Naval Surface Warfare Center
Carderock Division
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Survivability, Structures, and Materials Department

Technical Report

Wave Impact Analysis and Results Obtained from a Segmented Model of the High-Speed Sealift Trimaran Model 5594

by

Christina Simone and Thomas F. Brady

DEPARTMENT OF THE NAVY

NAVAL SURFACE WARFARE CENTER, CARDEROCK DIVISION
9500 MACARTHUR BOULEVARD
WEST BETHESDA MD 20817-5700

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1. Reference (a) requested the Naval Surface Warfare Center, Carderock Division (NSWCCD) to collaborate with the High-Speed Sealift Innovation Cell to design, build, instrument and test a hydrodynamic loads model of a high-speed trimaran concept.

2. The results of the secondary loads analysis for wave impacts from this model are provided in enclosure (1) as summary tables of Weibull analyses with amplitude statistics. Data are also plotted by test condition to reveal significant trends. Testing was performed in a variety of irregular wave conditions in the Maneuvering and Seakeeping (MASK) basin and in the David Taylor Model Basin on Carriage 2. The model tests and measurements were performed cooperatively between the Structures and Composites Division and the Seakeeping Division. This report deals exclusively with the measurement and analysis of secondary loads on Model 5594, a 1:45-scale, five-segment, hydrodynamic loads model. Statistical analysis results are provided for measurements at eight hull girder shell locations and three foredeck locations with maximum wave impact and green sea loading measurements of 64 and 195 psi respectively.

2. Comments or questions may be referred to Mr. Thomas F. Brady, Code 653; telephone (301) 227-3962; e-mail, BradyTF@nswccd.navy.mil.

E. A. RASMUSSEN
By direction

Subj: HIGH-SPEED SEALIFT PROJECT TRIMARAN CONCEPT HYDRODYNAMIC LOADS MODEL TEST

Copy to:

Attn: OPNAV N42 (Johnathan Kaskin)
Chief of Naval Operations
2000 Navy Pentagon
Washington DC 20350-2000

Program Executive Officer Ships
1333 Isaac Hull Ave SE
Washington Navy Yard DC 20376-2101

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14. ABSTRACT
Hydrodynamic loads testing was completed on a segmented high-speed sealift (HSS) trimaran model, number 5594, scaled ratio 1:45, containing six shell sections connected using a calibrated backspline with instrumentation to measure primary and secondary hull girder loading. This test is an evaluation by the Navy of a notional structural design for a lightweight high-speed hull form in support of the High Speed Sealift Program. Irregular wave experiments have been completed to evaluate primary and secondary structural loads and seakeeping performance. This report documents the secondary structural loads data analysis for the irregular wave test series. Model testing was performed at the NSWC Harold Saunders Maneuvering and Seakeeping (MASK) facility in June 2002 and ended with irregular wave testing in July 2002 on Carriage Two of the David Taylor Model Basin. A cursory evaluation of Weibull analysis results and trends indicate that this is a viable design without excessive wave impact pressures. Maximum values from eight locations ranged from 13 to 64 psi. The utility of these results will be realized through comparisons with analytically based secondary load computations.

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Administrative Information

The work described in this report was performed by the Structures and Composites Division (Code 65) of the Survivability, Structures and Materials Department at the Naval Surface Warfare Center, Carderock Division (NSWCCD). The work was sponsored in FY02 by Naval Sea Systems Command under Program Element 0603564N, work unit number 1-2820-401. Program management was provided by John Offutt Expeditionary/Logistics/USMC Systems Department (Code 28), and the technical point of contact for this report is Colen Kennell (Code 242).

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Introduction

Hydrodynamic loads testing was completed on a segmented, high-speed sealift (HSS) trimaran model, number 5594, having a scaled ratio 1:45. The model was comprised of six shell sections connected using a calibrated backspline with instrumentation to measure primary and secondary hull girder loading. Table 1 contains both model and full-scale dimensional data. This test was an evaluation by the Navy of a notional structural design for a lightweight high-speed hull form in support of the High Speed Sealift Program. Irregular wave experiments have been completed to evaluate primary and secondary structural loads and seakeeping performance. This report documents the secondary structural loads data analysis for the irregular wave test series. Model testing was performed at the NSWC Harold Saunders Maneuvering and Seakeeping (MASK) facility in June 2002 and ended with irregular wave testing in July 2002 on Carriage 2 of the David Taylor Model Basin. Maximum wave impact pressures from eight hull girder shell locations ranged from 13 psi to 64 psi. The foredeck green sea loading events ranged from 42 to 195 psi in Sea State 5 at 45 knots. The utility of these results will be realized through comparisons and validations of analytically based secondary load computations.

Testing

The model tests and measurements were performed co-operatively between the Structures and Composites Division, Code 65 and the Seakeeping Division, Code 55. This report deals exclusively with the measurement and analysis of secondary wave impact loads. Results of the primary loads analysis can be found in Reference 1. Test data were obtained from Model 5594, a 1:45 scale five-segment hydrodynamic loads model. Test conditions were based on irregular wave conditions simulating random ocean seaways. Various conditions are required to obtain both primary and secondary loads data. The primary mission requirement placed on the HSS is to operate at 55 knots in 4-meter wave heights. This is a subset of the model test matrix which included other conditions necessary to define response in high sea states at low speeds, see Table 2. The test matrix represents the summary of all sea state, speed and heading combinations achieved from tests run in the MASK or on Carriage 2. Sea state is defined by the NATO based Northern Atlantic wave height parameters listed in Table 3. The extreme test conditions were chosen to maximize global loads and the likelihood of secondary loading on the bow and the outrigger cross structure.

Secondary Loads

Wave impact or secondary loads data were measured using pressure panels and pressure transducers. Pressure loads often govern the design of local structure at the bow, outrigger cross-structure, and transom. Pressure panels are calibrated with uniform static loads providing the means to convert measured dynamic responses to equivalent uniform static pressures acting on the entire surface of the panel. This calibration provides responses in a format beneficial to the designers who require static patch loads for sizing scantlings. Wave impact measurements require high sample rates and a specialized data collection system.

Pressure Panels

Pressure panels are fabricated from structurally scaled rigid polyvinyl chloride (PVC). They are installed in the shell of the model in areas expected to incur significant numbers of wave impacts. PVC panels are designed to have Froude-scaled, water-backed responses to an impact loading. PVC panels have the scaled stiffness properties of a plate panel bounded by stiffeners representing typical architecture. PVC panels are calibrated to provide a convenient uniform pressure measurement over a scaleable area. The rectangular area of each panel used for the HSS model measures one by two inches and scales to 45 by 90 inches for an area of 28 square feet. The panels shown in Figure 1 are instrumented with strain gages wired into a bridge configuration which produces an output voltage proportional to differential bending across the short axis of the panel; see Figure 2. Results of a typical pressure panel calibration are shown in Figure 3. Calibration is performed by placing a small box over the face of the pressure panel to achieve an airtight seal so that the volume inside the enclosed box can be pressurized, repeatedly, between zero and three pounds per square inch (psi). For more dynamic loading, the pressure panel is checked against the response of the pressure transducer (or pressure gauge) used in the calibration process, see Figure 4. Wave impact pressure scales as the model scale factor of 45. This places the maximum calibrated pressure at 135 psi. Details of panel design and Froude-scaling of wave impact pressures may be found in References 2 and 3.

PVC panels were installed on the port and starboard side shell centered at the intersection of Station 2 and the 4-meter waterline; see Figure 5. Other areas of the bow side shell were not instrumented because it was anticipated that the wave-piercing bow form would efficiently cut through waves reducing the incidence of large wave impacts. Three pressure panels, port and starboard, were also measured in the tunnel between the center hull and outriggers in the plane of the wet deck; see Figure 6 and Figure 7. Pressure loads on the transom were not measured because it was anticipated that the design of the transom would be driven by local loads associated with the water jets. A total of eight panels were installed in the model; see Table 4 for details.

Pressure Gauge

Large pressure transducers with a 0.75 inch diameter pressure sensitive surface (scales to 6.2 ft^2) were used for secondary loads measurements on the foredeck, see Figure 8. The transducer location used in the initial MASK tests were changed and optimized before the Carriage 2 tests. The new foredeck arrangements resulted from observations which revealed a shielding effect for surfaces forward of Station 2 caused by the wave piercing bow geometry. Water that would normally hit the foredeck tended to arc over the pressure transducer at Station 2. Areas of the foredeck between Stations 3 and 4 would see most of the heavy green sea loading. For the Carriage 2 tests, gages were relocated to cover the Station 3 and 4 areas. The analysis of foredeck transducer data was limited to the Carriage 2 test series. An example of a single Foredeck green sea loading event for all three transducer measurements is provided in Figure 9.

MASK testing results did not reveal significant wave impact events for the small pressure transducers located on the vertical leading edge of the cross structure. As a result, no analysis or results are presented for the port and starboard fascia pressure transducers.

The small pressure transducer at the Station 2 keel location did not measure significant bottom slamming events. This phenomena is explained by the high dead rise angle of the Station 2 cross section combined with a sharp keel allowing for smooth re-entry, see Figure 5.

Data Acquisition System

Three data sets were used to cover the variety of structural response sensors in the model. Global response channels from the instrumented beam of the center hull and PVC load cells were recorded to data files labeled slow. Analysis of slow data can be found in Reference 1. Local slam loads from pressure panels were recorded to data files labeled medium. Local wave impact or green sea loadings on the foredeck were recorded to data files labeled fast.

This report summarizes the results of analyzed medium and fast data files. The three data sets were collected from independent signal conditioning boxes using a single computer with three analog-to-digital (A-D) boards, storing the data in separate files. Medium speed wave impact data were collected from pressure panel instrumentation listed in Table 4. Pressure panels were digitized at 5,000 samples per second for 8 channels with a 12-bit A-D converter. Pressure transducer instrumentation listed in Table 5 was digitized at 20,000 samples per second for four channels with a 12-bit A-D converter.

The collection software starts each A-D board at virtually the same time so that time correlation between files is possible. To save weight in the model, all structural response sensors were completed and energized in the model using small 8-channel completion boxes. This arrangement reduced the number of wires emanating from the model to five flexible small multi-conductor cables. The completion boxes ran off a 24-Vdc power supply and were capable of supplying 10 Vdc and 3.33 Vdc excitation to the structural response sensors (strain gage bridges).

Weibull Analysis

Based on previous analyses and the findings in References 4 through 8, wave impact responses collected during the model test were assumed to fit a Weibull distribution. Once Weibull probability distribution parameters are determined, extrapolations can determine lifetime maximum values, provided a sufficient number of amplitudes are recorded for a given sea state, speed and relative heading. The general three-parameter Weibull cumulative distribution function may be expressed as follows:

$$P(x) = 1 - e^{-\left(\frac{x - x_o}{\theta - x_o}\right)^{\beta}} \qquad \text{Equation 1}$$

where,

χ	represents the data ($\chi \geq \chi_o$),
$P(\chi)$	represents the cumulative probability at x,
χ_o	is the positive threshold value below which there are no measurable impact data,
β	is Weibull shape parameter or slope, and
θ	is the characteristic value of impact pressure, corresponding to the value with a cumulative probability of 0.632.

Depending on the Weibull shape parameter, β, the distribution can be Exponential (β = 1.0), Rayleigh (β = 2.0), or approximate a normal distribution (β = 3.44), with many other distributions possible. The characteristic value, θ, occurs at the same cumulative probability (0.632) on every Weibull distribution, independent of slope. Estimates of the Weibull parameters may be obtained in a variety of ways; two in use currently are the linear regression and moment analysis methods.

Order Statistics / Linear Regression Method

The shape parameter, β, or slope can be determined from a linear regression of the best-fit line made through the data on a Weibull plot. This is accomplished by rearranging the distribution function in Equation 1 and taking the natural logarithm of both sides twice, resulting in the following equation.

$$\ln\ln\left(\frac{1}{1 - P(x)}\right) = \beta\ln(x - x_0) - \beta\ln(\theta - x_0) \qquad \text{Equation 2}$$

When plotted in log space, Equation 2 has the form of a straight line, $Y = BX+A$. By choosing $\ln(x\text{-}x_0)$ as X, the scale on the abscissa, and $\ln\ln\frac{1}{1-P(x)}$ as Y, the scale on the ordinate, the cumulative Weibull distribution can be represented as a straight line. The Weibull shape parameter, β, then becomes the slope, B, of the straight-line. Both the slope and intercept, A, are determined from the method of least squares. The characteristic value is then related to the coefficients of the straight-line fit in the equation below.

$$\ln(\theta - x_0) = -\left(\frac{A}{\beta}\right) \text{ Conversely, } (\theta - x_0) = e^{-\left(\frac{A}{\beta}\right)} \qquad \text{Equation 3}$$

Typically, the method of least squares is performed on an ordered set of impact data sorted from smallest to largest with a cumulative probability assigned to each X-value using the following equation.

$$P(x) = \frac{m}{n+1} \qquad \text{Equation 4}$$

where,

m is an ordered ranking term equal to 1,2,…n with,

n is the total number of wave impact data points.

Performing a Weibull analysis in this fashion is easy to implement within a spreadsheet. The threshold value, x_0, can be chosen through an iterative process so that the correlation coefficient of the linear regression analysis is maximized. Using this method, the threshold value, x_0, must be less than the smallest measured pressure. It is important to note that the estimates of the characteristic value do have the threshold value subtracted, and for this reason the characteristic value in Equation 3 is expressed as, $\theta - x_0$. Typical results of the Weibull analysis performed on impact pressures from the model test are shown graphically in Figure 10.

Data Analysis and Results

All of the wave impact data for the MASK test series were fitted to a three-parameter Weibull distribution with results listed in Table 6 through Table 13. The Carriage 2 Weibull analysis results are shown in Table 14 through Table 21. These tables include estimated Weibull parameters for slope or shape (β), characteristic value (θ) and threshold (x_0) for each sensor and test condition. Since the parameters are estimated in linearized Weibull space, the intercept and correlation are also provided. The Weibull parameters were also used to calculate a most probable maximum value (P_{max}) to compare with the maximum measured value. These tables also list slam rates and population statistics for the wave impact data. Analyzed data with correlations less than 0.97 are considered poor fits and the Weibull results should not be used. Also, results will be suspect for wave impact populations with fewer than 6 data points. Good and bad statistical results are included in the summary tables to demonstrate that relatively large populations sometimes have poor fits in Weibull space. The physical cause of a poor fit is seen for speed, sea state and heading combinations which produce many small local pressures some of which are near the resolution of the pressure panel measurement. Valid information can be gained from the data, but the data cannot be represented by the Weibull distribution. Furthermore, this type of data may not have value in determining design loads which are much greater in magnitude.

The largest measured wave impacts that occurred for the MASK and Carriage 2 test conditions are listed in Table 22 and Table 23. The largest wave impact pressures that occurred, by speed, heading, sea state and by pressure panel location, are summarized in Table 24 for the MASK tests and Table 25 for Carriage 2 tests. The MASK and Carriage 2 test series were reported separately to allow for comparison of similar test conditions for determining variability in test results. This comparison will be helpful when comparing analytical predictions with model test results.

To better understand the wave impact phenomena and identify trends which might develop in the data, a series of plots with trends are shown in Figure 11 through Figure 29. These plots also include discussions to annotate specific details of the trend.

As with pressure panel data, Weibull analyses were also performed on “green sea” loading data measured using an array of pressure transducers along the foredeck. The foredeck green sea loading phenomena is most prominent in head sea test conditions. For this reason, the Carriage 2 high-speed head sea tests conditions were used to develop the database for green sea loading. The Weibull analysis is summarized in Table 26 through Table 28.

During testing, technical problems developed with some of the sensors. As a result some data are considered bad and are omitted from analysis. Summary tables with blanks indicate a lack of impact data or a bad sensor. For completeness, summaries were produced listing when a particular pressure panel was considered *dead*; see Table 29 and Table 30.

Conclusions

Examination of the trending plots show that pressure generally increases with speed and sea state for most measurement locations. Additionally, wave impact rates also increase with speed, see Figure 30. Generally, oblique headings produce the largest wave impacts for the wet deck, with bow 60-degree relative heading seen most often in the summary tables. The “Starboard Cross Structure Forward” shows up most often as the location of maximum pressure based on speed, heading or sea state. The identical location port side also repeats as a location of maximum pressure. On the model, these pressure panels are located aft of the foam block that forms the leading edge of the cross structure near the entrance of the enclosed area between the center hull and outriggers, see Figure 6. This may be the location of the cross structure that “clips” waves as they pass between the hulls, attenuating any slam events that occur further aft on the cross structure. Based on sea state, speed or heading for any particular summary, the weather side measurements tend to produce slightly more of the maximum slam events than lee side measurements.

Trending of the Weibull shape parameter shows the most consistent behavior for the "Starboard Mid Cross Structure" pressure panel; see also Figure 31 through Figure 34 for individual summaries. In general, wave impact events are assumed to be exponentially distributed; that is, the Weibull shape parameter is one. Overall, the averaged Weibull analysis results for the MASK slam events have a shape parameter of 1.3, over a range from 0.4 to a maximum slightly over 5. For Carriage 2 testing, the average value of the shape parameter is 1.4, over a range from 0.4 to a maximum slightly over 3.6. These values were calculated for Weibull fits with correlations greater than 0.97 and populations with 6 or more slam events. The bow pressure panels tended to have the highest slam rates with a relatively high Weibull shape parameter.

The HSS hull form appears to be a viable design based on comparisons with available wave impact measurements made with other ships in severe test conditions; however, foredeck green sea loadings appear to be relatively high. Maximum observed values from eight hull girder pressure panel locations on the HSS ranged from 13 to 64 psi for all test conditions. Pressure transducers used to measure green sea loading on the foredeck produced values ranging from 42 psi to a maximum of 195 psi measured in Sea State 5 at 45 knots. Although these measurements are based on small diaphragm areas, it should be noted that the possibility exists for larger pressures since some untested condition could produce wave impact pressures greater than those summarized in this report. Furthermore, increased expose time will also increase the likelihood of larger events. The Weibull parameters documented in this report can be used to extrapolate lifetime maximum or extreme values using the expected operational profile for the ship.

For a ship of this large size, there are no direct high-speed comparisons. However, a generalized comparison between wet deck locations at low speed in high sea states can be made with that of a small water plane area twin hull (SWATH). The T-AGOS 19 SWATH model tests and full-scale trials documented maximum measured pressures of 50 and 53 psi, respectively, for the wet deck. For the HSS wet deck, a maximum low speed pressure of 57 psi was recorded for the wet deck in Hurricane Camille. The wet deck clearance of the T-AGOS 19 and the HSS model are both approximately 13 feet.

In Table 31 general characteristics are provided for other hull forms previously tested as models. The largest foredeck green sea loading event for each model type is listed by speed in Table 32. The maximum 55 knot test speed for the HSS model was more than twice the previous maximum speed of the listed model tests. This stark difference clearly shows the limit of what is known for secondary loading at high speed for large vessels. It appears that the wave piercing bow geometry does not limit green sea loading (shipping of water over the bow) allowing for increasing loads with increasing speed. The bulwarks of bow flare geometries appear to be beneficial, effectively reducing green sea loading as speed increases. It is not clear if bow flare would be beneficial at 45 knots as no high-speed data exist for bow flare geometries. All of the reported maximum measured values could easily be exceeded through extended exposure time or by some unknown combination of sea state, speed and heading. Critical to a design which incorporates a wave piercing geometry will be to use a bulwark, breakwater or shroud to eliminate large green sea loading events at high speeds under moderate sea conditions.

To make estimates of maximum lifetime wave impact pressures, the lifetime (years of service) and operational profile must be developed for the HSS hull form. The results show that high speed and moderate sea state combine to produce the largest wave impact pressures. Since the ship will spend most of its operational life at high speed in low to moderate seas, the measured maximum wet deck pressure panel value of 64 psi and foredeck pressure gauge maximum of 195 psi are likely to occur and possibly be exceeded over the life of the ship. Estimates of maximum lifetime wave impact pressure are useful and can be scaled to fit geosims of different displacements, providing useful comparisons with future analytically based secondary load predictions.

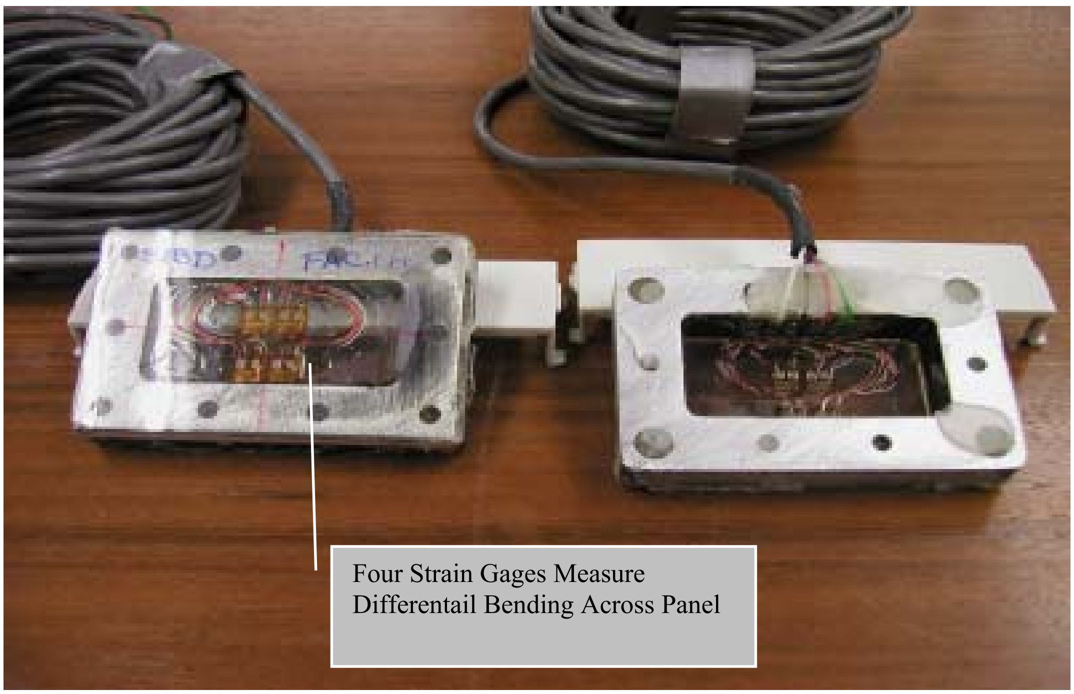


Figure 1. Instrumented Pressure Panel

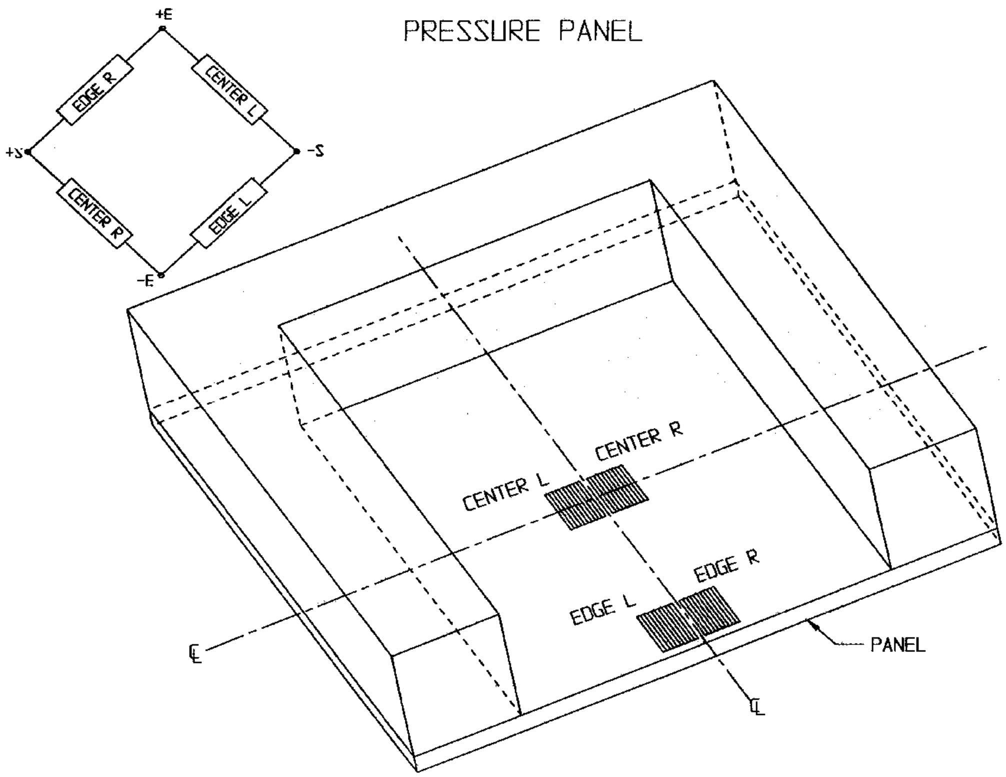


Figure 2. Pressure Panel Strain Gage Layout

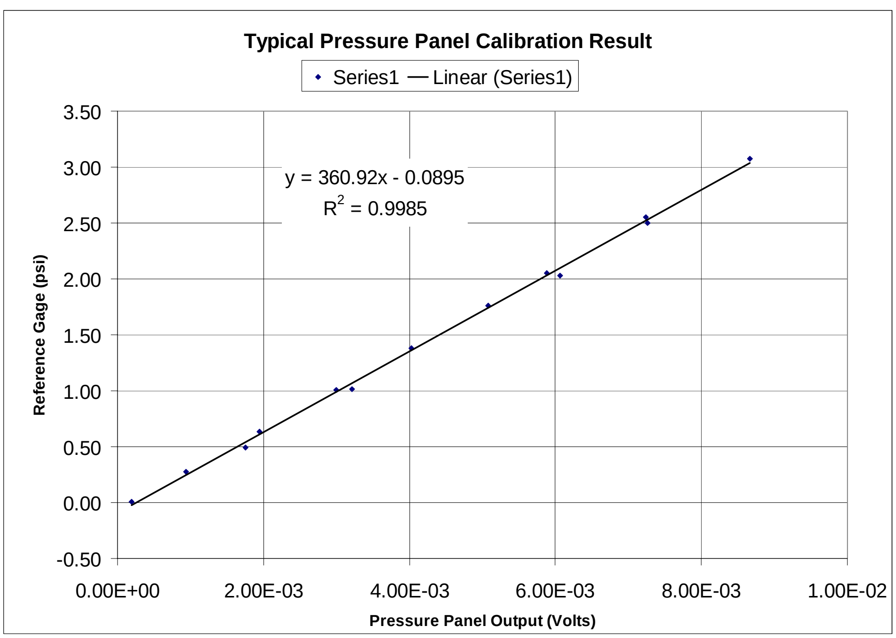


Figure 3. Results of Typical Calibration of PVC Pressure Panel Calibration

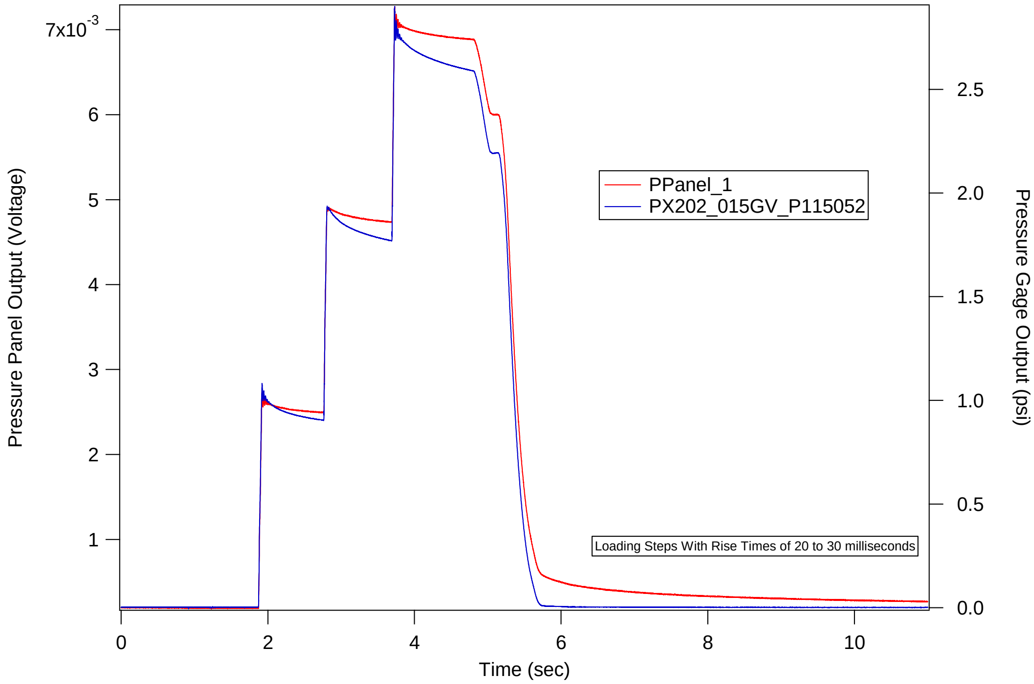


Figure 4. Pressure Panel and Pressure Transducer Dynamic Loading Comparison

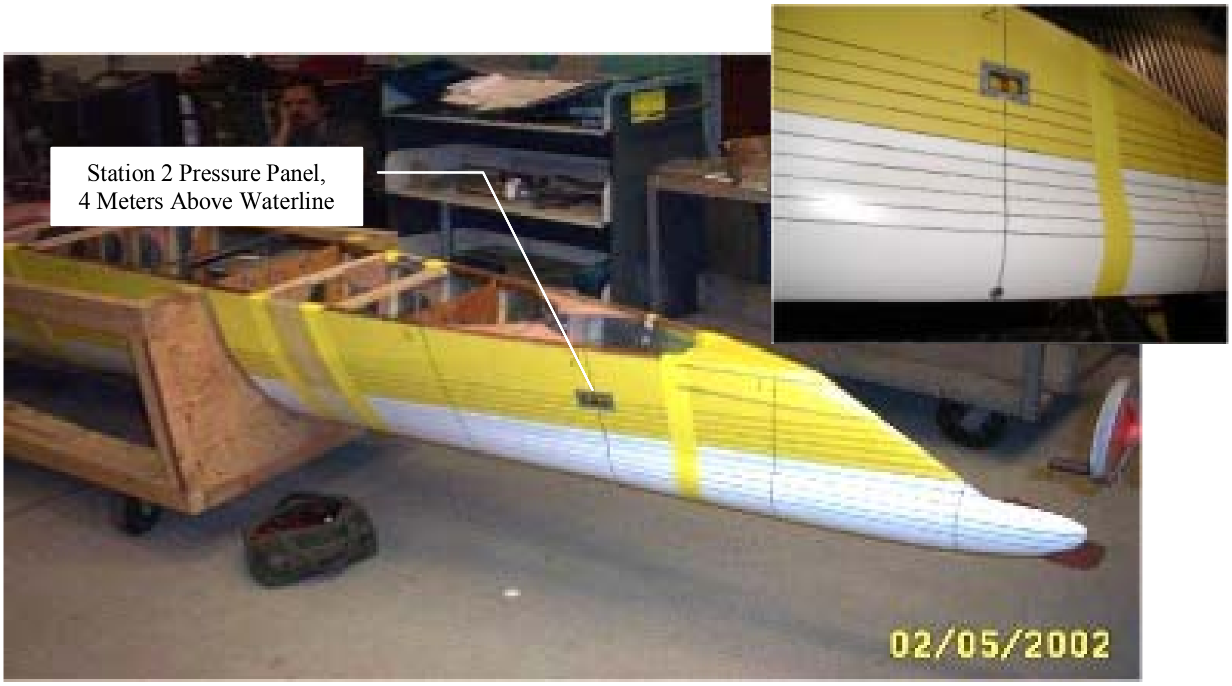


Figure 5. Starboard Bow View of Station 2 Pressure Panel and Keel Pressure Transducer

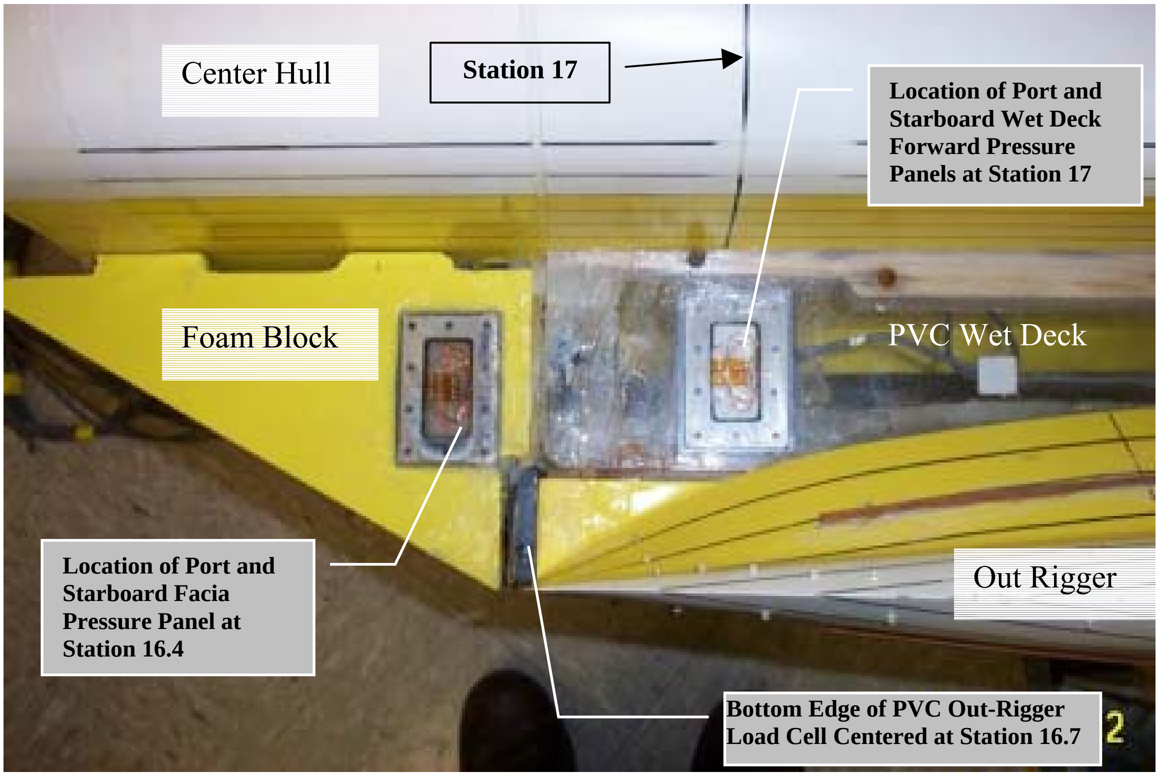


Figure 6. Underside View of Forward Wet Deck and Pressure Panel Arrangement

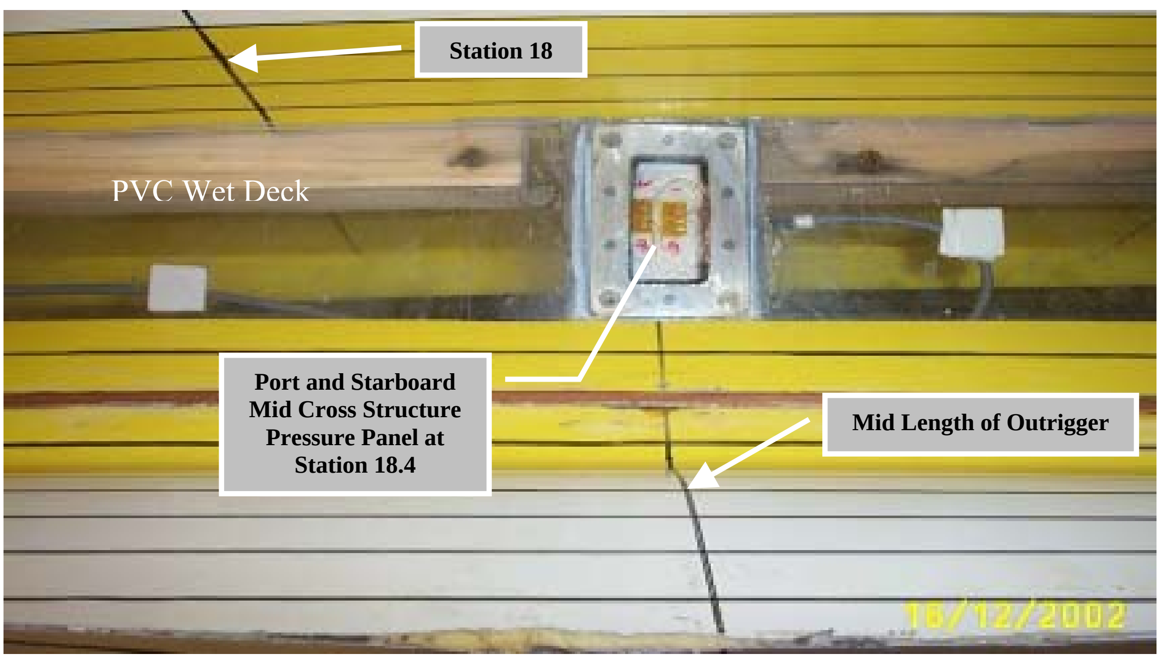


Figure 7. Underside Inboard Outer hull and Wet Deck at Mid Span with Pressure Panel Arrangement

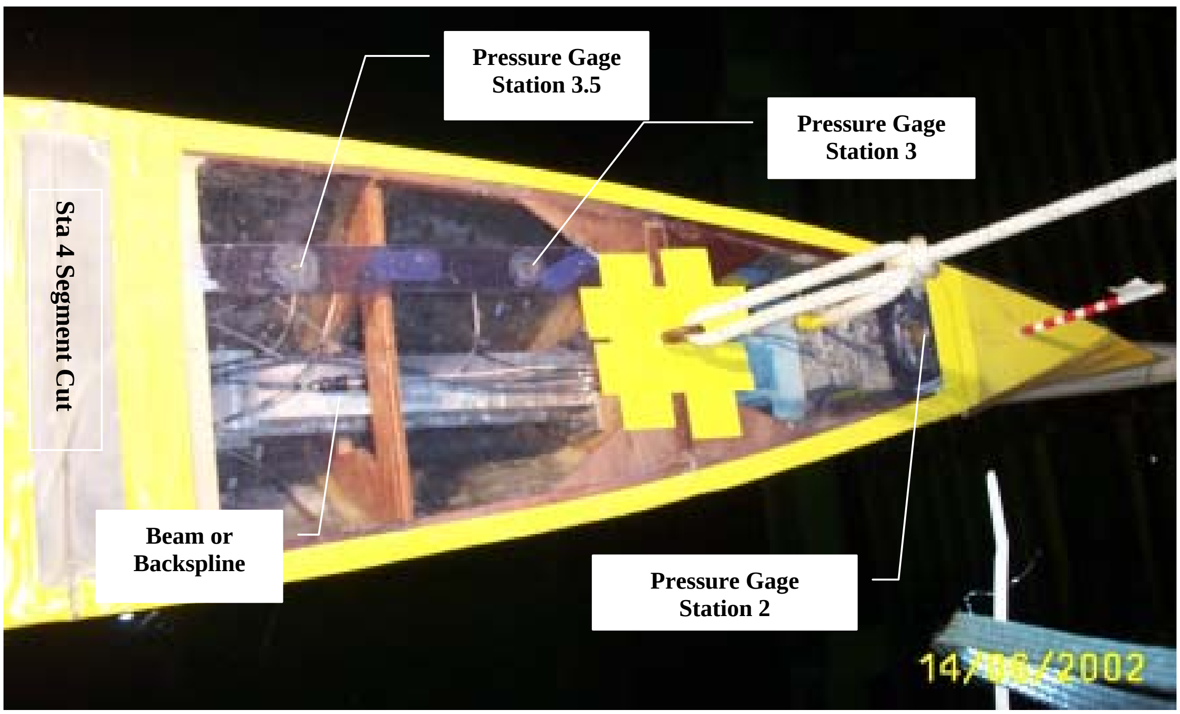


Figure 8. Pressure Gages on Foredeck Sta 2 Through Station 3.5

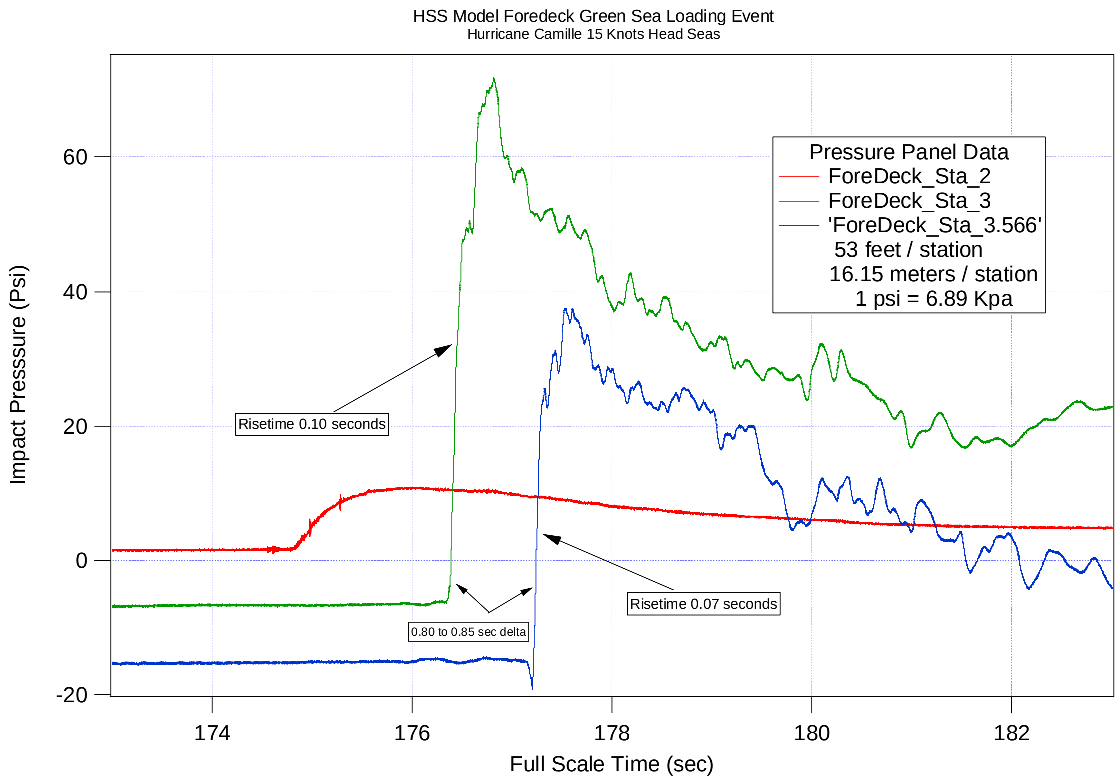


Figure 9. Foredeck Pressure Gage Green Sea Loading Event

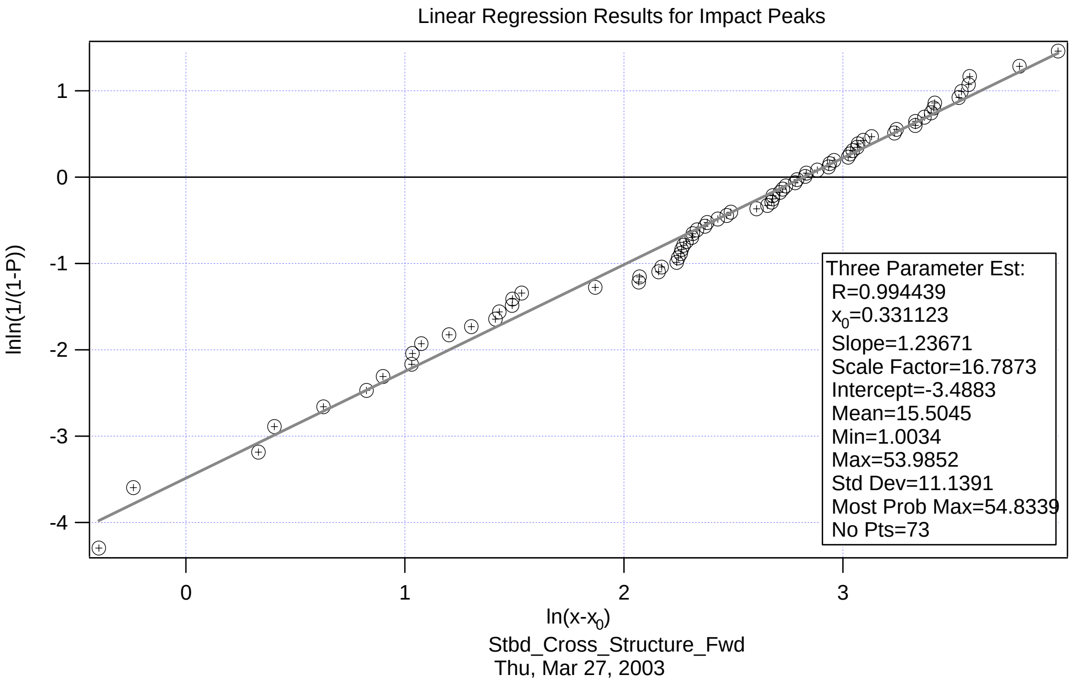


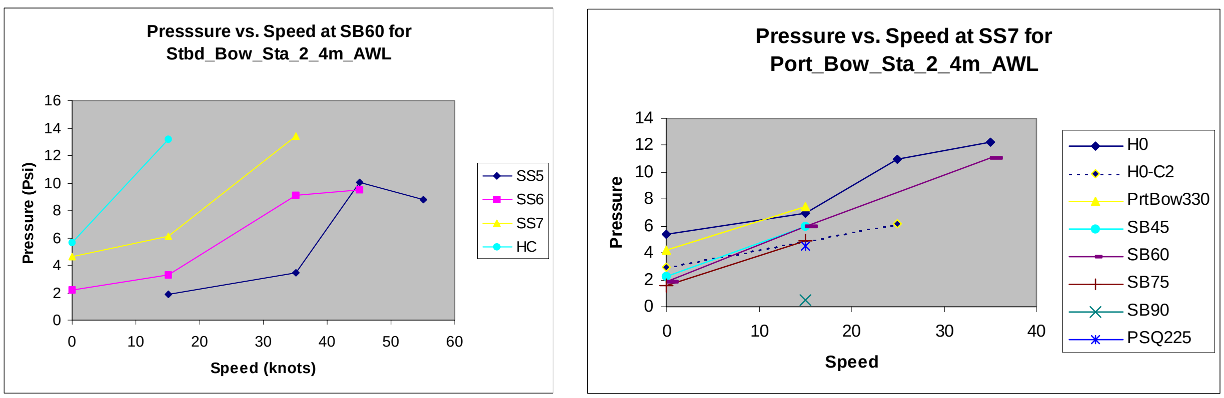
Figure 10. Typical Weibull Analysis Fitting Results

Trends for HSS model test (Pressure Panel Data)

In general, in any given sea state or at any heading, pressure increases with increasing speed (as seen in Figure 11). As sea state increases, pressure increases at any speed or heading (as seen in Figure 12).

Notes for Figure 11 through Figure 34:

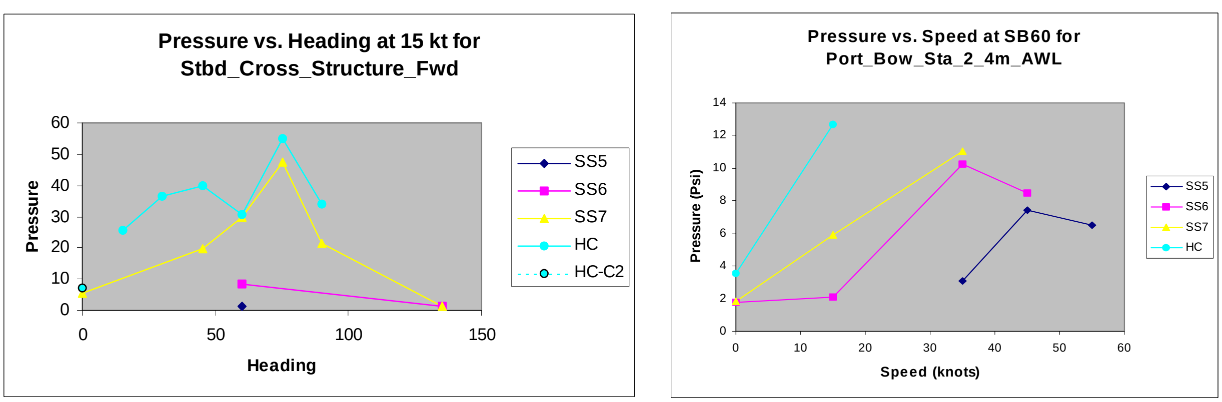
1. The head sea test condition is defined as zero degrees.
2. Speed is in knots.
3. Heading is in degrees.



a) At heading SB60 and various sea states for pressure panel Stbd_Bow_Sta_2_4m_AWL

b) At sea state 7 and various headings for pressure panel Port_Bow_Sta_2_4m_AWL

Figure 11. Pressure vs. Speed



a) Pressure vs. heading at speed 15 knots and various sea states for pressure panel Stbd_Cross_Structure_Fwd

b) Pressure vs. speed at heading SB60 and various sea states for pressure panel Port_Bow_Sta_2_4m_AWL

Figure 12. Pressure vs. Heading and Speed

Port Bow Sta 2 4m AWL

By Heading: At headings H0, PrtBow330, and SB60 as speed increases, pressure increases in all sea states. At heading SB75, pressure decreases or remains constant in sea state HC (Figure 13).

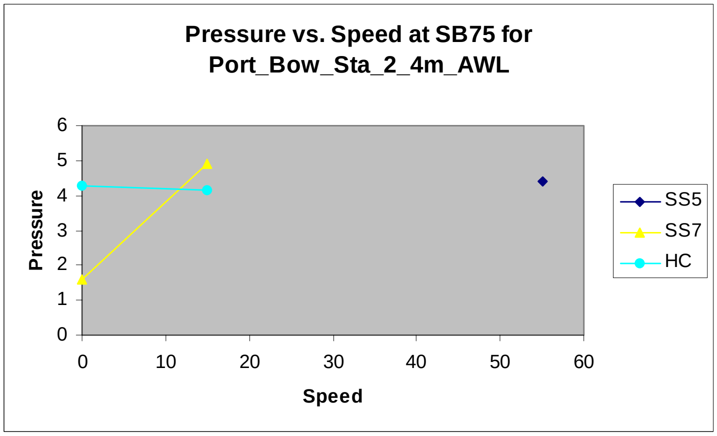


Figure 13. Pressure vs. Speed at Heading SB75 for Pressure Panel port_Bow_Sta_2_4m_AWL

By Sea State: At sea states 5, 6, and HC, pressure peaks at 15° and 60° relative headings. At sea state 7, pressure decreases as relative heading angle increases, with a trough at 90° (Figure 14). Please note that the head sea test condition is defined as zero degrees.

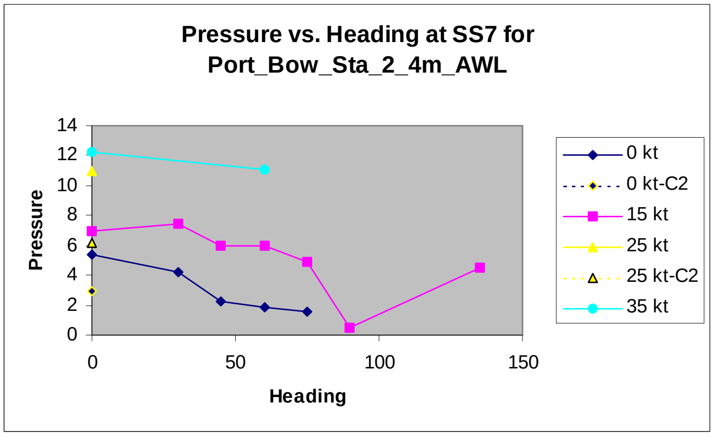
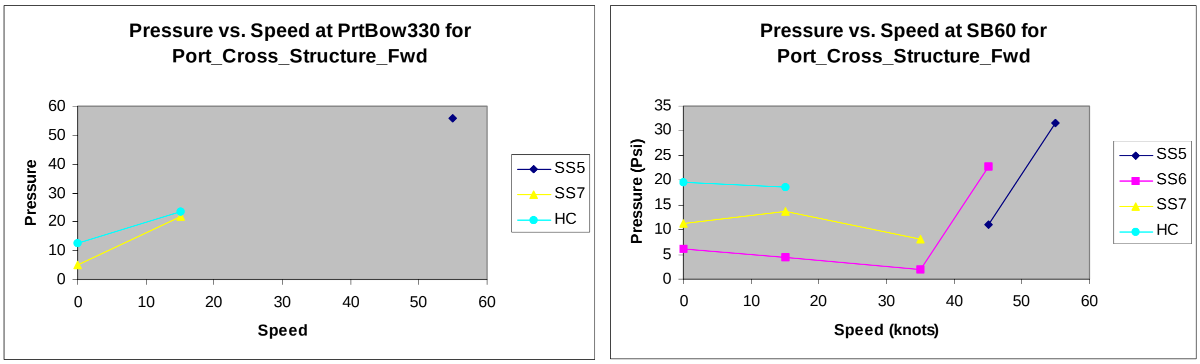


Figure 14. Pressure vs. Heading at Sea State 7 for Pressure Panel Port_Bow_Sta_2_4m_AWL

Port Cross Structure Fwd

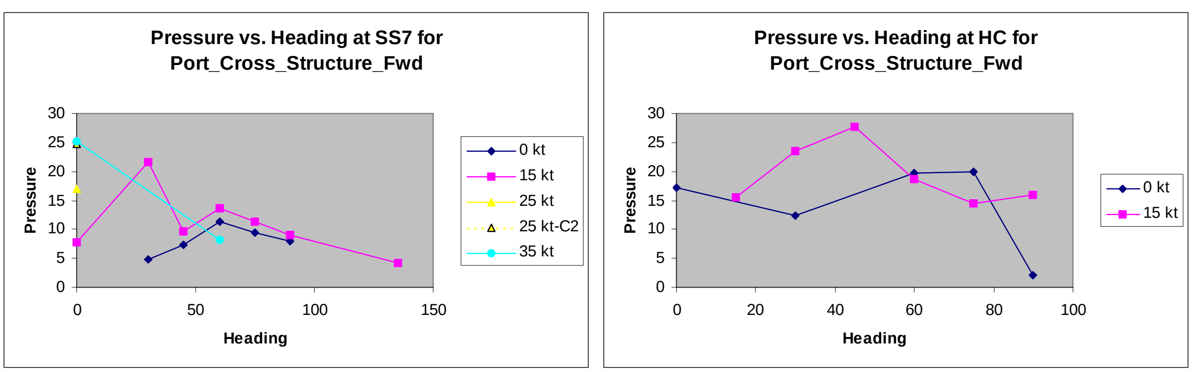
By Heading: At heading PrtBow330, pressure increases as speed increases in all sea states (Figure 15a). At headings H0, SB60 and SB75 as speed increases, pressure increases in all sea states except HC, where pressure decreases or remains constant (Figure 15b).



a) At heading PrtBow330 **b) At heading SB60**

Figure 15. Pressure vs. Speed for Pressure Panel Port_Cross_Structure_Fwd

By Sea State: At sea state 7, pressure peaks at 30° and 60° relative headings (Figure 16a). At sea state HC, pressure peaks at 75° at 0 knots and 45° at 15 knots (Figure 16b). There was not enough data for sea state 5 and the data at sea state 6 was inconsistent for drawing conclusions. Please note that the head sea test condition is defined as zero degrees.

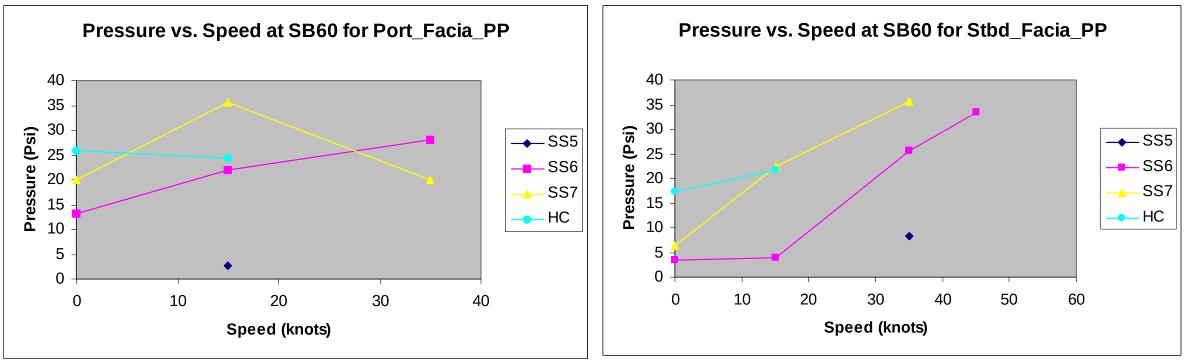


a) At sea state 7 **b) At sea state HC**

Figure 16. Pressure vs. heading for Pressure Panel Port_Cross_Structure_Fwd

Port Facia PP

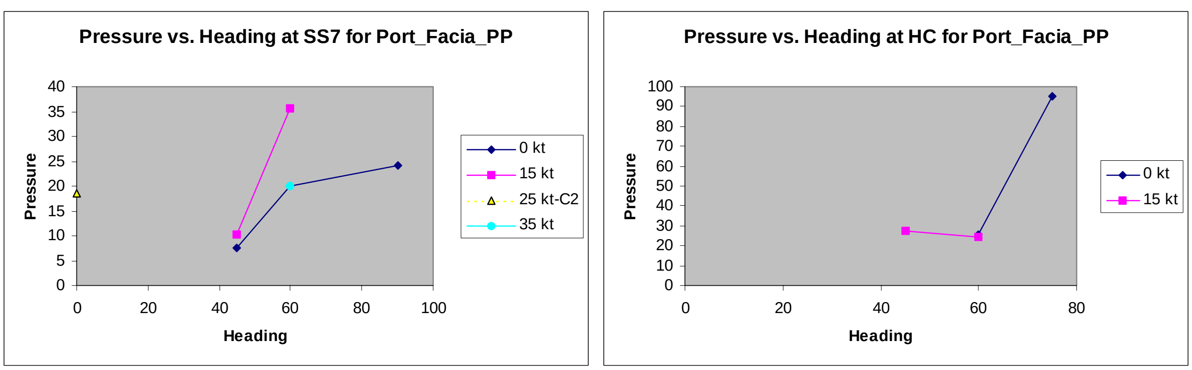
By Heading: At headings H0 and SB60, pressure decreases as speed increases in sea states 7 and HC. At heading SB60, pressure increases as speed increases in sea state 6 (Figure 17There was not enough data for headings PrtBow330 and SB75.



a) b)

Figure 17. Pressure vs. Speed for Port and Starboard Facia_PP at Heading SB60

By Sea State: At sea state 7, pressure peaks at 60° and 90° relative headings (Figure 18a). Pressure at sea state 6 also peaks at 60°. At sea state HC, pressure peaks at 75° (Figure 18b). There was not enough data for sea state 5. Please note that the head sea test condition is defined as zero degrees.



a) At sea state 7 b) At sea state HC

Figure 18. Pressure vs. Heading for Pressure Panel Port_Facia_PP

Port Mid Cross Structure

By Heading: At headings H0 and SB60, pressure increases as speed increases in all sea states (Figure 19). There was not enough data for headings PrtBow330 and SB75.

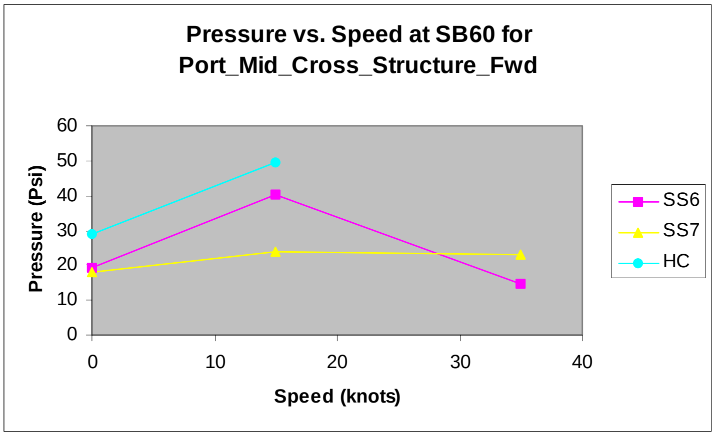


Figure 19. Pressure vs. Speed for Pressure Panel Port_Mid_Cross_Structure_Fwd at Heading SB60

By Sea State: No relevant data for plots.

Stbd Bow Sta 2 4m AWL

By Heading: At headings H0, PrtBow330, SB60 and SB75, as speed increases, pressure increases in all sea states (Figure 20).

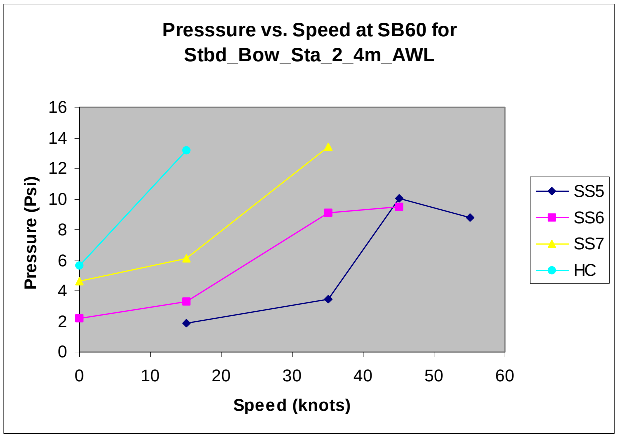
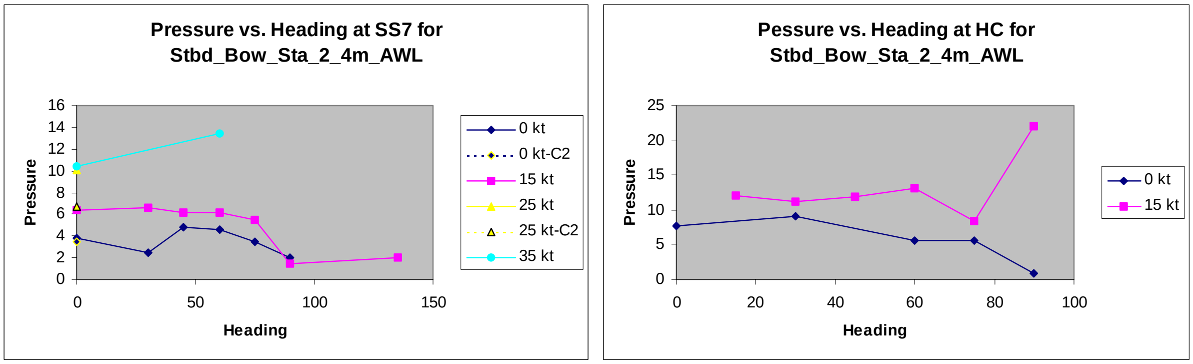


Figure 20. Pressure vs. Speed for Pressure Panel Stbd_Bow_Sta_2_4m_AWL at Heading SB60

By Sea State: At sea states 5 and 6, pressure peaks at 60°. At sea state 7, pressure decreases as relative heading angle increases at speeds below 35 knots and up to a heading of 90°. Above a heading of 90° pressure starts to rise again. At speeds of 35 knots pressure increases with increasing heading angle (Figure 21a). At sea state HC, pressure peaks at 60° at a speed of 15 knots. At 0 knots, pressure decreases as relative heading angle increases (Figure 21b). Please note that the head sea test condition is defined as zero degrees.



a) At sea state 7 **b) At sea state HC**

Figure 21. Pressure vs. Heading for Pressure Panel Stbd_Bow_Sta_2_4m_AWL

Stbd Cross Structure Fwd

By Heading: At headings H0, SB60, and SB75, pressure increases as speed increases in all sea states, except HC in heading H0, where pressure remains constant or increases gradually (Figure 22). There was not enough data for heading PrtBow330.

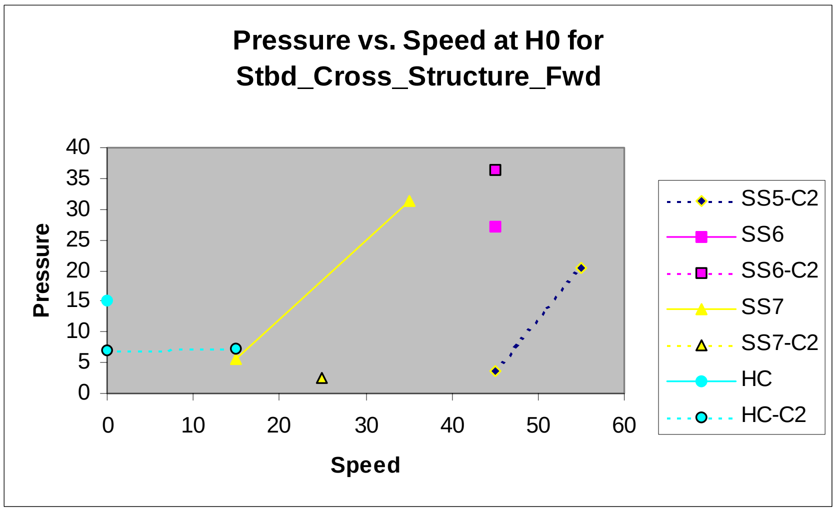
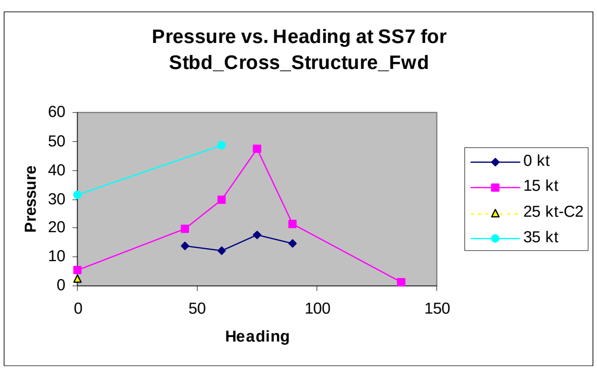
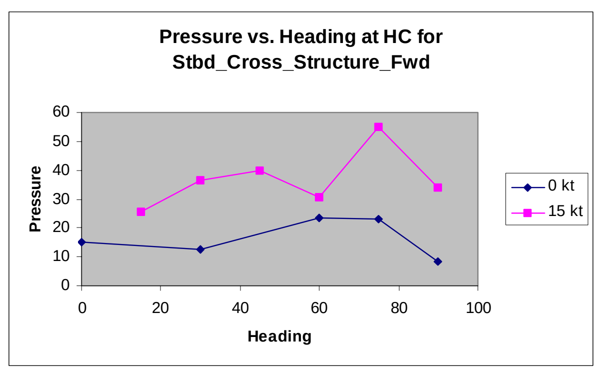


Figure 22. Pressure vs. speed for pressure panel Stbd_Cross_Structure_Fwd at heading H0

By Sea State: At sea states 5 and 6, pressure peaks at 60° relative headings. At sea state 7, pressure peaks at 60° and 75° relative headings (Figure 23a). At sea state HC, pressure peaks at 45° and 75° (Figure 23b). Please note that the head sea test condition is defined as zero degrees.



a) At sea state 7.



b) At sea state HC

Figure 23. Pressure vs. heading for pressure panel Stbd_Cross_Structure_Fwd

Stbd Facia PP

By Heading: At heading SB60, pressure increases as speed increases in all sea states (Figure 24). There was not enough data for H0, PrtBow330, and SB75.

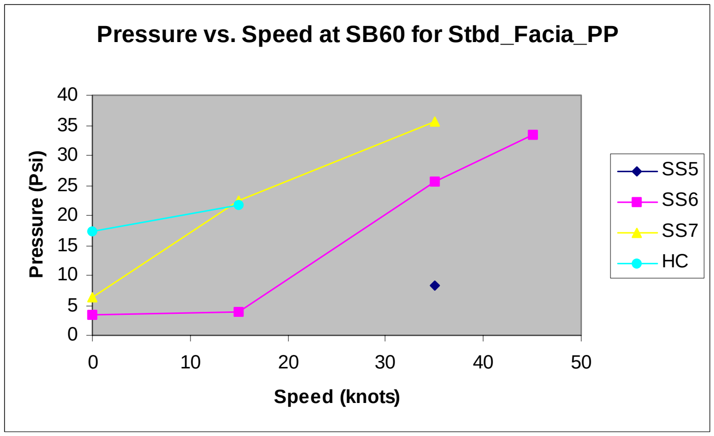
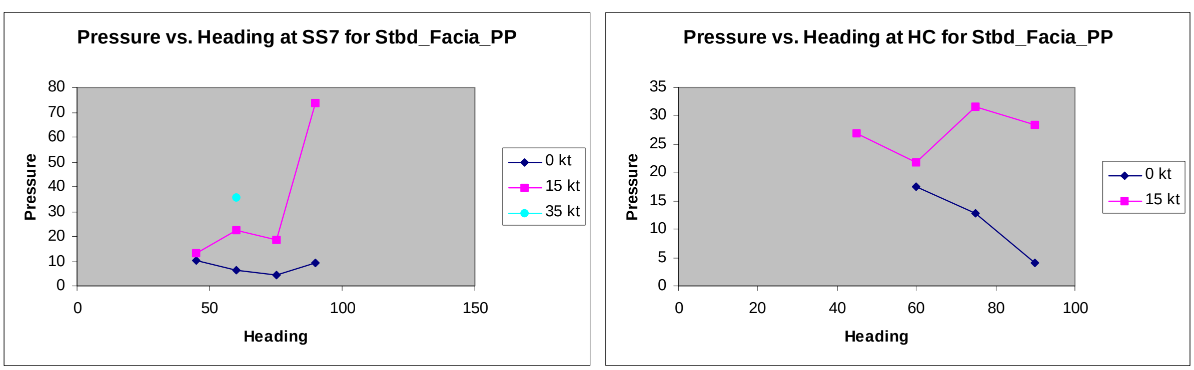


Figure 24. Pressure vs. Speed for Pressure Panel Stbd_Facia_PP at Heading SB60

By Sea State: At sea state 6, pressure peaks at 60°. At sea state 7, pressure peaks at 60° and 90° (Figure 25a). At sea state HC, pressure peaks at 45° and 75° at a speed of 15 knots. It seems that there is a peak at 60° at a speed of 0 knots, but there is no data before 60° (Figure 25b). There was not enough data for sea state 5. Please note that the head sea test condition is defined as zero degrees.

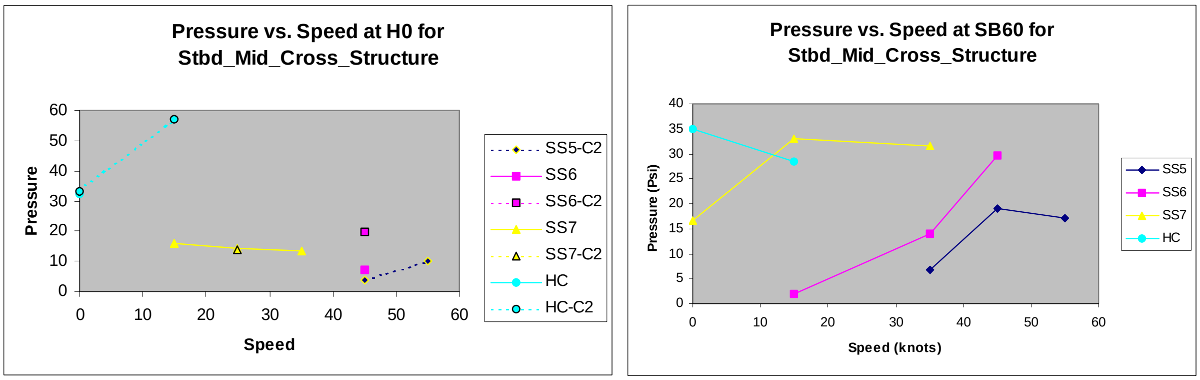


a) At sea state 7 **b) At sea state HC**

Figure 25. Pressure vs. Heading for Pressure Panel Stbd_Facia_PP

Stbd Mid Cross Structure

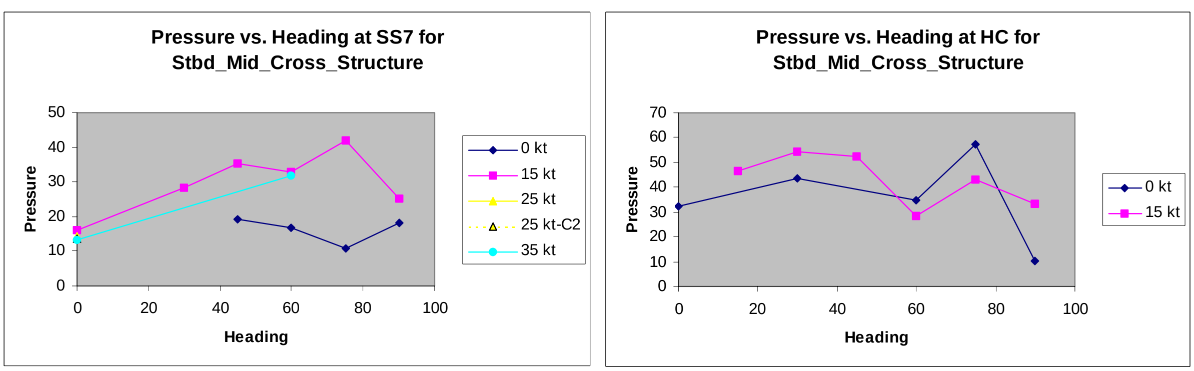
By Heading: At heading H0, pressure increases as speed increases in sea states 5 and HC but decreases in sea state 7 (Figure 26a). At heading PrtBow330, pressure increases as speed increases in sea state HC. At heading SB60, pressure increases as speed increases in all sea states but HC, in which it decreases (Figure 26b). At heading SB75, pressure increases as speed increases in sea state 7, but decreases in sea state HC.



a) At heading H0 **b) At heading SB60**

Figure 26. Pressure vs. Speed for Pressure Panel Stbd_Mid_Cross_Structure

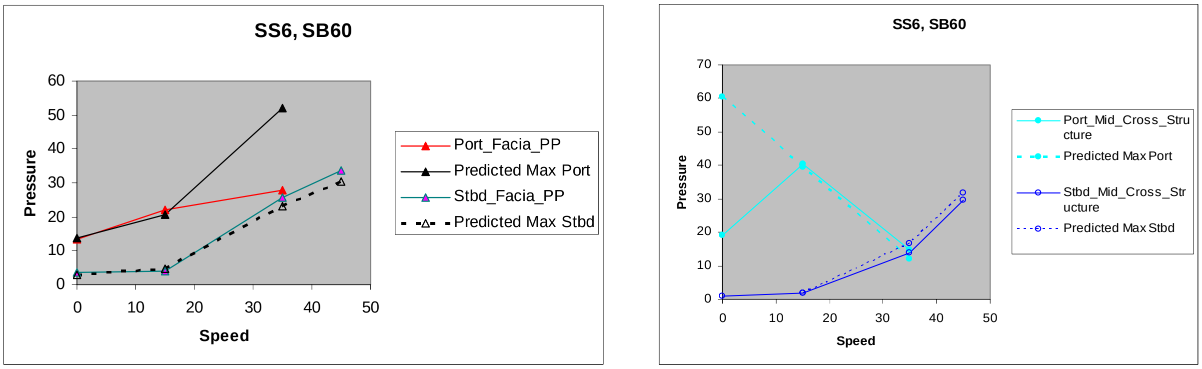
By Sea State: At sea states 5 and 6, pressure peaks at 60°. At sea state 7, pressure peaks at 45° and 75°at speeds of 15 knots and above. At a speed of 0 knots, there is a peak at 45° and 90° (Figure 27a). At sea state HC, pressure peaks at 30° and 75° (Figure 27b). Please note that the head sea test condition is defined as zero degrees.



a) At sea state 7 **b) At sea state HC**

Figure 27. Pressure vs. Heading for Pressure Panel Stbd_Mid_Cross_Structure

It is also noted that port pressures are greater at a port heading. The same holds true for starboard pressures at a starboard heading. One inconsistency found in starboard pressures is that Facia PP and Mid Cross Structure panel readings are not always higher than port pressures (Figure 28).

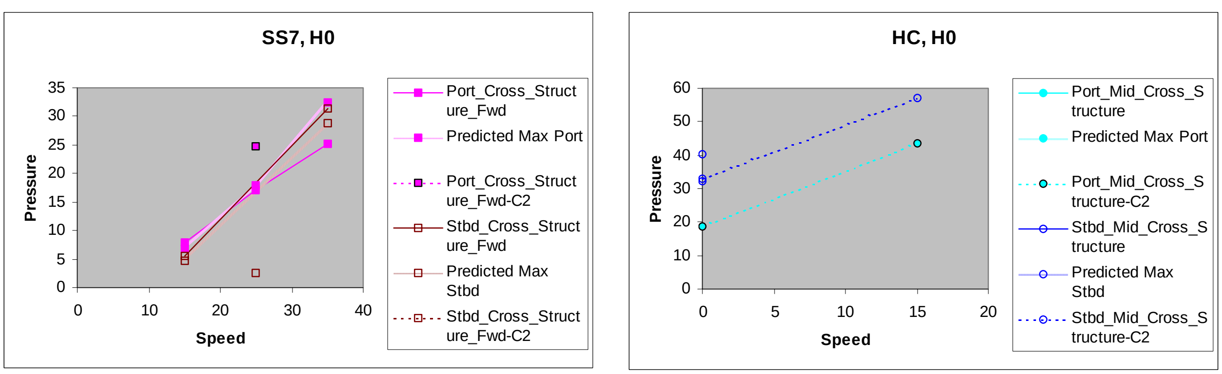


a) Port and Starboard Facia_PP pressure panels. Port pressures are greater than starboard pressures

b) Port and Starboard Mid_Cross_Structure pressure panels. Port pressures tend to be greater than starboard pressures

Figure 28. Pressure vs. speed at sea state 6 and heading SB60

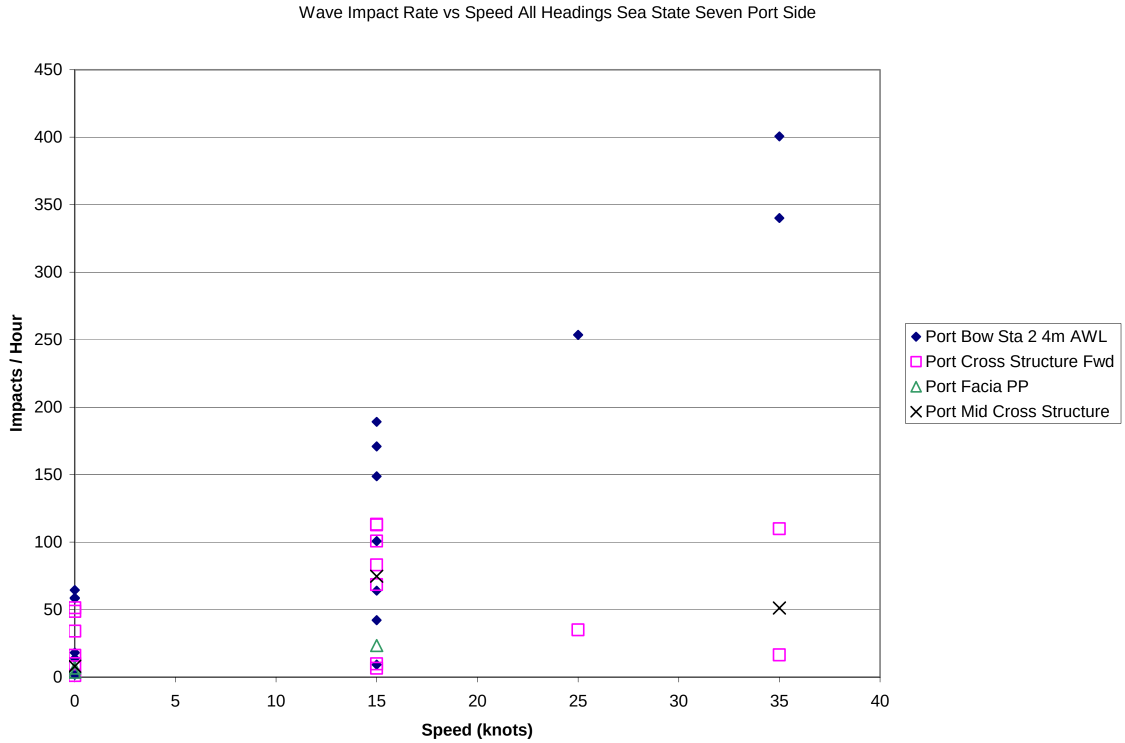
At zero heading, port pressures are generally greater than starboard pressures. However in sea state 7, port and starboard pressures cross in the Cross Structure Fwd panel readings (Figure 29a), and in sea state HC, starboard pressures are greater than port pressures in Mid Cross Structure panel readings (Figure 29b).



a) At sea state 7 port and starboard pressures crossin Cross_Structure_Fwd pressure panel readings

b) At sea state HC starboard pressures are greater than port pressures in Mid_Cross_Structure pressure

Figure 29. Pressure vs. Speed at Heading H0



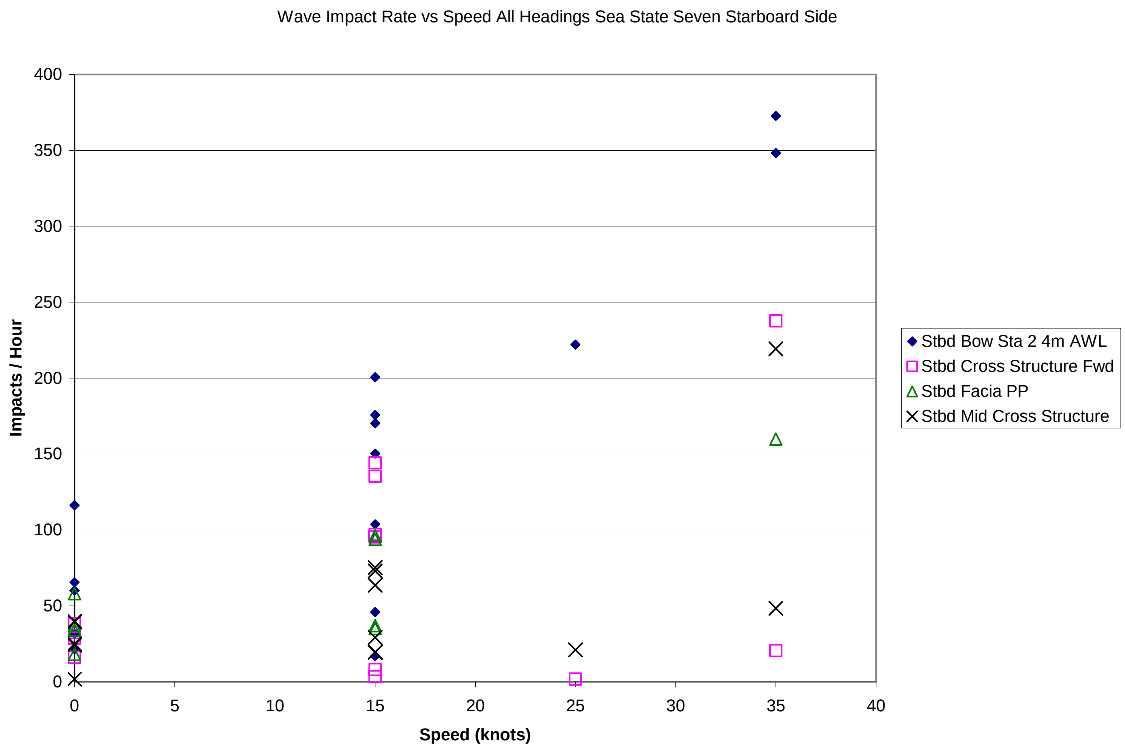


Figure 30. Effect of Speed on Hull Girder Pressure Panel Measurements

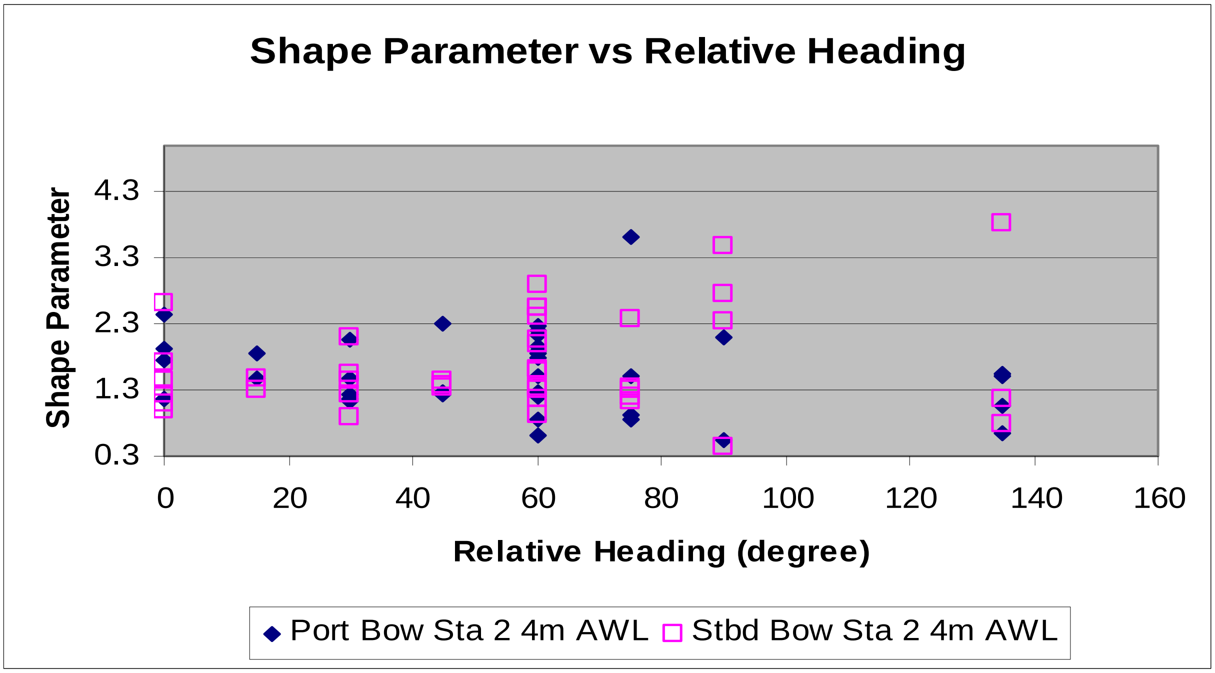


Figure 31. Trend of Weibull Shape Parameter Bow Sta 2 4m AWL

* Please note that the head sea test condition is defined as zero degrees.

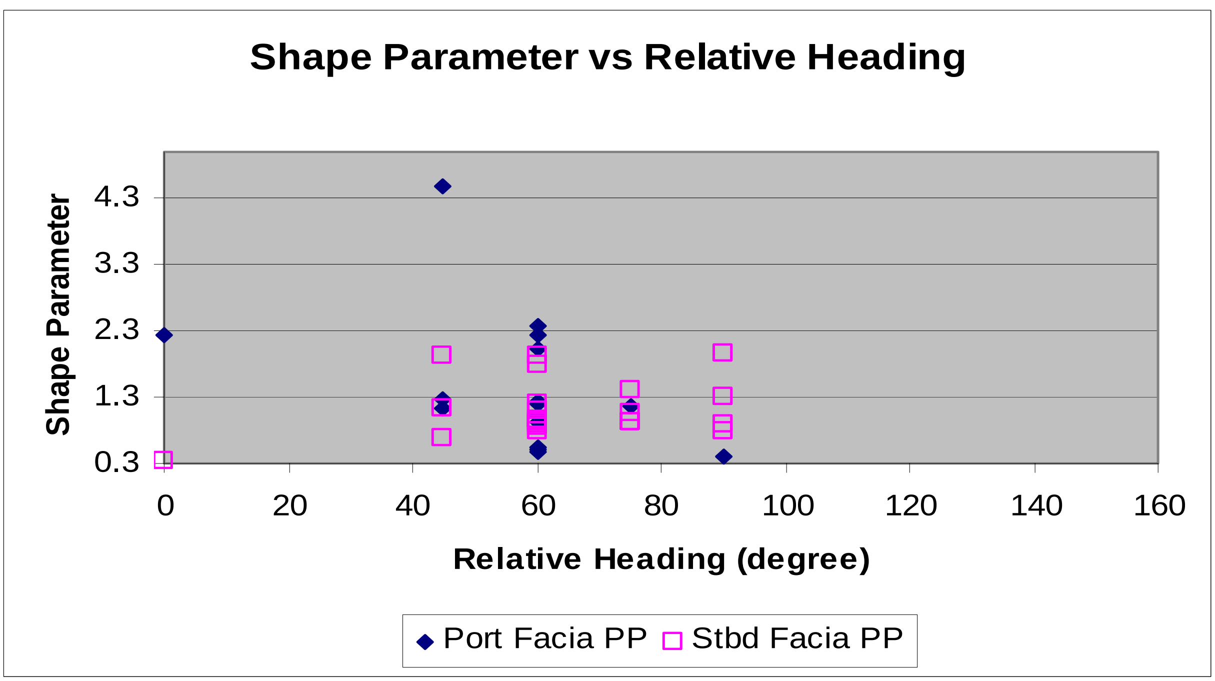


Figure 32. Trend of Weibull Shape Parameter Facia Cross Structure

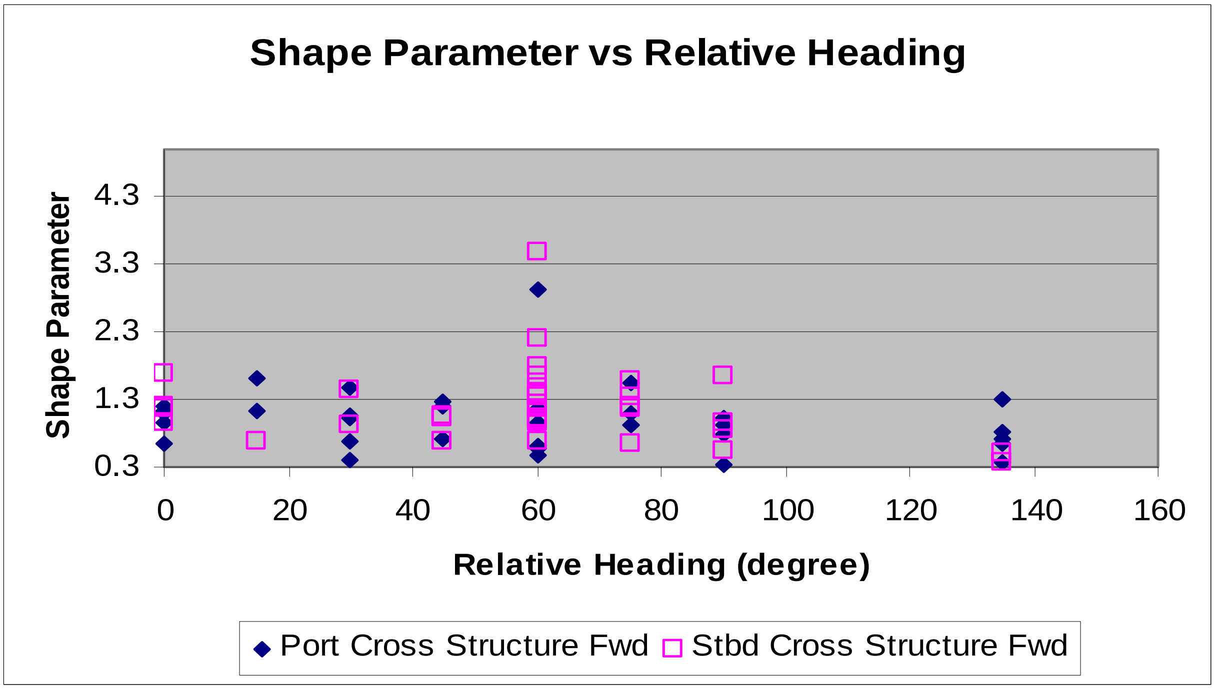


Figure 33. Trend of Weibull Shape Parameter Forward Cross Structure

* Please note that the head sea test condition is defined as zero degrees.

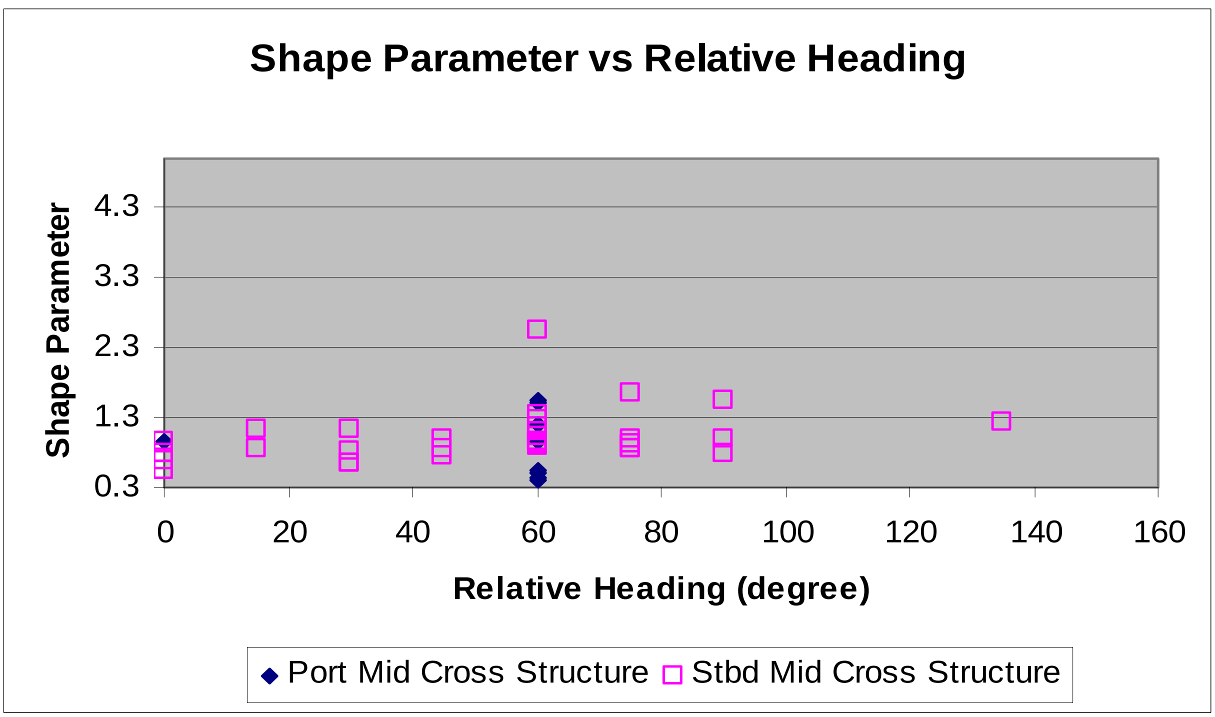


Figure 34. Trend of Weibull Shape Parameter Mid Cross Structure

Table 1. HSS General Ship Characteristics

Principal Dimension	Model Scale		Full Scale			
	US	unit	US	unit	Metric	unit
Length Center Hull (CH)	282.59	in	1059.7	feet	323	meters
Beam Center Hull Max	16.45	in	61.7	feet	18.8	meters
Length Side Hull (SH)	39.36	in	147.6	feet	45	meters
Beam Side Hull	2.61	in	9.8	feet	3	meters
Max Beam (CH+SH)	32.37	in	121.4	feet	37	meters
Draft (CH)	8.21	in	30.8	feet	9.4	meters
Depth (CH)	19.25	in	72.2	feet	22	meters
Draft (SH)	5.68	in	21.3	feet	6.5	meters
Depth (SH)	13.12	in	49.2	feet	15	meters
Displacement	532.27	pounds	21653	lton	22000	mtons
Cross Struc Depth	7.52	in	28.2	feet	8.59	meters
Cross Struc Clearence	5.60	in	21.0	feet	6.41	meters

Table 2. HSS Test Matrix of Completed Runs

Heading	Speed (knots)						
	0	15	25	35	45	50 *	55
0	6,7,HC	7, HC	7, HC	5, 6, 7	5, 6	4, 5	X
15	HC	HC	X	X	X	X	5
(PrtBow330) 30	7, HC	7, HC	X	X	X	X	5
45	7, HC	6, 7, HC	X	X	X	X	5
60	6, 7, HC	5, 6, 7, HC	X	5, 6, 7	5,6	X	5
75	7, HC	7, 8	X	X	X	X	5
90	7, HC	7, HC	X	X	X	X	X
(PSQ 225) 135	6	6, 7, 8	X	6	6	X	5
180	7, HC	7, HC	X	5	5	X	X

Note:

Head sea relative heading is defined as zero degrees, numbers in matrix denote sea state, where “HC” denotes Hurricane Camille or Sea State 8, and “X” denotes condition not tested.

Table 3. NATO Based Northern Atlantic Wave Height Probabilities

Sig Wav Ht (Meters)	Sig Wav Ht (feet)	Nato Sea State	Prob (%)	Range	Prob (%)
<1	<3.3	0-3	8.7	Low	0.78
1-2	3.3-6.6	4	19.2		
2-3	6.6-13.1	5	22		
3-4	9.8-13.1		15.7		
4-5	13.1-16.4	6	12.4		
5-6	16.4-19.7		8	Medium	0.209
6-7	19.7-23.0	7	5.2		
7-8	23.0-26.2		3.9		
8-9	26.2-29.5		2.5		
9-10	29.5-32.8	8	1.3		
10-11	32.8-36.1		0.7	High	0.011
11-12	36.1-39.4		0.4		
12-13	39.4-42.7		0		
13-14	42.7-45.9		0		
14-15	45.9-49.2	>8	0		
>15	>49.2		0		

Table 4. Medium Speed Pressure Panel Structural Data Channels

Measurement	Location	Station	Distance Aft From FP (feet)	Notes
Port Bow Sta 2 4m AWL	Center Hull Segment 1	2	103	Centered on the 4 meter water line or 12.8 feet above the surface of the water
Stbd Bow Sta 2 4m AWL	Center Hull Segment 1	2	103	Centered on the 4 meter water line or 12.8 feet above the surface of the water
Port Facia	Cross Structure	16.4	842	Approximately 13 feet above the waterline parallel to surface of water
Port Cross Structure Fwd	Cross Structure	17	873	Approximately 13 feet above the waterline parallel to surface of water
Port Mid Cross Structure	Cross Structure	18.4	945	Approximately 13 feet above the waterline parallel to surface of water
Stbd Facia	Cross Structure	16.4	842	Approximately 13 feet above the waterline parallel to surface of water
Stbd Cross Structure Fwd	Cross Structure	17	873	Approximately 13 feet above the waterline parallel to surface of water
Stbd Mid Cross Structure	Cross Structure	18.4	945	Approximately 13 feet above the waterline parallel to surface of water

Table 5. Fast Speed Pressure Transducer Structural Data Channels

Measurement	Center Hull Cut	Station	Distance Aft From FP (feet)	Notes
Keel Sta 2	Keel Segment 1	2	103	MASK Tests Only No Significant Keel slams measured
Port Facia	Cross Structure	16.4	842	MASK Tests Only No Reliable Measurements
Stbd Facia	Cross Structure	16.4	842	MASK Tests Only No Reliable Measurements
ForeDeck Sta 2	ForeDeck Segment 1	2	103	MASK and Carriage 2 Tests
ForeDeck Sta 3	ForeDeck Segment 1	3	154	Carriage 2 Tests Only
ForeDeck Sta 3.5	ForeDeck Segment 1	3.5	180	Carriage 2 Tests Only

Table 6. MASK Weibull Analysis Results Port Bow Sta 2 4m AWL

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15		0.6			1	1.5						
SB60	5	35	0.4	3.1	1.4	0.7	55	98.4	0.9871	1.86	-0.5527	0.3	1.3	3.1
SB60	5	45	0.5	7.4	2.5	1.1	199	370.8	0.9948	2.20	-1.9839	0.3	2.5	5.5
PrtBow330	5	55	0.4	4.8	2.2	1.0	157	492.7	0.9952	2.06	-1.7503	0.1	2.3	5.3
PrtBow345	5	55	0.6	10.6	2.2	1.1	143	401.8	0.9903	1.86	-1.1916	0.5	1.9	5.0
SB60	5	55	1.2	6.5	2.7	0.9	159	484.8	0.9950	1.95	-1.3109	1.0	2.0	5.5
SB75	5	55	1.2	4.4	2.7	0.7	20	466.7	0.9764	3.63	-4.0310	0.0	3.0	4.1
PSQ225	6	0	0.3	1.4	0.6	0.4	6	10.3	0.9926	0.65	0.6651	0.3	0.4	1.2
SB60	6	0	0.3	1.8	1.1	1.0	2	3.5						
PSQ225	6	15	0.7	3.2	1.7	0.7	13	13.8	0.9766	1.54	-0.6168	0.5	1.5	3.2
SB60	6	15	0.4	2.1	1.2	0.5	24	47.0	0.9909	2.28	-0.8102	0.0	1.4	2.4
PSQ225	6	35	0.6	4.4	1.6	0.8	30	39.6	0.9872	1.52	-0.4140	0.4	1.3	3.4
SB60	6	35	0.7	10.3	2.6	1.5	126	286.5	0.9927	1.50	-1.1586	0.6	2.2	6.8
H0	6	45	1.1	6.6	3.0	1.1	77	426.0	0.9900	2.43	-2.3698	0.6	2.7	5.5
PSQ225	6	45	0.5	0.7	0.6	0.1	4	102.2	0.9796	5.08	2.1134	0.0	0.7	0.7
SB60	6	45	0.9	8.5	3.6	1.5	254	415.6	0.9908	2.12	-2.5248	0.7	3.3	8.1
H0	7	0	0.4	5.4	1.6	1.1	52	58.7	0.9711	1.17	-0.2515	0.4	1.2	4.4
PrtBow330	7	0	0.6	4.2	1.9	1.0	35	58.3	0.9769	1.24	-0.6017	0.4	1.6	5.0
SB45	7	0	0.3	2.3	1.1	0.4	36	64.4	0.9924	2.30	-0.2093	0.1	1.1	2.0
SB60	7	0	0.5	1.8	1.1	0.5	9	18.0	0.9727	0.87	0.3164	0.5	0.7	2.2
SB75	7	0	1.1	1.6	1.4	0.2	6	13.9	0.9192	6.15	-2.4221	0.0	1.5	1.6
SB90	7	0		1.0			1	1.7						
H0	7	15	0.5	7.0	2.5	1.5	106	170.8	0.9861	1.15	-0.8877	0.5	2.2	8.7
PrtBow330	7	15	0.7	7.5	2.5	1.4	117	189.1	0.9940	1.13	-0.8424	0.6	2.1	9.0
PSQ225	7	15	0.5	4.5	1.6	1.0	39	64.0	0.9925	1.06	-0.1901	0.5	1.2	4.6
SB45	7	15	0.6	6.0	2.0	1.0	89	148.8	0.9946	1.22	-0.5334	0.6	1.5	5.8
SB60	7	15	0.6	5.9	1.7	0.9	58	100.7	0.9931	1.27	-0.2548	0.6	1.2	4.3
SB75	7	15	0.4	4.9	1.2	0.8	28	42.1	0.9576	1.50	-0.1384	0.2	1.1	2.7
SB90	7	15	0.3	0.5	0.4	0.1	6	9.2	0.9468	0.55	1.5694	0.3	0.1	0.5
H0	7	25	0.3	11.0	3.0	1.9	145	253.5	0.9922	1.75	-2.0344	0.2	3.2	8.1
H0	7	35	0.7	12.2	4.2	2.1	215	400.6	0.9953	1.92	-2.7567	0.5	4.2	10.6
SB60	7	35	0.8	11.0	3.4	1.8	166	340.0	0.9852	1.89	-2.1254	0.7	3.1	7.9
H0	HC	0	0.6	7.7	2.7	1.7	83	144.2	0.9960	1.16	-0.9951	0.5	2.4	9.0
PrtBow330	HC	0	0.5	8.3	2.9	1.7	84	153.3	0.9851	1.16	-1.1722	0.5	2.7	10.4
SB60	HC	0	0.4	3.6	1.3	0.7	23	35.4	0.9778	1.77	-0.3845	0.2	1.2	2.5
SB75	HC	0	0.7	4.3	1.4	0.9	14	23.9	0.9761	0.85	0.1924	0.7	0.8	3.2
SB90	HC	0					0							
PrtBow330	HC	15	0.8	11.4	4.6	2.6	173	283.9	0.9951	1.47	-2.1509	0.7	4.3	13.9
PrtBow345	HC	15	0.6	13.5	3.7	2.3	169	253.3	0.9974	1.46	-1.8503	0.5	3.6	11.4
SB45	HC	15	0.6	12.9	4.3	2.8	152	250.2	0.9970	1.28	-1.8224	0.5	4.1	15.1
SB60	HC	15	0.5	12.7	2.9	2.0	82	170.6	0.9937	1.20	-1.1600	0.5	2.6	9.4
SB75	HC	15	0.7	4.2	1.6	0.9	42	76.1	0.9931	0.92	0.1389	0.7	0.9	4.3
SB90	HC	15	0.4	1.3	0.8	0.3	12	19.2	0.9767	2.10	0.5285	0.1	0.8	1.3

Table 7. MASK Weibull Analysis Results Starboard Bow Sta 2 4m AWL

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15	0.7	1.9	1.2	0.3	16	24.6	0.9893	1.61	0.6804	0.6	0.7	1.8
SB60	5	35	0.6	3.5	1.8	0.7	80	143.1	0.9968	2.56	-1.6076	0.2	1.9	3.5
SB60	5	45	0.4	10.1	2.9	1.2	195	363.4	0.9763	2.91	-3.4416	0.0	3.3	5.8
PrtBow330	5	55	0.4	4.4	2.3	0.9	106	332.7	0.9721	2.11	-2.0649	0.0	2.7	5.5
PrtBow345	5	55	0.7	4.6	2.2	1.0	84	236.0	0.9870	1.47	-0.9373	0.5	1.9	5.7
SB60	5	55	1.1	8.8	3.4	1.2	142	433.0	0.9920	2.41	-2.6404	0.8	3.0	6.6
SB75	5	55	1.2	6.6	3.3	1.3	18	420.0	0.9815	2.37	-2.9359	0.3	3.5	5.7
PSQ225	6	0	0.5	0.8	0.6	0.1	5	8.6	0.9903	5.42	2.0336	0.0	0.7	0.8
SB60	6	0	0.5	2.2	1.3	0.5	17	29.8	0.9911	2.53	-0.9958	0.0	1.5	2.3
PSQ225	6	15	1.1	2.1	1.7	0.4	8	8.5	0.9611	3.83	-2.4480	0.0	1.9	2.3
SB60	6	15	0.5	3.3	1.4	0.5	56	109.7	0.9930	2.00	-0.2909	0.4	1.2	2.7
PSQ225	6	35	0.5	2.3	1.1	0.6	15	19.8	0.9763	0.77	0.3305	0.5	0.7	2.8
SB60	6	35	0.7	9.1	2.8	1.5	127	288.8	0.9914	1.59	-1.4258	0.6	2.5	7.2
H0	6	45	1.2	6.4	2.9	0.9	73	403.9	0.9738	2.62	-2.1876	0.8	2.3	4.9
PSQ225	6	45	1.1	1.2	1.1	0.1	2	51.1	1.0000	10.06	-1.4522	0.0	1.2	1.1
SB60	6	45	1.3	9.5	4.0	1.5	248	405.8	0.9925	2.06	-2.3558	1.2	3.1	8.4
H0	7	0	0.5	3.8	1.5	0.9	58	65.5	0.9951	1.23	-0.1667	0.5	1.1	4.0
PrtBow330	7	0	0.6	2.5	1.3	0.6	19	31.7	0.9847	0.88	0.2910	0.6	0.7	3.0
SB45	7	0	0.6	4.9	2.0	1.0	65	116.3	0.9975	1.34	-0.6410	0.5	1.6	5.2
SB60	7	0	0.4	4.6	1.6	1.0	30	60.1	0.9689	1.30	-0.4768	0.3	1.4	4.0
SB75	7	0	0.4	3.5	1.5	0.9	26	60.1	0.9953	1.30	-0.4019	0.3	1.4	3.7
SB90	7	0	0.7	2.0	1.3	0.4	13	21.5	0.9943	2.32	-0.1324	0.3	1.1	1.9
H0	7	15	0.6	6.4	2.3	1.5	109	175.7	0.9910	1.00	-0.6008	0.6	1.8	9.2
PrtBow330	7	15	0.6	6.5	2.2	1.2	93	150.3	0.9960	1.25	-0.7937	0.5	1.9	6.9
PSQ225	7	15	0.6	2.0	1.1	0.4	28	46.0	0.9960	1.18	0.6562	0.6	0.6	2.2
SB45	7	15	0.5	6.1	2.3	1.3	120	200.6	0.9959	1.38	-0.9250	0.5	2.0	6.6
SB60	7	15	0.6	6.1	2.2	1.3	98	170.2	0.9968	1.33	-0.7986	0.5	1.8	6.2
SB75	7	15	0.5	5.5	1.6	0.9	69	103.7	0.9950	1.20	-0.2188	0.5	1.2	4.5
SB90	7	15	0.5	1.4	1.0	0.3	11	16.9	0.9829	2.77	-0.2096	0.0	1.1	1.5
H0	7	25	0.9	10.1	3.1	1.7	127	222.0	0.9972	1.46	-1.4290	0.7	2.7	8.6
H0	7	35	1.4	10.4	4.3	1.9	200	372.7	0.9979	1.72	-2.1622	1.2	3.5	10.5
SB60	7	35	1.1	13.4	3.5	1.7	170	348.2	0.9948	1.60	-1.6125	1.0	2.7	8.6
H0	HC	0	0.5	7.7	2.5	1.6	79	137.2	0.9969	1.11	-0.8389	0.5	2.1	8.6
PrtBow330	HC	0	0.6	9.0	2.4	1.4	65	118.7	0.9857	1.56	-1.2601	0.4	2.2	6.0
SB60	HC	0	0.6	5.6	2.3	1.4	78	119.9	0.9907	0.93	-0.5112	0.6	1.7	9.1
SB75	HC	0	0.4	5.6	1.8	1.2	56	95.7	0.9871	1.35	-0.6447	0.4	1.6	4.9
SB90	HC	0	0.6	0.8	0.7	0.1	2	25.0	1.0000	3.46	0.7142	0.0	0.8	0.7
PrtBow330	HC	15	0.6	11.2	3.7	2.2	164	269.2	0.9977	1.45	-1.8512	0.5	3.6	11.6
PrtBow345	HC	15	0.6	12.1	3.4	2.1	159	238.3	0.9970	1.29	-1.4354	0.6	3.0	11.2
SB45	HC	15	0.7	11.8	4.7	2.7	167	274.9	0.9954	1.45	-2.2288	0.5	4.7	14.9
SB60	HC	15	0.6	13.2	3.5	2.6	111	230.9	0.9966	1.18	-1.3799	0.5	3.2	12.5
SB75	HC	15	0.6	8.3	2.3	1.6	82	148.7	0.9912	1.12	-0.6247	0.6	1.7	7.1
SB90	HC	15	0.7	22.1	3.5	6.1	12	19.2	0.9831	0.45	-0.1212	0.7	1.3	10.4

Table 8. MASK Weibull Analysis Results Port Facia

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15	1.9	2.6	2.2	0.3	3	4.6						
SB60	5	35												
SB60	5	45												
PrtBow330	5	55												
PrtBow345	5	55												
SB60	5	55												
SB75	5	55												
PSQ225	6	0												
SB60	6	0	6.1	13.2	9.8	2.6	8	14.0	0.9899	2.24	-4.5807	3.1	7.7	13.8
PSQ225	6	15												
SB60	6	15	7.6	22.0	12.1	3.6	20	39.2	0.9952	1.23	-2.1090	7.1	5.6	20.7
PSQ225	6	35												
SB60	6	35	7.3	28.0	14.5	7.3	16	36.4	0.9744	0.54	-1.0306	7.2	6.8	52.1
H0	6	45	5.9	28.1	15.0	6.0	18	99.6	0.9907	2.22	-6.1392	1.2	15.8	26.7
PSQ225	6	45												
SB60	6	45												
H0	7	0												
PrtBow330	7	0												
SB45	7	0	6.1	7.6	6.9	1.1	2	3.6						
SB60	7	0												
SB75	7	0					0							
SB90	7	0	9.9	24.1	14.0	6.8	4	6.6	0.9594	0.40	-0.5092	9.8	3.6	17.9
H0	7	15												
PrtBow330	7	15												
PSQ225	7	15												
SB45	7	15	7.1	10.2	8.2	0.9	14	23.4	0.9773	1.28	-0.3966	7.0	1.4	9.9
SB60	7	15												
SB75	7	15												
SB90	7	15												
H0	7	25												
H0	7	35												
SB60	7	35												
H0	HC	0												
PrtBow330	HC	0												
SB60	HC	0	6.0	25.8	8.9	3.7	46	70.7	0.9914	0.92	-0.9511	5.9	2.8	18.0
SB75	HC	0												
SB90	HC	0												
PrtBow330	HC	15												
PrtBow345	HC	15												
SB45	HC	15	2.1	27.3	7.4	5.1	75	123.5	0.9928	1.14	-1.9609	2.0	5.6	22.2
SB60	HC	15	6.7	24.3	13.5	3.6	74	153.9	0.9941	2.38	-5.2662	5.5	9.1	22.3
SB75	HC	15												
SB90	HC	15												

Table 9. MASK Weibull Analysis Results Stbd Facia

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15					0							
SB60	5	35	3.6	8.4	5.8	1.8	9	16.1	0.9555	1.18	-1.3751	3.1	3.2	9.4
SB60	5	45												
PrtBow330	5	55												
PrtBow345	5	55												
SB60	5	55												
SB75	5	55												
PSQ225	6	0												
SB60	6	0	0.8	3.5	1.7	1.0	6	10.5	0.9907	0.86	-0.1271	0.7	1.2	3.0
PSQ225	6	15					0							
SB60	6	15	0.6	3.9	1.8	1.0	16	31.3	0.9882	0.89	-0.2690	0.5	1.4	4.8
PSQ225	6	35												
SB60	6	35	1.0	25.6	7.0	5.4	42	95.5	0.9908	1.11	-2.1388	0.7	6.9	23.2
H0	6	45	1.7	6.0	3.8	2.0	5	27.7	0.9494	0.35	-0.3075	1.6	2.4	11.0
PSQ225	6	45												
SB60	6	45	1.0	33.4	11.6	6.7	107	175.1	0.9951	1.80	-4.6062	0.1	12.9	30.5
H0	7	0												
PrtBow330	7	0												
SB45	7	0	1.7	10.2	3.7	2.1	19	34.0	0.9867	0.67	-0.4883	1.7	2.1	12.0
SB60	7	0	1.1	6.3	3.4	1.4	9	18.0	0.9370	1.93	-2.7123	0.0	4.1	6.1
SB75	7	0	1.0	4.5	2.6	1.2	16	37.0	0.9637	1.06	-0.7810	0.8	2.1	6.3
SB90	7	0	1.7	9.4	4.2	2.1	35	58.0	0.9901	0.90	-0.8793	1.7	2.6	12.5
H0	7	15												
PrtBow330	7	15												
PSQ225	7	15					0							
SB45	7	15	2.1	12.9	5.2	2.7	21	35.1	0.9612	1.13	-1.6194	1.6	4.2	12.7
SB60	7	15	1.0	22.4	6.4	5.6	54	93.8	0.9906	0.95	-1.5995	1.0	5.4	24.0
SB75	7	15	1.1	18.3	6.5	4.7	64	96.2	0.9925	0.93	-1.6380	1.0	5.8	27.7
SB90	7	15	3.2	15.9	7.0	3.5	24	36.9	0.9966	1.02	-1.4890	3.0	4.3	16.4
H0	7	25												
H0	7	35												
SB60	7	35	1.2	35.6	7.4	6.4	78	159.8	0.9949	0.96	-1.7845	1.1	6.4	30.5
H0	HC	0												
PrtBow330	HC	0												
SB60	HC	0	1.3	17.4	4.2	3.6	38	58.4	0.9965	0.78	-0.7440	1.3	2.6	15.1
SB75	HC	0	1.0	12.8	3.6	2.6	48	82.0	0.9933	0.94	-0.9279	1.0	2.7	12.4
SB90	HC	0	1.9	4.0	2.8	0.6	12	149.8	0.9680	1.95	-0.6773	1.6	1.4	3.8
PrtBow330	HC	15												
PrtBow345	HC	15												
SB45	HC	15	2.5	27.0	11.8	5.7	63	103.7	0.9972	1.92	-4.8431	0.8	12.5	27.0
SB60	HC	15	2.2	21.8	8.4	5.6	65	135.2	0.9897	0.93	-1.7738	2.0	6.7	33.1
SB75	HC	15	2.0	31.7	10.5	6.5	78	141.4	0.9954	1.42	-3.2555	1.6	9.9	29.3
SB90	HC	15	1.9	28.4	8.7	5.4	79	126.2	0.9891	1.29	-2.7134	1.3	8.2	26.8

Table 10. MASK Weibull Analysis Results Port Cross Structure Forward

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15		0.9			1	1.5						
SB60	5	35					0							
SB60	5	45	7.8	10.9	9.4	2.2	2	3.7						
PrtBow330	5	55	2.1	55.9	18.2	10.8	54	169.5	0.9792	1.46	-4.4354	0.0	20.9	53.8
PrtBow345	5	55	3.8	38.7	17.8	9.9	41	115.2	0.9820	1.61	-4.8208	0.4	20.0	45.6
SB60	5	55	8.0	31.5	20.0	11.7	3	9.1	0.9895	1.11	-3.6033	0.0	25.4	27.7
SB75	5	55		30.9			1	23.3						
PSQ225	6	0	0.4	0.5	0.4	0.1	3	5.1						
SB60	6	0	0.4	6.2	1.8	1.9	8	14.0	0.9797	0.58	-0.1499	0.4	1.3	4.9
PSQ225	6	15	1.3	6.0	3.7	3.3	2	2.1						
SB60	6	15	0.4	4.4	1.2	1.3	9	17.6	0.9788	0.61	0.2417	0.4	0.7	2.8
PSQ225	6	35	1.6	15.4	6.2	3.6	22	29.0	0.9941	1.30	-2.2907	1.1	5.8	14.9
SB60	6	35	1.4	2.0	1.7	0.3	3	6.8	1.0000	0.92	0.6296	1.3	0.5	1.8
H0	6	45	1.0	34.0	12.9	8.2	40	221.3	0.9674	1.18	-3.2061	0.0	15.1	45.6
PSQ225	6	45	1.4	9.7	4.7	3.3	5	127.8	0.9848	0.71	-1.0635	1.0	4.4	9.6
SB60	6	45	1.4	22.8	6.1	6.8	10	16.4	0.9767	0.46	-0.6075	1.4	3.7	23.6
H0	7	0		0.4			1	1.1						
PrtBow330	7	0	1.0	4.8	3.0	1.9	6	10.0	0.9591	0.41	-0.3103	1.0	2.1	9.8
SB45	7	0	0.9	7.4	3.4	2.5	9	16.1	0.9656	0.71	-0.7484	0.7	2.9	9.3
SB60	7	0	0.7	11.3	3.2	2.7	17	34.0	0.9746	0.57	-0.4913	0.7	2.4	15.8
SB75	7	0	1.0	9.4	4.5	2.5	21	48.6	0.9862	1.53	-2.4718	0.1	5.0	10.5
SB90	7	0	0.6	7.9	2.7	2.0	31	51.3	0.9950	0.91	-0.7581	0.5	2.3	9.5
H0	7	15	2.0	7.9	4.5	2.5	4	6.4	0.9996	0.97	-1.3707	1.1	4.1	6.8
PrtBow330	7	15	1.4	21.7	6.4	4.6	70	113.2	0.9921	1.06	-1.7896	1.3	5.4	22.5
PSQ225	7	15	0.9	4.2	1.9	1.2	6	9.8	0.9804	0.80	-0.2138	0.8	1.3	3.5
SB45	7	15	1.0	9.7	3.6	2.1	41	68.5	0.9923	1.27	-1.4436	0.8	3.1	9.6
SB60	7	15	0.5	13.7	3.7	2.9	58	100.7	0.9968	1.11	-1.4195	0.4	3.6	13.0
SB75	7	15	0.8	11.4	3.1	2.1	75	112.7	0.9858	0.93	-0.8477	0.7	2.5	12.7
SB90	7	15	0.6	9.1	2.7	2.5	54	83.0	0.9914	0.78	-0.5307	0.6	2.0	12.1
H0	7	25	2.0	17.1	7.0	4.2	20	35.0	0.9906	1.11	-2.0115	1.6	6.1	17.9
H0	7	35	1.6	25.1	9.6	6.3	59	109.9	0.9900	1.14	-2.4989	1.4	9.0	32.4
SB60	7	35	1.6	8.2	3.1	2.2	8	16.4	0.9923	0.59	-0.2116	1.6	1.4	6.6
H0	HC	0	1.2	17.2	6.1	6.4	5	8.7	0.9578	0.65	-1.1573	0.8	6.0	13.3
PrtBow330	HC	0	0.7	12.4	4.6	3.6	22	40.2	0.9833	0.69	-0.9717	0.6	4.1	21.8
SB60	HC	0	0.4	19.7	3.7	3.5	70	107.6	0.9932	0.96	-1.1838	0.3	3.4	15.7
SB75	HC	0	0.5	19.9	3.8	3.6	62	106.0	0.9956	0.93	-1.0980	0.5	3.3	15.6
SB90	HC	0	0.4	2.1	1.0	0.8	5	62.4	0.9877	0.35	0.2383	0.4	0.5	2.4
PrtBow330	HC	15	1.4	23.4	7.3	5.7	88	144.4	0.9945	1.02	-1.8289	1.3	6.0	27.6
PrtBow345	HC	15	1.0	15.5	5.6	3.6	61	91.4	0.9945	1.14	-1.8772	0.9	5.2	18.9
SB45	HC	15	0.8	27.7	8.0	5.7	118	194.3	0.9975	1.19	-2.4623	0.7	7.9	29.9
SB60	HC	15	0.9	18.6	5.5	3.8	79	164.3	0.9959	1.16	-1.8985	0.7	5.1	19.1
SB75	HC	15	0.6	14.5	3.9	2.8	93	168.6	0.9964	1.11	-1.4174	0.5	3.6	14.6
SB90	HC	15	0.8	15.9	4.0	2.8	98	156.5	0.9946	1.04	-1.3012	0.8	3.5	15.8

Table 11. MASK Weibull Analysis Results Starboard Cross Structure Forward

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15	0.3	1.4	0.9	0.3	13	20.0	0.9436	2.21	-0.1405	0.0	1.1	1.6
SB60	5	35	2.6	26.9	12.5	7.6	29	51.9	0.9927	1.17	-2.8921	1.8	12.0	35.7
SB60	5	45	2.2	47.0	21.1	11.6	97	180.8	0.9922	1.64	-5.2297	0.0	24.0	60.6
PrtBow330	5	55		2.2			1	3.1						
PrtBow345	5	55					0							
SB60	5	55	2.1	64.0	22.6	15.1	70	213.4	0.9916	1.38	-4.4376	0.1	25.2	72.2
SB75	5	55	17.0	54.3	35.4	18.7	3	70.0						
PSQ225	6	0	0.4	0.6	0.5	0.1	3	5.1						
SB60	6	0	0.3	0.4	0.4	0.1	2	3.5						
PSQ225	6	15	0.7	1.4	1.0	0.3	4	4.2	0.9597	0.37	0.3993	0.7	0.3	1.5
SB60	6	15	0.3	8.4	3.1	2.6	27	52.9	0.9854	0.68	-0.6901	0.3	2.8	16.3
PSQ225	6	35		4.9			1	1.3						
SB60	6	35	1.0	54.0	15.5	11.1	73	166.0	0.9944	1.24	-3.4883	0.3	16.8	54.8
H0	6	45	3.0	27.2	18.2	9.1	8	44.3	0.9399	1.16	-3.6177	0.0	22.7	42.7
PSQ225	6	45					0							
SB60	6	45	2.4	61.7	23.9	12.3	148	242.2	0.9913	1.78	-5.9011	0.0	27.4	67.7
H0	7	0												
PrtBow330	7	0												
SB45	7	0	1.0	14.0	5.5	4.4	16	28.6	0.9642	0.67	-1.0115	1.0	4.5	21.6
SB60	7	0	0.8	12.1	5.6	3.6	8	16.0	0.9547	1.00	-1.9337	0.0	6.9	14.4
SB75	7	0	1.9	17.8	5.4	4.8	14	32.4	0.9842	0.64	-0.7492	1.8	3.2	16.4
SB90	7	0	1.2	14.6	7.5	3.6	23	38.1	0.9754	1.66	-3.6137	0.0	8.8	17.5
H0	7	15	1.4	5.5	2.8	1.5	5	8.1	0.9536	0.95	-0.7759	1.0	2.3	4.7
PrtBow330	7	15												
PSQ225	7	15	1.1	1.2	1.1	0.1	2	3.3						
SB45	7	15	1.0	19.9	6.3	4.4	58	97.0	0.9922	1.02	-1.7948	0.9	5.8	23.9
SB60	7	15	0.7	29.7	8.0	6.9	83	144.2	0.9974	0.97	-1.9487	0.6	7.5	35.7
SB75	7	15	1.2	47.6	9.1	7.4	90	135.3	0.9962	1.16	-2.4984	1.0	8.6	32.3
SB90	7	15	1.1	21.5	6.0	5.1	62	95.3	0.9966	0.85	-1.3593	1.0	4.9	27.0
H0	7	25		5.2			1	1.7						
H0	7	35	1.7	31.4	12.0	9.0	11	20.5	0.9673	1.20	-3.1691	0.0	13.9	28.8
SB60	7	35	1.0	48.6	16.7	10.6	116	237.6	0.9955	1.46	-4.2966	0.0	18.9	54.8
H0	HC	0	8.3	15.0	11.7	4.7	2	3.5						
PrtBow330	HC	0	2.4	12.5	6.5	3.2	9	16.4	0.9914	1.45	-2.7284	0.9	6.6	12.2
SB60	HC	0	0.9	23.3	6.7	4.9	38	58.4	0.9839	1.32	-2.6412	0.1	7.4	19.6
SB75	HC	0	1.1	22.9	7.3	4.5	32	54.7	0.9886	1.59	-3.2974	0.3	7.9	17.6
SB90	HC	0	1.5	8.4	5.1	3.5	4	49.9	0.9687	0.54	-0.8359	1.2	4.7	9.9
PrtBow330	HC	15	1.1	36.4	8.9	9.0	19	31.2	0.9881	0.91	-1.9203	0.8	8.3	28.0
PrtBow345	HC	15	2.3	25.4	9.8	8.5	6	9.0	0.9957	0.67	-1.4527	1.8	8.7	22.6
SB45	HC	15	1.2	40.0	8.9	7.1	88	144.9	0.9977	1.06	-2.2356	1.1	8.2	34.8
SB60	HC	15	0.8	30.6	9.6	7.5	91	189.3	0.9918	1.03	-2.3095	0.7	9.5	41.7
SB75	HC	15	1.3	54.9	14.0	10.4	98	177.7	0.9977	1.21	-3.2041	1.0	14.1	50.5
SB90	HC	15	0.7	34.1	9.0	7.5	116	185.3	0.9957	0.95	-2.0398	0.7	8.5	44.4

Table 12. Weibull Analysis Results Port Mid Cross Structure MASK

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15												
SB60	5	35												
SB60	5	45												
PrtBow330	5	55												
PrtBow345	5	55												
SB60	5	55												
SB75	5	55												
PSQ225	6	0												
SB60	6	0	0.4	19.2	5.6	5.5	21	36.8	0.9756	0.42	-0.6246	0.4	4.4	60.5
PSQ225	6	15												
SB60	6	15	5.2	40.5	12.6	10.3	11	21.5	0.9914	0.52	-0.9561	5.1	6.3	39.5
PSQ225	6	35												
SB60	6	35	2.3	14.7	5.3	4.4	7	15.9	0.9894	0.54	-0.5781	2.2	2.9	12.0
H0	6	45	3.1	19.1	7.4	4.1	38	210.2	0.9930	0.96	-1.4448	3.0	4.5	20.3
PSQ225	6	45												
SB60	6	45												
H0	7	0												
PrtBow330	7	0												
SB45	7	0												
SB60	7	0	3.9	18.0	9.5	6.6	4	8.0	0.9879	0.39	-0.6969	3.8	5.9	17.4
SB75	7	0												
SB90	7	0												
H0	7	15												
PrtBow330	7	15												
PSQ225	7	15												
SB45	7	15												
SB60	7	15	4.4	24.1	9.3	4.9	43	74.7	0.9912	0.95	-1.5545	4.2	5.2	25.2
SB75	7	15												
SB90	7	15												
H0	7	25												
H0	7	35												
SB60	7	35	7.3	23.0	11.0	3.2	25	51.2	0.9715	1.53	-2.3969	6.7	4.8	17.0
H0	HC	0												
PrtBow330	HC	0												
SB60	HC	0	1.5	29.1	7.1	5.3	54	83.0	0.9886	1.20	-2.2117	1.3	6.3	21.3
SB75	HC	0												
SB90	HC	0												
PrtBow330	HC	15												
PrtBow345	HC	15												
SB45	HC	15												
SB60	HC	15	8.0	49.6	18.4	8.3	63	131.0	0.9830	1.51	-3.7828	7.4	12.2	38.5
SB75	HC	15												
SB90	HC	15												

Table 13. Weibull Analysis Results Starboard Mid Cross Structure MASK

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
SB60	5	15		1.2			1	1.5						
SB60	5	35	1.1	6.7	2.4	1.4	23	41.1	0.9943	0.87	-0.3266	1.0	1.5	6.4
SB60	5	45	2.0	19.0	5.3	3.2	96	178.9	0.9928	1.10	-1.3601	1.9	3.5	15.8
PrtBow330	5	55	1.5	4.3	2.1	0.8	11	34.5	0.9842	0.65	0.4142	1.5	0.5	3.5
PrtBow345	5	55	1.1	4.7	1.8	0.8	23	64.6	0.9937	0.84	0.3111	1.1	0.7	3.8
SB60	5	55	1.6	17.1	4.9	3.0	126	384.2	0.9925	1.17	-1.4540	1.5	3.5	15.0
SB75	5	55	3.2	10.8	5.9	2.7	7	163.3	0.9922	0.86	-1.0948	2.8	3.6	10.5
PSQ225	6	0					0							
SB60	6	0		0.8			1	1.8						
PSQ225	6	15					0							
SB60	6	15	0.9	1.9	1.5	0.4	4	7.8	0.9899	2.56	-1.3578	0.0	1.7	1.9
PSQ225	6	35	0.8	1.7	1.2	0.7	2	2.6						
SB60	6	35	1.0	14.0	4.4	3.2	71	161.5	0.9959	0.96	-1.1868	1.0	3.5	16.7
H0	6	45	1.4	7.1	3.2	1.8	27	149.4	0.9899	0.67	-0.4018	1.3	1.8	12.0
PSQ225	6	45		1.0			1	25.6						
SB60	6	45	2.2	29.7	7.1	4.7	188	307.6	0.9964	0.93	-1.5091	2.2	5.0	31.8
H0	7	0												
PrtBow330	7	0		0.4			1	1.7						
SB45	7	0	1.2	19.3	5.2	5.2	14	25.0	0.9738	0.75	-1.0542	1.1	4.1	15.9
SB60	7	0	1.0	16.6	6.4	5.3	12	24.0	0.9861	1.01	-1.9124	0.5	6.6	16.6
SB75	7	0	1.4	10.7	5.0	2.7	17	39.3	0.9873	1.64	-2.7656	0.3	5.4	10.5
SB90	7	0	1.0	18.2	8.2	4.7	24	39.8	0.9930	1.54	-3.4478	0.0	9.4	19.9
H0	7	15	1.2	16.1	4.9	4.6	12	19.3	0.9821	0.53	-0.6083	1.2	3.2	19.2
PrtBow330	7	15	1.5	28.2	8.8	8.7	12	19.4	0.9934	0.64	-1.2427	1.4	7.0	30.4
PSQ225	7	15					0							
SB45	7	15	1.7	35.4	9.9	8.5	38	63.5	0.9913	0.85	-1.8026	1.5	8.4	39.7
SB60	7	15	1.3	33.0	9.6	7.0	42	72.9	0.9923	1.01	-2.2537	1.0	9.3	35.4
SB75	7	15	1.2	41.8	8.6	7.1	50	75.2	0.9887	0.85	-1.7476	1.1	7.8	39.8
SB90	7	15	1.7	25.2	9.2	6.3	19	29.2	0.9713	0.79	-1.7055	1.4	8.7	35.4
H0	7	25	1.0	14.2	4.7	3.9	12	21.0	0.9808	0.55	-0.7057	1.0	3.6	19.4
H0	7	35	1.1	13.3	5.0	3.7	26	48.4	0.9867	0.79	-1.1224	1.0	4.2	19.6
SB60	7	35	1.2	31.7	6.9	5.2	107	219.2	0.9960	1.25	-2.3144	1.0	6.3	22.7
H0	HC	0	1.0	32.2	13.8	9.7	10	17.4	0.9398	0.97	-2.7569	0.0	17.0	40.1
PrtBow330	HC	0	1.7	43.3	10.8	11.3	14	25.6	0.9626	0.84	-1.8924	1.4	9.6	32.1
SB60	HC	0	1.0	34.9	9.8	8.2	45	69.2	0.9974	0.97	-2.1606	0.8	9.3	37.9
SB75	HC	0	1.2	57.3	10.1	9.7	49	83.7	0.9944	0.93	-2.0593	1.0	9.2	40.9
SB90	HC	0	1.2	10.1	4.5	4.3	4	49.9	0.9679	0.26	-0.2369	1.1	2.5	10.2
PrtBow330	HC	15	1.0	54.3	14.2	12.9	77	126.4	0.9818	1.14	-2.9988	0.8	13.9	51.1
PrtBow345	HC	15	1.2	46.4	13.2	11.2	43	64.5	0.9948	1.12	-2.8682	0.8	13.1	43.6
SB45	HC	15	1.6	52.6	14.5	11.3	96	158.0	0.9951	0.99	-2.5855	1.4	13.8	65.8
SB60	HC	15	0.9	28.5	12.4	7.7	66	137.3	0.9889	1.33	-3.5374	0.0	14.2	41.5
SB75	HC	15	1.8	43.3	11.9	8.7	71	128.7	0.9898	0.98	-2.3549	1.6	11.1	50.6
SB90	HC	15	1.4	33.1	11.7	8.8	59	94.2	0.9946	1.00	-2.4266	1.1	11.3	46.9

Table 14. Carraige 2 Weibull Analysis Results Port Bow Sta 2 4m AWL

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	1.12	4.8	2.5	0.8	152	248	0.9945	2.10	-1.2356	0.9	1.8	4.8
H0	5	55	0.31	5.7	2.6	1.0	132	383	0.9760	2.37	-2.5965	0.0	3.0	5.9
H0	6	45	1.38	12.6	4.8	2.0	386	466	0.9897	2.02	-2.7848	1.2	4.0	10.9
H0	7	0	1.28	2.9	1.9	0.5	18	35	0.9923	1.28	0.3983	1.2	0.7	2.9
H0	7	25	0.55	6.2	2.4	1.2	109	188	0.9892	1.70	-1.3208	0.4	2.2	5.8
H0	HC	0	1.01	8.7	2.9	1.8	45	107	0.9937	1.02	-0.7174	1.0	2.0	8.5
H0	HC	15	0.72	13.1	4.1	2.5	138	254	0.9939	1.40	-1.9626	0.5	4.1	13.1

Table 15. Carraige 2 Weibull Analysis Results Starboard Bow Sta 2 4m AWL

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	0.73	4.7	2.6	0.8	139	227	0.9915	3.62	-3.8834	0.0	2.9	4.5
H0	5	55	1.00	5.4	2.9	0.8	115	334	0.9892	3.57	-3.9306	0.2	3.0	4.8
H0	6	45	0.47	13.0	4.5	1.8	366	441	0.9660	3.05	-4.8850	0.0	5.0	8.9
H0	7	0	1.08	3.4	1.8	0.6	24	46	0.9947	1.37	0.0315	1.0	1.0	3.3
H0	7	25	0.56	6.7	2.5	1.3	98	169	0.9972	1.55	-1.2889	0.4	2.3	6.5
H0	HC	0	1.01	8.8	2.9	1.9	44	105	0.9935	0.85	-0.5529	1.0	1.9	10.1
H0	HC	15	0.62	12.4	4.1	2.3	130	239	0.9974	1.67	-2.3888	0.4	4.2	11.2

Table 16. Carraige 2 Weibull Analysis Results Port Facia

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	3.27	20.2	9.8	7.3	7	11	0.9733	0.44	-0.7875	3.2	6.0	30.8
H0	5	55	0.72	1.2	0.9	0.2	7	20	0.9551	0.48	0.7799	0.7	0.2	1.5
H0	6	45	2.00	56.9	13.6	9.2	86	104	0.9875	1.43	-3.7944	0.8	14.3	41.4
H0	7	0					0							
H0	7	25	3.00	18.5	9.9	7.9	3	5						
H0	HC	0	3.04	6.5	5.0	1.4	4	10	0.9625	2.52	-4.3997	0.0	5.7	6.5
H0	HC	15	1.04	2.3	1.7	0.9	2	4						

Table 17. Carraige 2 Weibull Analysis Results Starboard Facia

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45					0							
H0	5	55	5.15	18.5	10.1	7.3	3	9	1.0000	0.34	-0.5527	5.0	5.1	11.8
H0	6	45	3.21	30.4	12.3	7.0	53	64	0.9971	1.25	-2.9199	2.8	10.4	34.3
H0	7	0					0							
H0	7	25					0							
H0	HC	0		0.8			1	2						
H0	HC	15		0.4			1	2						

Table 18. Carraige 2 Weibull Analysis Results Port Cross Structure Forward

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	1.16	19.3	7.2	5.4	72	117	0.9889	0.83	-1.5052	1.1	6.1	35.9
H0	5	55	1.89	19.8	9.8	5.9	27	78	0.9856	1.26	-2.9094	0.8	10.1	27.0
H0	6	45	2.04	34.5	13.4	6.3	283	341	0.9921	2.06	-5.5600	0.3	14.9	34.9
H0	7	0					0							
H0	7	25	3.42	24.8	7.3	5.2	17	29	0.9886	0.63	-0.7865	3.4	3.5	22.0
H0	HC	0	1.75	14.6	7.9	4.6	5	12	0.9210	1.04	-2.4039	0.0	10.1	16.0
H0	HC	15	1.83	11.8	6.0	2.9	12	22	0.9948	1.90	-3.6619	0.0	6.9	11.1

Table 19. Carraige 2 Weibull Analysis Results Starboard Cross Structure Forward

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	1.09	3.6	1.9	1.1	4	7	0.9719	0.50	0.0415	1.0	0.9	2.8
H0	5	55	2.05	20.3	8.4	5.7	16	46	0.9881	0.78	-1.5084	1.9	7.0	27.7
H0	6	45	2.25	36.4	13.6	8.6	104	125	0.9926	1.17	-2.9841	2.0	12.8	49.5
H0	7	0					0							
H0	7	25	0.32	2.6	0.7	0.5	18	31	0.9721	0.92	0.7899	0.3	0.4	1.7
H0	HC	0	0.83	7.0	3.9	4.3	2	5						
H0	HC	15	1.12	7.2	2.7	2.0	9	17	0.9701	0.48	-0.1590	1.1	1.4	8.4

Table 20. Carraige 2 Weibull Analysis Results Port Cross Structure Mid

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	1.50	9.9	3.0	1.6	102	166	0.9922	1.01	-0.4092	1.5	1.5	8.4
H0	5	55	2.01	11.5	3.6	1.7	84	244	0.9961	0.97	-0.4718	2.0	1.6	9.5
H0	6	45	2.07	26.1	7.6	5.2	265	320	0.9971	1.04	-1.7958	2.1	5.7	31.7
H0	7	0					0							
H0	7	25	1.95	14.7	6.9	4.1	15	26	0.9915	1.14	-2.0805	1.4	6.3	16.4
H0	HC	0	2.85	18.7	11.7	5.6	6	14	0.9512	1.28	-3.4216	0.0	14.5	22.9
H0	HC	15	1.85	43.6	12.0	9.4	43	79	0.9925	1.22	-2.9819	1.4	11.5	35.2

Table 21. Carraige 2 Weibull Analysis Results Starboard Cross Structure Mid

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max (psi)
H0	5	45	0.73	3.7	1.3	0.6	69	113	0.9912	1.05	0.5331	0.7	0.6	3.1
H0	5	55	1.18	10.2	3.5	1.7	122	354	0.9978	1.41	-1.3791	1.1	2.7	9.2
H0	6	45	2.07	19.6	5.2	2.8	98	118	0.9923	1.30	-1.6509	1.9	3.6	13.4
H0	7	0					0							
H0	7	25	1.37	13.6	6.9	5.0	7	12	0.9515	0.49	-0.8909	1.3	6.2	25.6
H0	HC	0	0.59	33.0	10.1	10.7	11	26	0.9705	0.53	-1.2015	0.5	9.5	49.4
H0	HC	15	2.05	57.0	18.1	12.1	35	64	0.9836	1.61	-4.8410	0.0	20.4	45.0

Table 22. MASK Test Summary of Largest Wave Impact Pressures by Location and Test Condition

	Channel	Max Pressure (psi)	Max Pressure Location	Max Pmax (psi)	Max Pmax Location
Pressure Panel	Port_Bow_Sta_2_4m_AWL	13.5	0517_HC_15kt_PrtBow345	15.1	0513_HC_15kt_SB45
	Stbd_Bow_Sta_2_4m_AWL	22.1	0510_HC_15kt_SB90	14.9	0513_HC_15kt_SB45
	Port_Facia_PP	28.1	0509_SS6_45kt_H0_A	52.1	0509_SS6_35kt_SB60
	Stbd_Facia_PP	35.6	0509_SS7_35kt_SB60	33.1	0509_HC_15kt_SB60
	Port_Cross_Structure_Fwd	55.9	0517_SS5_55kt_PrtBow330	53.8	0517_SS5_55kt_PrtBow330
	Stbd_Cross_Structure_Fwd	64.0	0517_SS5_55kt_SB60	72.2	0517_SS5_55kt_SB60
	Port_Mid_Cross_Structure	49.6	0509_HC_15kt_SB60	60.5	0509_SS6_0kt_SB60
	Stbd_Mid_Cross_Structure	57.3	0510_HC_0kt_SB75	65.8	0513_HC_15kt_SB45

Table 23. Carriage 2 Test Summary of Largest Wave Impact Pressures by Location and Test Condition

	Channel	Max Pressure (psi)	Max Pressure Location	Max Pmax (psi)	Pmax Location
Pressure Panel	Port_Bow_Sta_2_4m_AWL	13.1	0613_HC_15kt_H0	13.1	0613_HC_15kt_H0
	Stbd_Bow_Sta_2_4m_AWL	13.0	0611_SS6_45kt_H0	11.2	0613_HC_15kt_H0
	Port_Facia_PP	56.9	0611_SS6_45kt_H0	41.4	0611_SS6_45kt_H0
	Stbd_Facia_PP	30.4	0611_SS6_45kt_H0	34.3	0611_SS6_45kt_H0
	Port_Cross_Structure_Fwd	34.5	0611_SS6_45kt_H0	35.9	0611_SS5_45kt_H0
	Stbd_Cross_Structure_Fwd	36.4	0611_SS6_45kt_H0	49.5	0611_SS6_45kt_H0
	Port_Mid_Cross_Structure	43.6	0613_HC_15kt_H0	35.2	0613_HC_15kt_H0
	Stbd_Mid_Cross_Structure	57.0	0613_HC_15kt_H0	49.4	0613_HC_0kt_H0

Table 24. Trending Summary of MASK Wave Impact Pressure

Condition		Max Pressure (psi)	Max Pressure Condition*	Max Pressure Location	Max Pmax (psi)	Max Pmax Condition	Max Pmax Location
Sea State	5	64.0	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd	72.2	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd
	6	61.7	0509_SS6_45kt_SB60_a	Stbd_Cross_Structure_Fwd	67.7	0509_SS6_45kt_SB60_a	Stbd_Cross_Structure_Fwd
	7	48.6	0509_SS7_35kt_SB60	Stbd_Cross_Structure_Fwd	54.8	0509_SS7_35kt_SB60	Stbd_Cross_Structure_Fwd
	HC	57.3	0510_HC_0kt_SB75	Stbd_Mid_Cross_Structure	65.8	0513_HC_15kt_SB45	Stbd_Mid_Cross_Structure
Heading	H0	34.0	0509_SS6_45kt_H0_A	Port_Cross_Structure_Fwd	45.6	0509_SS6_45kt_H0_A	Port_Cross_Structure_Fwd
	PrtBow345	46.4	0517_HC_15kt_PrtBow345	Stbd_Mid_Cross_Structure	45.6	0517_SS5_55kt_PrtBow345	Port_Cross_Structure_Fwd
	PrtBow330	55.9	0517_SS5_55kt_PrtBow330	Port_Cross_Structure_Fwd	53.8	0517_SS5_55kt_PrtBow330	Port_Cross_Structure_Fwd
	SB45	52.6	0513_HC_15kt_SB45	Stbd_Mid_Cross_Structure	65.8	0513_HC_15kt_SB45	Stbd_Mid_Cross_Structure
	SB60	64.0	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd	72.2	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd
	SB75	57.3	0510_HC_0kt_SB75	Stbd_Mid_Cross_Structure	50.6	0510_HC_15kt_SB75	Stbd_Mid_Cross_Structure
	SB90	34.1	0510_HC_15kt_SB90	Stbd_Cross_Structure_Fwd	46.9	0510_HC_15kt_SB90	Stbd_Mid_Cross_Structure
	PSQ225	15.4	0515_SS6_35kt_PSQ225	Port_Cross_Structure_Fwd	14.9	0515_SS6_35kt_PSQ225	Port_Cross_Structure_Fwd
Speed	0	57.3	0510_HC_0kt_SB75	Stbd_Mid_Cross_Structure	60.5	0509_SS6_0kt_SB60	Port_Mid_Cross_Structure
	15	54.9	0510_HC_15kt_SB75	Stbd_Cross_Structure_Fwd	65.8	0513_HC_15kt_SB45	Stbd_Mid_Cross_Structure
	25	17.1	0516_SS7_25kt_H0	Port_Cross_Structure_Fwd	19.4	0516_SS7_25kt_H0	Stbd_Mid_Cross_Structure
	35	54.0	0509_SS6_35kt_SB60	Stbd_Cross_Structure_Fwd	54.8	0509_SS6_35kt_SB60	Stbd_Cross_Structure_Fwd
	45	61.7	0509_SS6_45kt_SB60_a	Stbd_Cross_Structure_Fwd	67.7	0509_SS6_45kt_SB60_a	Stbd_Cross_Structure_Fwd
	55	64.0	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd	72.2	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd
Max of maxes		64.0	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd	72.2	0517_SS5_55kt_SB60	Stbd_Cross_Structure_Fwd

*Notes: Condition Name includes: Date, Sea State, Speed, and Relative Heading.
Relative Headings: Zero for Head Sea, 45 for Starboard Bow, 90 for Starboard Beam and 180 for Following.
Lee Side in Blue

Table 25. Trending Summary of Carriage 2 Wave Impact Pressure

		Max Pressure (psi)	Max Pressure Condition	Max Pressure Location	Max Pmax (psi)	Max Pmax Condition	Max Pmax Location
Sea State	5	20.3	0613_SS5_55kt_H0_A	Stbd_Cross_Structure_Fwd	35.9	0611_SS5_45kt_H0	Stbd_Cross_Structure_Fwd
	6	56.9	0611_SS6_45kt_H0	Port_Facia_PP	49.5	0611_SS6_45kt_H0	Port_Facia_PP
	7	24.8	0613_SS7_25kt_H0-A	Port_Facia_PP	25.6	0613_SS7_25kt_H0-A	Port_Facia_PP
	HC	57.0	0613_HC_15kt_H0	Port_Facia_PP	49.4	0613_HC_0kt_H0	Port_Facia_PP
Heading	H0	57.0	0613_HC_15kt_H0	Stbd_Mid_Cross_Structure	49.5	0611_SS6_45kt_H0	Stbd_Cross_Structure_Fwd
Speed	0	33.0	0613_HC_0kt_H0	Port_Facia_PP	49.4	0613_HC_0kt_H0	Port_Facia_PP
	15	57.0	0613_HC_15kt_H0	Stbd_Mid_Cross_Structure	45.0	0613_HC_15kt_H0	Stbd_Mid_Cross_Structure
	25	24.8	0613_SS7_25kt_H0-A	Port_Cross_Structure_Fwd	25.6	0613_SS7_25kt_H0-A	Stbd_Mid_Cross_Structure
	45	56.9	0611_SS6_45kt_H0	Port_Facia_PP	49.5	0611_SS6_45kt_H0	Port_Facia_PP
	55	20.3	0613_SS5_55kt_H0_A	Stbd_Cross_Structure_Fwd	27.7	0613_SS5_55kt_H0_A	Stbd_Cross_Structure_Fwd
Max of maxes		57.0	0611_SS6_45kt_H0	Port_Facia_PP	49.5	0611_SS6_45kt_H0	Port_Facia_PP

Table 26. Weibull Analysis Summary Foredeck Station 2Green Sea Loading

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max
H0	5	45					0							
H0	5	55	1.7	3.3	2.3	0.9	3	9						
H0	6	45	6.3	20.5	9.3	3.1	23	28	0.9908	1.01	-1.2276	6.2	3.4	16.6
H0	7	0					0							
H0	7	25	2.9	16.7	6.5	3.3	35	60	0.9904	1.20	-1.7005	2.7	4.1	14.7
H0	HC	0	3.4	18.4	9.6	4.3	10	24	0.9557	2.08	-5.0146	0.0	11.1	16.6
H0	HC	15	2.0	41.9	5.7	5.8	52	96	0.9812	1.03	-1.3122	2.0	3.6	15.4

Table 27. Weibull Analysis Summary Foredeck Station 3 Green Sea Loading

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max
H0	5	45	49.2	194.8	87.5	57.1	6	10	0.9809	0.45	-1.5634	48.7	32.0	165.4
H0	5	55	30.4	170.5	74.9	51.9	7	20	0.9730	0.42	-1.5806	29.9	42.2	234.2
H0	6	45	32.3	135.9	50.6	16.3	169	204	0.9932	1.23	-3.6658	32.0	19.6	105.7
H0	7	0		6.9			1	2						
H0	7	25	20.7	140.0	52.8	27.8	32	55	0.9861	1.24	-4.5267	18.1	38.5	123.0
H0	HC	0	15.8	97.4	43.8	30.0	14	33	0.9908	0.71	-2.3658	15.1	28.1	125.7
H0	HC	15	21.5	78.5	36.8	14.8	42	77	0.9826	1.06	-2.9770	21.1	16.4	77.8

Table 28. Weibull Analysis Summary Foredeck Station 3.5 Green Sea Loading

Conditions			Observed						Weibull Parameters					
Heading	Sea State	Speed (kts)	Min Value (psi)	Max Value (psi)	Avg Value (psi)	Std Dev (psi)	Impacts	Rate (per hr)	Correla-tion	Slope	Intercept	x0 (psi)	Char Value (psi)	Most Prob Max
H0	5	45	4.4	10.0	7.2	4.0	2	3						
H0	5	55		48.1			1	3						
H0	6	45	22.0	42.0	28.2	5.2	23	28	0.9967	1.17	-2.3636	21.5	7.5	41.3
H0	7	0					0							
H0	7	25	11.1	102.1	43.1	23.7	22	38	0.9969	1.43	-5.3414	6.2	42.1	98.9
H0	HC	0	32.0	77.2	59.9	19.5	4	10	0.9280	1.99	-8.5037	0.0	71.2	83.9
H0	HC	15	8.0	63.3	22.8	12.7	81	149	0.9942	1.20	-3.3668	7.6	16.4	63.7

Table 29. Bad Data by Channel Name Caused by Technical Difficulties Mask Part 1

Date & Condition	Speed	Sea State	Heading	Channel
0517_SS5_55kt_PrtBow330	55	5	PrtBow330	Port_Facia_PP
0517_SS5_55kt_PrtBow330	55	5	PrtBow330	Port_Mid_Cross_Structure
0517_SS5_55kt_PrtBow330	55	5	PrtBow330	Stbd_Facia_PP
0517_SS5_55kt_PrtBow345	55	5	PrtBow345	Port_Facia_PP
0517_SS5_55kt_PrtBow345	55	5	PrtBow345	Port_Mid_Cross_Structure
0517_SS5_55kt_PrtBow345	55	5	PrtBow345	Stbd_Facia_PP
0514_SS5_35kt_SB60	35	5	SB60	Port_Facia_PP
0514-0517_SS5_45kt_SB60_concat	45	5	SB60	Port_Facia_PP
0517_SS5_55kt_SB60	55	5	SB60	Port_Facia_PP
5013_SS5_15kt_SB60	15	5	SB60	Port_Mid_Cross_Structure
0514_SS5_35kt_SB60	35	5	SB60	Port_Mid_Cross_Structure
0514-0517_SS5_45kt_SB60_concat	45	5	SB60	Port_Mid_Cross_Structure
0517_SS5_55kt_SB60	55	5	SB60	Port_Mid_Cross_Structure
0514-0517_SS5_45kt_SB60_concat	45	5	SB60	Stbd_Facia_PP
0517_SS5_55kt_SB60	55	5	SB60	Stbd_Facia_PP
0517_SS5_55kt_SB75	55	5	SB75	Port_Facia_PP
0517_SS5_55kt_SB75	55	5	SB75	Port_Mid_Cross_Structure
0517_SS5_55kt_SB75	55	5	SB75	Stbd_Facia_PP
0514_SS6_0kt_PSQ225	0	6	PSQ225	Port_Facia_PP
0514_SS6_15kt_PSQ225	15	6	PSQ225	Port_Facia_PP
0515_SS6_35kt_PSQ225	35	6	PSQ225	Port_Facia_PP
0515_SS6_45kt_PSQ225	45	6	PSQ225	Port_Facia_PP
0514_SS6_0kt_PSQ225	0	6	PSQ225	Port_Mid_Cross_Structure
0514_SS6_15kt_PSQ225	15	6	PSQ225	Port_Mid_Cross_Structure
0515_SS6_35kt_PSQ225	35	6	PSQ225	Port_Mid_Cross_Structure
0515_SS6_45kt_PSQ225	45	6	PSQ225	Port_Mid_Cross_Structure
0514_SS6_0kt_PSQ225	0	6	PSQ225	Stbd_Facia_PP
0515_SS6_35kt_PSQ225	35	6	PSQ225	Stbd_Facia_PP
0515_SS6_45kt_PSQ225	45	6	PSQ225	Stbd_Facia_PP
0509_SS6_45kt_SB60_a	45	6	SB60	Port_Facia_PP
0509_SS6_45kt_SB60_a	45	6	SB60	Port_Mid_Cross_Structure
0516_SS7_0kt_H0	0	7	H0	Port_Facia_PP
0516_SS7_15kt_H0	15	7	H0	Port_Facia_PP
0516_SS7_25kt_H0	25	7	H0	Port_Facia_PP
0516_SS7_35kt_H0	35	7	H0	Port_Facia_PP
0516_SS7_0kt_H0	0	7	H0	Port_Mid_Cross_Structure
0516_SS7_15kt_H0	15	7	H0	Port_Mid_Cross_Structure
0516_SS7_25kt_H0	25	7	H0	Port_Mid_Cross_Structure
0516_SS7_35kt_H0	35	7	H0	Port_Mid_Cross_Structure
0516_SS7_0kt_H0	0	7	H0	Stbd_Cross_Structure_Fwd
0516_SS7_0kt_H0	0	7	H0	Stbd_Facia_PP
0516_SS7_15kt_H0	15	7	H0	Stbd_Facia_PP
0516_SS7_25kt_H0	25	7	H0	Stbd_Facia_PP
0516_SS7_35kt_H0	35	7	H0	Stbd_Facia_PP
0516_SS7_0kt_H0	0	7	H0	Stbd_Mid_Cross_Structure
0515_SS7_0kt_PrtBow330	0	7	PrtBow330	Port_Facia_PP

Table 30. Bad Data by Channel Name Caused by Technical Difficulties Mask Part 2

Date & Condition	Speed	Sea State	Heading	Channel
0515-0516_SS7_15kt_PrtBow330_concat	15	7	PrtBow330	Port_Facia_PP
0515_SS7_0kt_PrtBow330	0	7	PrtBow330	Port_Mid_Cross_Structure
0515-0516_SS7_15kt_PrtBow330_concat	15	7	PrtBow330	Port_Mid_Cross_Structure
0515_SS7_0kt_PrtBow330	0	7	PrtBow330	Stbd_Cross_Structure_Fwd
0515-0516_SS7_15kt_PrtBow330_concat	15	7	PrtBow330	Stbd_Cross_Structure_Fwd
0515_SS7_0kt_PrtBow330	0	7	PrtBow330	Stbd_Facia_PP
0515-0516_SS7_15kt_PrtBow330_concat	15	7	PrtBow330	Stbd_Facia_PP
0514_SS7_15kt_PSQ225	15	7	PSQ225	Port_Facia_PP
0514_SS7_15kt_PSQ225	15	7	PSQ225	Port_Mid_Cross_Structure
0513_SS7_0kt_SB45	0	7	SB45	Port_Mid_Cross_Structure
0513_SS7_15kt_SB45	15	7	SB45	Port_Mid_Cross_Structure
0509_SS7_0kt_SB60	0	7	SB60	Port_Facia_PP
0509_SS7_15kt_SB60	15	7	SB60	Port_Facia_PP
0509_SS7_35kt_SB60	35	7	SB60	Port_Facia_PP
0510_SS7_15kt_SB75	15	7	SB75	Port_Facia_PP
0510_SS7_0kt_SB75	0	7	SB75	Port_Mid_Cross_Structure
0510_SS7_15kt_SB75	15	7	SB75	Port_Mid_Cross_Structure
0510_SS7_15kt_SB90	15	7	SB90	Port_Facia_PP
0513_SS7_0kt_SB90	0	7	SB90	Port_Mid_Cross_Structure
0510_SS7_15kt_SB90	15	7	SB90	Port_Mid_Cross_Structure
0516_HC_0kt_H0	0	HC	H0	Port_Facia_PP
0516_HC_0kt_H0	0	HC	H0	Port_Mid_Cross_Structure
0516_HC_0kt_H0	0	HC	H0	Stbd_Facia_PP
0516_HC_0k_PrtBow330	0	HC	PrtBow330	Port_Facia_PP
0516_HC_15kt_PrtBow330	15	HC	PrtBow330	Port_Facia_PP
0516_HC_0k_PrtBow330	0	HC	PrtBow330	Port_Mid_Cross_Structure
0516_HC_15kt_PrtBow330	15	HC	PrtBow330	Port_Mid_Cross_Structure
0516_HC_0k_PrtBow330	0	HC	PrtBow330	Stbd_Facia_PP
0516_HC_15kt_PrtBow330	15	HC	PrtBow330	Stbd_Facia_PP
0517_HC_15kt_PrtBow345	15	HC	PrtBow345	Port_Facia_PP
0517_HC_15kt_PrtBow345	15	HC	PrtBow345	Port_Mid_Cross_Structure
0517_HC_15kt_PrtBow345	15	HC	PrtBow345	Stbd_Facia_PP
0513_HC_15kt_SB45	15	HC	SB45	Port_Mid_Cross_Structure
0510_HC_0kt_SB75	0	HC	SB75	Port_Facia_PP
0510_HC_15kt_SB75	15	HC	SB75	Port_Facia_PP
0510_HC_0kt_SB75	0	HC	SB75	Port_Mid_Cross_Structure
0510_HC_15kt_SB75	15	HC	SB75	Port_Mid_Cross_Structure
0510_HC_0kt_SB90	0	HC	SB90	Port_Facia_PP
0510_HC_15kt_SB90	15	HC	SB90	Port_Facia_PP
0510_HC_0kt_SB90	0	HC	SB90	Port_Mid_Cross_Structure
0510_HC_15kt_SB90	15	HC	SB90	Port_Mid_Cross_Structure

Table 31. Summary of Available Test Data for Comparison of Green Sea Loading

Model	Length	Displacement	Beam	Height Above Baseline or Depth of Section at Measurement	Draft	Free Board
	(feet)	(lton)	(feet)	(feet)	(feet)	(feet)
HSS (5594)	1059.7	21653	62.0	72.2	30.8	41.4
SL-7 (5409)	880.5	49963	105.5	75.3	36.7	38.6
CG-61	529	9680	55	42	23.2	18.8
DD-21 (5525)	466.0	7830	61.6	40.9	18.4	22.5

Table 32. Summary of Maximum Green Sea Loading for Conditions HSS, SL-7, CG-61 and DD-21 Models

Model		Measurement		Speed						
			(knots)	0	10	15	20	25	45	55
HSS (5594)	Wave Piercing Bow	Fordeck Sta 3.5	(psi)	97	N/A	79	n/a	140	195	171
SL-7 (5409)	Bow Flare with Bulwark	Foredeck Sta 1.9	(psi)	59	N/A	N/A		N/A	N/A	N/A
CG-61	Bow Flare with Bulwark	Foredeck Sta 1.4	(psi)	23	84	12	26	N/A	N/A	N/A
DD-21 (5525)	Wave Piercing Bow	Fordeck Sta 3.5	(psi)	N/A	20.8	18		N/A	N/A	N/A

Notes:

1. Low Speed Runs are Typically SS8 or Hurricaner Camile Wave Spectra. High Speed Runs are Typically SS5 to SS6. All Data is Head Seas.
2. CG-61 see Reference 2
3. SL-7 see Reference 9
4. DD-21 see Reference 10

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