
8/3/2018

# DOUBLE-ENDED AZIMUTH DRIVE FERRY

## Stability Assessment

Prepared for: North Carolina DOT • Raleigh, NC

Ref: 18026-200-843-5 Rev. - August 3, 2018

Elliott Bay Design Group
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## PREPARED BY

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## GENERAL NOTES

1. This report is NOT intended for regulatory submittal to the USCG MSC.

## REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| - | Initial issue | 8/3/18 | KAJ 55055 |

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# 1 PURPOSE

This report details the stability assessment for the Double-Ended Azimuth Drive Ferry. The vessel is a passenger and vehicular ferry that will be owned and operated by the North Carolina Department of Transportation that is intended to operate in the partially protected waters of the Outer Banks and associated rivers. The vessel particulars are 183 feet 7 inch length by 46 feet breadth by 11 feet depth. The subject vessel is designed to carry a maximum of 40 cars, 300 passengers, and 7 crew.

# 2 PROCEDURE

## 2.1 General

The vessel is a USCG Subchapter H vessel subject to the applicable intact, subdivision, and damaged stability requirements of Subchapter S in Title 46 of the US Code of Federal Regulations [1]. The intact criteria include a wind heel criterion, unusual proportion and form criterion, and passenger heel criterion.

General HydroStatics (GHS) and Excel are used to evaluate all applicable intact and damaged stability criteria and floodable length curves for the vessel. The GHS computer model of the subject vessel [2] includes the hull, tanks, and a sail profile but does not include shell thickness. This model was created from the 3D Rhino hull model [3], and the Profiles and Deck Arrangements [4].

## 2.2 Intact Stability Calculation

The following intact stability criteria are applicable to this vessel:

1. 46 CFR 170.173(e)(1), Unusual proportion and form criterion, Partially Protected Waters
2. 46 CFR 171.050, Passenger heel criterion
3. 46 CFR 170.170, Wind heel criterion

Intact stability is analyzed using maximum allowable keel to vertical center of gravity (VCG) versus displacement curves as shown in the Intact Stability Curves Graph in Section 6.

GHS is used to produce points of maximum allowable VCG versus displacement for criterion 1. Excel worksheets are used to produce points of maximum allowable VCG versus displacement for criteria 2 and 3. Displacements range from light ship to the subdivision draft and trims from even keel to 2.0 feet. The GHS output and Excel worksheets used to create the intact stability curves are provided in Section 8.5. The intended subdivision draft is shown along with the curves given by criteria 1, 2, and 3 on the plot in Section 8.6 for reference.

The intact stability curves are compounded in Section 6 to show the maximum allowable vessel VCG within the range of operational displacements. Displacement and VCG of the normal operating loading conditions are plotted on the Compound Stability Curve to demonstrate compliance with relevant criteria.

### 2.3 Damaged Stability Calculations

Damaged stability calculations are performed for this vessel according to Damaged Stability for Type II Subdivision, 46 CFR 171.080(f). GHS is used to assess the survival of the vessel for all applicable damage cases for each loading condition. The GHS output of the damaged stability calculations for the worst loading condition (Condition 4) is included in Section 8.10.

### 2.4 Floodable Length Calculations

The GHS output of the Type II Subdivision calculations for the loading conditions are found in Section 8.8 and a curve of Floodable Length is included in Section 8.7. Because the subject vessel has a length greater than 150 feet and less than 200 feet, a combination of one-compartment and two-compartment standard of flooding as specified in 46 CFR Table 171.070(b) would apply to this vessel. This vessel was analyzed using two-compartment standard of flooding throughout to be conservative. Permeability's have been assigned in accordance with 46 CFR 171.072. Floodable length calculations are performed for the vessel at the 4.83 foot subdivision draft.

## 3 GIVEN AND ASSUMED PARAMETERS

### 3.1 Vessel Particulars

- Length Overall 183.58 feet
- Beam, Molded 46.0 feet
- Depth at Side 10.5 feet
- Subdivision Draft 4.83 feet
- Displacement @ Sub. Draft 602.9 LT

### 3.2 Reference Origin

Longitudinal locations are referenced from Frame 0 (amidships), positive aft (B End). Transverse locations are measured from centerline, positive to starboard. Vertical locations are referenced from the baseline at the molded bottom of the keel, positive upwards.

### 3.3 Route

The vessel will operate on partially protected waters. Additionally, the salinity of the water the vessel will operate on varies. A conservatively low specific gravity value of 1.014 is used for these calculations.

### 3.4 Light Ship Weight

A weight estimate [5] was developed to determine the vessel light ship weight and center of gravity. The resulting light ship weight characteristics are:

| | | |
|---|---|---|
| Light ship weight: | 395 | LT |
| VCG: | 8.54 | feet above baseline |
| LCG: | 0.8 | feet fwd of Frame 0 |
| TCG: | 1.73 | feet to starboard |

The vessel transverse center of gravity is offset because of the asymmetric deckhouse. See Section 3.8 for a summary of the vessel heel.

### 3.5 Service Life Margin

A service life margin (SLM) is included (separate from the light ship weight above) in the stability calculations. The SLM encompasses 3% of the light ship weight (11.9 LT) to account for weight changes over the life of the vessel.

### 3.6 Passengers and Crew

Per USCG, individual passengers and crew are assumed to weigh an average of 185 lb. Crew effects are assumed to weigh 65 lb per crew member.

The vessel carries a maximum of 300 passengers (24.78 LT) located at amidships and at a height of 14.0 feet above baseline. The maximum capacity of the passenger lounge is assumed to be 30 seated and 30 standing passengers. The remaining passengers are assumed to be distributed amongst the cars.

The vessel is assumed to require 7 crew and their effects (0.78 LT) located at amidships, 17.75 feet off centerline and at a height of 23.0 feet above baseline.

### 3.7 Stores and Outfit

The vessel is assumed to carry 5 LT of ship stores 20.0 feet above baseline.

### 3.8 Heel and Trim

The trim is assumed to remain between 0.0 and 2.0 feet to account for passenger and vehicle movement and variations in tank loading. Even trim and heel is beneficial to ensure the margin line will not be submerged in certain damage cases. Ballast tanks are fitted to correct for trim or heel but loading of the vehicles is likely to be the most effective method to maintain an even heel and trim. However, in light loading cases ballast is likely to be needed to correct for heel, and potentially to keep the azimuth drives submerged. With a full load of vehicles these potential issues are less likely, and the vessel may be limited by the intended subdivision draft in the case of a completely full load.

### 3.9 Ballast Tanks

Ballast tanks are sized such that the vessel can be loaded with a total nominal weight of 200 long tons of water (at 1.014 specific gravity). Ballast tanks are located fore and aft in the thruster rooms, with symmetrical tanks on the port and starboard side. Ballast tanks can be used to ensure azimuth drive submersion for light ship conditions or to correct list or trim. Additionally, they can be used to temporarily assist in maintaining trim caused by larger trucks loading or unloading from the vessel.

### 3.10 Free Surface Correction

The free surface correction for the vessel is calculated based on the most conservative requirements of 46 CFR 170.285 and 170.290. The free surface correction accounts for the

moment of transference of liquid within a tank by artificially raising the vertical center of gravity of the vessel.

The maximum free surface moment for each of the consumable and non-consumable liquid tanks are included. The maximum free surface moment for each tank can be found in the tank list in Section 8.3. The total free surface moment for the vessel is 649.1 LT-feet, as shown in Table 1.

**Table 1 - Free Surface Moment**

| TANK | FSM |
|---|---|
| FW.P | 6.4 |
| FUEL_A.P | 9.1 |
| FUEL_B.P | 9.1 |
| BAL_A.P | 156.1 |
| BAL_A.S | 156.1 |
| BAL_B.P | 156.2 |
| BAL_B.S | 156.2 |
| **TOTAL** | **649.1** |

Further tank details are provided in Section 8.3.

### 3.11 Downflooding Points

Table 2 lists all critical and downflooding points used in this stability assessment.

**Table 2 - Critical Points**

| CRITICAL POINTS | TYPE | Longitudina | Transverse | Vertical |
|---|---|---|---|---|
| | | *ft +aft* | *ft (p/s)* | *ft +abl* |
| Thruster A Supply | Tight | -68.00 | 18.50 | 11.90 |
| Thruster A Exhaust | Tight | -66.00 | 18.90 | 11.83 |
| Void A Intake | Tight | -47.50 | 22.00 | 12.29 |
| E/R Supply A End | Tight | -24.00 | 21.18 | 12.12 |
| E/R Supply A End-2 | Tight | -14.00 | 21.18 | 12.12 |
| E/R Intake B End-2 | Tight | 4.00 | 21.18 | 12.12 |
| E/R Intake B End | Tight | 16.00 | 21.18 | 12.12 |
| Void B Intake | Tight | 33.75 | 21.00 | 12.29 |
| Thruster B Supply | Tight | 68.00 | 18.50 | 11.90 |
| Thruster B Exhaust | Tight | 66.00 | 18.90 | 11.83 |
| ER Air Intake | Flood | 0.00 | 12.00 | 11.90 |
| Void A Exhaust | Tight | -40.50 | 17.50 | 11.90 |
| Void B Exhaust | Tight | 40.50 | 17.50 | 11.90 |

The superstructure is assumed to provide neither buoyancy nor righting energy in the calculations, even though it is fully weathertight. This is a conservative assumption.

### 3.12 Loading Conditions

Eight loading conditions are analyzed as follows:

Condition 0: Light Ship Condition

Condition 1: Operational Light Ship – Crew and Effects, Normal Tanks

Condition 2: Operational Light Ship with Full Ballast – Crew & Eff., Normal Tanks, Ballast

Condition 3: Departure – No SLM, Crew & Eff., Normal Tanks, Passengers, Vehicles

Condition 4: Departure w/SLM –3% SLM, Crew & Eff., Normal Tanks, Passengers, Vehicles

Condition 5: Arrival– No SLM, Crew & Eff., Light Tanks, Passengers, Vehicles

Condition 6: Arrival w/SLM –3% SLM, Crew & Eff., Light Tanks, Passengers, Vehicles

Condition 7: 150kip Truck – Crew & Eff., Normal Tanks, 150kip Truck, Light Pax/Veh.

The Loading Condition Summaries are included in Section 8.4.

## 4 CONCLUSIONS

The subject vessel, at the current stage of design, exhibits satisfactory stability characteristics for its proposed service and route. The vessel will be subject to the following operating restrictions:

1. The vessel has a maximum passenger capacity of 300 persons. The vessel has a maximum vehicle capacity of 40 standard autos or a total vehicle load of approximately 90LT.
2. The vessel's intended maximum subdivision draft is 4.83 feet.

The vessel is shown to meet intact stability criteria as shown in the Compound Stability Curve in Section 6. The vessel is shown to meet damaged stability criteria in all loading conditions assessed, although even loading of the vessel is essential to ensure the margin line will not submerge in some damage cases.

Floodable length of the vessel is shown to be adequate at the subdivision draft. Calculations are listed in Sections 8.7 and 8.8.

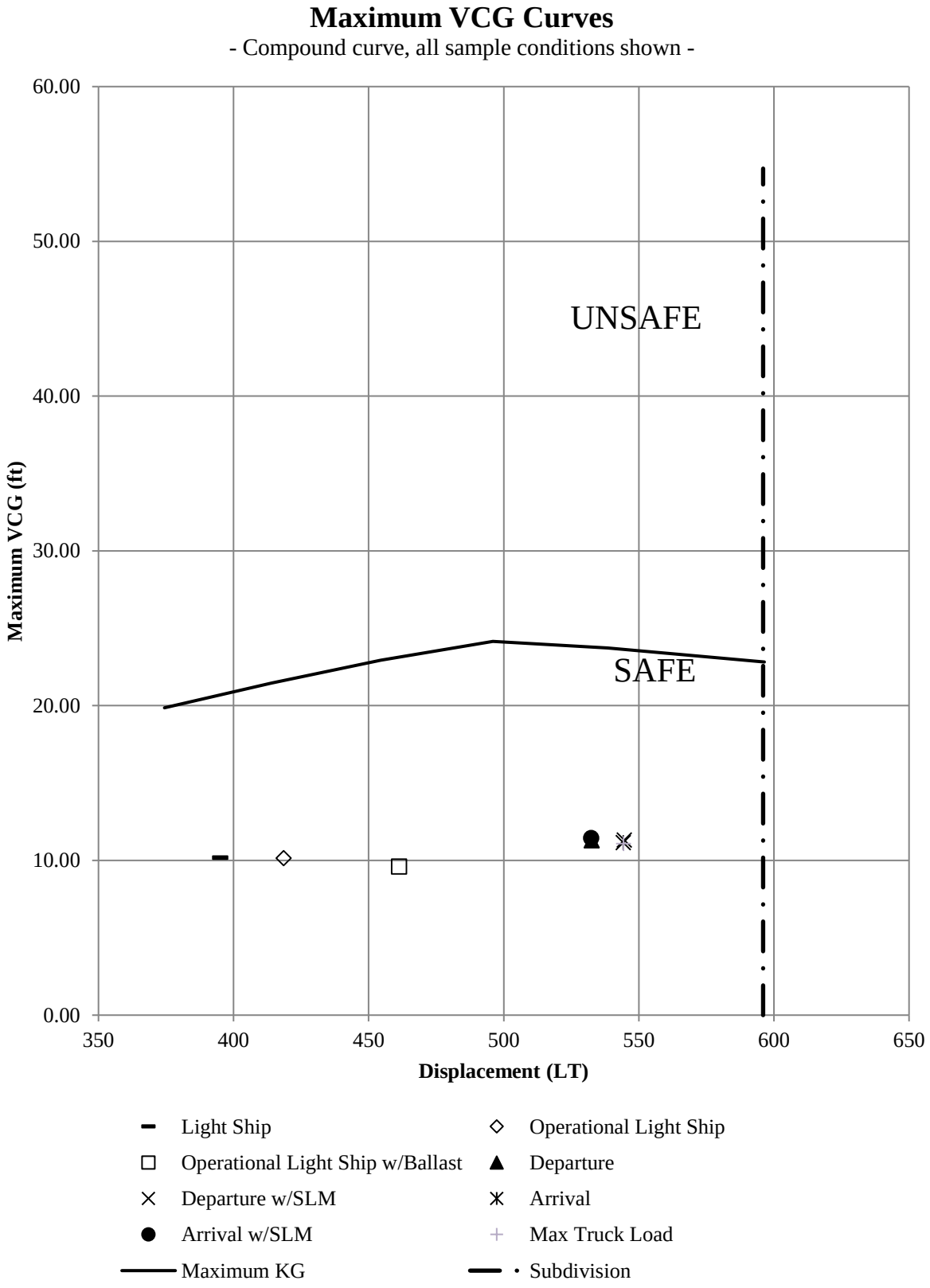
Additionally, it is worth noting that an operational draft of 4.5 feet is a preferred limit set by the operator.

## 5 LOADING CONDITION SUMMARY

**Table 3 - Loading Condition Summary**

| No. | Description | Disp. *LT* | Draft Fr. 44-A *ft* | Draft Fr. 00 *ft* | Draft Fr. 44-B *ft* | VCG *ft* | GMT *ft* | Trim *ft +aft* | Heel *deg +stbd* |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Light Ship Condition | 395.04 | 3.50 | 3.62 | 3.74 | 10.18 | 45.00 | 0.24 | 2.20 |
| 1 | Operational Light Ship | 418.58 | 3.76 | 3.77 | 3.79 | 10.14 | 43.67 | 0.03 | 1.45 |
| 2 | Operational Light Ship with Ballast | 461.29 | 4.04 | 4.04 | 4.04 | 9.61 | 41.29 | 0.00 | 0.00 |
| 3 | Departure | 532.55 | 4.46 | 4.47 | 4.48 | 11.30 | 34.98 | 0.02 | 0.40 |
| 4 | Departure with SLM | 544.61 | 4.53 | 4.54 | 4.55 | 11.32 | 34.28 | 0.02 | 0.40 |
| 5 | Arrival | 538.63 | 4.46 | 4.50 | 4.54 | 11.15 | 34.77 | 0.08 | 0.56 |
| 6 | Arrival with SLM | 532.41 | 4.42 | 4.46 | 4.50 | 11.44 | 34.79 | 0.08 | 1.12 |
| 7 | Maximum Truck Load (25 Pax, 10 Cars | 538.43 | 4.49 | 4.50 | 4.51 | 11.08 | 34.87 | 0.02 | 0.35 |

## 6 COMPOUND STABILITY CURVE



# 7 REFERENCES

[1] U.S. Government Publishing Office, Code of Federal Regulations; Title 46 - Shipping, Subchapter H, 2016.

[2] Elliott Bay Design Group, "GHS Geometry," File: 18026.GFT, August 2, 2018.

[3] Elliott Bay Design Group, *Rhino 3D Hull Model,* 16101-200-100-G, Rev. -, August 2, 2018.

[4] Elliott Bay Design Group, *Profiles and Deck Arrangements,* 18026-200-101-1, Rev. A, July 25, 2018.

[5] Elliott Bay Design Group, "Weight Estimate," 18026-200-833-1, Rev. -, August 3, 2018.

# 8 CALCULATIONS

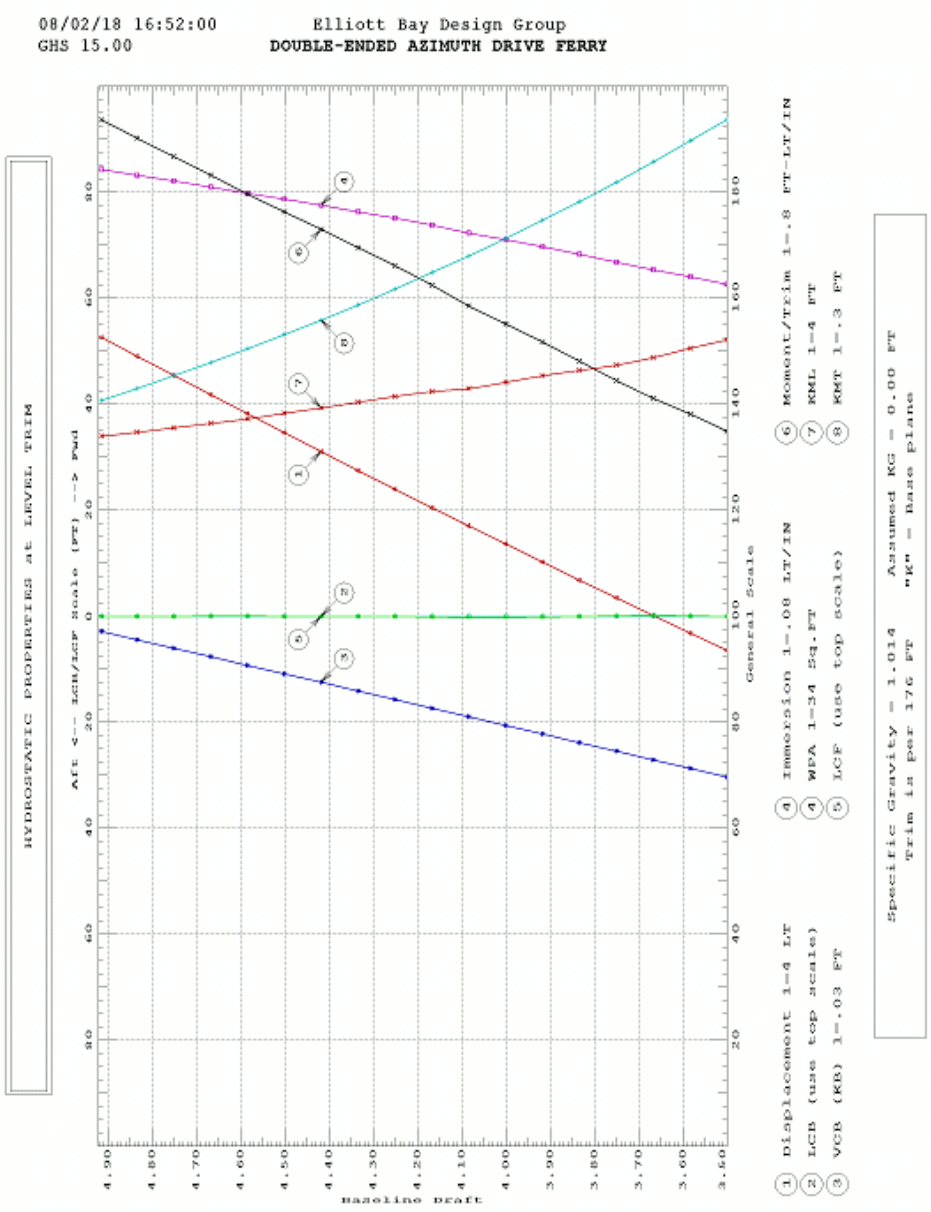
## 8.1 Hydrostatic Properties

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

HYDROSTATIC PROPERTIES
No Trim, No Heel, Fixed VCG = 0.00

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | KML | KMT |
|---|---|---|---|---|---|---|---|---|
| 3.500 | 374.42 | 0.01a | 2.09 | 13.01 | 0.04f | 107.92 | 608.8 | 58.13 |
| 3.583 | 387.49 | 0.00a | 2.14 | 13.13 | 0.12f | 110.51 | 602.3 | 56.93 |
| 3.667 | 400.67 | 0.00 | 2.19 | 13.24 | 0.16f | 112.96 | 595.4 | 55.73 |
| 3.750 | 413.96 | 0.01f | 2.24 | 13.35 | 0.11f | 115.61 | 589.8 | 54.57 |
| 3.833 | 427.37 | 0.01f | 2.29 | 13.47 | 0.00f | 118.54 | 585.8 | 53.47 |
| 3.917 | 440.89 | 0.01f | 2.33 | 13.58 | 0.10a | 121.43 | 581.7 | 52.43 |
| 4.000 | 454.52 | 0.00 | 2.38 | 13.69 | 0.15a | 124.13 | 576.8 | 51.40 |
| 4.083 | 468.26 | 0.00a | 2.43 | 13.79 | 0.15a | 126.84 | 572.1 | 50.40 |
| 4.167 | 482.11 | 0.01a | 2.48 | 13.91 | 0.05a | 130.03 | 569.6 | 49.46 |
| 4.250 | 496.07 | 0.01a | 2.53 | 14.01 | 0.00a | 132.91 | 565.9 | 48.53 |
| 4.333 | 510.13 | 0.01a | 2.58 | 14.11 | 0.02f | 135.66 | 561.7 | 47.63 |
| 4.417 | 524.28 | 0.01a | 2.63 | 14.20 | 0.03f | 138.38 | 557.4 | 46.77 |
| 4.500 | 538.53 | 0.00a | 2.67 | 14.30 | 0.04f | 141.06 | 553.2 | 45.95 |
| 4.583 | 552.88 | 0.00 | 2.72 | 14.39 | 0.05f | 143.72 | 549.0 | 45.15 |
| 4.667 | 567.31 | 0.00 | 2.77 | 14.48 | 0.04f | 146.61 | 545.8 | 44.37 |
| 4.750 | 581.84 | 0.00 | 2.82 | 14.57 | 0.03f | 149.38 | 542.2 | 43.62 |
| 4.833 | 596.46 | 0.00 | 2.87 | 14.66 | 0.01f | 152.18 | 538.9 | 42.89 |
| 4.913 | 610.58 | 0.00 | 2.92 | 14.75 | 0.00 | 154.95 | 536.0 | 42.22 |

Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline.


08/02/18 16:52:00
GHS 15.00
Elliott Bay Design Group
DOUBLE-ENDED AZIMUTH DRIVE FERRY
HYDROSTATIC PROPERTIES at LEVEL TRIM
Aft <-- LCB/LCF Scale (FT) --> Fwd
General Scale
Baseline Draft
1 Displacement 1=4 LT
2 LCB (use top scale)
3 VCB (KB) 1=.03 FT
4 Immersion 1=.08 LT/IN
5 WPA 1=34 Sq.FT
6 LCF (use top scale)
6 Moment/Trim 1=.8 FT-LT/IN
7 KML 1=4 FT
8 KMT 1=.3 FT
Specific Gravity = 1.014
Trim is per 176 FT
Assumed KG = 0.00 FT
"K" = Base plane

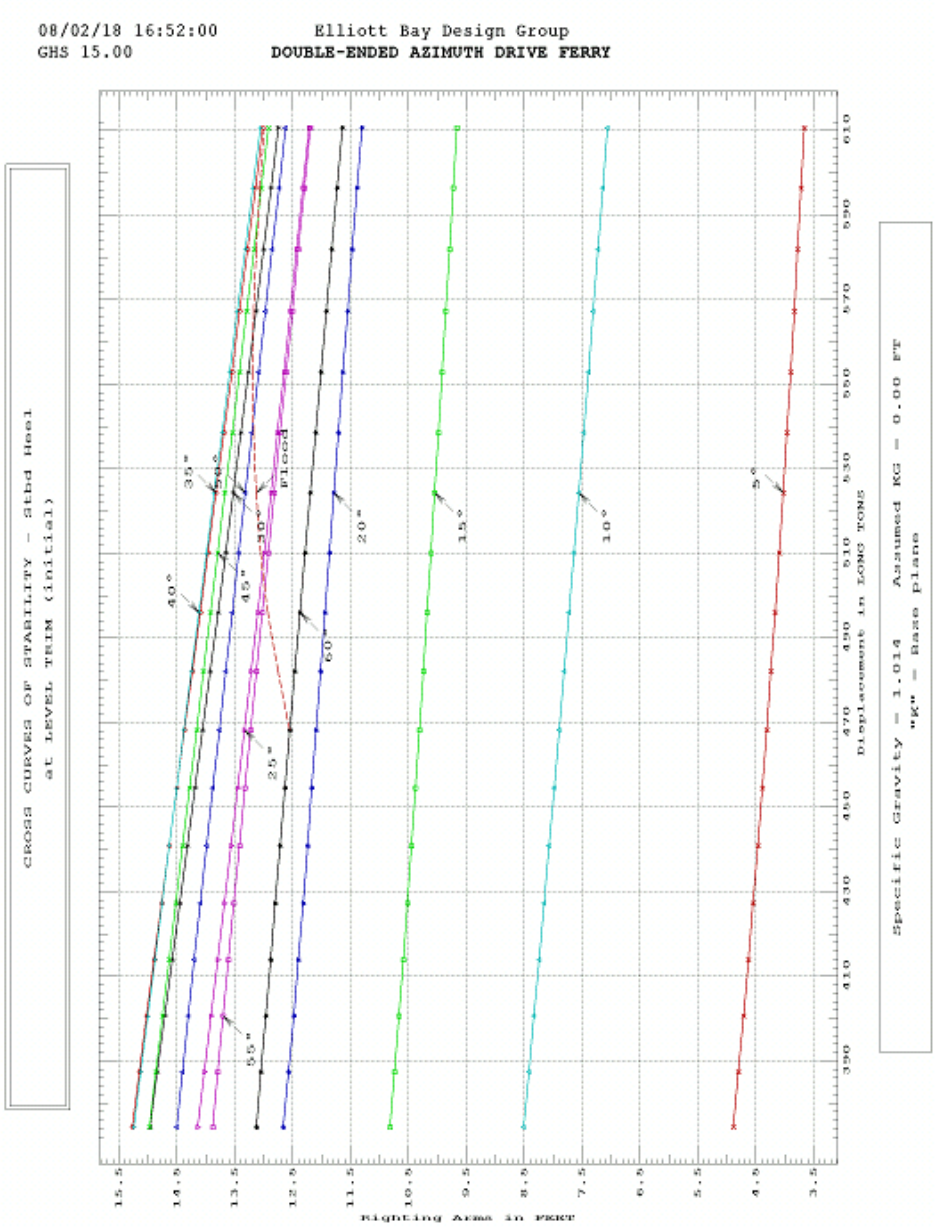
08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CROSS CURVES OF STABILITY
Showing righting arms in heel at VCG = 0.00
Trim: zero at zero heel (trim righting arm held at zero)

| Displacement | Heel Angles in Degrees | | | | | | |
|---|---|---|---|---|---|---|---|
| LONG TONS | 5.00s | 10.00s | 15.00s | 20.00s | 25.00s | 30.00s | 35.00s |
| 374.42 | 4.89s | 8.51s | 10.82s | 12.66s | 14.13s | 14.96s | 15.26s |
| 387.49 | 4.80s | 8.42s | 10.74s | 12.56s | 14.02s | 14.83s | 15.14s |
| 400.67 | 4.71s | 8.33s | 10.66s | 12.48s | 13.90s | 14.70s | 15.02s |
| 413.96 | 4.63s | 8.24s | 10.59s | 12.39s | 13.79s | 14.57s | 14.89s |
| 427.37 | 4.55s | 8.15s | 10.51s | 12.32s | 13.67s | 14.44s | 14.76s |
| 440.89 | 4.47s | 8.07s | 10.44s | 12.24s | 13.56s | 14.31s | 14.63s |
| 454.52 | 4.39s | 7.98s | 10.37s | 12.16s | 13.44s | 14.18s | 14.50s |
| 468.26 | 4.31s | 7.89s | 10.31s | 12.09s | 13.33s | 14.05s | 14.36s |
| 482.11 | 4.24s | 7.81s | 10.24s | 12.01s | 13.21s | 13.92s | 14.23s |
| 496.07 | 4.17s | 7.72s | 10.17s | 11.94s | 13.10s | 13.78s | 14.09s |
| 510.13 | 4.10s | 7.64s | 10.11s | 11.86s | 12.98s | 13.65s | 13.96s |
| 524.28 | 4.03s | 7.55s | 10.04s | 11.78s | 12.87s | 13.52s | 13.82s |
| 538.53 | 3.96s | 7.47s | 9.98s | 11.71s | 12.75s | 13.39s | 13.68s |
| 552.88 | 3.90s | 7.39s | 9.91s | 11.63s | 12.64s | 13.26s | 13.55s |
| 567.31 | 3.84s | 7.31s | 9.85s | 11.55s | 12.54s | 13.13s | 13.41s |
| 581.84 | 3.78s | 7.22s | 9.79s | 11.47s | 12.43s | 13.00s | 13.27s |
| 596.46 | 3.72s | 7.14s | 9.72s | 11.38s | 12.32s | 12.87s | 13.14s |
| 610.58 | 3.67s | 7.07s | 9.66s | 11.30s | 12.22s | 12.74s | 13.01s |

| Displacement | Heel Angles in Degrees | | | | | @ Flooding | |
|---|---|---|---|---|---|---|---|
| LONG TONS | 40.00s | 45.00s | 50.00s | 55.00s | 60.00s | Arm | Angle |
| 374.42 | 15.24s | 14.96s | 14.50s | 13.88s | 13.12s | | |
| 387.49 | 15.12s | 14.85s | 14.40s | 13.78s | 13.04s | | |
| 400.67 | 15.00s | 14.74s | 14.30s | 13.69s | 12.96s | | |
| 413.96 | 14.87s | 14.63s | 14.19s | 13.60s | 12.88s | | |
| 427.37 | 14.75s | 14.51s | 14.09s | 13.51s | 12.79s | | |
| 440.89 | 14.62s | 14.39s | 13.98s | 13.41s | 12.71s | | |
| 454.52 | 14.50s | 14.27s | 13.87s | 13.32s | 12.63s | | |
| 468.26 | 14.37s | 14.15s | 13.76s | 13.22s | 12.54s | 12.54s | 60.00s |
| 482.11 | 14.24s | 14.03s | 13.65s | 13.12s | 12.46s | 12.75s | 57.93s |
| 496.07 | 14.11s | 13.91s | 13.54s | 13.02s | 12.37s | 12.92s | 55.83s |
| 510.13 | 13.98s | 13.79s | 13.42s | 12.92s | 12.28s | 13.04s | 53.87s |
| 524.28 | 13.85s | 13.66s | 13.31s | 12.81s | 12.19s | 13.12s | 52.05s |
| 538.53 | 13.71s | 13.54s | 13.20s | 12.71s | 12.10s | 13.17s | 50.33s |
| 552.88 | 13.58s | 13.41s | 13.08s | 12.60s | 12.01s | 13.18s | 48.72s |
| 567.31 | 13.45s | 13.29s | 12.96s | 12.50s | 11.91s | 13.16s | 47.21s |
| 581.84 | 13.31s | 13.16s | 12.85s | 12.40s | 11.82s | 13.12s | 45.80s |
| 596.46 | 13.18s | 13.03s | 12.73s | 12.29s | 11.73s | 13.06s | 44.47s |
| 610.58 | 13.05s | 12.91s | 12.62s | 12.19s | 11.64s | 12.98s | 43.26s |

Distances in FEET.---Specific Gravity = 1.014.----------


08/02/18 16:52:00
GHS 15.00
Elliott Bay Design Group
DOUBLE-ENDED AZIMUTH DRIVE FERRY
CROSS CURVES OF STABILITY - Stbd Heel
at LEVEL TRIM (Initial)
Specific Gravity = 1.014 Assumed KG = 0.00 FT
"K" = Base plane
Displacement in LONG TONS
Righting Arms in FEET
Flood
5°
10°
15°
20°
25°
30°
35°
40°
45°
50°
55°
60°

## 8.2 Wind Profile Areas

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

------ WIND AREAS -------
LATERAL PLANE STATUS
Baseline draft: 3.500
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 617.9 | 0.00 | -1.75 | 1353.0 | 0.00 | 3.78 |
| SAIL | | | | 2407.9 | 0.39a | 18.59 |
| Total Lateral Plane-> | 617.9 | 0.00 | -1.75 | 3760.9 | 0.25a | 13.26 |

LATERAL PLANE STATUS
Baseline draft: 3.583
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 632.7 | 0.00 | -1.79 | 1338.3 | 0.00 | 3.73 |
| SAIL | | | | 2407.9 | 0.39a | 18.51 |
| Total Lateral Plane-> | 632.7 | 0.00 | -1.79 | 3746.1 | 0.25a | 13.23 |

LATERAL PLANE STATUS
Baseline draft: 3.667
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 647.5 | 0.00 | -1.83 | 1323.4 | 0.00 | 3.69 |
| SAIL | | | | 2407.9 | 0.39a | 18.43 |
| Total Lateral Plane-> | 647.5 | 0.00 | -1.83 | 3731.3 | 0.25a | 13.20 |

LATERAL PLANE STATUS
Baseline draft: 3.750
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 662.3 | 0.00 | -1.87 | 1308.6 | 0.00 | 3.65 |
| SAIL | | | | 2407.9 | 0.39a | 18.34 |
| Total Lateral Plane-> | 662.3 | 0.00 | -1.87 | 3716.5 | 0.25a | 13.17 |

LATERAL PLANE STATUS
Baseline draft: 3.833
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 677.2 | 0.00 | -1.91 | 1293.8 | 0.00 | 3.61 |
| SAIL | | | | 2407.9 | 0.39a | 18.26 |
| Total Lateral Plane-> | 677.2 | 0.00 | -1.91 | 3701.6 | 0.25a | 13.14 |

LATERAL PLANE STATUS
Baseline draft: 3.917
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 692.0 | 0.00 | -1.95 | 1278.9 | 0.00 | 3.57 |
| SAIL | | | | 2407.9 | 0.39a | 18.18 |
| Total Lateral Plane-> | 692.0 | 0.00 | -1.95 | 3686.8 | 0.26a | 13.11 |

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

LATERAL PLANE STATUS
Baseline draft: 4.000
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 706.8 | 0.00 | -1.99 | 1264.1 | 0.00 | 3.52 |
| SAIL | | | | 2407.9 | 0.39a | 18.09 |
| Total Lateral Plane-> | 706.8 | 0.00 | -1.99 | 3672.0 | 0.26a | 13.08 |

LATERAL PLANE STATUS
Baseline draft: 4.083
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 721.7 | 0.00 | -2.04 | 1249.3 | 0.00 | 3.48 |
| SAIL | | | | 2407.9 | 0.39a | 18.01 |
| Total Lateral Plane-> | 721.7 | 0.00 | -2.04 | 3657.1 | 0.26a | 13.05 |

LATERAL PLANE STATUS
Baseline draft: 4.167
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 736.5 | 0.00 | -2.08 | 1234.4 | 0.00 | 3.44 |
| SAIL | | | | 2407.9 | 0.39a | 17.93 |
| Total Lateral Plane-> | 736.5 | 0.00 | -2.08 | 3642.3 | 0.26a | 13.02 |

LATERAL PLANE STATUS
Baseline draft: 4.250
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 751.3 | 0.00 | -2.12 | 1219.6 | 0.00 | 3.40 |
| SAIL | | | | 2407.9 | 0.39a | 17.84 |
| Total Lateral Plane-> | 751.3 | 0.00 | -2.12 | 3627.5 | 0.26a | 12.99 |

LATERAL PLANE STATUS
Baseline draft: 4.333
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 766.2 | 0.00 | -2.16 | 1204.8 | 0.00 | 3.36 |
| SAIL | | | | 2407.9 | 0.39a | 17.76 |
| Total Lateral Plane-> | 766.2 | 0.00 | -2.16 | 3612.6 | 0.26a | 12.96 |

LATERAL PLANE STATUS
Baseline draft: 4.417
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 781.0 | 0.00 | -2.20 | 1189.9 | 0.00 | 3.31 |
| SAIL | | | | 2407.9 | 0.39a | 17.68 |
| Total Lateral Plane-> | 781.0 | 0.00 | -2.20 | 3597.8 | 0.26a | 12.93 |

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

LATERAL PLANE STATUS
Baseline draft: 4.500
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 795.9 | 0.00 | -2.24 | 1175.1 | 0.00 | 3.27 |
| SAIL | | | | 2407.9 | 0.39a | 17.59 |
| Total Lateral Plane-> | 795.9 | 0.00 | -2.24 | 3582.9 | 0.26a | 12.90 |

LATERAL PLANE STATUS
Baseline draft: 4.583
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 810.7 | 0.00 | -2.29 | 1160.2 | 0.00 | 3.23 |
| SAIL | | | | 2407.9 | 0.39a | 17.51 |
| Total Lateral Plane-> | 810.7 | 0.00 | -2.29 | 3568.1 | 0.26a | 12.87 |

LATERAL PLANE STATUS
Baseline draft: 4.667
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 825.5 | 0.00 | -2.33 | 1145.4 | 0.00 | 3.19 |
| SAIL | | | | 2407.9 | 0.39a | 17.43 |
| Total Lateral Plane-> | 825.5 | 0.00 | -2.33 | 3553.3 | 0.27a | 12.84 |

LATERAL PLANE STATUS
Baseline draft: 4.750
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 840.4 | 0.00 | -2.37 | 1130.6 | 0.00 | 3.14 |
| SAIL | | | | 2407.9 | 0.39a | 17.34 |
| Total Lateral Plane-> | 840.4 | 0.00 | -2.37 | 3538.4 | 0.27a | 12.81 |

LATERAL PLANE STATUS
Baseline draft: 4.833
Trim: zero, Heel: zero

| Part | LPA | LCP | HCP | LPA | LCP | HCP |
|---|---|---|---|---|---|---|
| HULL | 855.2 | 0.00 | -2.41 | 1115.7 | 0.00 | 3.10 |
| SAIL | | | | 2407.9 | 0.39a | 17.26 |
| Total Lateral Plane-> | 855.2 | 0.00 | -2.41 | 3523.6 | 0.27a | 12.78 |

## 8.3 Tank List

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

-------TANK LIST--------
-------Capacities at 100%-------

TANK STATUS
Trim: zero, Heel: zero

| Part | Gals. | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|---|
| FW.P | 1573.7 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 6.4* |
| FUEL_A.P | 1851.4 | 0.870 | 6.00 | 36.00f | 13.00p | 5.75 | 9.1* |
| FUEL_B.P | 1851.4 | 0.870 | 6.00 | 36.00a | 13.00p | 5.75 | 9.1* |
| BAL_A.P | 13834 | 1.014 | 52.26 | 55.58f | 12.04p | 6.89 | 156.1* |
| BAL_A.S | 13834 | 1.014 | 52.26 | 55.58f | 12.04s | 6.89 | 156.1* |
| BAL_B.P | 13837 | 1.014 | 52.27 | 55.57a | 12.05p | 6.89 | 156.2* |
| BAL_B.S | 13837 | 1.014 | 52.27 | 55.57a | 12.05s | 6.89 | 156.2* |
| Total Tanks---------> | | | 226.94 | 1.13f | 1.02p | 6.82 | 649.1 |

Distances in FEET.----------Moments in Ft-LT.

Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.

## 8.4 Loading Condition Output

```
08/02/18 16:42:33          Elliott Bay Design Group
 GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY


                          ***** Condition 0 *****
                                Lightship

                                WEIGHT STATUS
          Baseline draft: 3.499 @ 88.00f, 3.619 @ 0.00, 3.739 @ 88.00a
                  Trim: Aft 0.24/176.00,  Heel: Stbd 2.09 deg.
 Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
 WEIGHT                               395.00    0.80a   1.73s   8.54
                 Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
   Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
   Total Weight-------->              395.00    0.80a   1.73s   8.54
     Free Surface Adjustment---------->                          1.64
     Adjusted CG---------------------->           0.80a   1.67s  10.18
 Distances in FEET.-----------------------------------------------Moments in Ft-LT.
                                      +
     Note:  FSM values marked with an asterisk (*) are formal values which are
            not the same as the true values in the present condition.
                                      +

                               FREEBOARD STATUS
          Baseline draft: 3.499 @ 88.00f, 3.619 @ 0.00, 3.739 @ 88.00a
                  Trim: Aft 0.24/176.00,  Heel: Stbd 2.09 deg.
                  Least freeboard is 6.01 Ft located at 30.26a
       Least extra freeboard (to margin line) is 5.28 Ft located at 9.08a

                            HYDROSTATIC PROPERTIES
              Trim: Aft 0.24/176.00, Heel: Stbd 2.09 deg., VCG = 8.54

    LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
   Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
   3.620       395.04    0.80a   2.20    13.10    0.50a  109.80   587.0   45.00
  Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                             Trim is per 176.00Ft
  Draft is from Baseline.                        Formal Free Surface included.

       Note:  GMT includes the formal free surface moment 649.1 Ft-LT

                            CRITICAL POINT STATUS
          Baseline draft: 3.499 @ 88.00f, 3.619 @ 0.00, 3.739 @ 88.00a
                  Trim: Aft 0.24/176.00,  Heel: Stbd 2.09 deg.
                                      +
        Lowest Critical Point----------------LCP-----TCP-----VCP-----Height
    (15) MS at side                        0.00   23.00s  10.50       6.04
    (15) MS at side                        0.00   23.00p  10.50       7.71
      Distances in FEET.-----------------------------------------------------
```

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 1 *****
Operational Light Ship

WEIGHT STATUS
Baseline draft: 3.760 @ 88.00f, 3.774 @ 0.00, 3.788 @ 88.00a
Trim: Aft 0.03/176.00, Heel: Stbd 1.45 deg.

| Part | | | Weight(LT) | LCG | TCG | VCG | |
|---|---|---|---|---|---|---|---|
| LIGHT SHIP | | | 395.00 | 0.80a | 1.73s | 8.54 | |
| STORES & SPARES | | | 5.00 | 0.00 | 0.00 | 20.00 | |
| 7 CREW&EFF. @250lb | | | 0.78 | 0.00 | 17.75s | 23.00 | |
| ZERO DISCHARGE TKS @ 100 | | | 0.37 | 40.00f | 12.33s | 6.00 | |
| E-GEN DISEL OIL @ 50 GAL | | | 0.16 | 46.00f | 18.00s | 11.00 | |
| Total Fixed---------> | | | 401.31 | 0.73a | 1.76s | 8.71 | |
| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
| FW.P | 1.000 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 0.0 |
| FUEL_A.P | 0.950 | 0.870 | 5.70 | 36.00f | 12.96p | 5.61 | 9.1 |
| FUEL_B.P | 0.950 | 0.870 | 5.70 | 36.00a | 12.96p | 5.61 | 9.1 |
| Total Tanks---------> | | | 17.27 | 14.94f | 12.89p | 5.83 | 649.1* |
| Total Weight--------> | | | 418.58 | 0.09a | 1.15s | 8.59 | |
| Free Surface Adjustment----------> | | | | | | 1.55 | |
| Adjusted CG----------> | | | | 0.09a | 1.11s | 10.14 | |

Distances in FEET.----------Moments in Ft-LT.
+
Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.
+

FREEBOARD STATUS
Baseline draft: 3.760 @ 88.00f, 3.774 @ 0.00, 3.788 @ 88.00a
Trim: Aft 0.03/176.00, Heel: Stbd 1.45 deg.
Least freeboard is 6.14 Ft located at 23.20a
Least extra freeboard (to margin line) is 5.39 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.03/176.00, Heel: Stbd 1.45 deg., VCG = 8.59

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 3.774 | 418.58 | 0.09a | 2.27 | 13.36 | 0.02a | 114.79 | 579.2 | 43.67 |

Distances in FEET.-------Specific Gravity = 1.014.----------Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

CRITICAL POINT STATUS
Baseline draft: 3.760 @ 88.00f, 3.774 @ 0.00, 3.788 @ 88.00a
Trim: Aft 0.03/176.00, Heel: Stbd 1.45 deg.
+

| Lowest Critical Point | | LCP | TCP | VCP | Height |
|---|---|---|---|---|---|
| (15) MS at side | | 0.00 | 23.00s | 10.50 | 6.14 |
| (15) MS at side | | 0.00 | 23.00p | 10.50 | 7.30 |

Distances in FEET.----------

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 2 *****
Operational Light Ship w/Ballast

WEIGHT STATUS
Baseline draft: 4.044 @ 88.00f, 4.041 @ 0.00, 4.039 @ 88.00a
Trim: 0.00/176.00, Heel: 0.00 deg.

| Part | | | Weight(LT) | LCG | TCG | VCG | |
|---|---|---|---|---|---|---|---|
| LIGHT SHIP | | | 395.00 | 0.80a | 1.73s | 8.54 | |
| STORES & SPARES | | | 5.00 | 0.00 | 0.00 | 20.00 | |
| 7 CREW&EFF. @250lb | | | 0.78 | 0.00 | 17.75s | 23.00 | |
| ZERO DISCHARGE TKS @ 100 | | | 0.37 | 40.00f | 12.33s | 6.00 | |
| E-GEN DISEL OIL @ 50 GAL | | | 0.16 | 46.00f | 18.00s | 11.00 | |
| Total Fixed---------> | | | 401.31 | 0.73a | 1.76s | 8.71 | |
| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
| FW.P | 1.000 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 0.0 |
| FUEL_A.P | 0.950 | 0.870 | 5.70 | 36.00f | 13.00p | 5.61 | 9.1 |
| FUEL_B.P | 0.950 | 0.870 | 5.70 | 36.00a | 13.00p | 5.61 | 9.1 |
| BAL_A.P | 0.416 | 1.014 | 21.72 | 55.23f | 11.28p | 4.48 | 106.0 |
| BAL_B.P | 0.402 | 1.014 | 20.99 | 55.21a | 11.25p | 4.41 | 105.3 |
| Total Tanks---------> | | | 59.98 | 4.98f | 11.74p | 4.84 | 649.1* |
| Total Weight--------> | | | 461.29 | 0.01f | 0.00 | 8.21 | |
| Free Surface Adjustment----------> | | | | | | 1.41 | |
| Adjusted CG----------> | | | | 0.01f | 0.00 | 9.61 | |

Distances in FEET.---Moments in Ft-LT.

Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS
Baseline draft: 4.044 @ 88.00f, 4.041 @ 0.00, 4.039 @ 88.00a
Trim: 0.00/176.00, Heel: 0.00 deg.
Least freeboard is 6.46 Ft located at 19.17f
Least extra freeboard (to margin line) is 5.71 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: 0.00/176.00, Heel: 0.00 deg., VCG = 8.21

| LCF | Displacement | Buoyancy-Ctr. | | Weight/ | | Moment/ | | |
|---|---|---|---|---|---|---|---|---|
| Draft | Weight(LT) | LCB | VCB | Inch | LCF | In trim | GML | GMT |
| 4.041 | 461.29 | 0.01f | 2.41 | 13.74 | 0.15a | 123.50 | 565.4 | 41.29 |

Distances in FEET.---Specific Gravity = 1.014.---Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.044 @ 88.00f, 4.041 @ 0.00, 4.039 @ 88.00a
Trim: 0.00/176.00, Heel: 0.00 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 6.46 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.46 |

Distances in FEET.

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 3 *****
Departure Condition

WEIGHT STATUS
Baseline draft: 4.455 @ 88.00f, 4.465 @ 0.00, 4.475 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.

| Part | Weight(LT) | LCG | TCG | VCG |
|---|---|---|---|---|
| LIGHT SHIP | 395.00 | 0.80a | 1.73s | 8.54 |
| STORES & SPARES | 5.00 | 0.00 | 0.00 | 20.00 |
| 7 CREW&EFF. @250lb | 0.78 | 0.00 | 17.75s | 23.00 |
| ZERO DISCHARGE TKS @ 100 | 0.37 | 40.00f | 12.33s | 6.00 |
| E-GEN DISEL OIL @ 50 GAL | 0.16 | 46.00f | 18.00s | 11.00 |
| 60 PAX @ 185lb - LOUNGE | 4.96 | 0.00 | 18.00s | 14.00 |
| 240 PAX @ 185lb - CARS | 19.82 | 0.00 | 4.00p | 14.00 |
| 40 VEHICLES @5,000lb | 89.27 | 0.00 | 4.00p | 16.00 |
| Total Fixed---------> | 515.36 | 0.57a | 0.69s | 10.23 |

| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|---|
| FW.P | 1.000 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 0.0 |
| FUEL_A.P | 0.950 | 0.870 | 5.70 | 36.00f | 12.99p | 5.61 | 9.1 |
| FUEL_B.P | 0.950 | 0.870 | 5.70 | 36.00a | 12.99p | 5.61 | 9.1 |
| Total Tanks---------> | | | 17.27 | 14.94f | 12.91p | 5.83 | 649.1* |
| Total Weight--------> | | | 532.63 | 0.07a | 0.25s | 10.08 | |
| Free Surface Adjustment----------> | | | | | | 1.22 | |
| Adjusted CG----------> | | | | 0.07a | 0.24s | 11.30 | |

Distances in FEET. Moments in Ft-LT.

Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS
Baseline draft: 4.455 @ 88.00f, 4.465 @ 0.00, 4.475 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.
Least freeboard is 5.87 Ft located at 23.20a
Least extra freeboard (to margin line) is 5.12 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg., VCG = 10.08

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 4.465 | 532.55 | 0.07a | 2.66 | 14.26 | 0.01f | 137.29 | 544.5 | 34.98 |

Distances in FEET. Specific Gravity = 1.014. Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.455 @ 88.00f, 4.465 @ 0.00, 4.475 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 5.87 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.20 |

Distances in FEET.

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 4 *****
Departure Condition w/SLM

WEIGHT STATUS
Baseline draft: 4.525 @ 88.00f, 4.535 @ 0.00, 4.545 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.

| Part | Weight(LT) | LCG | TCG | VCG |
|---|---|---|---|---|
| LIGHT SHIP | 395.00 | 0.80a | 1.73s | 8.54 |
| STORES & SPARES | 5.00 | 0.00 | 0.00 | 20.00 |
| 7 CREW&EFF. @250lb | 0.78 | 0.00 | 17.75s | 23.00 |
| ZERO DISCHARGE TKS @ 100 | 0.37 | 40.00f | 12.33s | 6.00 |
| E-GEN DISEL OIL @ 50 GAL | 0.16 | 46.00f | 18.00s | 11.00 |
| 60 PAX @ 185lb - LOUNGE | 4.96 | 0.00 | 18.00s | 14.00 |
| 240 PAX @ 185lb - CARS | 19.82 | 0.00 | 4.00p | 14.00 |
| 40 VEHICLES @5,000lb | 89.27 | 0.00 | 4.00p | 16.00 |
| 3% SERVICE LIFE MARGIN | 11.90 | 0.00 | 0.00 | 12.00 |
| Total Fixed---------> | 527.26 | 0.56a | 0.68s | 10.27 |

| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|---|
| FW.P | 1.000 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 0.0 |
| FUEL_A.P | 0.950 | 0.870 | 5.70 | 36.00f | 12.99p | 5.61 | 9.1 |
| FUEL_B.P | 0.950 | 0.870 | 5.70 | 36.00a | 12.99p | 5.61 | 9.1 |
| Total Tanks---------> | | | 17.27 | 14.94f | 12.91p | 5.83 | 649.1* |
| Total Weight--------> | | | 544.53 | 0.07a | 0.25s | 10.13 | |
| Free Surface Adjustment----------> | | | | | | 1.19 | |
| Adjusted CG----------> | | | | 0.07a | 0.24s | 11.32 | |

Distances in FEET.---Moments in Ft-LT.

Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS
Baseline draft: 4.525 @ 88.00f, 4.535 @ 0.00, 4.545 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.
Least freeboard is 5.80 Ft located at 23.20a
Least extra freeboard (to margin line) is 5.05 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg., VCG = 10.13

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 4.535 | 544.61 | 0.07a | 2.70 | 14.33 | 0.03f | 139.42 | 540.7 | 34.28 |

Distances in FEET.---Specific Gravity = 1.014.---Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.525 @ 88.00f, 4.535 @ 0.00, 4.545 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.40 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 5.80 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.12 |

Distances in FEET.

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 5 *****
Arrival Condition

WEIGHT STATUS
Baseline draft: 4.462 @ 88.00f, 4.500 @ 0.00, 4.538 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 0.56 deg.

| Part | Weight(LT) | LCG | TCG | VCG |
|---|---|---|---|---|
| LIGHT SHIP | 395.00 | 0.80a | 1.73s | 8.54 |
| STORES & SPARES | 5.00 | 0.00 | 0.00 | 20.00 |
| 7 CREW&EFF. @250lb | 0.78 | 0.00 | 17.75s | 23.00 |
| ZERO DISCHARGE TKS @ 1000 | 3.73 | 40.00f | 12.33s | 6.00 |
| E-GEN DISEL OIL @ 50 GAL | 0.16 | 46.00f | 18.00s | 11.00 |
| 60 PAX @ 185lb - LOUNGE | 4.96 | 0.00 | 18.00s | 14.00 |
| 240 PAX @ 185lb - CARS | 19.82 | 0.00 | 4.00p | 14.00 |
| 40 VEHICLES @5,000lb | 89.27 | 0.00 | 4.00p | 16.00 |
| Total Fixed---------> | 518.72 | 0.31a | 0.77s | 10.20 |

| Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|
| FW.P 0.100 | 1.000 | 0.59 | 44.00f | 12.64p | 3.78 | 6.4 |
| FUEL_A.P 0.100 | 0.870 | 0.60 | 36.00f | 12.85p | 3.28 | 9.1 |
| FUEL_B.P 0.100 | 0.870 | 0.60 | 36.00a | 12.85p | 3.28 | 9.1 |
| BAL_A.P 0.174 | 1.014 | 9.07 | 54.58f | 10.39p | 3.33 | 84.6 |
| BAL_B.P 0.172 | 1.014 | 8.97 | 54.58a | 10.38p | 3.33 | 84.4 |
| Total Tanks---------> | | 19.82 | 1.58f | 10.60p | 3.34 | 649.1* |
| Total Weight--------> | | 538.54 | 0.24a | 0.35s | 9.95 | |
| Free Surface Adjustment----------> | | | | | 1.21 | |
| Adjusted CG----------> | | | 0.24a | 0.34s | 11.15 | |

Distances in FEET.----------Moments in Ft-LT.
+
Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.
+

FREEBOARD STATUS
Baseline draft: 4.462 @ 88.00f, 4.500 @ 0.00, 4.538 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 0.56 deg.
Least freeboard is 5.77 Ft located at 23.20a
Least extra freeboard (to margin line) is 5.03 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.08/176.00, Heel: Stbd 0.56 deg., VCG = 9.95

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 4.500 | 538.63 | 0.24a | 2.68 | 14.29 | 0.08a | 138.16 | 541.7 | 34.77 |

Distances in FEET.-------Specific Gravity = 1.014.----------Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.462 @ 88.00f, 4.500 @ 0.00, 4.538 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 0.56 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 5.78 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.22 |

Distances in FEET.

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 6 *****
Arrival Condition w/SLM

WEIGHT STATUS
Baseline draft: 4.422 @ 88.00f, 4.462 @ 0.00, 4.502 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 1.12 deg.

| Part | Weight(LT) | LCG | TCG | VCG |
|---|---|---|---|---|
| LIGHT SHIP | 395.00 | 0.80a | 1.73s | 8.54 |
| STORES & SPARES | 5.00 | 0.00 | 0.00 | 20.00 |
| 7 CREW&EFF. @250lb | 0.78 | 0.00 | 17.75s | 23.00 |
| ZERO DISCHARGE TKS @ 1000 | 3.73 | 40.00f | 12.33s | 6.00 |
| E-GEN DISEL OIL @ 50 GAL | 0.16 | 46.00f | 18.00s | 11.00 |
| 60 PAX @ 185lb - LOUNGE | 4.96 | 0.00 | 18.00s | 14.00 |
| 240 PAX @ 185lb - CARS | 19.82 | 0.00 | 4.00p | 14.00 |
| 40 VEHICLES @5,000lb | 89.27 | 0.00 | 4.00p | 16.00 |
| 3% SERVICE LIFE MARGIN | 11.90 | 0.00 | 0.00 | 12.00 |
| Total Fixed---------> | 530.62 | 0.30a | 0.75s | 10.24 |

| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|---|
| FW.P | 0.100 | 1.000 | 0.59 | 44.00f | 12.54p | 3.78 | 6.4 |
| FUEL_A.P | 0.100 | 0.870 | 0.60 | 36.00f | 12.70p | 3.28 | 9.1 |
| FUEL_B.P | 0.100 | 0.870 | 0.60 | 36.00a | 12.70p | 3.28 | 9.1 |
| Total Tanks---------> | | | 1.79 | 14.44f | 12.65p | 3.44 | 649.1* |
| Total Weight--------> | | | 532.41 | 0.25a | 0.71s | 10.22 | |
| Free Surface Adjustment----------> | | | | | | 1.22 | |
| Adjusted CG----------> | | | | 0.25a | 0.68s | 11.44 | |

Distances in FEET.---Moments in Ft-LT.

Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.

FREEBOARD STATUS
Baseline draft: 4.422 @ 88.00f, 4.462 @ 0.00, 4.502 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 1.12 deg.
Least freeboard is 5.58 Ft located at 23.20a
Least extra freeboard (to margin line) is 4.84 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.08/176.00, Heel: Stbd 1.12 deg., VCG = 10.22

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 4.462 | 532.41 | 0.25a | 2.66 | 14.24 | 0.04a | 136.84 | 542.8 | 34.79 |

Distances in FEET.---Specific Gravity = 1.014.---Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.422 @ 88.00f, 4.462 @ 0.00, 4.502 @ 88.00a
Trim: Aft 0.08/176.00, Heel: Stbd 1.12 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 5.59 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.49 |

Distances in FEET.

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

***** Condition 7 *****
Max Truck Load, 25 Pax, 10 Autos, w/ SLM

WEIGHT STATUS
Baseline draft: 4.491 @ 88.00f, 4.499 @ 0.00, 4.508 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.35 deg.

| Part | Weight(LT) | LCG | TCG | VCG |
|---|---|---|---|---|
| LIGHT SHIP | 395.00 | 0.80a | 1.73s | 8.54 |
| STORES & SPARES | 5.00 | 0.00 | 0.00 | 20.00 |
| 7 CREW&EFF. @250lb | 0.78 | 0.00 | 17.75s | 23.00 |
| ZERO DISCHARGE TKS @ 100 | 0.37 | 40.00f | 12.33s | 6.00 |
| E-GEN DISEL OIL @ 50 GAL | 0.16 | 46.00f | 18.00s | 11.00 |
| 150kip Truck | 66.96 | 0.00 | 0.00 | 17.00 |
| 10 VEHICLES @5,000lb | 22.32 | 0.00 | 8.50p | 16.00 |
| 25 PAX @ 185lb | 2.06 | 0.00 | 0.00 | 14.00 |
| 3% SERVICE LIFE MARGIN | 11.90 | 0.00 | 0.00 | 12.00 |
| Total Fixed---------> | 504.55 | 0.58a | 1.02s | 10.23 |

| | Load | SpGr | Weight(LT) | LCG | TCG | VCG | FSM |
|---|---|---|---|---|---|---|---|
| FW.P | 1.000 | 1.000 | 5.86 | 44.00f | 12.75p | 6.25 | 0.0 |
| FUEL_A.P | 0.950 | 0.870 | 5.70 | 36.00f | 12.99p | 5.61 | 9.1 |
| FUEL_B.P | 0.950 | 0.870 | 5.70 | 36.00a | 12.99p | 5.61 | 9.1 |
| BAL_A.P | 0.161 | 1.014 | 8.42 | 54.50f | 10.34p | 3.27 | 83.0 |
| BAL_B.P | 0.159 | 1.014 | 8.31 | 54.48a | 10.32p | 3.26 | 82.8 |
| Total Tanks---------> | | | 34.00 | 7.76f | 11.64p | 4.57 | 649.1* |
| Total Weight--------> | | | 538.55 | 0.06a | 0.22s | 9.87 | |
| Free Surface Adjustment----------> | | | | | | 1.21 | |
| Adjusted CG----------> | | | | 0.06a | 0.21s | 11.08 | |

Distances in FEET.----------Moments in Ft-LT.
+
Note: FSM values marked with an asterisk (*) are formal values which are not the same as the true values in the present condition.
+

FREEBOARD STATUS
Baseline draft: 4.491 @ 88.00f, 4.499 @ 0.00, 4.508 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.35 deg.
Least freeboard is 5.86 Ft located at 23.20a
Least extra freeboard (to margin line) is 5.11 Ft located at 2.02a

HYDROSTATIC PROPERTIES
Trim: Aft 0.02/176.00, Heel: Stbd 0.35 deg., VCG = 9.87

| LCF Draft | Displacement Weight(LT) | Buoyancy-Ctr. LCB | VCB | Weight/ Inch | Moment/ LCF | In trim | GML | GMT |
|---|---|---|---|---|---|---|---|---|
| 4.499 | 538.43 | 0.06a | 2.68 | 14.29 | 0.03f | 138.28 | 542.4 | 34.87 |

Distances in FEET.-------Specific Gravity = 1.014.----------Moment in Ft-LT.
Trim is per 176.00Ft
Draft is from Baseline. Formal Free Surface included.

Note: GMT includes the formal free surface moment 649.1 Ft-LT

08/02/18 16:42:33 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

CRITICAL POINT STATUS
Baseline draft: 4.491 @ 88.00f, 4.499 @ 0.00, 4.508 @ 88.00a
Trim: Aft 0.02/176.00, Heel: Stbd 0.35 deg.
+

| Lowest Critical Point | LCP | TCP | VCP | Height |
|---|---|---|---|---|
| (15) MS at side | 0.00 | 23.00s | 10.50 | 5.86 |
| (15) MS at side | 0.00 | 23.00p | 10.50 | 6.14 |

Distances in FEET.

## 8.5 Intact Stability Max VCG Calculations

08/02/18 16:21:19 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

MAXIMUM VCG vs. DISPLACEMENT with ROLL
Heeling moment is present from: user specification
Trim = zero at zero heel (trim righting arm held at zero)

| Displacement | | Margins | | | | |
|---|---|---|---|---|---|---|
| LONG TONS | Max VCG | LIM1 | LIM2 | LIM3 | LIM4 | LIM5 |
| 374.42 | 20.04 | 12d | 59d | 512% | 0% | 1084% |
| 387.49 | 20.58 | 11d | 56d | 477% | 0% | 1009% |
| 400.67 | 21.12 | 9d | 53d | 375% | 0% | 935% |
| 413.96 | 21.65 | 8d | 51d | 317% | 0% | 862% |
| 427.37 | 22.17 | 7d | 48d | 272% | 0% | 790% |
| 440.89 | 22.67 | 5d | 45d | 240% | 0% | 720% |
| 454.52 | 23.15 | 4d | 43d | 213% | 0% | 652% |
| 468.26 | 23.61 | 3d | 40d | 191% | 0% | 586% |
| 482.11 | 24.02 | 1d | 38d | 170% | 0% | 524% |
| 496.07 | 24.40 | 0d | 36d | 153% | 0% | 465% |
| 510.13 | 24.33 | 0d | 34d | 148% | 66% | 447% |
| 524.28 | 24.09 | 0d | 32d | 155% | 142% | 442% |
| 538.53 | 23.85 | 0d | 30d | 158% | 205% | 438% |
| 552.88 | 23.62 | 0d | 29d | 159% | 256% | 435% |
| 567.31 | 23.38 | 0d | 27d | 161% | 298% | 432% |
| 581.84 | 23.14 | 0d | 26d | 161% | 332% | 429% |
| 595.88 | 22.91 | 0d | 25d | 159% | 357% | 426% |

Heeling moment is present from: user specification
Trim = Aft 1.00/187.00 at zero heel (trim righting arm held at zero)

| Displacement | | Margins | | | | |
|---|---|---|---|---|---|---|
| LONG TONS | Max VCG | LIM1 | LIM2 | LIM3 | LIM4 | LIM5 |
| 374.42 | 19.99 | 12d | 60d | 510% | 0% | 1086% |
| 387.49 | 20.54 | 11d | 57d | 472% | 0% | 1011% |
| 400.67 | 21.08 | 9d | 54d | 376% | 0% | 937% |
| 413.96 | 21.60 | 8d | 51d | 323% | 0% | 864% |
| 427.37 | 22.12 | 7d | 48d | 277% | 0% | 792% |
| 440.89 | 22.62 | 5d | 45d | 244% | 0% | 722% |
| 454.52 | 23.10 | 4d | 43d | 217% | 0% | 654% |
| 468.26 | 23.55 | 3d | 40d | 193% | 0% | 589% |
| 482.11 | 23.97 | 1d | 38d | 173% | 0% | 527% |
| 496.07 | 24.34 | 0d | 36d | 153% | 0% | 468% |
| 510.13 | 24.29 | 0d | 34d | 154% | 62% | 448% |
| 524.28 | 24.06 | 0d | 32d | 156% | 139% | 444% |
| 538.53 | 23.82 | 0d | 30d | 159% | 201% | 439% |
| 552.88 | 23.59 | 0d | 29d | 161% | 253% | 435% |
| 567.31 | 23.35 | 0d | 27d | 161% | 295% | 432% |
| 581.84 | 23.11 | 0d | 26d | 161% | 330% | 429% |
| 595.88 | 22.88 | 0d | 25d | 158% | 356% | 426% |

08/02/18 16:21:19 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

Heeling moment is present from: user specification
Trim = Aft 2.00/187.00 at zero heel (trim righting arm held at zero)

| Displacement | | Margins | | | | |
|---|---|---|---|---|---|---|
| LONG TONS | Max VCG | LIM1 | LIM2 | LIM3 | LIM4 | LIM5 |
| 374.42 | 19.86 | 13d | 60d | 493% | 0% | 1089% |
| 387.49 | 20.40 | 11d | 57d | 445% | 0% | 1015% |
| 400.67 | 20.94 | 10d | 54d | 392% | 0% | 941% |
| 413.96 | 21.45 | 8d | 51d | 337% | 0% | 870% |
| 427.37 | 21.98 | 7d | 48d | 289% | 0% | 798% |
| 440.89 | 22.47 | 5d | 46d | 255% | 0% | 729% |
| 454.52 | 22.93 | 4d | 43d | 225% | 0% | 662% |
| 468.26 | 23.37 | 3d | 41d | 201% | 0% | 598% |
| 482.11 | 23.78 | 2d | 38d | 181% | 0% | 537% |
| 496.07 | 24.15 | 0d | 36d | 164% | 0% | 478% |
| 510.13 | 24.18 | 0d | 34d | 158% | 49% | 451% |
| 524.28 | 23.96 | 0d | 33d | 160% | 126% | 445% |
| 538.53 | 23.73 | 0d | 31d | 161% | 190% | 441% |
| 552.88 | 23.50 | 0d | 29d | 161% | 244% | 437% |
| 567.31 | 23.26 | 0d | 28d | 160% | 288% | 434% |
| 581.84 | 23.03 | 0d | 26d | 158% | 323% | 430% |
| 595.88 | 22.82 | 0d | 25d | 155% | 350% | 425% |

Distances in FEET.---Specific Gravity = 1.014.---d = degrees.

+

LIM--------170.173E1 RIGHTING ENERGY CRITERION--------Min/Max

| | | |
|---|---|---|
| (1) Angle from 0 deg to RAzero | > | 35.00 deg |
| (2) Angle from 0 deg to Flood | > | 20.00 deg |
| (3) Area from 0 deg to MaxRA | > | 15.00 Ft-deg |
| (4) Area from 0 deg to Flood | > | 15.00 Ft-deg |
| (5) Area from 0 deg to 40 | > | 15.00 Ft-deg |

---

**WEATHER CRITERION MAXIMUM KG CALCULATION**

from 46 CFR 170.170

For Service on Partially Protected Waters

$$GM_{reqd} = \frac{PAH}{\Delta \tan(T)}$$

P = $0.0033 + (L/14200)^2$ = 0.003 LT/ft²

*A* = lateral area above waterline

*H* = vertical distance from centroid of A to 1/2 draft point

$\Delta$ = displacement in long tons

*T* = 14 degrees or angle of heel where 1/2 freeboard is submerged, whichever is less.

| | | |
|---|---|---|
| Length on max waterline: | 180.5 | ft |
| Depth to freeboard deck: | 10.5 | ft (low point, at edge) |
| Beam: | 46 | ft |

| Draft, T: | 3.50 | 3.75 | 4.00 | 4.25 | 4.50 | 4.83 |
|---|---|---|---|---|---|---|
| Displacement to T: | 374.42 | 413.96 | 454.52 | 496.01 | 538.53 | 596.46 |
| Area above waterline: | 3760.90 | 3716.50 | 3672.00 | 3627.50 | 3582.90 | 3523.60 |
| h of area above waterline: | 13.26 | 13.17 | 13.08 | 12.99 | 12.90 | 12.78 |
| h of area to baseline: | 16.76 | 16.92 | 17.08 | 17.24 | 17.40 | 17.61 |
| Vertical distance, H: | 15.01 | 15.05 | 15.08 | 15.12 | 15.15 | 15.20 |
| Freeboard: | 7.00 | 6.75 | 6.50 | 6.25 | 6.00 | 5.67 |
| Tangent to 1/2 freeboard: | 0.15 | 0.15 | 0.14 | 0.14 | 0.13 | 0.12 |
| Tangent 14 deg: | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| GM required: | 3.43 | 3.19 | 2.98 | 2.82 | 2.67 | 2.52 |
| KMt at draft T: | 58.13 | 54.57 | 51.40 | 48.53 | 45.95 | 42.89 |
| Max KG incl. free surface: | 54.70 | 51.38 | 48.42 | 45.71 | 43.28 | 40.37 |

SUMMARY TABLE

| DRAFT | DISP | MAX KG | MIN GMt |
|---|---|---|---|
| 3.50 | 374.42 | 54.70 | 3.43 |
| 3.75 | 413.96 | 51.38 | 3.19 |
| 4.00 | 454.52 | 48.42 | 2.98 |
| 4.25 | 496.01 | 45.71 | 2.82 |
| 4.50 | 538.53 | 43.28 | 2.67 |
| 4.83 | 596.46 | 40.37 | 2.52 |

**PASSENGER CRITERION MAXIMUM KG CALCULATION**
from 46 CFR 171.050

$$GM_{reqd} = \frac{2\,W\,b}{3\,\Delta\,\tan(T)}$$

$\Delta$ = displacement of the vessel in long tons.
$W$ = total weight in long tons of persons other than required crew, including personal effects of those persons expected to be carried on the vessel.
$T$ = 14 degrees or angle of heel where freeboard is submerged,
$b$ = distance in feet (meters) from the centerline of the vessel to the geometric center of the passenger deck on one side of the centerline.

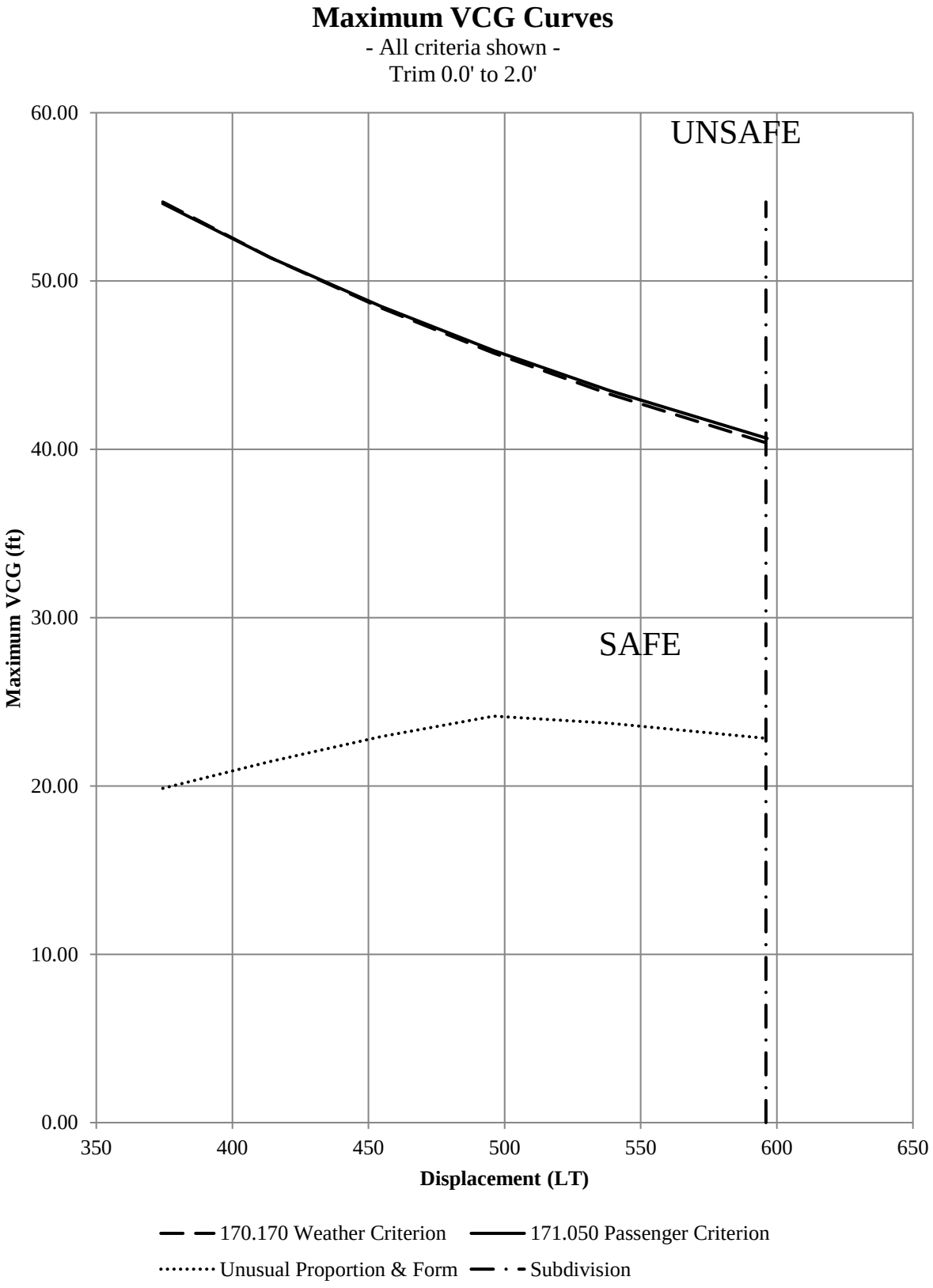
| | | |
|---|---|---|
| Number of passengers: | 307 | |
| Weight per passenger: | 185 | lb |
| Personal effects per passenger: | 15 | lb |
| Total passenger weight: | 27.41 | LT |
| | | |
| Depth to freeboard deck: | 10.50 | ft (low point, at edge) |
| Beam: | 46 | ft |
| b: | 18 | ft |

| Draft, T: | 3.50 | 3.75 | 4.00 | 4.25 | 4.50 | 4.83 |
|---|---|---|---|---|---|---|
| Displacement to T: | 374.42 | 413.96 | 454.52 | 496.01 | 538.53 | 596.46 |
| Freeboard: | 7.00 | 6.75 | 6.50 | 6.25 | 6.00 | 5.67 |
| Tangent to freeboard: | 0.30 | 0.29 | 0.28 | 0.27 | 0.26 | 0.25 |
| Tangent 14 deg: | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| GM required: | 3.52 | 3.19 | 2.90 | 2.66 | 2.45 | 2.24 |
| KMt at draft T: | 58.13 | 54.57 | 51.40 | 48.53 | 45.95 | 42.89 |
| Max KG incl. free surface: | 54.61 | 51.38 | 48.50 | 45.87 | 43.50 | 40.65 |

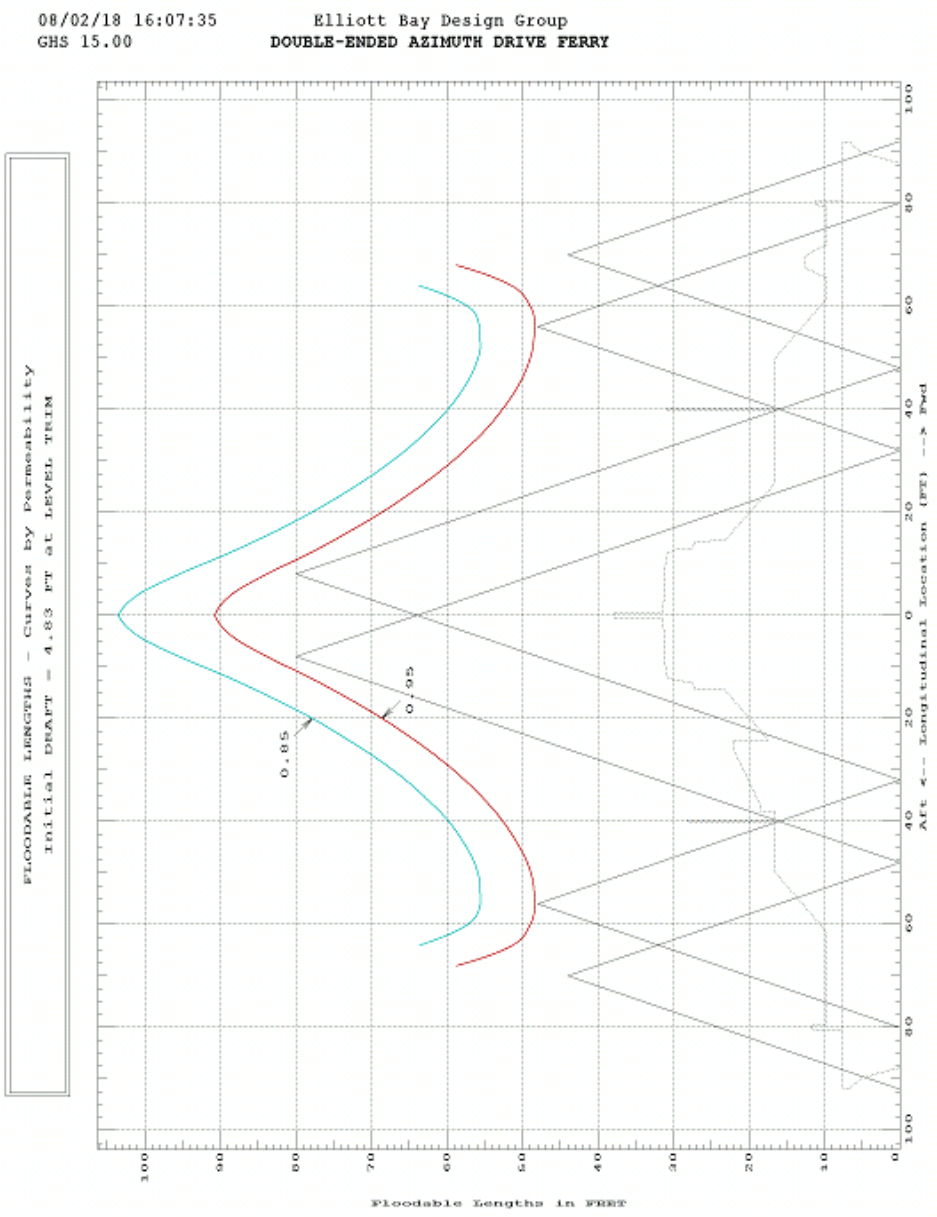
SUMMARY TABLE

| DRAFT | DISP | MAX KG | MIN GMt |
|---|---|---|---|
| 3.50 | 374.42 | 54.61 | 3.52 |
| 3.75 | 413.96 | 51.38 | 3.19 |
| 4.00 | 454.52 | 48.50 | 2.90 |
| 4.25 | 496.01 | 45.87 | 2.66 |
| 4.50 | 538.53 | 43.50 | 2.45 |
| 4.83 | 596.46 | 40.65 | 2.24 |

## 8.6 Maximum Allowable VCG Curves



## 8.7 Floodable Length Plot



## 8.8 Floodable Length GHS Output

08/02/18 16:21:19 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

FLOODABLE LENGTHS
Baseline draft: 4.833 Trim: zero
Vertical CG: 12.00 Permeability: 0.950

| Origin Depth | Degrees Trim | F L O O D E D Center | Length | Margin | GMt |
|---|---|---|---|---|---|
| 6.18 | 2.80f | 68.00f | 58.74 | 0.28 | 23.92 |
| 6.19 | 2.79f | 64.00f | 51.44 | 0.28 | 23.89 |
| 6.26 | 2.75f | 60.00f | 48.95 | 0.28 | 23.73 |
| 6.35 | 2.68f | 56.00f | 48.28 | 0.28 | 23.46 |
| 6.47 | 2.61f | 52.00f | 48.55 | 0.29 | 23.12 |
| 6.59 | 2.53f | 48.00f | 49.39 | 0.29 | 22.76 |
| 6.74 | 2.44f | 44.00f | 50.77 | 0.29 | 22.39 |
| 6.90 | 2.33f | 40.00f | 52.64 | 0.29 | 21.82 |
| 7.08 | 2.22f | 36.00f | 54.88 | 0.29 | 21.23 |
| 7.27 | 2.09f | 32.00f | 57.68 | 0.30 | 20.63 |
| 7.50 | 1.94f | 28.00f | 60.87 | 0.31 | 19.82 |
| 7.75 | 1.78f | 24.00f | 64.52 | 0.31 | 19.00 |
| 8.03 | 1.59f | 20.00f | 68.64 | 0.32 | 18.08 |
| 8.35 | 1.37f | 16.00f | 73.21 | 0.32 | 17.17 |
| 8.73 | 1.11f | 12.00f | 78.28 | 0.35 | 16.39 |
| 9.17 | 0.79f | 8.00f | 83.83 | 0.41 | 15.98 |
| 9.57 | 0.41f | 4.00f | 88.56 | 0.62 | 16.52 |
| 9.75 | 0.00 | 0.00 | 90.70 | 0.75 | 16.34 |
| 9.57 | 0.42a | 4.00a | 88.50 | 0.63 | 16.50 |
| 9.17 | 0.79a | 8.00a | 83.79 | 0.44 | 15.99 |
| 8.73 | 1.11a | 12.00a | 78.28 | 0.37 | 16.38 |
| 8.35 | 1.37a | 16.00a | 73.14 | 0.33 | 17.18 |
| 8.03 | 1.59a | 20.00a | 68.57 | 0.31 | 18.09 |
| 7.75 | 1.78a | 24.00a | 64.46 | 0.31 | 19.00 |
| 7.50 | 1.94a | 28.00a | 60.80 | 0.30 | 19.86 |
| 7.27 | 2.09a | 32.00a | 57.63 | 0.30 | 20.57 |
| 7.07 | 2.22a | 36.00a | 54.85 | 0.29 | 21.27 |
| 6.90 | 2.33a | 40.00a | 52.60 | 0.29 | 21.86 |
| 6.74 | 2.44a | 44.00a | 50.72 | 0.29 | 22.32 |
| 6.59 | 2.53a | 48.00a | 49.36 | 0.29 | 22.78 |
| 6.47 | 2.61a | 52.00a | 48.49 | 0.29 | 23.20 |
| 6.36 | 2.68a | 56.00a | 48.30 | 0.28 | 23.44 |
| 6.26 | 2.75a | 60.00a | 48.90 | 0.28 | 23.65 |
| 6.18 | 2.79a | 64.00a | 51.29 | 0.28 | 23.84 |
| 6.18 | 2.80a | 68.00a | 58.76 | 0.28 | 23.87 |

Distances in FEET.----------

08/02/18 16:21:19 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

FLOODABLE LENGTHS
Baseline draft: 4.833 Trim: zero
Vertical CG: 12.00 Permeability: 0.850

| Origin | Degrees | F L O O D E D | | | |
|---|---|---|---|---|---|
| Depth | Trim | Center | Length | Margin | GMt |
| 6.28 | 2.73f | 64.00f | 63.67 | 0.28 | 23.66 |
| 6.30 | 2.72f | 60.00f | 57.20 | 0.28 | 23.59 |
| 6.38 | 2.67f | 56.00f | 55.62 | 0.28 | 23.33 |
| 6.49 | 2.60f | 52.00f | 55.51 | 0.29 | 23.03 |
| 6.61 | 2.52f | 48.00f | 56.36 | 0.29 | 22.68 |
| 6.75 | 2.43f | 44.00f | 57.79 | 0.29 | 22.30 |
| 6.92 | 2.32f | 40.00f | 59.85 | 0.29 | 21.74 |
| 7.09 | 2.21f | 36.00f | 62.43 | 0.29 | 21.15 |
| 7.29 | 2.08f | 32.00f | 65.49 | 0.30 | 20.54 |
| 7.51 | 1.93f | 28.00f | 69.07 | 0.31 | 19.73 |
| 7.76 | 1.77f | 24.00f | 73.23 | 0.31 | 18.90 |
| 8.04 | 1.58f | 20.00f | 77.89 | 0.32 | 17.98 |
| 8.36 | 1.36f | 16.00f | 83.12 | 0.32 | 17.06 |
| 8.74 | 1.10f | 12.00f | 89.01 | 0.35 | 16.25 |
| 9.18 | 0.79f | 8.00f | 95.42 | 0.41 | 15.80 |
| 9.57 | 0.41f | 4.00f | 100.91 | 0.62 | 16.30 |
| 9.75 | 0.00 | 0.00 | 103.44 | 0.75 | 16.11 |
| 9.57 | 0.41a | 4.00a | 100.88 | 0.63 | 16.28 |
| 9.17 | 0.79a | 8.00a | 95.38 | 0.44 | 15.81 |
| 8.74 | 1.10a | 12.00a | 88.99 | 0.37 | 16.24 |
| 8.36 | 1.36a | 16.00a | 83.10 | 0.33 | 17.06 |
| 8.04 | 1.58a | 20.00a | 77.81 | 0.31 | 17.99 |
| 7.76 | 1.77a | 24.00a | 73.20 | 0.31 | 18.91 |
| 7.51 | 1.93a | 28.00a | 69.03 | 0.30 | 19.77 |
| 7.29 | 2.08a | 32.00a | 65.43 | 0.30 | 20.49 |
| 7.09 | 2.21a | 36.00a | 62.37 | 0.29 | 21.17 |
| 6.91 | 2.32a | 40.00a | 59.76 | 0.29 | 21.79 |
| 6.75 | 2.42a | 44.00a | 57.80 | 0.29 | 22.24 |
| 6.61 | 2.52a | 48.00a | 56.32 | 0.29 | 22.69 |
| 6.49 | 2.60a | 52.00a | 55.56 | 0.29 | 23.08 |
| 6.38 | 2.67a | 56.00a | 55.52 | 0.28 | 23.35 |
| 6.30 | 2.72a | 60.00a | 57.19 | 0.28 | 23.54 |
| 6.27 | 2.73a | 64.00a | 63.63 | 0.28 | 23.60 |

Distances in FEET.----------

## 8.9 Frame Table

| Frame Number | | Feet Aft Frame 0 | Frame Number | Feet Aft Frame 0 | Frame Number | | Feet Aft Frame 0 |
|---|---|---|---|---|---|---|---|
| 46-A | | -92 | 15-A | -30 | 16-B | WT | 32 |
| 45-A | | -90 | 14-A | -28 | 17-B | | 34 |
| 44-A | | -88 | 13-A | -26 | 18-B | | 36 |
| 43-A | | -86 | 12-A | -24 | 19-B | | 38 |
| 42-A | | -84 | 11-A | -22 | 20-B | | 40 |
| 41-A | | -82 | 10-A | -20 | 21-B | | 42 |
| 40-A | WT | -80 | 09-A | -18 | 22-B | | 44 |
| 39-A | | -78 | 08-A | -16 | 23-B | | 46 |
| 38-A | | -76 | 07-A | -14 | 24-B | WT | 48 |
| 37-A | | -74 | 06-A | -12 | 25-B | | 50 |
| 36-A | | -72 | 05-A | -10 | 26-B | | 52 |
| 35-A | | -70 | 04-A | -8 | 27-B | | 54 |
| 34-A | | -68 | 03-A | -6 | 28-B | | 56 |
| 33-A | | -66 | 02-A | -4 | 29-B | | 58 |
| 32-A | | -64 | 01-A | -2 | 30-B | | 60 |
| 31-A | | -62 | 00 | 0 | 31-B | | 62 |
| 30-A | | -60 | 01-B | 2 | 32-B | | 64 |
| 29-A | | -58 | 02-B | 4 | 33-B | | 66 |
| 28-A | | -56 | 03-B | 6 | 34-B | | 68 |
| 27-A | | -54 | 04-B | 8 | 35-B | | 70 |
| 26-A | | -52 | 05-B | 10 | 36-B | | 72 |
| 25-A | | -50 | 06-B | 12 | 37-B | | 74 |
| 24-A | WT | -48 | 07-B | 14 | 38-B | | 76 |
| 23-A | | -46 | 08-B | 16 | 39-B | | 78 |
| 22-A | | -44 | 09-B | 18 | 40-B | WT | 80 |
| 21-A | | -42 | 10-B | 20 | 41-B | | 82 |
| 20-A | | -40 | 11-B | 22 | 42-B | | 84 |
| 19-A | | -38 | 12-B | 24 | 43-B | | 86 |
| 18-A | | -36 | 13-B | 26 | 44-B | | 88 |
| 17-A | | -34 | 14-B | 28 | 45-B | | 90 |
| 16-A | WT | -32 | 15-B | 30 | 46-B | | 92 |

Frame spacing is 24 inches throughout

## 8.10 Sample Damaged Stability Output

```
08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
     ***** Damage Case 1: LAZARETTE A & THRUSTER ROOM A FLOODED *****

                     WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 6.449 @ 93.50f, 4.952 @ 0.00, 3.454 @ 93.50a
                Trim: Fwd 2.99/187.00,  Heel: Stbd 1.12 deg.
Part------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                              544.53    0.07a   0.25s  10.13
               Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->          --- Included in Fixed Weight ---      649.1*
  Total Weight-------->             544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                    1.014        625.40    8.28f   0.74s   3.04      -4.95
BAL_A.S        Flooded  1.014        -19.48   55.28f  11.31s   4.35      -4.95
LAZ_A.C        Flooded  1.014         -5.31   83.13f   0.29s   4.75      -4.95
THRUST_A.C     Flooded  1.014        -56.09   64.59f   0.34s   3.79      -4.95
  Total Displacement--> 1.014        544.53    0.07f   0.41s   2.90
--------------------------------------------------------------------------------
               WEIGHT EXCESS:          0.00
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                    +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                    +

                               FREEBOARD STATUS
        Baseline draft: 6.449 @ 93.50f, 4.952 @ 0.00, 3.454 @ 93.50a
                Trim: Fwd 2.99/187.00,  Heel: Stbd 1.12 deg.
                Least freeboard is 4.07 Ft located at 81.70f
     Least extra freeboard (to margin line) is 3.69 Ft located at 68.59f

                     HYDROSTATIC PROPERTIES with FLOODING
          Trim: Fwd 2.99/187.00, Heel: Stbd 1.12 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  4.856       544.53    0.07f   2.90    12.34    5.99a   82.66   340.6   31.39
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                          Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
```

08/02/18 16:22:55 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 1: LAZARETTE A & THRUSTER ROOM A FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL Rrighting ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Area | Flood Pt Height |
|---|---|---|---|---|---|---|---|
| 4.950 | 0.92f | 1.12s | 544.53 | 0.00 | 0.000 | 0.00 | 5.95(12) |
| 4.931 | 1.11f | 6.12s | 544.56 | 0.00 | 2.669 | 6.67 | 5.62(11) |
| 4.806 | 1.32f | 10.12s | 544.53 | 0.00 | 4.614 | 21.31 | Marg Imm. |
| 4.754 | 1.37f | 11.12s | 544.53 | 0.00 | 5.039 | 26.12 | 4.61(11) |
| 4.389 | 1.68f | 15.92s | 544.53 | 0.00 | 6.439 | 53.92 | 0.00(3) |
| 4.371 | 1.70f | 16.12s | 544.53 | 0.00 | 6.474 | 55.22 | 3.73(11) |
| 3.917 | 2.09f | 21.12s | 544.53 | 0.00 | 6.898 | 89.07 | 2.86(11) |
| 3.812 | 2.18f | 22.25s | 544.53 | 0.00 | 6.908 | 96.89 | 2.65(11) |
| 3.449 | 2.49f | 26.12s | 544.55 | 0.00 | 6.788 | 123.48 | 1.95(11) |
| 2.956 | 2.93f | 31.12s | 544.52 | 0.00 | 6.334 | 156.45 | 1.02(11) |
| 2.439 | 3.40f | 36.12s | 544.49 | 0.00 | 5.652 | 186.51 | 0.10(11) |
| 2.385 | 3.45f | 36.63s | 544.48 | 0.00 | 5.573 | 189.40 | -0.00(11) |
| 1.902 | 3.89f | 41.12s | 544.52 | 0.00 | 4.828 | 212.77 | -0.83(11) |
| 1.351 | 4.38f | 46.12s | 544.50 | 0.00 | 3.910 | 234.66 | -1.75(11) |
| 0.789 | 4.86f | 51.12s | 544.53 | 0.00 | 2.926 | 251.78 | -2.65(11) |
| 0.219 | 5.31f | 56.12s | 544.52 | 0.00 | 1.899 | 263.86 | -3.53(11) |
| -0.354 | 5.73f | 61.12s | 544.52 | 0.00 | 0.845 | 270.73 | -4.38(11) |
| -0.805 | 6.03f | 65.07s | 544.53 | 0.00 | 0.000 | 272.40 | -5.03(11) |
| -0.924 | 6.11f | 66.12s | 544.53 | 0.00 | -0.225 | 272.29 | -5.20(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

+

Note: No tank loads are present.

+

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

+

| Critical Points | | LCP | TCP | VCP |
|---|---|---|---|---|
| (3) | Void A Intake | TIGHT 47.50f | 22.00 | 12.29 |
| (11) | ER Air Intake | FLOOD 0.00 | 12.00 | 11.90 |
| (12) | Void A Exhaust | TIGHT 40.50f | 17.50 | 11.90 |

| LIM | 46 CFR 171.080-Passenger Vessels | Min/Max | | Attained | |
|---|---|---|---|---|---|
| (1) | Angle from Equilibrium to RAzero | > | 10.00 | deg | 63.95 P |
| (2) | Angle from Equilibrium to Flood | > | 10.00 | deg | 35.51 P |
| (3) | Area from Equilibrium to Flood or RAzero | > | 2.82 | Ft-deg | 189.40 P |
| (4) | Righting Arm at MaxRA | > | 1.00 | Ft | 6.91 P |
| (6) | Absolute Angle at Equilibrium | < | 7.00 | deg | 1.12 P |
| (7) | Angle from Equilibrium to Dk/margin Immersion | > | 0.00 | deg | 9.00 P |

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08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
        ***** Damage Case 2: THRUSTER ROOM A & VOID A FLOODED *****

                      WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 8.679 @ 93.50f, 5.585 @ 0.00, 2.492 @ 93.50a
                Trim: Fwd 6.18/187.00,  Heel: Stbd 2.10 deg.
Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                               544.53    0.07a   0.25s  10.13
                Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
  Total Weight-------->              544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                     1.014       756.52   14.98f   1.19s   3.64      -5.58
BAL_A.S        Flooded   1.014       -30.72   55.53f  11.73s   5.32      -5.58
THRUST_A.C     Flooded   1.014       -87.75   65.96f   0.58s   4.95      -5.58
VOID_A.C       Flooded   1.014       -93.50   39.91f   2.07s   4.00      -5.58
  Total Displacement--> 1.014       544.54    0.20f   0.54s   3.28
--------------------------------------------------------------------------------
         DISPLACEMENT EXCESS:          0.01
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                     +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                     +

                               FREEBOARD STATUS
        Baseline draft: 8.679 @ 93.50f, 5.585 @ 0.00, 2.492 @ 93.50a
                Trim: Fwd 6.18/187.00,  Heel: Stbd 2.10 deg.
                Least freeboard is 1.74 Ft located at 84.73f
     Least extra freeboard (to margin line) is 1.40 Ft located at 81.70f

                    HYDROSTATIC PROPERTIES with FLOODING
          Trim: Fwd 6.18/187.00, Heel: Stbd 2.10 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  5.381       544.54    0.20f   3.28    11.32    6.19a   84.45   348.0   27.98
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                            Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
```

08/02/18 16:22:55 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 2: THRUSTER ROOM A & VOID A FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL RIGHTING ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Flood Pt Area | Height |
|---|---|---|---|---|---|---|---|
| 5.579 | 1.89f | 2.10s | 544.56 | 0.00 | 0.000 | 0.00 | 4.33(12) |
| 5.561 | 2.03f | 6.00s | 544.61 | 0.00 | 1.881 | 3.67 | Marg Imm. |
| 5.541 | 2.07f | 7.10s | 544.53 | 0.00 | 2.398 | 6.02 | 4.78(11) |
| 5.386 | 2.40f | 12.10s | 544.52 | 0.00 | 4.441 | 23.27 | 3.73(11) |
| 5.289 | 2.63f | 14.45s | 544.44 | 0.00 | 5.071 | 34.47 | 0.00(12) |
| 5.167 | 2.93f | 17.10s | 544.52 | 0.00 | 5.494 | 48.55 | 2.67(11) |
| 4.912 | 3.51f | 22.10s | 544.55 | 0.00 | 5.729 | 76.97 | 1.59(11) |
| 4.625 | 4.12f | 27.10s | 544.51 | 0.00 | 5.507 | 105.25 | 0.49(11) |
| 4.487 | 4.41f | 29.32s | 544.55 | 0.00 | 5.311 | 117.27 | -0.00(11) |
| 4.302 | 4.77f | 32.10s | 544.53 | 0.00 | 5.007 | 131.62 | -0.61(11) |
| 3.943 | 5.44f | 37.10s | 544.52 | 0.00 | 4.337 | 155.07 | -1.70(11) |
| 3.551 | 6.09f | 42.10s | 544.52 | 0.00 | 3.561 | 174.86 | -2.77(11) |
| 3.132 | 6.71f | 47.10s | 544.52 | 0.00 | 2.714 | 190.58 | -3.82(11) |
| 2.684 | 7.29f | 52.10s | 544.54 | 0.00 | 1.821 | 201.93 | -4.83(11) |
| 2.211 | 7.81f | 57.10s | 544.52 | 0.00 | 0.903 | 208.75 | -5.79(11) |
| 1.734 | 8.25f | 61.94s | 544.60 | 0.00 | -0.001 | 210.94 | -6.68(11) |
| 1.715 | 8.26f | 62.10s | 544.45 | 0.00 | -0.029 | 210.94 | -6.70(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

Note: No tank loads are present.

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

| Critical Points | | LCP | TCP | VCP |
|---|---|---|---|---|
| (11) | ER Air Intake | FLOOD 0.00 | 12.00 | 11.90 |
| (12) | Void A Exhaust | TIGHT 40.50f | 17.50 | 11.90 |

| LIM | 46 CFR 171.080-Passenger Vessels | Min/Max | | Attained | |
|---|---|---|---|---|---|
| (1) | Angle from Equilibrium to RAzero | > | 10.00 | deg | 59.84 P |
| (2) | Angle from Equilibrium to Flood | > | 10.00 | deg | 27.22 P |
| (3) | Area from Equilibrium to Flood or RAzero | > | 2.82 | Ft-deg | 117.27 P |
| (4) | Righting Arm at MaxRA | > | 1.00 | Ft | 5.73 P |
| (6) | Absolute Angle at Equilibrium | < | 7.00 | deg | 2.10 P |
| (7) | Angle from Equilibrium to Dk/margin Immersion | > | 0.00 | deg | 3.90 P |

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08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
          ***** Damage Case 3: VOID A & ENGINE ROOM FLOODED *****

                      WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 8.792 @ 93.50f, 7.724 @ 0.00, 6.656 @ 93.50a
                Trim: Fwd 2.14/187.00,  Heel: Stbd 1.56 deg.
Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                               544.53    0.07a   0.25s  10.13
                Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
  Total Weight-------->              544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                     1.014      1,139.98    4.23f   0.68s   4.55      -7.72
VOID_A.C       Flooded   1.014       -114.00   39.85f   1.88s   4.64      -7.72
ER.C           Flooded   1.014       -481.40    0.56f   0.68s   4.21      -7.72
  Total Displacement--> 1.014        544.57    0.01f   0.42s   4.83
--------------------------------------------------------------------------------
         DISPLACEMENT EXCESS:          0.05
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                     +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                     +

                               FREEBOARD STATUS
        Baseline draft: 8.792 @ 93.50f, 7.724 @ 0.00, 6.656 @ 93.50a
                Trim: Fwd 2.14/187.00,  Heel: Stbd 1.56 deg.
                Least freeboard is 1.54 Ft located at 75.65f
     Least extra freeboard (to margin line) is 1.04 Ft located at 54.47f

                    HYDROSTATIC PROPERTIES with FLOODING
          Trim: Fwd 2.14/187.00, Heel: Stbd 1.56 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  7.701       544.57    0.01f   4.83     9.26    2.00a  167.75   691.2   18.76
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                            Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
```

08/02/18 16:22:55 Elliott Bay Design Group
GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 3: VOID A & ENGINE ROOM FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL RIGHTING ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Area | Flood Pt Height |
|---|---|---|---|---|---|---|---|
| 7.720 | 0.65f | 1.56s | 544.53 | 0.00 | 0.000 | 0.00 | 2.84(2) |
| 7.674 | 0.64f | 4.34s | 544.53 | 0.00 | 0.918 | 1.28 | Marg Imm. |
| 7.609 | 0.64f | 6.56s | 544.57 | 0.00 | 1.663 | 4.14 | 2.84(11) |
| 7.517 | 0.69f | 10.14s | 544.50 | 0.00 | 2.657 | 11.90 | 0.00(2) |
| 7.499 | 0.73f | 11.56s | 544.53 | 0.00 | 2.935 | 15.90 | 1.75(11) |
| 7.494 | 0.91f | 16.56s | 544.53 | 0.00 | 3.431 | 32.08 | 0.49(11) |
| 7.502 | 0.98f | 18.40s | 544.61 | 0.00 | 3.469 | 38.44 | -0.00(11) |
| 7.503 | 0.99f | 18.75s | 544.57 | 0.00 | 3.470 | 39.63 | -0.09(11) |
| 7.506 | 1.11f | 21.56s | 544.53 | 0.00 | 3.410 | 49.36 | -0.85(11) |
| 7.479 | 1.31f | 26.56s | 544.53 | 0.00 | 3.099 | 65.78 | -2.20(11) |
| 7.405 | 1.50f | 31.56s | 544.47 | 0.00 | 2.636 | 80.18 | -3.55(11) |
| 7.283 | 1.69f | 36.56s | 544.53 | 0.00 | 2.084 | 92.02 | -4.87(11) |
| 7.108 | 1.86f | 41.56s | 544.53 | 0.00 | 1.476 | 100.94 | -6.17(11) |
| 6.883 | 2.02f | 46.56s | 544.53 | 0.00 | 0.832 | 106.72 | -7.42(11) |
| 6.611 | 2.16f | 51.56s | 544.53 | 0.00 | 0.166 | 109.23 | -8.61(11) |
| 6.537 | 2.19f | 52.79s | 544.54 | 0.00 | 0.000 | 109.33 | -8.90(11) |
| 6.296 | 2.28f | 56.56s | 544.53 | 0.00 | -0.510 | 108.37 | -9.75(11) |
| 5.944 | 2.37f | 61.56s | 544.53 | 0.00 | -1.187 | 104.12 | -10.83(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

Note: No tank loads are present.

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

| Critical Points | | LCP | TCP | VCP |
|---|---|---|---|---|
| (2) | Thruster A Exhaust | TIGHT 66.00f | 18.90 | 11.83 |
| (11) | ER Air Intake | FLOOD 0.00 | 12.00 | 11.90 |

| LIM | 46 CFR 171.080-Passenger Vessels | Min/Max | | Attained |
|---|---|---|---|---|
| (1) | Angle from Equilibrium to RAzero | > 10.00 | deg | 51.23 P |
| (2) | Angle from Equilibrium to Flood | > 10.00 | deg | 16.84 P |
| (3) | Area from Equilibrium to Flood or RAzero | > 2.82 | Ft-deg | 38.44 P |
| (4) | Righting Arm at MaxRA | > 1.00 | Ft | 3.47 P |
| (6) | Absolute Angle at Equilibrium | < 7.00 | deg | 1.56 P |
| (7) | Angle from Equilibrium to Dk/margin Immersion | > 0.00 | deg | 2.78 P |

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08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
          ***** Damage Case 4: ENGINE ROOM & VOID B FLOODED *****

                      WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 6.628 @ 93.50f, 7.768 @ 0.00, 8.908 @ 93.50a
                Trim: Aft 2.28/187.00,  Heel: Stbd 1.22 deg.
Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                               544.53    0.07a   0.25s  10.13
                Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
  Total Weight-------->              544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                     1.014      1,148.65    4.49a   0.53s   4.57      -7.77
ER.C           Flooded   1.014       -484.42    0.60a   0.53s   4.22      -7.77
VOID_B.C       Flooded   1.014       -119.69   40.02a   1.19s   4.71      -7.77
  Total Displacement--> 1.014        544.54    0.15a   0.39s   4.84
--------------------------------------------------------------------------------
         DISPLACEMENT EXCESS:          0.01
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                     +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                     +

                               FREEBOARD STATUS
        Baseline draft: 6.628 @ 93.50f, 7.768 @ 0.00, 8.908 @ 93.50a
                Trim: Aft 2.28/187.00,  Heel: Stbd 1.22 deg.
                Least freeboard is 1.54 Ft located at 79.69a
     Least extra freeboard (to margin line) is 1.09 Ft located at 58.50a

                    HYDROSTATIC PROPERTIES with FLOODING
          Trim: Aft 2.28/187.00, Heel: Stbd 1.22 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  7.744       544.54    0.15a   4.84     9.22    1.95f  168.40   693.9   18.64
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                            Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 4: ENGINE ROOM & VOID B FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL RIGHTING ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Flood Pt Area | Height |
|---|---|---|---|---|---|---|---|
| 7.765 | 0.70a | 1.22s | 544.53 | 0.00 | 0.000 | 0.00 | 2.85(10) |
| 7.714 | 0.68a | 4.16s | 544.50 | 0.00 | 0.957 | 1.41 | Marg Imm. |
| 7.653 | 0.68a | 6.22s | 544.58 | 0.00 | 1.637 | 4.08 | 2.88(11) |
| 7.550 | 0.72a | 9.95s | 544.50 | 0.00 | 2.666 | 12.15 | 0.00(10) |
| 7.531 | 0.76a | 11.22s | 544.53 | 0.00 | 2.915 | 15.70 | 1.81(11) |
| 7.515 | 0.92a | 16.22s | 544.53 | 0.00 | 3.432 | 31.83 | 0.56(11) |
| 7.520 | 1.01a | 18.33s | 544.55 | 0.00 | 3.478 | 39.14 | 0.00(11) |
| 7.521 | 1.12a | 21.22s | 544.53 | 0.00 | 3.426 | 49.15 | -0.77(11) |
| 7.494 | 1.32a | 26.22s | 544.53 | 0.00 | 3.125 | 65.68 | -2.12(11) |
| 7.419 | 1.52a | 31.22s | 544.46 | 0.00 | 2.668 | 80.23 | -3.47(11) |
| 7.299 | 1.71a | 36.22s | 544.53 | 0.00 | 2.119 | 92.24 | -4.79(11) |
| 7.127 | 1.88a | 41.22s | 544.53 | 0.00 | 1.514 | 101.34 | -6.09(11) |
| 6.906 | 2.05a | 46.22s | 544.53 | 0.00 | 0.872 | 107.33 | -7.34(11) |
| 6.638 | 2.19a | 51.22s | 544.53 | 0.00 | 0.208 | 110.04 | -8.54(11) |
| 6.546 | 2.23a | 52.77s | 544.53 | 0.00 | 0.000 | 110.20 | -8.90(11) |
| 6.327 | 2.31a | 56.22s | 544.53 | 0.00 | -0.467 | 109.39 | -9.68(11) |
| 5.978 | 2.40a | 61.22s | 544.53 | 0.00 | -1.143 | 105.37 | -10.76(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

Note: No tank loads are present.

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

| Critical Points | | LCP | TCP | VCP |
|---|---|---|---|---|
| (10) Thruster B Exhaust | TIGHT | 66.00a | 18.90 | 11.83 |
| (11) ER Air Intake | FLOOD | 0.00 | 12.00 | 11.90 |

| LIM 46 CFR 171.080-Passenger Vessels | Min/Max | | Attained | |
|---|---|---|---|---|
| (1) Angle from Equilibrium to RAzero | > | 10.00 | deg | 51.55 P |
| (2) Angle from Equilibrium to Flood | > | 10.00 | deg | 17.11 P |
| (3) Area from Equilibrium to Flood or RAzero | > | 2.82 | Ft-deg | 39.14 P |
| (4) Righting Arm at MaxRA | > | 1.00 | Ft | 3.48 P |
| (6) Absolute Angle at Equilibrium | < | 7.00 | deg | 1.22 P |
| (7) Angle from Equilibrium to Dk/margin Immersion | > | 0.00 | deg | 2.94 P |

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08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
        ***** Damage Case 5: VOID B & THRUSTER ROOM B FLOODED *****

                      WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 2.414 @ 93.50f, 5.616 @ 0.00, 8.817 @ 93.50a
                Trim: Aft 6.40/187.00,  Heel: Stbd 1.98 deg.
Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                               544.53    0.07a   0.25s  10.13
                Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
  Total Weight-------->              544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                     1.014       763.37   15.41a   1.11s   3.68      -5.61
BAL_B.S        Flooded   1.014       -31.18   55.54a  11.74s   5.36      -5.61
VOID_B.C       Flooded   1.014       -97.93   40.05a   1.53s   4.07      -5.61
THRUST_B.C     Flooded   1.014       -89.76   66.03a   0.55s   5.02      -5.61
  Total Displacement--> 1.014       544.51    0.34a   0.52s   3.29
--------------------------------------------------------------------------------
               WEIGHT EXCESS:          0.02
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                     +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                     +

                                FREEBOARD STATUS
        Baseline draft: 2.414 @ 93.50f, 5.616 @ 0.00, 8.817 @ 93.50a
                Trim: Aft 6.40/187.00,  Heel: Stbd 1.98 deg.
                Least freeboard is 1.65 Ft located at 83.72a
     Least extra freeboard (to margin line) is 1.31 Ft located at 83.72a

                    HYDROSTATIC PROPERTIES with FLOODING
          Trim: Aft 6.40/187.00, Heel: Stbd 1.98 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  5.410       544.51    0.34a   3.29    11.22    6.01f   83.84   345.5   27.70
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                             Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 5: VOID B & THRUSTER ROOM B FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL RIGHTING ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Flood Pt Area | Height |
|---|---|---|---|---|---|---|---|
| 5.609 | 1.96a | 1.98s | 544.55 | 0.00 | 0.000 | 0.00 | 3.30(10) |
| 5.588 | 2.07a | 5.68s | 544.53 | 0.00 | 1.777 | 3.29 | Marg Imm. |
| 5.564 | 2.12a | 6.98s | 544.53 | 0.00 | 2.382 | 5.98 | 4.78(11) |
| 5.456 | 2.33a | 10.62s | 544.47 | 0.00 | 3.936 | 17.55 | 0.00(10) |
| 5.405 | 2.43a | 11.98s | 544.55 | 0.00 | 4.410 | 23.20 | 3.74(11) |
| 5.185 | 2.95a | 16.98s | 544.53 | 0.00 | 5.472 | 48.22 | 2.68(11) |
| 4.944 | 3.50a | 21.69s | 544.52 | 0.00 | 5.716 | 74.89 | 1.67(11) |
| 4.928 | 3.53a | 21.98s | 544.53 | 0.00 | 5.715 | 76.52 | 1.60(11) |
| 4.641 | 4.15a | 26.98s | 544.55 | 0.00 | 5.503 | 104.75 | 0.51(11) |
| 4.498 | 4.45a | 29.28s | 544.58 | 0.00 | 5.301 | 117.20 | -0.00(11) |
| 4.319 | 4.80a | 31.98s | 544.53 | 0.00 | 5.006 | 131.12 | -0.59(11) |
| 3.964 | 5.47a | 36.98s | 544.61 | 0.00 | 4.340 | 154.57 | -1.69(11) |
| 3.574 | 6.12a | 41.98s | 544.51 | 0.00 | 3.566 | 174.38 | -2.76(11) |
| 3.154 | 6.74a | 46.98s | 544.51 | 0.00 | 2.721 | 190.12 | -3.80(11) |
| 2.706 | 7.32a | 51.98s | 544.47 | 0.00 | 1.832 | 201.52 | -4.81(11) |
| 2.233 | 7.85a | 56.98s | 544.49 | 0.00 | 0.914 | 208.40 | -5.78(11) |
| 1.751 | 8.30a | 61.89s | 544.55 | 0.00 | 0.000 | 210.65 | -6.68(11) |
| 1.742 | 8.31a | 61.98s | 544.55 | 0.00 | -0.017 | 210.65 | -6.69(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

Note: No tank loads are present.

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

| Critical Points | LCP | TCP | VCP |
|---|---|---|---|
| (10) Thruster B Exhaust | TIGHT 66.00a | 18.90 | 11.83 |
| (11) ER Air Intake | FLOOD 0.00 | 12.00 | 11.90 |

| LIM 46 CFR 171.080-Passenger Vessels | Min/Max | | Attained | |
|---|---|---|---|---|
| (1) Angle from Equilibrium to RAzero | > | 10.00 | deg | 59.91 P |
| (2) Angle from Equilibrium to Flood | > | 10.00 | deg | 27.30 P |
| (3) Area from Equilibrium to Flood or RAzero | > | 2.82 | Ft-deg | 117.20 P |
| (4) Righting Arm at MaxRA | > | 1.00 | Ft | 5.72 P |
| (6) Absolute Angle at Equilibrium | < | 7.00 | deg | 1.98 P |
| (7) Angle from Equilibrium to Dk/margin Immersion | > | 0.00 | deg | 3.71 P |

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08/02/18 16:22:55          Elliott Bay Design Group
GHS 15.00              DOUBLE-ENDED AZIMUTH DRIVE FERRY

                          ***** Condition 4 *****
                        Departure Condition w/SLM
     ***** Damage Case 6: THRUSTER ROOM B & LAZARETTE B FLOODED *****

                      WEIGHT and DISPLACEMENT STATUS
        Baseline draft: 3.416 @ 93.50f, 4.955 @ 0.00, 6.495 @ 93.50a
                Trim: Aft 3.08/187.00,  Heel: Stbd 1.13 deg.
Part-------------------------------Weight(LT)----LCG-----TCG-----VCG-------FSM
WEIGHT                               544.53    0.07a   0.25s  10.13
               Load-----SpGr-----Weight(LT)----LCG-----TCG-----VCG
  Total Tanks--------->           --- Included in Fixed Weight ---      649.1*
  Total Weight-------->              544.53    0.07a   0.25s  10.13
                                  Displ(LT)----LCB-----TCB-----VCB------RefHt
HULL                     1.014       626.41    8.49a   0.75s   3.04      -4.95
BAL_B.S        Flooded   1.014       -19.67   55.29a  11.32s   4.36      -4.95
THRUST_B.C     Flooded   1.014       -56.74   64.66a   0.34s   3.82      -4.95
LAZ_B.C        Flooded   1.014        -5.44   83.13a   0.29s   4.79      -4.95
  Total Displacement--> 1.014       544.57    0.20a   0.41s   2.90
--------------------------------------------------------------------------------
         DISPLACEMENT EXCESS:          0.04
Distances in FEET.-----------------------------------------Moments in Ft-LT.
                                     +
    Note:  FSM values marked with an asterisk (*) are formal values which are
           not the same as the true values in the present condition.
                                     +

                                FREEBOARD STATUS
        Baseline draft: 3.416 @ 93.50f, 4.955 @ 0.00, 6.495 @ 93.50a
                Trim: Aft 3.08/187.00,  Heel: Stbd 1.13 deg.
                Least freeboard is 4.04 Ft located at 83.72a
     Least extra freeboard (to margin line) is 3.65 Ft located at 72.63a

                    HYDROSTATIC PROPERTIES with FLOODING
          Trim: Aft 3.08/187.00, Heel: Stbd 1.13 deg., VCG = 10.13

   LCF   Displacement   Buoyancy-Ctr.  Weight/          Moment/
  Draft----Weight(LT)----LCB-----VCB-----Inch-----LCF---In trim----GML-----GMT
  4.856       544.57    0.20a   2.90    12.35    6.01f   82.91   341.6   31.39
 Distances in FEET.-------Specific Gravity = 1.014.-----------Moment in Ft-LT.
                            Trim is per 187.00Ft
 Draft is from Baseline.                        Formal Free Surface included.

      Note:  GMT includes the formal free surface moment 649.1 Ft-LT
```

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GHS 15.00 DOUBLE-ENDED AZIMUTH DRIVE FERRY

**** Condition 4 ****
Departure Condition w/SLM
Damage Case 6: THRUSTER ROOM B & LAZARETTE B FLOODED
46 CFR 171.080(f) Damage Stability Criterion - Protected Waters

RESIDUAL RIGHTING ARMS vs HEEL ANGLE with FLOODING
Total CG: LCG = 0.07a TCG = 0.25s VCG = 10.13
Free Surface Adjustment: 1.19
Adjusted CG: LCG = 0.07a TCG = 0.25s VCG = 11.32

| Origin Depth | Degrees of Trim | Heel | Displacement Weight(LT) | Residual Arms in Trim | in Heel | Area | Flood Pt Height |
|---|---|---|---|---|---|---|---|
| 4.954 | 0.94a | 1.13s | 544.56 | 0.00 | 0.000 | 0.00 | 5.41(10) |
| 4.933 | 1.13a | 6.13s | 544.58 | 0.00 | 2.667 | 6.67 | 5.62(11) |
| 4.810 | 1.33a | 10.08s | 544.53 | 0.00 | 4.588 | 21.06 | Marg Imm. |
| 4.756 | 1.39a | 11.13s | 544.53 | 0.00 | 5.035 | 26.10 | 4.60(11) |
| 4.432 | 1.68a | 15.45s | 544.53 | 0.00 | 6.344 | 50.89 | 0.00(10) |
| 4.374 | 1.73a | 16.13s | 544.53 | 0.00 | 6.466 | 55.22 | 3.72(11) |
| 3.922 | 2.12a | 21.13s | 544.53 | 0.00 | 6.889 | 88.61 | 2.85(11) |
| 3.814 | 2.21a | 22.29s | 544.51 | 0.00 | 6.900 | 96.64 | 2.64(11) |
| 3.455 | 2.52a | 26.13s | 544.54 | 0.00 | 6.777 | 122.96 | 1.94(11) |
| 2.965 | 2.96a | 31.13s | 544.52 | 0.00 | 6.320 | 155.87 | 1.01(11) |
| 2.448 | 3.45a | 36.13s | 544.53 | 0.00 | 5.637 | 185.86 | 0.08(11) |
| 2.400 | 3.50a | 36.58s | 544.53 | 0.00 | 5.568 | 188.40 | -0.00(11) |
| 1.912 | 3.95a | 41.13s | 544.51 | 0.00 | 4.814 | 212.04 | -0.84(11) |
| 1.361 | 4.45a | 46.13s | 544.52 | 0.00 | 3.895 | 233.86 | -1.76(11) |
| 0.800 | 4.93a | 51.13s | 544.51 | 0.00 | 2.914 | 250.91 | -2.67(11) |
| 0.231 | 5.38a | 56.13s | 544.52 | 0.00 | 1.887 | 262.93 | -3.55(11) |
| -0.341 | 5.80a | 61.13s | 544.51 | 0.00 | 0.833 | 269.75 | -4.40(11) |
| -0.785 | 6.10a | 65.03s | 544.53 | 0.00 | 0.000 | 271.37 | -5.04(11) |
| -0.910 | 6.18a | 66.13s | 544.53 | 0.00 | -0.235 | 271.25 | -5.21(11) |

Distances in FEET.------Specific Gravity = 1.014.----------Area in Ft-Deg.

Note: No tank loads are present.

Note: The Residual Righting Arms shown above are in excess of the overturning arms derived from these moments (in Ft-LT):
Stbd heeling moment = 0.00

| Critical Points | | LCP | TCP | VCP |
|---|---|---|---|---|
| (10) | Thruster B Exhaust | TIGHT 66.00a | 18.90 | 11.83 |
| (11) | ER Air Intake | FLOOD 0.00 | 12.00 | 11.90 |

| LIM | 46 CFR 171.080-Passenger Vessels | | Min/Max | | Attained | |
|---|---|---|---|---|---|---|
| (1) | Angle from Equilibrium to RAzero | > | 10.00 | deg | 63.90 | P |
| (2) | Angle from Equilibrium to Flood | > | 10.00 | deg | 35.45 | P |
| (3) | Area from Equilibrium to Flood or RAzero | > | 2.82 | Ft-deg | 188.40 | P |
| (4) | Righting Arm at MaxRA | > | 1.00 | Ft | 6.90 | P |
| (6) | Absolute Angle at Equilibrium | < | 7.00 | deg | 1.13 | P |
| (7) | Angle from Equilibrium to Dk/margin Immersion | > | 0.00 | deg | 8.95 | P |