

15 x 4,6 m Pontoon

Stability Study

Drw. no. **202535-1-1**

for
FBP Shipyards Oy

Revision	Author	Date	Changes
0	Tommi Korte	14.2.2020	-

1. General

In this document the stability of a 15 x 4.5 m pontoon (with own propulsion) is shortly studied.

This vessel is working as a floating platform for large commercial displays. It has two electric driven steerable thrusters and required battery capacity onboard (plus a generator for temporary battery charging). The battery room is in an “open hold” in the middle of the pontoon and has weathertight covers.

2. Geometry

The arrangement and geometry of the pontoon is based on the drawings supplied by FBP Shipyards Ltd.

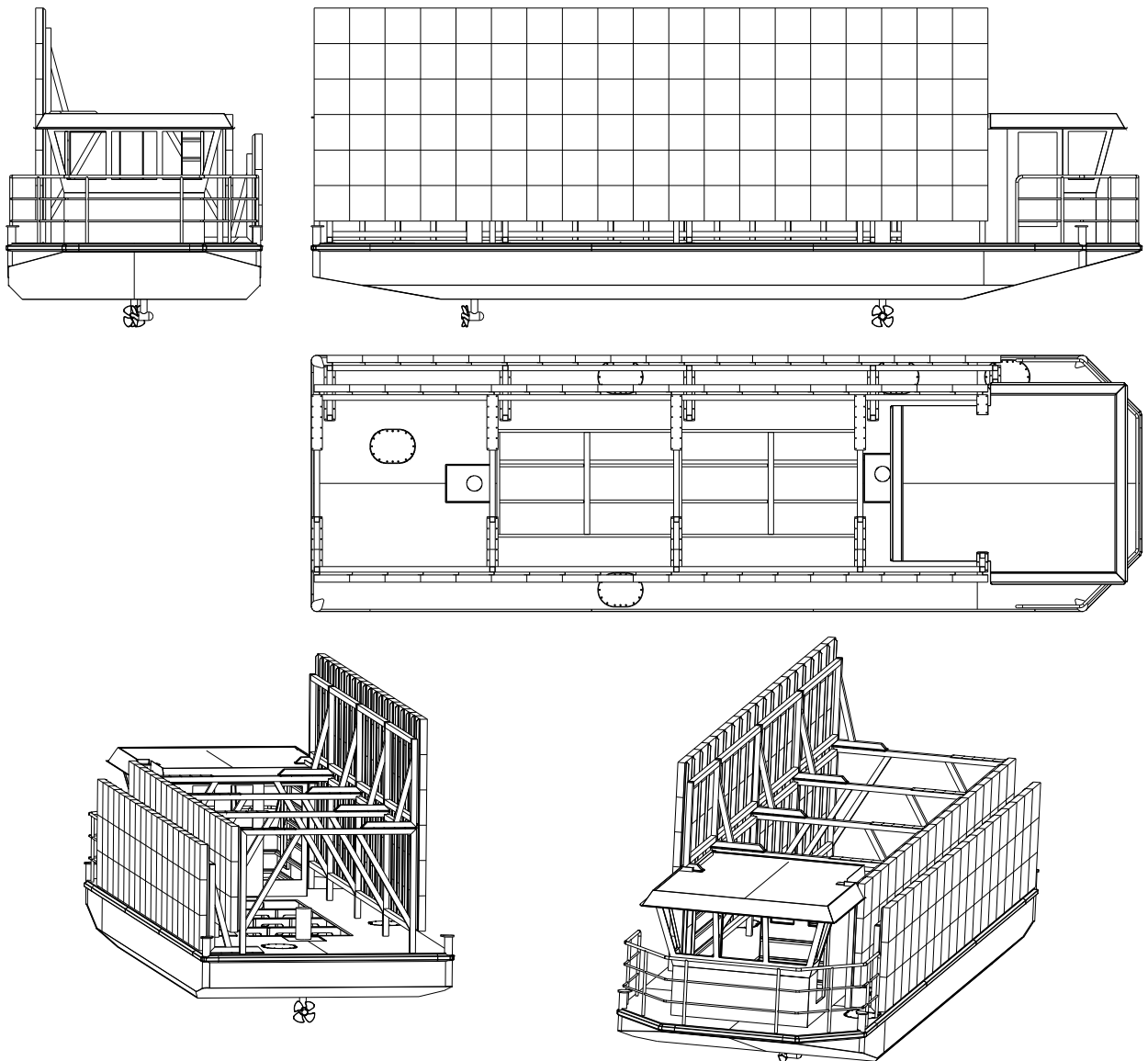



Fig 1. General Arrangement, 3D Views.

The geometry is modelled into the NAPA-program, modelling and calculation has been done with NAPA version 2019.2 .

The modelled geometry is shown in the Figure 2 below. Blue dotted lines indicate the thruster wells. The well volumes are reduced from the total hull volume.

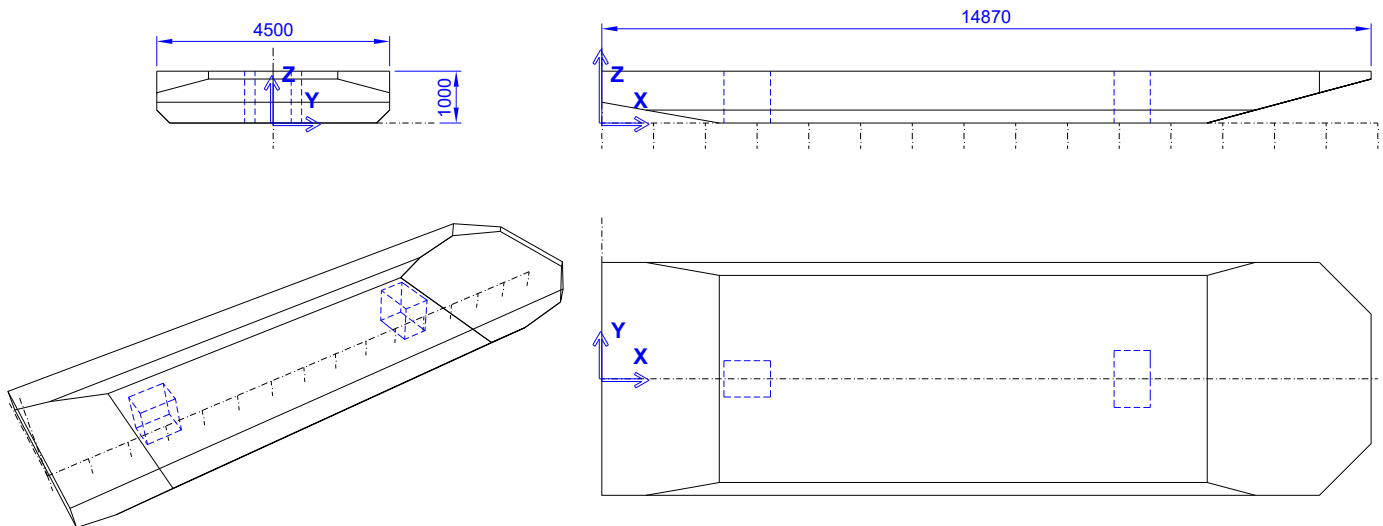


Fig 2. Modelled geometry in NAPA.

3. Light Weight

According to FBP Shipyard calculations the light weight and light weight COG of the pontoon is:

W	=	32 ton
X _{CG}	=	6.67 m
Y _{CG}	=	0.00 m
Z _{CG}	=	1.35 m

These figures contain all outfitting (i.e. thrusters, batteries, aggregate, commercial displays, etc.). The COG is calculated for both sides commercial displays in working (up) position.

4. Operation area

According to FBP Shipyard the allowed operational area of the pontoon is equal to **TRAFI Kotimaanliikenne I**. That means rivers, channels, bays, lakes and very sheltered sea areas close to the shore.

5. Stability

5.1 Lateral Wind Area

Due to large lateral wind area of the commercial displays, the wind heeling effect is studied for the vessel.

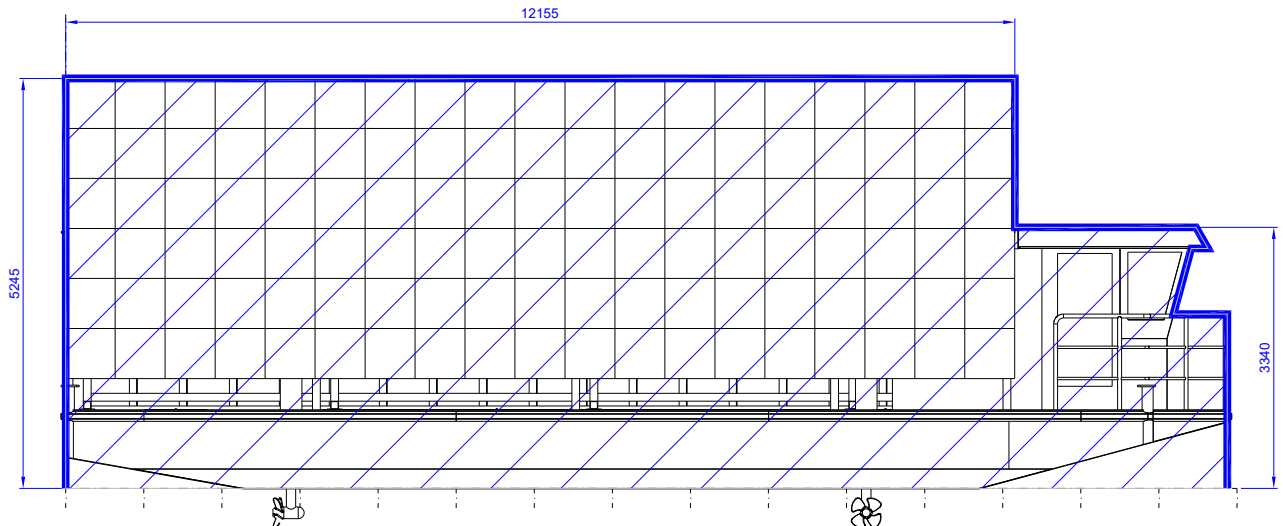


Fig 3. Lateral Wind Area.

5.2 Criteria for Stability

The stability is checked against Finnish rules, *TRAFI/34001/03.04.01.00/2018 Alusten Vakavuus*. Following criteria are used:

AREA30	Area under GZ curve up to 30 deg. >0.055 mrad
AREA40	Area under GZ curve up to 40 deg. >0.090 mrad
AREA3040	Area under GZ curve btw. 30-40 deg. > 0.030 mrad
GZ0.2	Max GZ > 0.2 m
TRAFI2.8	Area under GZ curve up to 15 deg. >0.070 mrad
GM0.15	GM > 0.15 m

The wind heeling effect is studied using TRAFI 2.9.2, which is actually meant for an unmanned pontoon:

TRAFI2.9.2	Static heeling caused by lateral wind pressure 540 N/m ² should not decrease the freeboard more than half of the initial freeboard without the wind force.
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For printing out the achieved wind force heeling angle, there is still one more criterion

MAXHEEL8	Heeling angle should not over 8°.
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5.3 Loading cases

The batteries will be permanently onboard. There is an aggregate, which has a built-on fuel tank on it. Except this tank, there are no consumables. The effect of the filling degree of this tank to the stability is very small, so in following calculation it is assumed to be full. Also, the effect of the crew weight is negligible, but stability is anyway calculated with and without crew weight.

Following loading cases has been studied:

- **Load case L1**
 - o Fully equipped, no crew on board
- **Load Case L2**
 - o Fully equipped, operation crew 2 persons

Water density of 1.005 ton/m³ is used for all calculated cases.

In pages 7-12 the listings of the corresponding NAPA calculations are presented.

All stability criterions (except wind heeling requirements) are full filled in the studied load cases. The large lateral wind area will heel vessel so that the remaining freeboard will be slightly lower than required by TRAFI2.9.2. However, the static heeling angle will be less than 8 degrees.

It is recommended that the maximum allowed wind speed for the pontoon operation is 10 m/s.

In operation condition the pontoon draft will be 0.61 m. This is also the maximum allowed draft. The minimum free board of the pontoon is 0.39 m.

5.4 Summary of Loading Cases

CASE	DESCRIPTION	DISP t	DWT t	T m	TA m	TF m
L1	FULLY EQUIPPED, NO CREW	32.00	0.00	0.603	0.630	0.577
L2	FULLY EQUIPPED, WITH CREW	32.17	0.17	0.607	0.625	0.588

CASE	TR m	HEEL deg	GM m	GMCORR m
L1	-0.053	0.0	2.302	0.000
L2	-0.037	0.0	2.287	0.000

6. NOTES TO THE MASTER

In this document, selected loading cases for the pontoon are presented.

The electric driven vessel is assumed to have standard equipment onboard, there is actually no consumables (except a small tank for the auxiliary battery generator). No any kind of additional cargo weight has been studied.

With any different cargo scenarios, separate stability study will be needed.

Maximum allowed pontoon draft is 0.61 m.

Due to big lateral wind area, wind force will cause bigger heeling angles than allowed by TRAFI2.9.2.

Wind has also a big effect on the manoeuvring characteristics of the vessel.

The maximum allowed windspeed for operation is 10 m/s.

Supporting mechanism for the commercial displays must be locked/secured before the voyage.

Any other heavy items onboard must be secured before the voyage.

The weather tight hatches in main deck and all the watertight hatches on deck or between the compartments inside the pontoons must be closed when the pontoon is under way.

The water probably condensed inside the pontoon compartments must be dried off to prevent extra weight and free surface effects.

Compliance with the stability criteria does not ensure immunity against capsize or absolve the Master from his responsibilities. Masters should therefore exercise prudence and good seamanship having regard to the season of year, weather forecast and the navigational zone.

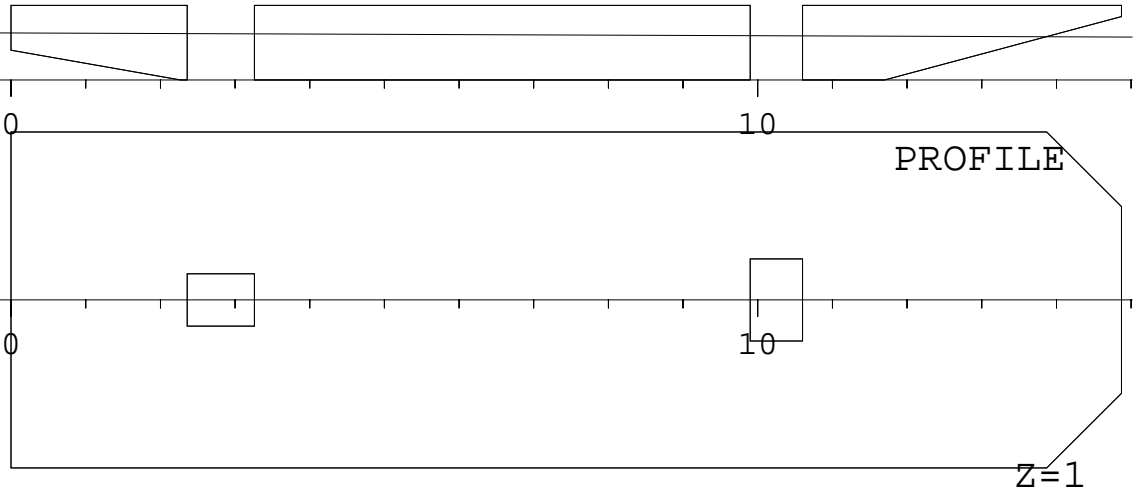
LOADING CONDITION L1, FULLY EQUIPPED, NO CREW

L O A D I N G C O M P O N E N T S

Deadweight	0.00	0.00	0.00	0.00	0.0
Lightweight	32.00	6.67	0.00	1.35	
Displacement (rho=1.005)	32.00	6.67	0.00	1.35	0.0

FLOATING POSITION

Draught moulded	0.603	m	KM	3.65	m
Trim	-0.053	m	KG	1.35	m
Heel, PS=+	0.0	deg			
TA	0.630	m	GM0	2.30	m
TF	0.577	m	GMCORR	0.00	m
Trimming moment	-3	tonm	GM	2.30	m



X=1

X=7.5

X=13

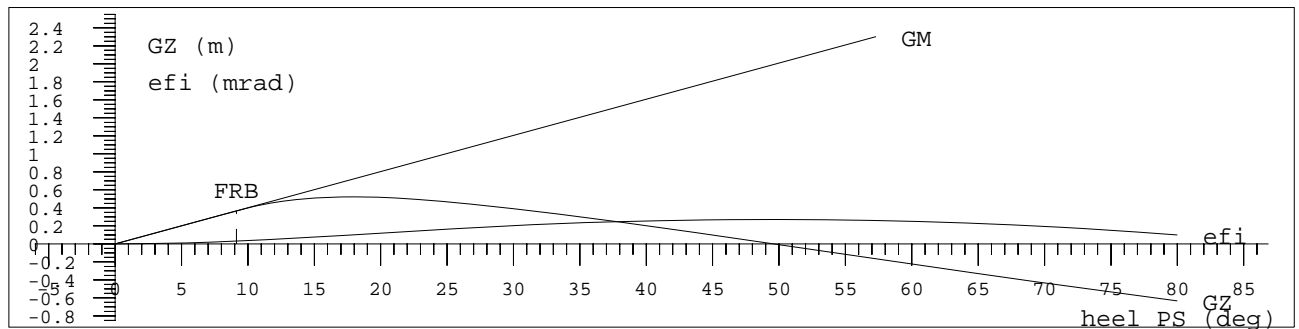
STABILITY CURVE

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LOADING CONDITION L1, FULLY EQUIPPED, NO CREW

HEEL deg	MS m	HPHI m	EPHI mrad	FSMOM tm	DGZ m
0.0	0.000	0.00	0.000	0.0	0.000
5.0	0.001	0.20	0.009	0.0	0.000
10.0	-0.001	0.40	0.035	0.0	0.000
15.0	-0.087	0.51	0.076	0.0	0.000
20.0	-0.270	0.52	0.121	0.0	0.000
25.0	-0.505	0.47	0.164	0.0	0.000
30.0	-0.760	0.39	0.202	0.0	0.000
45.0	-1.530	0.10	0.267	0.0	0.000
50.0	-1.772	-0.01	0.271	0.0	0.000
60.0	-2.217	-0.22	0.251	0.0	0.000
70.0	-2.597	-0.43	0.193	0.0	0.000
80.0	-2.899	-0.63	0.100	0.0	0.000

Loading condition L1, GM=2.302 m



Scale : GZ=1/81, ANGLE=1/549.2

STABILITY CRITERIA

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BEACON FINLAND Ltd Oy
NAPA/D/LD/191004
P202535/A
P202535

LOADING CONDITIONS

DATE 2020-02-14
TIME 13.47
USER TPK
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LOADING CONDITION L1, FULLY EQUIPPED, NO CREW

RCR	TEXT	REQ	ATTN	UNIT	STAT
AREA30	Area under GZ curve up to 30 deg.	0.055	0.202	mrاد	OK
AREA40	Area under GZ curve up to 40 deg.	0.090	0.254	mrاد	OK
AREA3040	Area under GZ curve btw. 30-40 deg.	0.030	0.052	mrاد	OK
GZ0.2	Max GZ > 0.2	0.200	0.391	m	OK
TRAFI2.8	Area by TRAFI2.8	0.067	0.103	mrاد	OK
GM0.15	GM > 0.15 m	0.150	2.302	m	OK
TRAFI2.9.2	Windforce, 1/2 of freeboard remains	0.185	0.096	m	NOT MET
MAXHEEL8	8 deg maxheel with wind	8.000	6.817	deg	OK

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 NAPA/D/LD/191004
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LOADING CONDITIONS

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 USER TPK
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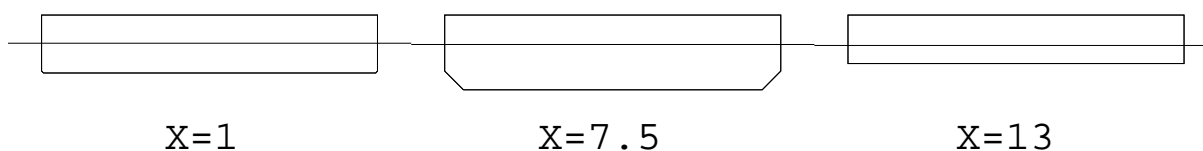
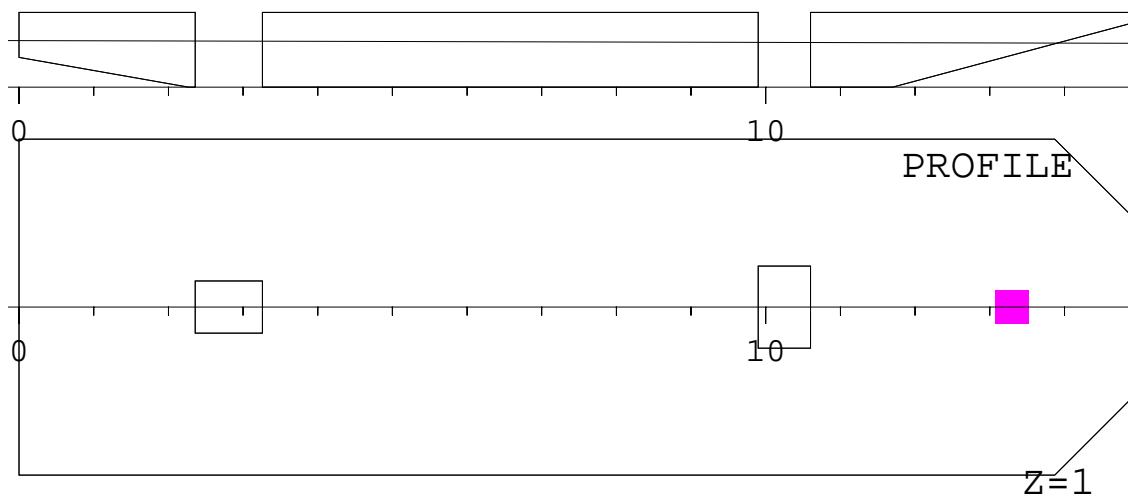
LOADING CONDITION L2, FULLY EQUIPPED, WITH CREW

LOADING COMPONENTS

Name	Max. weight	Mass	Center of gravity			Free s. moment
			cgx	cgy	cgz	
CREW						
CREW	0.0	0.17	13.30	0.00	2.00	0.00
Deadweight		0.17	13.30	0.00	2.00	0.0
Lightweight		32.00	6.67	0.00	1.35	
Displacement (rho=1.005)		32.17	6.71	0.00	1.35	0.0

FLOATING POSITION

Draught moulded	0.607	m	KM	3.64	m
Trim	-0.037	m	KG	1.35	m
Heel, PS=+	0.0	deg			
TA	0.625	m	GM0	2.29	m
TF	0.588	m	GMCORR	0.00	m
Trimming moment	-2	tonm	GM	2.29	m



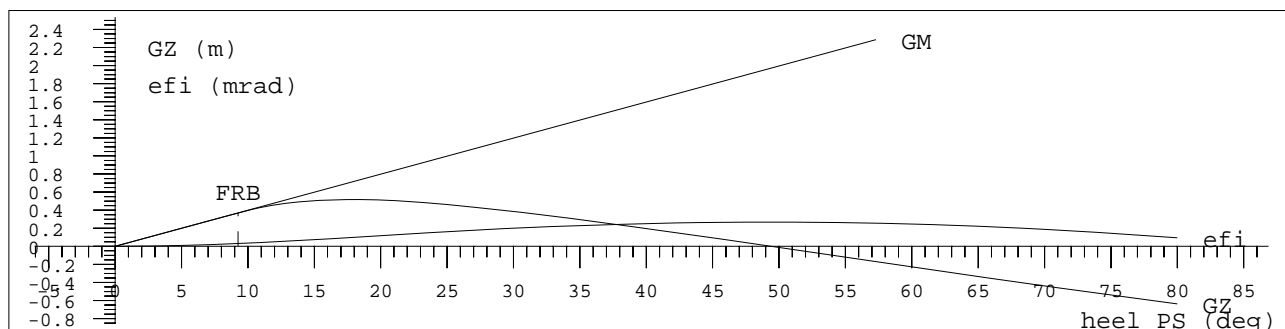
STABILITY CURVE

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LOADING CONDITION L2, FULLY EQUIPPED, WITH CREW

HEEL deg	MS m	HPHI m	EPHI mrad	FSMOM tm	DGZ m
0.0	0.000	0.00	0.000	0.0	0.000
5.0	0.001	0.20	0.009	0.0	0.000
10.0	0.000	0.40	0.035	0.0	0.000
15.0	-0.087	0.50	0.075	0.0	0.000
20.0	-0.270	0.51	0.120	0.0	0.000
25.0	-0.504	0.46	0.163	0.0	0.000
30.0	-0.758	0.39	0.200	0.0	0.000
45.0	-1.524	0.09	0.264	0.0	0.000
50.0	-1.765	-0.01	0.268	0.0	0.000
60.0	-2.209	-0.23	0.246	0.0	0.000
70.0	-2.587	-0.44	0.188	0.0	0.000
80.0	-2.888	-0.64	0.094	0.0	0.000

Loading condition L2, GM=2.287 m



Scale : GZ=1/80.7, ANGLE=1/549.2

STABILITY CRITERIA

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NAPA/D/LD/191004
P202535/A
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LOADING CONDITIONS

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LOADING CONDITION L2, FULLY EQUIPPED, WITH CREW
RCR TEXT

		REQ	ATTN UNIT	STAT
AREA30	Area under GZ curve up to 30 deg.	0.055	0.200 mrad	OK
AREA40	Area under GZ curve up to 40 deg.	0.090	0.251 mrad	OK
AREA3040	Area under GZ curve btw. 30-40 deg.	0.030	0.051 mrad	OK
GZ0.2	Max GZ > 0.2	0.200	0.386 m	OK
TRAFI2.8	Area by TRAFI2.8	0.067	0.102 mrad	OK
GM0.15	GM > 0.15 m	0.150	2.287 m	OK
TRAFI2.9.2	Windforce, 1/2 of freeboard remains	0.188	0.101 m	NOT MET
MAXHEEL8	8 deg maxheel with wind	8.000	6.813 deg	OK