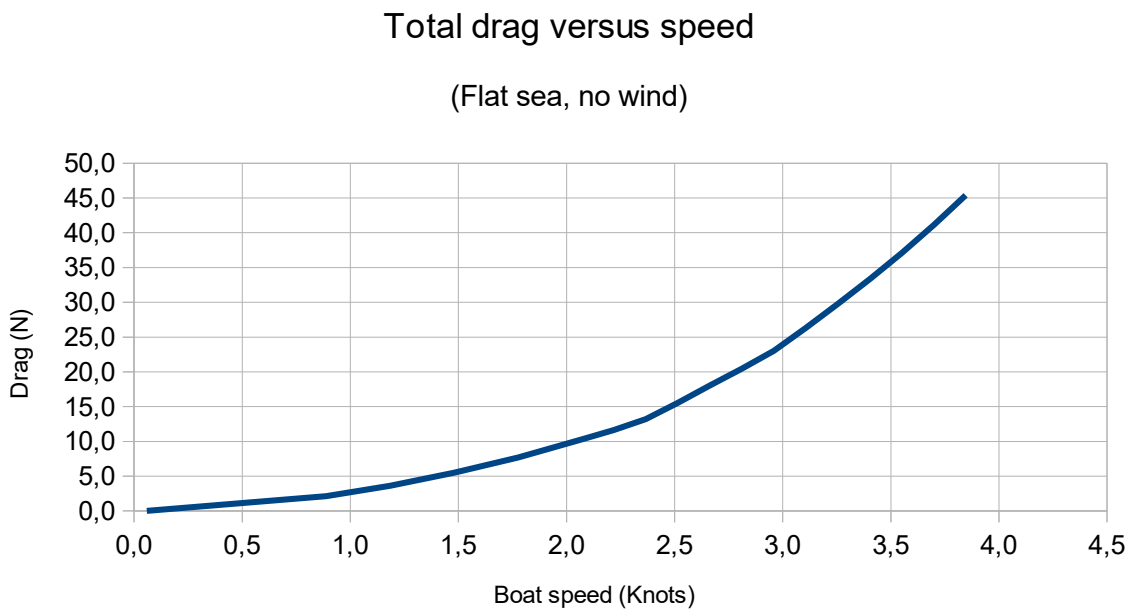


>>> The righting moment is still positive : RM25° = 0,486 kN.m

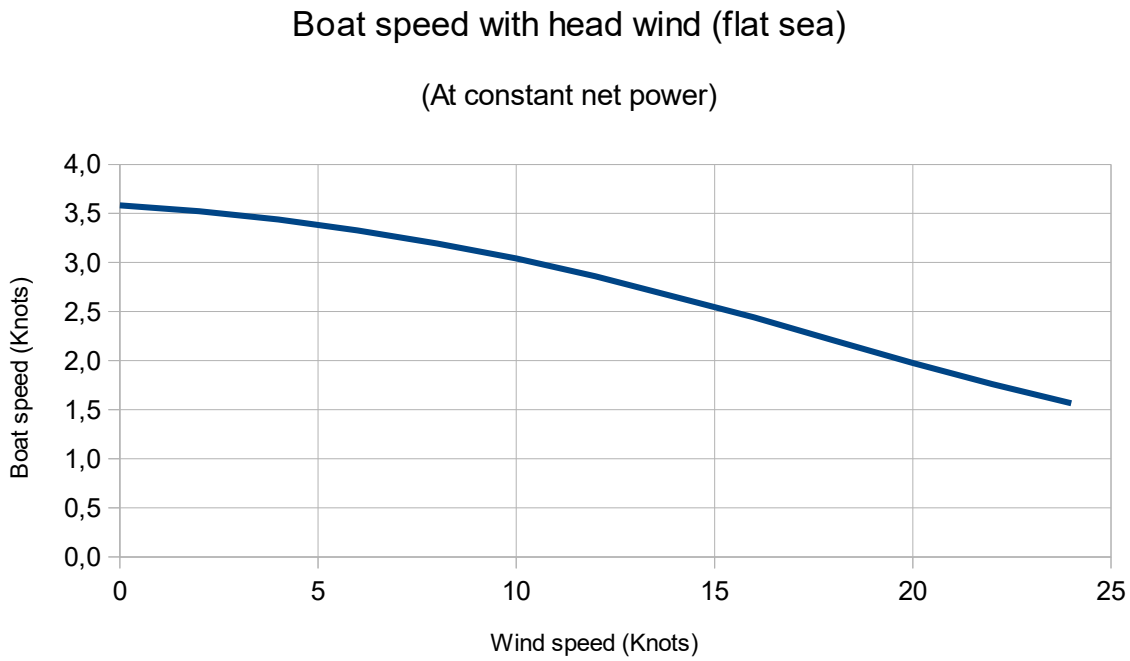
>>> The minimum freeboard is 3,6 cm

P1 - VPP Output :

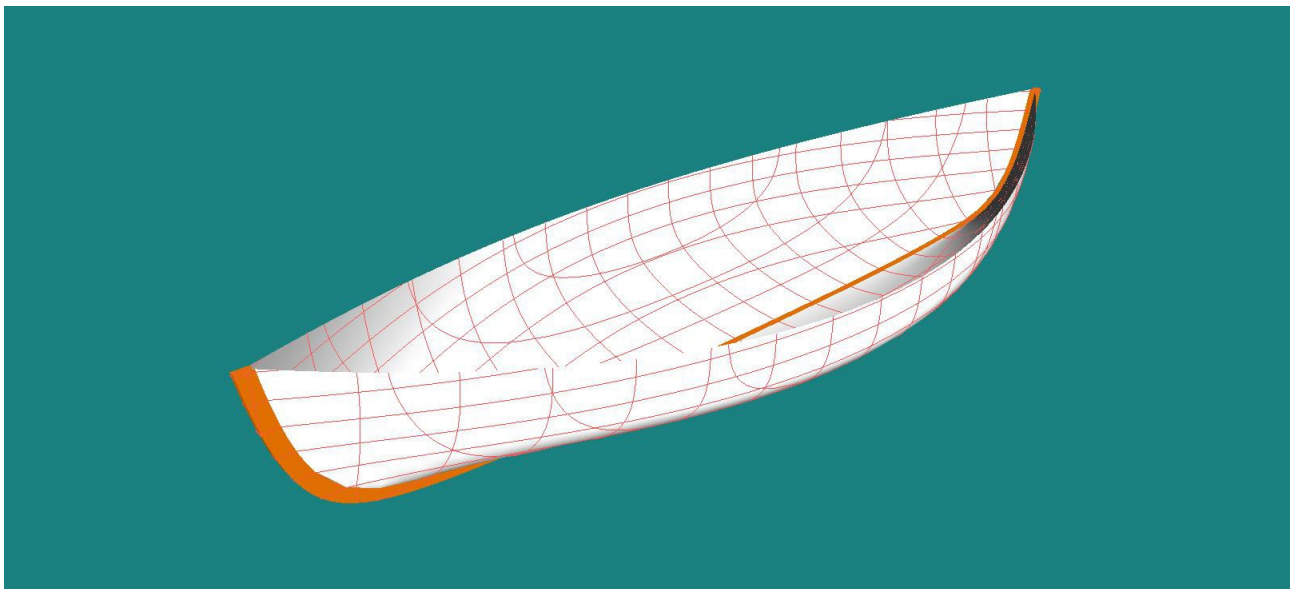
Drag curve :

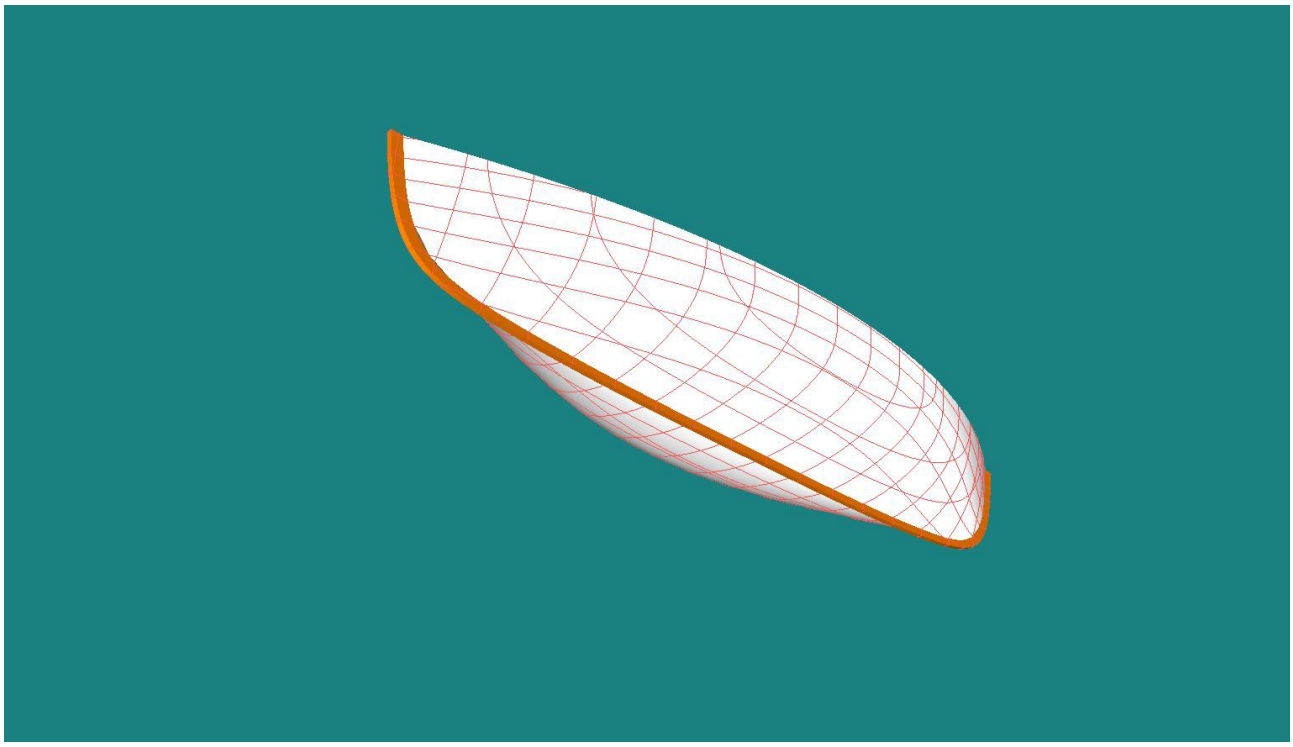


Speed estimation with a net propulsion power of 70 W :



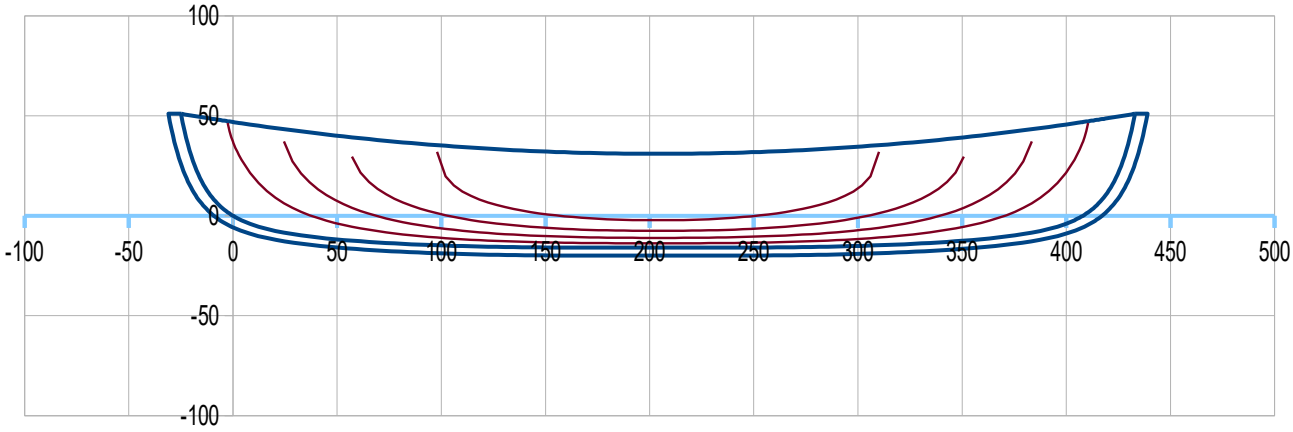
P1 - 3D views, done with Multisurf from the data in the Offsets sheet :

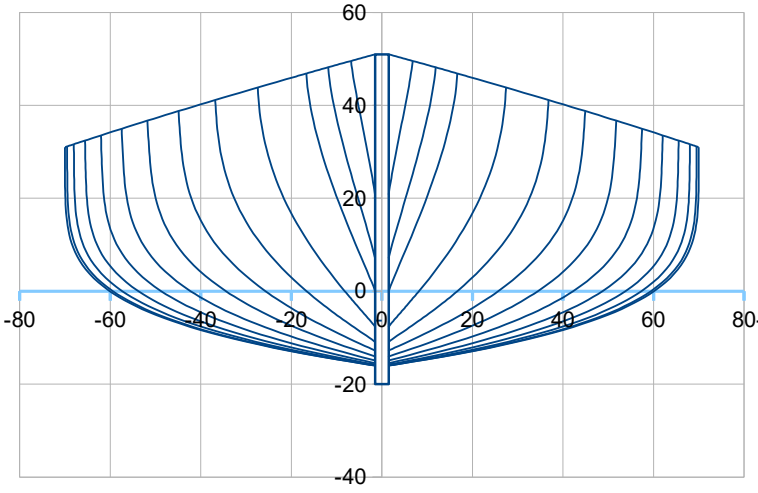


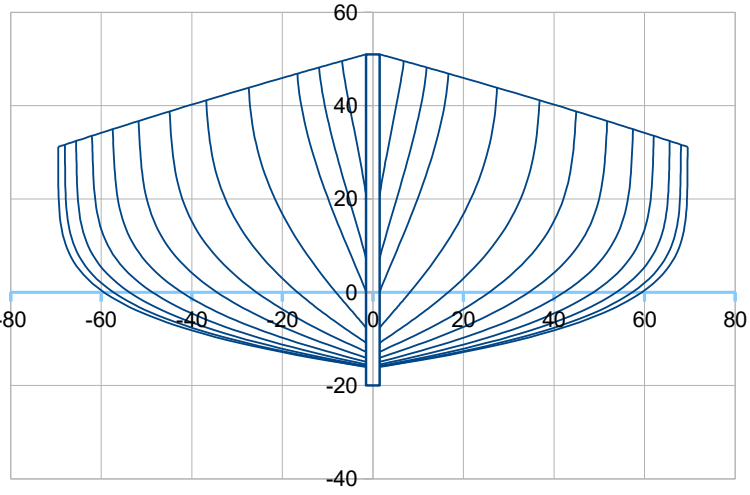


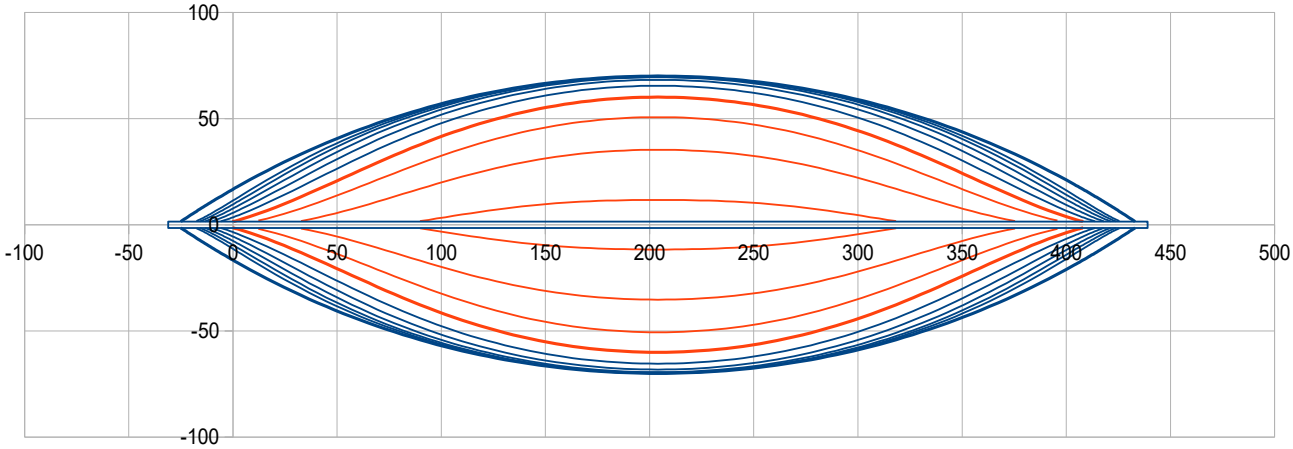
P1,1 – Peapod 15'

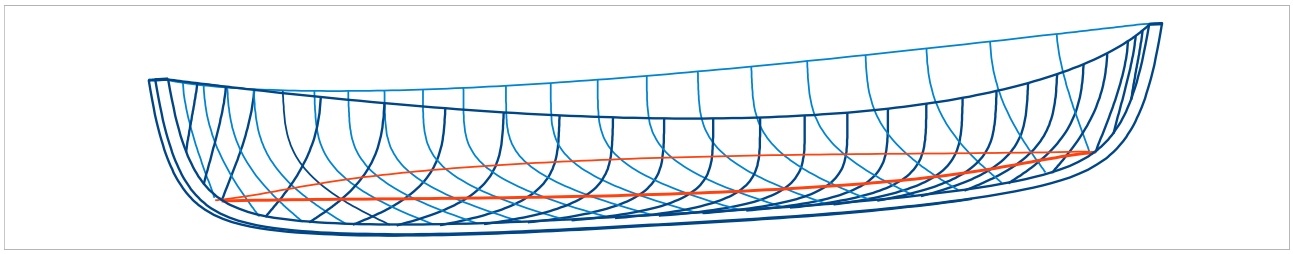
Loa : 4,70 m (15,4 ft) ; Lwl body : 4,08 m (13,4 ft) ; Boa : 1,40 m (55,1'') ; Bwl : 1,202 m (47,3'') ; Tc body : 0,160 m (6,3'') ; Displacement : 291,0 kg (641 lbs)











P1,1 - Hydrostatics data with the displacement 291,0 kg (i.e. with a load of 150 kg).

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	**4,70**	**L body (m)**	**4,58**	**Lwl body(m)**	**4,08**	> Lwl/D^(1/3)	6,21		
>> ft	*15,42*	*>> ft*	*13,39*						
Bsheer (m)	**1,40**	**at X (% Lwl)**	**50,0**	**Bmax (m)**	**1,40**	**at X (% Lwl)**	**50,0**		
>> inch	*55,12*			*>> inch*	*55,12*				
Bwl (m)	**1,202**	**at X (% Lwl)**	**50,0**	> Bwl / Bmax	0,859	> Lwl / Bwl	4,75		
>> inch	*47,32*					**Freeboards (m) >**	**Aft**	**Minimum**	**Fore**
Tc (m)	**0,160**	**at X (%Lwl)**	**50**	**Draft oa (m)**	**0,200**		**0,51**	**0,31**	**0,51**
>> inch	*6,30*				*>> inch*		*20,08*	*12,20*	*20,08*
Displacement at H0 (m3)		**0,28389**	**at Xc (m)**	**2,040**	**Xc (%Lwl)**	**50,00**	**Zc (m)**		**-0,058**
(kg)		**291,0**	*>> ft*	*6,69*			*>> inch*		*-2,28*
>> lbs		*641,5*	*with water mass / vol. of*		*1025*	*kg/m3*			
Cp	**0,570**								
Sf (m2)	**3,08**	**at Xf (m)**	**2,040**	**Xf (%Lwl)**	**50,00**	>>> Xc – Xf (%Lwl)			0,00
>> ft2	*33,16*	*>> ft*	*6,69*						
Angle immersed sheer (°)		**24,3**	at midship (50% Lwl)			**Entry half angle (°)**	**12,5**		
Sw (m2)	**3,61**	>Sw/D^(2/3)	8,37						
>> ft2	*38,90*								
Shull (m2)	**7,38**	**at X (m)**	**2,028**	**Z (m)**	**0,038**				
>> ft2	*79,47*	*>> ft*	*6,65*	*>> inch*	*1,51*				

B1.2 Daggerboard (if any)

Volume (m3)	**0,00000**	**at X (m)**	**0,000**	**X (%Lwl)**	**0,00**	**Z (m)**	**0,000**	
		>> ft	*0,00*			*>> ft*	*0,00*	
Draft oa (m)	**0,00**		**Sw (m2)**	**0,00**		**Sxz (m2)**	**0,00**	
>> ft	*0,00*		*>> ft2*	*0,00*		*>> ft2*	*0,00*	
CLR (m)	**0,00**	**CLR (%Lwl)**	**0,00**	*CLR = Center of Lateral Resistance*				
>> ft	*0,00*	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

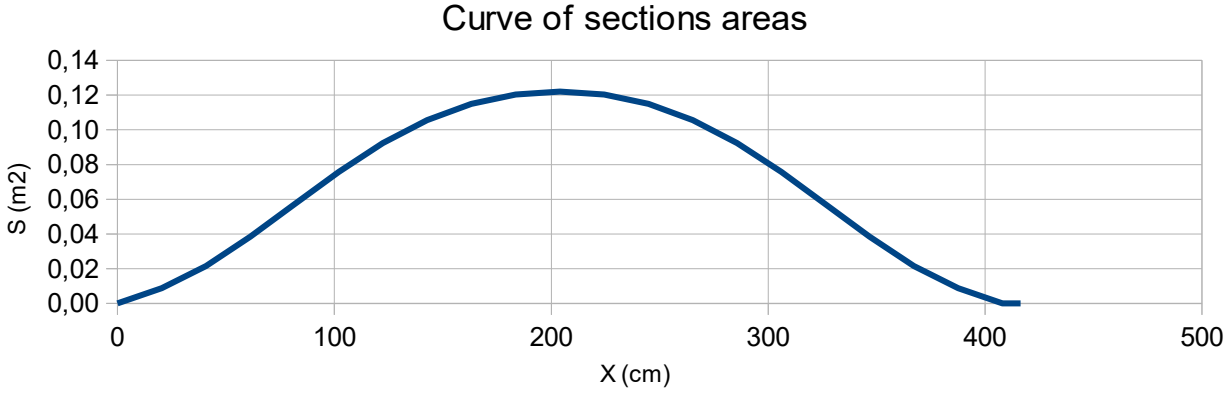
Volume (m3)	**0,00000**	**at X (m)**	**0,00**	**X (%Lwl)**	**0,00**	**Z (m)**	**0,00**	
Sw (m2)	**0,00**	*>> ft*	*0,00*			**Sxz (m2)**	**0,00**	
>> ft2	*0,00*					*>> ft2*	*0,00*	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	**0,28389**	**at LCB (m)**	**2,040**	**LCB (%Lwl)**	**50,00**		**at ZCB (m)**	**-0,058**
(kg)	**291,0**	*>> ft*	*6,69*				*>> ft*	*-0,19*
>> lbs	*641*							
Sw (m2)	**3,61**	>Sw/D^(2/3)	8,37	Lwl/D^(1/3)	6,21			
>> ft2	*38,90*			***DLR***	***119***	*M(lbs/2240)/(Lwl(ft)/100)^3*		

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	**291,0**	**at Xg (m)**	**1,958**	**Xg (%Lwl)**	**47,99**	**at Zg (m)**	**0,189**
Light boat	141,0		2,031				0,063



P1,1 - Initial stability , with the loading 150 kg (typically 2 rowers) at Z 0,297 m (i.e. 18'' above the rabbet line)

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*140,95*	*2,031*	*0,063*	*0*	*from the mass spreadsheet*
Load (kg)	**150,00**	**2,04**	**0,297**	**0,00**	Crew at center
(lbs)			**0,297**	**0,00**	Crew at windward
Total >>> Mass (kg)	**290,95**	**2,035**	**0,184**	**0,000**	**Crew at center**
Disp. (m3)	**0,28385**		**0,184**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

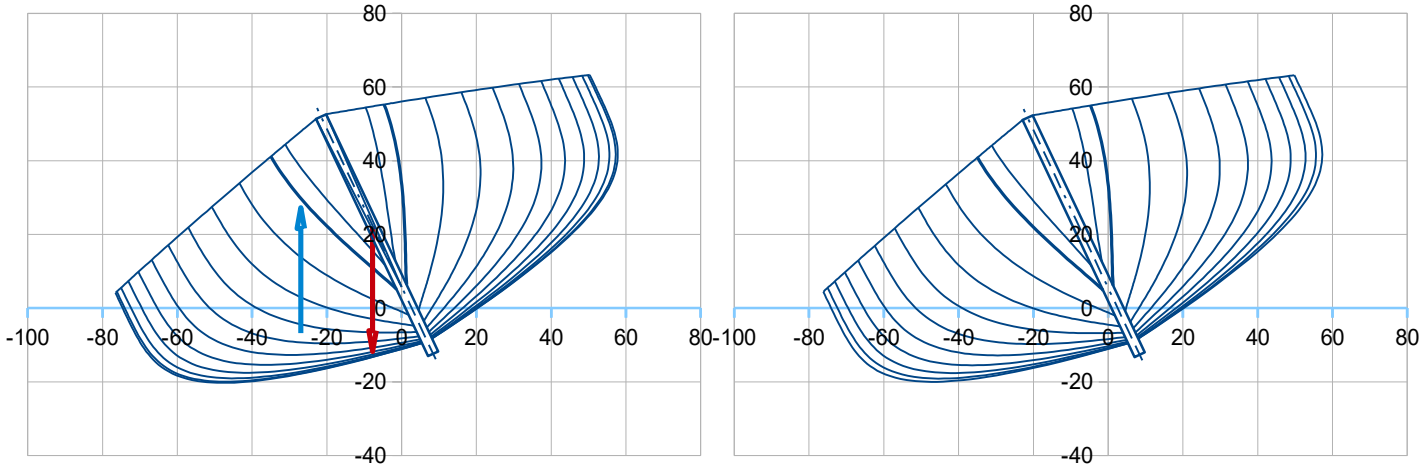
Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**1**	**> Disp. (m3)**	**0,28385**	**/ Disp. (m3)**	**0,28385**	Relevant only when heel = 0°			
Height (cm)	**0,0325**	**Xc (m)**	**2,035**	**/ Xg (m)**	**2,035**	Lwl (m)	4,079	Z fore (cm)	-6,2
Trim (°)	**0,0310**	Yc (m)	-0,014	Yg heel (m)	-0,003	Bwl (m)	1,201	Z aft (cm)	-6,5
		Zc (m)	-0,058	**> GZ (m)**	**0,011**	Draft (m)	0,160		
		Sw heel (m2)	**3,66**	**> RM (kN.m)**	**0,031**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**0,01**	**FB mini (cm)**	**29,8**	> Yg (m)	-0,003		
				Bwl (m)	**1,20**	**> GM1° (m)**	**0,63**		

>>> GM1° = 0,63 m

P1,1 - Check of the freeboard mini and of the stability at heel 25° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**25**	**> Disp. (m3)**	**0,28385**	**/ Disp. (m3)**	**0,28385**	Relevant only when heel = 0°			
Height (cm)	**5,6033**	**Xc (m)**	**2,035**	**/ Xg (m)**	**2,035**	Lwl (m)	3,852	Z fore (cm)	0,0
Trim (°)	**0,0400**	Yc (m)	-0,270	Yg heel (m)	-0,078	Bwl (m)	0,971	Z aft (cm)	-0,3
		Zc (m)	-0,068	**> GZ (m)**	**0,192**	Draft (m)	0,104		
		Sw heel (m2)	**3,21**	**> RM (kN.m)**	**0,548**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**-0,04**	**FB mini (cm)**	**4,1**	> Yg (m)	-0,078		
				Bwl (m)	**0,95**	**> GM1° (m)**	**0,45**		

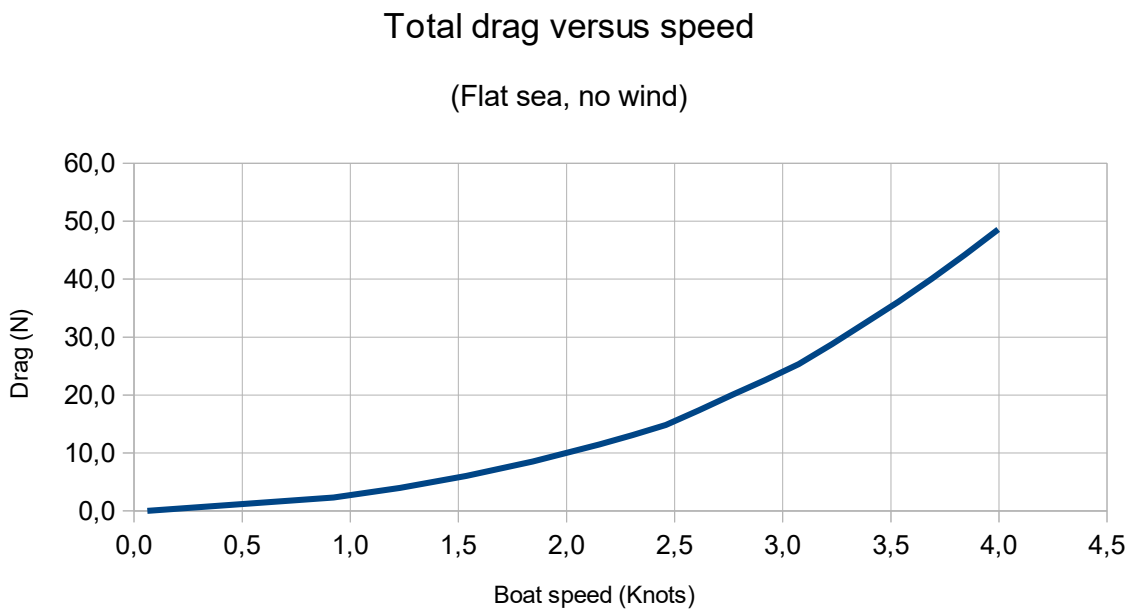


>>> The righting moment is still positive : RM25° = 0,548 kN.m

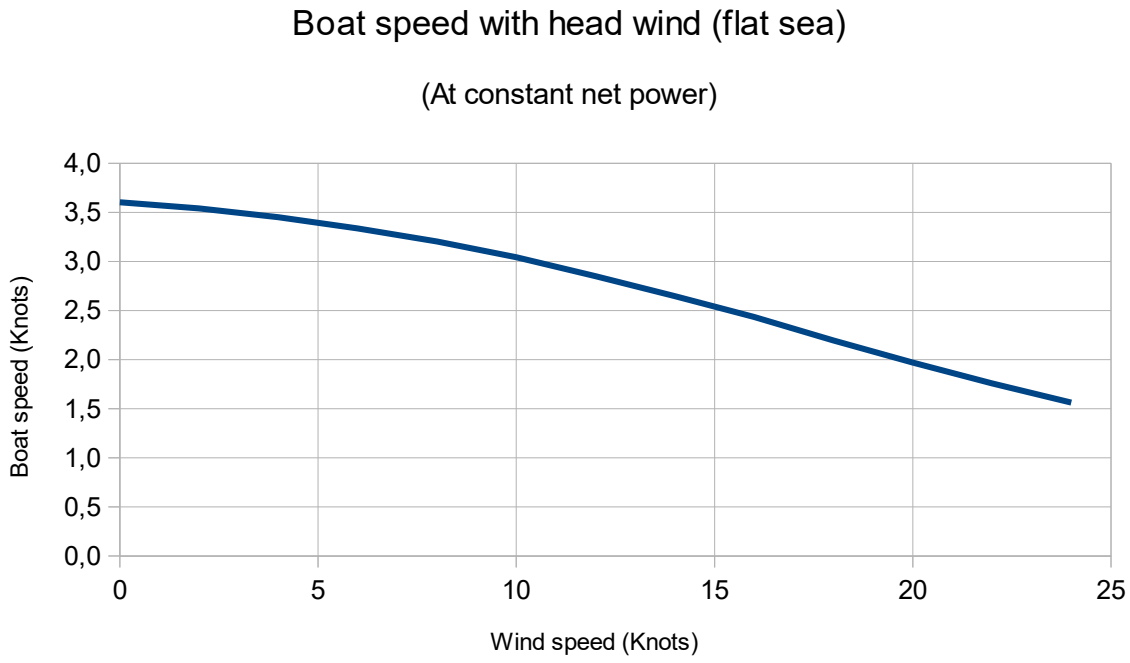
>>> The minimum freeboard is 4,1 cm

P1,1 - VPP Output :

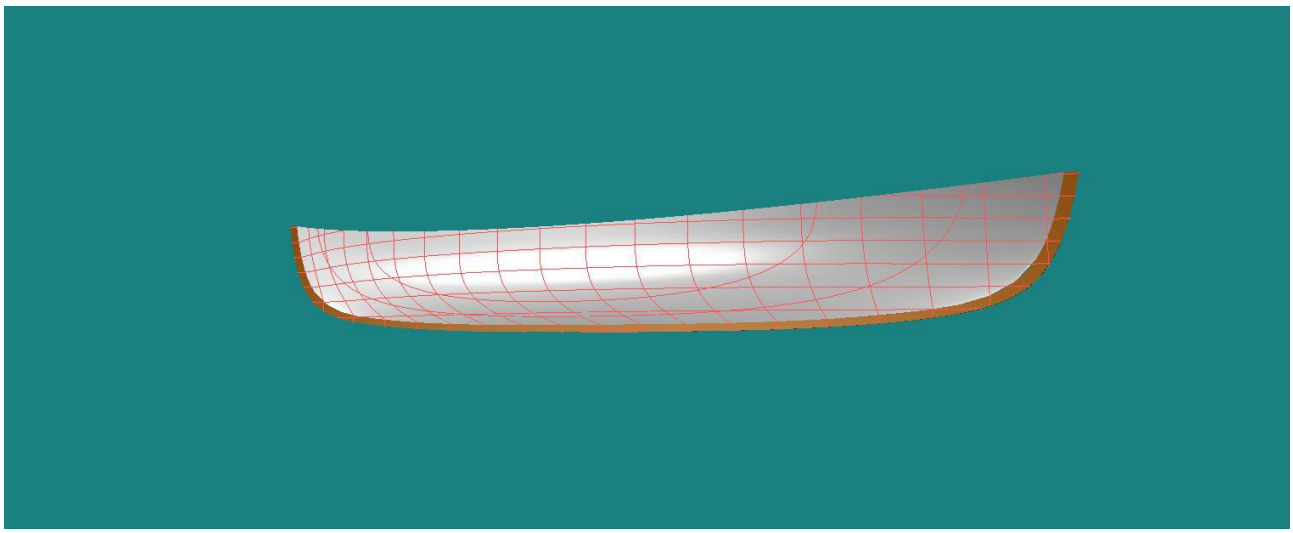
Drag curve :



Speed estimation with a net propulsion power of 70 W :

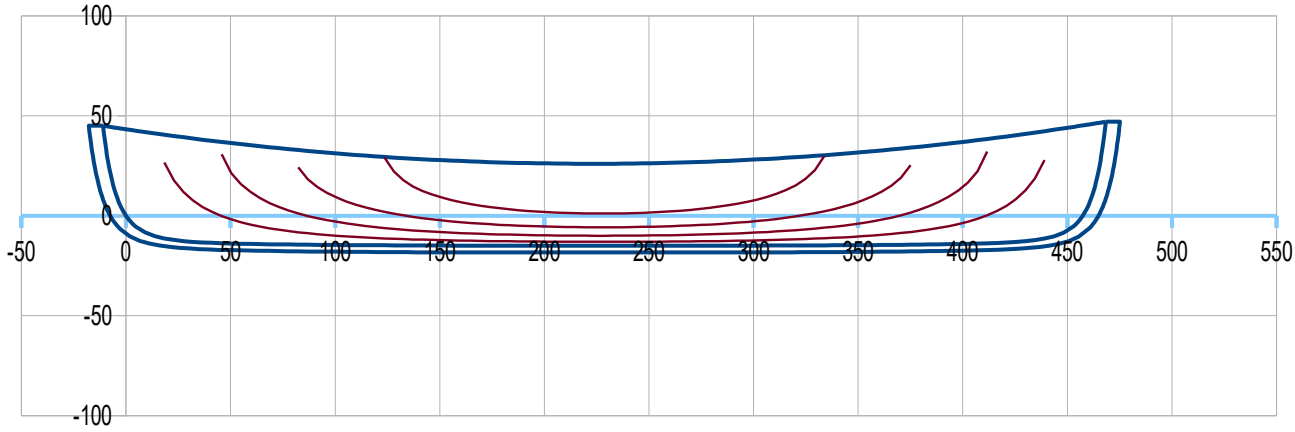


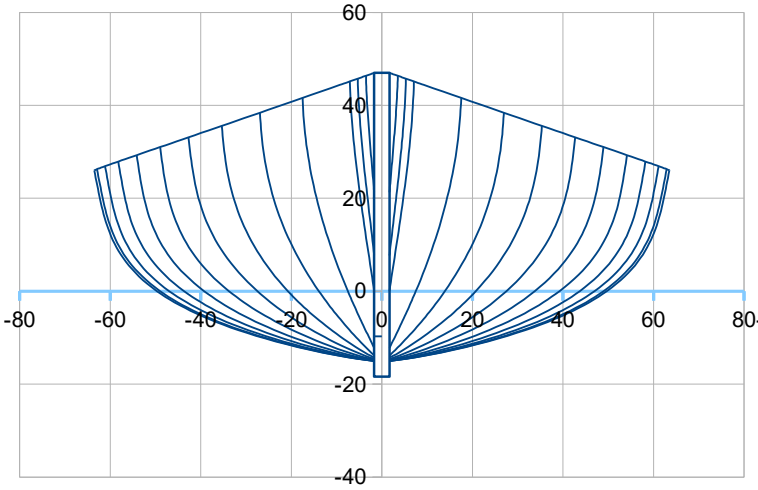
P1,1 - 3D view, done with Multisurf from the data in the Offsets sheet :

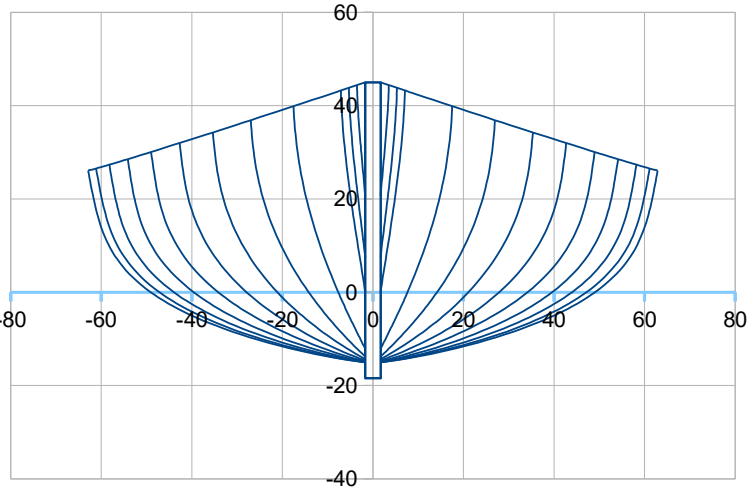


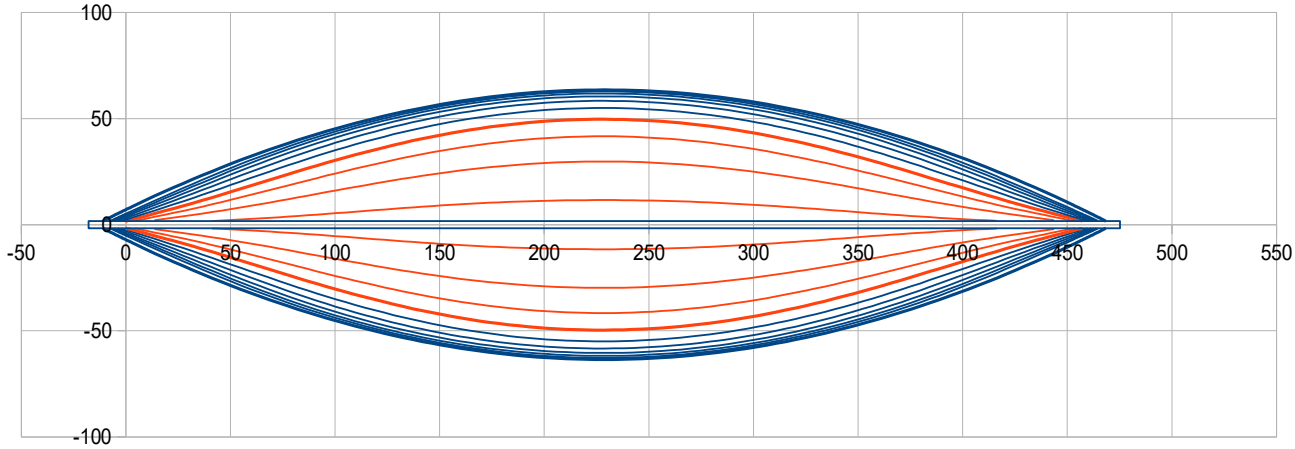
P1,2 – Peapod 16'

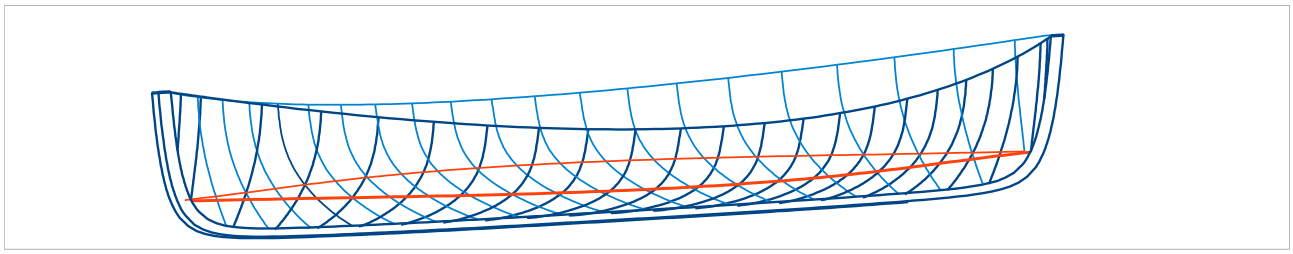
Loa : 4,93 m (16,2 ft) ; Lwl body : 4,57 m (15,0 ft) ; Boa : 1,27 m (50,0'') ; Bwl : 0,993 m (39,1'') ; Tc body : 0,150 m (5,9'') ; Displacement : 269,9 kg (595 lbs)











P1,2 - Hydrostatics data with the displacement 269,9 kg (i.e. with a load of 136,1 kg (300 lbs)).

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	4,93	L body (m)	4,79	Lwl body(m)	4,57	> Lwl/D^(1/3)	7,14	
>> ft	16,17	>> ft	15,01					
Bsheer (m)	1,27	at X (% Lwl)	50,0	Bmax (m)	1,27	at X (% Lwl)	50,0	
>> inch	50,00			>> inch	50,00			
Bwl (m)	0,993	at X (% Lwl)	50,0	> Bwl / Bmax	0,782	> Lwl / Bwl	5,85	
>> inch	39,10					Freeboards (m) >	Aft	Minimum	Fore
Tc (m)	0,150	at X (%Lwl)	50	Draft oa (m)	0,184		0,45	0,26	0,47
>> inch	5,91				>> inch		17,72	10,23	18,50

Displacement at H0 (m3)	0,26333	at Xc (m)	2,283	Xc (%Lwl)	49,91	Zc (m)	-0,058	
(kg)	269,9	>> ft	7,49			>> inch	-2,28	
>> lbs	595,1	with water mass / vol. of		1025	kg/m3			
Cp	0,597							
Sf (m2)	2,83	at Xf (m)	2,282	Xf (%Lwl)	49,90	>>> Xc – Xf (%Lwl)	0,01	
>> ft2	30,48	>> ft	7,49					
Angle immersed sheer (°)	22,8	at midship (50% Lwl)				Entry half angle (°)	12,4	
Sw (m2)	3,47	>Sw/D^(2/3)	8,45					
>> ft2	37,39							
Shull (m2)	6,98	at X (m)	2,291	Z (m)	0,028			
>> ft2	75,15	>> ft	7,52	>> inch	1,09			

B1.2 Daggerboard (if any)

Volume (m3)	0,00000	at X (m)	0,000	X (%Lwl)	0,00	Z (m)	0,000	
		>> ft	0,00			>> ft	0,00	
Draft oa (m)	0,00		Sw (m2)	0,00		Sxz (m2)	0,00	
>> ft	0,00		>> ft2	0,00		>> ft2	0,00	
CLR (m)	0,00	CLR (%Lwl)	0,00	*CLR = Center of Lateral Resistance*				
>> ft	0,00	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

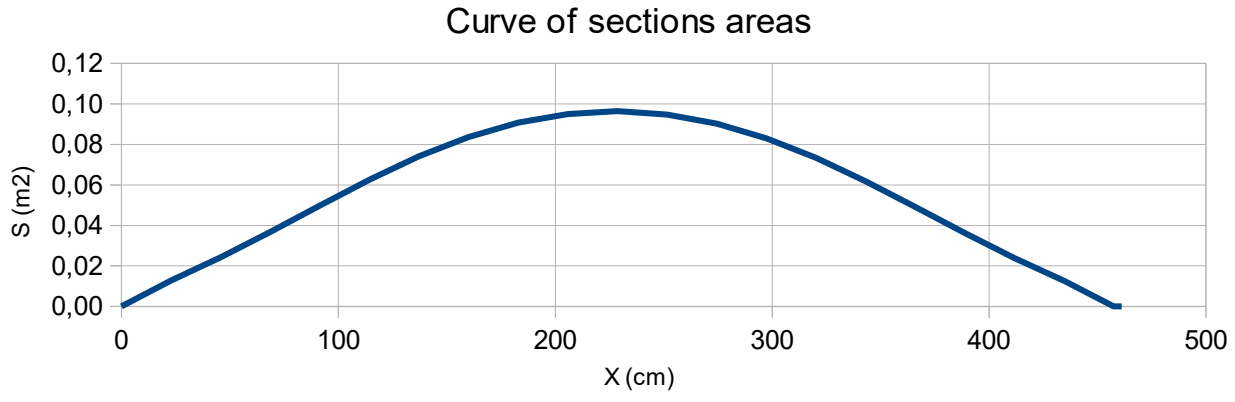
Volume (m3)	0,00000	at X (m)	0,00	X (%Lwl)	0,00	Z (m)	0,00	
Sw (m2)	0,00	>> ft	0,00			Sxz (m2)	0,00	
>> ft2	0,00					>> ft2	0,00	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	0,26333	at LCB (m)	2,283	LCB (%Lwl)	49,91	at ZCB (m)	-0,058	
(kg)	269,9	>> ft	7,49			>> ft	-0,19	
>> lbs	595							
Sw (m2)	3,47	>Sw/D^(2/3)	8,45	Lwl/D^(1/3)	7,14			
>> ft2	37,39			DLR	79	M(lbs/2240)/(Lwl(ft)/100)^3		

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	269,9	at Xg (m)	2,289	Xg (%Lwl)	50,04	at Zg (m)	0,169
Light boat	133,8		2,291				0,028



P1,2 - Initial stability , with the loading 136,1 kg (300 lbs) at Z 0,307 m (i.e. 18'' above the rabbet line)

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*133,78*	*2,291*	*0,028*	*0*	*from the mass spreadsheet*
Load (kg)	**136,10**	**2,287**	**0,307**	**0,00**	Crew at center
(lbs)	*300,05*		**0,307**	**0,00**	Crew at windward
Total >>> Mass (kg)	**269,88**	**2,289**	**0,169**	**0,000**	**Crew at center**
Disp. (m3)	**0,26329**		**0,169**	**0,000**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

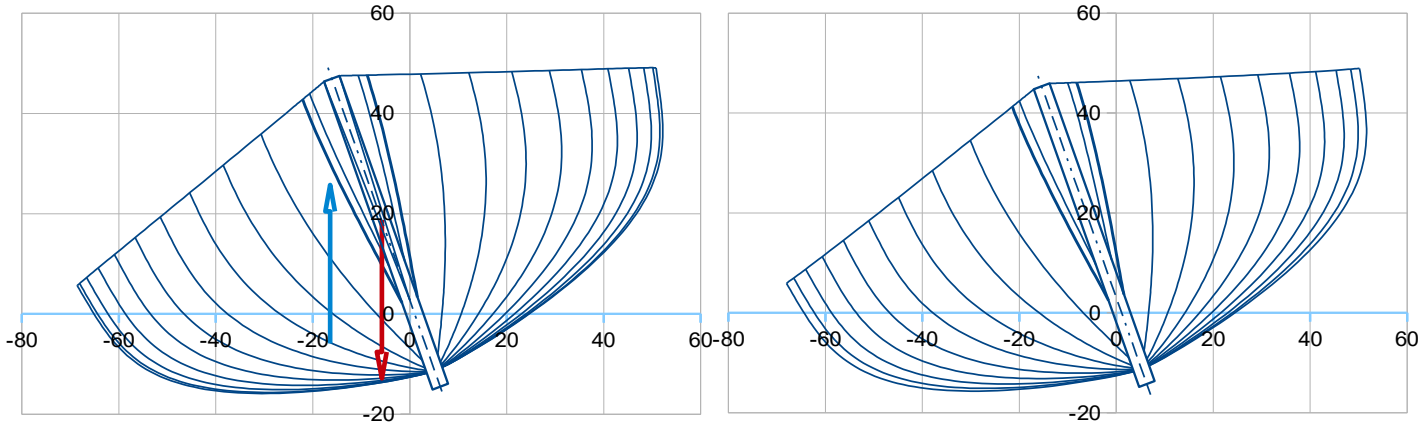
Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**1**	**> Disp. (m3)**	**0,26329**	**/ Disp. (m3)**	**0,26329**	Relevant only when heel = 0°			
Height (cm)	**0,0450**	**Xc (m)**	**2,289**	**/ Xg (m)**	**2,289**	Lwl (m)	4,573	Z fore (cm)	-9,8
Trim (°)	**-0,0350**	Yc (m)	-0,009	Yg heel (m)	-0,003	Bwl (m)	0,992	Z aft (cm)	-9,5
		Zc (m)	-0,058	**> GZ (m)**	**0,006**	Draft (m)	0,150		
		Sw heel (m2)	**3,53**	**> RM (kN.m)**	**0,016**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**0,02**	**FB mini (cm)**	**24,9**	> Yg (m)	-0,003		
				Bwl (m)	**0,99**	**> GM1° (m)**	**0,35**		

>>> GM1° = 0,35 m

P1,2 - Check of the freeboard mini and of the stability at heel 20° :

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		Results				Specific results			
Heel (°)	**20**	**> Disp. (m3)**	**0,26329**	**/ Disp. (m3)**	**0,26329**	Relevant only when heel = 0°			
Height (cm)	**2,9026**	**Xc (m)**	**2,289**	**/ Xg (m)**	**2,289**	Lwl (m)	4,532	Z fore (cm)	-6,4
Trim (°)	**-0,0350**	Yc (m)	-0,164	Yg heel (m)	-0,058	Bwl (m)	0,897	Z aft (cm)	-6,1
		Zc (m)	-0,059	**> GZ (m)**	**0,106**	Draft (m)	0,121		
		Sw heel (m2)	**3,35**	**> RM (kN.m)**	**0,282**	Relevant only when heel = 1°			
		LCB – LCF (%Lwl)	**0,06**	**FB mini (cm)**	**5,6**	> Yg (m)	-0,058		
				Bwl (m)	**0,90**	**> GM1° (m)**	**0,31**		



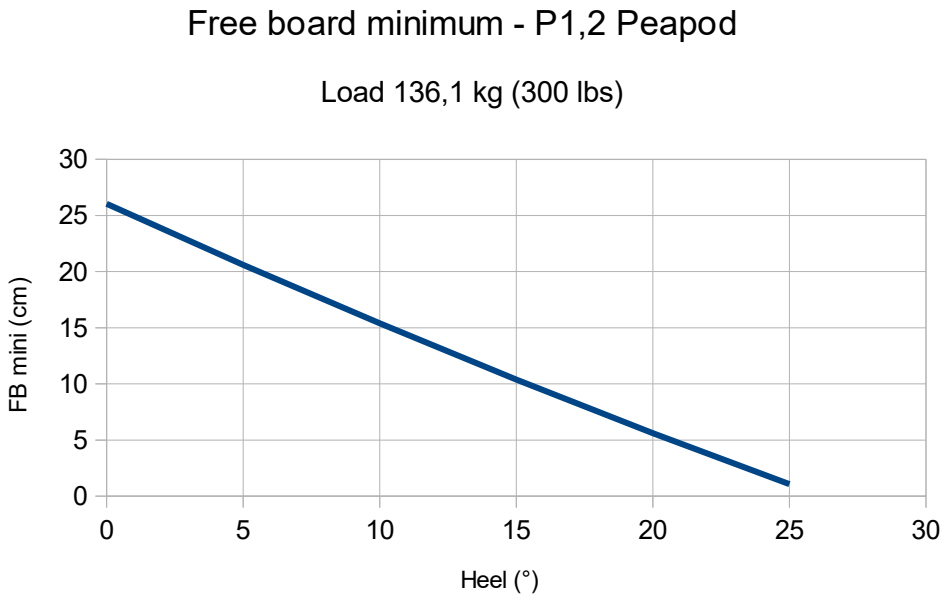
>>> The righting moment is still positive : RM20° = 0,282 kN.m

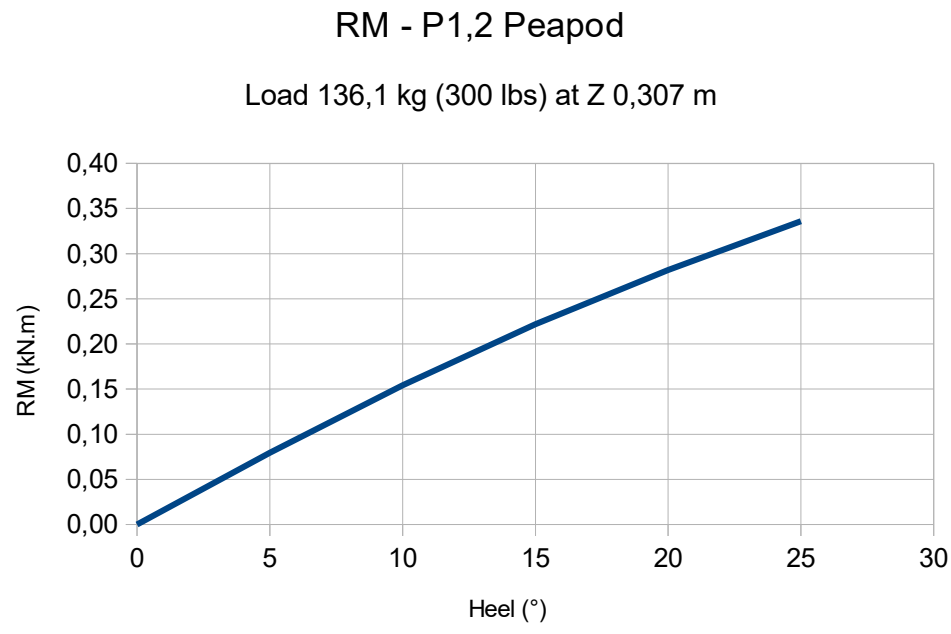
>>> The minimum freeboard is 5,6 cm

P1,2 – Free-board mini and Righting Moment up to heel 25°

The computation done for Heel 20° can be done for the all the range 0° to 25° for which the free-board remains positive (before the water swamping) :

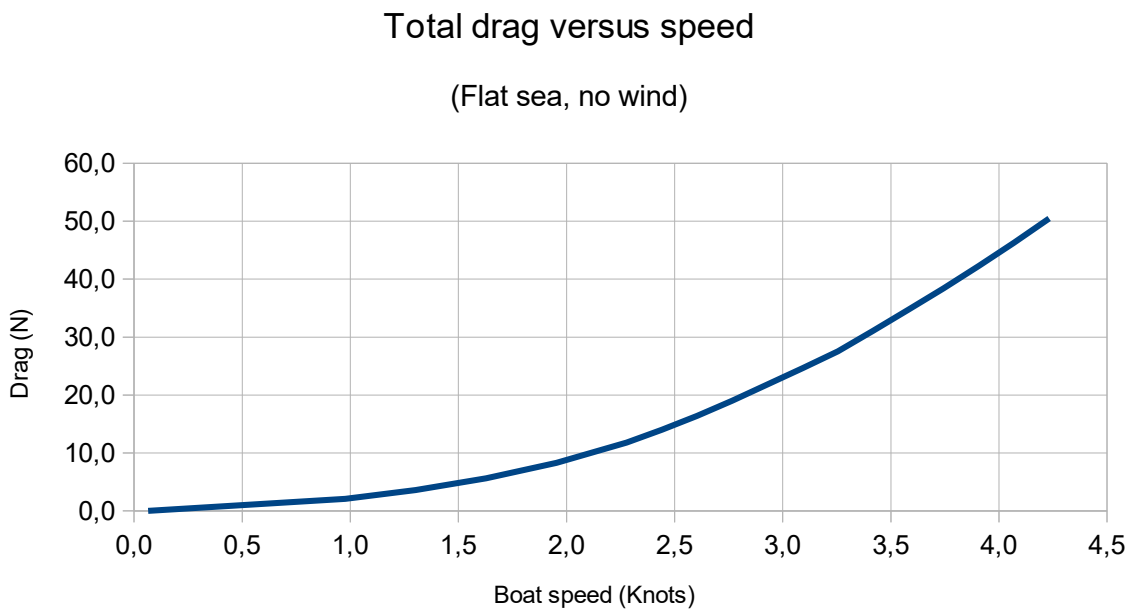
Load (kg) >	136,1					
Heel (°)	**0**	**5**	**10**	**15**	**20**	**25**
Height (cm)	**0,0360**	**0,2343**	**0,8067**	**1,7120**	**2,9026**	**4,3410**
Trim (°)	**-0,0350**	**-0,0350**	**-0,0350**	**-0,0350**	**-0,0350**	**-0,0355**
FB mini (cm)	26,0	20,6	15,4	10,4	5,6	1,1
GZ (m)	0,000	0,030	0,058	0,084	0,106	0,127
RM (kN.m)	0,000	0,079	0,154	0,222	0,282	0,336



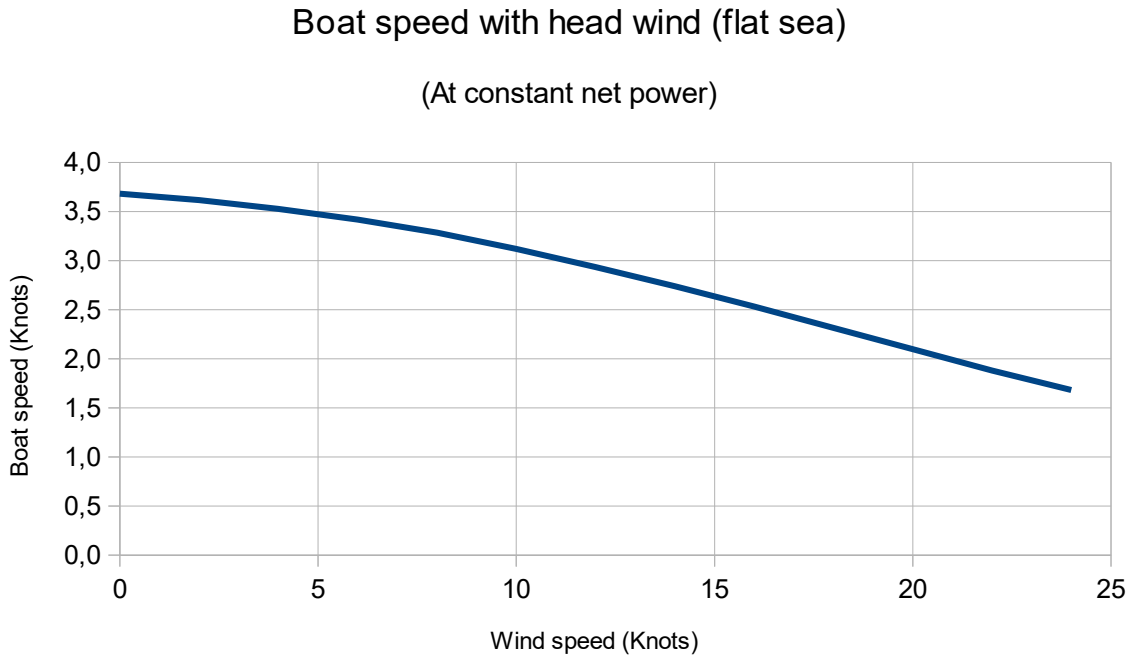


P1,2 - VPP Output :

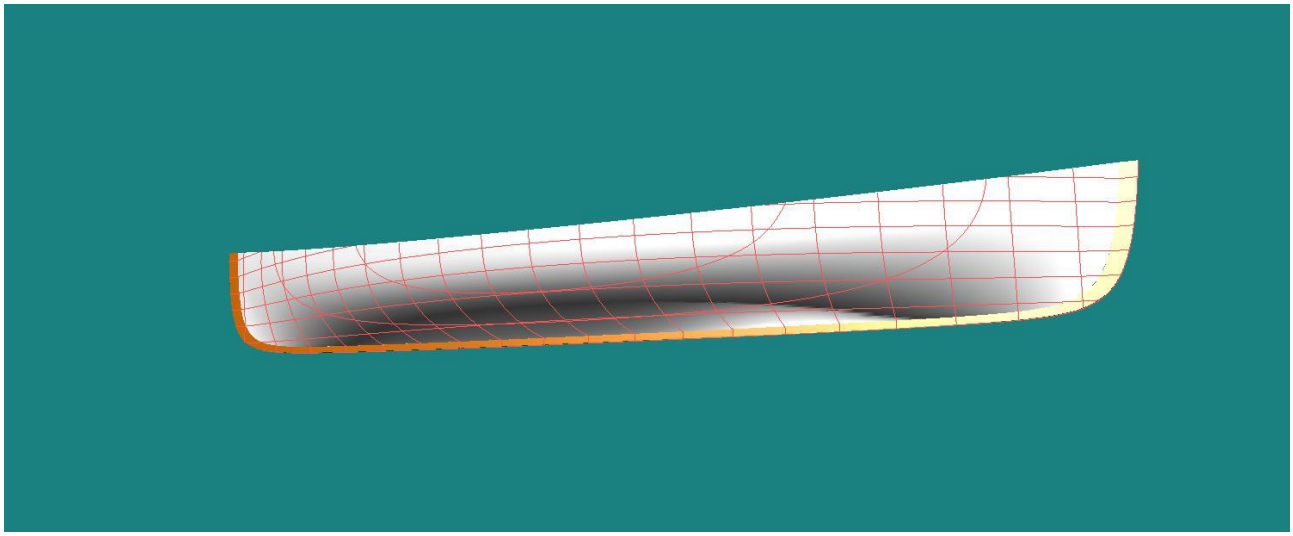
Drag curve :



Speed estimation with a net propulsion power of 70 W :

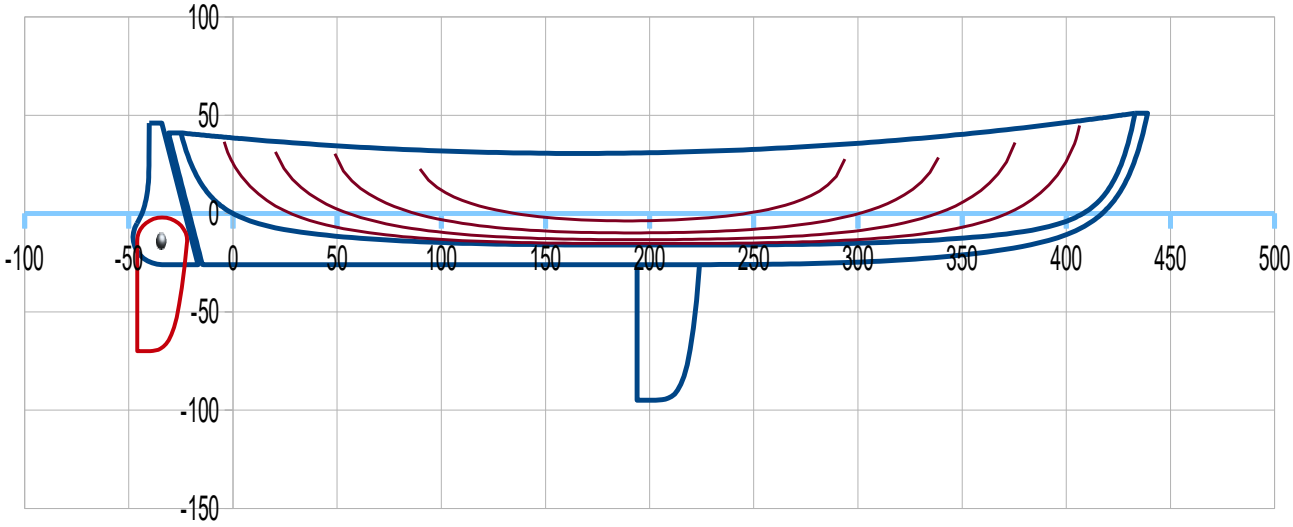


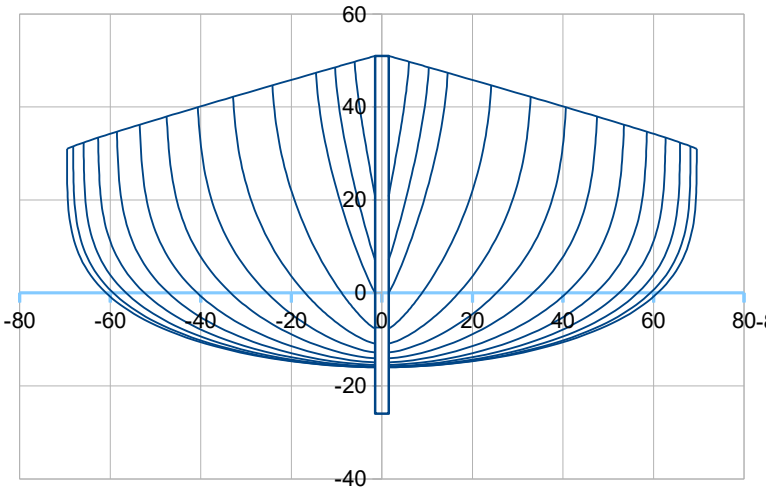
P1,2 - 3D view, done with Multisurf from the data in the Offsets sheet :

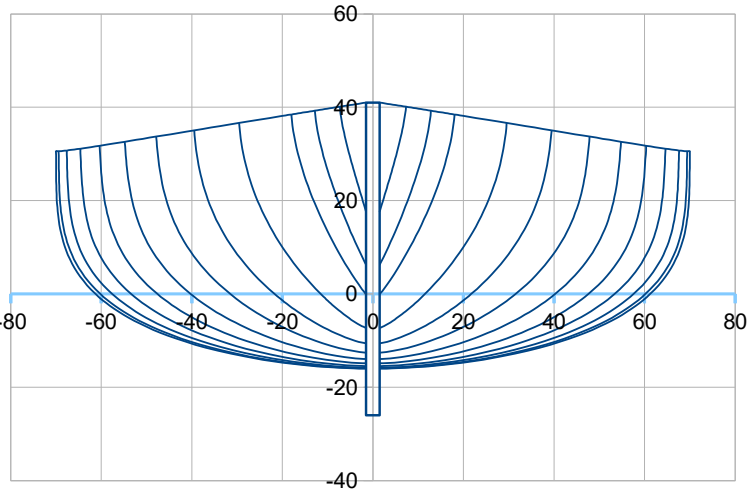


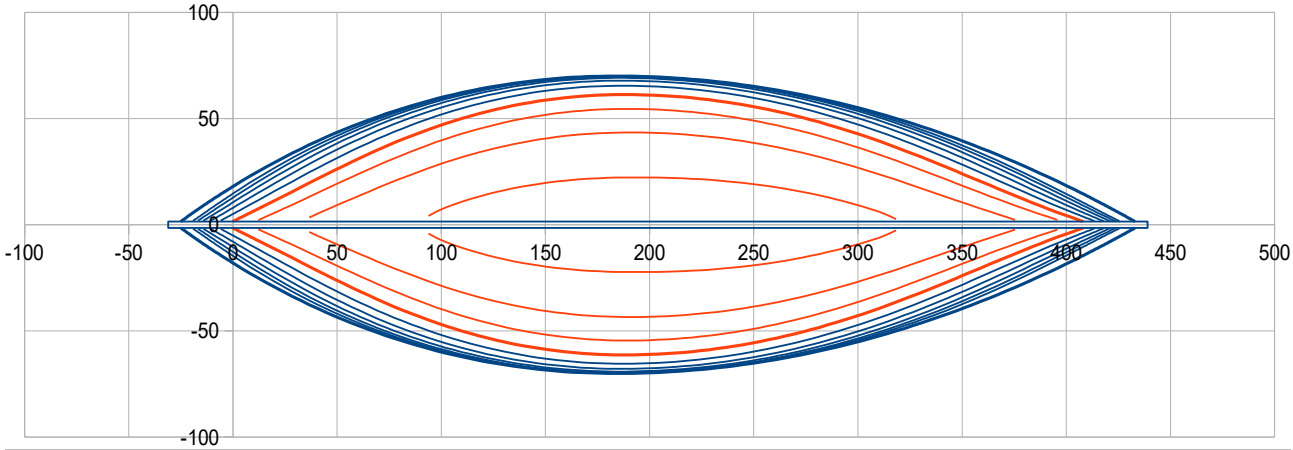
P2 – Pointu with a sailplan

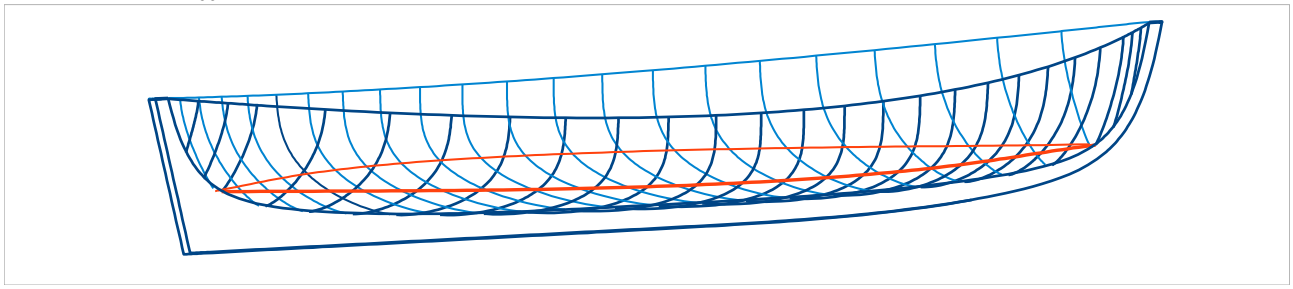
Loa : 4,70 m (15,4 ft) ; Lwl body : 4,08 m (19,1 ft) ; Boa : 1,40 m (55,1'') ; Bwl : 1,226 m (48,3'') ; Tc body : 0,160 m (6,3'') ; Displacement : 359,6 kg (793 lbs)











P2 - Hydrostatics data with the displacement 359,6 kg (i.e. with a load of 160 kg).

B1. Data sum-up and results of hydrostatic and surfaces calculations

B1.1 Hull

Loa (m)	**4,70**	**L body (m)**	**4,58**	**Lwl body(m)**	**4,08**	> Lwl/D^(1/3)	5,83	
>> ft	***15,42***	***>> ft***	***13,39***	***>> ft***	***19,11***			
Bsheer (m)	**1,40**	**at X (% Lwl)**	**45,0**	**Bmax (m)**	**1,40**	**at X (% Lwl)**	**45,0**	
>> inch	***55,12***			***>> inch***	***55,12***			
Bwl (m)	**1,226**	**at X (% Lwl)**	**46,0**	> Bwl / Bmax	0,876	> Lwl / Bwl	4,66	
>> inch	***48,26***					**Freeboards (m) >**	**Aft**	**Minimum**	**Fore**
Tc (m)	**0,160**	**at X (%Lwl)**	**50**	**Draft oa (m)**	**0,260**		**0,41**	**0,31**	**0,51**
>> inch	***6,30***				***>> inch***		***16,14***	***12,04***	***20,08***
Displacement at H0 (m3)		**0,34355**	**at Xc (m)**	**1,986**	**Xc (%Lwl)**	**48,67**	**Zc (m)**	**-0,066**
(kg)		**352,1**	*>> ft*	*6,52*			*>> inch*	*-2,60*
>> lbs		***776,3***	*with water mass / vol. of*		*1025*	*kg/m3*		
Cp	**0,586**							
Sf (m2)	**3,22**	**at Xf (m)**	**1,980**	**Xf (%Lwl)**	**48,53**	>>> Xc – Xf (%Lwl)		0,14
>> ft2	*34,68*	*>> ft*	*6,50*					
Angle immersed sheer (°)		**24,5**	at midship (50% Lwl)			**Entry half angle (°)**	**19,1**	
Sw (m2)	**4,29**	>Sw/D^(2/3)	8,75					
>> ft2	*46,20*							
Shull (m2)	**7,96**	**at X (m)**	**1,980**	**Z (m)**	**0,006**			
>> ft2	*85,69*	*>> ft*	*6,50*	*>> inch*	*0,24*			

B1.2 Daggerboard (if any)

Volume (m3)	**0,00428**	**at X (m)**	**2,095**	**X (%Lwl)**	**51,34**	**Z (m)**	**-0,545**	
		>> ft	*6,87*			*>> ft*	*-1,79*	
Draft oa (m)	**0,95**		**Sw (m2)**	**0,37**		**Sxz (m2)**	**0,18**	
>> ft	*3,12*		*>> ft2*	*3,97*		*>> ft2*	*1,91*	
CLR (m)	**2,14**	**CLR (%Lwl)**	**52,48**	*CLR = Center of Lateral Resistance*				
>> ft	*7,03*	method: keel profile extended to the waterline, CLR at Z 45% draft and					25,00	% chord

B1.3 Rudder (if any)

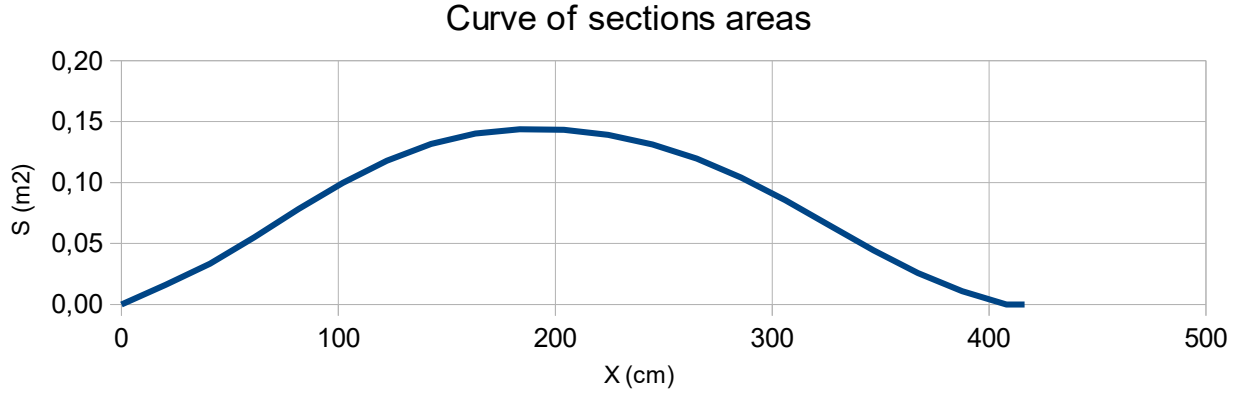
Volume (m3)	**0,00303**	**at X (m)**	**-0,33**	**X (%Lwl)**	**-8,20**	**Z (m)**	**0,00**	
Sw (m2)	**0,23**	*>> ft*	*-1,10*			**Sxz (m2)**	**0,11**	
>> ft2	*2,50*					*>> ft2*	*1,20*	

B1.4 Hull + Daggerboard + Rudder

Displacement at H0 (m3)	**0,35086**	**at LCB (m)**	**1,967**	**LCB (%Lwl)**	**48,22**	**at ZCB (m)**	**-0,071**
(kg)	**359,6**	*>> ft*	*6,45*			*>> ft*	*-0,23*
>> lbs	*793*						
Sw (m2)	**4,89**	>Sw/D^(2/3)	9,84	Lwl/D^(1/3)	5,78		
>> ft2	*52,67*			***DLR***	***148***	*M(lbs/2240)/(Lwl(ft)/100)^3*	

B1.5 Data from the mass spreadsheet

Boat with payload M(kg)	**359,6**	**at Xg (m)**	**1,916**	**Xg (%Lwl)**	**46,95**	**at Zg (m)**	**0,264**
Light boat	199,6		2,008				0,155



P2 - Initial stability , with the loading 160 kg at Z 0,40 m

B4.1 Mass and center of gravity with the input of a load

Data to enter : yellow cells	Mass (kg)	Xg (m)	Zg (m)	Yg (m)	(in the coordinates of the 2D plan views abo
Boat light weight (kg)	*199,61*	*2,008*	*0,155*	*0*	*from the mass spreadsheet*
Load (kg)	**160,00**	**1,80**	**0,40**	**0,00**	Crew at center
(lbs)			**0,40**	**0,50**	Crew at windward
Total >>> Mass (kg)	**359,61**	**1,916**	**0,264**	**0,000**	**Crew at center**
Disp. (m3)	**0,35084**		**0,264**	**0,222**	**Crew at windward**

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

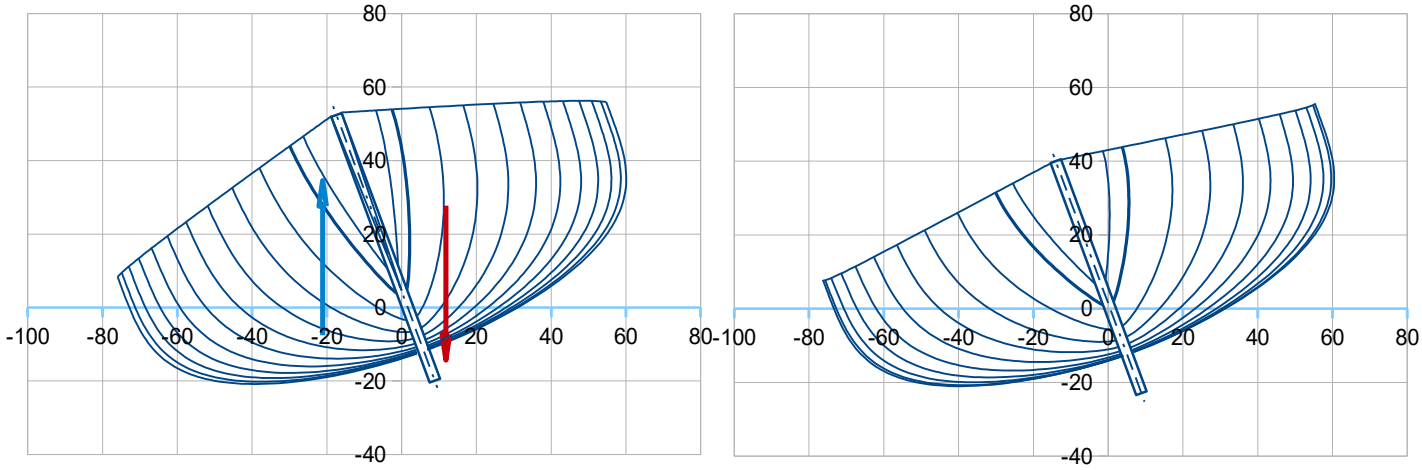
Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**1**	**> Disp. (m3)**	**0,35084**	**/ Disp. (m3)**	**0,35084**	Relevant only when heel = 0°			
Height (cm)	**-0,1433**	**Xc (m)**	**1,916**	**/ Xg (m)**	**1,916**	Lwl (m)	4,085	Z fore (cm)	-5,7
Trim (°)	**0,4960**	Yc (m)	-0,013	Yg heel (m)	0,218	Bwl (m)	1,229	Z aft (cm)	-27,9
	0,45	Zc (m)	-0,066	**> GZ (m)**	**0,230**	Draft (m)	0,161		
	0,230	**Sw heel (m2)**	**4,44**	**> RM (kN.m)**	**0,813**	Relevant only when heel = 1°			
	0,813	**– LCF (%Lwl)**	**-0,80**	**FB mini (cm)**	**28,9**	> Yg (m)	-0,005		
				Bwl (m)	**1,23**	**> GM1° (m)**	**0,45**		

>>> GM1° = 0,45 m

P2 - Check of the freeboard mini and of the stability at heel 20° , with the load at Y 0,50 m (i.e. the crew sit windward)

B4.2 Computation : by input of Heel angle, and iteration on Height up to displacement equality

Data to enter (yellow cases)		**Results**				**Specific results**			
Heel (°)	**20**	**> Disp. (m3)**	**0,35084**	**/ Disp. (m3)**	**0,35084**	Relevant only when heel = 0°			
Height (cm)	**2,9543**	**Xc (m)**	**1,916**	**/ Xg (m)**	**1,916**	Lwl (m)	3,967	Z fore (cm)	-2,5
Trim (°)	**0,4100**	Yc (m)	-0,211	Yg heel (m)	0,119	Bwl (m)	1,150	Z aft (cm)	-22,9
	7,70	Zc (m)	-0,075	**> GZ (m)**	**0,330**	Draft (m)	0,130		
	0,330	**Sw heel (m2)**	**4,15**	**> RM (kN.m)**	**1,163**	Relevant only when heel = 1°			
	1,163	**– LCF (%Lwl)**	**-0,94**	**FB mini (cm)**	**7,7**	> Yg (m)	-0,090		
				Bwl (m)	**1,05**	**> GM1° (m)**	**0,35**		

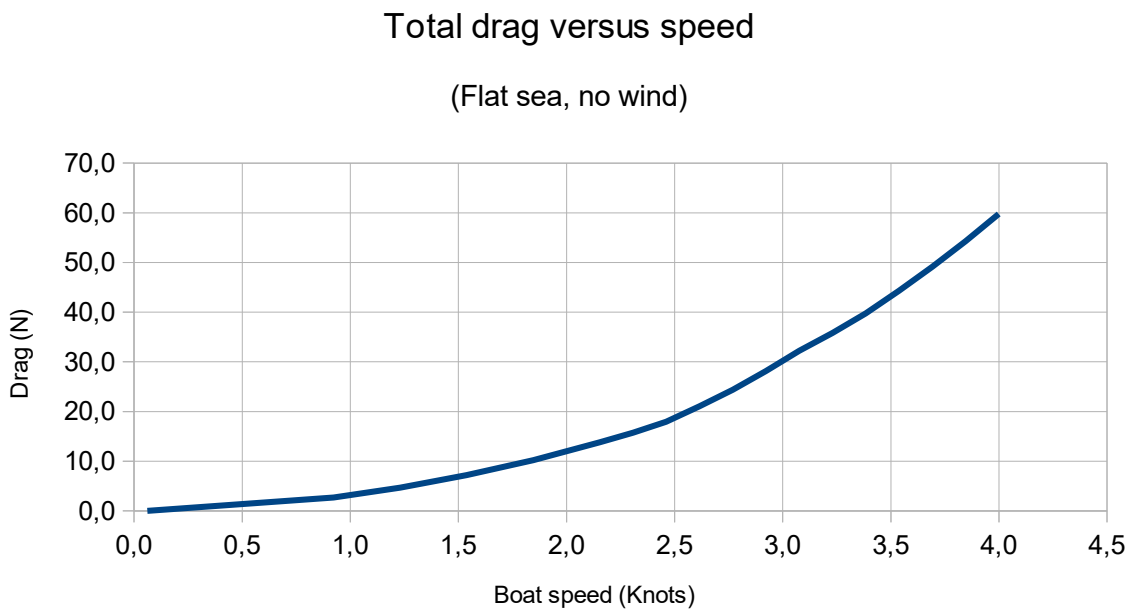


>>> The righting moment in sailing conditions (crew sit windward) is : RM20° = 1,163 kN.m

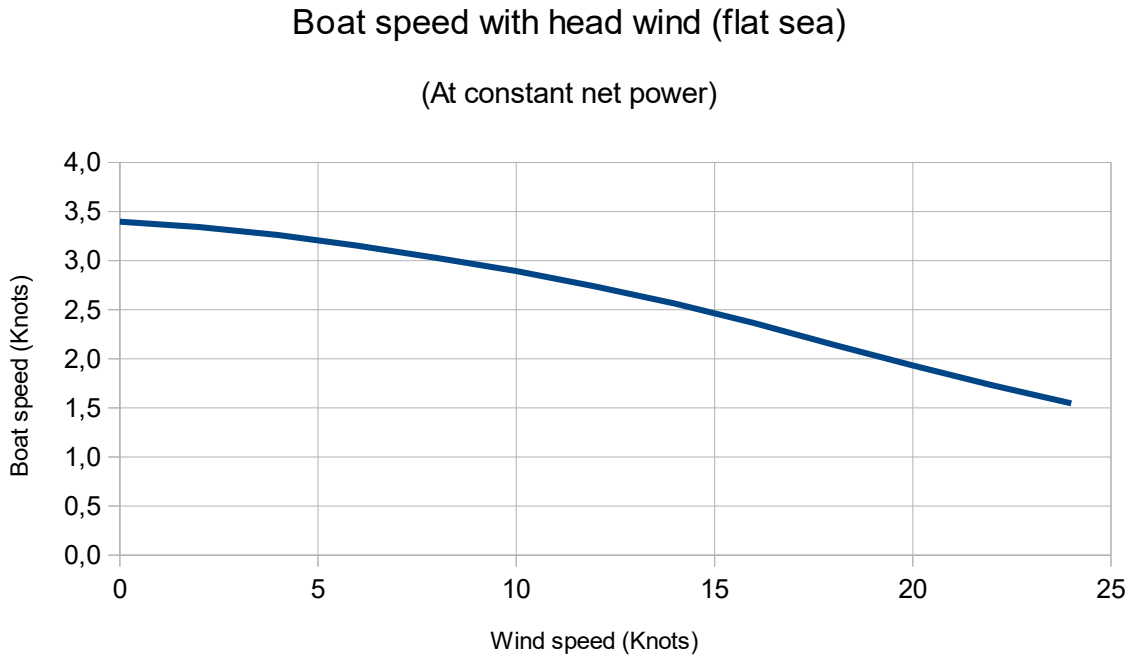
>>> The minimum freeboard is then 7,7 cm

P2 - VPP Output (in rowing conditions)

Drag curve :



Speed estimation with a net propulsion power of 70 W (2 rowers) :



P2 – Sailplan

C - Sailplan – early stage definition							
Mast	**1**	*>> in feet*	**Mainsail**		*>> in feet*	**Results**	
X foot (m)	**3,20**	*10,50*	**X Fore (m)**	**3,23**	*10,60*	S Main (m2)	7,35
Z top (m)	**4,50**	*14,76*	**Z Fore (m)**	**0,75**	*2,46*	S Jib (m2)	2,38
Alfa (°)	**1,00**		**X aft (m)**	**0,80**	*2,62*	**>> SA (m2)**	**9,73**
Boom	**0**		**Z aft (m)**	**0,80**	*2,62*	**X (m)**	**2,43**
Vergue	**1**	*>> in feet*	**Jib**	**1**	*>> in feet*	**Z (m)**	**2,35**
X fore (m)	**3,23**	*10,60*	**X stay (m)**	**4,35**	*14,27*	**Lead (% Lw)**	**7,2**
Z fore (m)	**3,00**	*9,84*	**Z top (m)**	**4,00**	*13,12*		
Alfa (°)	**30,00**		**X aft (m)**	**2,80**	*9,19*		
L (m)	**3,00**	*9,84*	**Z aft (m)**	**0,80**	*2,62*		

