SSC-263

(SL-7-7)

STATIC STRUCTURAL CALIBRATION OF SHIP RESPONSE INSTRUMENTATION SYSTEM ABOARD THE SEA-LAND McLEAN

SHIP STRUCTURE COMMITTEE
1976

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ADDRESS CORRESPONDENCE TO:

Secretary
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SR-211

This report is one of a group of Ship Structure Committee Reports which describes the SL-7 Instrumentation Program. This program, a jointly funded undertaking of Sea-Land Service, Inc., the American Bureau of Shipping and the Ship Structure Committee, represents an excellent example of cooperation between private industry, regulatory authority and government. The goal of the program is to advance understanding of the performance of ships' hull structures and the effectiveness of the analytical and experimental methods used in their design. While the experiments and analyses of the program are keyed to the SL-7 Containership and a considerable body of data will be developed relating specifically to that ship, the conclusions of the program will be completely general, and thus applicable to any surface ship structure.

The program includes measurement of hull stresses, accelerations and environmental and operating data on the S.S. Sea-Land McLean, development and installation of a microwave radar wavemeter for measuring the seaway encountered by the vessel, a wave tank model study and a theoretical hydrodynamic analysis which relate to the wave induced loads, a structural model study and a finite element structural analysis which relate to the structural response, and installation of long term stress recorders on each of the eight vessels of the class. In addition, work is underway to develop the initial correlations of the results of the several program elements.

Results of each of the program elements will be published as Ship Structure Committee Reports and each of the reports relating to this program will be identified by an SL- designation along with the usual SSC- number. A list of all of the SL- reports published to date is included on the back cover of this report.

This report contains the results and a discussion of the calibration of the full-scale instrumentation and compares the results with calculated predictions.

W. M. Benkert
Rear Admiral, U. S. Coast Guard
Chairman, Ship Structure Committee

SSC-263

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Technical Report

on

Project SR-211, "SL-7 Data Collection"

STATIC STRUCTURAL CALIBRATION OF SHIP RESPONSE INSTRUMENTATION SYSTEM ABOARD THE SEA-LAND McLEAN

by

R. R. Boentgen and J. W. Wheaton

Teledyne Materials Research

under

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U. S. Coast Guard Headquarters
Washington, D.C.
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ABSTRACT

This document reports the results of the calibration of the strain gage portion of the ship response instrumentation installed on the SEA-LAND McLEAN SL-7 class containership. The calibration consisted of a succession of loading conditions achieved by selectively removing container cargo, and was performed on April 9-10, 1973 in Rotterdam. The measured stress changes are compared with calculated predictions, and the results are discussed. In general, the measurements and calculations agree substantially within tolerances assignable to physical conditions.

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I. INTRODUCTION

The SEA-LAND McLEAN is the first in a class of eight high-speed (33 knot) containerships. Each carries 200 forty-foot and 896 thirty-five-foot containers. In order to insure a rapid turnaround, the ships were designed with virtually unobstructed hatches running over 80% of the ship's length for loading of below-decks cargo. Such an arrangement, however, greatly reduces torsional stiffness and necessitates a revised structural layout.

Instrumentation of the vessel and collection of seaway response data by Teledyne Materials Research is part of a larger SL-7 program of model testing, structural analysis and data correlation between various tasks. Calibration of the strain gage sensors forms an integral part of the data collection and correlation tasks.

II. OBJECTIVE

The calibration event supplies two important factors necessary to the evaluation of seaway data.

1. Checkout of the Instrumentation System. The calibration was the first opportunity to check out the sense and magnitude of the installed gaging system against a deterministically varying load. Due to the complexity of the structure it is not always possible to make successful a priori decisions regarding gage locations. Unusual load paths, stress concentrations, interactions of applied loads, thermal environments, service conditions, modeling approximations, construction techniques, and other unpredictable conditions all may act to invalidate or reduce the desired effectiveness of applied instrumentation. Calibration, therefore, makes possible an overall check of the data system under a rational applied load.

2. Determination of Constants. The second and perhaps more important aspect of the calibration is that it provides data for the development of proportionality constants or influence coefficients between the applied load and the measured response. These factors can then be used to generate applied loads from the recorded seaway stresses.

Ideally, a calibration procedure seeks to apply sequentially a series of pure (single-component) loads while the specimen is at a uniform and constant temperature and free from other influencing factors or loads. These conditions were not fulfilled in the present calibration experiment due to various practical limitations. The limitations will be noted and the deviations from ideal conditions described in the appropriate succeeding sections.

III. CONCLUSIONS

The following general conclusions can be drawn based on the data gathered during the calibration experiment:

1. Measured changes in midship vertical longitudinal bending stress were consistently 80 percent of the calculated changes. Because of possible differences between the as-constructed and the theoretical (minimum-

scantling) section modulus upon which the calculations were based, this correlation is reasonable and indicates further that the load/response characteristic is linear and that data acquisition and reduction techniques do not contain any significant systematic errors.

2. Data have been reported relating response to applied loads, making possible the development of proportionality constants.

3. Stress levels achieved during the calibration are in most cases small relative to maximum measured seaway stress variations, and thermal conditions were not constant over the duration of the experiment. Extrapolations of loads by proportionality, therefore, should be undertaken with caution.

4. The maximum observed stress change for the calibrations loadings (10,200 psi, Sensor SY_A, during the torsion loading, Condition 4 to Condition 6) occurred at the starboard aft corner of Hatch No. 9, just forward of the Aft House. Other hatch corners at stations where hatch width changes are encountered exhibited high shear stresses near the stress relief cutouts. The hatch corners, therefore, are probably the most highly stressed parts of the structure.

IV. INSTRUMENTATION

General System. The sensors used in the calibration experiment were the identical ones used in the Fall/Winter 1972-73 seaway data collection program. A total of 105 discrete instrumentation channels are installed and were available for monitoring. Of these, 97 were strain gage sensors (including some multiple active element bridges designed to be sensitive to only specific types of loading), six were ship's motion (four linear acceleration and two rotational displacements), one was a multiplexed combination of ship operating parameters and one was assigned to a wave height radar. Only the strain gage sensors saw useful input levels during the calibration experiment. Table I contains a listing of all instrumentation sensors. It should be noted that the vertical bending stress is repeated on both recorders for matching purposes. For record keeping convenience, however, each of the five repeated monitorings (on Recorder No. 1 and on Recorder No. 2 in Modes A, B, C, and D) is assigned a separate sensor number. Table II lists abbreviations used for sensor nomenclature.

Figure 1 presents the overall instrumentation layout and signal flow as installed on the SEA-LAND McLEAN. All strain gages and ship motion sensors are first terminated in Intermediate Junction Boxes (IJB) positioned near the sensor location. All instrumentation is then routed to Junction Boxes (JB) installed by the ship's electrical contractors. Cabling for the data collection system is designated "612" throughout the ship. The majority of strain gage signals are fed directly from IJB's to JB's. Sensors Nos. 43 through 84 and 86 through 105 additionally pass through the Rosette Selection Box (RSB) and Girder Selection Box (GSB), respectively, where signals are selected and patched for recording. During the calibration, all available signals were patched and recorded for each loading condition. (For a more detailed definition of these gages and selection arrangement see Reference 1.)

Scratch Gages. All ships in the SL-7 series have a "scratch gage" mechanism installed in the starboard tunnel at midships for long-term monitoring. These self-contained gages are intended to record the maximum strain in the tunnel side stringer on which they are mounted. In the McLEAN (only) two instruments are installed, one each port and starboard midships. Both instruments were manually advanced and recorded the strain at these locations for each calibration condition.

Additional Gages. Three additional gages, not available for analog monitoring during seaway runs, were installed for future reference. Located at the Aft House/Hatch 9 starboard cutout, these gages were read manually using a strain indicator during the calibration for Conditions 3 to 7.

Gage Locations. A short reference description of the location of all sensors is included in Table I. An expanded description and brief rationale for each sensor are presented in Tables II and III. Reflected in the gage layout is the realization that longitudinal vertical bending is the single most important operating parameter. Due to the unusually high speed of the ship, extensive ship motion sensors are incorporated to gather data on rigid-body motions. The majority of the remaining gages are located to ascertain the magnitude and effect of the torsional loading and distributions which are major considerations in the structural design. Such loadings tend to induce a fixed-end-bending type of deformation in the transverse girders and develop stress concentrations at hatch corners.

Figure 2 presents an overall plan of gage locations. Figure 3 presents installation details of the strain gage instrumentation.

V. THE CALIBRATION EXPERIMENT

The dockside calibration experiment was conducted on 9-10 April 1973 in Rotterdam, Holland. Originally the plan was to begin from a fully-loaded ship and selectively remove container cargo so as first to produce three increments of change in longitudinal vertical bending moment and then two torsional (twisting about a longitudinal axis) moment distribution increments. The initial (dockside) condition was designated No. 1, the five unloading increments described are Conditions Nos. 2 through 6, and the final (empty) condition is No. 7. Due to schedule constraints Condition No. 2 was deleted. For similar reasons a full set of zero readings at dockside (Condition No. 1) using all patching options was not possible. For this reason a previous condition, coming up the Maas River at slow speed, was defined as Condition Zero. All other measurements reported are referred to it unless otherwise noted. (Any other condition may be defined as Zero by algebraically subtracting the reading for that condition from all readings at the other conditions.)

Environmental conditions during the calibration are presented in Table IV, and the observed drafts are in Table V. Figures 4a-4d illustrate the changes in container loadings which are presented in Table VI. Figures 5a-5f present the calculated vertical bending moment, vertical shear force, and torsional moment distributions for each condition. Container unloading proceeded as described below:

Condition 1

Dockside initial readings were taken, no unloading, all channels and patch options were read by meter, tape recordings made on all modes but options not patched. (Note: Cargo holds beneath Hatch 3 and 10 were empty throughout the calibration.)

Condition 3 (Figure 4a)

Deck containers removed from Hatches 1 through 4 and 12 through 15. All options were read from meter and recorded on tape for this and subsequent conditions. This condition is the maximum decrease in hogging (vertical bending) moment.

Condition 4 (Figure 4b)

Remaining deck containers on Hatches 5 through 11 removed. This midship cargo removal results in an increase in hogging moment toward arrival level.

Condition 5 (Figure 4c)

Containers were removed from starboard side of Hatches 1 through 7, and the port side of Hatches 8 through 15, generating a torsional moment. After approximately one-half of the unloading was complete, Condition 5 was recorded. Hatch covers were placed asymmetrically to contribute to the torsional moment.

Condition 6 (Figure 4d)

Completion of unloading described in Condition 5. This is the maximum torsional load. It should be noted that this also changes the hogging moment component.

Condition 7

Nominally empty ship except for one propeller (47 long tons) loaded into Hatch 3 and one propeller in Hatch 4, all hatch covers on.

VI. RESULTS

As previously noted only strain gage sensors produced useful outputs during the calibration. A summary of all strain gage outputs, referenced to Condition Zero, is presented in Table VII. Single gage strains have been converted to stress by multiplying by Young's Modulus (E). In the case of three-arm rosette gages, calculated principal maximum (σ_1) and principal minimum (σ_1) stresses are also given along with the angular orientation to the principal axis as measured from the "A" or longitudinal gage. Changes in Hatch 7 dimensions were measured during the torsional part of the calibration, and are presented in Table VIII.

VII. DISCUSSION

The results of the calibration experiment fall into two classes depending upon whether or not the data can be predicted by theoretical calculations. Calculations of vertical bending moment, vertical shear force, and torsional moment were prepared by the American Bureau of Shipping from the loading information, but only a relatively small number of the sensors were designed to measure the effects of these basic loadings. The remainder of the strain gages were placed in areas of interest where calculations are difficult, and there are no specific predicted values available for comparison. The response of these gages to the applied loadings is, therefore, of great interest, and these results will be considered first. Figures have been prepared as noted to illustrate this discussion.

Rectangular Rosette Gages (Mounted Underdeck)

There is a great similarity in recorded strain (converted to stress) between geometrically comparable rosette elements located at Frames 226 and 258; R5 and R10; R6 and R11; R7 and R12; R8 and R13; R9 and R14. Although the gages at the more forward location show approximately 25 percent lower stress, the general changes with load are similar. This would be expected from the similar sections as the load decreases forward. Another decrease in stress is exhibited at the next forward location (Frame 290), but the response is modified due to the influence of the Forward House, especially in reducing the diagonal stresses. In this connection, the longitudinal stresses predominate in the tunnel at Frames 258 and 290, whereas the diagonal stresses predominate in the transverse girder near the hatch corners.

Figure 6 shows the output of each element of AR1 and AR2. These are located symmetrically on the port and starboard sides, respectively, at Frame 143 near the Hatch 9 corners just forward of the After House (see Figure 3). The opposite action of the torsional loading can be seen clearly here; the longitudinal and transverse elements exhibit nearly equal stress changes but in opposite directions. Similar behavior could not be expected in the case of the diagonal elements since these are tangent to the hatch corner cutout on the port side, but radial to the cutout on the starboard side. Note the relatively large tensile stress on the port (tangential side) diagonal indicating a stress concentration around this detail.

Figure 7 presents a similar representation for the R1 and R2 gages located port and starboard just aft of the Forward House, near the Hatch 1 corners. Since all the cargo used to apply the vertical bending and torsional moments was aft of this section, one might expect negligible stress changes. Relatively significant longitudinal stress changes are exhibited, however. These are associated more with the restraint of warping stresses than with the bending moment changes. Apparently, both the Forward and Aft Houses restrain the free action of the open cell torsional deflections, thus giving rise to significant (in comparison with those induced by vertical bending) longitudinal stress components. These components are especially important at hatch corners near the house structures because the house structure geometries further increase their magnitudes.

Additional Gages

Three additional gages (SY) were located circumferentially about the hatch corner reinforcement on the starboard side just forward of the Aft House (Hatch 9). The first of these gages, SYA, displayed the highest recorded strain change of any gage during the calibration. This gage was located 22 1/2 degrees from the longitudinal direction around the cutout ring. These gages were installed especially for the calibration, and were read with a strain indicator.

Transverse Girder (Normal Stresses)

Gages TGFS, TGMS, and TGAS were located in forward (Frames 242-244), mid (Frames 194-196), and aft (Frames 78-80) transverse girders, respectively. Each exhibited similar general responses which may be characterized as a change in bending stress distribution from vertical to horizontal as the loading conditions were varied from Conditions 1 to 6. The mid girder was the most heavily instrumented, with three normal stress gages in each side (one each at the corners and midpoint), one each at the top and bottom midpoint, and one shear installation at each side quarter point. Forward and aft transverse girders were instrumented only with normal strain gages near each side corner. (No readings were obtained from the aft transverse girder forward bottom corner gage, TGAS2, due to excessive zero offset.) Each gage set was mounted in a vertical plane about four feet inboard from the starboard tunnel--transverse girder interface. The change from the slow, steady ahead river condition (Condition Zero) to dockside (Condition 1) shows as a significant increase in vertical bending. In all cases, the change in stress distribution from Condition 1 to Condition 6 is characterized by a change from vertical to horizontal bending in the gage arrays, as shown in Figure 8. This is assumed to result from first the decrease in vertical bending and then the torsional warping of the hull cross sections. The former will result in upper fiber tension and lower fiber compression, since the reference condition is loaded, and unloading is the same as application of an upward load. The latter will result in tension in the aft fibers and compression in the forward fibers. Some of the distortion in the stress plots is probably due to the influence of the bulkhead on the aft side of each transverse girder section.

Shear stresses recorded at the upper section remain fairly constant while those at the lower quarter points tend to become increasingly negative, especially on the bulkhead side where a change in shearing stress of -6450 psi was recorded.

Forward Longitudinal Strain

Four single-element gages were located 12 inches below each longitudinal tunnel (port and starboard) and 12 inches above each tank top at Frame 290. Three of these gages exhibited fairly low stress (1,000 psi or less) with little response to bending loads and limited but definite torsional response. The fourth gage in the group (top, port) showed a large, linear increase in tensile strain between Conditions Zero and 3. Since there was no static load change between Conditions Zero and 1, there should have been no significant induced strain. Similarly, the load change between Conditions 1 and 3 should not cause the amount of tensile change indicated at this location. Additionally, the strain remains high through Condition 7. It must be assumed, therefore, that there was a warm-to-cool (coming up river/dockside shadow) thermal restraint stress induced at this location. The general response after Condition 4 is consistent with the loading conditions assuming an initial zero offset.

Calculated Data

The longitudinal vertical bending moments and the vertical shear forces were obtained from the ABS "Static Longitudinal Strength Calculation for SL-7 Sea-Land Containership Study" dated February 8, 1974 for the appropriate frame (see Figures 5a through 5f). The vertical bending moments were divided by the appropriate section modulus (top or bottom) taken from the Sea-Land Service, Inc. Containership Construction Center Drawing No. 10-097, "Section Moduli, Bending Moment (Cond. 7) and Bend. Stresses Curves", dated May 5, 1972. Using these data the normal stresses were calculated by the relationship

$$S_b = \frac{M_b}{Z}$$

where S_b and M_b are the bending stress and bending moment, and Z is the section modulus at the section of interest. The results of the calculations are shown in Table IX.

The torsional moments at each hatch for each load condition were obtained from ABS calculations titled "SEA-LAND McLEAN Calibration Tests, Torsional Moments (Ton-Feet)", and are also plotted in Figures 5a through 5f. Summing these torsional moment contributions per hatch for each load condition along the ship length aft to forward, using the appropriate sign convention, produces an accumulative torsional moment per hatch for each load condition. These torsional moments are tabulated in Table X.

Longitudinal Vertical Bending

A comparison of measured and calculated values is presented in Figures 9 and 10. The tracking of the two sets of data against Condition is good in Figure 9, even though the absolute magnitudes are relatively low. Figure 10 demonstrates this relationship more clearly by plotting the measured values against the calculated ones. All of the points lie on a straight line having a slope of 0.8.

Figure 11 presents the longitudinal stresses measured top and bottom, port and starboard, at midship with the measured and calculated vertical bending stresses and the calculated torsional moments. These plots show the ship bending as the unloading proceeds from the slight hogging sense at Condition 1 to the greatest hogging sense at the unloaded Condition 7. In proceeding from Condition 1 to Condition 3, it is evident that the ship changes from a hogging sense toward a sagging sense. This result is reasonable, as in going from Condition 1 to Condition 3 containers are removed from the deck over Hatches 1-4 and 12-15, which tends to produce a more concentrated load at midship. Proceeding to Condition 4 shows a moment change back to a hogging sense. The hogging continues to increase to the unloaded Condition 7. This increase in hogging can be attributed to the fact that as the ship is unloaded the buoyant forces forward and aft decrease at a faster rate than at midship.

Detailed analysis of Figure 11 and the data in Table VII reveals some unexpected results, however, especially from the starboard neutral axis and bottom gages. Although the extreme fiber (top and bottom) gages respond in the expected sense for the two vertical bending conditions, the magnitude of change for the port and starboard gages, which should be approximately equal, in fact is considerably different. This indicates a nonuniformity of the bending moment across the section which is presently unexplained. Further, the relatively high stress changes indicated at the starboard neutral axis (not plotted) is also unexplained. This gage is located on the neutral axis approximately 24-3/4 feet above the base line, which, for the calibration, equals the draft shortly after Condition 4. In other words, this gage is at water temperature under one condition, and at approximately air temperature during the succeeding condition. Due to the inherent self-temperature compensation of the strain gages used, thermally-induced strains will not be indicated. However, restraints of thermal strains are actual stresses and are indicated by the gage. Three types of thermally-induced stresses are possible for the calibration conditions: gross horizontal bending, gross vertical bending, and local stress changes across thermal interfaces (i.e., the waterline). Gross horizontal and vertical bending due to restraint of thermally-induced strains result in compressive stresses in the starboard side and deck, respectively, for the calibration condition of cool water and warm air/sun on the starboard side and deck. The large stress exhibited by the starboard neutral axis gage cannot be explained by these considerations. It is also interesting to note that this stress is largely maintained at Condition 7 (unloaded). As a result of this unexplained behavior, a physical check was performed on the installation. All circuits were found to be operating correctly and were correctly identified.

Scratch Gages

A scratch gage (a timer-advanced, peak-strain-reading, mechanical recording strain gage) has been installed in both longitudinal tunnels, midship, at the half-height side shell longitudinal stringer. (Other vessels in the SL-7 class have been fitted with one such gage each, in the starboard tunnel at a similar location.) Both recording charts were advanced manually at each calibration condition for recording peak strain. For the calibration experiment induced strains produced stylus deflections on the order of 0.020 inch, a quantity which is difficult to scale precisely. The plot of these stresses in Figure 12 also presents the corresponding outputs from the tunnel top stress gages near the same locations. Agreement between the two types of instrumentation is generally good, especially for the low stresses involved.

Torsional Shear Midship

In the absence of detailed sectional information suitable for calculating shear stresses using the calculated torsional moments, the moments themselves have been plotted in Figure 13 along with the measured shear data. The comparison is generally good. Virtually no output is indicated until the start of the torsional loading condition. Although there is no change in the horizontal bending sensor output for Conditions 1 through 4, an increasing output is indicated for Conditions 5 and 6. This corresponds to the torsional stress distribution (restraint of torsional warping resulting in symmetrically opposite normal stresses about the centerline and torsional neutral axis). It is also possible that some of this is due to thermally-induced horizontal bending which is restrained by the constant-temperature ship bottom.

Low outputs are exhibited by the two boxgirder (longitudinal tunnel) gages located on the tunnel top (deck) and bottom (see Figure 14). However, the indication is larger for the shear conditions and of opposite sign on top and bottom as would be expected due to the shear flow around the closed box section. The top gage on the starboard boxgirder appears to track fairly well with the calculated torsional moment. The bottom gage appears to be responding to shear associated with horizontal bending, which tends to reduce its response to the torsional moment. However, it is very difficult to relate calculated and measured data when the measured stresses are of such low magnitude.

Forward and Aft Sideshell Shear

One vertical shear sensor was installed on each sideshell neutral axis at Frames 289-290 and Frames 87-88 with each monitored separately. The forward pair (Figure 15) are located at the neutral axis and exhibited similar shear stresses, indicating that their response was associated principally with vertical bending loads. At the aft location (Figure 16) the gages were located above the neutral axis and exhibited similar but opposite behavior. A check of seaway data in head seas revealed that the Shear Aft Port transducer consistently produced data opposite in polarity from the Starboard data, indicating a polarity error in the bridge circuit. However, if horizontal bending and/or torsional loads were present, their effects could not be separated from vertical shear with transducers of this configuration. The shear stresses measured were very low in absolute magnitude.

VIII. GENERAL CONSIDERATIONS

Various factors present in the calibration experiment militate against more completely explainable results. Some of these are:

1. A clear, bright-sun day. Due to the ambient temperatures, the fact that the sun shone directly on the starboard side, and the almost 24-hour period required for the calibration, thermal effects from port to starboard, deck to waterline, and between day and night loading conditions resulted in appreciable strains. A determination of the magnitude of these strains is difficult for several reasons. First, the actual distribution of temperatures through material thicknesses and along various length and width dimensions is not known. From the temperature measurements made during the calibration (Table IV) a probable distribution may be assumed, but this may not be adequate. Second, the induced apparent strain depends on the degree of restraint of thermal expansion. (As mentioned previously, no response due to unrestrained thermal expansion is indicated by the gages employed. Evaluation of this problem requires a model analysis, and the exercise would become circular.

2. Schedule and other operational limitations. The original offloading plan called for an intermediate vertical bending condition (No. 2) which would have added another data point to indicate the linearity and correctness of the measured strains. Due to schedule considerations, this point was deleted. Further, due to the excessive time and labor which would have been required, a reverse torsional loading condition was not included in the original plan. This would have been useful in aiding the elimination of biased or nonsymmetrical loading behavior.

3. Low load level. Due to various logistical and other factors the ship arrived for the calibration experiment with less than a full cargo load. Most of the missing containers had been located fore and aft, resulting in a decreased change in hogging bending moment during the calibration. This situation contributed to the relatively low strain levels recorded. These low strain levels are, in many cases, of a magnitude similar to the thermal restraint stresses, built-in fabrication stresses, non-linear stresses due to structural nonuniformities and irregularities and/or zero offsets and drifts in the instrumentation. In many cases the load-induced stress levels are insufficient to rise above these

types of noise. However, the linearity of the vertical bending results provides considerable confidence in this important area.

4. Simultaneous variation in applied load. Ideally, during a calibration the various loads are varied individually so that the effect of each may be ascertained easily. During this calibration experiment it was not possible to achieve this ideal, primarily because the loading changes which induced a torsional response also caused changes in vertical bending moment. Such a situation makes it difficult to separate the cause (load) and effect (strain) relationship.

IX. REFERENCES

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2. Fain, R. A., Boentgen, R. R., and Wheaton, J. W. "First Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," Ship Structure Committee Report SSC-264.

TABLE I

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
1 (1)	LVB	186 1/4	Tunnel Tops	Dyadic	Long.	V. Bend.	1	1	-	8214	PSI	1
2	TSM	186 1/4	Side N/A	Shear	Vert.	H.T. Shear	1	2	-	4991	PSI	3
3	Wave Ht.	300	Fwd Deckhouse (Stbd)	Radar	Angled	Range(3)	1	3	-	3.6	Volt	-
4	Roll	178	26" Fwd 31' ATT	Pend.	Trans.	Roll	1	4	-	20	Deg.	-
5	Pitch	178	26" Fwd 31' ATT	Pend.	Long.	Pitch	1	5	-	20	Deg.	-
6	MAV	178	23" Fwd 31' ATT	Mass	Vert.	V. Accel.	1	6	-	1	g	-
7	MAT	178	23" Fwd 31' ATT	Mass	Trans.	T. Accel.	1	7	-	1	g	-
8	FAV	290	14" Fwd 59' ATT	Mass	Vert.	V. Accel.	1	8	-	1	g	-
9	FAT	290	14" Fwd 59' ATT	Mass	Trans.	T. Accel.	1	9		1	g	-
10	Op Para.	-	RPM, Rud, Wind S&D	Multiplex	-	Transmitters	1	10	-	3.6	Volt	-
11	LHB	186 1/4	Side NA	Dyadic	Long.	H. Bend	1	11	-	8214	PSI	2
12	SFP	265	P Side 32' ATT	Shear	Vert.	Shear	1	12	-	5000	PSI	4
13	SFS	265	S Side 32' ATT	Shear	Vert.	Shear	1	13	-	5000	PSI	4
14 (1)	LVB						2	1	A			
15	LSTS	186	S Tunnel Top	Dyadic	Long.	N. Stress	2	2	A	8240	PSI	5
16	LSNS	186	S Side N.A.	Dyadic	Long.	N. Stress	2	3	A	8240	PSI	5
17	LSBS	186	S Side Bottom	Dyadic	Long.	N. Stress	2	4	A	8240	PSI	5
18	LSTP	186	P Tunnel Top	Dyadic	Long.	N. Stress	2	5	A	8240	PSI	5
19	LSNP	186	P Side NA	Dyadic	Long.	N. Stress	2	6	A	8240	PSI	5
20	LSBP	186	P Side Bottom	Dyadic	Long.	N. Stress	2	7	A	8240	PSI	5
21	SAP	87	P Side 26' ATT	Shear	Vert.	Shear	2	8	A	5000	PSI	4
22	SAS	87	S Side 26' ATT	Shear	Vert.	Shear	2	9	A	5000	PSI	4

2.

TABLE I(Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Location (2) Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
23	FDWV	307	Level 04 CL	Mass	Vert.	V. Accel.	2	10	A	+1 (4)	g	-
24	FDWT	307	Level 04 CL	Mass	Trans.	T. Accel.	2	11	A	+1	g	-
25	ADHL	130	Level 05 1" P	Mass	Long.	L. Accel.	2	10 (a)	A	+1	g	-
26	ADHT	130	Level 05 1" P	Mass	Trans	T. Accel.	2	11 (a)	A	+1	g	-
27	BGST	186 $\frac{1}{4}$	S Tunnel Top	Shear	Long.	Shear	2	12	A	5000	PSI	4
28	BGSB	186 $\frac{1}{4}$	S Tunnel Bot	Shear	Long.	Shear	2	13	A	5000	PSI	4
29 (1)	LV3						2	1	B			
30	AR-1A	143	Port Side Girder	Single	Long.	N. Strain	2	2	B	334.6	μ"/"	6
31	AR-1B	143	Near Deck Cutout	Single	Diag.	N. Strain	2	3	B	334.6	μ"/"	6
32	AR-1C	143	Under Deck	Single	Trans.	N. Strain	2	4	B	334.6	μ"/"	6
33	AR-2A	143	Stbd Side Gird.	Single	Long.	N. Strain	2	5	B	334.6	μ"/"	6
34	AR-2B	143	Near Deck Cutout	Single	Diag.	N. Strain	2	6	B	334.6	μ"/"	6
35	AR-2C	143	Under Deck	Single	Trans.	N. Strain	2	7	B	334.6	μ"/"	6
36	AR-3A	143	Stbd Tunnel	Single	Long.	N. Strain	2	8	B	334.6	μ"/"	6
37	AR-3B	143	In Board	Single	Diag.	N. Strain	2	9	B	334.6	μ"/"	6
38	AR-3C	143	Under Deck	Single	Trans.	N. Strain	2	10	B	334.6	μ"/"	6
39	AR-4A	143	Stbd Tunnel	Single	Long.	N. Strain	2	11	B	334.6	μ"/"	6
40	AR-4B	143	Out Board	Single	Diag.	N. Strain	2	12	B	334.6	μ"/"	6
41	AR-4C	143	Under Deck	Single	Trans.	N. Strain	2	13	B	334.6	μ"/"	6

3.

TABLE I (Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
42 (1)	LVB						2	1	C			6
43	R1A	291	Port Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
44	R1B	291	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
45	R1C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
46	R2A	291	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
47	R2B	291	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
48	R3C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
49	R3A	291	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
50	R3B	291	In Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
51	R3C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
52	R4A	291	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
53	R4B	291	Out Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
54	R4C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
55	R5A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
56	R5B	258	In Corn. Hat 2	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
57	R5C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
58	R6A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
59	R6B	258	Out Corn. Hat 2	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
60	R6C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
61	R7A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
62	R7B	258	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
63	R7C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
64	R8A	258	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
65	R8B	258	In Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
66	R8C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6

TABLE I (Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Location (2) Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
67	R9A	258	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
68	R9B	258	Out Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
69	R9C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
70	R10A	226	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
71	R10B	226	In Corn. Hat 4	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
72	R10C	226	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
73	R11A	226	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
74	R11B	226	Out Corn Hat 4	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
75	R11C	226	Underdeck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
76	R12A	226	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
77	R12B	226	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
78	R12C	226	Underdeck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
79	R13A	226	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
80	R13B	226	In Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
81	R13C	226	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
82	R14A	226	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
83	R14B	226	Out Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
84	R14C	226	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
85 (1)	LVB						2	1	D			
86	TGFS1	244	Fwd Top	Single	Trans.	N. Stress	2	2	D	10038	PSI	6

TABLE I (Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
87	HLSST	289	S Side 1' BT	Single	Long.	N. Stress	2	2 (a)	D	10038	PSI	6
88	TGFS2	244	Fwd Bot.	Single	Trans.	N. Stress	2	3	D	10038	PSI	6
89	HLSSB	289	S Side 1' ATT	Single	Long.	N. Stress	2	3 (a)	D	10038	PSI	6
90	TGFS3	242	Aft Bot	Single	Trans.	N. Stress	2	4	D	10038	PSI	6
91	HLSPT	289	P Side 1' BT	Single	Long.	N. Stress	2	4 (a)	D	10038	PSI	6
92	TGFS4	242	Aft Top	Single	Trans.	N. Stress	2	5	D	10038	PSI	6
93	HLSPB	289	P Side 1' ATT	Single	Long.	N. Stress	2	5 (a)	D	10038	PSI	6
94	TGMS1	196	Fwd Gird. Top	Single	Trans.	N. Stress	2	6	D	10038	PSI	6
95	TGMS2	196	Fwd Gird Bot.	Single	Trans.	N. Stress	2	7	D	10038	PSI	6
96	TGMS3	194	Aft Gird Bot.	Single	Trans.	N. Stress	2	8	D	10038	PSI	6
97	TGMS4	194	Aft Gird Top	Single	Trans.	N. Stress	2	9	D	10038	PSI	6
98	TGMS1X	194	Fwd Gird Mid	Single	Trans.	N. Stress	2	6 (a)	D	10038	PSI	6
99	TGMS2X	195	Bot Gird Mid	Single	Trans.	N. Stress	2	7 (a)	D	10038	PSI	6
100	TGMS3X	194	Aft Gird Mid	Single	Trans.	N. Stress	2	8 (a)	D	10038	PSI	[illegible]
101	TGMS4X	195	Top Gird Mid	Single	Trans.	N. Stress	2	9 (a)	D	[illegible]	PSI	[illegible]
102	TGSS1X	196	Fwd Gir Q Top	Shear	Trans.	Shear	2	6 (a)	D	5000	PSI	4
103	TGSS2X	196	Fwd Gir Q Bot	Shear	Trans.	Shear	2	7 (a)	D	5000	PSI	4
104	TGSS3X	194	Aft Gir Q Bot	Shear	Trans.	Shear	2	8 (a)	D	5000	PSI	4
105	TGSS4X	194	Aft Gir Q Top	Shear	Trans.	Shear	2	9 (a)	D	5000	PSI	4
106	TGAS1	80	Fwd Top	Single	Trans.	N. Stress	2	10	D	10038	PSI	6
107	TGAS2	80	Fwd Bot	Single	Trans.	N. Stress	2	11	D	10038	PSI	6
108	TGAS3	78	Aft Bot	Single	Trans.	N. Stress	2	12	D	10038	PSI	6
109	TGAS4	78	Aft Top	Single	Trans.	N. Stress	2	13	D	10038	PSI	6

TABLE II

SENSOR AND SIGNAL NOMENCLATURE

ADHL	After Deck House Longitudinal (Acceleration)
ADHT	After Deck House Transverse (Acceleration)
$AR_{1-4}(Z)$	Aft Rosettes, (Z) denotes gage element: A is longitudinal orientation B is diagonal (45°) orientation C is transverse (athwart) to longitudinal
BGSB	Box Girder Shear Bottom
BGST	Box Girder Shear Top
FAV	Forward Acceleration Vertical (Hull)
FAT	Forward Acceleration Transverse (Hull)
FDHT	Forward Deck House Transverse (Acceleration)
FDHV	Forward Deck House Vertical (Acceleration)
HLSPB	Hull Longitudinal Strain Port Bottom
HLSPT	Hull Longitudinal Strain Port Top
HLSSB	Hull Longitudinal Strain Starboard Bottom
HLSST	Hull Longitudinal Strain Starboard Top
LHB	Longitudinal Horizontal Bending (combination of LHBP and LHBS)
LHBP	Longitudinal Horizontal Bending Port (Stress)
LHBS	Longitudinal Horizontal Bending Starboard (Stress)
LSBP	Longitudinal Stress Bottom Port
LSBS	Longitudinal Stress Bottom Starboard
LSMP	Longitudinal Stress Mid Port
LSMS	Longitudinal Stress Mid Starboard
LSTP	Longitudinal Stress Top Port
LSTS	Longitudinal Stress Top Starboard

TABLE II (Continued)

SENSOR AND SIGNAL NOMENCLATURE

LVB	Longitudinal Vertical Bending (combination of LVBP and LVBS)
LVBP	Longitudinal Vertical Bending Port (Stress)
LVBS	Longitudinal Vertical Bending Starboard (Stress)
MAT	Midship Acceleration Transverse (Hull)
MAV	Midship Acceleration Vertical (Hull)
R_{1-14}(Z)	Rosettes (Forward), (Z) denotes gage element:
	A is longitudinal orientation
	B is diagonal (45°) orientation
	C is transverse (athwart) to longitudinal
SAP	Shear Aft Port
SAS	Shear Aft Starboard
SFP	Shear Forward Port
SFS	Shear Forward Starboard
$TGAS_{1-4}$	Transverse Girder Aft Starboard (Strain)
$TGFS_{1-4}$	Transverse Girder Forward Starboard (Strain)
$TGMS_{1-4}$	Transverse Girder Midship Starboard (Strain)
$TGMS_{1X-4X}$	Transverse Girder Midship Starboard (Strain, midpoints)
$TGSS_{1X-4X}$	Transverse Girder Shear Starboard (Midships, vertical quarterpoints)
TSM	Torsional Shear Midship (combination of TSMP and TSMS)
TSMP	Torsional Shear Midship Port
TSMS	Torsional Shear Midship Starboard

TABLE III

SIGNAL DESCRIPTION AND RATIONALE

RECORDER NO. 1

Channel(s)

1 Vertical Bending: Longitudinal stress gages, P&S, under deck, near midship (Frame 186 1/4), in box girder wired to eliminate longitudinal horizontal bending; primary reference stress; provides data comparable to SSC Project SR-153 and ABS 5-Vessel program. This signal serves as a common reference with each group of gages.

2 Midship Torsional Shear: Shear rosettes amidship (Frame 186 1/4) P&S, on sideshell at neutral axis wired into single bridge to eliminate shear associated with vertical bending. Will show shear associated with torsion and horizontal bending. Primary value is in comparison with similar SS BOSTON data.

3 Wave Height: Reserved for output of a wave height sensor.

4,5 Roll and Pitch: Pendulums, roll and pitch angle transducers located close to vertical and longitudinal vessel CG (Frame 178). Rigid body motions. Similar to BOSTON data; useful in container load evaluation.

6,7 Hull Accelerations: Vertical and transverse accelerometers located at vessel CG (Frame 178), similar to array used on BOSTON. Vertical unit required for heave acceleration.

8,9 Hull Accelerations: Vertical and transverse accelerometers located forward (Frame 290). Rigid body as well as whipping motions. Useful for comparison with WOLVERINE STATE and BOSTON data, and probably indicative of most severe accelerations on vessel.

10 Multiplexed Ship Parameters: RPM, rudder angle, wind speed and direction.

11 Horizontal Bending: Longitudinal stress gages, P&S, near midship (Frame 186 1/4), at neutral axis; wired to provide a longitudinal horizontal bending signal.

12,13 Shear-Forward: Shear rosettes near forward quarter point (Frame 265-266), P&S, on sideshell, at neutral axis. P&S recorded separately since shear associated with vertical bending may be of major interest here; signals can be recombined on playback to produce shear component associated with vertical bending or torsion.

TABLE III (Continued)

RECORDER NO. 2, MODE A

Channel(s)

Channel(s)	Description
1	Vertical Bending: Reference signal
2,3,4,5,6,7	Longitudinal Stress Gages: Six stress gages at deck, neutral axis, and bottom (lower sideshell), P&S, amidship (Frame 186 1/4). Recorded separately, but data can be combined to provide signals proportional to longitudinal vertical bending, longitudinal horizontal bending, and warping longitudinal stresses. Neutral axis gages added to simplify direct evaluation of transverse stresses and subsequent separation of vertical and warping stresses. First time this array has been used.
8,9	Shear-Aft: Shear rosettes near after quarter point (Frame 87-88) P&S, on sideshell, 18.2' at above neutral axis P&S recorded separately. Torsional shear was initial concern, but present interest is in shear associated with vertical bending as well. Separate recording permits recombination of signals to produce shear component associated with vertical bending or torsion.
10,11	Deckhouse Accelerations: Vertical and transverse accelerometers mounted high near centerline in the forward house, and transverse and longitudinal accelerometers in the after house. Any two of the four signals may be recorded at one time. Primary interest is in possible springing or higher frequency vibratory effects.
12,13	Box Girder Shear: Shear rosettes located on overhead and deck of starboard box girder. Each recorded independently; a torsional shear in the box girder can be reduced from these signals.

RECORDER NO. 2, MODE B

Channel(s)

Channel(s)	Description
1	Vertical Bending: Reference signal.
2 thru 13	After Hatch Corner: Four, three-arm strain gage rosettes will be placed in an athwartship array under the deck between Frame 143-144, just forward of the after house. Of interest here is the transfer of longitudinal stress (from all sources--torsion, vertical bending, etc.) from the box beam ligament structure in way of the holds to the relatively complete and rigid hull at the house. The gross hatch corner stress concentration will also be

TABLE III (Continued)

Channel(s)

evaluated port and starboard. Original suggestion of ABS, but this and following locations shown to be of concern in California model work and British, German, and Japanese model and full-scale tests.

RECORDER NO. 2, MODE C

This gage group is the same as Gage Group 3, except that the rosettes are located at one of the following positions:

5 Rosettes at Frame 226-227	(hatch transition)
5 Rosettes at Frame 258-260	(hatch transition) and
4 Rosettes at Frame 290-291	(aft of Fwd Deckhouse)

Since Gage Group 4 consists of 14 rosettes with 3 elements per rosette for a total of 42 separate signals; some means was required to allow for a selection of inputs into the 12 recorder channels available.

A patching unit designated the "Rosette Selection Box" (RSB) has been installed in the starboard box girder at approximately Frame 272. This unit takes the 14 rosette signals as inputs and by means of patching cable allows the operator to select any 4 rosettes as input to the recorder. The only restriction is that all elements, i.e., the A, B, and C arms of any rosette must be recorded together.

RECORDER NO. 2, MODE D

Channel(s)

1 Vertical Bending: Reference signal.

2,3,4,5 Gages in Transverse Deck Girder: Four single gages mounted at the corners of a transverse deck girder, Frames 242-244. Double-S bending in girder used as measure of torsional hull deflection at that frame. Similar to BOSTON arrays. Or, by PSU selection, four single strain gages around the hull section at Frame 240 (2 top, 2 bottom) to measure strain distribution at this location.

6,7,8,9 Gages in Transverse Deck Girder: Same as above at Frames 194-196.

In addition to the four corner gages, four additional single element gages have been placed at the midpoint of each dimension of the girder. Four 2-element shear gages have been installed at the quarter points of the two side walls.

TABLE III (Concluded)

In a manner similar to the rosette selection technique it was again necessary to select four of twelve signals available for recording. This time a similar Girder Selection Box (GSB) was installed in the starboard box girder at Frame 194.

The selection was limited to three possible combinations due to wiring and bridge requirements.
The three possible patches are:

(1) 4 corner gages

(2) 4 midpoint gages

(3) 4 shear gages (quarter points)

It is possible to mix signals but additional changes are required at the signal conditioning equipment.

10,11,12,13 Gages in Transverse Deck Girder: Same as above at Frame 78-80.

TABLE IV

ENVIRONMENTAL CONDITION AT CALIBRATION

Cond.	Time	Temperatures, °F Air, Dry	Air Wet	Water	Port Tunnel*	Stbd Tunnel*	Location of Sun, degrees Elevation	Azimuth**	Wind Speed, mph	Direction
	9 Apr'73									
1	0900	49.5	43	43	51	52	45 (Overcast)	50 Stbd	15	60° Port
3	1300	58	50.5	43	49	64	60 (Clear)	100 Stbd	20	60° Port
4	1725	49	44	43	49	63	30 (Clear)	Aft	10	110° Port
5	2130	38	36	43	45	52	-	-	8	90° Port
	10 Apr'73									
6	0105	36.5	35	43	43	46	-	-	12	60° Port
7	0830	40	-	42	40	46	-	-	10	90° Port

Notes:

* Measured on hull plating backside
** Relative to ship

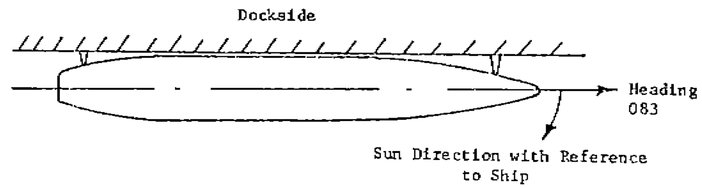


TABLE V

OBSERVED DRAFTS

Condition	PORT Fwd	PORT Mid	PORT Aft	STBD Fwd	STBD Mid	STBD Aft
1	30' 11"	31' 0"	31' 1"	-	-	-
3	28' 11"	-	29' 11 1/2"	28' 11"	27' 11"	29' 7 1/2"
4	27' 2"	-	28' 9"	27' 2"	26' 9"	28' 9"
5	25' 5"	-	27' 1"	25' 5"	25' 1"	27' 0"
6	23' 0"	-	26' 11"	23' 2"	24' 5"	26' 10"

HATCH LIST HATCH NO 01 | S E A - L A N D S E R V I C E I N C | PAGE NO 002
VESSEL SL MCLEAN | VOYAGE 012W | MASTER
PORT DEPARTURE BHV | DESTINATION ROT | DATE 04/08/73
FINAL PLAN

TABLE VI
CALIBRATION UNLOADING PLAN

			0110 18.0 SLS 71810 BHV-FEL		18.0
	0609 10.5 SLS 38479 BHV-FEL	0209 22.1 SLS 63887 BHV-FEL	0109 20.0 950113 ELZ-ROTTN	0509 7.6 SLS 50939 BHV-FEL	60.2
	0608 23.5 SLS 95731 ELZ-ROTTN			0508 23.4 SLS 95626 ELZ-ROTTN	
	0608 23.6 SLS 95952 ELZ-ROTTN	0208 22.0 SLS 60429 BHV-FEL	0108 20.6 950112 ELZ-ROTTN	0508 23.5 SLS 95733 ELZ-ROTTN	136.6
	57.6	44.1	58.6	54.5	21[illegible].8

Removed for Cond. 3

PORT 101.7 | CENTER LINE .0 | STBD 113.1 | DIFF DIR 11.4 STBD | TOTAL WT

Removed for Cond. 6

0607 9.5 SLS 57221 ELZ-ROT M	0407 8.5 SLS 70739 ELZ-ROT M		0107 13.2 301016 ELZ-ROT RG		31.2
0606 10.2 SLS 55959 ELZ-ROT M	0406 19.9 SLS 70267 BAL-ROT	0206 11.5 SLS 37498 BAL-ROT S	0106 13.6 301703 ELZ-ROT	0306 21.6 SLS 68939 ELZ-ROT	76.8
	0405 18.5 301117 ELZ-FEL	0205 14.5 SLS 40026 BAL-ROT	0105 15.2 301733 ELZ-ROT	0305 21.7 301209 ELZ-ROT	69.9
	0404 23.3 SLS 69784 ELZ-FEL	0204 16.2 SLS 67701 BAL-ROT	0104 15.8 SLS 63391 BAL-FEL	0304 24.5 301473 ELZ-ROT	76.6
		0203 18.3 SLS 44258 ELZ-ROT	0103 18.1 SLS 35943 ELZ-FEL		36.4
		0202 19.8 SLS 55291 BAL-FEL	0102 19.4 SLS 50859 ELZ-ROT		39.2
		0201 21.9 SLS 39120 BAL-LHA	0101 20.8 SLS 69073 ELZ-ROT		42.7
19.7	67.2	102.2	116.1	67.8	373.[illegible]

PORT | CENTER LINE | STBD | DIFF DIR | TOTAL WT

HATCH LIST   HATCH NO 02
VESSEL   SL MCLEAN
PORT DEPARTURE   BHV
FINAL PLAN

S E A - L A N D   S E R V I C E   I N C
VOYAGE   012W
DESTINATION   ROT

FASTER
DATE   04/08/73

TABLE VI (Cont'd)

0809 22.4 SLS 69779 GRA-ROT	0209 17.1 SLS 69621 GRA-ROT	0109 17.7 SLS 73986 GRA-ROT	0309 20.1 SLS 95598 ELZ-ROTTN	0709 17.5 SLS 37782 BHV-ROT		94.8
	0208 20.8 SLS 95888 JAX-FELTR		0308 20.5 SLS 95945 JAX-FELTR			
0808 6.0 SLS 45694 ELZ-ROT	0208 20.8 SLS 95910 JAX-FELTR	0108 8.0 SLS 52047 ELZ-ROT G	0308 20.8 SLS 93593 JAX-FELTR	0708 7.8 SLS 51293 BAL-ROT 5	Removed for Cond. 3	106.7
30.4	58.7	25.7	61.4	25.3		201.5

PORT 89.1   CENTER LINE .0   STBD 112.4   DIFF DIR 23.3 STBD   TOTAL WT

0607 14.3 SLS 52666 JAX-LEG		0207 16.0 SLS 50849 NRF-VAL	0107 17.7 SLS 57754 CHS-VAL		0507 14.8 SLS 53469 JAX-LEG		62.3
0606 17.1 SLS 59663 NRF-LEG	0406 12.1 SLS 61566 BAL-LHA	0206 18.5 SLS 65575 NRF-NAP	0106 18.2 SLS 49674 NRF-NAP	0306 14.4 SLS 61812 BAL-ROT	0506 17.3 SLS 70080 NRF-LEG	Removed for Cond. 5	97.6
0605 17.4 SLS 60964 NRF-LEG	0405 17.3 SLS 74361 BAL-FEL	0205 18.5 SLS 64950 NRF-NAP	0105 18.5 SLS 70457 NRF-NAP	0305 14.7 SLS 56629 ELZ-ROT G	0505 17.0 SLS 69516 NRF-LEG		103.4
	0404 17.5 SLS 50687 JAX-CDZ	0204 18.7 SLS 66090 NRF-NAP	0104 19.6 SLS 39533 NRF-VAL	0304 16.2 SLS 69958 ELZ-ROT G			72.0
	0403 20.6 SLS 37034 BAL-ROT	0203 20.1 SLS 46057 BAL-NRS	0103 19.9 SLS 51659 ELZ-VAL	0303 21.7 SLS 17526 ELZ-ROT			32.5
	0402 22.1 SLS 40915 ELZ-ROT	0202 20.8 SLS 37217 JAX-CDZ	0102 20.5 SLS 61278 BAL-VAL	0302 23.0 SLS 17520 ELZ-ROT			86.4
		0201 20.9 SLS 17353 BAL-FEL	0101 20.8 SLS 46940 JAX-CDZ	Removed for Cond. 6			41.7
48.8	89.8	133.5	135.2	90.0	49.1		546.4

PORT 272.1   CENTER LINE .0   STBD 274.3   DIFF DIR 2.2 STBD   TOTAL WT 747.9

HATCH LIST   HATCH NO 03   S E A - L A N D S E R V I C E I N C   PAGE NO 004
VESSEL SL MCLEAN   VOYAGE 0124   MASTER
PORT DEPARTURE BHV   DESTINATION ROT   DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

0809 14.8			0209 5.1	0109 18.1		0509 18.6	0709 20.0		76.6
SLS 26878			SLS 38759	SLS 26480		SLS 20385	SLS 20667		
ELZ-ROTX			CHS-ROT	ELZ-ROTX G		ELZ-ROTX G	ELZ-LHAX		
0808 19.1	0608 21.5	0408 20.2	0208 21.9	0108 22.6	0308 22.5	0508 21.7	0706 22.6		172.1
SLS 26711	SLS 27354	SLS 26586	SLS 29588	SLS 2047?	SLS 21331	SLS 20002	SLS 29822		
ELZ-ROTX	POS-FELV	ELZ-ROTX G	ELZ-LHAX	JAX-PTNX	ELZ-PTNX	BAL-ROTX	ELZ-FELX	Removed for Cond. 3	
33.9	21.5	20.2	27.0	40.7	22.5	40.3	42.6		248.7

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
102.6	.0	146.1	43.5 STBD	

.0

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
.0	.0	.0	.0 STBD	248.7

Empty
(All Conditions)

HATCH LIST HATCH NO 04
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

PAGE NO 005

TABLE VI (Cont'd)

1009 17.7 SLS 22036 BOS-FELX		0409 21.5 SLS 22648 ELZ-FELX	0209 17.7 SLS 28592 BOS-PTNX	0109 17.7 SLS 28931 BOS-PTNX				0909 17.7 SLS 20376 BOS-FELX	92.3
1008 17.7 SLS 28920 BOS-PTNX	0608 19.5 SLS 24062 LBC-PTNX	0408 19.1 200152 ELZ-ROTX	0208 24.5 851000 ELZ-ELZX	0108 20.4 200249 ELZ-FELX	0308 22.5 SLS 28763 ELZ-PTNX	0508 21.0 SLS 26371 ELZ-FELX	0708 19.9 SLS 26254 LBC-ROTX	0908 21.7 SLS 29871 ELZ-FELX	Removed for Cond. 3 186.3
35.4	19.5	40.6	42.2	38.1	22.5	21.0	19.9	39.4	278.6

PORT 137.7 CENTER LINE .0 STBD 140.9 DIFF DIR 3.2 STBD TOTAL WT

Removed for Cond. 6

	0607 13.9 SLS 48776 ELZ-LEG	0407 13.9 SLS 41886 ELZ-LEG	0207 12.4 SLS 45236 ELZ-LEG	0107 2.5 SLS 64517 *EMPTY* E				42.7
	0606 16.4 SLS 62270 ELZ-LEG	0406 14.6 SLS 65932 ELZ-LEG	0206 12.7 SLS 64265 ELZ-LEG	0106 12.4 SLS 55075 ELZ-LEG			0706 4.7 SLS 54198 BOS-PTN	60.3
0305 9.5 SLS 69010 BOS-VAL	0605 17.7 SLS 72487 ELZ-VAL	0405 17.1 SLS 33761 BOS-GOA	0205 12.9 SLS 63811 ELZ-LEG	0105 12.5 SLS 69118 ELZ-LEG			0705 5.7 SLS 39365 ELZ-FEL	74.8
0304 13.7 SLS 54026 ELZ-LEG	0604 10.8 SLS 26102 ELZ-ROT	0404 15.2 SLS 70711 ELZ-LEG	0204 13.5 SLS 58063 ELZ-LEG	0104 12.8 SLS 63241 ELZ-LEG		0504 7.5 SLS 47386 ELZ-ROT	0704 8.6 SLS 65180 BAL-LHA S	90.1
0303 22.0 301729 BOS-CDZ	0603 22.2 SLS 29177 ELZ-FEL	0403 17.6 SLS 64490 ELZ-GOA	0203 13.8 SLS 55197 ELZ-LEG	0103 13.5 SLS 67538 ELZ-LEG		0503 8.8 SLS 34555 BAL-LHA S	0703 9.0 SLS 55676 ELZ-ROT	106.9
	0602 23.6 SLS 22589 ELZ-FEL	0402 17.7 SLS 70787 ELZ-LEG	0202 15.2 SLS 61931 ELZ-LEG	0102 13.7 SLS 17033 ELZ-LEG	0302 20.4 950020 ELZ-ROTTN	0502 20.6 950099 ELZ-ROTTN		111.2
		0401 21.5 SLS 71720 BOS-CDZ	0201 22.7 SLS 61152 BOS-CDZ	0101 14.5 SLS 60728 ELZ-LEG	0301 23.1 SLS 55062 ELZ-ROT			81.8
45.2	112.0	117.6	103.2	81.9	43.5	36.9	28.0	568.3

PORT 378.0 CENTER LINE .0 STBD 190.3 DIFF DIR 187.7 PORT TOTAL WT 946.9

HATCH LIST   HATCH NO 05   S E A - L A N D S E R V I C E I N C   PAGE NO 006
VESSEL SL MCLEAN   VOYAGE 012W   MASTER
PORT DEPARTURE BHV   DESTINATION ROT   DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

1010 4.3 SLS 62651 CHS-ROT	0810 4.8 SLS 52744 ELZ-ROT G	0610 6.8 SLS 69659 ELZ-ROT	0410 5.1 SLS 73960 CHS-ROT	0210 4.9 302069 CHS-ROT	0110 4.4 SLS 71077 CHS-ROT	0310 9.1 SLS 60023 CHS-ROT	0510 9.1 SLS 52759 NRF-ROT	0710 5.0 SLS 41615 CHS-ROT	0910 5.1 SLS 62873 CHS-ROT	58.6
1009 10.4 SLS 48726 NRF-ROT	0809 10.7 SLS 63320 ELZ-ROT	0609 21.5 SLS 29184 ELZ-LHAX	0409 10.8 SLS 26832 ELZ-ROTX G	0209 12.2 SLS 29765 NRF-ROTX	0109 12.3 200483 NRF-ROTX	0309 12.1 200596 NRF-ROTX	0509 8.6 200452 NRF-ROTX	0709 21.3 SLS 20874 ELZ-LHAX	0909 10.7 SLS 39307 ELZ-ROT G	130.6
1008 16.0 200550 NRF-ROTX	0808 16.2 200601 NRF-ROTX	0608 16.2 200602 NRF-ROTX	0408 16.5 SLS 23141 ELZ-ROTX	0208 13.9 200463 NRF-ROTX	0108 12.5 SLS 23085 ELZ-ROTX	0308 15.1 200082 CHS-ROTX	0508 14.1 SLS 26383 NRF-ROTX	0708 15.3 200490 NRF-ROTX	0908 13.2 200619 NRF-ROTX	Removed for Cond. 4 149.0
30.7	31.7	44.5	32.4	31.0	29.2	36.3	31.8	41.6	29.0	338.2

PORT 170.3   CENTER LINE .0   STBD 167.9   DIFF DIR 2.4 PORT   TOTAL WT

Removed for Cond. 5

1007 12.5 SLS 17127 ELZ-ROT G		0607 14.5 SLS 39353 JAX-ROT	0407 14.8 SLS 32234 JAX-ROT	0207 17.6 SLS 39216 NRF-ROT	0107 17.5 SLS 34582 NRF-ROT	0307 14.6 SLS 30760 NRF-ROT	0507 14.4 SLS 33696 CHS-ROT		0907 13.2 SLS 64801 ELZ-ROT G	119.1
1006 17.9 SLS 59640 NRF-ROT	0806 13.5 SLS 45477 ELZ-ROT G	0606 18.1 SLS 59695 NRF-ROT	0406 19.6 SLS 44604 CHS-ROT	0206 19.6 SLS 47642 CHS-ROT	0106 19.6 SLS 45206 CHS-ROT	0306 19.6 SLS 45735 CHS-ROT	0506 19.6 SLS 40088 CHS-ROT	0706 14.0 SLS 57398 ELZ-ROT G	0906 17.9 SLS 45652 NRF-ROT	179.4
1005 20.0 SLS 54477 ELZ-ROT	0805 18.1 SLS 73215 CHS-ROT	0605 20.3 SLS 43626 ELZ-ROT	0405 20.8 SLS 39688 NRF-ROT	0205 21.1 SLS 46035 NRF-ROT	0105 20.8 SLS 47949 NRF-ROT	0305 22.6 SLS 53364 NRF-ROT	0505 20.3 SLS 69533 NRF-ROT	0705 18.0 SLS 61267 CHS-ROT	0905 19.6 SLS 42781 CHS-ROT	201.6
	0804 20.2 SLS 51308 ELZ-ROT	0604 21.7 SLS 60287 JAX-ROT	0404 22.6 SLS 60819 JAX-ROT	0204 22.3 SLS 34585 CHS-ROT	0104 22.1 SLS 34442 JAX-ROT	0304 20.8 SLS 50109 NRF-ROT	0504 21.7 SLS 38075 JAX-ROT	0704 20.1 SLS 48254 BAL-ROT		171.5
	0803 21.7 SLS 63040 JAX-ROT	0603 22.6 SLS 56905 CHS-ROT	0403 22.0 SLS 62361 ELZ-ROT G	0203 22.6 SLS 39351 JAX-ROT	0103 22.7 SLS 42723 CHS-ROT	0303 21.8 SLS 37844 NRF-ROT	0503 22.5 SLS 42701 ELZ-ROT	0703 21.7 SLS 52829 ELZ-ROT G		177.6
	0802 22.4 SLS 54782 CHS-ROT	0602 22.5 SLS 49824 CHS-ROT	0402 22.7 SLS 44205 CHS-ROT	0202 22.7 SLS 46946 CHS-ROT	0102 22.6 SLS 52644 ELZ-ROT	0302 22.5 SLS 59963 CHS-ROT	0502 22.6 SLS 55350 JAX-ROT	0702 22.3 SLS 34360 CHS-ROT		180.3
		0601 23.0 SLS 60230 CHS-ROT	0401 23.0 SLS 47926 CHS-ROT	0201 23.0 SLS 39798 CHS-ROT	0101 23.0 SLS 37581 CHS-ROT	0301 23.0 SLS 42837 CHS-ROT	0501 23.0 SLS 48142 CHS-ROT			138.0
50.4	95.9	142.7	145.5	148.9	148.3	144.9	144.1	96.1	50.7	1167.5

PORT 583.4   CENTER LINE .0   STBD 584.1   DIFF DIR .7 STBD   TOTAL WT 1505.7

HATCH LIST HATCH NO 06
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

TABLE VI (Cont'd)

10	08	06	04	02	01	03	05	07	09	Total
1009 15.3 SLS 28273 ELZ-ROTX G		0609 17.7 SLS 27178 ELZ-PTNX	0409 17.3 SLS 26170 ELZ-FELX	0209 19.1 SLS 29399 CHS-FELX	0109 19.5 SLS 26403 ELZ-PTNX	0309 18.5 SLS 29809 JAX-FELX			0909 16.2 SLS 26336 ELZ-PTNX	123.6
1008 20.8 SLS 26740 ELZ-LHAX	0808 21.4 SLS 20499 ELZ-FELX	0608 21.7 SLS 21658 ELZ-FELX	0408 21.5 SLS 26199 ELZ-FELX	0208 23.2 SLS 28834 JAX-ROTX	0108 19.5 SLS 26962 ELZ-LHAX	0308 22.2 SLS 28619 JAX-ROTX	0508 17.5 SLS 21669 ELZ-ROTX	0708 21.2 SLS 26295 ELZ-LHAX	0908 19.9 200580 ELZ-ROTX	208.9
36.1	21.4	39.4	38.8	42.3	39.0	40.7	17.5	21.2	36.1	332.5

Removed for Cond. 4

PORT 178.0 CENTER LINE .0 STBD 154.5 DIFF DIR 23.5 PORT TOTAL WT

Removed for Cond. 6

10	08	06	04	02	01	03	05	07	09	Total
		0607 10.2 775158 ELZ-ROT G	0407 12.7 SLS 58038 NRF-LHA	0207 14.9 SLS 60668 NRF-PTN	0107 19.2 SLS 67429 ELZ-PTN	0307 11.9 SLS 47476 ELZ-ROT G	0507 11.2 SLS 69897 ELZ-ROT G			80.1
		0606 12.8 SLS 53040 CHS-ROT	0406 11.9 SLS 72410 ELZ-LHA	0206 16.7 SLS 72972 ELZ-PTN	0106 15.5 SLS 59142 ELZ-PTN	0306 12.4 SLS 54584 ELZ-ROT	0506 12.7 SLS 68511 ELZ-ROT		0906 5.9 SLS 15479 ELZ-LHA	87.9
		0605 15.7 SLS 62827 JAX-ROT	0405 15.7 SLS 52317 JAX-ROT	0205 17.4 SLS 50330 NRF-PTN	0105 13.5 300379 BOS-PTN	0305 15.6 SLS 59107 NRF-ROT	0505 15.7 SLS 58293 JAX-ROT		0905 6.4 SLS 27300 ELZ-ROT G	100.0
	0804 19.8 SLS 70283 BAL-FEL	0604 16.1 SLS 55147 ELZ-ROT	0404 17.4 SLS 62057 NRF-ROT	0204 18.3 SLS 15035 ELZ-PTN	0104 17.3 SLS 35163 BOS-PTN	0304 15.8 SLS 50003 ELZ-ROT	0504 17.4 SLS 59620 NRF-ROT		0904 9.7 300438 ELZ-ROT G	133.8
	0803 20.1 302330 ELZ-PTN	0603 17.5 SLS 60678 NRF-ROT	0403 17.6 SLS 40793 NRF-ROT	0203 19.9 SLS 15810 ELZ-PTN	0103 21.1 SLS 62940 LBC-PTN	0303 17.6 SLS 62971 NRF-ROT	0503 17.6 SLS 54176 NRF-ROT	0703 22.4 301787 ELZ-ROT G	0903 16.9 301031 ELZ-ROT G	170.7
	0802 22.3 SLS 9[illegible]850 ELZ-PTNTN							0702 22.2 SLS 95854 ELZ-PTNTN		
	0802 22.1 SLS 95844 ELZ-PTNTN	0602 20.3 SLS 55684 CHS-ROT	0402 22.6 SLS 46188 NRF-LHA	0202 22.3 SLS 60670 ELZ-PTN	0102 18.1 SLS 15753 ELZ-PTN	0302 20.8 SLS 35359 CHS-PTN	0502 18.8 SLS 29078 JAX-ROT	0702 22.5 SLS 95882 ELZ-PTNTN		212.0
	0801 21.3 SLS 67069 BAL-FEL	0601 23.4 SLS 72254 MAY-ROT	0401 21.8 SLS 64982 ELZ-LHA	0201 22.6 SLS 61994 JAX-PTN	0101 22.5 SLS 56751 JAX-PTN	0301 22.4 SLS 15439 ELZ-PTN	0501 22.5 SLS 70418 ELZ-ROT	0701 22.0 SLS 66619 ELZ-ROT G		178.5
	105.6	118.0	119.7	132.1	127.2	116.5	115.9	89.1	38.9	963.0

PORT 475.4 CENTER LINE .0 STBD 487.6 DIFF DIR 12.2 STBD TOTAL WT 1295.5

HATCH LIST HATCH NO 07
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

PAGE NO 008

TABLE VI (Cont'd)

1010 5.2 SLS 30505 CHS-ROT	0810 5.3 SLS 60235 CHS-ROT	0610 5.5 SLS 36181 CHS-ROT	0410 5.6 SLS 71365 CHS-ROT	0210 5.7 SLS 62199 CHS-ROT	0110 8.9 SLS 56822 ELZ-ROT G	0310 5.7 SLS 55650 CHS-ROT	0510 5.6 SLS 70757 CHS-ROT	0710 5.3 SLS 66002 CHS-ROT	0910 5.2 SLS 36748 CHS-ROT	58.0
1009 16.5 200315 NRF-ROTX	0809 17.5 SLS 21431 ELZ-ROTX G	0609 18.0 SLS 21666 CHS-ROTX	0409 18.8 200599 NRF-ROTX	0209 18.8 SLS 29742 ELZ-ROTX G	0109 18.6 200547 NRF-ROTX	0309 18.6 200556 NRF-ROTX	0509 18.6 200189 JAX-ROTX	0709 17.8 200131 ELZ-ROTX G	0909 17.1 200540 NRF-ROTX	180.3
1008 19.9 SLS 29907 NRF-ROTX	0808 19.9 200608 ELZ-ROTX G	0608 19.8 200544 NRF-ROTX	0408 19.8 SLS 26500 ELZ-ROTX	0208 18.9 200488 NRF-ROTX	0108 18.8 200606 NRF-ROTX	0308 19.6 200543 NRF-ROTX	0508 19.7 200604 NRF-ROTX	0708 19.4 200647 NRF-ROTX	0908 18.9 200623 NRF-ROTX	194.7
41.6	42.7	43.3	44.2	43.4	46.3	43.9	43.9	42.5	41.2	433.0 TOTAL WT

Removed for Cond. 4

PORT 215.2 CENTER LINE .0 STBD 217.8 DIFF 2.6 DIR STBD

Removed for Cond. 5

1007 14.7 SLS 69326 CHS-ROT	0807 11.7 SLS 15920 ELZ-ROT G	0607 14.4 SLS 69765 CHS-ROT	0407 14.1 SLS 65657 ELZ-LHA	0207 15.0 SLS 48412 CHS-FEL	0107 14.8 301654 BOS-FEL	0307 14.6 SLS 58649 BOS-FEL	0507 11.0 SLS 61894 LBC-LHA	0707 13.6 SLS 48822 ELZ-ROT	0907 14.8 SLS 54595 CHS-ROT	138.7
1006 15.9 SLS 45352 CHS-ROT	0806 15.1 SLS 55087 NRF-ROT	0606 15.9 300889 CHS-ROT	0406 14.7 SLS 46184 ELZ-LHA	0206 19.7 SLS 43343 ELZ-FEL	0106 19.3 SLS 54573 ELZ-FEL	0306 15.7 SLS 73276 CHS-FEL	0506 14.1 SLS 48625 ELZ-LHA	0706 15.9 SLS 65017 CHS-ROT	0906 15.9 SLS 63159 CHS-ROT	162.2
1005 17.6 SLS 73954 NRF-ROT	0805 16.5 300310 CHS-ROT	0605 20.7 SLS 36978 NRF-LHA	0405 19.7 SLS 34192 JAX-LHA	0205 21.0 SLS 70824 ELZ-FEL	0105 22.1 SLS 61503 JAX-FEL	0305 19.8 302235 ELZ-FEL	0505 20.7 SLS 46867 NRF-LHA	0705 16.9 SLS 52297 CHS-ROT	0905 17.8 SLS 62408 NRF-ROT	188.8
1004 17.8 SLS 69781 CHS-ROT	0804 17.7 SLS 63954 NRF-ROT	0604 22.1 SLS 69281 JAX-LHA	0404 22.1 SLS 56226 JAX-FEL	0204 22.1 SLS 55622 JAX-FEL	0104 20.8 SLS 41679 JAX-FEL	0304 22.1 SLS 64603 JAX-FEL	0504 22.0 SLS 51152 JAX-LHA	0704 17.7 SLS 69985 NRF-ROT	0904 17.8 SLS 56363 NRF-ROT	202.2
1003 22.4 SLS 61614 CHS-ROT	0803 22.1 301426 JAX-ROT	0603 22.7 SLS 34662 JAX-LHA	0403 22.8 SLS 40802 JAX-FEL	0203 22.7 SLS 54146 ELZ-FEL	0103 22.5 SLS 60299 JAX-FEL	0303 22.5 SLS 51389 JAX-FEL	0503 22.7 SLS 47108 JAX-LHA	0703 22.4 SLS 61864 CHS-ROT	0903 22.5 SLS 67614 CHS-ROT	225.3
1002 23.1 505572 CHS-ROT	0802 23.1 SLS 73523 CHS-ROT	0602 22.7 SLS 54230 JAX-LHA	0402 23.3 SLS 47503 JAX-FEL	0202 23.3 SLS 39167 JAX-FEL	0102 22.8 SLS 44712 JAX-FEL	0302 23.3 SLS 44513 JAX-FEL	0502 22.7 SLS 40832 JAX-LHA	0702 22.5 SLS 68415 ELZ-ROT	0902 23.0 SLS 63870 CHS-ROT	229.8
	0801 22.7 SLS 73132 CHS-ROT	0601 23.0 SLS 57606 JAX-LHA	0401 23.3 SLS 50497 JAX-FEL	0201 23.3 SLS 50965 JAX-FEL	0101 23.3 SLS 69677 JAX-FEL	0301 23.3 SLS 58539 JAX-FEL	0501 22.8 304739 JAX-LHA	0701 22.8 301237 CHS-ROT		184.5
111.5	128.9	141.5	136.0	147.1	145.6	141.3	136.0	131.8	111.8	1331.5

PORT 665.0 CENTER LINE .0 STBD 666.5 DIFF 1.5 DIR STBD

TOTAL WT 1764.5

HATCH LIST HATCH NO 10 S E A - L A N D S E R V I C E I N C PAGE NO 011
VESSEL SL MCLEAN VOYAGE 012W MASTER
PORT DEPARTURE BHV DESTINATION ROT DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

1009 2.6 SLS 73389 *EMPTY* E	0209 2.5 SLS 70743 *EMPTY* E	0109 3.3 300779 *EMPTY* E	0909 3.3 300856 *EMPTY* E	11.7
1008 2.5 SLS 70803 *EMPTY* E	0208 2.6 SLS 74065 *EMPTY* E	0108 2.5 SLS 70277 *EMPTY* E	0908 2.4 SLS 64039 *EMPTY* E	10.0
5.1	5.1	5.8	5.7	21.7

Removed for Cond. 4

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
10.2	.0	11.5	1.3 STBD	

.0

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
.0	.0	.0	.0 STBD	21.7

Empty (All Conditions)

HATCH LIST HATCH NO 11
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

PAGE NO 012

TABLE VI (Cont'd)

1010 5.8 SLS 69449 ELZ-ROT	0810 5.9 SLS 62049 CHS-ROT	0610 6.2 SLS 60101 CHS-ROT	0410 6.5 SLS 62914 CHS-ROT	0210 7.6 SLS 72442 CHS-ROT	0110 8.3 SLS 42425 CHS-ROT	0310 7.6 SLS 60665 CHS-ROT	0510 6.5 SLS 61465 CHS-ROT	0710 6.1 SLS 42815 CHS-ROT	0910 5.9 SLS 55191 CHS-ROT		66.4
1009 20.1 200611 NRF-ROTX	0809 20.3 SLS 26821 NRF-ROTX	0609 20.2 200624 NRF-ROTX	0409 20.3 200493 NRF-ROTX	0209 20.6 200640 NRF-ROTX	0109 20.6 200646 NRF-ROTX	0309 20.4 200639 NRF-ROTX	0509 20.3 200108 NRF-ROTX	0709 20.2 200625 NRF-ROTX	0909 20.1 200613 NRF-ROTX		203.1
1008 21.2 SLS 26830 JAX-ROTX	0808 21.5 SLS 29038 JAX-ROTX	0608 22.3 SLS 28022 ELZ-ROTX	0408 22.6 SLS 22185 JAX-ROTX	0208 21.6 SLS 20342 ELZ-ROTX	0108 20.8 SLS 26716 JAX-ROTX	0308 22.3 SLS 26375 ELZ-ROTX	0508 21.6 SLS 21524 ELZ-ROTX G	0708 21.5 SLS 29162 JAX-ROTX	0908 20.9 SLS 26684 ELZ-ROTX	Removed for Cond. 4	216.3
47.1	47.7	48.7	49.4	49.8	49.7	50.3	48.4	47.8	46.9		485.8

PORT 242.7 CENTER LINE .0 STBD 243.1 DIFF DIR .4 STBD TOTAL WT

Removed for Cond. 5

1007 17.5 SLS 63956 NRF-LEG	0807 18.3 SLS 63285 NRF-LEG	0607 15.6 SLS 37817 CHS-GOA	0407 15.0 SLS 39551 NRF-GOA	0207 11.0 SLS 37876 BAL-GOA	0107 8.1 SLS 48251 JAX-GOA	0307 14.1 SLS 32360 NRF-GOA	0507 9.6 SLS 72190 BAL-GOA	0707 22.6 SLS 17656 JAX-CDZ	0907 18.4 SLS 55339 NRF-LEG	150.2
1006 16.7 SLS 40958 NRF-LEG	0806 19.6 SLS 46707 NRF-LEG	0606 17.0 SLS 71928 NRF-GOA	0406 16.0 SLS 35596 NRF-GOA	0206 15.9 SLS 37052 NRF-GOA	0106 15.7 SLS 64802 CHS-GOA	0306 15.9 SLS 73129 CHS-GOA	0506 15.7 SLS 17561 JAX-GOA	0706 17.3 SLS 27368 NRF-LEG	0706 19.8 SLS 27349 NRF-LEG	172.1
1005 19.9 SLS 52839 NRF-LEG	0805 20.3 SLS 55440 CHS-LEG	0605 20.3 SLS 48994 BAL-GOA	0405 20.1 SLS 54579 JAX-GOA	0205 18.0 SLS 68347 NRF-GOA	0105 17.4 SLS 36637 NRF-GOA	0305 20.0 SLS 25107 BAL-GOA	0505 17.7 SLS 71066 NRF-GOA	0705 15.7 SLS 41226 CHS-GOA	0905 20.8 SLS 35915 CHS-LEG	190.2
1004 25.7 SLS 53434 CHS-LEG	0804 20.8 SLS 61209 CHS-LEG	0604 22.2 SLS 25046 BAL-GOA	0404 22.2 SLS 25057 BAL-GOA	0204 21.0 SLS 44470 JAX-GOA	0104 20.6 SLS 25066 BAL-GOA	0304 21.7 SLS 52871 NRF-GOA	0504 22.4 SLS 35496 CHS-GOA	0704 20.5 SLS 71576 CHS-GOA	0904 22.3 SLS 71490 CHS-LEG	214.4
1003 21.4 SLS 50190 CHS-LEG	0803 21.5 SLS 43510 CHS-LEG	0603 23.1 302103 CHS-GOA	0403 23.0 SLS 62834 CHS-GOA	0203 22.7 SLS 66373 CHS-GOA	0103 22.3 SLS 47039 NRF-GOA	0303 22.7 SLS 69481 CHS-GOA	0503 20.9 SLS 33631 NRF-GOA	0703 22.2 SLS 54817 NRF-GOA	0903 20.5 SLS 55630 NRF-LEG	220.3
98.2	100.5	98.2	96.3	88.6	84.1	94.4	86.3	98.8	101.8	947.2

PORT 481.8 CENTER LINE .0 STBD 465.4 DIFF DIR 16.4 PORT TOTAL WT 1433.0

HATCH LIST HATCH NO 08 — S E A - L A N D S E R V I C E I N C — PAGE NO 009

VESSEL SL MCLEAN — VOYAGE 012W — MASTER

PORT DEPARTURE BHV — DESTINATION ROT — DATE 04/08/73

FINAL PLAN

TABLE VI (Cont'd)

1010 10.2 103466 BAL-ROT4	0810 10.3 103464 BAL-ROT4	0610 9.4 501579 HAM-HOU4	0410 23.4 101461 GRA-ROT4	0210 23.4 100654 GRA-ROT4	0110 13.4 100010 HAM-HOB4		0510 5.1 101515 ELZ-ROT4	0710 5.7 871340 BHV-HOU4	0910 5.0 100987 ELZ-ROT4	105.9
1009 11.8 103458 BAL-ROT4	0809 11.5 872376 ELZ-FEL4	0609 8.4 103603 BAL-FEL4	0409 9.3 424792 BHV-HOU4	0209 9.7 986027 PAK-HOU4	0109 8.1 424179 BHV-HOU4	0309 8.6 420546 BHV-HOU4	0509 7.2 902404 BHV-HOU4	0709 6.9 101353 ELZ-FEL4	0909 8.1 872665 ELZ-FEL4	89.6
1008 8.9 101220 ELZ-FEL4	0808 11.4 101302 ELZ-ROT4 H	0608 11.9 101987 ELZ-LHA4	0408 13.3 422515 ELZ-FEL4	0208 9.3 100905 ELZ-FEL4	0108 7.1 101179 ELZ-ROT4	0308 6.6 100080 ELZ-ROT4	0508 8.4 101687 ELZ-FEL4	0708 9.4 100924 ELZ-FEL4	0908 11.3 423368 BHV-HOU4 Removed for Cond.4	97.6
30.9	33.2	29.7	46.0	42.4	28.6	15.2	20.7	22.0	24.4	293.1

PORT 182.2 — CENTER LINE .0 — STBD 110.9 — DIFF DIR 71.3 PORT — TOTAL

Removed for Cond. 6

1007 20.6 422406 ELZ-ROT4	0807 15.1 103473 BAL-ROT4	0607 11.5 604481 BHV-HOU4	0407 16.5 605042 BHV-HOU4	0207 18.3 101913 ELZ-ROT4RG	0107 18.1 100380 ELZ-ROT4	0307 19.3 101639 ELZ-ROT4 G	0507 21.5 428199 ELZ-ROT4	0707 19.2 103529 ELZ-ROT4	0907 16.2 100616 ELZ-FEL4	176.3
1006 15.0 101350 ELZ-FEL4	0806 18.3 872614 ELZ-ROT4 G	0606 13.4 872481 BHV-HOU4	0406 17.8 100122 BHV-HOU4	0206 19.1 101131 BOS-ROT4	0106 18.1 100287 ELZ-FEL4	0306 20.9 100305 ELZ-ROT4 G	0506 21.0 100949 ELZ-ROTK G	0706 20.7 100008 ELZ-ROT4	0906 21.7 601303 ELZ-FEL4	186.0
1005 17.3 100780 ELZ-ROT4	0805 18.9 903825 PHL-ROT4	0605 13.4 601339 BHV-HOU4	0405 17.4 790909 HAM-HOU4	0205 18.7 101824 ELZ-ROT4 C	0105 18.3 100609 ELZ-ROT4	0305 18.4 100275 BAL-ROT4	0505 22.1 100150 ELZ-ROT4	0705 20.5 101605 ELZ-ROT4	0905 21.0 600228 ELZ-ROT4 G	186.0
1004 18.3 100523 ELZ-ROT4 G	0804 20.0 100117 ELZ-ROT4 G	0604 14.2 600227 BHV-HOU4	0404 18.3 707868 HAM-HOU4	0204 19.4 100713 ELZ-ROT4 G	0104 19.4 100366 ELZ-ROT4 G	0304 19.4 101493 ELZ-ROT4	0504 22.9 100456 ELZ-LHA4Y	0704 22.1 101015 ELZ-ROT4	0904 19.4 101842 ELZ-PTN4R	193.4
1003 20.1 101647 BAL-ROT4	0803 20.7 101087 BAL-ROT4	0603 15.0 421638 HAM-HOU4	0403 13.6 901413 HAM-HOU4	0203 19.9 100061 ELZ-ROT4	0103 19.8 101535 ELZ-FEL4	0303 21.1 100781 ELZ-ROT4 G	0503 22.1 100679 ELZ-ROT4	0703 22.0 100244 ELZ-ROT4	0903 21.7 427358 ELZ-ROT4 G	196.0
1002 21.1 103322 ELZ-ROT4	0802 22.0 605030 ELZ-ROT4	0602 15.0 501517 HAM-HOU4	0402 18.5 701466 HAM-HOU4	0202 20.5 100271 ELZ-FEL4	0102 20.1 101163 ELZ-ROT4 G	0302 21.0 601312 BAL-FEL4	0502 22.1 901284 ELZ-LHA4Y	0702 20.4 101415 ELZ-ROT4 G	0902 17.0 604249 ELZ-ROT4 G	197.7
1001 22.8 960357 BAL-ROT4	0801 22.3 903750 ELZ-ROT4	0601 14.8 903846 HAM-HOU4	0401 18.5 904345 HAM-HOU4	0201 21.0 101263 ELZ-LHA4	0101 20.7 100288 ELZ-FEL4	0301 23.0 100136 ELZ-ROT4RG	0501 23.7 100701 ELZ-ROT4	0701 20.6 627295 ELZ-ROT4	0901 19.2 100624 ELZ-ROT4	206.6
135.2	137.3	97.3	120.6	136.9	134.5	143.1	155.4	145.5	136.2	1342.0

PORT 627.3 — CENTER LINE .0 — STBD 714.7 — DIFF DIR 87.4 STBD — TOTAL WT 1635.1

HATCH LIST   HATCH NO 09   S E A - L A N D S E R V I C E I N C   PAGE NO 010
VESSEL SL MCLEAN   VOYAGE 012W   MASTER
PORT DEPARTURE BHV   DESTINATION ROT   DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

1010 5.6 100647 JAX-LHA4	0810 7.7 101727 ELZ-ROT4	0610 7.9 872626 ELZ-ROT4	0410 7.3 960429 ELZ-ROT4 G	0210 5.1 904643 BAL-ROT4	0110 8.4 872617 ELZ-ROT4RG	0310 6.9 100120 ELZ-ROT4	0510 5.2 101991 JAX-FEL4	0710 3.8 601062 BAL-ROT4	0910 5.9 901909 ELZ-ROT4		63.8
1009 9.1 100123 NRF-PTN4	0809 4.9 103358 ELZ-ROT4 G	0609 6.3 101362 ELZ-ROT4 G	0409 11.8 103461 BAL-ROT4	0209 16.5 100403 ELZ-ROT4 G	0109 21.4 103346 ELZ-ROT4 G	0309 14.7 100483 ELZ-ROT4 G	0509 16.7 101346 ELZ-ROT4	0709 10.1 102180 ELZ-ROT4 S	0909 9.7 102021 ELZ-ROT4 G		121.2
1008 9.0 101201 JAX-FEL4	0808 12.1 100472 ELZ-PTN4	0608 11.0 101397 NRF-ROT4	0408 10.9 101992 ELZ-LHA4	0208 12.4 100468 ELZ-FEL4	0108 13.9 100139 ELZ-PTN4	0308 11.8 100002 NRF-FEL4	0508 11.3 900262 NRF-FEL4	0708 13.6 100544 ELZ-LHA4	0908 12.1 100111 ELZ-PTN4	Removed for Cond. 4	118.1
23.7	24.7	25.2	30.0	34.0	43.7	33.4	33.2	27.5	27.7		303.1

PORT 137.6   CENTER LINE .0   STBD 165.5   DIFF DIR 27.9 STBD   TOTAL WT

Removed for Cond. 5

1007 11.3 100338 ELZ-ROT4	0807 15.4 101407 ELZ-ROT4	0607 15.2 600243 ELZ-ROT4	0407 15.9 101691 ELZ-PTN4	0207 17.7 607202 ELZ-PTN4	0107 21.7 103579 ELZ-ROT4YG	0307 18.1 103618 ELZ-ROT4 G	0507 13.3 103617 ELZ-ROT4 G	0707 16.9 426521 ELZ-ROT4RG	0907 16.8 101808 ELZ-ROT4 G	160.3
1006 19.6 103443 ELZ-ROT4 G	0806 19.4 103591 ELZ-ROT4 G	0606 19.6 871435 ELZ-FEL4	0406 18.6 103593 ELZ-ROTK G	0206 18.6 103606 ELZ-ROTK	0106 21.4 103619 ELZ-ROT4YG	0306 19.6 426360 ELZ-FEL4	0506 19.9 902247 ELZ-FEL4	0706 19.1 103508 ELZ-ROT4 G	0906 19.9 424716 ELZ-FEL4	195.7
1005 19.6 610142 ELZ-FEL4	0805 19.5 101233 ELZ-ROT4	0605 19.7 605318 ELZ-FEL4	0405 21.3 607209 ELZ-LHA4	0205 21.4 103616 ELZ-ROT4 G	0105 18.7 103602 ELZ-ROTK G	0305 21.5 602398 ELZ-FEL4	0505 19.7 103578 ELZ-ROT4	0705 19.4 103366 ELZ-ROT4 G	0905 22.4 100864 ELZ-ROT4 G	203.2
1004 20.3 100551 NRF-ROT4	0804 19.0 424202 ELZ-ROT4 G	0604 19.8 607178 ELZ-FEL4	0404 21.3 909311 ELZ-LHA4	0204 21.6 601376 ELZ-FEL4	0104 21.5 103431 ELZ-ROTK G	0304 21.3 871318 ELZ-LHA4	0504 19.9 871535 ELZ-ROT4 G	0704 19.5 103605 ELZ-ROT4 G	0904 19.5 101678 ELZ-FEL	203.7
1003 20.7 101936 ELZ-ROT4 G	0803 20.6 101009 ELZ-ROT4 C	0603 20.1 103576 ELZ-ROT4 G	0403 20.9 426571 ELZ-FEL4	0203 21.6 601457 ELZ-FEL4	0103 22.3 103370 ELZ-LHA4	0303 21.6 103460 ELZ-ROT4	0503 20.1 600503 ELZ-ROT4	0703 22.2 100142 ELZ-LHA4	0903 20.7 100297 ELZ-FEL4	210.8
1002 22.5 100202 ELZ-ROT4	0802 21.4 101365 ELZ-LHA4	0602 22.2 101089 ELZ-LHA4	0402 21.1 103325 CHS-FEL4	0202 22.7 103582 ELZ-ROT4 G	0102 21.6 960215 ELZ-FEL4	0302 21.6 904679 ELZ-FEL4	0502 20.4 102058 ELZ-PTN4	0702 22.1 101079 ELZ-LHA4	0902 22.8 100084 ELZ-ROT4	218.4
1001 23.4 101006 ELZ-LHA4	0801 22.2 100995 ELZ-ROTK G	0601 22.1 100490 ELZ-LHA4	0401 21.2 103620 ELZ-ROT4 G	0201 23.3 103604 ELZ-ROT4 G	0101 23.0 103607 ELZ-ROT4 G	0301 23.1 103585 ELZ-ROT4 G	0501 21.1 103590 ELZ-ROT4 G	0701 24.3 100897 ELZ-LHA4	0901 22.8 101616 ELZ-ROT4 G	226.5
137.4	137.5	136.7	140.3	146.9	150.2	146.8	134.4	143.5	144.9	1418.6

PORT 698.8   CENTER LINE .0   STBD 719.8   DIFF DIR 21.0 STBD   TOTAL WT 1721.7

HATCH LIST HATCH NO 12 S E A - L A N D S E R V I C E I N C PAGE NO 013
VESSEL SL MCLEAN VOYAGE 012W MASTER
PORT DEPARTURE BHV DESTINATION ROT DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

1010 8.9 100087 ELZ-FEL4	0810 12.3 100633 ELZ-FEL4	0610 12.1 100517 ELZ-PTN4	0410 12.3 101042 ELZ-FEL4	0210 6.5 SLS 47650 ELZ-PTN	0110 8 9 101140 ELZ-FEL4	0310 12.7 100718 ELZ-ROT4 H		0710 12.0 101190 ELZ-LHA4	0910 12.3 100688 ELZ-FEL4	98.8
1009 14.9 SLS 23184 ELZ-ROTX	0809 17.0 200236 ELZ-ROTX	0609 17.4 SLS 23290 ELZ-ROTX	0409 17.7 200046 ELZ-ROTX	0209 24.0 SLS 27387 PAP-LHAV	0109 18.3 SLS 26231 ELZ-ROTX	0309 2.3 SLS 44196 *EMPTY* E		0709 17.3 SLS 23176 ELZ-ROTX	0909 15.0 200003 ELZ-PTNX	143.9
1008 18.3 SLS 26635 ELZ-ROTX	0808 18.8 SLS 26567 JAX-FELX	0608 19.5 SLS 23041 ELZ-LHAX	0408 21.7 SLS 20656 ELZ-FELX	0208 24.5 SLS 89625 ELZ-ELZX	0108 22.9 SLS 28371 ELZ-FELX	0308 21.9 SLS 28895 ELZ-FELX	0508 19.5 SLS 23194 ELZ-LHAX	0708 19.0 SLS 29042 BAL-ROTX	0908 18.3 SLS 28164 ELZ-ROTX	204.4
42.1	48.1	49.0	51.7	55.0	50.1	36.9	19.5	49.1	45.6	447.1

Removed for Cond. 3

PORT 245.9 CENTER LINE .0 STBD 201.2 DIFF DIR 44.7 PORT TOTAL WT

Removed for Cond. 6

1007 2.5 SLS 59958 *EMPTY* E	0807 2.5 SLS 51273 *EMPTY* E	0607 2.5 SLS 39608 *EMPTY* E	0407 7.0 SLS 51194 BAL-LEG	0207 11.2 SLS 37912 JAX-BCL	0107 8.7 SLS 47816 ELZ-GRA	0307 4.8 SLS 45950 NRF-LEG	0507 2.5 SLS 53080 *EMPTY* E	0707 2.5 SLS 40865 *EMPTY* E	0907 2.5 SLS 39566 *EMPTY* E	46.7
1006 2.5 SLS 70879 *EMPTY* E	0806 2.5 SLS 73472 *EMPTY* E	0606 2.5 SLS 45087 *EMPTY* E	0406 13.4 SLS 63785 CHS-LEG	0206 11.9 300714 NRF-BCL	0106 13.5 SLS 62733 NRF-VAL	0306 11.6 SLS 46972 NRF-LEG	0506 2.6 300385 *EMPTY* E	0706 2.6 301318 *EMPTY* E	0906 2.5 SLS 45827 *EMPTY* E	65.6
1005 2.6 300404 *EMPTY* E	0805 2.6 300789 *EMPTY* E	0605 13.5 SLS 72949 ELZ-LEG	0405 13.6 SLS 42690 NRF-LEG	0205 16.2 SLS 43265 NRF-BCL	0105 14.5 SLS 65219 BAL-VAL	0305 15.9 SLS 70837 NRF-BCL	0505 14.1 SLS 63584 ELZ-LEG	0705 2.5 SLS 37574 *EMPTY* E	0905 2.5 SLS 52367 *EMPTY* E	98.0
	0804 15.4 SLS 44971 ELZ-LEG	0604 14.1 SLS 60994 ELZ-LEG	0404 13.9 SLS 52215 JAX-LEG	0204 16.6 SLS 69127 NRF-BCL	0104 15.4 SLS 51663 CHS-VAL	0304 16.2 SLS 31337 ELZ-BCL	0504 13.6 SLS 72092 NRF-LEG	0704 15.7 SLS 53851 ELZ-LEG		120.9
	0803 15.8 SLS 38895 ELZ-VAL	0603 17.1 SLS 33832 ELZ-LEG	0403 16.8 SLS 47694 NRF-LEG	0203 17.5 SLS 63772 NRF-NAP	0103 17.4 SLS 69746 BOS-VAL	0303 17.0 SLS 35511 NRF-BCL	0503 14.0 SLS 52960 NRF-LEG	0703 17.8 SLS 52886 ELZ-VAL		133.4
7.6	38.8	49.7	64.7	73.4	69.5	65.5	46.8	41.1	7.5	464.6

PORT 234.2 CENTER LINE .0 STBD 230.4 DIFF DIR 3.8 PORT TOTAL WT 911.7

HATCH LIST HATCH NO 13
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

PAGE NO 014

TABLE VI (Cont'd)

0809 13.5 SLS 22595 NRF-FELX	0609 22.3 SLS 20623 JAX-FELX	0409 21.7 SLS 21580 BOS-FELX	0209 20.3 SLS 21215 ELZ-FELX	0109 17.9 SLS 28197 ELZ-FELX	0309 20.3 SLS 26912 ELZ-FELX	0509 19.5 SLS 20507 ELZ-FELX	0709 18.2 200032 KNG-FELX	153.7
0808 23.9 SLS 20914 KNG-FELX	0608 23.2 SLS 23037 JAX-FELX	0408 22.6 SLS 26021 JAX-FELX	0208 22.1 SLS 29827 ELZ-ROTX	0108 22.4 SLS 28586 KNG-FELX	0308 22.6 SLS 26194 JAX-FELX	0508 22.6 SLS 28848 JAX-FELX	0708 22.6 SLS 28790 JAX-FELX	182.0
37.4	45.5	44.3	42.4	40.3	42.9	42.1	40.8	335.7

Removed for Cond. 3

PORT 169.6 CENTER LINE .0 STBD 166.1 DIFF DIR 3.5 PORT TOTAL WT

Removed for Cond. 5

0807 10.3 301145 ELZ-ROT G	0607 9.6 SLS 73345 ELZ-ROT					0507 6.6 SLS 70215 CHS-FEL	0707 10.1 SLS 41691 ELZ-ROT G	36.6
0806 14.5 301738 CHS-ROT	0606 9.8 SLS 72955 ELZ-ROT G	0406 13.7 SLS 38747 BOS-FEL				0506 13.7 SLS 50357 BOS-FEL	0706 13.1 SLS 71473 CHS-ROT	64.8
0805 17.6 SLS 56669 NRF-ROT	0605 19.1 SLS 60857 BOS-FEL	0405 18.0 SLS 54009 ELZ-FEL		0105 5.1 SLS 54666 CHS-ROT		0505 18.9 SLS 36837 ELZ-FEL	0705 16.4 SLS 21461 ELZ-ROT	95.1
0804 22.5 SLS 73304 CHS-ROT	0604 20.2 SLS 47827 LBC-FEL	0404 19.4 SLS 63439 ELZ-FELK		0104 11.1 SLS 68121 ELZ-PTN M		0504 19.5 SLS 47941 LBC-FEL	0704 22.5 SLS 63859 ELZ-ROT	115.2
	0603 22.5 SLS 51253 ELZ-FEL	0403 20.4 SLS 48548 LBC-FEL		0103 17.6 SLS 73429 LBC-FEL		0503 20.7 SLS 61093 ELZ-FELK		31.2
64.9	61.2	71.5		53.8		79.4	62.1	392.9

PORT 217.6 CENTER LINE .0 STBD 175.3 DIFF DIR 42.3 PORT TOTAL WT 726.6

HATCH LIST HATCH NO 14 — S E A - L A N D S E R V I C E I N C — PAGE NO 015
VESSEL SL MCLEAN — VOYAGE 012W — MASTER
PORT DEPARTURE BHV — DESTINATION ROT — DATE 04/08/73
FINAL PLAN

TABLE VI (Cont'd)

0810 8.1 102233 ELZ-FEL4	0210 9.9 100316 ELZ-ROT4	0110 10.9 101015 NRF-ROT4		0710 7.4 100420 ELZ-ROT4	36.3
0809 2.4 SLS 60884 *EMPTY* E	0209 2.6 SLS 72504 *EMPTY* E	0109 2.6 SLS 73996 *EMPTY* E		0709 2.5 SLS 70737 *EMPTY* E	10.1
0808 2.4 SLS 54033 *EMPTY* E	0208 2.4 SLS 59290 *EMPTY* E	0108 14.9 200551 NRF-ROTX	0308 17.7 SLS 28711 BHV-FELX	0708 14.7 SLS 28988 NRF-ROTX	52.1
12.9	14.9	28.4	17.7	24.6	98.5

Removed for Cond. 3

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
27.8	.0	70.7	42.9 STBD	

.0

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
.0	.0	.0	.0 STBD	98.5

Empty (All Conditions)

HATCH LIST HATCH NO 15
VESSEL SL MCLEAN
PORT DEPARTURE BHV
FINAL PLAN

S E A - L A N D S E R V I C E I N C
VOYAGE 012W
DESTINATION ROT

MASTER
DATE 04/08/73

TABLE VI (Concluded)

0609 2.4 SLS 53667 *EMPTY* E	0209 11.7 200068 ELZ-LHAX	0109 18.6 SLS 23695 ELZ-LHAX	0509 2.4 SLS 56367 *EMPTY* E	35.1
0608 18.0 SLS 23167 ELZ-ROTX	0208 18.5 SLS 23106 ELZ-LHAX	0108 21.9 SLS 20695 ELZ-FELX	0508 22.6 SLS 28948 ELZ-FELX	81.0
28.4	30.2	40.5	25.0	116.1

Removed for Cond. 3

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
50.6	.0	65.5	14.9 STBD	

Removed for Cond. 5

	0207 2.2 SLS 34065 *EMPTY* E	0107 2.4 SLS 46417 *EMPTY* E		4.6
	0206 2.2 SLS 36140 *EMPTY* E	0106 2.2 SLS 33966 *EMPTY* E	0306 3.3 SLS 17320 *EMPTY* E	7.7
0405 7.6 300037 BHV-FEL	0205 2.4 SLS 46455 *EMPTY* E	0105 2.4 SLS 59595 *EMPTY* E	0305 2.4 SLS 16116 *EMPTY* E	14.8
7.6	6.8	7.0	5.7	27.1

PORT	CENTER LINE	STBD	DIFF DIR	TOTAL WT
14.4	.0	12.7	1.7 PORT	143.2

TABLE VII

SUMMARY OF REDUCED STRAIN DATA
CALIBRATION EXPERIMENT
SEA-LAND McLEAN

Sensor No.	Sensor Nomen.	Quantity	Condition (1)						Units
			1	3	4	5	6	7	
1	LVB	Stress	530	-618	397	1104	1413	2649	psi
2	TSM	Shear	0	0	183	882	1156	-304	psi
11	LHB	Stress	-530	-530	-574	-1236	-1501	-751	psi
12	SFP	Shear	-171	171	-445	-651	-616	-1507	psi
13	SFS	Shear	-28	527	-56	-695	-945	-1417	psi
15	LSTS	Stress	450	-1306	-1036	-45	630	2702	psi
16	LSMS	Stress	-78	-1616	38	2746	3319	2518	psi
17	LSBS	Stress	-229	1556	1419	732	870	-46	psi
18	LSTP	Stress	225	-1144	137	1007	1511	2014	psi
19	LSMP	Stress	0	0	479	287	479	575	psi
20	LSBP	Stress	-272	317	181	0	317	-46	psi
21	SAP	Shear	-284	682	511	568	739	369	psi
22	SAS	Shear	0	-927	-702	-449	-393	-253	psi
27	BGST	Shear	0	167	167	-250	-556	-111	psi
28	BGSB	Shear	-28	0	111	56	139	250	psi
30	AR1A	Stress	703	110	494	1920	2194	-55	psi
31	AR1B	Stress	418	-232	836	4089	4554	0	psi
32	AR1C	Stress	0	0	279	1115	1394	0	psi
-	AR1	σ_1(2)	671	302	896	4141	4670	-8.0	psi
-	AR1	σ_2(2)	167	-152	172	71.9	310	-71	psi
-	AR1	θ (2)	10.5	-39.7	38.3	40.5	40.9	67.5	deg.

TABLE VII (Continued)

Sensor No.	Sensor Nomen.	Quantity	Condition (1)						Units
			1	3	4	5	6	7	
33	AR2A	Stress	781	725	1729	-446	-2063	335	psi
34	AR2B	Stress	58	1109	0	759	1050	-234	psi
35	AR2C	Stress	-330	-1489	279	-992	-1820	-165	psi
-	AR2	σ_1	766	918	2358	174.5	-359	432	psi
-	AR2	σ_2	-141	-1980	425	-2166	-5029	-199	psi
-	AR2	θ	-8.4	26.7	-27.0	39.8	46.2	-26.0	deg.
36	AR3A	Stress	-342	-1426	1540	-855	-2281	570	psi
37	AR3B	Stress	226	-225	621	-733	-1409	508	psi
38	AR3C	Stress	-223	-781	-112	-558	-781	-223	psi
-	AR3	σ_1	6.1	-801	1639	-864	-1532	645	psi
-	AR3	σ_2	-794	-2262	340	-1099	-2718	-166	psi
-	AR3	θ	48.3	55.1	-3.3	-85.1	85.5	20.0	deg.
39	AR4A	Stress	-654	-2618	-1636	709	491	-54	psi
40	AR4B	Stress	223	-390	-167	168	223	502	psi
41	AR4C	Stress	1227	2119	1673	502	892	279	psi
-	AR4	σ_1	1134	1506	1324	1190	1354	746	psi
-	AR4	σ_2	-338	-2198	-1274	489	563	475	psi
-	AR4	θ	-88.1	-88.3	-86.8	-38.3	-56.7	10.9	deg.
43	R1A	Stress	226	-711	-108	-1644	-2192	-876	psi
44	R1B	Stress	233	279	233	-232	-557	-96	psi
45	R1C	Stress	167	279	-233	0	0	-233	psi
-	R1	σ_1	351	247	85.7	-351	567	-293	psi
-	R1	σ_2	262	-847	-544	-1933	-2475	-1232	psi
-	R1	θ	6.8	67.5	40.9	72.1	76.9	61.5	deg.

TABLE VII (Continued)

Sensor No.	Sensor Nomen.	Quantity	Condition (1) 1	3	4	5	6	7	Units
46	R2A	Stress	390	-335	-1172	780	1338	725	psi
47	R2B	Stress	467	-350	-1226	-117	175	-292	psi
48	R2C	Stress	-276	-55	-276	-276	55	-276	psi
-	R2	σ_1	491	-108	-478	853	1613	874.3	psi
-	R2	σ_2	-332	-434	-1530	-153	320	-249.3	psi
-	R2	θ	25.4	-65.7	-65.8	-17.5	-19.6	-22.9	deg.
49	R3A	Stress	285	-228	-1540	285	628	484	psi
50	R3B	Stress	-451	-169	-1184	-677	-225	-225	psi
51	R3C	Stress	223	279	0	0	390	0	psi
-	R3	σ_1	674	9.8	-657	630	1070	610	psi
-	R3	σ_2	-278	-247	-1789	-543	33.7	-206	psi
-	R3	θ	-38	-75	-77.7	-35.1	-34.9	-22.6	deg.
52	R4A	Stress	818	655	436	-327	-436	382	psi
53	R4B	Stress	634	1056	792	-211	-528	0	psi
54	R4C	Stress	-167	335	502	279	0	-446	psi
-	R4	σ_1	904	1142	904	243	-6.0	279	psi
-	R4	σ_2	0	220	398	-210	-598	-367	psi
-	R4	θ	16.0	37.0	47.9	-74.4	-62.5	2.2	deg.
55	R5A	Stress	(243)	768	384	55	0	55	psi
56	R5B	Stress	(-176)	140	419	-232	-418	-464	psi
57	R5C	Stress	(-614)	-1060	167	-279	-502	-725	psi
-	R5	σ_1	(78)	546	524	3.4	-113	-145	psi
-	R5	σ_2	(-390)	-950	243	-316	-583	-784	psi
-	R5	θ	(0.7)	8.7	26.6	-17.7	-16.8	-9.1	deg.

TABLE VII (Continued)

VII-4

Sensor No.	Sensor Nomen.	Quantity	Condition (1) 1	3	4	5	6	7	Units
58	R6A	Stress	(1562)	223	112	0	0	223	psi
59	R6B	Stress	(21)	59	351	-350	-875	-583	psi
60	R6C	Stress	(-462)	-331	551	-331	-276	-717	psi
-	R6	σ_1	(1654)	162	631	-36.6	393	110	psi
-	R6	σ_2	(-129)	-308	290	-422	-776	-794	psi
-	R6	θ	(-365)	11.3	-24.0	39.7	-39.7	-17.8	deg.
61	R7A	Stress	(-365)	-1254	-1026	913	1255	628	psi
62	R7B	Stress	(0)	-3102	-1297	1635	2312	846	psi
63	R7C	Stress	(-433)	-1283	-614	167	390	-502	psi
-	R7	σ_1	(-318)	-327	-733	1651	2352	841	psi
-	R7	σ_2	(-790)	-3194	-1546	-151	-69	-666	psi
-	R7	θ	(-41.9)	-44.8	56.6	35.6	36.9	27.1	deg.
64	R8A	Stress	(-1173)	-2510	-1691	927	1582	982	psi
65	R8B	Stress	(-812)	-1743	-1162	212	687	0	psi
66	R8C	Stress	(-39)	265	317	-158	-264	-792	psi
-	R8	σ_1	(-370)	-373	-89	979	1636	838	psi
-	R8	σ_2	(-1313)	-2748	-1824	88	194	-565	psi
-	R8	θ	(-80)	-78.0	-77.3	-8.9	-8.8	-3.0	deg.
67	R9A	Stress	(639)	-55	-329	438	548	1755	psi
68	R9B	Stress	(101)	214	72	72	-116	401	psi
69	R9C	Stress	(-307)	223	390	223	390	-112	psi
-	R9	σ_1	(604)	268	325	680	1112	1941	psi
-	R9	σ_2	(-141)	-30	241	241	192	342	psi
-	R9	θ	(-3.9)	-68.5	-68.5	-33.8	-41.1	-12.1	deg.

TABLE VII (Continued)

Sensor No.	Sensor Nomen.	Quantity	Condition (1) 1	3	4	5	6	7	Units
70	R10A	Stress	-	-	-	-	-	-	psi
71	R10B	Stress	(-87)	377	143	-499	-965	-1199	psi
72	R10C	Stress	(-1110)	-441	496	-166	-221	-552	psi
-	R10	σ_1	-	-	-	-	-	-	psi
-	R10	σ_2	-	-	-	-	-	-	psi
-	R10	θ	-	-	-	-	-	-	deg.
73	R11A	Stress	(286)	171	-57	171	685	1084	psi
74	R11B	Stress	(502)	226)	959	226	0	508	psi
75	R11C	Stress	(-321)	-502	112	-167	56	-223	psi
-	R11	σ_1	(445)	172.5	767	1940	892	1110	psi
-	R11	σ_2	(-495)	-635	-692	464	133	81	psi
-	R11	θ	(29.9)	24.6	47.6	-68.6	-24.8	3.4	deg.
76	R12A	Stress	(77)	0	219	764	764	873	psi
77	R12B	Stress	(-1031)	-2536	-106	2588	2853	0	psi
78	R12C	Stress		-1473	218	1364	1255	-491	psi
-	R12	σ_1	(141)	495	557	2688	2854	1403	psi
-	R12	σ_2	(-1111)	-2541	51	262	-54	-875	psi
-	R12	θ	(-29.0)	-33.7	-44.9	30.7	48.8	31.0	deg.
79	R13A	Stress	(-1008)	-2084	-932	1645	2249	2139	psi
80	R13B	Stress	(-678)	-1379	-357	665	851	-78	psi
81	R13C	Stress	(182)	558	781	112	-55	-836	psi
-	R13	σ_1	(-64)	79	599	1845	2445	2200	psi
-	R13	σ_2	(-1082)	-2196	-808	601	605	-388	psi
-	R13	θ	(-78.0)	-77.5	-80.9	-7.8	-6.0	-13.1	deg.

TABLE VII (Continued)

Sensor No.	Sensor Nomen.	Quantity	Condition (1) 1	3	4	5	6	7	Units
82	R14A	Stress	(1143)	-725	111	836	948	2007	psi
83	R14B	Stress	(45)	231	288	346	231	-115	psi
84	R14C	Stress	(44)	819	546	-163	-109	-709	psi
-	R14	σ_1	(1432)	686	629	856	1021	2120	psi
-	R14	σ_2	(218)	-552	283	78	145	-316	psi
-	R14	θ	(-22.5)	83	-84.7	-0.5	-9.8	-14.7	deg.
86	TGFS1	Stress	(1363)	-713	658	-1536	-2249	-1536	psi
87	HLSST	Stress	-987	713	392	-110	-55	-55	psi
88	TGFS2	Stress	(995)	2092	1441	(-1263)	(-2393)	47	psi
89	HLSSB	Stress	419	279	233	-325	-697	-604	psi
90	TGFS3	Stress	(1171)	1283	279	502	1283	-279	psi
91	HLSPT	Stress	1060	2119	2677	2733	2733	2956	psi
92	TGFS4	Stress	(-1060)	-1506	-1673	1115	2398	-948	psi
93	HLSPB	Stress	-725	-613	-836	-167	223	-446	psi
94	TGMS1	Stress	-759	-292	1692	-350	-1342	1809	psi
95	TGMS2	Stress	772	1765	1158	-2261	-1269	-828	psi
96	TGMS3	Stress	1483	1711	799	1141	1597	0	psi
97	TGMS4	Stress	-2426	-2030	-1410	1804	2819	-452	psi
98	TGMS1X	Stress	(1012)	2334	1692	-409	-876	1050	psi
99	TGMS2X	Stress	(1422)	2647	993	801	-110	938	psi
100	TGMS3X	Stress	(422)	798	57	-400	57	-571	psi
101	TGMS4X	Stress	(-925)	(-2807)	-677	112	225	169	psi
102	TGSS1X	Shear	(-147)	-95	-236	-165	-95	-448	psi
103	TGSS2X	Shear	(635)	874	172	-1275	-990	-1231	psi

TABLE VII (Concluded)

Sensor No.	Sensor Nomen.	Quantity	Condition (1) 1	3	4	5	6	7	Unit
104	TGSS3X	Shear	-1378)	-2027	-3915	-5020	(-6456)	-2441	psi
105	TGSSdX	Shear	(770)	553	737	783	1520	1106	psi
106	TGAS1	Stress	-2677	-2454	-4685	-4852	-5354	-3179	psi
107	TGAS2	Stress	-	-	-	-	-	-	psi
108	TGAS3	Stress	1171	2621	1115	613	836	-279	psi
109	TGAS4	Stress	-669	725	223	1338	1785	-	psi
Port	Scratch	Stress	690	1380	0	-690	-1380	-2760	psi
Stbd	Scratch	Stress	-650	1300	-650	-650	1300	-2600	psi
Added	SYA	Stress*	-	-4200	0*	-7050	-10200	-300	psi
Added	SYB	Stress*	-	-3600	0*	-6300	-8100	-1800	psi
Added	SYC	Stress*	-	-2100	0*	-1500	-2700	-1350	psi

NOTES: (1) All data except * assumes instrumentation zero to be condition 0 (coming up Mass River). All data manually reduced from oscillographs produced from analog magnetic tape except ( ) which is meter reading.

(2) σ_1 is maximum principal normal stress

σ_2 is minimum principal normal stress

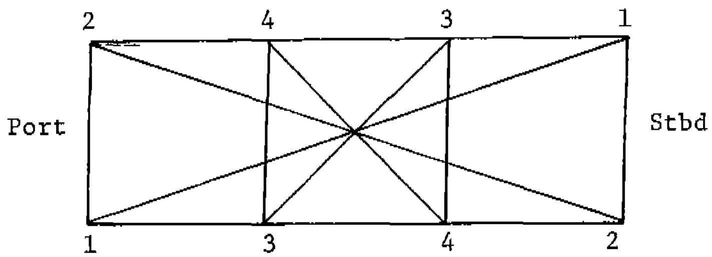
θ is angle from "A" gage to principal axis

TABLE VIII

HATCH MEASUREMENTS

Condition	Direction	Measurement	Cumulative Change
4	1-1	96' 4 3/4"	0
4	2-2	96' 4 9/16"	0
4	3-3	50' 5"	0
4	4-4	50' 4 1/4"	0
5	1-1	96' 4 5/8"	- 1/8
5	2-2	96' 4 5/8"	+ 1/16
5	3-3	50' 4 3/4"	- 1/4
5	4-4	-*	-*
6	1-1	96' 4 3/8"	- 3/8
6	2-2	96' 4 15/16"	+ 3/8
6	3-3	50' 4 11/16"	- 5/16
6	4-4	-*	-*

HATCH 7



*Reading not taken due to safety considerations.

TABLE IX

SEA-LAND McLEAN CALIBRATION RESULTS

CALCULATED BENDING MOMENTS, SHEAR FORCES, AND NORMAL STRESSES

FRAME	COND.	M_b	ΔM_b	F_s	ΔF_s	Z_T	Z_B	n.a.	σ_T	$\Delta\sigma_T$	σ_B	$\Delta\sigma_B$
		10^6 IN-LB	10^6 IN-LB	10^6 LB	10^6 LB	$10^6 IN^3$	$10^6 IN^3$	IN	PSI	PSI	PSI	PSI
265	1	8668		-3.80		1.434	0.976	457				
	3	8324	-344	-3.05	+0.75							
	4	9047	+723	-3.81	-0.76							
	5	9636	+589	-4.37	-0.56							
	6	9957	+321	-4.56	-0.19							
	7	11021	+1064	-5.37	-0.81							
186	1	10977		1.16		1.745	2.166	342.5	6291		5068	
	3	8566	-2411	3.87	+2.71				4908	-1383	3955	-1113
	4	10693	+2127	1.96	-1.91				6128	+1220	4937	+ 982
	5	12324	+1631	2.41	+0.45				7062	+ 934	5690	+ 753
	6	13175	+ 851	2.20	-0.21				7550	+ 488	6083	+ 393
	7	15678	+2503	2.53	+0.33				8985	+1435	7238	+1155
87	1	5290		3.25		1.495	1.404	423				
	3	4752	-538	2.11	-1.14							
	4	5222	+470	2.83	+0.72							
	5	5525	+303	3.14	+0.31							
	6	5636	+111	3.14	0							
	7	5957	+321	3.38	+0.24							

Nomenclature

M_b = vertical bending moment

ΔM_b = change in M_b

F_s = vertical shear force

ΔF_s = change in F_s

Z_T = section modulus, top

Z_b = section modulus, bottom

n.a. = neutral axis

σ_T = vertical bending stress, top

$\Delta\sigma_T$ = change in σ_T

σ_B = vertical bending stress, bottom

$\Delta\sigma_B$ = change in σ_B

TABLE X

SEA-LAND McLEAN CALIBRATION RESULTS

ABS TORSIONAL MOMENTS FOR EACH HATCH AT EACH LOAD CONDITION

H# / LC	15	14	13	12	11	10		9	8	7	6	5	4	3	2	1
1	126 126	666 792	-930 -138	714 576	222 798	27 825		1057 1882	614 2496	42 2538	454 2992	37 3029	-2930 99	784 883	531 1414	-364 1050
3	-25 -25	0 -25	-931 -956	-4 -960	222 -738	27 -711		1057 346	614 960	42 1002	454 1456	37 1493	-3316 -1823	0 -1823	17 -1806	-364 -2170
4	-25 -25	0 -25	-931 -956	-4 -960	222 -738	0 -738		539 -199	1897 1698	42 1740	944 2684	39 2723	-3316 -593	0 -593	17 -576	-364 -940
5	667 667	-863 -196	4680 4484	-1031 3453	11813 15266	-1027 14239		17234 31473	672 32145	-1418 17964	-82 17882	-11873 6009	-4124 1885	-635 1250	-2148 -898	-825 -1723
6	667 667	-863 -196	4680 4484	2787 7271	11813 19084	-1027 18057		17234 35291	17233 52524	-14181 38343	-9157 29186	-11873 17313	-6776 10537	-635 9902	-3450 6452	-2291 4161
7	0 0	0 0	0 0	0 0	0 0	0 0		0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0

666 ← TOP NUMBER IS THE TORSIONAL MOMENT (TON-FT) CONTRIBUTION FOR THE HATCH

792 ← BOTTOM NUMBER IS THE ACCUMULATIVE TORSIONAL MOMENT FOR THE HATCH AS THE CONTRIBUTIONS ARE SUMMED AFT TO FORWARD

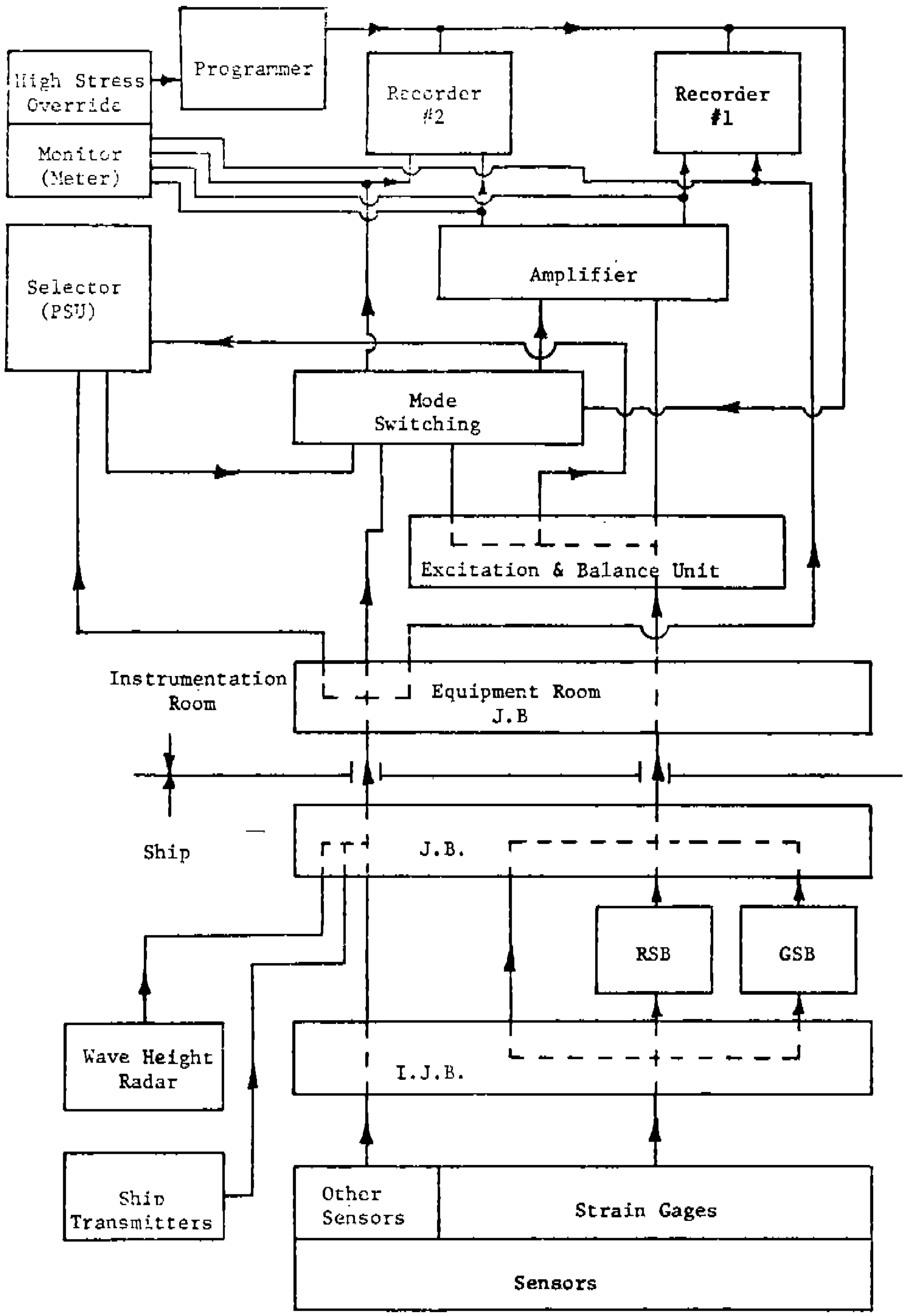
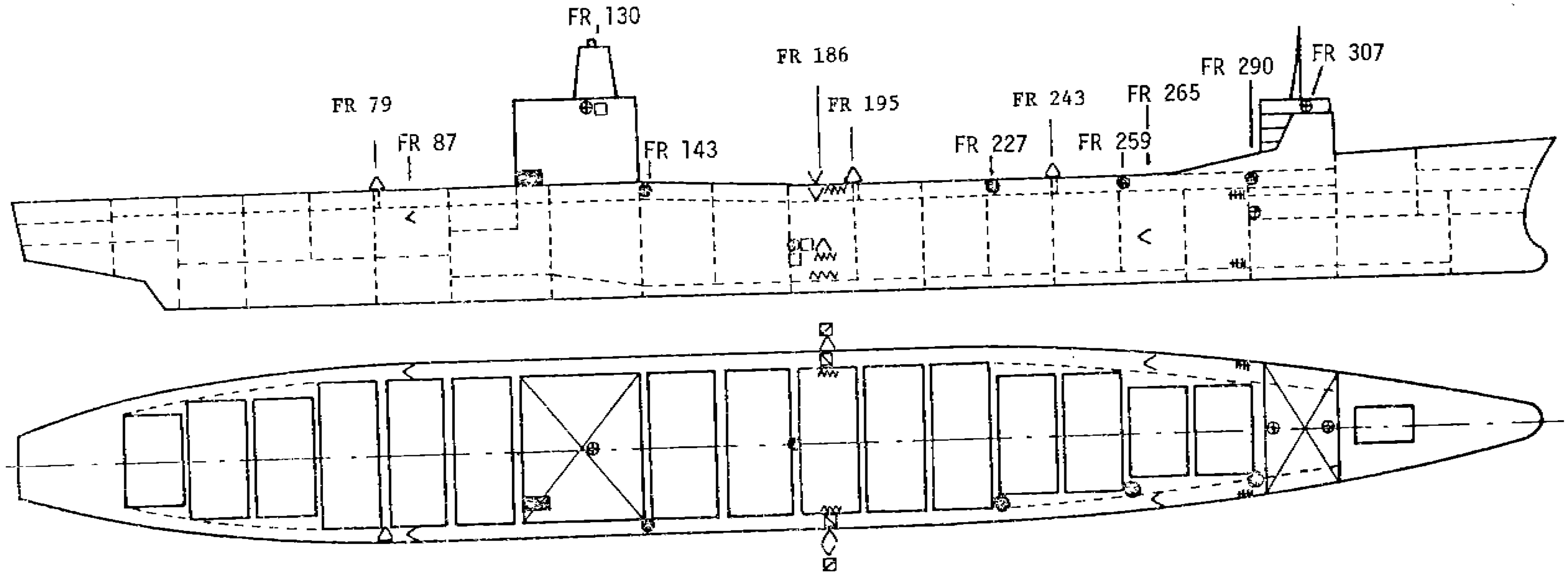


Figure 1 INSTRUMENTATION FLOW DIAGRAM



LEGEND

- ⊕ Bidirectional Accelerometer
- □ Pitch & Roll Pendulum
- ⧅ Longitudinal Vertical Bending Element
- V Torsional Shear Gage
- < Shear Gage
- ∿∿ Longitudinal Stress Gage
- △ Transverse Girder Gage
- ● Three Arm Rosette
- Λ Midship Torsional Shear Element
- ⧄ Longitudinal Horizontal Bending
- ╫╫ Hull Longitudinal Strain

Figure 2 GENERAL SENSOR LAYOUT

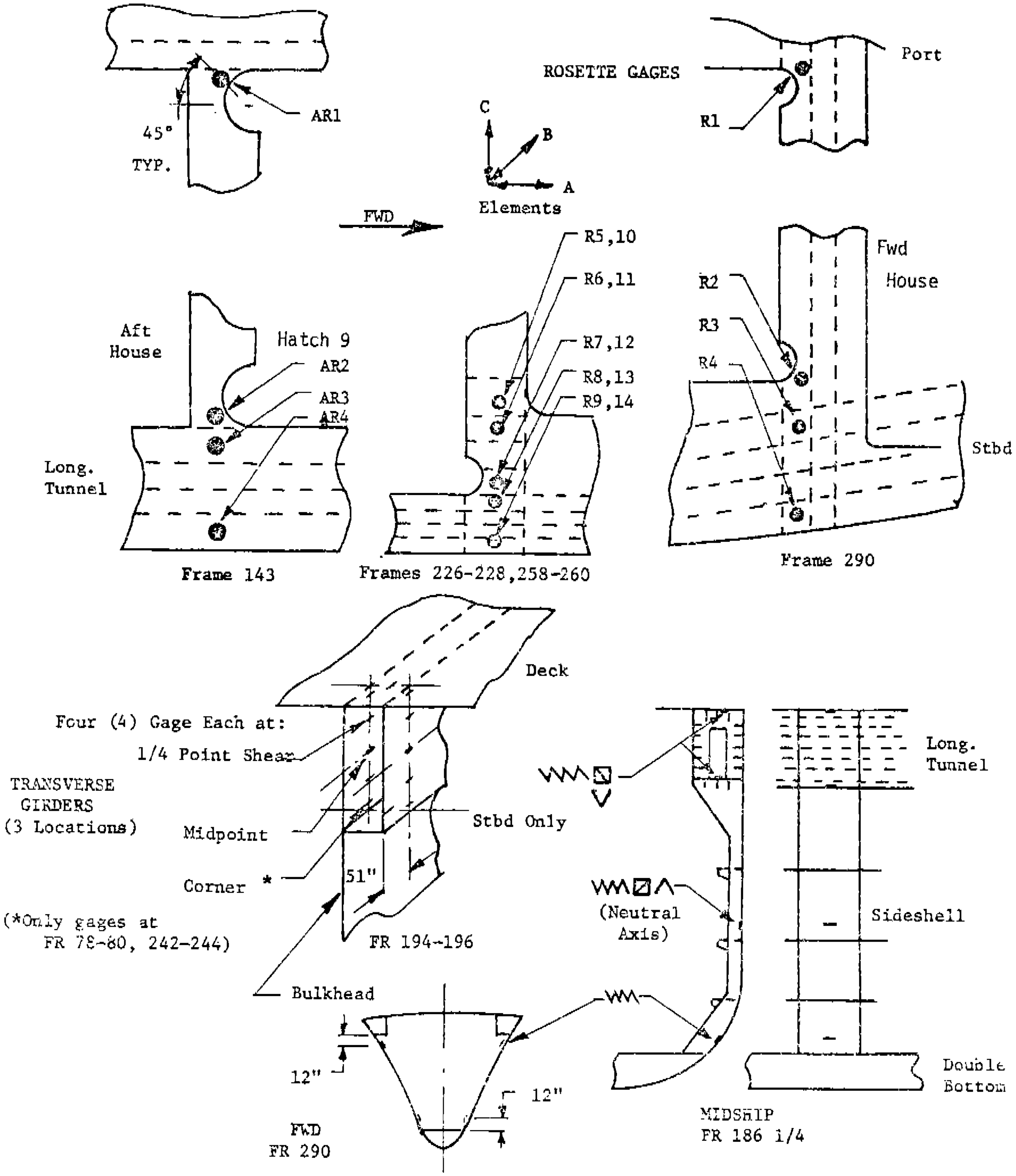
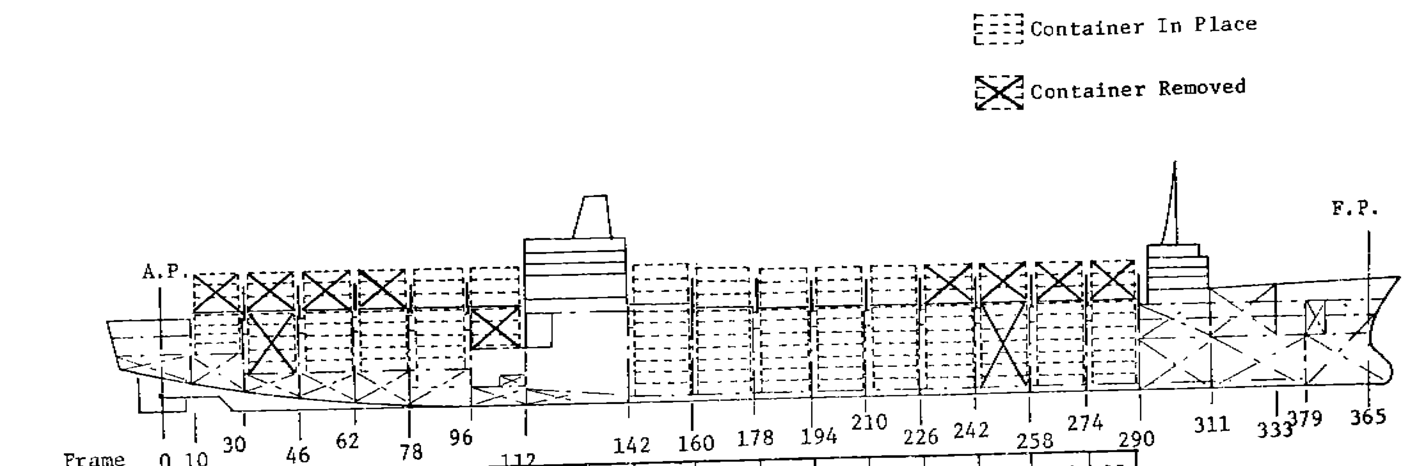


Figure 3

DETAILS OF STRAIN GAGE LAYOUT



Cont'r Length	35	35	35	35	35	35		40	40	35	35	35	35	35	35	35		
Qty. on Deck	18	24	24	30	30	30		30	30	30	30	30	30	24	24	18		
Qty. Below	18	34	38	46	50	30		70	70	68	64	58	48	44	30	26		
Hatch No.	15	14	13	12	11	10		9	8	7	6	5	4	3	2	1		
Hold No.	11		10		9	8		7		6		5		4		3	2	1

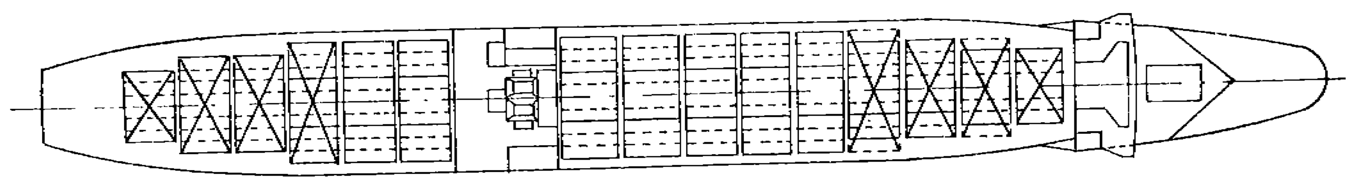
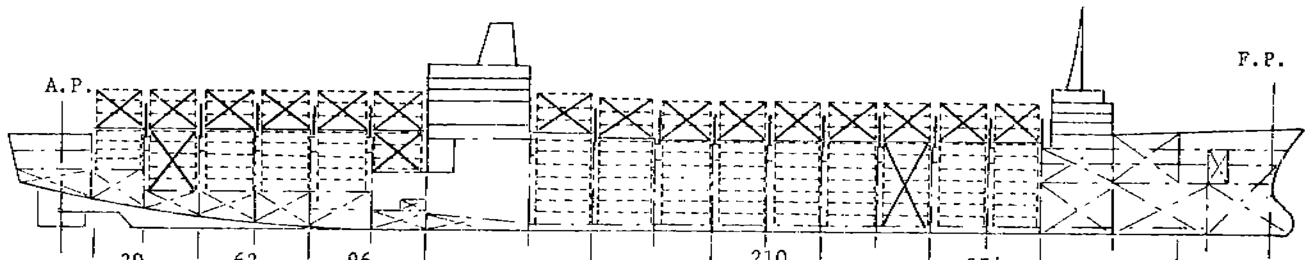


Figure 4-a

CONDITION NO. 3 CONTAINER LOADING
(Maximum change in hogging moment)

Container In Place

Container Removed



Cont'r Length	35	35	35	35	35	35		40	40	35	35	35	35	35	35	35		
Qty. on Deck	18	24	24	30	30	30		30	30	30	30	30	30	24	24	18		
Qty. Below	18	34	38	46	50	30		70	70	68	64	58	48	44	30	26		
Hatch No.	15	14	13	12	11	10		9	8	7	6	5	4	3	2	1		
Hold No.	11		10		9	8		7		6		5		4		3	2	1

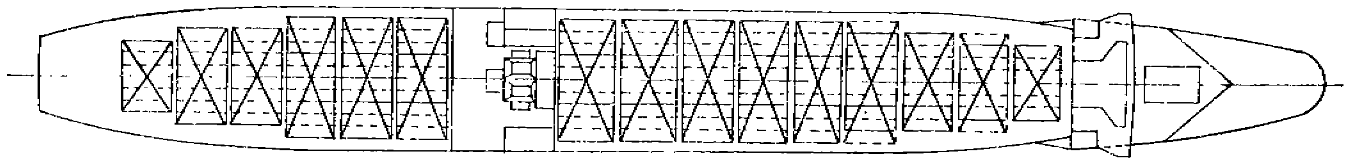
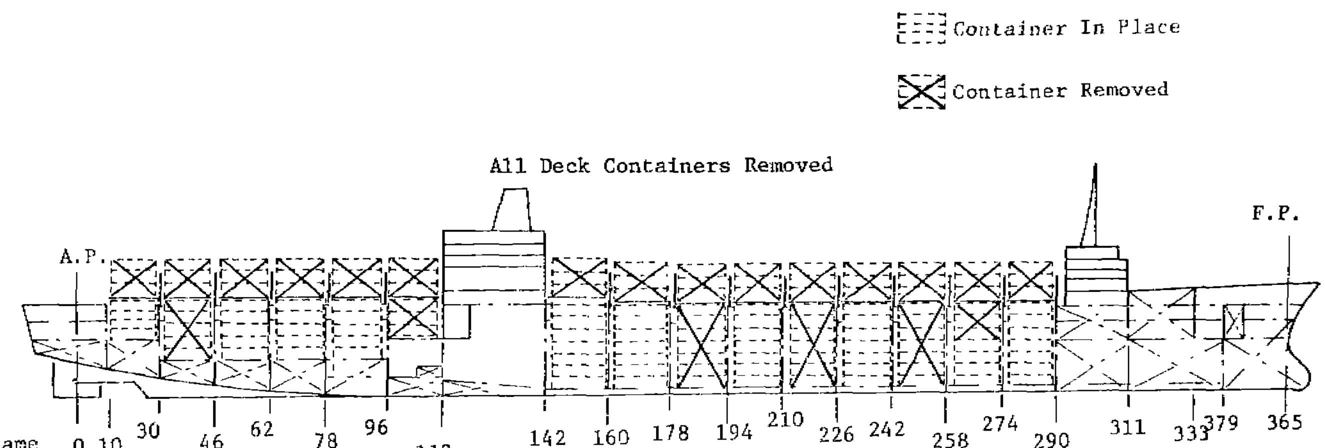


Figure 4-b

CONDITION NO. 4 CONTAINER LOADING
(All above deck containers removed)



Cont'r Length	35	35	35	35	35	35		40	40	35	35	35	35	35	35	35		
Qty. on Deck	18	24	24	30	30	30		30	30	30	30	30	30	24	24	18		
Qty. Below	18	34	38	46	50	30		70	70	68	64	58	48	44	30	26		
Hatch No.	15	14	13	12	11	10		9	8	7	6	5	4	3	2	1		
Hold No.	11		10		9	8		7		6		5		4		3	2	1

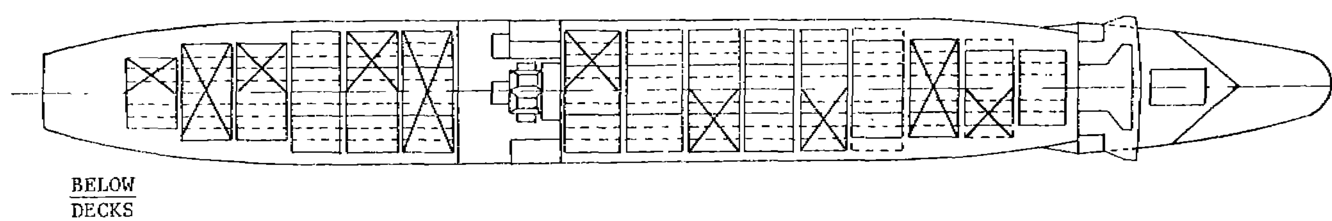
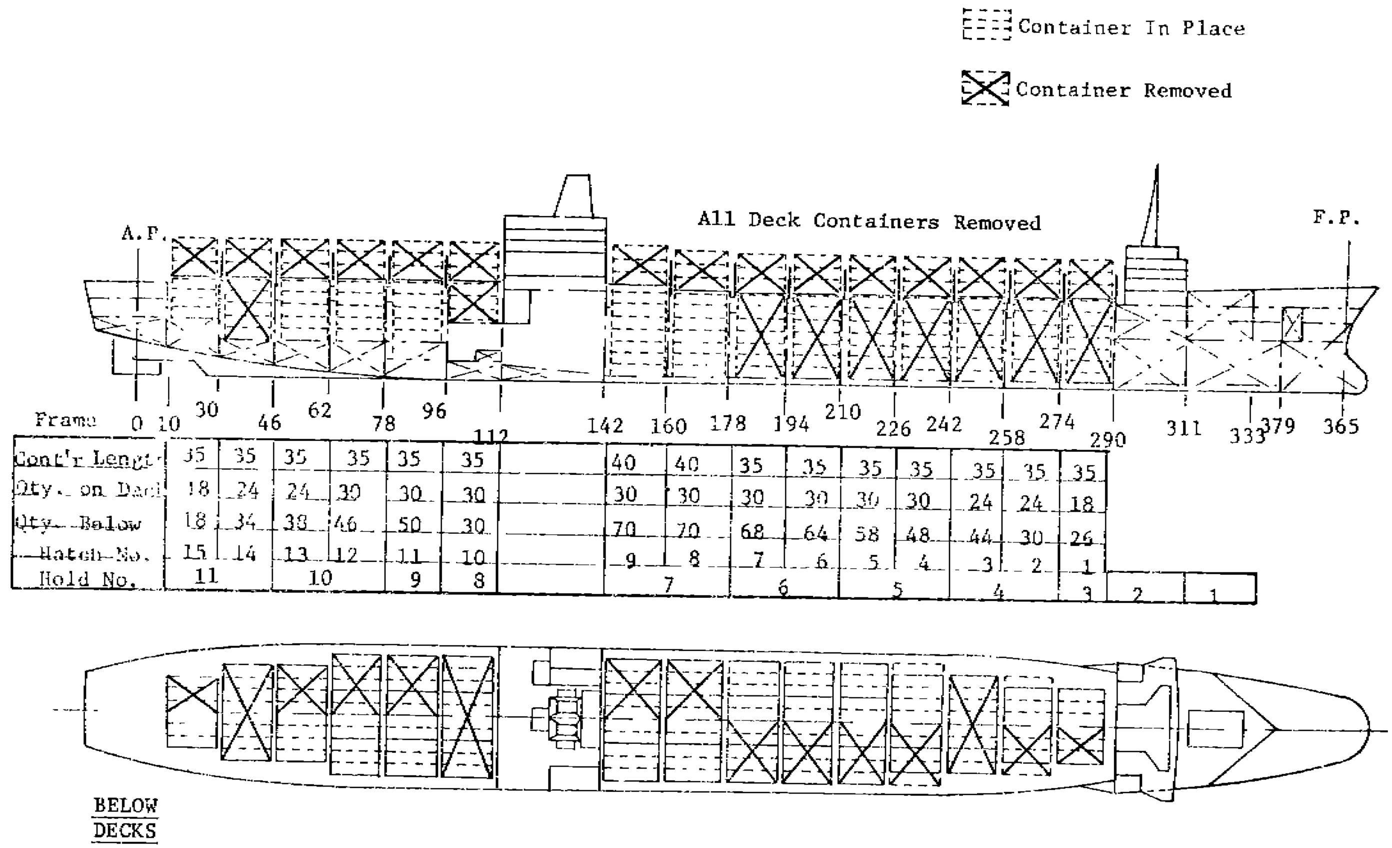


Figure 4-c

CONDITION NO. 5 CONTAINER LOADING
(Partial torsion)



Cont'r Length	35	35	35	35	35	35		40	40	35	35	35	35	35	35	35		
Qty. on Deck	18	24	24	30	30	30		30	30	30	30	30	30	24	24	18		
Qty. Below	18	34	38	46	50	30		70	70	68	64	58	48	44	30	26		
Hatch No.	15	14	13	12	11	10		9	8	7	6	5	4	3	2	1		
Hold No.	11		10		9	8		7		6		5		4		3	2	1

Figure 4-d

CONDITION NO. 6 CONTAINER LOADING
(Full torsion)

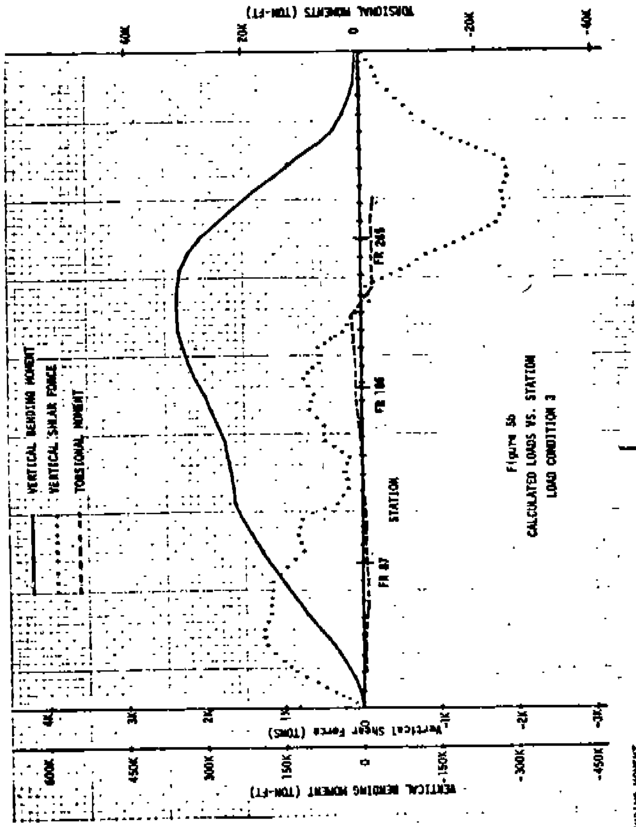


Figure 5b
CALCULATED LOADS VS. STATION
LOAD CONDITION 3

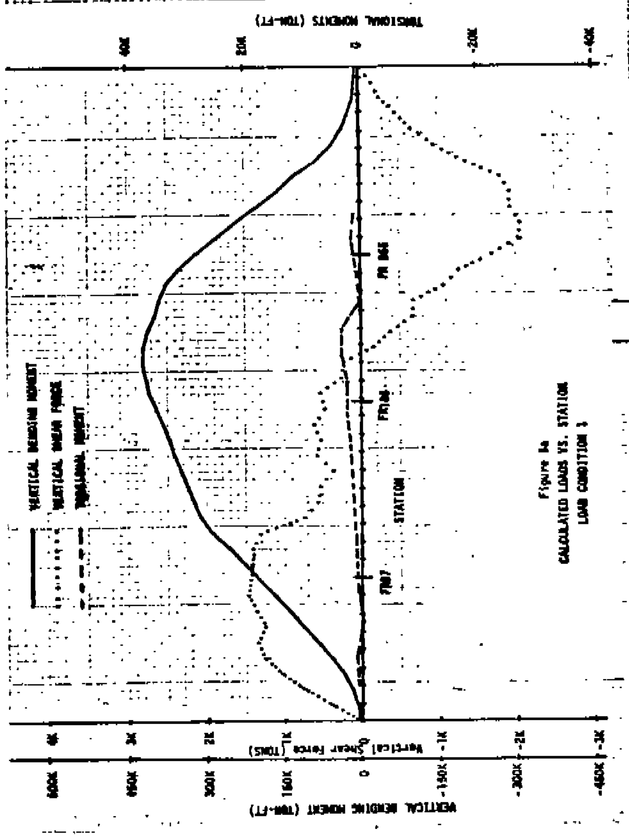


Figure 5a
CALCULATED LOADS VS. STATION
LOAD CONDITION 1

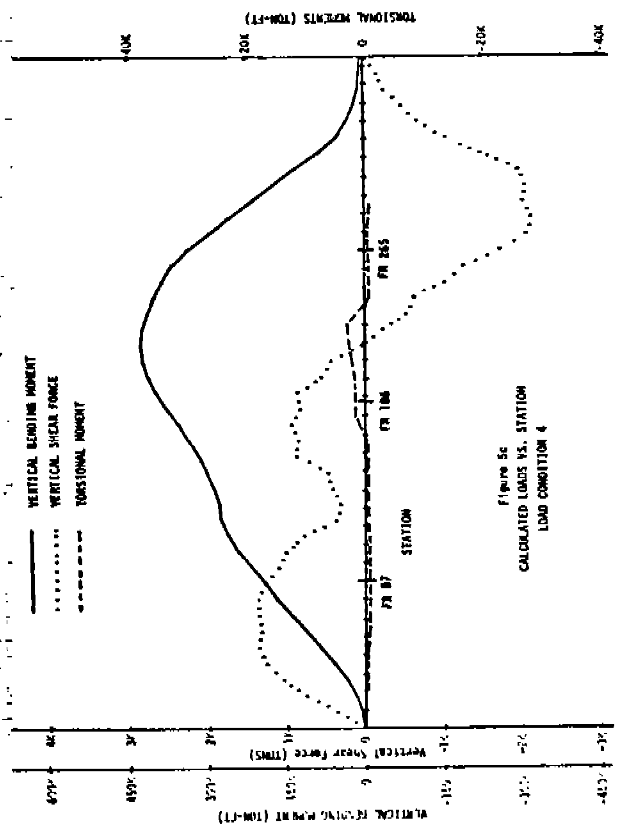


Figure 5c
CALCULATED LOADS VS. STATION
LOAD CONDITION 4

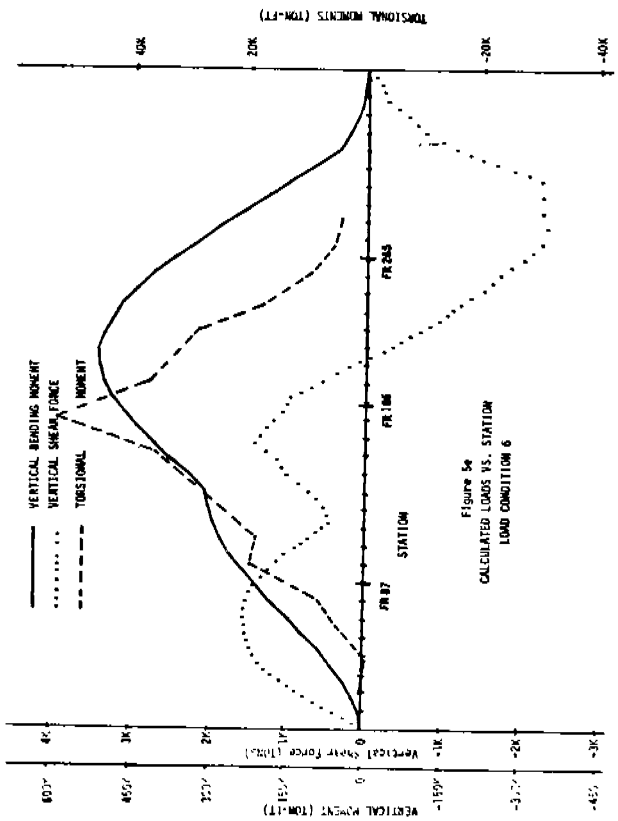


Figure 5e
CALCULATED LOADS VS. STATION
LOAD CONDITION 6

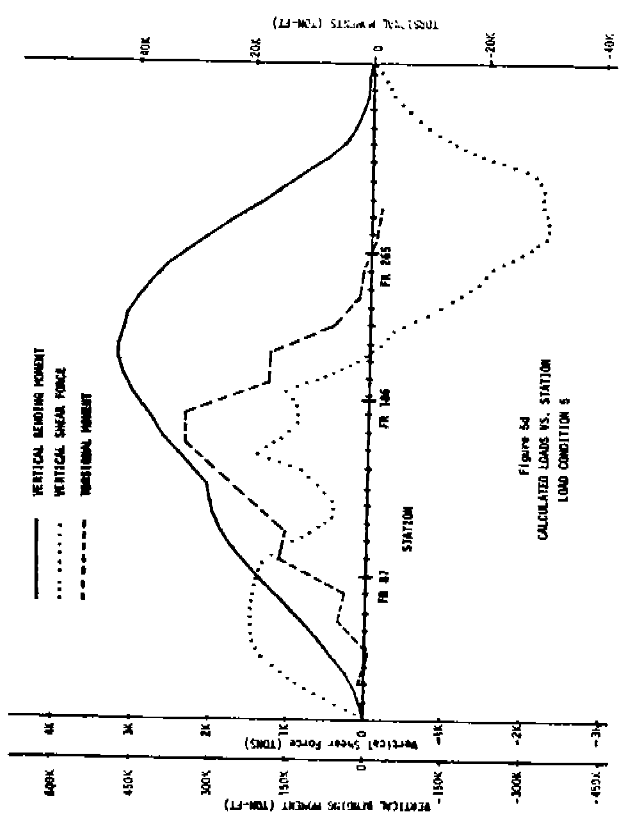


Figure 5d
CALCULATED LOADS VS. STATION
LOAD CONDITION 5

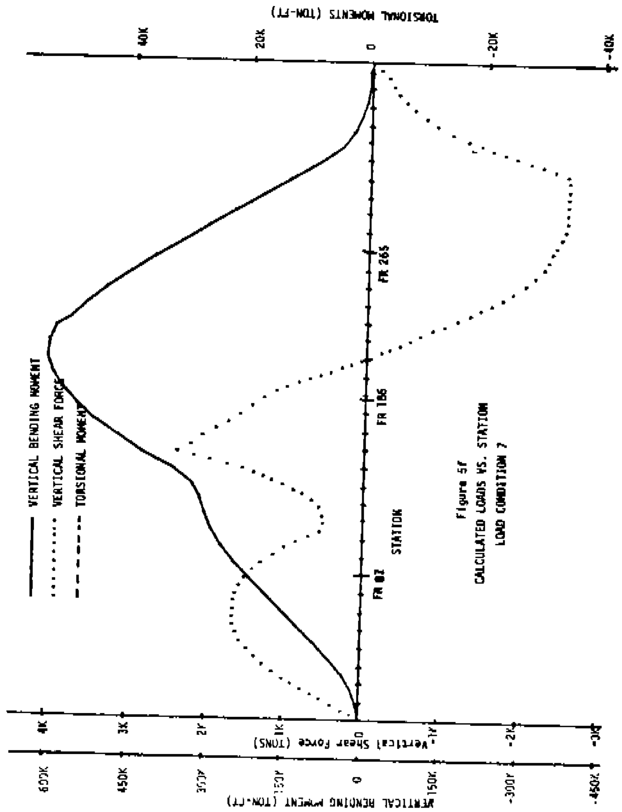


Figure 5f
CALCULATED LOADS VS. STATION
LOAD CONDITION 7

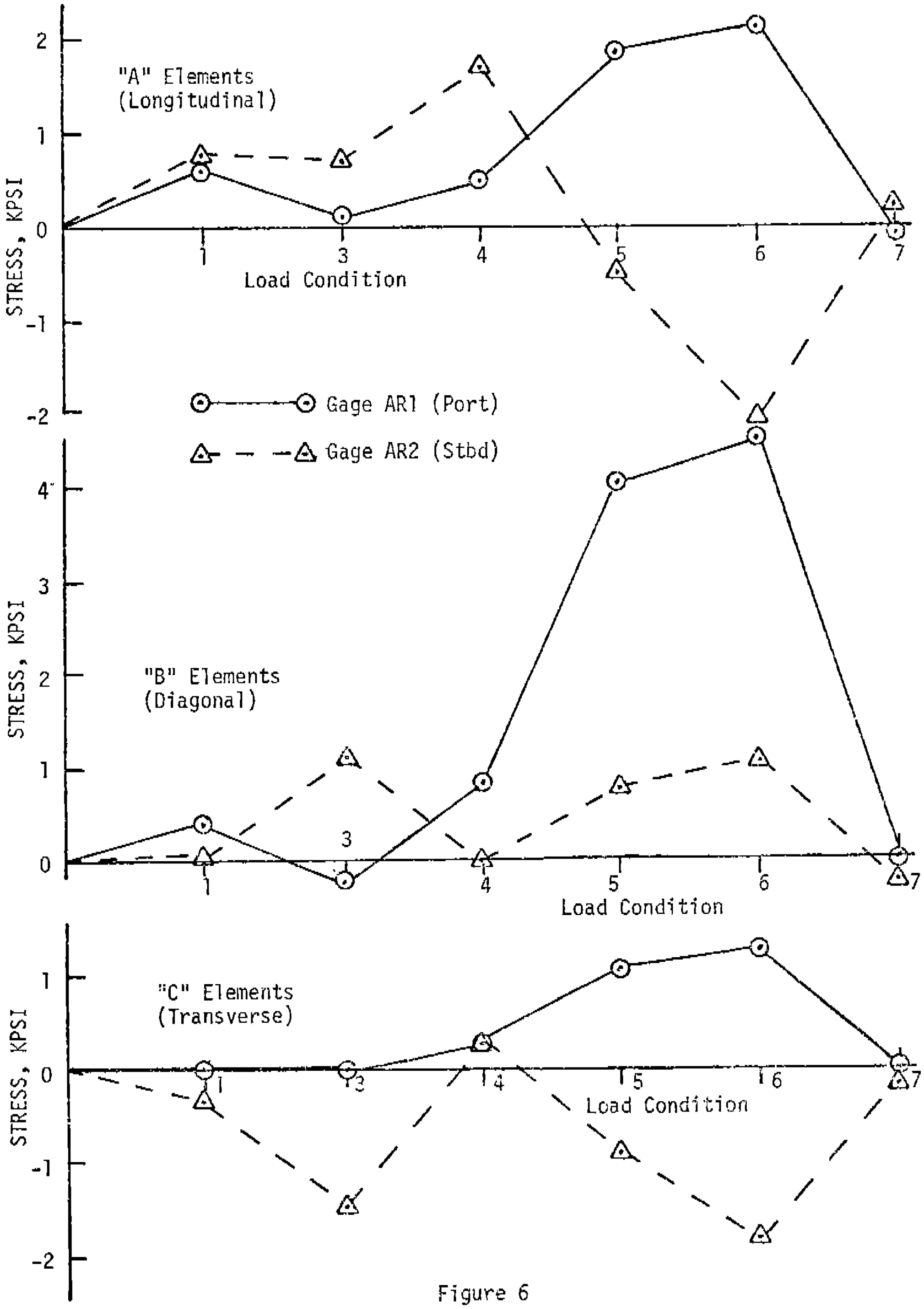


Figure 6

STRESS VS. LOAD CONDITION

ROSETTES AR1 AND AR2

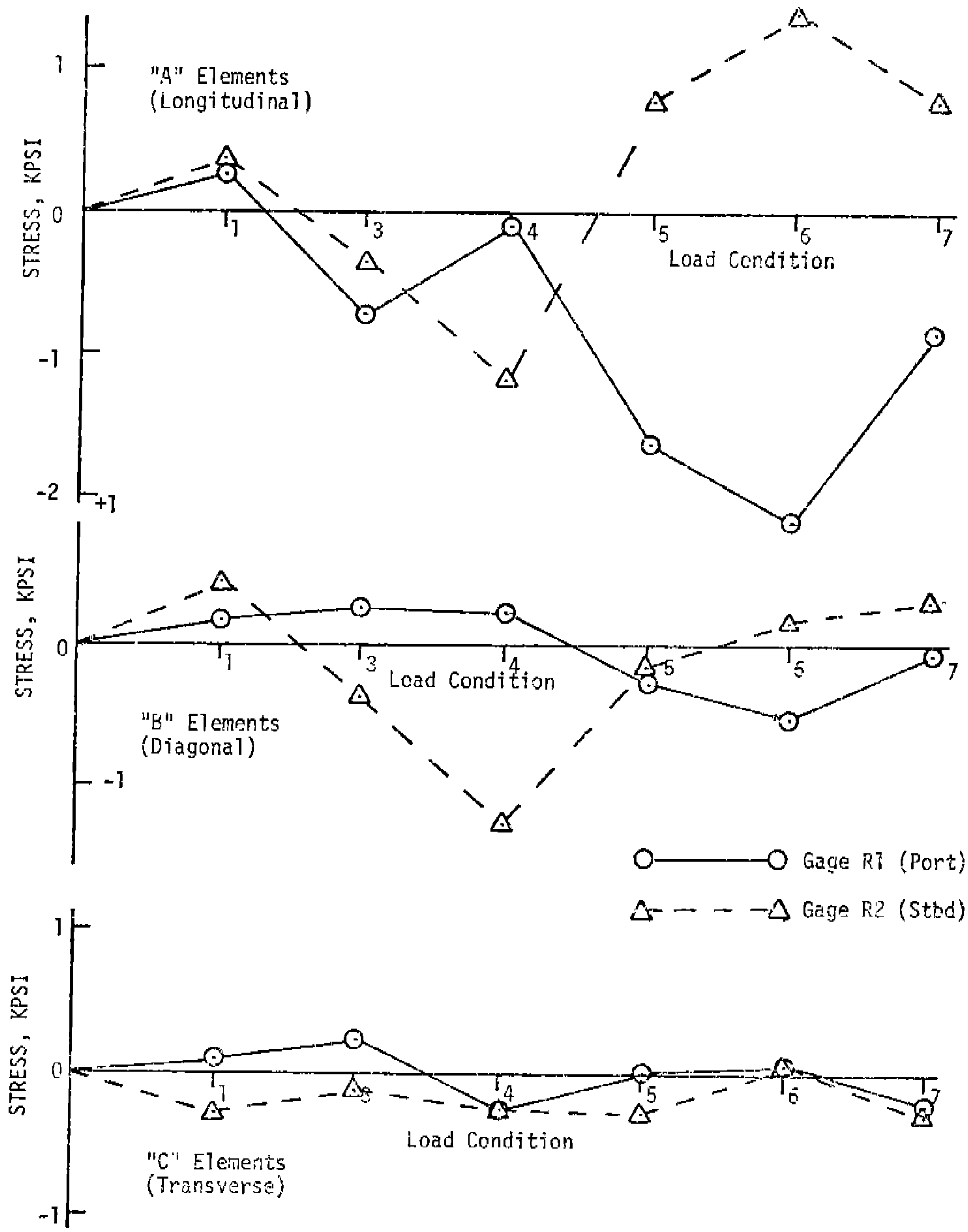


Figure 7

STRESS VS. LOAD CONDITION

ROSETTES R1 AND R2

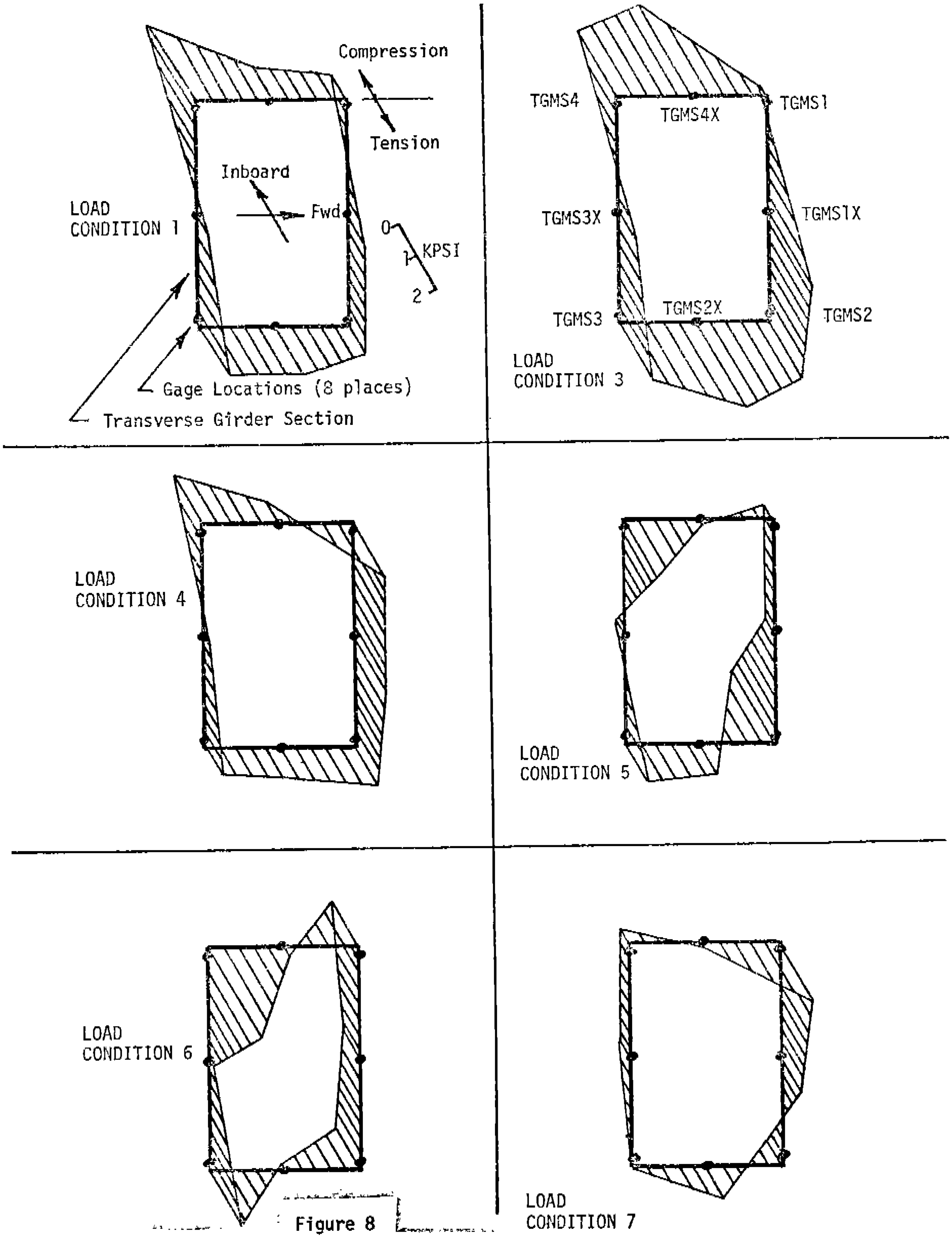


Figure 8

REPRESENTATION OF STRAIN GAGE DATA
MIDSHIP TRANSVERSE GIRDER

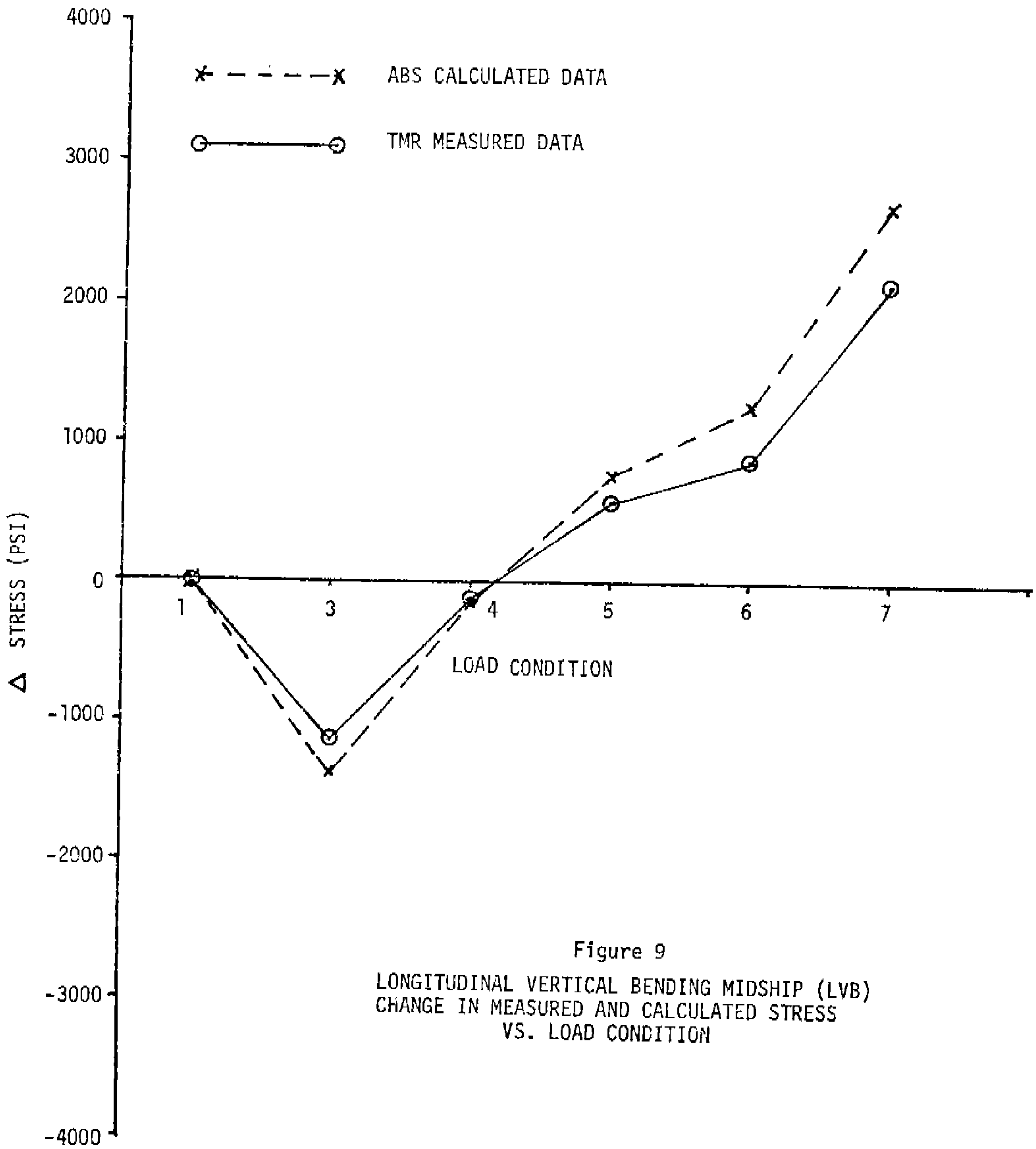


Figure 9

LONGITUDINAL VERTICAL BENDING MIDSHIP (LVB)
CHANGE IN MEASURED AND CALCULATED STRESS
VS. LOAD CONDITION

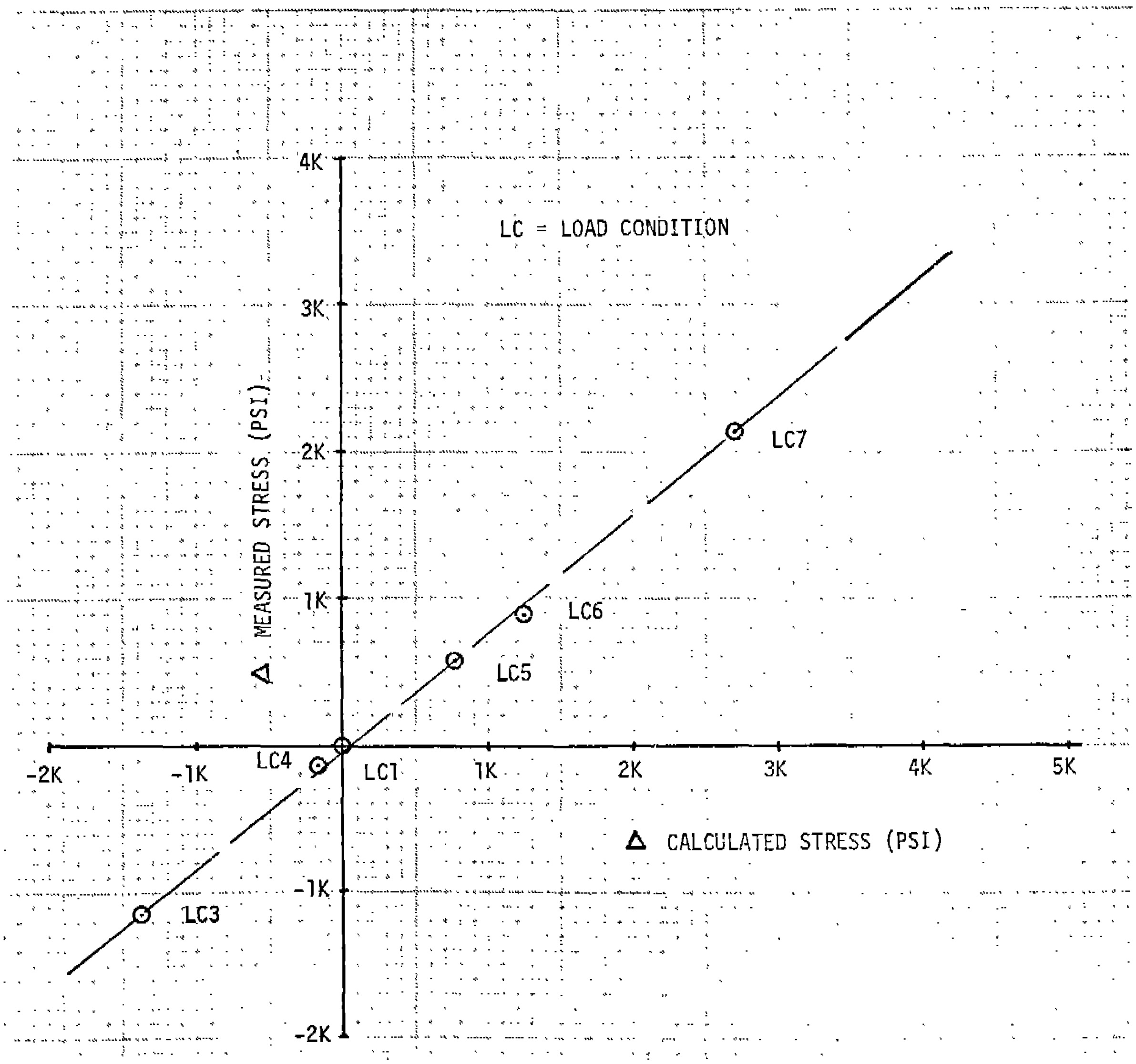


Figure 10

LONGITUDINAL VERTICAL BENDING MIDSHIP (LVB)
MEASURED STRESS VS. CALCULATED STRESS

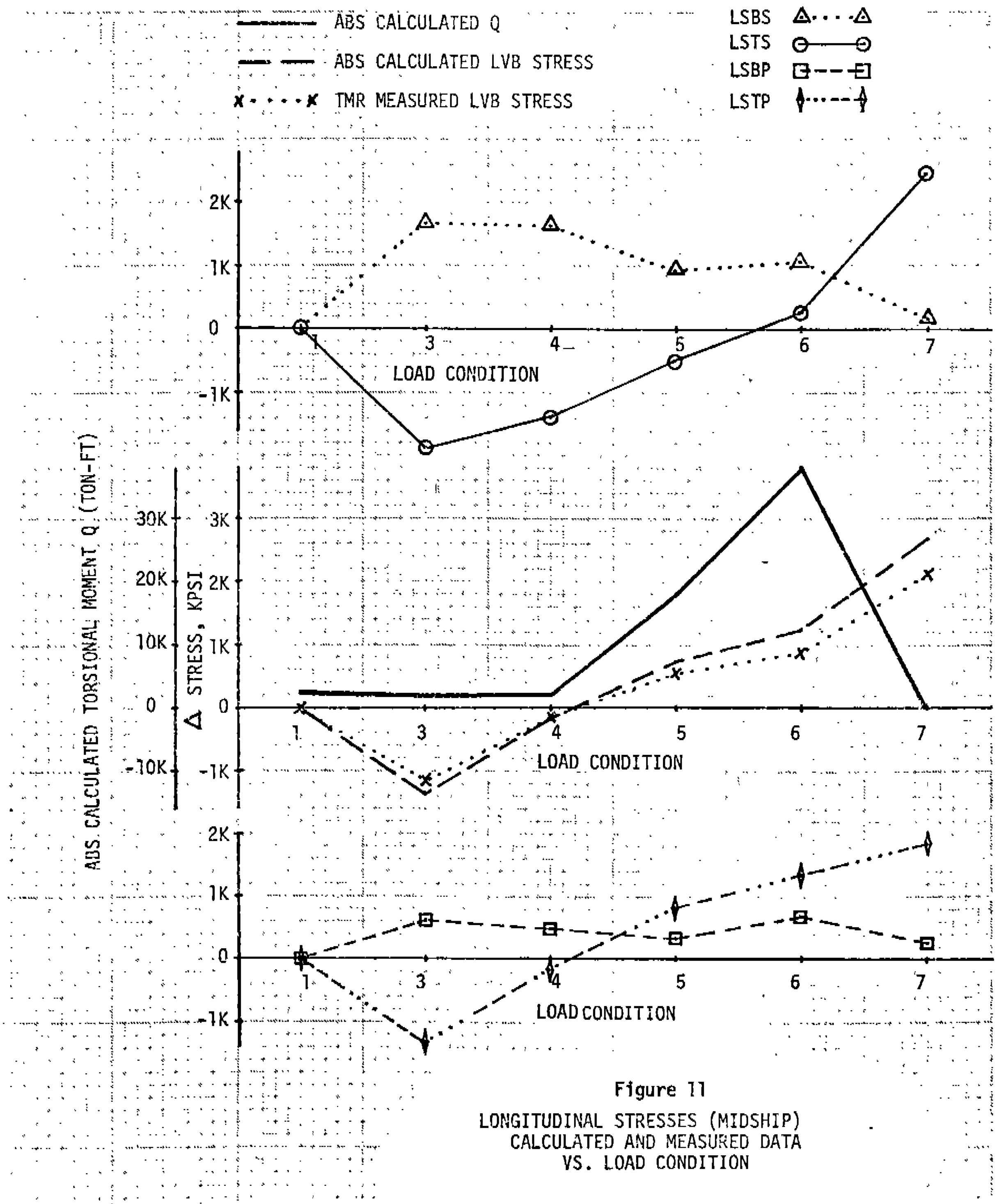


Figure 11

LONGITUDINAL STRESSES (MIDSHIP)
CALCULATED AND MEASURED DATA
VS. LOAD CONDITION

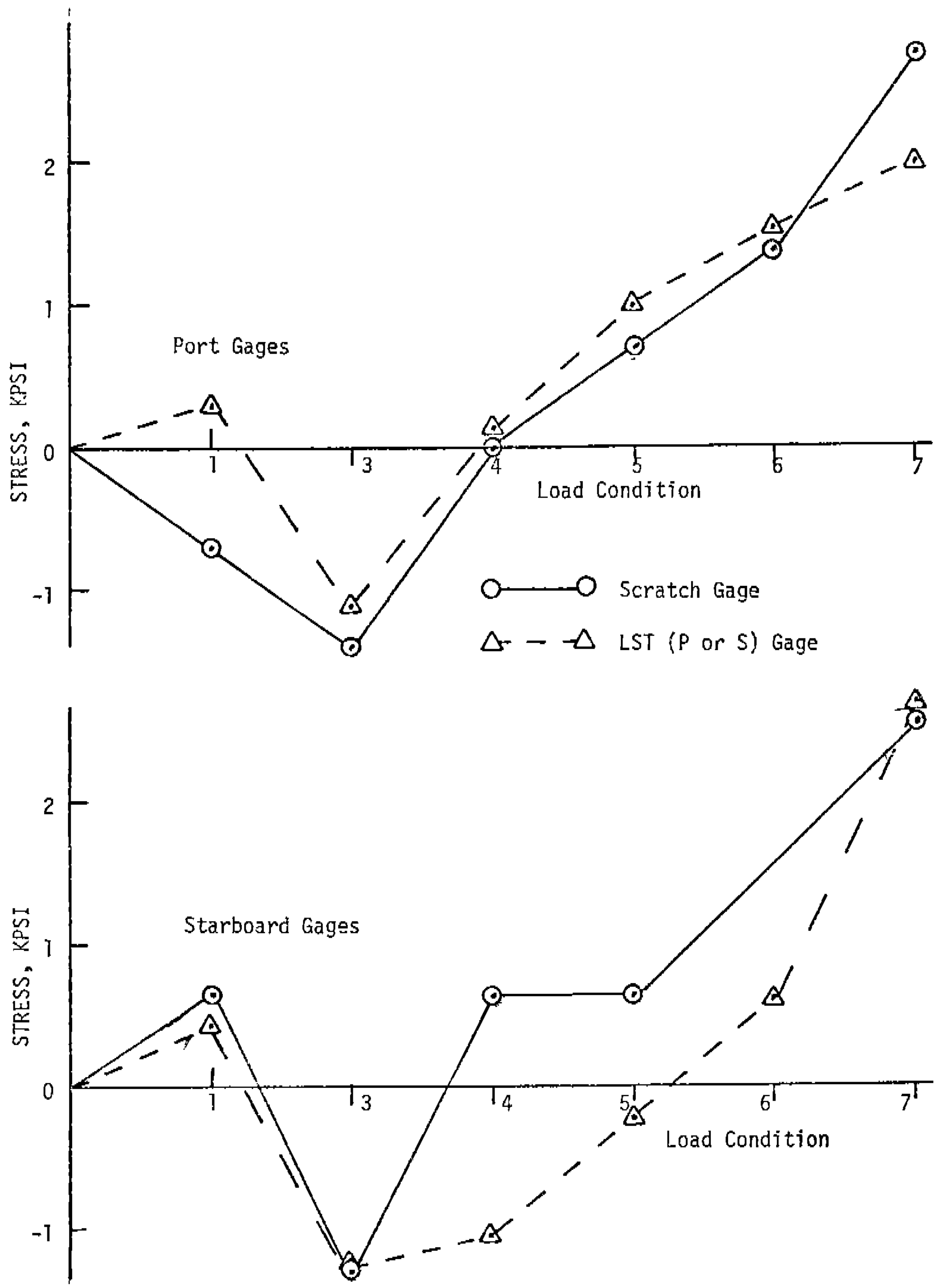


Figure 12

COMPARISON OF DATA FROM
SCRATCH GAGES AND LST GAGES

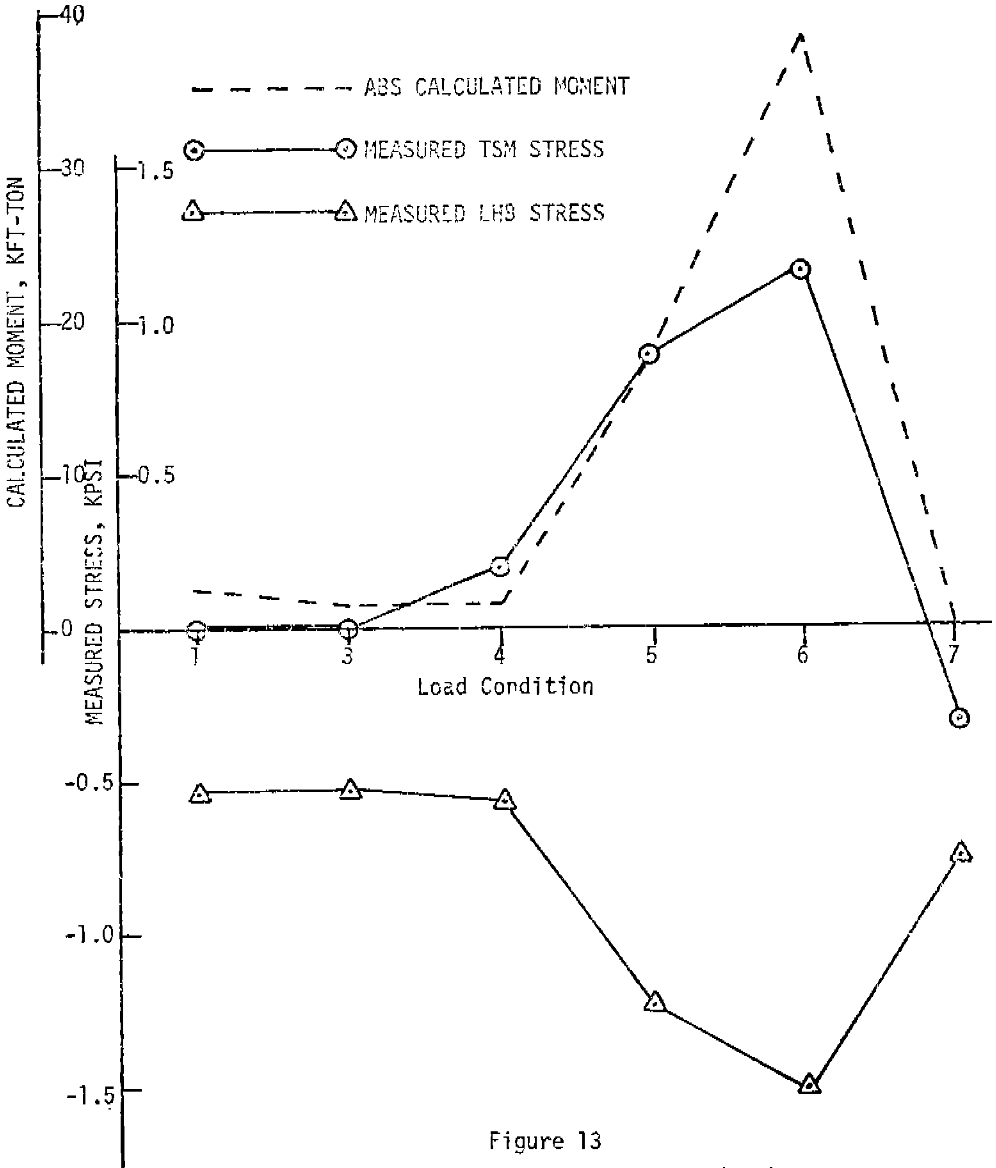


Figure 13

MEASURED TORSIONAL SHEAR MIDSHIP (TSM)
AND LONGITUDINAL HORIZONTAL BENDING (LHB)
AND CALCULATED TORSIONAL MOMENT
VS. LOAD CONDITION

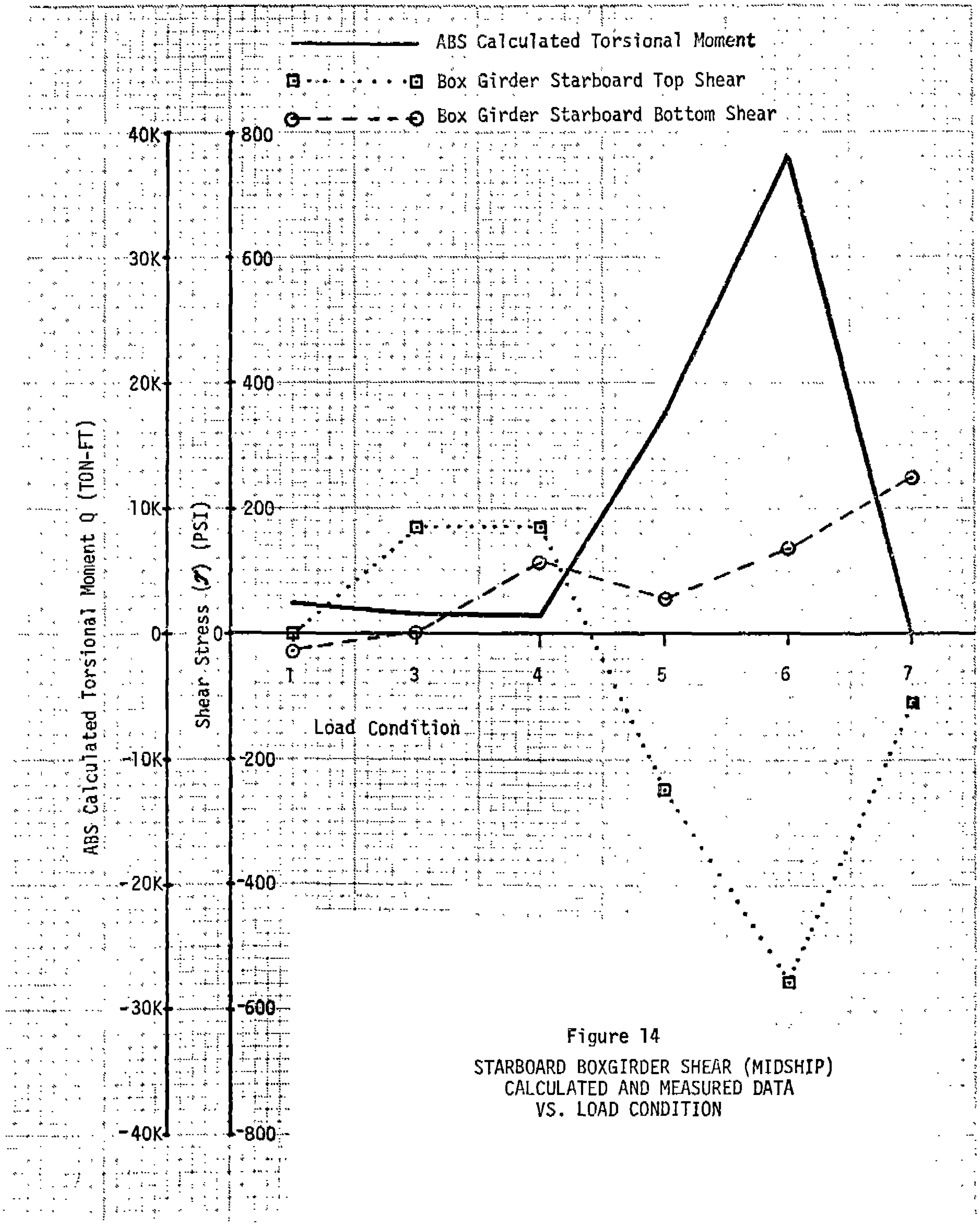


Figure 14

STARBOARD BOXGIRDER SHEAR (MIDSHIP)
CALCULATED AND MEASURED DATA
VS. LOAD CONDITION

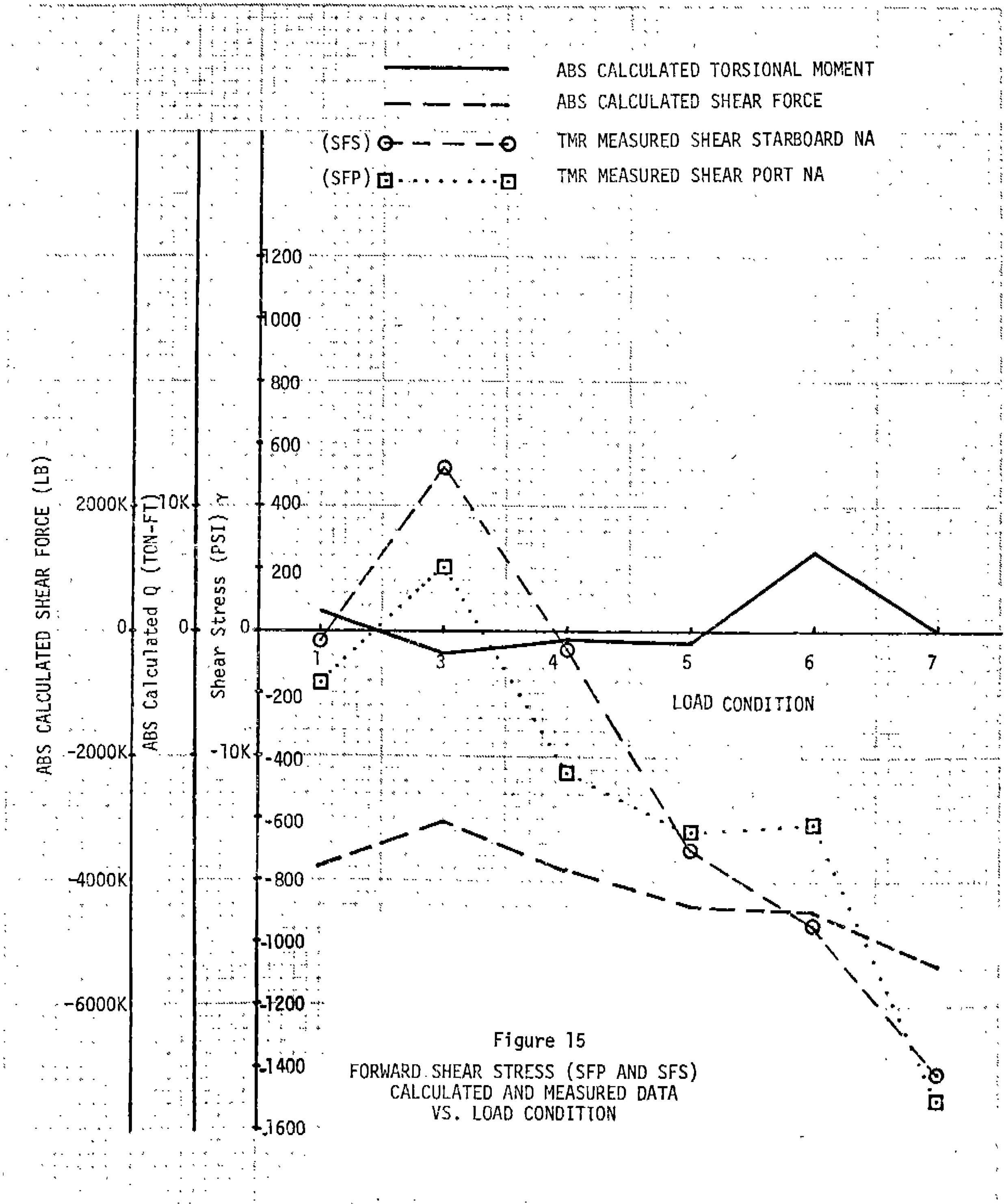


Figure 15

FORWARD SHEAR STRESS (SFP AND SFS)
CALCULATED AND MEASURED DATA
VS. LOAD CONDITION

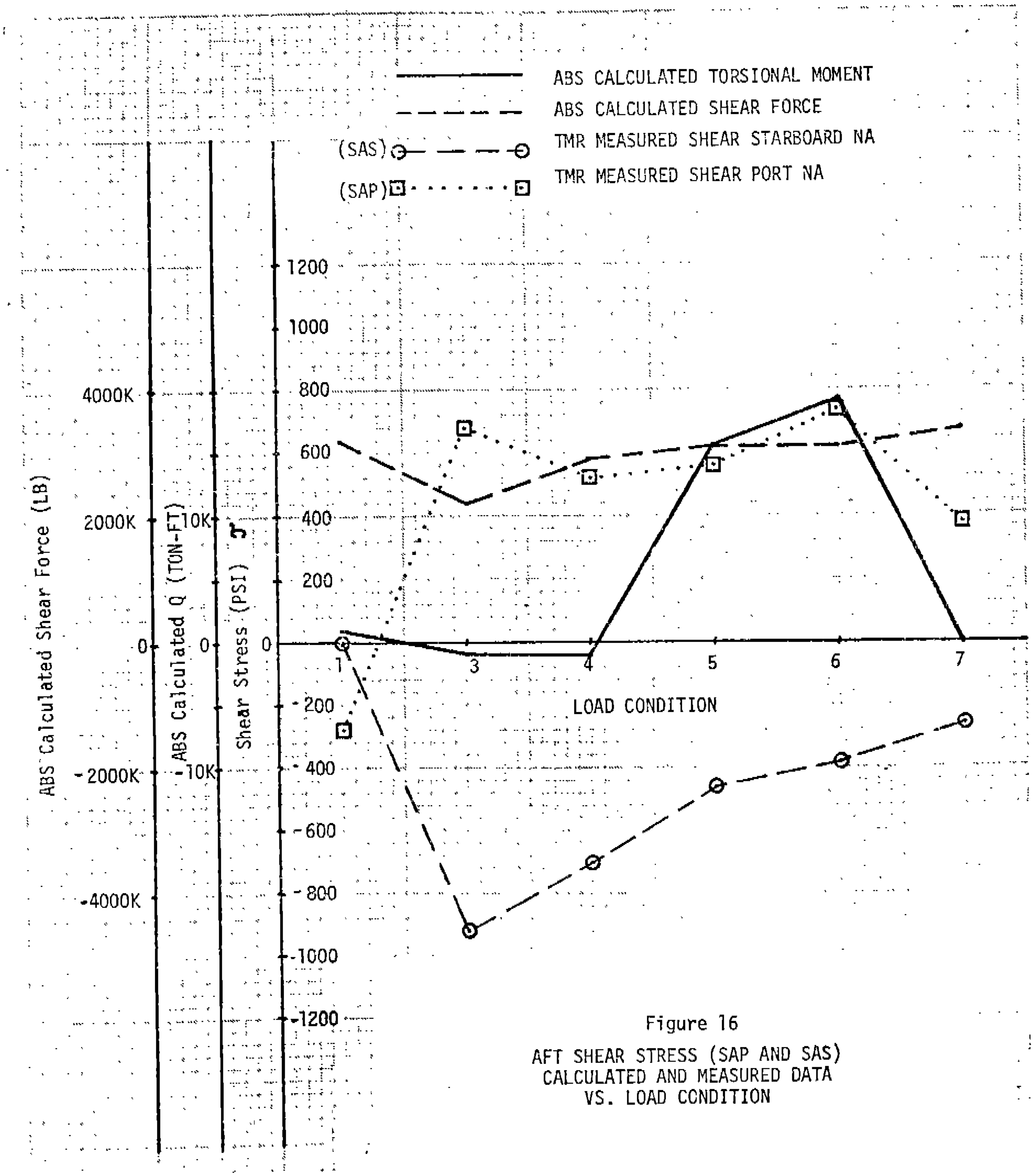


Figure 16

AFT SHEAR STRESS (SAP AND SAS)
CALCULATED AND MEASURED DATA
VS. LOAD CONDITION

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13. ABSTRACT

This document reports the results of the calibration of the strain gage portion of the ship response instrumentation installed on the SEA-LAND McLEAN SL-7 class containership. The calibration consisted of a succession of loading conditions achieved by selectively removing container cargo, and was performed on April 9-10, 1973 in Rotterdam. The measured stress changes are compared with calculated predictions, and the results are discussed. In general, the measurements and calculations agree substantially within tolerances assignable to physical conditions.

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