

July 19, 2013

Owners Rep – Northern Marine 8501 – “Blood Baron”

Attn: Aaron Pufal, Owners Representative

Re: Northern Marine 85 Weight Tracking and Stability Estimates-Letter Report

Roddan Engineering has been engaged to review build progress, track weight and prepare an Intact Stability analysis for the Northern Marine hull 8501. This hull is similar to a number of other successful Northern Marine vessels in the 85 foot range, but with a unique new look and extended pilothouse skylounge.

Since this new vessel has a somewhat different structural arrangement and superstructure to the other vessels of its size, it was necessary to monitor the weight and distribution through the build process. Part-way through construction the vessel was weighed and compared to a paper weight study. These results are shown in Appendices 1 and 2. The weighing confirmed that the paper weight study was within 10% of the actual weigh results.

The Full Load paper weight study is shown in Appendix 3. This shows that with the installation of about 17 L.T. of additional ballast, the full load weight of the vessel would be about 130 L.T. at a 6.5 foot draft. Light ship (no fluids) weight is in the range 110 L.T with the same ballast. See Appendix 6 for Hydrostatic Tables. The results indicate that the vessel is lighter than other Northern Marine builds of similar length (based on the results of the weighing), thus requiring more ballast to sit on a desired waterline. It is recommended that partial ballasting be done currently, with final ballasting for trim and desired waterline to be performed at launch.

Values from the weight study for both full load and lightship are used as input to an Intact Stability Program. Based on the Intact Stability analysis, shown in Appendices 4 and 5, the vessel complies with the USCG criteria for intact stability, **USCG - 46 CFR 170.173**, for all load conditions. This criteria ensures that the vessel will be seaworthy and safe with respect to intact stability issues.

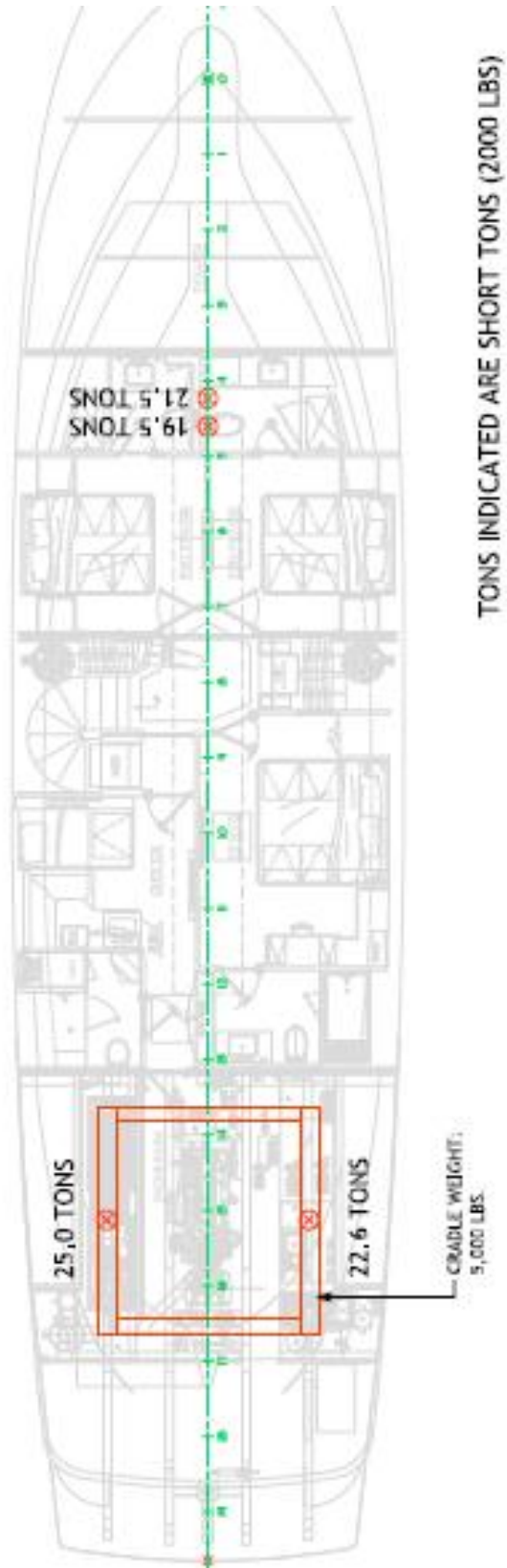
It is recommended that an Inclining Experiment, supervised by Roddan Engineering Ltd., be performed at launch (and after final ballasting) to confirm the stability estimates and determine exact VCG (vertical Center of Gravity) and LCG (Longitudinal Center of Gravity).

If there are questions concerning the above analysis, please do not hesitate to contact Roddan Engineering Ltd.

Best Regards,
for Roddan Engineering Ltd.,

(original signed by)
George Roddan, P.Eng.
President

Appendix 1 – Load Cell Configuration for Weighing



Appendix 2 – Comparison of Paper Weight Study to Vessel Weigh Results

8501 Blood Baron - Weight Study - Only Items at weighing											
		Surface Area ft^2	Laminate Wt/FT^2 lb/ft^2	Weight lbs	long tons	CG Location*			Moment		
						X ft	Y ft	Z ft	X ft-lt	Y ft-lt	Z ft-lt
FRP Parts											
On at weighing											
✓	Hull Bottom	3875.89	7.70	29844	13.32	40.33	0.00	4.00	537.38	0.00	53.29
✓	Hull Sides	4173.24	6.60	27543	12.30	33.33	0.00	5.42	409.87	0.00	66.60
✓	Hull Stiffening	1400.00	9.90	13860	6.19	42.42	0.00	8.00	262.45	0.00	49.50
✓	Bulkheads - LRDK Combined	659.96	6.60	4356	1.94	36.67	0.00	7.08	71.30	0.00	13.77
✓	Bulkheads - MNDK Combined	332.84	8.80	2929	1.31	13.42	0.00	15.33	17.54	0.00	20.05
✓	Bulkheads - BRDK Combined	116.84	8.80	1028	0.46	31.67	-2.67	22.75	14.54	-1.22	10.44
✓	Decks - LRDK Combined	72.28	6.60	477	0.21	34.17	0.00	3.71	7.28	0.00	0.79
✓	Decks - MNDK Combined	1300.38	6.60	8583	3.83	37.75	0.00	11.25	144.64	0.00	43.10
✓	Decks - BRDK Combined	173.16	6.60	1143	0.51	37.33	0.00	18.83	19.05	0.00	9.61
✓	Decks - FBDK Combined	951.34	6.60	6279	2.80	37.08	-0.33	26.50	103.95	-0.93	74.28
✓	Flybridge	1108.27	5.50	6095	2.72	33.33	0.00	20.17	90.71	0.00	54.88
✓	Hardtop	449.41	4.40	1977	0.88	32.83	0.00	27.08	28.98	0.00	23.91
✓	Fwd Sheer Coamings	228.78	4.40	1007	0.45	14.50	0.00	13.83	6.52	0.00	6.22
✓	Aft BRDK Coamings	265.30	4.40	1167	0.52	61.00	0.00	19.17	31.79	0.00	9.99
✓	Superstructure Walls - MNDK	486.11	5.50	2674	1.19	55.42	0.00	14.50	66.14	0.00	17.31
✓	Superstructure Walls - BRDK	729.17	5.50	4010	1.79	32.92	0.00	14.42	58.93	0.00	25.81
Machinery											
✓	Main Engine			4200	1.88	59.00	0.00	6.00	110.63	0.00	11.25
✓	Gear			1200	0.54	63.00	0.00	5.00	33.75	0.00	2.68
✓	Gen 1			1550	0.69	56.00	5.00	8.00	38.75	3.46	5.54
✓	Gen 2			1550	0.69	62.00	5.00	8.00	42.90	3.46	5.54
Systems											
✓	Ballast			20000.00	8.93	30.00	0.00	3.00	267.86	0.00	26.79
Hardware											
✓	Anchor Base Plate			327	0.15	3.44	0.00	12.17	0.50	0.00	1.78
✓	Hawsers			603	0.27	40.05	0.00	7.63	10.78	0.00	2.05
Tankage (Dry)											
✓	Diesel Oil - Fwd Tank			1818	0.81	12.03	0.00	0.02	9.76	0.00	0.02
✓	Diesel Oil - Day Keel Tank			367	0.16	39.64	0.00	4.40	6.49	0.00	0.72
✓	Diesel Oil - Saddle Tanks			935	0.42	58.01	8.04	0.43	24.22	3.36	0.18
✓	Lube Oil			169	0.08	57.61	5.54	2.53	4.34	0.42	0.19
✓	Gray Water			84	0.04	26.79	0.00	53.57	1.01	0.00	2.01
✓	Black Water			124	0.06	21.06	0.00	4.53	1.17	0.00	0.25
✓	Potable Water			479	0.21	8.00	0.00	0.31	1.71	0.00	0.07
Liquids											
Metal Parts											
✓	Keel Shoe			6800	3.04	22.00	0.00	0.80	66.79	0.00	2.43
Joinery											
	LRDK Level			4351	1.94	32.00	0.00	7.50	62.16	0.00	14.57
	MNDK Level			2785	1.24	32.00	0.00	15.00	39.79	0.00	18.65
	BRDK Level			450	0.20	29.00	0.00	23.00	5.83	0.00	4.62
Stonework											
	LRDK Level			561	0.25	32.00	0.00	7.50	8.01	0.00	1.88
	MNDK Level			893	0.40	32.00	0.00	15.00	12.75	0.00	5.98
	BRDK Level			332	0.15	29.00	0.00	23.00	4.29	0.00	3.40
	FBDK Level			43	0.02	29.00	0.00	32.00	0.56	0.00	0.62
Msc											
Totals (Estimated)											
				153179	73			VCG=	8.14	Sum of moments (z) =	590.75
										Sum of moments (x) =	2625.08
	Actual at weighing				76.9			LCG=	36.17		
*x,y,x 0 = aft of sta 0,to port from cl, up from baseline											
Note: Measured and estimated weights are within 10%											

Appendix 4 – Intact Stability Analysis – Light Condition

SHIPHUL 2000 V 2.11

RODDAN ENGINEERING

SERIAL NO. 0018 - Northern Marine 8500

INTACT STABILITY - Light Condition

SHIP WEIGHT SUMMARY

	WT (LTON)	VCG (FT)	LCG (FT)	TCG (FT)	FS MOM (FT-LTON)
FIXED WT	110.000	8.700	-1.300	.000	.000
TANK FLUID	.000	.000	.000	.000	.000
=====					
TOTAL INTACT SHIP	110.000	8.700	-1.300	.000	.000

INTACT CURVES OF STATIC STABILITY - FREE TO TRIM - 1.025 SP GR

HEEL (DEG)	RA (FT)	RA AREA (FT-DEG)	TCB (FT)	VCB (FT)	LCB (FT)	DRAFT (FT)	TRIM (FT)	
.000	.000	.000	.000	4.096	-1.300	5.879	1.469	
3.000	.233	.350	.474	4.109	-1.300	5.874	1.463	
5.000	.386	.969	.787	4.130	-1.300	5.865	1.452	
10.000	.745	3.813	1.545	4.230	-1.300	5.822	1.408	
15.000	1.051	8.327	2.244	4.384	-1.300	5.741	1.344	
20.000	1.293	14.212	2.875	4.583	-1.300	5.614	1.243	
25.000	1.474	21.154	3.438	4.815	-1.300	5.429	1.100	
30.000	1.603	28.864	3.942	5.078	-1.300	5.176	.916	
35.000	1.690	37.109	4.397	5.367	-1.300	4.840	.676	
40.000	1.751	45.723	4.814	5.687	-1.300	4.401	.393	
45.000	1.791	54.580	5.197	6.035	-1.300	3.845	.128	
50.000	1.839	63.645	5.562	6.434	-1.300	3.134	-.035	
60.000	2.064	83.163	6.278	7.459	-1.300	.957	.370	
64.084	2.089	91.660	** ANGLE OF MAXIMUM RIGHTING ARM **					
70.000	2.029	103.902	6.731	8.409	-1.300	-3.377	2.339	
80.000	1.596	122.267	6.919	9.101	-1.300	-16.404	8.572	
89.000	1.048	134.213	6.969	9.626	-1.300	-248.641	126.106	

NOTE: DATA AT OTHER THAN INPUT HEEL ANGLE VALUES ARE INTERPOLATED.

TRIM AND INITIAL UPRIGHT (ZERO HEEL) STABILITY

DRAFT AMIDSHIPS, FT	5.879	KMT, FT	+ 13.157
TRIM (ON LBP, + AFT), FT	1.469	KG, FT	- 8.700
LCB (+ FWD MID), FT	-1.300	FSC, FT	- .000
LCF (+ FWD MID), FT	-3.121		
MT1, FT-LTON/IN	15.597		=====
DRAFT AT FP, FT	5.145	GMT, FT	4.457
DRAFT AT AP, FT	6.613		

SHIPHUL 2000 V 2.11

RODDAN ENGINEERING

SERIAL NO. 0018 - Northern Marine 8500

STABILITY EVALUATION - Light Condition

USCG - 46 CFR 170.173(B) - STANDARD RAHOLA CRITERIA

RIGHTING ARM DATA TABLE

HEEL (DEG)	RA (FT)	TCB (FT)	VCB (FT)	TCG (FT)	VCG (FT)	DRAFT (FT)	TRIM (FT)
.000	.000	.000	4.096	.000	8.700	5.879	1.469
3.000	.233	.474	4.109	.000	8.700	5.874	1.463
5.000	.386	.787	4.130	.000	8.700	5.865	1.452
10.000	.745	1.545	4.230	.000	8.700	5.822	1.408
15.000	1.051	2.244	4.384	.000	8.700	5.741	1.344
20.000	1.293	2.875	4.583	.000	8.700	5.614	1.243
25.000	1.474	3.438	4.815	.000	8.700	5.429	1.100
30.000	1.603	3.942	5.078	.000	8.700	5.176	.916
35.000	1.690	4.397	5.367	.000	8.700	4.840	.676
40.000	1.751	4.814	5.687	.000	8.700	4.401	.393
45.000	1.791	5.197	6.035	.000	8.700	3.845	.128
50.000	1.839	5.562	6.434	.000	8.700	3.134	-.035
60.000	2.064	6.278	7.459	.000	8.700	.957	.370
70.000	2.029	6.731	8.409	.000	8.700	-3.377	2.339
80.000	1.596	6.919	9.101	.000	8.700	-16.404	8.572
89.000	1.048	6.969	9.626	.000	8.700	-248.641	126.106

CRITERION VALUES AT ACTUAL SHIP VCG (8.700 FT)

CRITERION	ACTUAL VALUE	ALLOWABLE VALUE	STATUS
RA AREA TO 30.0 DEG, FT-DEG	28.864	10.300 (MIN)	PASS
RA AREA TO 40.0 DEG, FT-DEG	45.723	16.900 (MIN)	PASS
RA AREA FROM 30.0 TO 40.0 DEG, FT-DEG	16.859	5.600 (MIN)	PASS
MAX RA FOR ANGLES BEYOND 30.0 DEG, FT	2.089	.660 (MIN)	PASS
ANGLE OF MAX RA, DEG	64.084	25.000 (MIN)	PASS
GMT, FT	4.457	.490 (MIN)	PASS

CRITERION VALUES AT LIMITING SHIP VCG (10.585 FT)

CRITERION	ACTUAL VALUE	ALLOWABLE VALUE	STATUS
RA AREA TO 30.0 DEG, FT-DEG	14.396	10.300 (MIN)	PASS
RA AREA TO 40.0 DEG, FT-DEG	20.457	16.900 (MIN)	PASS
RA AREA FROM 30.0 TO 40.0 DEG, FT-DEG	6.061	5.600 (MIN)	PASS
MAX RA FOR ANGLES BEYOND 30.0 DEG, FT	.660	.660 (MIN)	PASS
ANGLE OF MAX RA, DEG	25.418	25.000 (MIN)	PASS
GMT, FT	2.572	.490 (MIN)	PASS

Appendix 5 – Intact Stability Analysis – Full Load Condition

SHIPHUL 2000 V 2.11

RODDAN ENGINEERING

SERIAL NO. 0018 - Northern Marine 8500

INTACT STABILITY – Full Load Condition

SHIP WEIGHT SUMMARY

	WT (LTON)	VCG (FT)	LCG (FT)	TCG (FT)	FS MOM (FT-LTON)
FIXED WT	130.000	7.570	1.050	.000	.000
TANK FLUID	.000	.000	.000	.000	.000
=====					
TOTAL INTACT SHIP	130.000	7.570	1.050	.000	.000

INTACT CURVES OF STATIC STABILITY – FREE TO TRIM – 1.025 SP GR

HEEL (DEG)	RA (FT)	RA AREA (FT-DEG)	TCB (FT)	VCB (FT)	LCB (FT)	DRAFT (FT)	TRIM (FT)	
.000	.000	.000	.000	4.403	1.050	6.498	-.373	
3.000	.254	.380	.419	4.414	1.050	6.494	-.381	
5.000	.422	1.056	.698	4.433	1.050	6.487	-.396	
10.000	.829	4.194	1.379	4.523	1.050	6.451	-.466	
15.000	1.197	9.276	2.018	4.664	1.050	6.385	-.574	
20.000	1.522	16.091	2.609	4.850	1.050	6.280	-.726	
25.000	1.798	24.410	3.148	5.074	1.050	6.123	-.922	
30.000	2.031	34.000	3.639	5.329	1.050	5.901	-1.165	
35.000	2.226	44.655	4.087	5.614	1.050	5.598	-1.466	
40.000	2.394	56.216	4.501	5.931	1.050	5.200	-1.792	
45.000	2.547	68.570	4.887	6.285	1.050	4.688	-2.077	
50.000	2.706	81.701	5.259	6.690	1.050	4.028	-2.266	
60.000	3.004	110.339	5.916	7.623	1.050	2.087	-2.316	
67.495	3.095	133.299	** ANGLE OF MAXIMUM RIGHTING ARM **					
70.000	3.083	141.044	6.348	8.540	1.050	-1.481	-2.245	
80.000	2.726	170.354	6.524	9.188	1.050	-12.373	-.971	
89.000	2.227	192.701	6.572	9.683	1.050	-206.650	26.332	

NOTE: DATA AT OTHER THAN INPUT HEEL ANGLE VALUES ARE INTERPOLATED.

TRIM AND INITIAL UPRIGHT (ZERO HEEL) STABILITY

DRAFT AMIDSHIPS, FT	6.498	KMT, FT	+ 12.415
TRIM (ON LBP, + AFT), FT	-.373	KG, FT	- 7.570
LCB (+ FWD MID), FT	1.050	FSC, FT	- .000
LCF (+ FWD MID), FT	-2.876		
MT1, FT-LTON/IN	15.441		=====
DRAFT AT FP, FT	6.685	GMT, FT	4.845
DRAFT AT AP, FT	6.312		

SHIPHUL 2000 V 2.11

RODDAN ENGINEERING

SERIAL NO. 0018 - Northern Marine 8500

STABILITY EVALUATION - Full Load Condition

USCG - 46 CFR 170.173(B) - STANDARD RAHOLA CRITERIA

RIGHTING ARM DATA TABLE

HEEL (DEG)	RA (FT)	TCB (FT)	VCB (FT)	TCG (FT)	VCG (FT)	DRAFT (FT)	TRIM (FT)
.000	.000	.000	4.403	.000	7.570	6.498	-.373
3.000	.254	.419	4.414	.000	7.570	6.494	-.381
5.000	.422	.698	4.433	.000	7.570	6.487	-.396
10.000	.829	1.379	4.523	.000	7.570	6.451	-.466
15.000	1.197	2.018	4.664	.000	7.570	6.385	-.574
20.000	1.522	2.609	4.850	.000	7.570	6.280	-.726
25.000	1.798	3.148	5.074	.000	7.570	6.123	-.922
30.000	2.031	3.639	5.329	.000	7.570	5.901	-1.165
35.000	2.226	4.087	5.614	.000	7.570	5.598	-1.466
40.000	2.394	4.501	5.931	.000	7.570	5.200	-1.792
45.000	2.547	4.887	6.285	.000	7.570	4.688	-2.077
50.000	2.706	5.259	6.690	.000	7.570	4.028	-2.266
60.000	3.004	5.916	7.623	.000	7.570	2.087	-2.316
70.000	3.083	6.348	8.540	.000	7.570	-1.481	-2.245
80.000	2.726	6.524	9.188	.000	7.570	-12.373	-.971
89.000	2.227	6.572	9.683	.000	7.570	-206.650	26.332

CRITERION VALUES AT ACTUAL SHIP VCG (7.570 FT)

CRITERION	ACTUAL VALUE	ALLOWABLE VALUE	STATUS
RA AREA TO 30.0 DEG, FT-DEG	34.000	10.300 (MIN)	PASS
RA AREA TO 40.0 DEG, FT-DEG	56.216	16.900 (MIN)	PASS
RA AREA FROM 30.0 TO 40.0 DEG, FT-DEG	22.217	5.600 (MIN)	PASS
MAX RA FOR ANGLES BEYOND 30.0 DEG, FT	3.095	.660 (MIN)	PASS
ANGLE OF MAX RA, DEG	67.495	25.000 (MIN)	PASS
GMT, FT	4.845	.490 (MIN)	PASS

CRITERION VALUES AT LIMITING SHIP VCG (10.312 FT)

CRITERION	ACTUAL VALUE	ALLOWABLE VALUE	STATUS
RA AREA TO 30.0 DEG, FT-DEG	12.954	10.300 (MIN)	PASS
RA AREA TO 40.0 DEG, FT-DEG	19.466	16.900 (MIN)	PASS
RA AREA FROM 30.0 TO 40.0 DEG, FT-DEG	6.512	5.600 (MIN)	PASS
MAX RA FOR ANGLES BEYOND 30.0 DEG, FT	.660	.660 (MIN)	PASS
ANGLE OF MAX RA, DEG	31.140	25.000 (MIN)	PASS
GMT, FT	2.103	.490 (MIN)	PASS

Appendix 6 – Northern Marine 8501 Hydrostatics

SHIPHUL 2000 V 2.11

RODDAN ENGINEERING

SERIAL NO. 0018 - Northern Marine 8500

HYDROSTATICS

CURVES OF FORM PART 1 (.000 FT AFT TRIM, 1.025 SP GR, .000 FT SAG)

DRAFT (FT)	HULL VOL (FT3)	APG VOL (FT3)	DISPL (LTON)	LCB (FT)	TCB (FT)	KB (FT)
4.000	1689.603	.000	48.264	3.094	.000	2.835
4.500	2178.523	.000	62.231	2.845	.000	3.167
5.000	2716.488	.000	77.598	2.405	.000	3.484
5.500	3309.515	.000	94.538	1.720	.000	3.802
6.000	3933.109	.000	112.351	1.068	.000	4.112
6.250	4250.500	.000	121.418	.770	.000	4.263
6.500	4572.187	.000	130.607	.504	.000	4.411
6.750	4897.698	.000	139.906	.266	.000	4.559
7.000	5226.538	.000	149.299	.054	.000	4.704
7.250	5558.227	.000	158.774	-.136	.000	4.849
7.500	5892.277	.000	168.316	-.305	.000	4.992
8.000	6563.948	.000	187.503	-.580	.000	5.274
9.000	7917.826	.000	226.177	-.943	.000	5.826

CURVES OF FORM PART 2 (.000 FT AFT TRIM, 1.025 SP GR, .000 FT SAG)

DRAFT (FT)	WP AREA (FT2)	LCF (FT)	TCF (FT)	TP1 (LTON/IN)	CID1TS (LTON/FT)	MT1 (FT-LTON/IN)
4.000	931.63	2.431	.000	2.218	-.851	7.832
4.500	1020.01	1.596	.000	2.428	-.612	9.263
5.000	1133.29	-.419	.000	2.698	.178	12.006
5.500	1224.47	-1.999	.000	2.915	.920	14.338
6.000	1262.16	-2.798	.000	3.005	1.327	14.881
6.250	1278.39	-2.971	.000	3.043	1.428	15.149
6.500	1294.75	-3.047	.000	3.082	1.483	15.498
6.750	1309.02	-3.097	.000	3.116	1.524	15.812
7.000	1321.38	-3.124	.000	3.145	1.552	16.092
7.250	1331.80	-3.128	.000	3.170	1.566	16.336
7.500	1340.28	-3.109	.000	3.190	1.566	16.547
8.000	1344.73	-2.840	.000	3.201	1.435	16.633
9.000	1362.65	-2.561	.000	3.244	1.312	17.202