

AD-A270 581



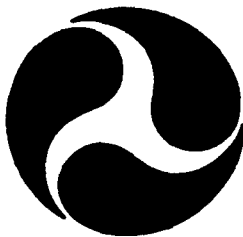
2

Report No. CG-D-18-93

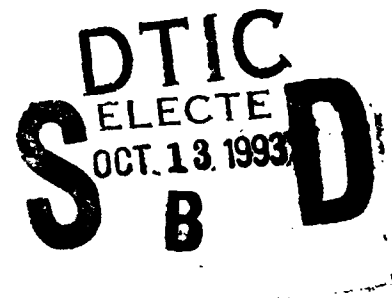
**Additional Seakeeping Model Tests of
Two U.S. Coast Guard Notional Designs
of 110 FT and 120 FT WPB Hulls**

Walter E. Klosinski
and
P. Ward Brown

Davidson Laboratory
Stevens Institute of Technology
Castle Point Station
Hoboken, NJ 07030



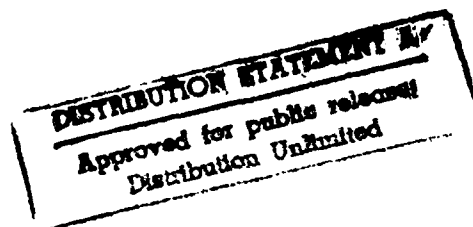
FINAL REPORT
JANUARY 1993



This document is available to the U.S. public through the
National Technical Information Service, Springfield, Virginia 22161

Prepared for:

U.S. Coast Guard
Research and Development Center
1082 Shennecossett Road
Groton, Connecticut 06340-6096



and

U.S. Department Of Transportation
United States Coast Guard
Office of Engineering, Logistics, and Development
Washington, DC 20593-0001

93-24105



73

00

83

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

The contents of this report reflect the views of the Coast Guard Research & Development Center. This report does not constitute a standard, specification, or regulation.



D. L. Motherway
D. L. Motherway
Technical Director, Acting
United States Coast Guard
Research & Development Center
1082 Shennecossett Road
Groton, CT 06340-6096

Technical Report Documentation Page

1. Report No. CG-D-18-93		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Additional Seakeeping Model Tests of Two U.S. Coast Guard Notional Designs of 110 FT and 120 FT WPB Hulls				5. Report Date January 1993	
				6. Performing Organization Code	
				8. Performing Organization Report No. R&DC 09/91	
7. Author(s) Walter E. Klosinski and P. Ward Brown				10. Work Unit No. (TRAIS)	
9. Performing Organization Name and Address Davidson Laboratory Stevens Institute of Technology Castle Point Station Hoboken, NJ 07030				11. Contract or Grant No. DTCG23-85-C-20060	
				13. Type of Report and Period Covered Final Report	
				14. Sponsoring Agency Code	
12. Sponsoring Agency Name and Address U.S. Coast Guard Research and Development Center 1082 Shennecossett Road Groton, Connecticut 06340-6096				Department of Transportation U.S. Coast Guard Office of Engineering, Logistics, and Development Washington, D.C. 20593-0001	
15. Supplementary Notes					
16. Abstract The research results presented in this report are concerned with the seakeeping characteristics of two Notional WPB Designs, the 110 FT WPB and the 120 FT WPB. Model tests of the two hulls were conducted at 10 knots in irregular head seas having significant wave heights of 12.5% of the beam and at speeds from 25 to 70 knots in irregular head seas having a significant wave height of 20% of the beam. Spectral analyses were performed on the motions and accelerations, including the 1/3 octave RMS accelerations. All data were scaled to full size and are tabulated.					
17. Key Words planing boat motions planing boat performance WPB notional hulls planing hulls				18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classif. (of this report) UNCLASSIFIED		20. SECURITY CLASSIF. (of this page) UNCLASSIFIED		21. No. of Pages	
				22. Price	

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	* 2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (WEIGHT)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (EXACT)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* 1 in = 2.54 (exactly).

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (WEIGHT)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (EXACT)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

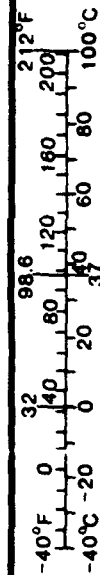


TABLE OF CONTENTS

NOMENCLATURE	vii
INTRODUCTION	1
MODEL AND INSTRUMENTATION	1
TEST FACILITY	2
MODEL TESTS	3
DATA PROCESSING	4
RESULTS	5
DISCUSSION	7
CONCLUDING REMARKS	8
REFERENCES	8

TABLES

TABLE 1	HULL CHARACTERISTICS	9
TABLE 2	ROUGH WATER RUN DIRECTORY	10
TABLE 3	TOTAL ROUGH WATER RESISTANCE	11
TABLE 4	ACCELERATION VARIANCE SPECTRAL DENSITY	12
TABLE 5	1/3-OCTAVE RMS ACCELERATIONS	23
TABLE 6	PITCH VARIANCE SPECTRAL DENSITY	34
TABLE 7	HEAVE VARIANCE SPECTRAL DENSITY	36
TABLE 8	WAVE VARIANCE SPECTRAL DENSITY	38
TABLE 9	ROUGH WATER RMS & MEAN VALUES OF MOTIONS AND ACCELERATIONS	40
TABLE 10	AVERAGE CRESTS & TROUGHS OF MOTIONS AND ACCELERATIONS	41
TABLE 11	AVERAGE 1/3-HIGHEST CRESTS & TROUGHS	43
TABLE 12	AVERAGE 1/10-HIGHEST CRESTS & TROUGHS	45

FIGURES

FIGURE 1	PHOTOGRAPH OF 120 FT WPB AT 46.4 KNOTS IN 4.3 FT SEAS	47
FIGURE 2	PHOTOGRAPH OF 110 FT WPB AT 50.1 KNOTS IN 5.0 FT SEAS	48
FIGURE 3	WPB PROFILES.	49
FIGURE 4	110 FT WPB BODY LINES.	50
FIGURE 5	120 FT WPB BODY LINES.	51
FIGURE 6	LOCATIONS OF VERTICAL ACCELEROMETERS	52
FIGURE 7	110 FT WPB TEST WAVE SPECTRA, 3.13 FT SIGNIFICANT HEIGHT	53
FIGURE 8	110 FT WPB TEST WAVE SPECTRA, 5.0 FT SIGNIFICANT HEIGHT	54
FIGURE 9	120 FT WPB TEST WAVE SPECTRA, 2.62 FT SIGNIFICANT HEIGHT	55
FIGURE 10	120 FT WPB TEST WAVE SPECTRA, 4.26 FT SIGNIFICANT HEIGHT	56

FIGURE 11	COMPARATIVE MOTION RESPONSE IN 20% BEAM SIGNIFICANT HEIGHT .	57
FIGURE 12	CORRELATION BETWEEN AFT & MIDSHIP ACCELERATION, 110 FT WPB .	58
FIGURE 13	CORRELATION BETWEEN FWD & MIDSHIP ACCELERATION, 110 FT WPB .	59
FIGURE 14	CORRELATION BETWEEN AFT & MIDSHIP ACCELERATION, 120 FT WPB .	60
FIGURE 15	CORRELATION BETWEEN FWD & MIDSHIP ACCELERATION, 120 FT WPB .	61
FIGURE 16	LONGITUDINAL VARIATION OF RELATIVE ACCELERATION, 110 FT WPB .	62
FIGURE 17	LONGITUDINAL VARIATION OF RELATIVE ACCELERATION, 120 FT WPB .	63
FIGURE 18	COMPARATIVE ACCELERATIONS IN 20% BEAM SIGNIFICANT HEIGHT . .	64

NOMENCLATURE

A_p	projected planing bottom area, sq.ft
b	beam over chines, ft
C_D	drag coefficient based on beam squared, R/qb^2
CG	center of gravity
C_f	ATTC frictional resistance coefficient
C_F	frictional resistance coefficient based on beam squared, $C_f(S/b^2)$
CP	center of pressure, intersection of the resultant hydrodynamic force vector with the keel baseline
C_R	resistance coefficient, R/wb^3
C_T	total resistance coefficient, R/qS
C_v	velocity coefficient, $V/\sqrt{gb}$
C_d	load coefficient, A/wb^3
d	transom draft, depth of keel at transom below still water level, ft
F_{nv}	volume Froude Number, $V/\sqrt{(g\nabla^{1/3})} = C_v/C_d^{1/6}$
f	frequency, Hz
f_e	frequency of encounter, Hz
$f\sqrt{(b/g)}$	non-dimensional frequency
g	acceleration due to gravity, 32.17 fps ²
$H_{1/3}$	significant wave height, 4 x RMS wave elevation, ft
k	radius of gyration, ft
L/b	length-beam ratio
LBP	length between perpendiculars, ft
LOG	longitudinal position of the center of gravity (CG), measured from the transom parallel to the keel, ft
LCP	longitudinal position of the hydrodynamic center of pressure (CP), measured from the transom parallel to the keel, ft
LOA	length overall, ft
l_c	chine wetted length, ft
l_k	keel wetted length, ft
l_m	mean wetted length, $(l_k + l_c)/2$
l_m/b	mean wetted length-beam ratio
n	vertical acceleration or load factor, g units
p	waterplane coefficient
q	dynamic pressure, $\frac{1}{2} \rho V^2$

DTIC QUALITY INSPECTED 21

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

R	resistance, lb
R_{aw}	added resistance in waves, lb
RMS	process root-mean-square
RMS_n	RMS acceleration, g units
RMS_θ	RMS pitch, degrees
R_n	Reynolds Number
S	wetted area, sq.ft
S/b^2	non-dimensional wetted area
t	time, seconds
$t\sqrt{(g/b)}$	non-dimensional time
V	velocity, fps
V_k	speed, knots
w	specific weight of water, 62.28 lb/cu.ft fresh water at 71.5°F, 64.00 lb/cu.ft salt water at 59°F
β	deadrise angle, degrees
Δ	displacement, lb
θ	pitch angle excursion, degrees
ρ	density of water, w/g
τ	trim angle of keel, degrees
∇	volumetric displacement, Δ/w , cu.ft

Area loading	$A_p/V^{2/3} = p(L/b)/C_\Delta^{2/3}$
Slenderness ratio	$L/V^{1/3} = (L/b)/C_\Delta^{1/3}$
Speed-length ratio	$V_k/\sqrt{L} = 3.36 C_v/\sqrt{(L/b)}$

Subscripts

s	denotes full-size or ship scale
m	denotes model scale

Sign Convention

The trim is positive in the bow up sense and is zero when the afterbody keel is horizontal.

The pitch is positive in the bow up sense and is zero when the afterbody keel is horizontal.

The heave is the height of the tow point above the still water surface, is positive vertically upward, and is zero when the tow point is at the still water level.

The draft is the depth of the keel at transom below the still water surface, is positive vertically downward, and is zero when the keel at transom is at the still water level.

The drag is a horizontal force vector, positive aft in the bow-to-stern sense, and is zero when the boat is at rest.

The velocity is a horizontal vector, positive forward in the stern-to-bow sense, and is zero when the boat is at rest.

The vertical acceleration is a vertical vector, positive upward, and is zero when the boat is at rest.

INTRODUCTION

The Davidson Laboratory is conducting a series of planing boat studies in support of the U.S. Coast Guard's pursuit of R&D projects which will enable it to evaluate advanced marine vehicles and advanced technologies which enhance the effectiveness of ship resources. The experimental results obtained at the Davidson Laboratory are intended to contribute to a relevant technical data base for the evaluation of vessels which are in service and for designs which are being considered for service.

The objective of this research is to obtain basic hydrodynamic information about planing hulls through the use of captive model tests. This information is required for the study of the transverse stability, yaw/roll stability, course keeping, maneuvering and control of planing hulls, and for the study of seakeeping, and the loss of speed in a seaway, of planing hulls.

The research results presented in this report are concerned with the seakeeping characteristics of two Notional WPB Designs (the 110 ft WPB and the 120 ft WPB) in a comparatively modest sea state of significant wave height equal to 20 percent of the craft beam. This data supplements that previously obtained at the Davidson Laboratory^{1,2} with the same two hulls operating in seas having significant wave heights of 40 and 60 percent of the beam. As before the tests were conducted at speeds up to 65 knots. In addition tests were run at 10 knots in irregular waves having a significant height of 12.5 percent of the beam, for direct comparison with earlier tests in regular waves¹.

MODEL AND INSTRUMENTATION

Two 1/18-scale models of the 110 ft WPB and the 120 ft WPB previously fabricated and tested were used in the tests¹. Photographs of the models under tests are included on Figures 1 and 2, and the WPB profiles are presented on Figure 3. Figures 4 and 5 present the body lines of each hull. The model hulls were made of fiberglass and epoxy to USCG specifications. Internal body frames and cut-out decks were included to make the models rigid but lightweight. A lower deck, made of marine plywood, was installed inside each model and extended for about a third of each model's length. These decks were used for attaching weights, instrumentation, and the apparatus which attached the models to the overhead towing carriage.

Each model was towed through a pitch pivot box, which had its axis located at the intersection of the thrust line with the LCG. Thus the towpoint was at the LCG at a height of 6.38 ft above the baseline. Here, as throughout this report, values are given in terms of full-size equivalents. Above the pivot box a drag balance was mounted and attached to twin vertical heave poles supported by a standard free-to-heave apparatus. The models were towed at constant speed along the center line of the tank at zero roll and yaw with freedom to pitch and heave. Five accelerometers were mounted in each model as shown on Figure 6. An inclinometer mounted in the model measured the trim in calm water and a linear differential transformer attached to the heave poles was used to measure the heave. The pitch excursions in waves were measured by a rotary differential transformer. Thin mylar strips were fastened to both chines of the 110 ft WPB and to the lower chine of the 120 ft WPB to ensure sharp edges on the scaled models. The spray rail built into the 120 ft WPB at the upper chine was V-shaped in cross-section, which resulted in a sharp edge, and therefore no mylar strip was required. The models were ballasted to the scaled values presented in Table 1.

TEST FACILITY

Tests were conducted in the Davidson Laboratory Tank 3, which is 313 ft long, 12 ft wide and 5.5 ft deep. A monorail above the water extends down the tank's length. A towing carriage rides on this rail and is attached to the model below it through the heave poles. The carriage is towed by a steel cable driven by an electric motor at one end of the tank. The model is accelerated up to the required constant speed, and data are acquired in the data trap. The signals are transmitted by overhead cables to shore-based signal conditioning equipment and thence to an on-line computer for processing and storage.

A color video camera was mounted ahead and to port of the model being tested. All runs were monitored on a shore based monitor, and a video recording was made of each run.

The Tank 3 wavemaker is an articulated double flap wet-back type in which the upper and lower flaps are powered by hydraulic cylinders. A dedicated computer generates the signals which control the movements of each of the hydraulic actuators.

The specified sea states had significant wave heights of 12.5 and 20 percent of each hull's maximum beam at the upper chine. These waves were generated and measured by a stationary wave-wire prior to tests with the model. When the specified waves were obtained their parametric settings were locked in the computer. A moving wave strut was mounted forward and to port of the model to monitor waves during model tests. The full size spectra of the generated sea states together with the Pierson-Moskowitz spectra are presented on Figures 7 to 10.

During the tests the water temperature was maintained at a value of 71.5° F which was checked twice daily.

MODEL TESTS

The ballast of each model was adjusted to obtain the specified radius of gyration in pitch equal to 25 percent of the LBP.

The models were tested at the half-load condition noted in Table 1 at three values of speed coefficient, C_v , equal to 1.5, 3.0, and 4.0, in two Pierson-Moskowitz seas having significant wave heights of 12.5 and 20 percent of each model's maximum chine beam. Pitch, heave, drag, and five vertical accelerations were measured.

Runs were made at the following matrix of test conditions:

<u>Model Designation</u>	<u>Significant Wave Height</u> <u>percent beam</u>	<u>Speed</u>
110 ft WPB	12.5	10 knots
110 ft WPB	20.0	$C_v = 1.5, 3.0, 4.0$
120 ft WPB	12.5	10 knots
120 ft WPB	12.5	$C_v = 1.5, 3.0, 4.0$
120 ft WPB	20.0	$C_v = 1.5, 3.0, 4.0$

The model was accelerated to a steady speed and then data were acquired in the 150 ft data trap. Additional runs were made in different sections of the seaway, by inserting a known time offset into the wavemaker computer, until a minimum of 70 waves had been encountered at each test

condition. The statistics were then calculated for this group of combined runs. Table 2 summarizes the irregular wave test runs. The models running at speed in irregular waves are shown on Figures 1 and 2.

DATA PROCESSING

The instrumentation was calibrated by applying known displacements to the motion transducers and wave strut, known loads to the force balance, and gravity multiples to the accelerometers. All calibrations were linear and a least-squares technique was used to determine the calibration rates, which were checked daily.

The primary measured quantities included drag, pitch, CG heave, and five accelerations. Heave is defined as the height of the tow point above the still water surface. The transom draft was calculated from the average heave, the average pitch, i.e. the trim, and the known position of the towpoint.

A quantity known as the "static keel wetted length" (SKWL) was calculated from the trim and the transom draft. The SKWL is defined by the intersection of the still water surface with the keel profile in the running condition and does not allow for the wave rise at keel. The SKWL, and its use, is more fully described later in the Results section.

The velocities were computed from the time taken to travel through the data trap which was 150 ft long. During data collection all data channels were scanned at a rate of 250 Hz and the results stored in the computer for appropriate processing.

In addition a peak-trough analysis was carried out for the pitch, heave, and five accelerations. The peak-trough analysis computes for each signal the mean and rms, the number of oscillations, the average of the peaks and troughs, the average of the 1/3-highest and the 1/10-highest peaks and troughs, and the extreme values of the peaks and troughs. All data were scaled to full size units.

Wave height statistics generated from time-series data sometimes involve an analysis procedure which identifies wave crests and troughs as the maximum and minimum values of wave height occurring between zero crossings, or between crossings of a reference data level. This is not the procedure customarily employed at the Davidson Laboratory. The procedure used in this

study identifies all maxima and minima regardless of magnitude, thereby avoiding a bias that would otherwise be introduced into the statistics.

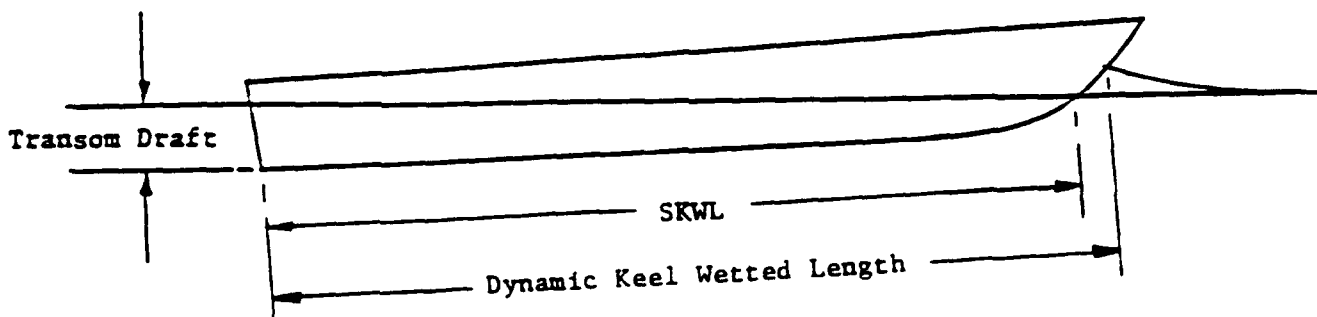
Spectral analyses were performed on the five accelerations, the pitch and heave time histories, and the encountered waves. Additionally 1/3-octave RMS analyses were performed on the five accelerations for those who wish to assess the habitability of the designs.

RESULTS

All the rough water test results are given in terms of full-size equivalents and are presented in data tables and plots. A Run Directory is included as Table 2.

The resistance expansion of planing boats requires a knowledge of the wetted area which is calculated from the keel and chine wetted lengths observed in the calm water underwater photographs. In rough water, however, it is not possible to use underwater photography and some other means has to be used to find the mean wetted area. This is the function of the static keel wetted length, because the SKWL can be calculated from the mean trim and transom draft in both calm and rough water. The dynamic wetted lengths at keel and chine observed in the calm water underwater photographs may be correlated with the static keel wetted length to provide the means for estimating the wetted area in rough water.

The static keel wetted length is defined by the intersection of the still water surface with the keel profile in the running condition, and is computed from the observed trim, the transom draft, and the known geometry of the keel. The SKWL is shown in Sketch A:



Sketch A

The relationship of the keel and chine wetted lengths to the SKWL was established in the earlier study in this series¹ for both WPB hulls. The SKWL was calculated for each rough water run in the present tests. The keel and chine wetted lengths were estimated from the SKWL using the established relationship. These estimated wetted lengths, together with the girths of each WPB, were used to compute the wetted area for each run, and these wetted areas were in turn used to calculate the full-size resistance given in Table 3.

A spectral analysis and a peak-trough analysis were performed on each group of runs tested at the same speed and sea state. The results of the spectral analysis are presented in Tables 4 to 8.

The full-size spectral estimates of the five accelerations on the 110 ft WPB and the 120 ft WPB are tabulated in Table 4. The center frequency of each pass band is tabulated in the left hand column, and the variance density in each pass band is given in subsequent columns for the five accelerometers from bow to transom, see Figure 6.

The maximum frequency of the analysis is chosen so that there is no contribution to the variance from frequencies above the maximum. The numerical value of the maximum center frequency is somewhat arbitrary being a function of the scanning rate and the scale ratio. For example, in Table 4.1 at a speed of 10 knots the maximum frequency is 3.6828 Hz. The frequency scale is divided into 30 intervals resulting in bandwidths of 0.1228 Hz. This detailed analysis facilitates the transformation into the 1/3-octave presentation and into the graphical presentations in the Appendices. Again in Table 4.1 at the center frequency of 0.37 Hz the variance density in the pass band for the #5 accelerometer is 0.1859 g^2/Hz . Multiplying by the bandwidth of 0.1228 Hz, the contribution to the variance in this band is 0.0228 g^2 . Proceeding in this manner the detailed spectra can be transformed into broader and more practical bandwidths and into the 1/3-octave format.

The 1/3-octave rms accelerations are tabulated in Table 5 for the 110 ft and the 120 ft WPB. The center frequencies of these 1/3-octave bandwidths are those specified in International Standard ISO 2631 and in MIL-STD-1472A, and they are tabulated in the left hand column. The rms acceleration in each 1/3-octave pass band is given in the subsequent columns for the five accelerometers. It may be noted that the rms is simply the square root of the variance.

The pitch variance spectral density estimates are presented in Table 6 for the two hulls; heave spectral densities are presented in Table 7; and encountered wave spectral densities are presented in Table 8.

The results of the peak-trough analysis of the motions and accelerations of the two hulls are presented in Tables 9 to 12. The tabulated statistical quantities include the pitch, heave, and the outputs from the five accelerometers. The RMS and mean values are given in Table 9, and average values of the crests and troughs, (i.e. the maxima and minima in the time histories) are given in Table 10. The 1/3-highest statistics are presented in Table 11 and the 1/10-highest statistics in Table 12.

DISCUSSION

The pitch and heave motion characteristics of the 110 ft and 120 ft WPB are compared on Figure 11 in irregular waves having a significant height corresponding to 20 percent of the beam. The hull with the higher length-beam ratio, the 120 ft WPB, has about 40% less response to the waves.

The rms accelerations at various longitudinal locations throughout the boat are linearly related to the midship acceleration. This is demonstrated for the 110 ft WPB on Figures 12 and 13 where the acceleration at each station from stern to bow is plotted against the midship acceleration. (The accelerometer locations are given on Figure 6). Thus the acceleration at any station on the 110 ft WPB can be referred to that measured by the midship accelerometer, Accelerometer #3, located two beams forward of the transom, for all speeds and sea states. Similarly, the accelerations at any station on the 120 ft WPB may be referred to that measured by Accelerometer #3 located three beams forward of the transom, as shown on Figures 14 and 15. These linear relationships are summarized in terms of intercept (a_0) and slope on Figures 16 and 17 for the 110 ft and 120 ft WPB respectively. The acceleration data includes the new data together with that previously reported^{1,2}.

The CG accelerations of the two designs operating in head seas of 20 percent beam significant are compared on Figure 18, where the rms acceleration of Accelerometer #2, located at the nominal LCG of each hull, is shown plotted versus the speed. The reduction in acceleration of the 120 ft WPB due to its higher beam loading is evident.

CONCLUDING REMARKS

The hydrodynamic characteristics of the two 110 ft and 120 ft WPB designs in irregular waves having significant heights equal to 20 percent of their maximum beam, and at speed coefficients, C_v , of 1.5, 3.0, and 4.0, are presented in tabular and graphical form. These test results are an extension of the previous tests¹ conducted at these same speeds in larger significant wave heights equal to 40 percent and 60 percent of the maximum chine beam.

Some of the previous work on the WPB's included tests in regular waves at 10 knots with wave heights equal to 12.5 percent of the maximum chine beam, and the present results in irregular waves provide the basis for verifying the linearity of response at low speed.

REFERENCES

1. Klosinski, Walter E., and Brown, P. Ward: "Resistance and Seakeeping Model Tests Two USCG Notional Designs of 110 ft and 120 ft WPB Hulls"
Davidson Laboratory Report 2548, February 1987.
2. Klosinski, Walter E., and Brown, P. Ward: "Additional Resistance and Seakeeping Model Tests of a USCG 120 ft Notional WPB Design"
Davidson Laboratory Report 2561, February 1987.

TABLE 1

HULL CHARACTERISTICS

110 ft WPB at Half Load

Displacement	119.0 ℓ -tons	44.45 lb
LOG forward of AP	37.2 ft	24.8 in
VOG above baseline	8.9 ft	5.93 in
Maximum beam at upper chine	24.69 ft	16.46 in
Propeller shaft angle, degrees	15.0	15.0
Pich radius of gyration, percent LBP	25.0	25.0
LOA	110.0 ft	73.33 in
LBP	104.0 ft	69.33 in

120 ft WPB at Half Load

Displacement	135.0 ℓ -tons	50.43 lb
LOG forward of AP	42.9 ft	26.8 in
VOG above baseline	7.66 ft	5.11 in
Maximum beam at upper chine	21.20 ft	14.13 in
Propeller shaft angle, degrees	10.0	10.0
Pich radius of gyration, percent LBP	25.0	25.0
LOA	118.79 ft	79.20 in
LBP	110.0 ft	73.33 in

TABLE 2

ROUGH WATER RUN DIRECTORY

SPEED knots	C _v	RUNS	Number of Wave Encounters
----------------	----------------	------	---------------------------------

110 ft WPB

Significant Wave Height - 3.13 ft, 12.5% Beam

10.0	0.60	126	75
------	------	-----	----

Significant Wave Height - 5.00 ft, 20% Beam

25.0	1.5	121	122	123		103
50.1	3.0	118	119	120	124	91
66.8	4.0	134	135	136	137	138
						93

120 ft WPB

Significant Wave Height - 2.62 ft, 12.5% Beam

10.0	0.65	75				82
23.2	1.5	40	42			86
46.4	3.0	44	45	46		77
61.9	4.0	48	49	63	64	80

Significant Wave Height - 4.26 ft, 20% Beam

23.2	1.5	65	66			75
46.4	3.0	67	68	69		74
61.9	4.0	71	72	73	74	82

TABLE 3
TOTAL ROUGH WATER RESISTANCE

120 ft WPB

SPEED knots	C_v	$F_n \nabla$	Significant Wave Height 12.5% beam (2.62 ft)	Significant Wave Height 20% beam (4.26 ft)
			DRAG lb	DRAG lb
10.0	0.64	0.72	7,830	-
23.2	1.50	1.68	26,520	27,970
46.4	3.0	3.36	45,430	45,300
61.9	4.0	4.48	50,760	54,180

110 ft WPB

SPEED knots	C_v	$F_n \nabla$	Significant Wave Height 12.5% beam (3.13 ft)	Significant Wave Height 20% beam (5.0 ft)
			DRAG lb	DRAG lb
10.0	0.60	0.74	8,400	-
25.0	1.50	1.86	-	28,540
50.08	3.0	3.72	-	47,990
66.78	4.0	4.96	-	56,520

TABLE 4.1
ACCELERATION VARIANCE SPECTRAL DENSITY
110 ft WPB
3.13 ft Significant Wave Height
12.5% Beam
37.2 ft LCG

$C_v = 0.60$
Speed = 10 knots

Run 126

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	-0.5220E-03	-0.2209E-03	-0.4765E-04	-0.1085E-04	0.1956E-04
0.12	0.6637E-02	0.2874E-02	0.8375E-03	0.4018E-03	0.5526E-03
0.25	0.9344E-01	0.4050E-01	0.1088E-01	0.4107E-02	0.3652E-02
0.37	0.1859E+00	0.8092E-01	0.2158E-01	0.7693E-02	0.5675E-02
0.49	0.9216E-01	0.4024E-01	0.1071E-01	0.3691E-02	0.2440E-02
0.61	0.9313E-02	0.4084E-02	0.1102E-02	0.3652E-03	0.2043E-03
0.74	0.4169E-02	0.1928E-02	0.6082E-03	0.2220E-03	0.3081E-04
0.86	0.5039E-02	0.2327E-02	0.7378E-03	0.2773E-03	0.4859E-04
0.98	0.2554E-02	0.1148E-02	0.3545E-03	0.1391E-03	0.4474E-04
1.11	0.1166E-02	0.4863E-03	0.1238E-03	0.4843E-04	0.2696E-04
1.23	0.6458E-03	0.2771E-03	0.6415E-04	0.2489E-04	0.7210E-05
1.35	0.3115E-03	0.1466E-03	0.3543E-04	0.1524E-04	0.5883E-05
1.47	0.1687E-03	0.8427E-04	0.2392E-04	0.1139E-04	0.2225E-05
1.60	0.1135E-03	0.5721E-04	0.1738E-04	0.1162E-04	0.3872E-05
1.72	0.7998E-04	0.4270E-04	0.1569E-04	0.9601E-05	0.2857E-05
1.84	0.4270E-04	0.2704E-04	0.1811E-04	0.1270E-04	0.1737E-04
1.97	0.2869E-04	0.2098E-04	0.2028E-04	0.1427E-04	0.2700E-04
2.09	0.1279E-04	0.8232E-05	0.1127E-04	0.8135E-05	0.1468E-04
2.21	0.9633E-05	0.6825E-05	0.8019E-05	0.7946E-05	0.4913E-05
2.33	0.6785E-05	0.7664E-05	0.6495E-05	0.7759E-05	0.4601E-05
2.46	0.7374E-05	0.9010E-05	0.1197E-04	0.8851E-05	0.5586E-05
2.58	0.4342E-05	0.6120E-05	0.1133E-04	0.8881E-05	0.6432E-05
2.70	0.5190E-05	0.5884E-05	0.8410E-05	0.1085E-04	0.3688E-05
2.82	0.3760E-05	0.5236E-05	0.7158E-05	0.1221E-04	0.3475E-05
2.95	0.6371E-05	0.9308E-05	0.1037E-04	0.1263E-04	0.5445E-05
3.07	0.1090E-04	0.1428E-04	0.1921E-04	0.1821E-04	0.1236E-04
3.19	0.1007E-04	0.8780E-05	0.1317E-04	0.1597E-04	0.8113E-05
3.32	0.1096E-04	0.4612E-05	0.1183E-04	0.1612E-04	0.5169E-05
3.44	0.1630E-04	0.7203E-05	0.1874E-04	0.2585E-04	0.7208E-05
3.56	0.1868E-04	0.5432E-05	0.2237E-04	0.3154E-04	0.5815E-05
3.68	0.1605E-04	0.4341E-05	0.2286E-04	0.2489E-04	0.3630E-05

TABLE 4.2
ACCELERATION VARIANCE SPECTRAL DENSITY
110 ft WPB
5.00 ft Significant Wave Height
20% Beam
37.2 ft LCG

$C_v = 1.5$
Speed = 25.0 knots

Runs 121, 122, 123

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.4682E-01	0.2713E-01	0.1487E-01	0.1131E-01	0.9100E-02
0.25	0.2081E+00	0.1124E+00	0.5564E-01	0.4022E-01	0.3504E-01
0.49	0.3217E+00	0.1653E+00	0.7464E-01	0.5111E-01	0.4605E-01
0.74	0.1493E+00	0.7221E-01	0.2798E-01	0.1659E-01	0.1438E-01
0.98	0.4745E-01	0.2222E-01	0.7190E-02	0.2818E-02	0.9289E-03
1.23	0.2897E-01	0.1365E-01	0.4463E-02	0.1741E-02	0.4917E-03
1.47	0.1625E-01	0.7569E-02	0.2466E-02	0.9559E-03	0.2585E-03
1.72	0.9986E-02	0.4593E-02	0.1484E-02	0.5277E-03	0.6631E-04
1.97	0.6407E-02	0.2977E-02	0.1043E-02	0.4142E-03	0.1163E-03
2.21	0.3852E-02	0.1728E-02	0.5940E-03	0.2027E-03	0.5255E-05
2.46	0.2846E-02	0.1289E-02	0.4891E-03	0.2072E-03	0.5801E-04
2.70	0.1754E-02	0.7476E-03	0.2708E-03	0.9591E-04	-0.3892E-05
2.95	0.1422E-02	0.6386E-03	0.2712E-03	0.1381E-03	0.4214E-04
3.19	0.8817E-03	0.3552E-03	0.1434E-03	0.7126E-04	-0.2536E-05
3.44	0.8427E-03	0.3519E-03	0.1611E-03	0.1040E-03	0.2816E-04
3.68	0.5323E-03	0.1937E-03	0.7384E-04	0.3747E-04	-0.6675E-05
3.93	0.5212E-03	0.2097E-03	0.9302E-04	0.5202E-04	0.2053E-04
4.17	0.3197E-03	0.9998E-04	0.3770E-04	0.9094E-05	-0.6076E-05
4.42	0.3354E-03	0.1262E-03	0.6592E-04	0.3434E-04	0.1806E-04
4.67	0.1937E-03	0.5075E-04	0.2715E-04	0.5794E-05	-0.2495E-05
4.91	0.2201E-03	0.7665E-04	0.4555E-04	0.2572E-04	0.1474E-04
5.16	0.1133E-03	0.2053E-04	0.1316E-04	0.1854E-05	-0.3855E-05
5.40	0.1508E-03	0.5467E-04	0.3518E-04	0.2190E-04	0.1190E-04
5.65	0.7828E-04	0.1023E-04	0.9201E-05	0.2253E-05	-0.3494E-05
5.89	0.1280E-03	0.4118E-04	0.2784E-04	0.2064E-04	0.1033E-04
6.14	0.7231E-04	0.6892E-05	0.6036E-05	0.2768E-05	-0.2834E-05
6.38	0.1212E-03	0.3649E-04	0.2423E-04	0.1843E-04	0.9511E-05
6.63	0.6005E-04	0.2960E-05	0.5700E-05	0.3007E-05	-0.2286E-05
6.88	0.8590E-04	0.2606E-04	0.2071E-04	0.2117E-04	0.8528E-05
7.12	0.3107E-04	-0.2646E-05	0.3232E-05	0.2130E-04	-0.1438E-05
7.37	0.6140E-04	0.1976E-04	0.1785E-04	0.3484E-04	0.8116E-05

TABLE 4.3
ACCELERATION VARIANCE SPECTRAL DENSITY
110 ft WPB
5.00 ft Significant Wave Height
20% Beam
37.2 ft LCG

$C_V = 3.0$
Speed = 50.1 knots

Runs 118,119,120,124

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.1836E-01	0.1087E-01	0.5927E-02	0.4240E-02	0.3128E-02
0.25	0.2134E+00	0.1260E+00	0.6831E-01	0.4926E-01	0.3013E-01
0.49	0.5985E+00	0.3515E+00	0.1886E+00	0.1340E+00	0.8143E-01
0.74	0.6070E+00	0.3525E+00	0.1863E+00	0.1278E+00	0.8231E-01
0.98	0.3973E+00	0.2232E+00	0.1118E+00	0.7126E-01	0.4708E-01
1.23	0.2754E+00	0.1483E+00	0.6899E-01	0.4087E-01	0.2461E-01
1.47	0.1754E+00	0.9263E-01	0.4285E-01	0.2511E-01	0.1705E-01
1.72	0.1085E+00	0.5632E-01	0.2658E-01	0.1566E-01	0.1247E-01
1.97	0.8015E-01	0.4064E-01	0.1911E-01	0.1107E-01	0.8856E-02
2.21	0.5937E-01	0.2902E-01	0.1332E-01	0.7615E-02	0.6107E-02
2.46	0.4277E-01	0.2011E-01	0.9108E-02	0.5163E-02	0.4364E-02
2.70	0.3235E-01	0.1463E-01	0.6515E-02	0.3543E-02	0.2709E-02
2.95	0.2335E-01	0.1027E-01	0.4619E-02	0.2524E-02	0.1716E-02
3.19	0.1552E-01	0.6704E-02	0.3211E-02	0.1845E-02	0.1063E-02
3.44	0.1242E-01	0.5068E-02	0.2449E-02	0.1333E-02	0.6739E-03
3.68	0.1015E-01	0.4045E-02	0.2042E-02	0.1079E-02	0.4380E-03
3.93	0.7473E-02	0.2875E-02	0.1597E-02	0.8627E-03	0.3323E-03
4.17	0.5429E-02	0.2020E-02	0.1210E-02	0.6460E-03	0.2544E-03
4.42	0.4775E-02	0.1632E-02	0.1045E-02	0.5371E-03	0.2270E-03
4.67	0.4489E-02	0.1453E-02	0.9736E-03	0.5267E-03	0.1902E-03
4.91	0.3453E-02	0.1036E-02	0.7534E-03	0.4574E-03	0.1869E-03
5.16	0.2973E-02	0.8321E-03	0.6231E-03	0.4140E-03	0.1689E-03
5.40	0.2615E-02	0.6601E-03	0.5264E-03	0.3599E-03	0.1591E-03
5.65	0.2214E-02	0.5310E-03	0.4672E-03	0.3174E-03	0.1334E-03
5.89	0.1661E-02	0.3456E-03	0.3285E-03	0.2326E-03	0.1231E-03
6.14	0.1282E-02	0.2456E-03	0.2514E-03	0.1863E-03	0.9761E-04
6.38	0.1006E-02	0.1731E-03	0.2050E-03	0.1548E-03	0.8357E-04
6.63	0.8253E-03	0.1381E-03	0.1780E-03	0.1370E-03	0.6368E-04
6.88	0.6446E-03	0.8575E-04	0.1406E-03	0.1240E-03	0.6337E-04
7.12	0.5471E-03	0.7041E-04	0.1299E-03	0.1351E-03	0.5199E-04
7.37	0.4661E-03	0.4449E-04	0.1076E-03	0.1250E-03	0.5748E-04

TABLE 4.4
ACCELERATION VARIANCE SPECTRAL DENSITY
110 ft WPB
5.00 ft Significant Wave Height
20% Beam
37.2 ft LCG

$C_v = 4.0$
Speed = 66.8 knots

Runs 134,135,136,137,138

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.4302E-02	0.2842E-02	0.1810E-02	0.1324E-02	0.8051E-03
0.25	0.1541E+00	0.9164E-01	0.5095E-01	0.3669E-01	0.2423E-01
0.49	0.6040E+00	0.3577E+00	0.1968E+00	0.1393E+00	0.9049E-01
0.74	0.7718E+00	0.4613E+00	0.2589E+00	0.1808E+00	0.1231E+00
0.98	0.6111E+00	0.3681E+00	0.2132E+00	0.1487E+00	0.1134E+00
1.23	0.4538E+00	0.2622E+00	0.1474E+00	0.1027E+00	0.8617E-01
1.47	0.2912E+00	0.1583E+00	0.8553E-01	0.5979E-01	0.5490E-01
1.72	0.2380E+00	0.1261E+00	0.6736E-01	0.4584E-01	0.4161E-01
1.97	0.1989E+00	0.1038E+00	0.5652E-01	0.3850E-01	0.3634E-01
2.21	0.1411E+00	0.7072E-01	0.3827E-01	0.2607E-01	0.2578E-01
2.46	0.9798E-01	0.4673E-01	0.2386E-01	0.1550E-01	0.1445E-01
2.70	0.7667E-01	0.3482E-01	0.1721E-01	0.1124E-01	0.1065E-01
2.95	0.7129E-01	0.2991E-01	0.1366E-01	0.8643E-02	0.8756E-02
3.19	0.5517E-01	0.2186E-01	0.9408E-02	0.5745E-02	0.5787E-02
3.44	0.3709E-01	0.1386E-01	0.6083E-02	0.3852E-02	0.3905E-02
3.68	0.3201E-01	0.1162E-01	0.5146E-02	0.3040E-02	0.2674E-02
3.93	0.2341E-01	0.7979E-02	0.3571E-02	0.2148E-02	0.1839E-02
4.17	0.1844E-01	0.6002E-02	0.2845E-02	0.1845E-02	0.1542E-02
4.42	0.1434E-01	0.4451E-02	0.2339E-02	0.1513E-02	0.1273E-02
4.67	0.1236E-01	0.3713E-02	0.2132E-02	0.1388E-02	0.1019E-02
4.91	0.9913E-02	0.2825E-02	0.1897E-02	0.1351E-02	0.9539E-03
5.16	0.6825E-02	0.1863E-02	0.1314E-02	0.9877E-03	0.6823E-03
5.40	0.6234E-02	0.1406E-02	0.9752E-03	0.6697E-03	0.4853E-03
5.65	0.6760E-02	0.1534E-02	0.1170E-02	0.8454E-03	0.5710E-03
5.89	0.5326E-02	0.1054E-02	0.8750E-03	0.6790E-03	0.4773E-03
6.14	0.3806E-02	0.7383E-03	0.6539E-03	0.5052E-03	0.3647E-03
6.38	0.2730E-02	0.4242E-03	0.4882E-03	0.3981E-03	0.3134E-03
6.63	0.2653E-02	0.4346E-03	0.5069E-03	0.3921E-03	0.2708E-03
6.88	0.2242E-02	0.2866E-03	0.4588E-03	0.3617E-03	0.2393E-03
7.12	0.1567E-02	0.2319E-03	0.3642E-03	0.3265E-03	0.2027E-03
7.37	0.9477E-03	0.7157E-04	0.2509E-03	0.2606E-03	0.1785E-03

TABLE 4.5
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
2.62 ft Significant Wave Height
12.5% Beam
42.9 ft LCG

$C_v = 0.65$
Speed = 10 knots

Run 75

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	-0.2175E-03	-0.1419E-03	-0.4117E-04	-0.3074E-05	-0.6409E-05
0.12	0.1646E-02	0.1124E-02	0.4101E-03	0.1204E-03	0.3354E-03
0.25	0.2836E-01	0.1914E-01	0.6681E-02	0.1172E-02	0.3272E-02
0.37	0.5815E-01	0.3928E-01	0.1387E-01	0.2185E-02	0.5287E-02
0.49	0.2925E-01	0.1986E-01	0.7237E-02	0.1161E-02	0.2085E-02
0.61	0.3237E-02	0.2261E-02	0.9313E-03	0.2158E-03	0.1685E-03
0.74	0.1244E-02	0.8369E-03	0.3387E-03	0.8227E-04	0.8934E-04
0.86	0.1449E-02	0.9772E-03	0.3712E-03	0.7397E-04	0.7670E-04
0.98	0.8757E-03	0.6125E-03	0.2309E-03	0.4506E-04	0.4332E-04
1.11	0.3005E-03	0.2175E-03	0.8576E-04	0.1884E-04	0.2281E-04
1.23	0.9876E-04	0.7028E-04	0.3481E-04	0.7928E-05	0.5707E-05
1.35	0.6897E-04	0.4722E-04	0.2331E-04	0.9340E-05	0.1064E-04
1.47	0.5546E-04	0.3649E-04	0.1972E-04	0.9935E-05	0.5815E-05
1.60	0.3800E-04	0.2383E-04	0.1285E-04	0.1105E-04	0.9935E-05
1.72	0.3966E-04	0.2166E-04	0.1185E-04	0.1010E-04	0.9362E-05
1.84	0.6198E-04	0.3264E-04	0.1972E-04	0.3407E-04	0.3830E-04
1.97	0.6328E-04	0.3750E-04	0.2403E-04	0.4004E-04	0.4301E-04
2.09	0.3033E-04	0.1774E-04	0.1545E-04	0.1650E-04	0.2581E-04
2.21	0.2242E-04	0.1074E-04	0.1226E-04	0.9000E-05	0.1629E-04
2.33	0.1385E-04	0.8733E-05	0.9075E-05	0.6503E-05	0.1133E-04
2.46	0.1380E-04	0.1328E-04	0.1038E-04	0.7865E-05	0.1220E-04
2.58	0.1628E-04	0.1296E-04	0.9965E-05	0.1026E-04	0.1502E-04
2.70	0.1806E-04	0.1165E-04	0.1061E-04	0.9783E-05	0.1166E-04
2.82	0.1222E-04	0.8302E-05	0.1069E-04	0.4980E-05	0.1021E-04
2.95	0.2163E-04	0.1279E-04	0.1542E-04	0.1245E-04	0.1919E-04
3.07	0.4039E-04	0.1823E-04	0.2114E-04	0.2628E-04	0.4174E-04
3.19	0.2614E-04	0.1235E-04	0.1448E-04	0.1569E-04	0.2454E-04
3.32	0.1168E-04	0.5262E-05	0.9653E-05	0.5568E-05	0.1026E-04
3.44	0.1313E-04	0.5847E-05	0.1034E-04	0.6563E-05	0.9917E-05
3.56	0.9351E-05	0.4502E-05	0.7588E-05	0.5143E-05	0.7633E-05
3.68	0.9216E-05	0.4762E-05	0.6884E-05	0.5940E-05	0.7844E-05

TABLE 4.6
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
2.62 ft Significant Wave Height
12.5 % Beam
42.9 ft LCG

$C_v = 1.5$
Speed = 23.2 knots

Runs 40, 42

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.1640E-02	0.1237E-02	0.6636E-03	0.3667E-03	0.3433E-03
0.25	0.1334E-01	0.9686E-02	0.4760E-02	0.2447E-02	0.3063E-02
0.49	0.2581E-01	0.1831E-01	0.8447E-02	0.4041E-02	0.5919E-02
0.74	0.1347E-01	0.9344E-02	0.4065E-02	0.1642E-02	0.2655E-02
0.98	0.4714E-02	0.3226E-02	0.1412E-02	0.3774E-03	0.3149E-03
1.23	0.2926E-02	0.2000E-02	0.8468E-03	0.2182E-03	0.1513E-03
1.47	0.1296E-02	0.8997E-03	0.3736E-03	0.1005E-03	0.7429E-04
1.72	0.6388E-03	0.4302E-03	0.1820E-03	0.5452E-04	0.5139E-04
1.97	0.3866E-03	0.2530E-03	0.1095E-03	0.4079E-04	0.4711E-04
2.21	0.2033E-03	0.1324E-03	0.5465E-04	0.1979E-04	0.2630E-04
2.46	0.1213E-03	0.8574E-04	0.4507E-04	0.2586E-04	0.2413E-04
2.70	0.6779E-04	0.4781E-04	0.2521E-04	0.1910E-04	0.1937E-04
2.95	0.6270E-04	0.4129E-04	0.2972E-04	0.2698E-04	0.3424E-04
3.19	0.5110E-04	0.2911E-04	0.2351E-04	0.1844E-04	0.3018E-04
3.44	0.3616E-04	0.2392E-04	0.1884E-04	0.1152E-04	0.1116E-04
3.68	0.2324E-04	0.1492E-04	0.9970E-05	0.6670E-05	0.5561E-05
3.93	0.2045E-04	0.1362E-04	0.8763E-05	0.8375E-05	0.5272E-05
4.17	0.1550E-04	0.8687E-05	0.5588E-05	0.5174E-05	0.4964E-05
4.42	0.1958E-04	0.1098E-04	0.9580E-05	0.9018E-05	0.9563E-05
4.67	0.2238E-04	0.9418E-05	0.8953E-05	0.8599E-05	0.1584E-04
4.91	0.1547E-04	0.8401E-05	0.8281E-05	0.8261E-05	0.8962E-05
5.16	0.6831E-05	0.3388E-05	0.3887E-05	0.4543E-05	0.3970E-05
5.40	0.6654E-05	0.4387E-05	0.4651E-05	0.8718E-05	0.4343E-05
5.65	0.4480E-05	0.2480E-05	0.3425E-05	0.7417E-05	0.4321E-05
5.89	0.4997E-05	0.3956E-05	0.4979E-05	0.9015E-05	0.4624E-05
6.14	0.3566E-05	0.2041E-05	0.2976E-05	0.6315E-05	0.4137E-05
6.38	0.4916E-05	0.3491E-05	0.4030E-05	0.2643E-04	0.4097E-05
6.63	0.4641E-05	0.2561E-05	0.3904E-05	0.6162E-04	0.4457E-05
6.88	0.5501E-05	0.4090E-05	0.5524E-05	0.5413E-04	0.4429E-05
7.12	0.8015E-05	0.4105E-05	0.7811E-05	0.1498E-03	0.5479E-05
7.37	0.1678E-04	0.7505E-05	0.1540E-04	0.4224E-03	0.8331E-05

TABLE 4.7
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
2.62 ft Significant Wave Height
12.5 % Beam
42.9 ft LCG

$C_v = 3.0$
Speed = 46.4 knots

Runs 44, 45, 46

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	-0.4111E-04	-0.3614E-04	0.9730E-05	0.6518E-04	0.2061E-04
0.25	0.3237E-02	0.2396E-02	0.1336E-02	0.7033E-03	0.5247E-03
0.49	0.3055E-01	0.2211E-01	0.1133E-01	0.4923E-02	0.3451E-02
0.74	0.8490E-01	0.6088E-01	0.2986E-01	0.1145E-01	0.7101E-02
0.98	0.9673E-01	0.6897E-01	0.3304E-01	0.1207E-01	0.5968E-02
1.23	0.6152E-01	0.4354E-01	0.2081E-01	0.7745E-02	0.2995E-02
1.47	0.3687E-01	0.2572E-01	0.1241E-01	0.4564E-02	0.1768E-02
1.72	0.2415E-01	0.1684E-01	0.8085E-02	0.2853E-02	0.1142E-02
1.97	0.1479E-01	0.1043E-01	0.4987E-02	0.1746E-02	0.6443E-03
2.21	0.8834E-02	0.6066E-02	0.2920E-02	0.9945E-03	0.3725E-03
2.46	0.4709E-02	0.3164E-02	0.1554E-02	0.5018E-03	0.2306E-03
2.70	0.2520E-02	0.1652E-02	0.8382E-03	0.2817E-03	0.1561E-03
2.95	0.1480E-02	0.9304E-03	0.5037E-03	0.1854E-03	0.1235E-03
3.19	0.7877E-03	0.4824E-03	0.2782E-03	0.1153E-03	0.8117E-04
3.44	0.3884E-03	0.2286E-03	0.1394E-03	0.5289E-04	0.3784E-04
3.68	0.2834E-03	0.1658E-03	0.1019E-03	0.3741E-04	0.2114E-04
3.93	0.2370E-03	0.1335E-03	0.8818E-04	0.3501E-04	0.1482E-04
4.17	0.2766E-03	0.1478E-03	0.9859E-04	0.4272E-04	0.1301E-04
4.42	0.2587E-03	0.1321E-03	0.9023E-04	0.3929E-04	0.1063E-04
4.67	0.2108E-03	0.9839E-04	0.7421E-04	0.4230E-04	0.9755E-05
4.91	0.1526E-03	0.6784E-04	0.6103E-04	0.3970E-04	0.8018E-05
5.16	0.1340E-03	0.6436E-04	0.5656E-04	0.3978E-04	0.9278E-05
5.40	0.9646E-04	0.4374E-04	0.4024E-04	0.3603E-04	0.1081E-04
5.65	0.8572E-04	0.3423E-04	0.3315E-04	0.3791E-04	0.1218E-04
5.89	0.5885E-04	0.1948E-04	0.2168E-04	0.3383E-04	0.1020E-04
6.14	0.4633E-04	0.1428E-04	0.1567E-04	0.3229E-04	0.8142E-05
6.38	0.3493E-04	0.9350E-05	0.1149E-04	0.6050E-04	0.7569E-05
6.63	0.3856E-04	0.1096E-04	0.1205E-04	0.1081E-03	0.6185E-05
6.88	0.3357E-04	0.9560E-05	0.1037E-04	0.1250E-03	0.4907E-05
7.12	0.4209E-04	0.1299E-04	0.1848E-04	0.2786E-03	0.7431E-05
7.37	0.5490E-04	0.1375E-04	0.3419E-04	0.5953E-03	0.9533E-05

TABLE 4.8
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
2.62 ft Significant Wave Height
12.5% Beam
42.9 ft LCG

$C_V = 4.0$
Speed = 61.9 knots

Runs 48, 49, 63, 64

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.9233E-03	0.7047E-03	0.3909E-03	0.1961E-03	0.4409E-04
0.25	0.4198E-02	0.3155E-02	0.1788E-02	0.8614E-03	0.4309E-03
0.49	0.2673E-01	0.1998E-01	0.1104E-01	0.5204E-02	0.2582E-02
0.74	0.9068E-01	0.6741E-01	0.3670E-01	0.1649E-01	0.7565E-02
0.98	0.1643E+00	0.1209E+00	0.6469E-01	0.2997E-01	0.1239E-01
1.23	0.1636E+00	0.1194E+00	0.6324E-01	0.3022E-01	0.1193E-01
1.47	0.1034E+00	0.7502E-01	0.3972E-01	0.1876E-01	0.7668E-02
1.72	0.6379E-01	0.4582E-01	0.2432E-01	0.1123E-01	0.4595E-02
1.97	0.4686E-01	0.3336E-01	0.1772E-01	0.8148E-02	0.3281E-02
2.21	0.3211E-01	0.2255E-01	0.1191E-01	0.5471E-02	0.2401E-02
2.46	0.2132E-01	0.1476E-01	0.7680E-02	0.3392E-02	0.1726E-02
2.70	0.1202E-01	0.8162E-02	0.4258E-02	0.1914E-02	0.1182E-02
2.95	0.6677E-02	0.4142E-02	0.2304E-02	0.1138E-02	0.9571E-03
3.19	0.5044E-02	0.2810E-02	0.1664E-02	0.8820E-03	0.8365E-03
3.44	0.2831E-02	0.1510E-02	0.9013E-03	0.4878E-03	0.4591E-03
3.68	0.1374E-02	0.7532E-03	0.4463E-03	0.2530E-03	0.2252E-03
3.93	0.9752E-03	0.5425E-03	0.3199E-03	0.1723E-03	0.1569E-03
4.17	0.7990E-03	0.4489E-03	0.2755E-03	0.1570E-03	0.1247E-03
4.42	0.8139E-03	0.4324E-03	0.2885E-03	0.1599E-03	0.7498E-04
4.67	0.8869E-03	0.4358E-03	0.3075E-03	0.2047E-03	0.4924E-04
4.91	0.7969E-03	0.3672E-03	0.2826E-03	0.2222E-03	0.3782E-04
5.16	0.6923E-03	0.3132E-03	0.2551E-03	0.2247E-03	0.4092E-04
5.40	0.6087E-03	0.2421E-03	0.2132E-03	0.1973E-03	0.4166E-04
5.65	0.5629E-03	0.2021E-03	0.1894E-03	0.2081E-03	0.4759E-04
5.89	0.5447E-03	0.1785E-03	0.1668E-03	0.2132E-03	0.4446E-04
6.14	0.5022E-03	0.1567E-03	0.1370E-03	0.2272E-03	0.4659E-04
6.38	0.4263E-03	0.1231E-03	0.1074E-03	0.2272E-03	0.3840E-04
6.63	0.3457E-03	0.9346E-04	0.7301E-04	0.2290E-03	0.3135E-04
6.88	0.3573E-03	0.8460E-04	0.5557E-04	0.2321E-03	0.3015E-04
7.12	0.3634E-03	0.8429E-04	0.5423E-04	0.2610E-03	0.4252E-04
7.37	0.3634E-03	0.7878E-04	0.5134E-04	0.3140E-03	0.6235E-04

TABLE 4.9
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
4.26 ft Significant Wave Height
20% Beam
42.9 ft LCG

$C_V = 1.5$
Speed = 23.2 knots

Runs 65, 66

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.2702E-01	0.2048E-01	0.1172E-01	0.6932E-02	0.6372E-02
0.25	0.1028E+00	0.7602E-01	0.4092E-01	0.2316E-01	0.2506E-01
0.49	0.1364E+00	0.9858E-01	0.4995E-01	0.2652E-01	0.3243E-01
0.74	0.5328E-01	0.3731E-01	0.1706E-01	0.7337E-02	0.9586E-02
0.98	0.1959E-01	0.1349E-01	0.5729E-02	0.1491E-02	0.5402E-03
1.23	0.1254E-01	0.8644E-02	0.3711E-02	0.9760E-03	0.3691E-03
1.47	0.6522E-02	0.4505E-02	0.2006E-02	0.5431E-03	0.1927E-03
1.72	0.3745E-02	0.2543E-02	0.1125E-02	0.2781E-03	0.7565E-04
1.97	0.2620E-02	0.1788E-02	0.8157E-03	0.2502E-03	0.1339E-03
2.21	0.1494E-02	0.9752E-03	0.4368E-03	0.1044E-03	0.3977E-04
2.46	0.1135E-02	0.7335E-03	0.3478E-03	0.1112E-03	0.6627E-04
2.70	0.5467E-03	0.3348E-03	0.1472E-03	0.3500E-04	0.1008E-04
2.95	0.5093E-03	0.3533E-03	0.1763E-03	0.6864E-04	0.5350E-04
3.19	0.2123E-03	0.1443E-03	0.6750E-04	0.1970E-04	0.1776E-04
3.44	0.2576E-03	0.1677E-03	0.8914E-04	0.4150E-04	0.3010E-04
3.68	0.9977E-04	0.4754E-04	0.2383E-04	0.7259E-05	-0.1672E-06
3.93	0.1659E-03	0.1044E-03	0.5636E-04	0.2765E-04	0.2219E-04
4.17	0.6513E-04	0.2589E-04	0.1370E-04	0.3798E-05	0.6071E-05
4.42	0.1242E-03	0.7286E-04	0.4582E-04	0.2558E-04	0.2345E-04
4.67	0.3160E-04	0.8448E-05	0.1174E-04	0.4839E-05	0.2457E-05
4.91	0.8086E-04	0.4923E-04	0.3451E-04	0.2095E-04	0.1597E-04
5.16	0.7380E-05	-0.3375E-05	0.3011E-05	0.4704E-05	0.1917E-05
5.40	0.5297E-04	0.3392E-04	0.2488E-04	0.2509E-04	0.1337E-04
5.65	-0.7765E-05	-0.1007E-04	-0.6170E-06	0.1419E-04	0.1262E-05
5.89	0.3679E-04	0.2489E-04	0.1822E-04	0.2138E-04	0.1150E-04
6.14	-0.1086E-04	-0.9742E-05	-0.2829E-05	0.8721E-05	0.7830E-06
6.38	0.3164E-04	0.2287E-04	0.1499E-04	0.4015E-04	0.1001E-04
6.63	-0.8340E-05	-0.7373E-05	-0.3353E-05	0.7387E-04	0.1556E-05
6.88	0.2843E-04	0.1914E-04	0.1209E-04	0.7350E-04	0.1031E-04
7.12	-0.3079E-05	-0.7726E-05	-0.9046E-06	0.1391E-03	0.4427E-05
7.37	0.4107E-04	0.1972E-04	0.2028E-04	0.3748E-03	0.1609E-04

TABLE 4.10
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
4.26 ft Significant Wave Height
20% Beam
42.9 ft LCG

$C_V = 3.0$
Speed = 46.4 knots

Runs 67, 68, 69

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.4820E-02	0.3766E-02	0.2457E-02	0.1414E-02	0.8686E-03
0.25	0.6734E-01	0.5132E-01	0.3019E-01	0.1749E-01	0.1438E-01
0.49	0.2411E+00	0.1803E+00	0.9985E-01	0.5250E-01	0.4260E-01
0.74	0.2968E+00	0.2175E+00	0.1133E+00	0.5126E-01	0.3865E-01
0.98	0.1848E+00	0.1329E+00	0.6594E-01	0.2581E-01	0.1541E-01
1.23	0.9935E-01	0.7053E-01	0.3438E-01	0.1286E-01	0.5095E-02
1.47	0.6946E-01	0.4873E-01	0.2338E-01	0.8328E-02	0.2933E-02
1.72	0.5078E-01	0.3514E-01	0.1678E-01	0.5773E-02	0.2035E-02
1.97	0.3702E-01	0.2522E-01	0.1212E-01	0.4019E-02	0.1494E-02
2.21	0.2494E-01	0.1685E-01	0.8156E-02	0.2595E-02	0.1010E-02
2.46	0.1604E-01	0.1067E-01	0.5181E-02	0.1603E-02	0.5846E-03
2.70	0.1168E-01	0.7539E-02	0.3755E-02	0.1217E-02	0.4890E-03
2.95	0.7560E-02	0.4636E-02	0.2414E-02	0.7824E-03	0.3131E-03
3.19	0.5148E-02	0.3091E-02	0.1720E-02	0.5646E-03	0.1806E-03
3.44	0.3780E-02	0.2292E-02	0.1320E-02	0.4561E-03	0.9399E-04
3.68	0.2350E-02	0.1382E-02	0.8515E-03	0.3221E-03	0.6569E-04
3.93	0.2011E-02	0.1159E-02	0.7620E-03	0.2942E-03	0.3638E-04
4.17	0.1530E-02	0.8969E-03	0.6089E-03	0.2718E-03	0.4277E-04
4.42	0.1058E-02	0.6027E-03	0.4299E-03	0.2196E-03	0.3787E-04
4.67	0.9149E-03	0.4793E-03	0.3716E-03	0.2104E-03	0.3500E-04
4.91	0.7252E-03	0.3497E-03	0.2870E-03	0.1797E-03	0.2196E-04
5.16	0.5359E-03	0.2342E-03	0.2144E-03	0.1494E-03	0.3042E-04
5.40	0.4346E-03	0.1758E-03	0.1809E-03	0.1316E-03	0.2628E-04
5.65	0.3124E-03	0.1194E-03	0.1323E-03	0.1073E-03	0.2812E-04
5.89	0.2062E-03	0.7048E-04	0.8710E-04	0.8627E-04	0.1825E-04
6.14	0.1508E-03	0.4889E-04	0.7134E-04	0.9509E-04	0.1792E-04
6.38	0.1091E-03	0.3184E-04	0.4524E-04	0.1237E-03	0.1083E-04
6.63	0.7035E-04	0.1806E-04	0.3278E-04	0.1672E-03	0.1372E-04
6.88	0.6524E-04	0.1470E-04	0.2397E-04	0.2240E-03	0.1200E-04
7.12	0.7385E-04	0.1539E-04	0.3451E-04	0.5619E-03	0.2027E-04
7.37	0.1154E-03	0.2182E-04	0.7321E-04	0.1315E-02	0.2887E-04

TABLE 4.11
ACCELERATION VARIANCE SPECTRAL DENSITY
120 ft WPB
4.26 ft Significant Wave Height
20% Beam
42.9 ft LCG

$C_v = 4.0$
Speed = 61.9 knots

Runs 71, 72, 73, 74

Accelerometer	#5	#4	#3	#2	#1
Frequency Hz	Spectral Estimates g^2/Hz				
0.00	0.7953E-03	0.6020E-03	0.3204E-03	0.1757E-03	0.3567E-04
0.25	0.3560E-01	0.2793E-01	0.1724E-01	0.1020E-01	0.6321E-02
0.49	0.2147E+00	0.1656E+00	0.9905E-01	0.5477E-01	0.3412E-01
0.74	0.4070E+00	0.3098E+00	0.1799E+00	0.9309E-01	0.5616E-01
0.98	0.3972E+00	0.2982E+00	0.1692E+00	0.8904E-01	0.4885E-01
1.23	0.2508E+00	0.1859E+00	0.1042E+00	0.5680E-01	0.2986E-01
1.47	0.1587E+00	0.1158E+00	0.6321E-01	0.3225E-01	0.1718E-01
1.72	0.1310E+00	0.9420E-01	0.5036E-01	0.2420E-01	0.1212E-01
1.97	0.8997E-01	0.6384E-01	0.3430E-01	0.1680E-01	0.9106E-02
2.21	0.5996E-01	0.4195E-01	0.2286E-01	0.1161E-01	0.6930E-02
2.46	0.5310E-01	0.3641E-01	0.1994E-01	0.9480E-02	0.5292E-02
2.70	0.3943E-01	0.2604E-01	0.1407E-01	0.6473E-02	0.4176E-02
2.95	0.2462E-01	0.1518E-01	0.8305E-02	0.4193E-02	0.2888E-02
3.19	0.1931E-01	0.1150E-01	0.6477E-02	0.3489E-02	0.2156E-02
3.44	0.1398E-01	0.8190E-02	0.4838E-02	0.2588E-02	0.1388E-02
3.68	0.1115E-01	0.6371E-02	0.3863E-02	0.1992E-02	0.1075E-02
3.93	0.8312E-02	0.4597E-02	0.2829E-02	0.1329E-02	0.7551E-03
4.17	0.6418E-02	0.3425E-02	0.2144E-02	0.1049E-02	0.5848E-03
4.42	0.4742E-02	0.2314E-02	0.1537E-02	0.8325E-03	0.3794E-03
4.67	0.4474E-02	0.2171E-02	0.1509E-02	0.9303E-03	0.3032E-03
4.91	0.3751E-02	0.1704E-02	0.1275E-02	0.7592E-03	0.2079E-03
5.16	0.2781E-02	0.1206E-02	0.9446E-03	0.5224E-03	0.1921E-03
5.40	0.2128E-02	0.8110E-03	0.7212E-03	0.4667E-03	0.1433E-03
5.65	0.2184E-02	0.8551E-03	0.7584E-03	0.6275E-03	0.1400E-03
5.89	0.1448E-02	0.5103E-03	0.4962E-03	0.5529E-03	0.1138E-03
6.14	0.1366E-02	0.4708E-03	0.4576E-03	0.5701E-03	0.1215E-03
6.38	0.9572E-03	0.2516E-03	0.3156E-03	0.5423E-03	0.9778E-04
6.63	0.8470E-03	0.2553E-03	0.2769E-03	0.6453E-03	0.1201E-03
6.88	0.5700E-03	0.1288E-03	0.1644E-03	0.6497E-03	0.1057E-03
7.12	0.5975E-03	0.1672E-03	0.1809E-03	0.7146E-03	0.1280E-03
7.37	0.4528E-03	0.7679E-04	0.1259E-03	0.7942E-03	0.1134E-03

R-2587

TABLE 5.1
1/3 OCTAVE RMS ACCELERATIONS
110 ft WPB
3.13 ft Significant Wave Height
12.5% Beam
37.2 ft LCG

$C_v = 0.60$
Speed = 10 knots

Run 126

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.121	0.080	0.043	0.030	0.035
0.125	0.136	0.089	0.048	0.033	0.039
0.157	0.153	0.100	0.054	0.038	0.044
0.198	0.593	0.390	0.202	0.125	0.118
0.250	0.722	0.475	0.246	0.151	0.143
0.315	1.035	0.682	0.353	0.212	0.186
0.397	1.225	0.809	0.418	0.249	0.213
0.500	0.978	0.646	0.333	0.196	0.159
0.630	0.339	0.225	0.118	0.068	0.048
0.794	0.286	0.194	0.109	0.066	0.027
1.000	0.231	0.155	0.085	0.053	0.030
1.260	0.128	0.084	0.041	0.026	0.016
1.587	0.065	0.046	0.026	0.020	0.010
2.000	0.033	0.027	0.026	0.022	0.027
2.520	0.018	0.020	0.023	0.023	0.017
3.175	0.028	0.024	0.032	0.036	0.023
4.000	0.035	0.018	0.046	0.044	0.019
5.040	0.030	0.023	0.033	0.046	0.024
6.350	0.037	0.024	0.028	0.055	0.035
8.000	0.009	0.008	0.012	0.022	0.011
10.079	0.000	0.000	0.000	0.000	0.000
12.699	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000	0.000

TABLE 5.2
 1/3 OCTAVE RMS ACCELERATIONS
 110 ft WPB
 5.00 ft Significant Wave Height
 20% Beam
 37.2 ft LCG

$C_V = 1.5$
 Speed = 25.0 knots

Runs 121,122,123

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.322	0.245	0.181	0.158	0.142
0.125	0.635	0.469	0.332	0.283	0.263
0.157	0.855	0.628	0.442	0.376	0.351
0.198	0.959	0.705	0.496	0.422	0.394
0.250	1.077	0.791	0.557	0.473	0.442
0.315	1.209	0.888	0.625	0.531	0.496
0.397	1.638	1.178	0.796	0.661	0.626
0.500	1.893	1.357	0.912	0.755	0.716
0.630	1.723	1.218	0.793	0.638	0.602
0.794	1.527	1.061	0.657	0.502	0.462
1.000	1.013	0.693	0.394	0.247	0.141
1.260	0.857	0.588	0.336	0.210	0.111
1.587	0.680	0.463	0.264	0.162	0.076
2.000	0.517	0.351	0.205	0.126	0.057
2.520	0.377	0.251	0.152	0.095	0.037
3.175	0.272	0.178	0.116	0.086	0.040
4.000	0.196	0.119	0.078	0.054	0.023
5.040	0.137	0.075	0.058	0.039	0.023
6.350	0.111	0.053	0.046	0.043	0.022
8.000	0.082	0.038	0.045	0.109	0.045
10.079	0.061	0.032	0.058	0.059	0.029
12.699	0.051	0.034	0.034	0.033	0.026
16.000	0.021	0.017	0.013	0.013	0.013

TABLE 5.3
 1/3 OCTAVE RMS ACCELERATIONS
 110 ft WPB
 5.00 ft Significant Wave Height
 20% Beam
 37.2 ft LCG

$C_v = 3.0$
 Speed = 50.1 knots

Runs 118,119,120,124

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.201	0.155	0.114	0.097	0.083
0.125	0.617	0.474	0.349	0.296	0.233
0.157	0.865	0.665	0.490	0.416	0.325
0.198	0.971	0.746	0.550	0.467	0.365
0.250	1.090	0.838	0.617	0.524	0.410
0.315	1.224	0.941	0.692	0.588	0.460
0.397	2.179	1.670	1.224	1.032	0.805
0.500	2.582	1.979	1.450	1.222	0.953
0.630	2.912	2.223	1.621	1.351	1.073
0.794	3.178	2.417	1.752	1.445	1.161
1.000	2.941	2.201	1.555	1.240	1.006
1.260	2.668	1.955	1.333	1.025	0.803
1.587	2.238	1.621	1.107	0.848	0.722
2.000	1.849	1.313	0.898	0.684	0.611
2.520	1.512	1.035	0.695	0.521	0.468
3.175	1.097	0.719	0.491	0.366	0.284
4.000	0.794	0.490	0.365	0.266	0.168
5.040	0.610	0.330	0.281	0.220	0.140
6.350	0.399	0.173	0.181	0.158	0.111
8.000	0.239	0.070	0.119	0.147	0.103
10.079	0.145	0.024	0.097	0.099	0.042
12.699	0.066	0.000	0.046	0.049	0.022
16.000	0.000	0.000	0.006	0.010	0.000

TABLE 5.4
 1/3 OCTAVE RMS ACCELERATIONS
 110 ft WPB
 5.00 ft Significant Wave Height
 20% Beam
 37.2 ft LCG

$C_v = 4.0$
 Speed = 66.8 knots

Runs 134,135,136,137,138

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.098	0.079	0.063	0.054	0.042
0.125	0.515	0.397	0.297	0.252	0.204
0.157	0.735	0.567	0.423	0.359	0.292
0.198	0.826	0.637	0.475	0.403	0.327
0.250	0.927	0.715	0.533	0.452	0.367
0.315	1.040	0.802	0.598	0.507	0.412
0.397	2.169	1.669	1.238	1.042	0.840
0.500	2.594	1.996	1.481	1.246	1.004
0.630	3.160	2.440	1.822	1.526	1.250
0.794	3.628	2.806	2.107	1.761	1.466
1.000	3.654	2.833	2.154	1.799	1.575
1.260	3.427	2.593	1.939	1.619	1.492
1.587	3.058	2.241	1.643	1.366	1.306
2.000	2.865	2.062	1.518	1.253	1.220
2.520	2.313	1.593	1.140	0.925	0.903
3.175	1.960	1.241	0.827	0.654	0.658
4.000	1.415	0.827	0.561	0.440	0.407
5.040	0.997	0.523	0.420	0.350	0.297
6.350	0.699	0.298	0.296	0.262	0.219
8.000	0.387	0.110	0.189	0.185	0.155
10.079	0.339	0.070	0.229	0.230	0.097
12.699	0.098	0.000	0.059	0.064	0.011
16.000	0.000	0.000	0.000	0.000	0.000

TABLE 5.5
 1/3 OCTAVE RMS ACCELERATIONS
 120 ft WPB
 2.62 ft Significant Wave Height
 12.5% Beam
 42.9 ft LCG

$C_v = 0.65$
 Speed = 10 knots

Run 75

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.060	0.050	0.030	0.016	0.027
0.125	0.068	0.056	0.034	0.018	0.031
0.157	0.076	0.063	0.038	0.021	0.034
0.198	0.326	0.268	0.158	0.067	0.111
0.250	0.398	0.327	0.193	0.081	0.135
0.315	0.577	0.474	0.281	0.113	0.179
0.397	0.686	0.564	0.336	0.133	0.205
0.500	0.551	0.454	0.274	0.110	0.147
0.630	0.198	0.165	0.106	0.051	0.046
0.794	0.154	0.127	0.079	0.037	0.038
1.000	0.130	0.108	0.067	0.030	0.030
1.260	0.057	0.048	0.032	0.017	0.017
1.587	0.040	0.031	0.023	0.019	0.017
2.000	0.045	0.034	0.028	0.034	0.038
2.520	0.029	0.025	0.024	0.021	0.026
3.175	0.038	0.027	0.031	0.029	0.037
4.000	0.029	0.022	0.027	0.026	0.030
5.040	0.032	0.025	0.032	0.038	0.032
6.350	0.066	0.035	0.060	0.159	0.037
8.000	0.016	0.012	0.017	0.058	0.015
10.079	0.000	0.000	0.000	0.000	0.000
12.699	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000	0.000

R-2587

TABLE 5.6
1/3 OCTAVE RMS ACCELERATIONS
120 ft WPB
2.62 ft Significant Wave Height
12.5% Beam
42.9 ft LCG

$C_v = 1.5$
Speed = 23.2 knots

Runs 40, 42

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.060	0.052	0.038	0.028	0.028
0.125	0.156	0.133	0.094	0.067	0.074
0.157	0.216	0.184	0.129	0.093	0.104
0.198	0.243	0.207	0.145	0.104	0.116
0.250	0.273	0.232	0.163	0.117	0.131
0.315	0.306	0.261	0.183	0.131	0.147
0.397	0.459	0.387	0.264	0.183	0.220
0.500	0.536	0.452	0.307	0.212	0.257
0.630	0.501	0.420	0.281	0.188	0.232
0.794	0.460	0.383	0.253	0.159	0.200
1.000	0.319	0.264	0.175	0.090	0.082
1.260	0.269	0.222	0.144	0.074	0.061
1.587	0.185	0.153	0.099	0.052	0.047
2.000	0.126	0.102	0.067	0.040	0.043
2.520	0.079	0.066	0.046	0.035	0.036
3.175	0.059	0.047	0.041	0.037	0.042
4.000	0.042	0.033	0.027	0.025	0.023
5.040	0.037	0.026	0.026	0.029	0.030
6.350	0.027	0.021	0.025	0.075	0.025
8.000	0.065	0.033	0.057	0.186	0.037
10.079	0.036	0.026	0.038	0.047	0.032
12.699	0.029	0.027	0.033	0.029	0.035
16.000	0.013	0.013	0.015	0.013	0.015

R-2587

TABLE 5.7
1/3 OCTAVE RMS ACCELERATIONS
120 ft WPB
2.62 ft Significant Wave Height
12.5% Beam
42.9 ft LCG

$C_v = 3.0$
Speed = 46.4 knots

Runs 44, 45, 46

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.000	0.000	0.005	0.012	0.007
0.125	0.074	0.063	0.048	0.035	0.030
0.157	0.107	0.092	0.068	0.050	0.043
0.198	0.120	0.103	0.077	0.056	0.048
0.250	0.134	0.116	0.086	0.063	0.054
0.315	0.151	0.130	0.097	0.070	0.061
0.397	0.481	0.409	0.293	0.194	0.162
0.500	0.583	0.496	0.355	0.234	0.196
0.630	0.957	0.811	0.570	0.357	0.285
0.794	1.240	1.049	0.733	0.452	0.350
1.000	1.448	1.222	0.846	0.512	0.358
1.260	1.255	1.055	0.730	0.445	0.277
1.587	1.038	0.867	0.601	0.362	0.227
2.000	0.789	0.660	0.457	0.270	0.166
2.520	0.496	0.407	0.285	0.164	0.111
3.175	0.249	0.196	0.147	0.091	0.075
4.000	0.153	0.114	0.092	0.059	0.037
5.040	0.128	0.087	0.080	0.066	0.033
6.350	0.080	0.045	0.048	0.111	0.033
8.000	0.140	0.061	0.103	0.256	0.043
10.079	0.080	0.040	0.060	0.066	0.037
12.699	0.042	0.031	0.035	0.033	0.034
16.000	0.015	0.011	0.012	0.011	0.014

R-2587

TABLE 5.8
1/3 OCTAVE RMS ACCELERATIONS
120 ft WPB
2.62 ft Significant Wave Height
12.5% Beam
42.9 ft LCG

$C_V = 4.0$
Speed = 61.9 knots

Runs 48, 49, 63, 64

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.093	0.045	0.039	0.029	0.021	0.010
0.125	0.090	0.078	0.059	0.041	0.028
0.157	0.121	0.105	0.079	0.055	0.039
0.198	0.136	0.118	0.089	0.062	0.044
0.250	0.153	0.133	0.100	0.069	0.049
0.315	0.172	0.149	0.112	0.078	0.055
0.397	0.452	0.391	0.291	0.200	0.141
0.500	0.546	0.472	0.351	0.241	0.170
0.630	0.974	0.840	0.621	0.418	0.285
0.794	1.352	1.164	0.857	0.577	0.385
1.000	1.913	1.641	1.200	0.817	0.525
1.260	2.055	1.755	1.277	0.882	0.556
1.587	1.717	1.460	1.063	0.727	0.465
2.000	1.401	1.181	0.860	0.583	0.375
2.520	1.030	0.856	0.619	0.415	0.299
3.175	0.584	0.445	0.338	0.243	0.230
4.000	0.298	0.221	0.173	0.129	0.115
5.040	0.286	0.192	0.170	0.153	0.071
6.350	0.249	0.135	0.124	0.179	0.075
8.000	0.330	0.140	0.174	0.285	0.098
10.079	0.230	0.097	0.164	0.157	0.080
12.699	0.022	0.000	0.024	0.031	0.040
16.000	0.000	0.000	0.006	0.010	0.019

TABLE 5.9
 1/3 OCTAVE RMS ACCELERATIONS
 120 ft WPB
 4.26 ft Significant Wave Height
 20% Beam
 42.9 ft LCG

$C_V = 1.5$
 Speed = 23.2 knots

Runs 65, 66

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.244	0.213	0.161	0.124	0.119
0.125	0.451	0.388	0.286	0.216	0.222
0.157	0.601	0.517	0.379	0.285	0.297
0.198	0.674	0.580	0.425	0.320	0.333
0.250	0.757	0.651	0.477	0.359	0.374
0.315	0.850	0.730	0.536	0.403	0.419
0.397	1.076	0.916	0.655	0.479	0.526
0.500	1.233	1.048	0.746	0.544	0.601
0.630	1.081	0.913	0.637	0.447	0.500
0.794	0.917	0.767	0.517	0.335	0.377
1.000	0.652	0.541	0.353	0.180	0.108
1.260	0.561	0.466	0.306	0.157	0.096
1.587	0.425	0.353	0.235	0.120	0.069
2.000	0.326	0.268	0.180	0.095	0.065
2.520	0.229	0.183	0.124	0.066	0.047
3.175	0.151	0.125	0.088	0.055	0.049
4.000	0.100	0.074	0.055	0.037	0.033
5.040	0.068	0.048	0.044	0.040	0.031
6.350	0.041	0.031	0.030	0.084	0.030
8.000	0.088	0.043	0.066	0.198	0.043
10.079	0.047	0.028	0.038	0.045	0.032
12.699	0.039	0.030	0.030	0.027	0.037
16.000	0.020	0.015	0.015	0.012	0.017

TABLE 5.10
 1/3 OCTAVE RMS ACCELERATIONS
 120 ft WPB
 4.26 ft Significant Wave Height
 20% Beam
 42.9 ft LCG

$C_v = 3.0$
 Speed = 46.4 knots

Runs 67, 68, 69

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.103	0.091	0.074	0.056	0.044
0.125	0.345	0.301	0.232	0.176	0.159
0.157	0.486	0.424	0.325	0.248	0.225
0.198	0.546	0.476	0.365	0.278	0.252
0.250	0.613	0.535	0.410	0.312	0.283
0.315	0.688	0.600	0.460	0.350	0.318
0.397	1.373	1.188	0.886	0.644	0.580
0.500	1.639	1.417	1.055	0.765	0.689
0.630	1.971	1.693	1.234	0.852	0.750
0.794	2.216	1.895	1.364	0.911	0.783
1.000	1.993	1.690	1.190	0.744	0.571
1.260	1.614	1.359	0.947	0.577	0.360
1.587	1.457	1.217	0.842	0.499	0.296
2.000	1.243	1.026	0.712	0.409	0.250
2.520	0.932	0.758	0.530	0.298	0.184
3.175	0.622	0.485	0.358	0.206	0.117
4.000	0.398	0.303	0.245	0.158	0.064
5.040	0.266	0.184	0.170	0.135	0.057
6.350	0.136	0.076	0.090	0.157	0.048
8.000	0.213	0.089	0.143	0.343	0.066
10.079	0.100	0.043	0.083	0.078	0.043
12.699	0.000	0.000	0.026	0.043	0.032
16.000	0.000	0.000	0.009	0.013	0.014

R-2587

TABLE 5.11
1/3 OCTAVE RMS ACCELERATIONS
120 ft WPB
4.26 ft Significant Wave Height
20% Beam
42.9 ft LCG

$C_v = 4.0$
Speed = 61.9 knots

Runs 71, 72, 73, 74

Accelerometer	#5	#4	#3	#2	#1
Center Frequency Hz	1/3 Octave RMS meters/sec ²				
0.099	0.042	0.036	0.027	0.020	0.009
0.125	0.247	0.219	0.172	0.132	0.104
0.157	0.353	0.313	0.246	0.189	0.149
0.198	0.397	0.351	0.276	0.212	0.167
0.250	0.445	0.394	0.310	0.238	0.188
0.315	0.500	0.443	0.348	0.268	0.211
0.397	1.283	1.127	0.872	0.649	0.512
0.500	1.547	1.358	1.051	0.781	0.617
0.630	2.177	1.903	1.455	1.055	0.823
0.794	2.677	2.333	1.775	1.278	0.985
1.000	2.933	2.541	1.913	1.389	1.028
1.260	2.545	2.188	1.635	1.202	0.872
1.587	2.262	1.926	1.416	0.998	0.719
2.000	1.947	1.639	1.203	0.844	0.625
2.520	1.644	1.355	1.000	0.690	0.532
3.175	1.166	0.905	0.679	0.491	0.389
4.000	0.834	0.617	0.486	0.344	0.253
5.040	0.602	0.402	0.350	0.275	0.154
6.350	0.392	0.223	0.226	0.293	0.128
8.000	0.444	0.188	0.255	0.420	0.140
10.079	0.250	0.110	0.197	0.156	0.105
12.699	0.016	0.008	0.041	0.057	0.047
16.000	0.000	0.000	0.009	0.024	0.020

TABLE 6.1
PITCH VARIANCE SPECTRAL DENSITY
110 ft WPB

Column				
1	Run 126			
2	Runs 121, 122, 123			
3	Runs 118, 119, 120, 124			
4	Runs 134, 135, 136, 137, 138			
	Significant Wave Height 3.13 ft 12.5% Beam	Significant Wave Height 5.00 ft 20% Beam		
SPEED knots	10	25.0	50.1	66.8
C _v	0.60	1.5	3.0	4.0
Fre- quency Hz	Spectral Estimates deg ² /Hz			
0.00	0.2018E+00	0.4572E+00	0.5959E-01	0.4515E-01
0.04	0.3601E+00	0.4421E+00	0.8494E-01	0.1746E+00
0.08	0.4765E+00	0.4675E+00	0.1838E+00	0.2560E+00
0.12	0.2878E+00	0.4373E+00	0.2168E+00	0.2195E+00
0.16	0.1444E+00	0.3375E+00	0.2299E+00	0.2100E+00
0.20	0.8474E+00	0.5184E+00	0.2488E+00	0.2863E+00
0.24	0.2571E+01	0.2000E+01	0.2622E+00	0.2624E+00
0.28	0.5143E+01	0.4661E+01	0.3313E+00	0.2274E+00
0.35	0.1097E+02	0.9825E+01	0.3045E+01	0.4062E+00
0.39	0.6805E+01	0.8363E+01	0.4826E+01	0.1372E+01
0.43	0.2316E+01	0.5912E+01	0.4895E+01	0.3154E+01
0.47	0.5872E+00	0.4328E+01	0.3916E+01	0.2649E+01
0.51	0.1462E+00	0.3162E+01	0.2793E+01	0.2361E+01
0.55	0.2969E-01	0.1640E+01	0.1946E+01	0.2434E+01
0.59	-0.1214E-02	0.7772E+00	0.1584E+01	0.1787E+01
0.63	0.9703E-03	0.3824E+00	0.1048E+01	0.1422E+01
0.67	0.2885E-02	0.1836E+00	0.5503E+00	0.1026E+01
0.71	0.1407E-02	0.1097E+00	0.4527E+00	0.7400E+00
0.75	-0.5828E-03	0.8511E-01	0.4439E+00	0.7534E+00
0.79	0.5742E-02	0.2916E-01	0.3103E+00	0.7248E+00
0.83	0.4574E-02	0.3945E-01	0.2808E+00	0.3935E+00
0.87	0.7328E-02	0.2748E-01	0.2634E+00	0.2946E+00
0.90	0.3836E-02	0.5996E-01	0.1606E+00	0.3142E+00
0.94	0.2812E-02	0.9169E-01	0.2488E+00	0.6104E+00
0.98	-0.7003E-03	0.1056E+00	0.6170E+00	0.1123E+01
1.02	0.7945E-03	0.5955E-01	0.8249E+00	0.1487E+01
1.06	-0.1905E-02	0.4692E-01	0.7172E+00	0.1318E+01
1.10	-0.4779E-04	0.4035E-01	0.3251E+00	0.9435E+00
1.14	-0.1822E-02	0.5044E-01	0.1834E+00	0.9481E+00
1.18	0.1378E-03	0.4097E-01	0.1577E+00	0.1274E+01

TABLE 6.2
PITCH VARIANCE SPECTRAL DENSITY
120 ft WPB

Column		Significant Wave Height 2.62 ft 12.5% Beam				Significant Wave Height 4.26 ft 20% Beam	
1	Run 75						
2	Runs 40, 42						
3	Runs 44, 45, 46						
4	Runs 48, 49, 63, 64						
5	Runs 65, 66						
6	Runs 67, 68, 69						
7	Runs 71, 72, 73, 74						
SPEED knots	10	23.2	46.4	61.9	23.2	46.4	61.9
C _v	0.65	1.5	3.0	4.0	1.5	3.0	4.0
Fre- quency Hz	Spectral Estimates deg ² /Hz						
0.00	0.4344E-01	0.1830E+00	0.8179E-02	0.1344E-01	0.1955E+00	0.2593E-01	0.1513E-01
0.04	0.1484E+00	0.1281E+00	0.8479E-02	0.1876E-01	0.1711E+00	0.2286E-01	0.3826E-01
0.08	0.2708E+00	0.9138E-01	0.1234E-01	0.2566E-01	0.1910E+00	0.3393E-01	0.5117E-01
0.12	0.1512E+00	0.9002E-01	0.1924E-01	0.3252E-01	0.7491E-01	0.3165E-01	0.3801E-01
0.16	0.5244E-01	0.3983E-01	0.2029E-01	0.1887E-01	0.1255E+00	0.2192E-01	0.3258E-01
0.20	0.1900E+00	0.2938E-01	0.2456E-01	0.1639E-01	0.1863E+00	0.3814E-01	0.7810E-01
0.24	0.7937E+00	0.1296E-01	0.2289E-01	0.2311E-01	0.1280E+01	0.8187E-01	0.8157E-01
0.28	0.2118E+01	0.3557E-01	0.1569E-01	0.2710E-01	0.3376E+01	0.7452E-01	0.1493E+00
0.32	0.4312E+01	0.1470E+00	0.1973E-01	0.3136E-01	0.6411E+01	0.1498E+00	0.2054E+00
0.35	0.5090E+01	0.5150E+00	0.4723E-01	0.4151E-01	0.7974E+01	0.6920E+00	0.3068E+00
0.39	0.3080E+01	0.7719E+00	0.5429E-01	0.6367E-01	0.6353E+01	0.1487E+01	0.4904E+00
0.43	0.1021E+01	0.7525E+00	0.4663E-01	0.1232E+00	0.4599E+01	0.1823E+01	0.4507E+00
0.47	0.2266E+00	0.6649E+00	0.5159E-01	0.9580E-01	0.2888E+01	0.2072E+01	0.4753E+00
0.51	0.4544E-01	0.5309E+00	0.7644E-01	0.4027E-01	0.1450E+01	0.2036E+01	0.8374E+00
0.55	0.1105E-01	0.2927E+00	0.1187E+00	0.3991E-01	0.7260E+00	0.1838E+01	0.1016E+01
0.59	0.2719E-02	0.1174E+00	0.1349E+00	0.4099E-01	0.4104E+00	0.1450E+01	0.9357E+00
0.63	0.1278E-02	0.5719E-01	0.1246E+00	0.7200E-01	0.1150E+00	0.1049E+01	0.8557E+00
0.67	0.2475E-02	0.2315E-01	0.1398E+00	0.1157E+00	0.4529E-01	0.6914E+00	0.7701E+00
0.71	0.2939E-02	0.1030E-01	0.1357E+00	0.1419E+00	0.2178E-02	0.5534E+00	0.7071E+00
0.75	0.5588E-02	0.1011E-02	0.1276E+00	0.1407E+00	0.1846E-01	0.5499E+00	0.6811E+00
0.79	0.7857E-02	0.2445E-02	0.1441E+00	0.1093E+00	0.4770E-01	0.4454E+00	0.5477E+00
0.83	0.5547E-02	0.1284E-02	0.1405E+00	0.1387E+00	0.1001E+00	0.3359E+00	0.5568E+00
0.87	0.1728E-02	0.3535E-02	0.1296E+00	0.1750E+00	0.6842E-01	0.2857E+00	0.7629E+00
0.90	0.9530E-03	0.5004E-02	0.1119E+00	0.2180E+00	0.8842E-01	0.4128E+00	0.9579E+00
0.94	0.9411E-03	0.1658E-01	0.1311E+00	0.2724E+00	0.6687E-01	0.5299E+00	0.1158E+01
0.98	0.9429E-03	0.1841E-01	0.1622E+00	0.3889E+00	0.5546E-01	0.4007E+00	0.1160E+01
1.02	0.1494E-03	0.1215E-01	0.1637E+00	0.3840E+00	0.1341E-01	0.1930E+00	0.7074E+00
1.06	-0.1079E-03	0.5513E-02	0.1242E+00	0.3302E+00	0.1690E-01	0.1213E+00	0.3098E+00
1.10	-0.3764E-03	0.6784E-02	0.1148E+00	0.2614E+00	0.3686E-02	0.7658E-01	0.3095E+00

TABLE 7.1
HEAVE VARIANCE SPECTRAL DENSITY
110 ft WPB

Column				
1	Run 126			
2	Runs 121, 122, 123			
3	Runs 118, 119, 120, 124			
4	Runs 134, 135, 136, 137, 138			
	Significant Wave Height 3.13 ft 12.5% Beam	Significant Wave Height 5.00 ft 20% Beam		
SPEED knots	10	25.0	50.1	66.8
C _v	0.60	1.5	3.0	4.0
Fre quency Hz	Spectral Estimates ft ² /Hz			
0.00	0.4166E-02	0.6043E+00	0.2559E-01	0.9259E-02
0.04	0.2114E-01	0.3435E+00	0.4509E-01	0.7289E-01
0.08	0.5152E-01	0.1224E+00	0.1020E+00	0.1238E+00
0.12	0.5618E-01	0.1025E+00	0.1703E+00	0.1818E+00
0.16	0.4353E-01	0.1363E+00	0.1933E+00	0.2354E+00
0.20	0.1332E+00	0.4499E+00	0.1891E+00	0.3218E+00
0.24	0.2897E+00	0.1637E+01	0.2260E+00	0.3366E+00
0.28	0.3821E+00	0.3386E+01	0.4202E+00	0.3136E+00
0.32	0.5543E+00	0.4982E+01	0.1202E+01	0.3469E+00
0.35	0.6709E+00	0.5246E+01	0.2474E+01	0.4744E+00
0.39	0.4342E+00	0.3631E+01	0.3479E+01	0.1182E+01
0.43	0.1465E+00	0.1950E+01	0.3746E+01	0.2408E+01
0.47	0.3379E-01	0.1053E+01	0.3335E+01	0.2344E+01
0.51	0.6105E-02	0.6822E+00	0.2333E+01	0.2242E+01
0.55	0.1618E-02	0.2961E+00	0.1523E+01	0.2069E+01
0.59	0.1171E-04	0.1160E+00	0.1157E+01	0.1335E+01
0.63	0.4702E-03	0.5149E-01	0.7144E+00	0.1048E+01
0.67	-0.1874E-03	0.3311E-01	0.3826E+00	0.6955E+00
0.71	0.2982E-03	0.1569E-01	0.3031E+00	0.4914E+00
0.75	-0.2813E-04	0.1940E-01	0.3488E+00	0.3923E+00
0.79	0.4563E-03	0.5628E-02	0.2447E+00	0.3665E+00
0.83	0.1664E-03	0.1336E-01	0.1291E+00	0.1940E+00
0.87	0.4777E-03	0.8199E-02	0.8326E-01	0.1136E+00
0.90	-0.4587E-04	0.1018E-01	0.5621E-01	0.9847E-01
0.94	0.1716E-03	0.4401E-02	0.2139E-01	0.1377E+00
0.98	-0.1712E-03	0.8870E-02	0.3462E-01	0.1011E+00
1.02	0.1312E-03	0.1452E-02	0.4466E-01	0.7378E-01
1.06	-0.1540E-03	0.5363E-02	0.2828E-01	0.5261E-01
1.10	0.1021E-03	-0.3043E-04	0.2082E-01	0.8492E-01
1.14	-0.1858E-03	0.6219E-02	0.1917E-01	0.7010E-01
1.18	0.9995E-04	0.2795E-02	0.3573E-02	0.5770E-01

TABLE 7.2
HEAVE VARIANCE SPECTRAL DENSITY
120 ft WPB

Column		Significant Wave Height 2.62 ft 12.5% Beam				Significant Wave Height 4.26 ft 20% Beam		
1	Run 75							
2	Runs 40, 42							
3	Runs 44, 45, 46							
4	Runs 48, 49, 63, 64							
5	Runs 65, 66							
6	Runs 67, 68, 69							
7	Runs 71, 72, 73, 74							
SPEED knots	10	23.2	46.4	61.9	23.2	46.4	61.9	
C _v	0.65	1.5	3.0	4.0	1.5	3.0	4.0	
Fre- quency Hz	Spectral Estimates ft ² /Hz							
0.00	0.1729E-01	0.1435E+00	0.1328E-01	0.2052E-01	0.3070E+00	-0.6565E-03	0.2406E-01	
0.04	0.2611E-01	0.8379E-01	0.1555E-01	0.1506E-01	0.1711E+00	0.6688E-02	0.4209E-01	
0.08	0.4383E-01	0.1789E-01	0.1900E-01	0.1028E-01	0.5648E-01	0.2521E-01	0.4259E-01	
0.12	0.3121E-01	0.1049E-01	0.2316E-01	0.1699E-01	0.2190E-02	0.2306E-01	0.4140E-01	
0.16	0.1429E-01	0.3851E-02	0.2079E-01	0.1274E-01	0.1524E-01	0.2437E-01	0.5537E-01	
0.20	0.2871E-01	0.4161E-02	0.1532E-01	0.1267E-01	0.1020E+00	0.3502E-01	0.7997E-01	
0.24	0.8663E-01	0.2420E-02	0.1033E-01	0.1492E-01	0.7168E+00	0.5999E-01	0.8628E-01	
0.28	0.1329E+00	0.1412E-01	0.7298E-02	0.1916E-01	0.1789E+01	0.6688E-01	0.1754E+00	
0.32	0.1754E+00	0.5973E-01	0.1057E-01	0.2210E-01	0.3161E+01	0.1474E+00	0.2371E+00	
0.35	0.1890E+00	0.2006E+00	0.2294E-01	0.2700E-01	0.3406E+01	0.5314E+00	0.2593E+00	
0.39	0.1181E+00	0.2821E+00	0.2387E-01	0.3901E-01	0.2237E+01	0.9894E+00	0.4286E+00	
0.43	0.4236E-01	0.2329E+00	0.1852E-01	0.6640E-01	0.1298E+01	0.1035E+01	0.4787E+00	
0.47	0.1188E-01	0.1586E+00	0.1927E-01	0.5412E-01	0.5899E+00	0.1004E+01	0.4901E+00	
0.51	0.4914E-02	0.9659E-01	0.2614E-01	0.2126E-01	0.2129E+00	0.8509E+00	0.5974E+00	
0.55	0.2285E-02	0.4347E-01	0.3877E-01	0.2176E-01	0.7021E-01	0.6596E+00	0.6146E+00	
0.59	0.1255E-02	0.9239E-02	0.4456E-01	0.2765E-01	0.3928E-01	0.4606E+00	0.5411E+00	
0.63	0.2426E-03	0.3554E-02	0.3970E-01	0.3569E-01	0.6540E-02	0.3109E+00	0.4751E+00	
0.67	0.1441E-03	0.1341E-02	0.3256E-01	0.4561E-01	0.9457E-02	0.1984E+00	0.3997E+00	
0.71	0.1583E-03	0.2465E-02	0.3379E-01	0.4425E-01	-0.7944E-03	0.1465E+00	0.3077E+00	
0.75	0.2993E-03	0.1208E-02	0.3549E-01	0.3476E-01	0.9182E-02	0.1348E+00	0.2315E+00	
0.79	0.1533E-03	0.2064E-02	0.2756E-01	0.2571E-01	0.2067E-02	0.9661E-01	0.1806E+00	
0.83	0.2428E-03	0.1338E-02	0.1860E-01	0.3016E-01	0.1025E-01	0.5197E-01	0.1477E+00	
0.87	0.6611E-04	0.1701E-02	0.1446E-01	0.3708E-01	0.2080E-02	0.2637E-01	0.1211E+00	
0.90	0.1242E-03	0.5548E-03	0.1181E-01	0.3035E-01	0.8456E-02	0.2196E-01	0.8113E-01	
0.94	0.1757E-04	0.1430E-02	0.9709E-02	0.2461E-01	0.2478E-02	0.1893E-01	0.6951E-01	
0.98	0.8103E-04	0.5447E-03	0.6988E-02	0.2242E-01	0.6845E-02	0.1317E-01	0.8353E-01	
1.02	-0.2227E-04	0.1102E-02	0.6987E-02	0.1856E-01	0.9169E-04	0.4248E-02	0.9381E-01	
1.06	0.4995E-04	0.2483E-03	0.6710E-02	0.1886E-01	0.5277E-02	0.7222E-02	0.5999E-01	
1.10	0.1233E-04	0.8319E-03	0.4164E-02	0.1907E-01	-0.4460E-03	0.8829E-02	0.4370E-01	

TABLE 8.1
WAVE VARIANCE SPECTRAL DENSITY
110 ft WPB

Column				
1	Run 126			
2	Runs 121, 122, 123			
3	Runs 118, 119, 120, 124			
4	Runs 134, 135, 137, 138			
	Significant Wave Height 3.13 ft 12.5% Beam	Significant Wave Height 5.00 ft 20% Beam		
SPEED knots	10	25.0	50.1	66.8
C _v	0.60	1.5	3.0	4.0
Fre- quency Hz	Spectral Estimates ft ² /Hz			
0.00	0.4235E+00	0.4131E+00	0.3878E-01	0.2897E-01
0.06	0.6051E+00	0.2730E+00	0.5788E-01	0.3882E-01
0.11	0.3985E+00	0.1095E+00	0.6059E-01	0.5612E-01
0.16	0.1719E+00	0.1405E+00	0.1154E+00	0.6189E-01
0.22	0.4713E+00	0.8187E+00	0.1028E+00	0.9727E-01
0.27	0.1062E+01	0.2331E+01	0.1780E+00	0.1318E+00
0.33	0.1790E+01	0.3714E+01	0.5068E+00	0.1772E+00
0.38	0.1940E+01	0.3943E+01	0.1488E+01	0.4589E+00
0.44	0.1464E+01	0.3600E+01	0.2433E+01	0.1072E+01
0.49	0.1127E+01	0.3168E+01	0.2883E+01	0.1600E+01
0.55	0.8853E+00	0.2374E+01	0.3009E+01	0.2053E+01
0.60	0.5388E+00	0.1873E+01	0.2898E+01	0.2297E+01
0.66	0.3217E+00	0.1300E+01	0.2361E+01	0.2322E+01
0.71	0.3200E+00	0.9723E+00	0.2139E+01	0.2664E+01
0.76	0.2612E+00	0.8243E+00	0.2201E+01	0.2756E+01
0.82	0.1572E+00	0.6408E+00	0.2120E+01	0.2224E+01
0.87	0.1292E+00	0.5113E+00	0.1850E+01	0.1694E+01
0.93	0.1001E+00	0.4034E+00	0.1214E+01	0.1864E+01
0.98	0.6541E-01	0.3271E+00	0.1053E+01	0.1954E+01
1.04	0.2693E-01	0.2114E+00	0.9261E+00	0.1586E+01
1.09	0.1703E-01	0.1588E+00	0.5574E+00	0.1269E+01
1.15	0.1215E-01	0.1206E+00	0.3875E+00	0.8761E+00
1.20	0.9126E-02	0.8004E-01	0.3130E+00	0.5200E+00
1.26	0.4434E-02	0.3557E-01	0.1981E+00	0.3433E+00
1.31	0.2847E-02	0.3005E-01	0.1078E+00	0.1863E+00
1.37	0.2211E-03	0.1664E-01	0.5623E-01	0.8033E-01
1.42	0.9858E-03	0.7303E-02	0.4196E-01	0.4324E-01
1.47	-0.3054E-03	0.4676E-03	0.2863E-01	0.3468E-01
1.53	0.6197E-03	0.2477E-02	0.2270E-01	0.1387E-01
1.58	-0.4239E-03	-0.3098E-03	0.1114E-01	0.1842E-01
1.64	0.6372E-03	0.1930E-02	0.1671E-01	0.2059E-01

TABLE 8.2
WAVE VARIANCE SPECTRAL DENSITY
120 ft WPB

Column		Significant Wave Height 2.62 ft 12.5% Beam				Significant Wave Height 4.26 ft 20% Beam		
1	Run 75							
2	Runs 40, 42							
3	Runs 44, 45, 46							
4	Runs 48, 49, 63, 64							
5	Runs 65, 66							
6	Runs 67, 68, 69							
7	Runs 71, 72, 73, 74							
SPEED knots	10	23.2	46.4	61.9	23.2	46.4	61.9	
C _v	0.65	1.5	3.0	4.0	1.5	3.0	4.0	
Fre- quency Hz	Spectral Estimates ft ² /Hz							
0.00	0.2557E+00	0.2958E+00	0.9401E-01	0.1514E+00	0.5149E+00	0.8307E-01	0.5587E-01	
0.06	0.3140E+00	0.1746E+00	0.7014E-01	0.1259E+00	0.2522E+00	0.8756E-01	0.5827E-01	
0.11	0.2002E+00	0.8218E-01	0.2989E-01	0.6175E-01	0.4786E-01	0.5388E-01	0.4625E-01	
0.16	0.6317E-01	0.8523E-01	0.3593E-01	0.6392E-01	0.2410E-01	0.5928E-01	0.2833E-01	
0.22	0.1516E+00	0.5536E-01	0.3926E-01	0.6619E-01	0.3809E+00	0.3005E-01	0.3367E-01	
0.27	0.5160E+00	0.2636E-01	0.4094E-01	0.7601E-01	0.1353E+01	0.4718E-01	0.3505E-01	
0.33	0.1123E+01	0.1021E+00	0.5154E-01	0.6765E-01	0.2288E+01	0.1887E+00	0.7023E-01	
0.38	0.1504E+01	0.3320E+00	0.7234E-01	0.5719E-01	0.2292E+01	0.5176E+00	0.9260E-01	
0.44	0.1327E+01	0.5678E+00	0.7390E-01	0.5032E-01	0.2379E+01	0.9694E+00	0.3653E+00	
0.49	0.1038E+01	0.6492E+00	0.1496E+00	0.6077E-01	0.2389E+01	0.1795E+01	0.8250E+00	
0.55	0.8149E+00	0.7064E+00	0.2249E+00	0.9568E-01	0.1867E+01	0.2231E+01	0.1204E+01	
0.60	0.5671E+00	0.7012E+00	0.3414E+00	0.1568E+00	0.1502E+01	0.1952E+01	0.1637E+01	
0.66	0.3794E+00	0.6285E+00	0.4239E+00	0.2443E+00	0.1222E+01	0.1675E+01	0.2002E+01	
0.71	0.3350E+00	0.6112E+00	0.5143E+00	0.4285E+00	0.9519E+00	0.1647E+01	0.2080E+01	
0.76	0.2661E+00	0.5193E+00	0.7018E+00	0.4457E+00	0.7434E+00	0.1970E+01	0.1839E+01	
0.82	0.1595E+00	0.3642E+00	0.8524E+00	0.4476E+00	0.6295E+00	0.1931E+01	0.1458E+01	
0.87	0.1400E+00	0.3107E+00	0.7995E+00	0.6366E+00	0.4383E+00	0.1428E+01	0.1448E+01	
0.93	0.1280E+00	0.3396E+00	0.6620E+00	0.7003E+00	0.3454E+00	0.1032E+01	0.1670E+01	
0.98	0.7778E-01	0.2802E+00	0.6430E+00	0.7605E+00	0.2062E+00	0.8699E+00	0.1654E+01	
1.04	0.3693E-01	0.1661E+00	0.6281E+00	0.8280E+00	0.1588E+00	0.5904E+00	0.1376E+01	
1.09	0.2560E-01	0.1424E+00	0.5085E+00	0.6612E+00	0.1373E+00	0.5922E+00	0.9637E+00	
1.15	0.1380E-01	0.8123E-01	0.3057E+00	0.5309E+00	0.8116E-01	0.4723E+00	0.6825E+00	
1.20	0.1087E-01	0.3219E-01	0.2030E+00	0.4552E+00	0.4424E-01	0.2504E+00	0.4467E+00	
1.26	0.4529E-02	0.2363E-01	0.1202E+00	0.2673E+00	0.5677E-01	0.1259E+00	0.2462E+00	
1.31	0.5636E-02	0.1482E-01	0.8309E-01	0.1545E+00	0.2908E-01	0.1059E+00	0.1364E+00	
1.37	0.1988E-02	0.9288E-02	0.5480E-01	0.9774E-01	0.1190E-01	0.5945E-01	0.1025E+00	
1.42	0.1784E-02	0.6842E-02	0.4079E-01	0.7597E-01	0.1336E-02	0.4483E-01	0.7685E-01	
1.47	-0.4104E-03	0.4322E-02	0.2043E-01	0.5770E-01	0.4917E-02	0.1496E-01	0.5859E-01	
1.53	0.1188E-02	0.2385E-02	0.1351E-01	0.3580E-01	-0.2143E-02	0.1560E-01	0.3257E-01	
1.58	-0.4838E-03	0.2332E-02	0.7971E-02	0.2618E-01	0.2005E-02	0.4868E-02	0.2901E-01	

TABLE 9
ROUGH WATER RMS AND MEAN VALUES
OF MOTIONS AND ACCELERATIONS

110 ft WPB											
RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ROOT MEAN SQUARE VALUES					MEAN VALUES	
					ACCELERATION, g					HEAVE ft	PITCH deg
					#5	#4	#3	#2	#1		
3.13 ft Significant Wave Height, 12.5% Beam											
126	10.0	0.60	1.254	0.333	0.222	0.147	0.076	0.047	0.040	1.41	-0.85
5.00 ft Significant Wave Height, 20% Beam											
121	25.0	1.5	1.439	0.985	0.450	0.321	0.213	0.173	0.159	1.82	1.79
118	50.1	3.0	1.130	0.949	0.814	0.606	0.433	0.352	0.282	3.80	2.34
134	66.8	4.0	1.045	0.835	0.986	0.733	0.546	0.455	0.401	4.40	1.74
120 ft WPB											
2.62 ft Significant Wave Height, 12.5% Beam											
75	10.0	0.65	0.828	0.191	0.124	0.102	0.062	0.031	0.039	1.16	0.41
40	23.2	1.5	0.421	0.224	0.126	0.105	0.072	0.052	0.056	1.25	2.48
44	46.4	3.0	0.322	0.153	0.304	0.255	0.179	0.113	0.078	2.80	3.23
48	61.9	4.0	0.383	0.176	0.432	0.366	0.269	0.187	0.121	3.66	3.12
4.26 ft Significant Wave Height, 20% Beam											
65	23.2	1.5	1.207	0.742	0.296	0.251	0.178	0.128	0.133	1.23	2.57
67	46.4	3.0	0.818	0.523	0.527	0.447	0.323	0.219	0.177	2.79	3.35
71	61.9	4.0	0.775	0.495	0.693	0.592	0.448	0.327	0.244	3.66	3.17

TABLE 10.1
ROUGH WATER AVERAGE CRESTS AND TROUGHS
OF MOTIONS AND ACCELERATIONS
110 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
3.13 ft Significant Wave Height, 12.5% Beam									
Crests									
126	10.0	0.60	0.85	1.85	0.31	0.21	0.15	0.12	0.10
Troughs									
126	10.0	0.60	-2.36	0.97	-0.36	-0.25	-0.18	-0.14	-0.10
5.00 ft Significant Wave Height, 20% Beam									
Crests									
121	25.0	1.5	3.60	2.95	0.68	0.45	0.26	0.21	0.20
118	50.1	3.0	3.93	4.96	1.34	0.98	0.65	0.48	0.39
134	66.8	4.0	3.50	5.40	1.32	1.14	0.82	0.61	0.58
Troughs									
121	25.0	1.5	0.25	0.70	-0.58	-0.43	-0.32	-0.27	-0.24
118	50.1	3.0	1.23	2.69	-0.69	-0.56	-0.45	-0.38	-0.35
134	66.8	4.0	0.91	3.46	-0.82	-0.63	-0.53	-0.44	-0.40

TABLE 10.2
ROUGH WATER AVERAGE CRESTS AND TROUGHS
OF MOTIONS AND ACCELERATIONS
120 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
2.62 ft Significant Wave Height, 12.5% Beam									
Crests									
75	10.0	0.65	1.58	1.45	0.24	0.16	0.12	0.09	0.10
40	23.2	1.5	3.30	1.55	0.24	0.20	0.14	0.11	0.11
44	46.4	3.0	4.12	3.03	0.45	0.37	0.27	0.19	0.13
48	61.9	4.0	4.02	3.93	0.59	0.50	0.37	0.27	0.21
Troughs									
75	10.0	0.65	-0.61	0.88	-0.25	-0.21	-0.15	-0.10	-0.11
40	23.2	1.5	2.12	0.96	-0.27	-0.21	-0.18	-0.13	-0.13
44	46.4	3.0	3.13	2.61	-0.39	-0.33	-0.25	-0.20	-0.16
48	61.9	4.0	2.93	3.42	-0.52	-0.43	-0.35	-0.26	-0.19
4.26 ft Significant Wave Height, 20% Beam									
Crests									
65	23.2	1.5	4.23	2.16	0.43	0.34	0.24	0.18	1.18
67	46.4	3.0	4.67	3.50	0.88	0.71	0.49	0.31	0.22
71	61.9	4.0	4.68	4.27	0.97	0.87	0.64	0.45	0.35
Troughs									
65	23.2	1.5	1.34	0.35	-0.45	-0.37	-0.30	-0.22	-0.22
67	46.4	3.0	2.63	2.14	-0.54	-0.47	-0.38	-0.31	-0.30
71	61.9	4.0	2.61	3.05	-0.64	-0.54	-0.47	-0.34	-0.29

TABLE 11.1
 ROUGH WATER AVERAGE 1/3 HIGHEST CRESTS AND TROUGHS
 OF MOTIONS AND ACCELERATIONS
 110 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
3.13 ft Significant Wave Height, 12.5% Beam									
Crests									
126	10.0	0.60	2.00	2.15	0.45	0.31	0.18	0.14	0.12
Troughs									
126	10.0	0.60	-3.26	0.72	-0.55	-0.38	-0.24	-0.19	-0.12
5.00 ft Significant Wave Height, 20% Beam									
Crests									
121	25.0	1.5	4.93	3.91	1.16	0.77	0.41	0.31	0.30
118	50.1	3.0	4.76	5.91	2.48	1.72	1.15	0.83	0.67
134	66.8	4.0	4.31	6.18	2.87	2.12	1.47	1.14	1.06
Troughs									
121	25.0	1.5	-0.73	-0.03	-0.87	-0.66	-0.50	-0.42	-0.36
118	50.1	3.0	0.35	2.09	-1.04	-0.84	-0.70	-0.64	-0.59
134	66.8	4.0	0.11	2.91	-1.23	-0.92	-0.80	-0.76	-0.72

TABLE 11.2
ROUGH WATER AVERAGE 1/3 HIGHEST CRESTS AND TROUGHS
OF MOTIONS AND ACCELERATIONS
120 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
2.62 ft Significant Wave Height, 12.5% Beam									
Crests									
75	10.0	0.65	2.32	1.60	0.31	0.22	0.15	0.11	0.12
40	23.2	1.5	3.67	1.75	0.34	0.27	0.18	0.14	0.14
44	46.4	3.0	4.33	3.15	0.71	0.59	0.40	0.26	0.17
48	61.9	4.0	4.27	4.10	0.98	0.81	0.59	0.41	0.31
Troughs									
75	10.0	0.65	-1.26	0.74	-0.36	-0.29	-0.21	-0.12	-0.14
40	23.2	1.5	1.85	0.82	-0.39	-0.32	-0.24	-0.18	-0.18
44	46.4	3.0	2.94	2.49	-0.59	-0.49	-0.38	-0.28	-0.22
48	61.9	4.0	2.67	3.33	-0.78	-0.65	-0.52	-0.39	-0.28
4.26 ft Significant Wave Height, 20% Beam									
Crests									
65	23.2	1.5	5.39	2.83	0.71	0.56	0.37	0.27	0.27
67	46.4	3.0	5.20	3.89	1.55	1.25	0.83	0.47	0.33
71	61.9	4.0	5.20	4.72	1.93	1.61	1.16	0.80	0.62
Troughs									
65	23.2	1.5	0.34	-0.24	-0.75	-0.63	-0.49	-0.36	-0.34
67	46.4	3.0	1.96	1.81	-0.89	-0.78	-0.63	-0.51	-0.45
71	61.9	4.0	2.06	2.73	-0.98	-0.85	-0.73	-0.60	-0.50

TABLE 12.1
 ROUGH WATER AVERAGE 1/10 HIGHEST CRESTS AND TROUGHS
 OF MOTIONS AND ACCELERATIONS
 110 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
3.13 ft Significant Wave Height, 12.5% Beam									
Crests									
126	10.0	0.60	2.79	2.32	0.54	0.36	0.22	0.17	0.15
Troughs									
126	10.0	0.60	-3.57	0.58	-0.70	-0.47	-0.30	-0.23	-0.14
5.00 ft Significant Wave Height, 20% Beam									
Crests									
121	25.0	1.5	6.13	4.82	1.84	1.19	0.60	0.39	0.38
118	50.1	3.0	5.33	6.59	3.35	2.33	1.64	1.23	0.98
134	66.8	4.0	4.82	6.75	4.15	2.89	1.99	1.61	1.60
Troughs									
121	25.0	1.5	-1.63	-0.54	-1.09	-0.84	-0.65	-0.58	-0.47
118	50.1	3.0	-0.34	1.71	-1.19	-0.95	-0.82	-0.79	-0.72
134	66.8	4.0	-0.46	2.53	-1.42	-0.98	-0.88	-0.86	-0.86

TABLE 12.2
ROUGH WATER AVERAGE 1/10 HIGHEST CRESTS AND TROUGHS
OF MOTIONS AND ACCELERATIONS
120 ft WPB

RUN GROUP	SPEED knots	C _v	PITCH deg	HEAVE ft	ACCELERATION, g				
					#5	#4	#3	#2	#1
2.62 ft Significant Wave Height, 12.5% Beam									
Crests									
75	10.0	0.65	2.80	1.73	0.34	0.24	0.16	0.13	0.12
40	23.2	1.5	3.92	1.87	0.42	0.32	0.21	0.15	0.17
44	46.4	3.0	4.46	3.24	0.90	0.74	0.50	0.30	0.20
48	61.9	4.0	4.43	4.23	1.19	1.00	0.70	0.47	0.39
Troughs									
75	10.0	0.65	-1.65	0.66	-0.45	-0.37	-0.25	-0.16	-0.17
40	23.2	1.5	1.60	0.73	-0.47	-0.28	-0.28	-0.21	-0.22
44	46.4	3.0	2.77	2.42	-0.71	-0.61	-0.48	-0.34	-0.29
48	61.9	4.0	2.51	3.26	-0.93	-0.77	-0.62	-0.47	-0.35
4.26 ft Significant Wave Height, 20% Beam									
Crests									
65	23.2	1.5	6.05	3.29	1.07	0.87	0.53	0.31	0.33
67	46.4	3.0	5.50	4.16	2.13	1.72	1.14	0.58	0.41
71	61.9	4.0	5.50	5.20	2.61	2.11	1.56	1.11	0.98
Troughs									
65	23.2	1.5	-0.22	-0.66	-0.94	-0.80	-0.61	-0.45	-0.45
67	46.4	3.0	1.39	1.49	-1.03	-0.90	-0.74	-0.60	-0.53
71	61.9	4.0	1.68	2.54	-1.09	-0.96	-0.84	-0.73	-0.63

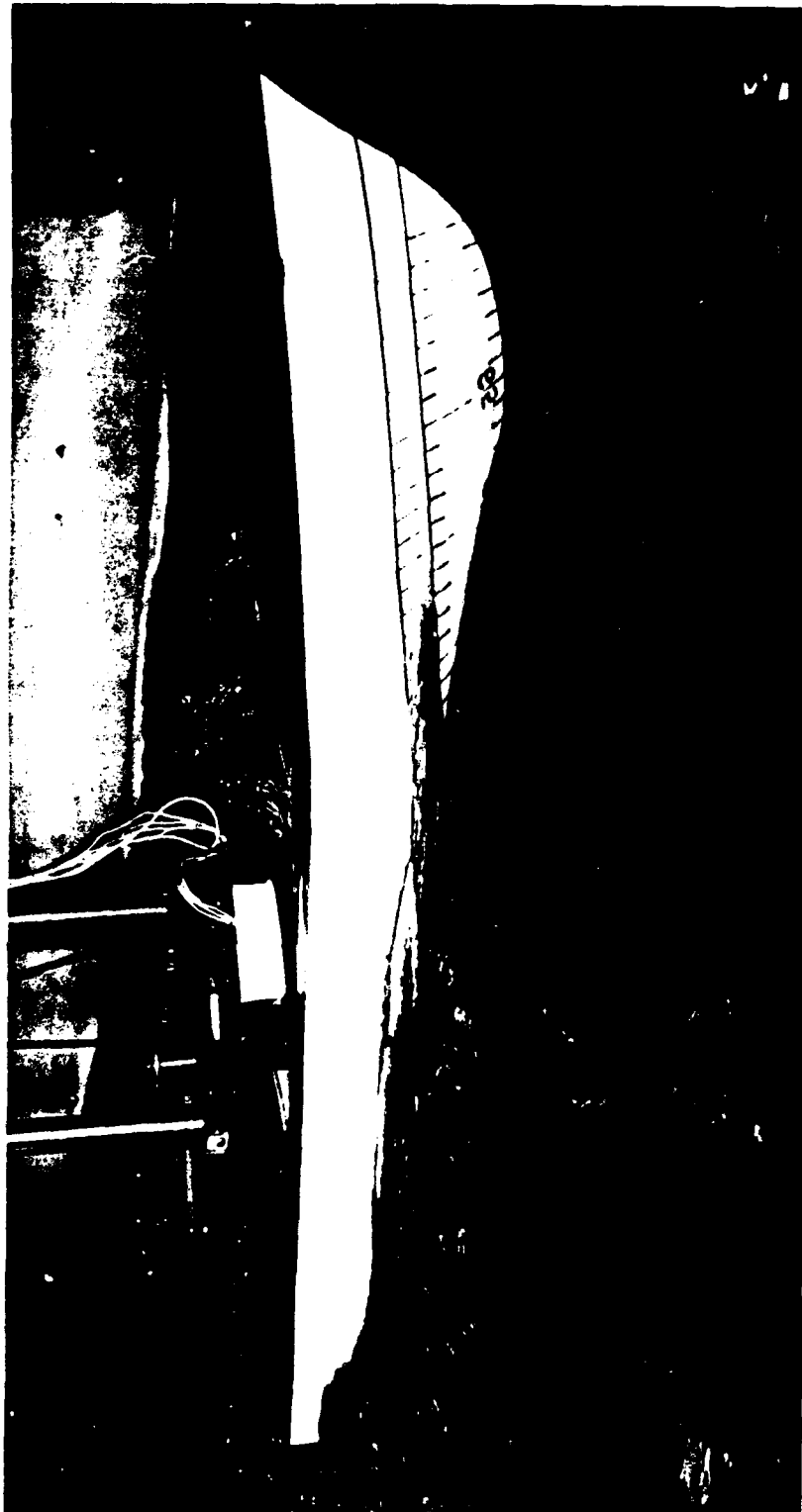


FIGURE 1 120 FT WPB, SPEED 46.4 KNOTS
4.3 FT SIGNIFICANT WAVE HEIGHT



FIGURE 2 110 FT WPB, SPEED 50.1 KNOTS
 5.0 FT SIGNIFICANT WAVE HEIGHT

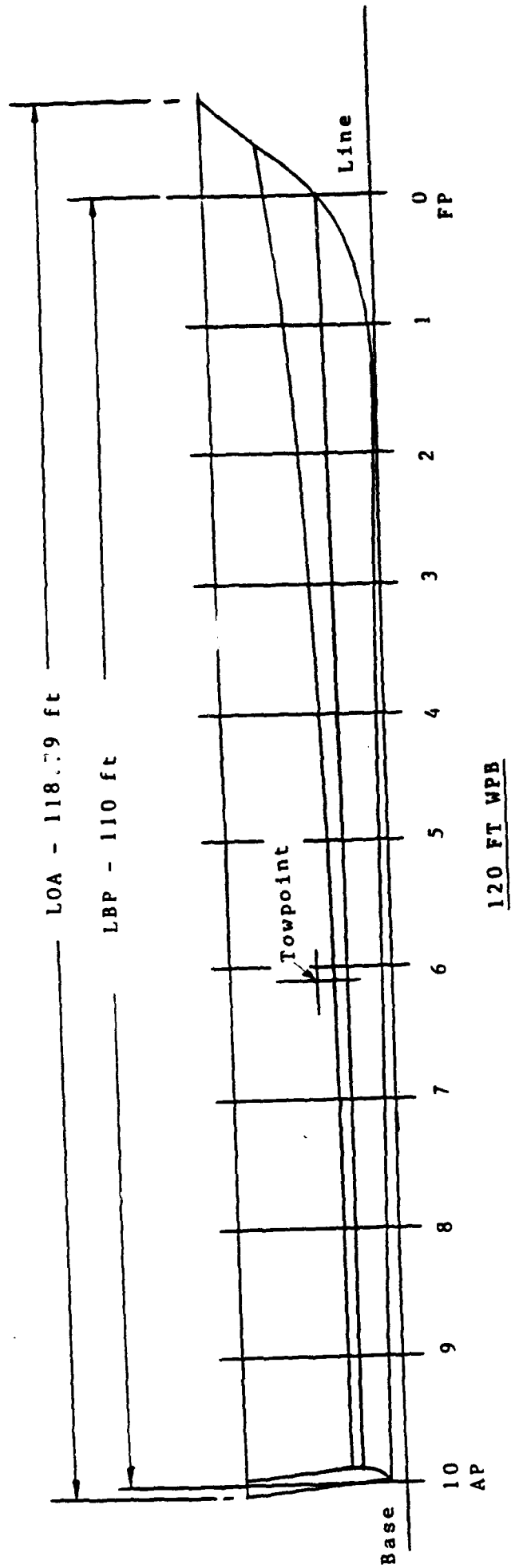
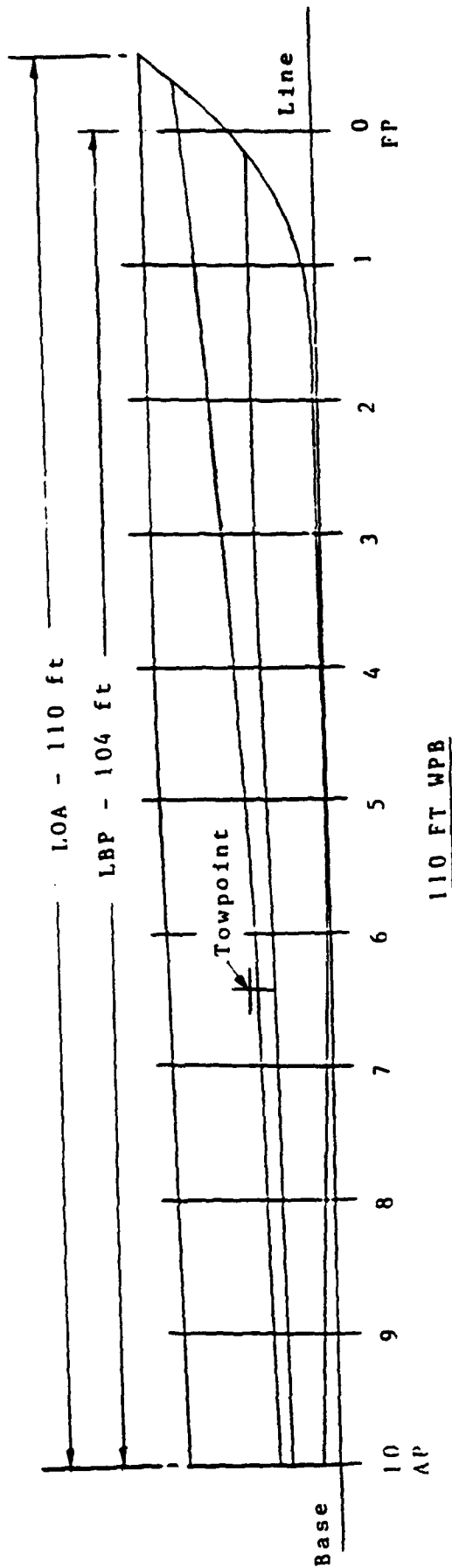


FIGURE 3 WPB PROFILES

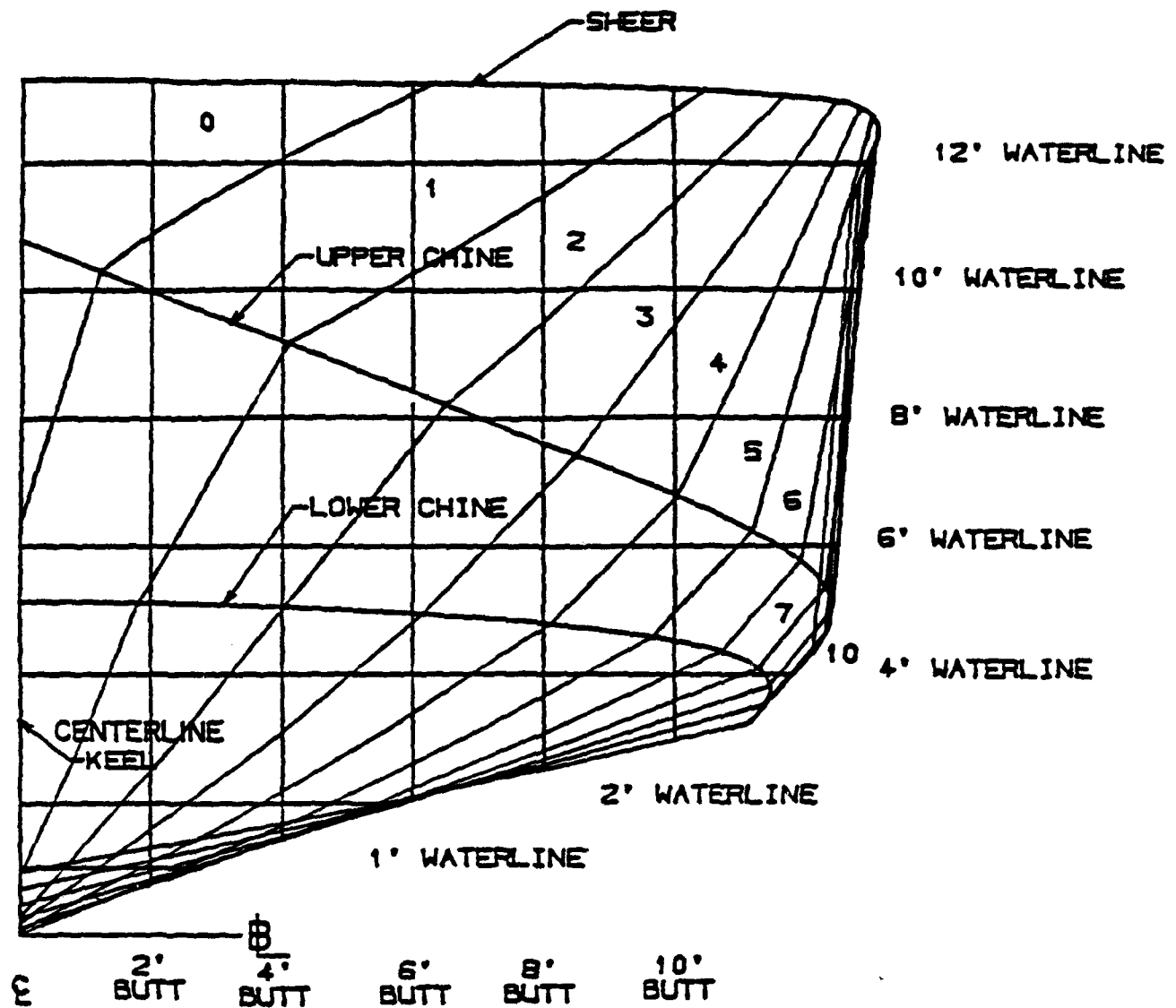


FIGURE 4 110 FT WPB BODY LINES

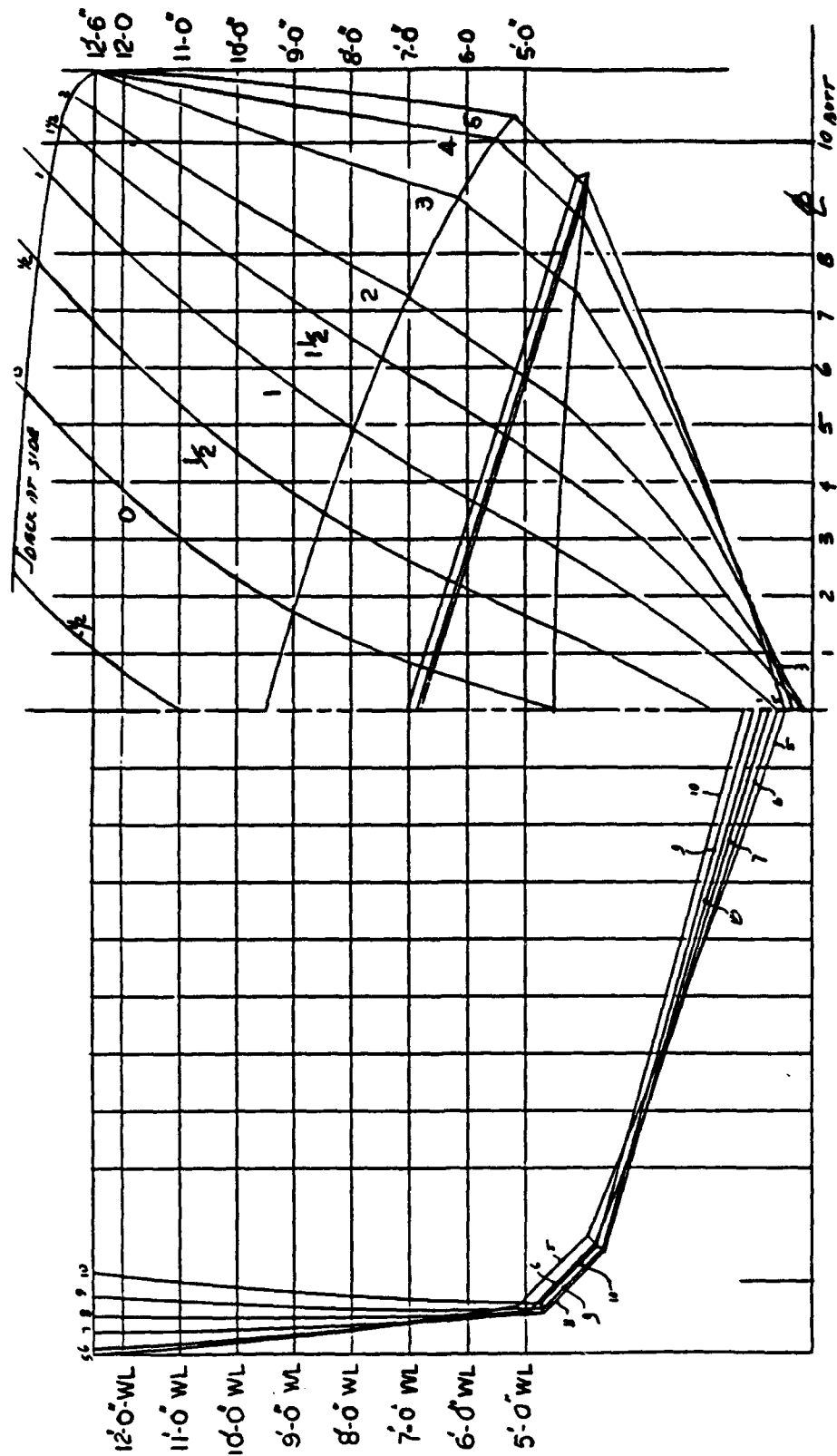
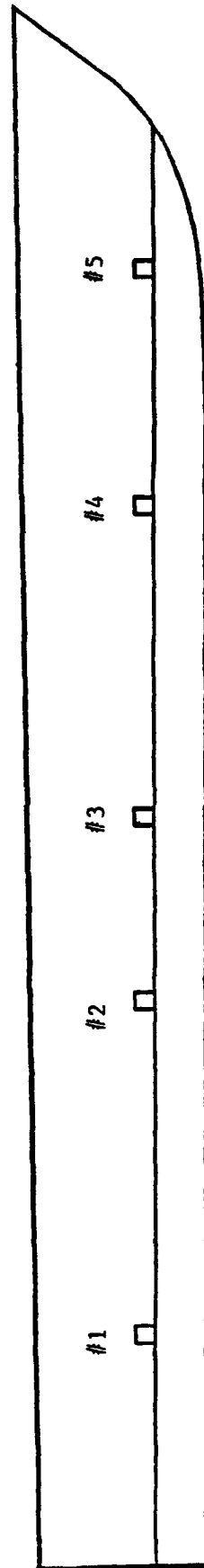


FIGURE 5 120 FT WPB BODY LINES



ACCELEROMETER	110 FT WPB		120 FT WPB	
	BEAMS	FEET FWD AP	BEAMS	FEET FWD AP
1	0.8	19.76	0.8	16.97
2	1.5	37.2 (LCG)	2.02	42.9 (LCG)
3	2.0	49.38	3.0	63.6
4	3.0	74.07	4.0	84.8
5	4.0	98.76	4.5	95.4

FIGURE 6 LOCATIONS OF VERTICAL ACCELEROMETERS

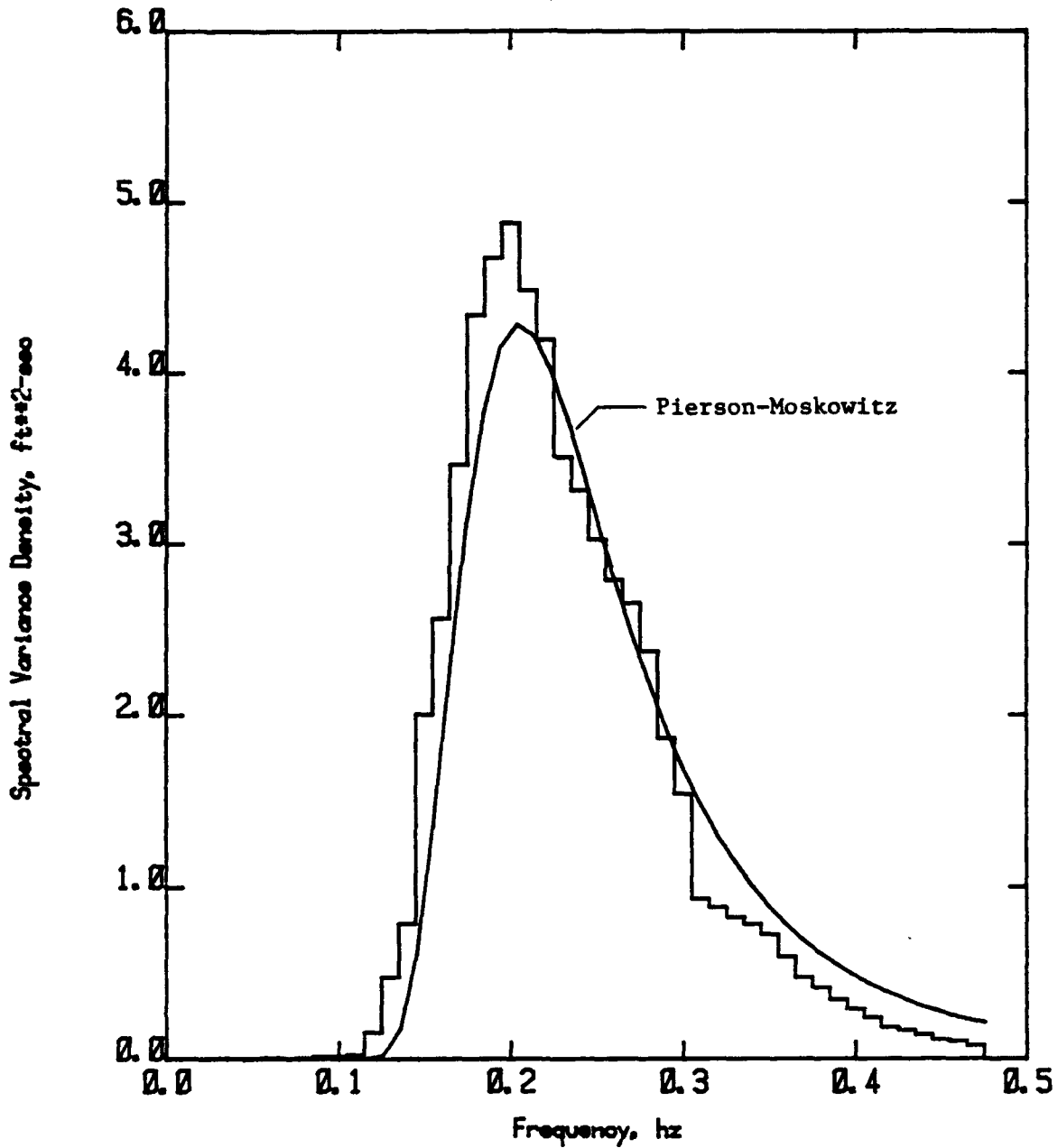


FIGURE 7 110 FT WPB TEST WAVE SPECTRUM
3.13 FT SIGNIFICANT WAVE HEIGHT

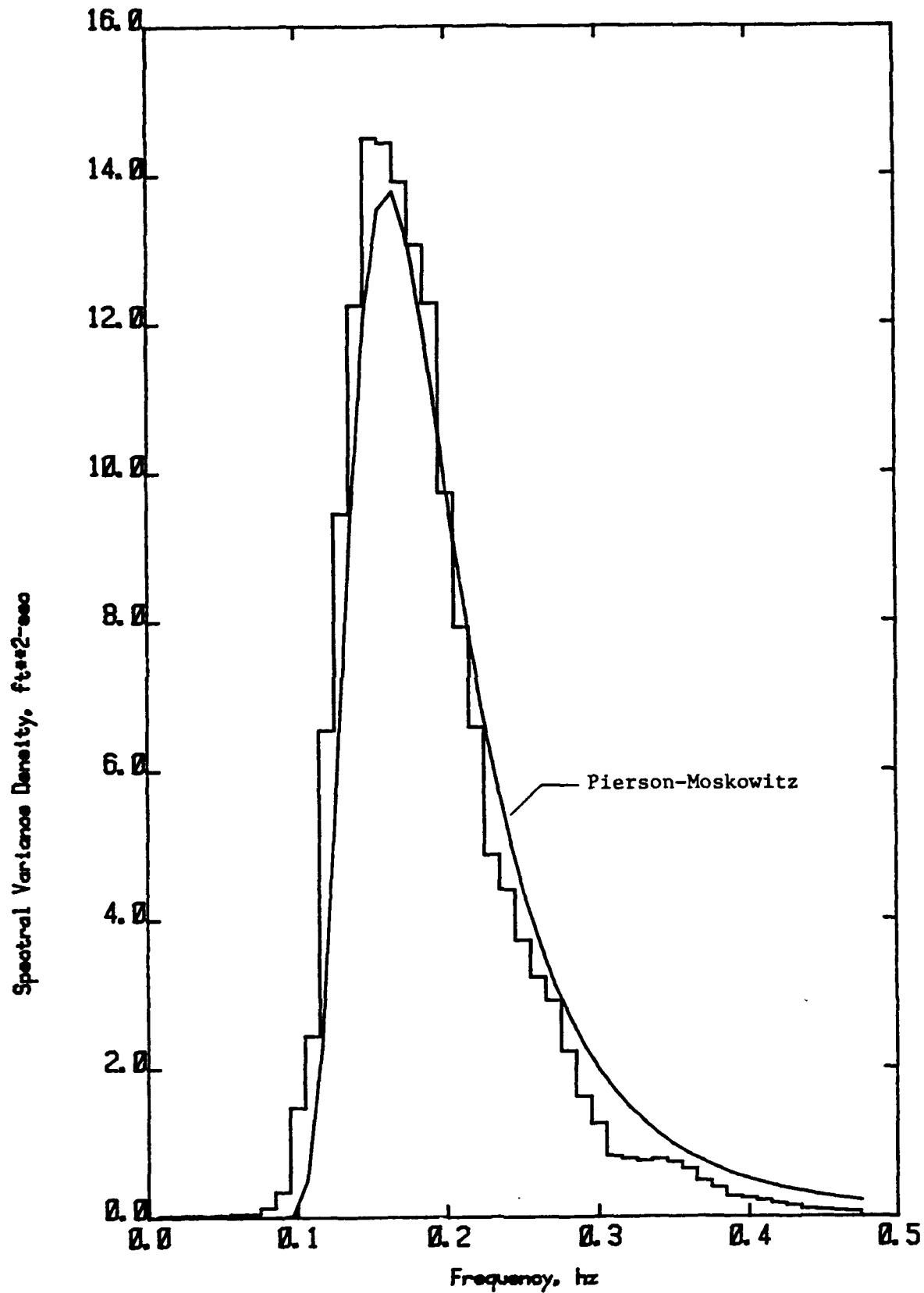


FIGURE 8 110 FT WPB TEST WAVE SPECTRUM
5.0 FT SIGNIFICANT WAVE HEIGHT

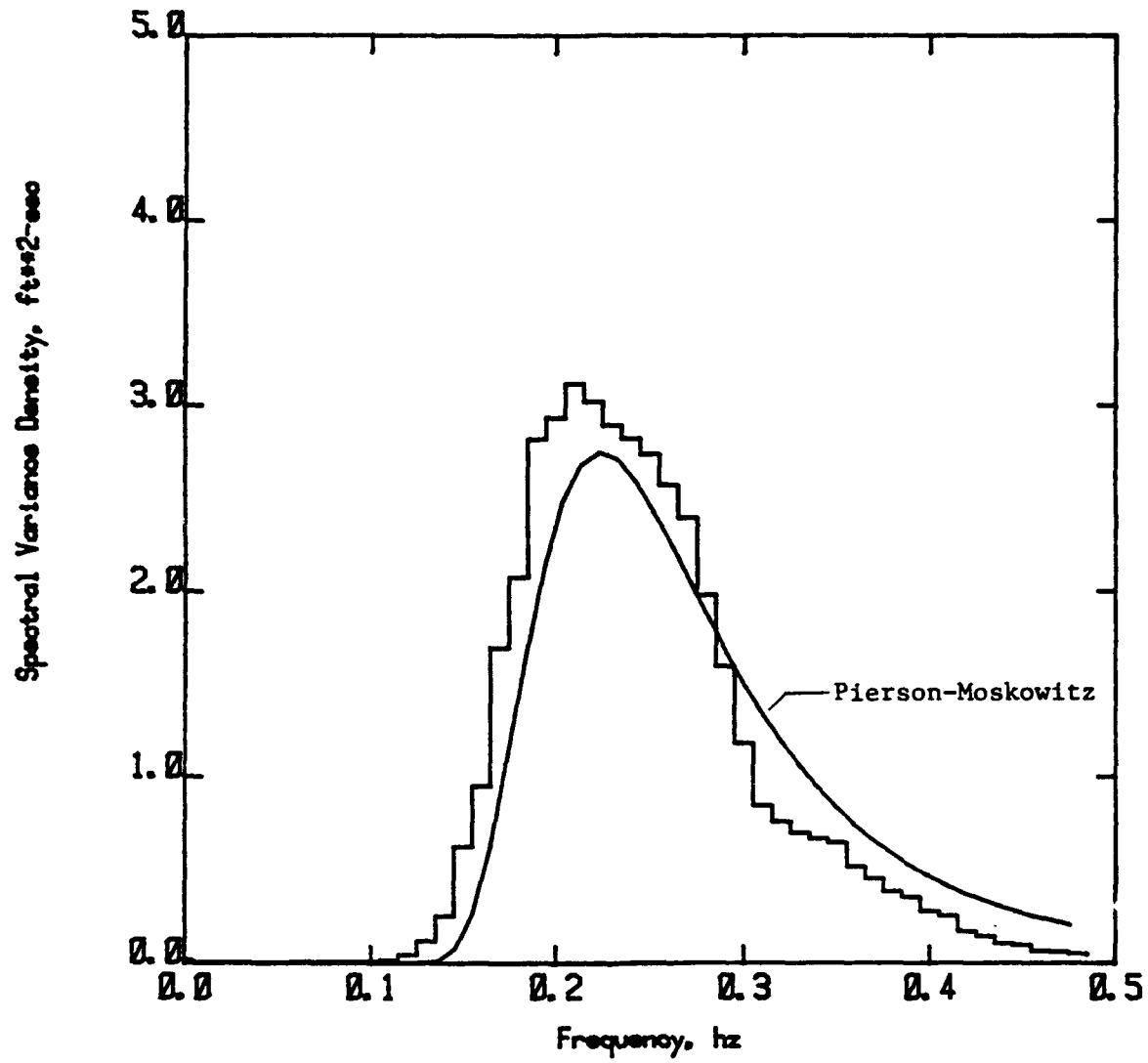


FIGURE 9 120 FT WPB TEST WAVE SPECTRUM
2.62 FT SIGNIFICANT WAVE HEIGHT

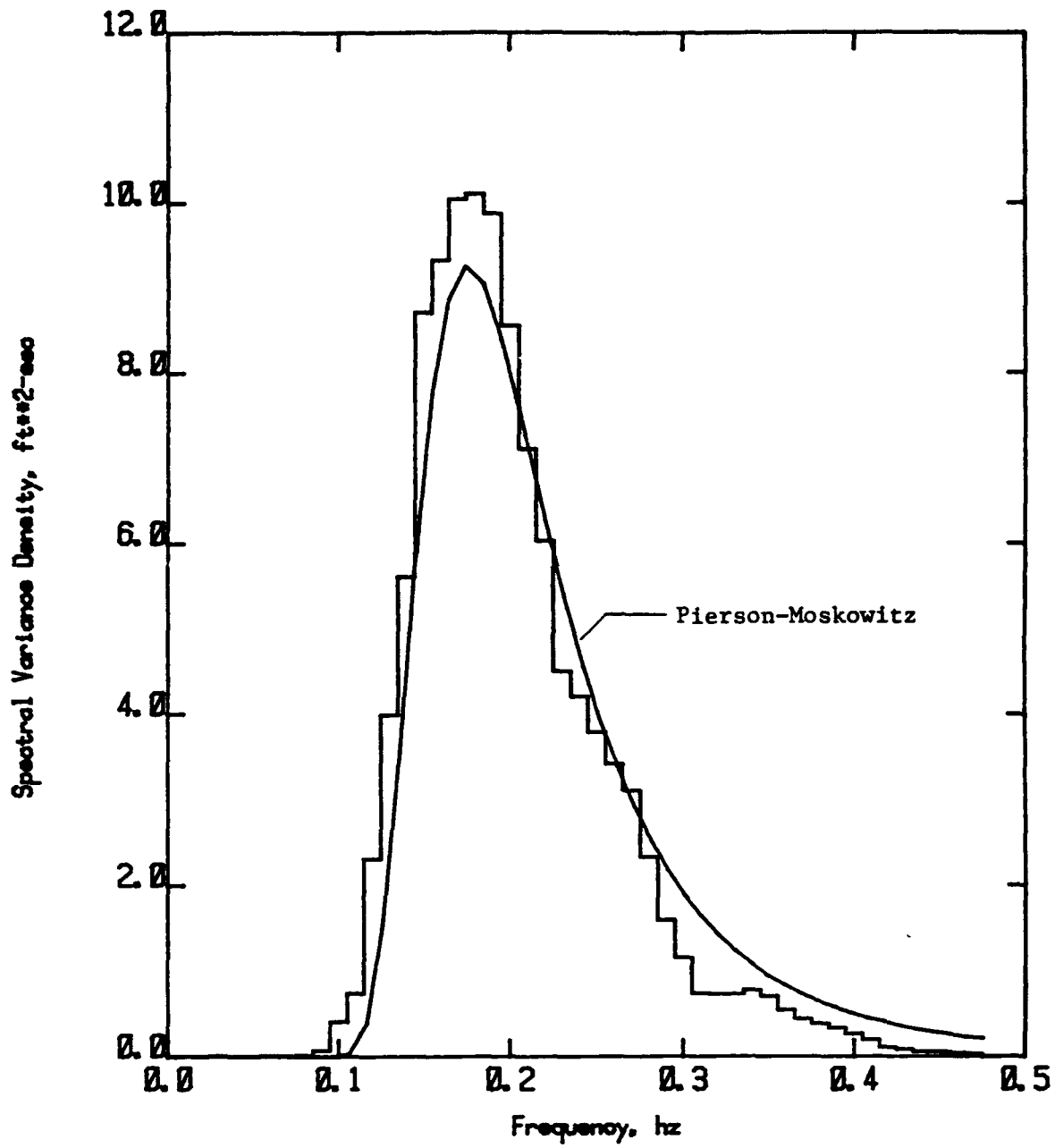


FIGURE 10 120 FT WPB TEST WAVE SPECTRUM
4.26 FT SIGNIFICANT WAVE HEIGHT

○ 120 FT WPB
△ 110 FT WPB

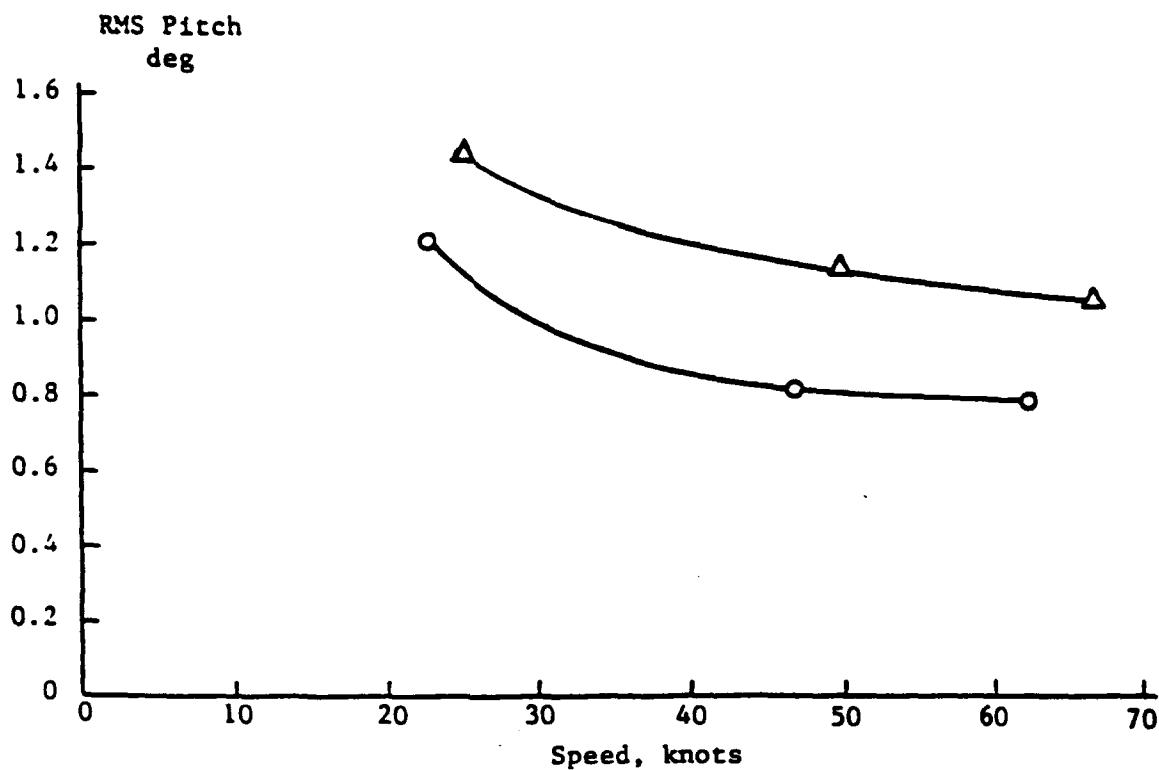
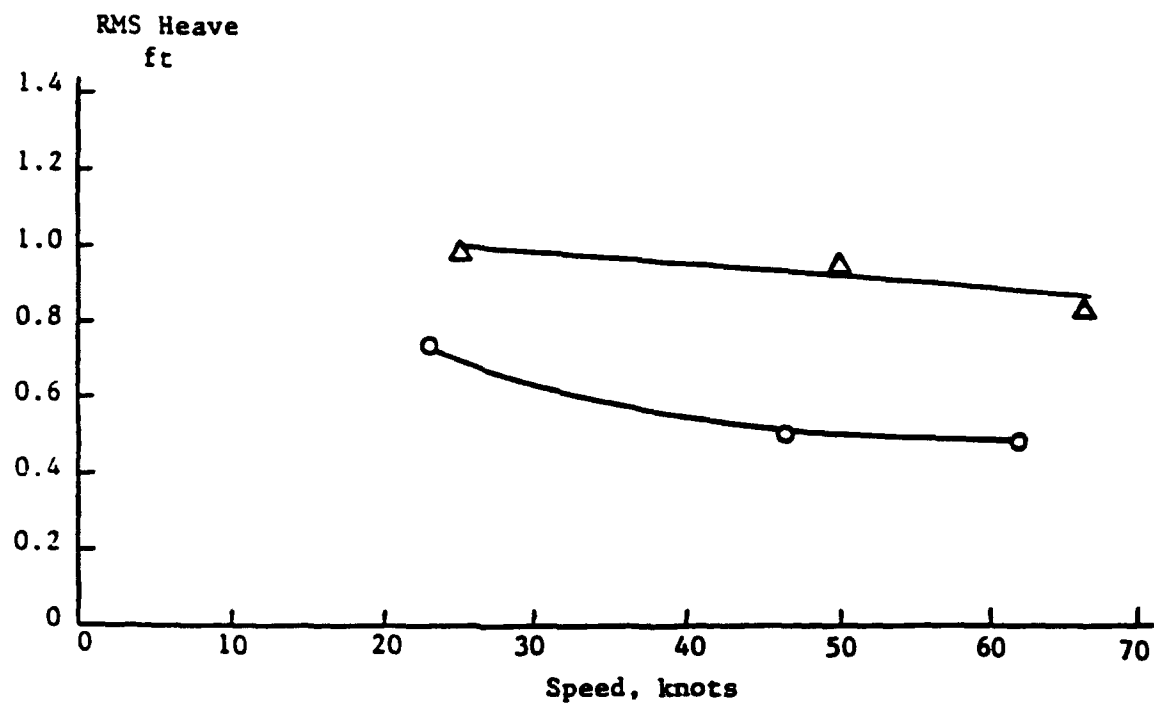


FIGURE 11 COMPARATIVE MOTION RESPONSE IN IRREGULAR WAVES,
20% BEAM SIGNIFICANT HEIGHT

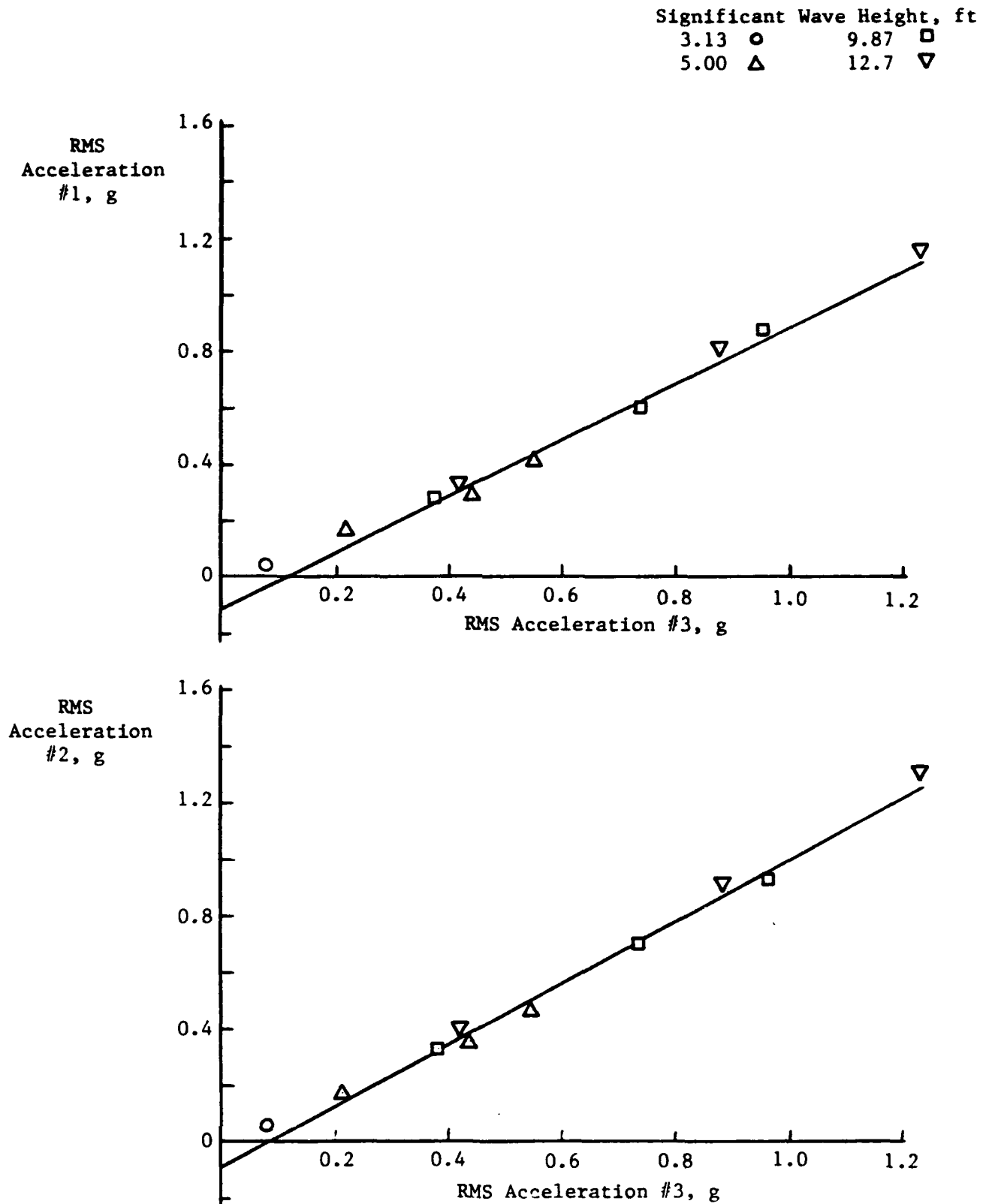


FIGURE 12 CORRELATION BETWEEN AFT AND MIDSHIP ACCELERATION
110 FT WPB

Significant Wave Height, ft

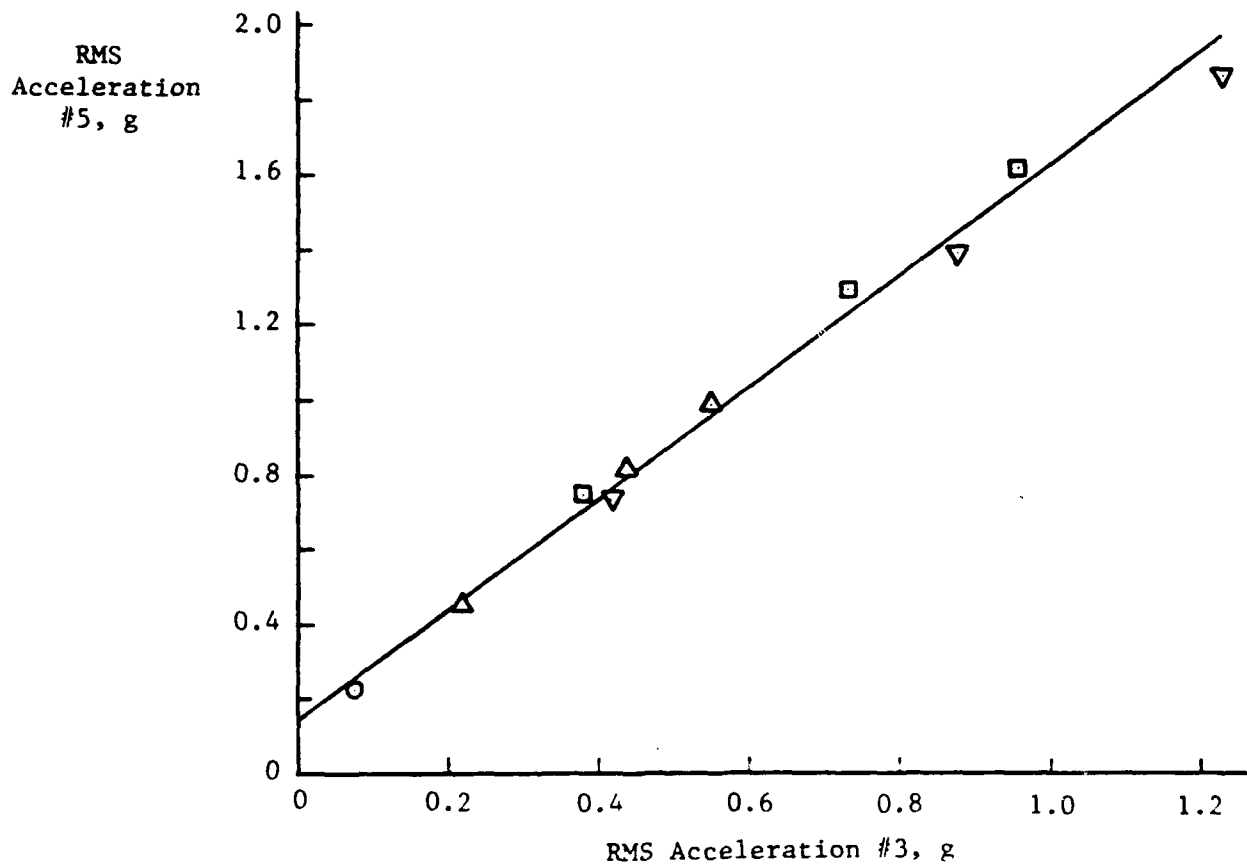
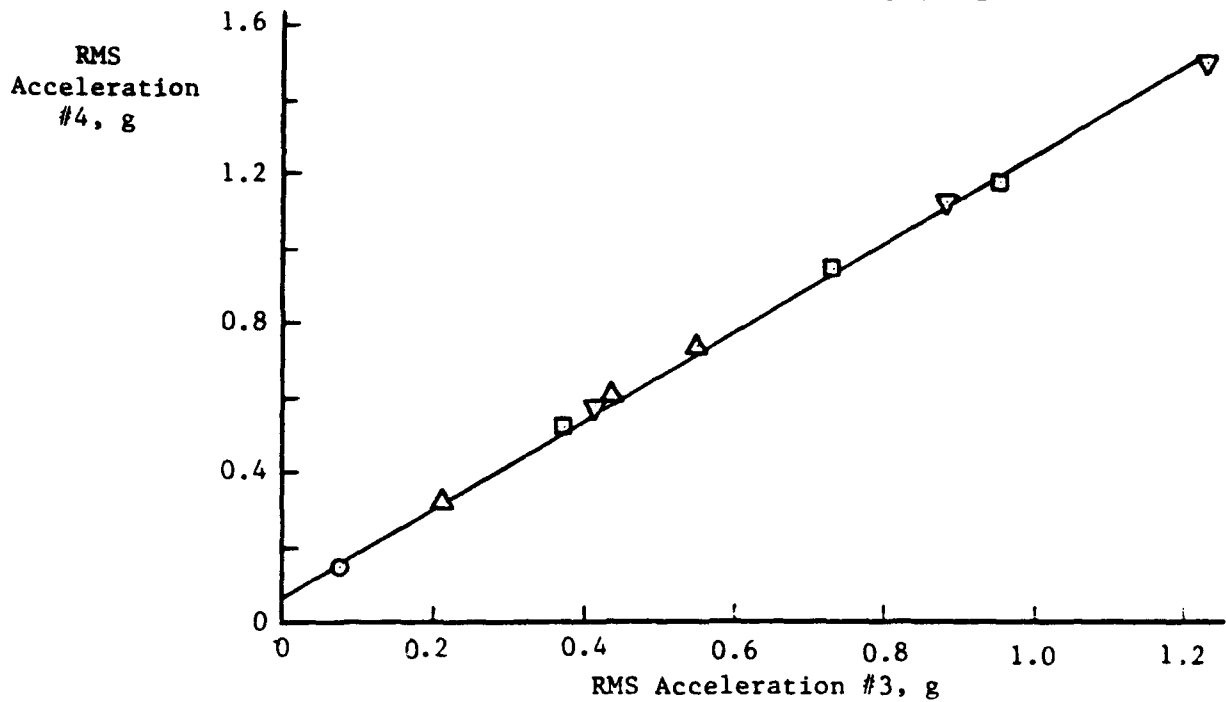
3.13 ○ 9.87 □
5.00 △ 12.7 ▽

FIGURE 13 CORRELATION BETWEEN FORWARD AND MIDSHIP ACCELERATION
110 FT WPB

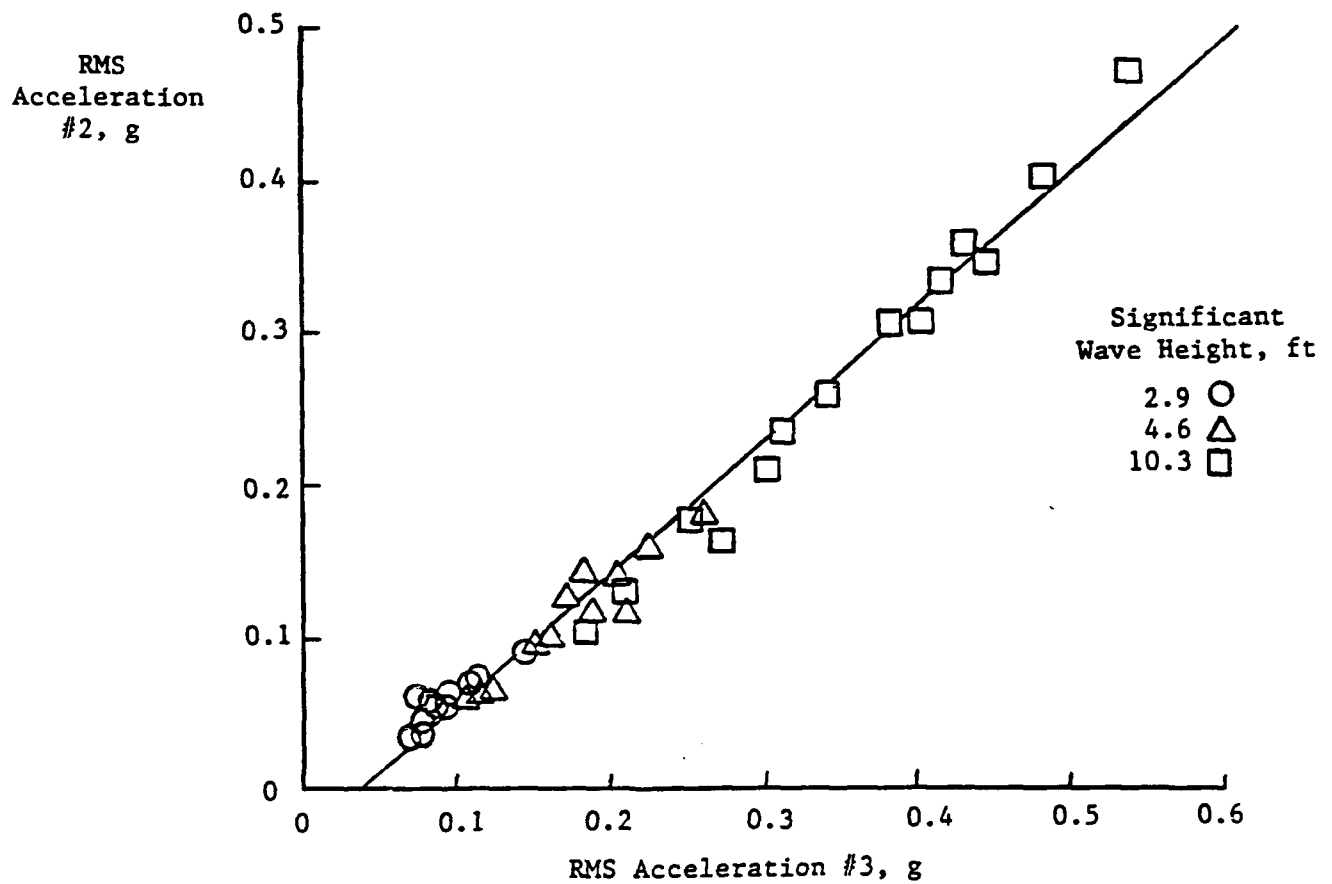
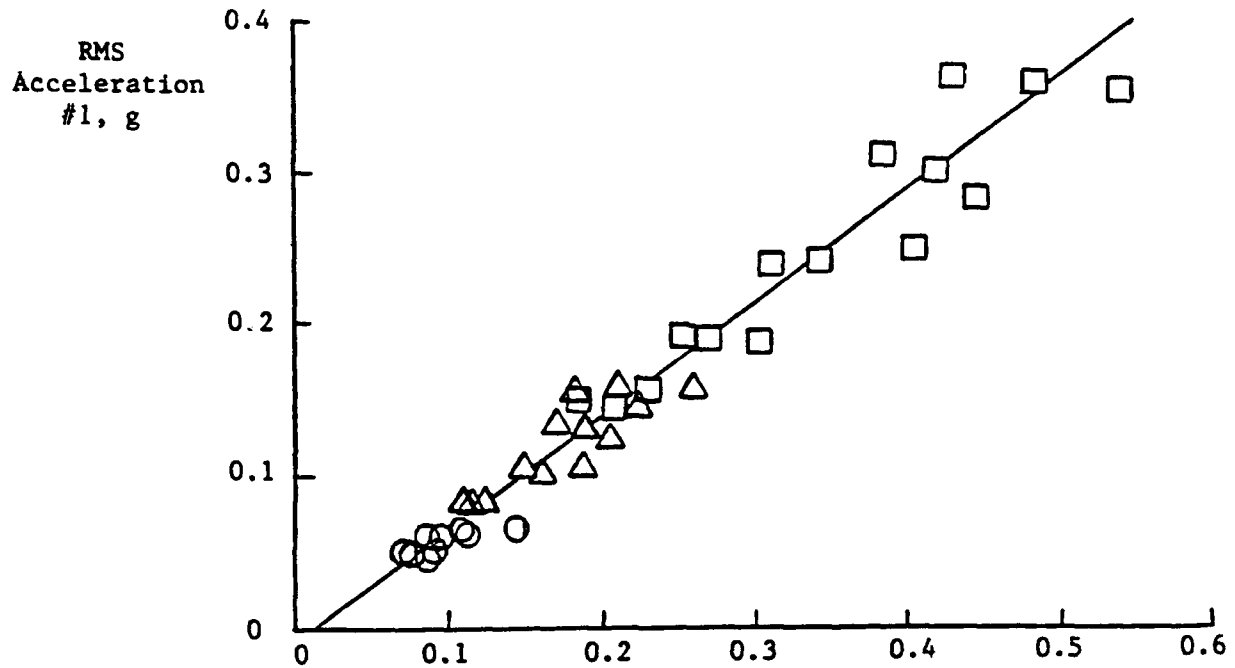
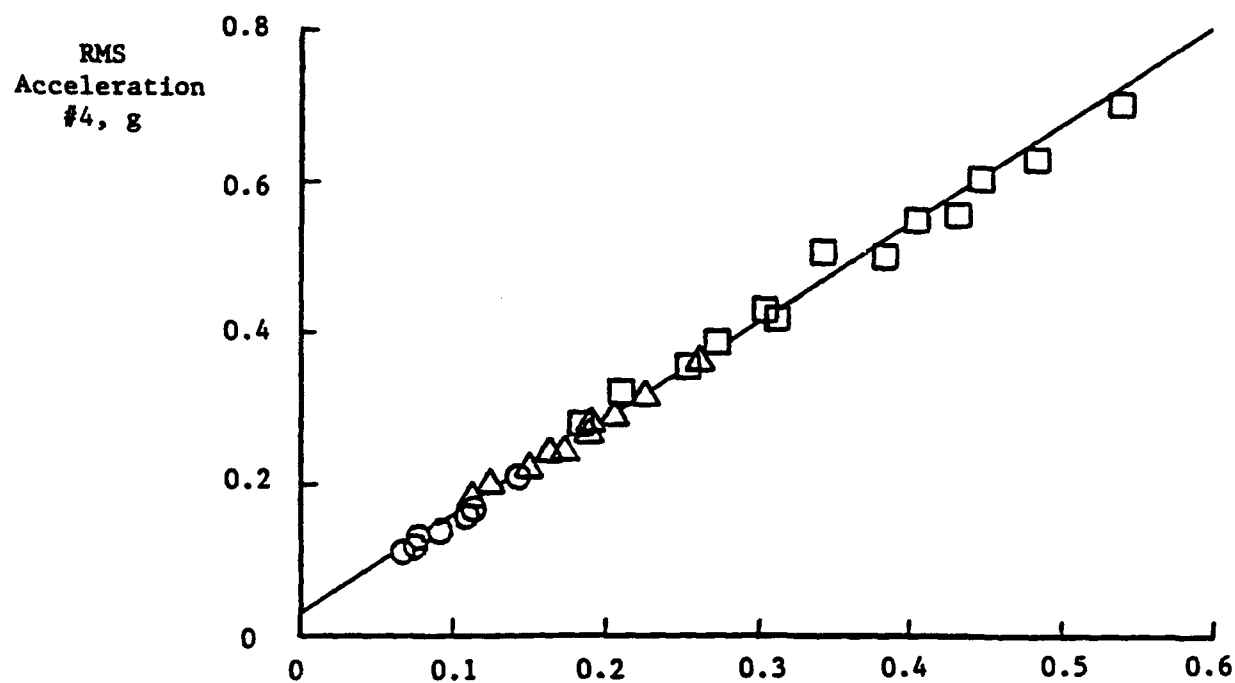
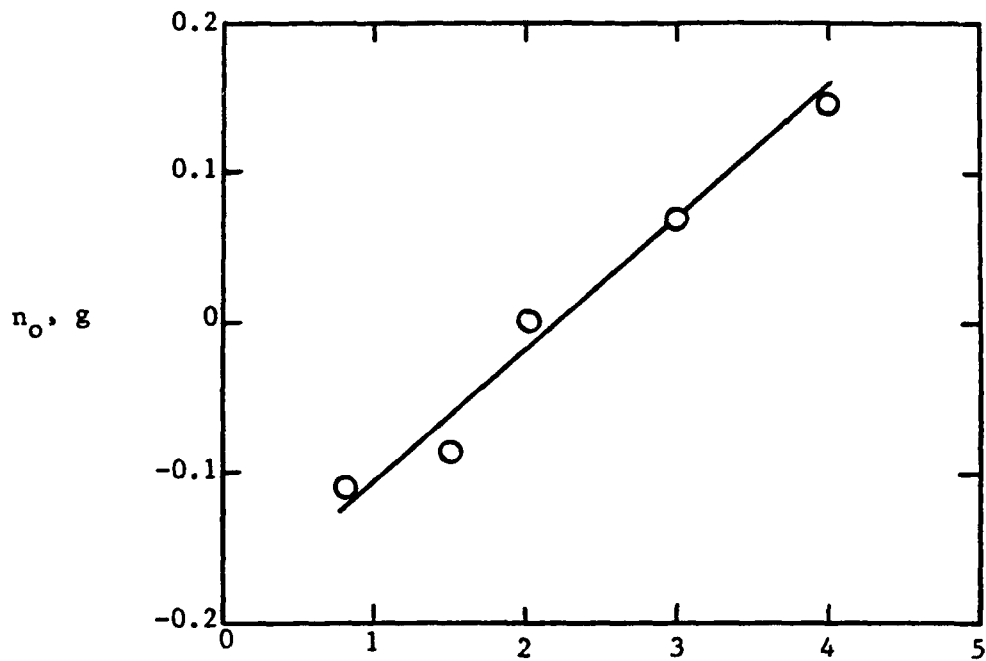


FIGURE 14 CORRELATION BETWEEN AFT AND MIDSHIP ACCELERATION
120 FT WPB





(RMS Acceleration at $x/b = n_o$)
 (RMS Acceleration at $x/b = 3$)

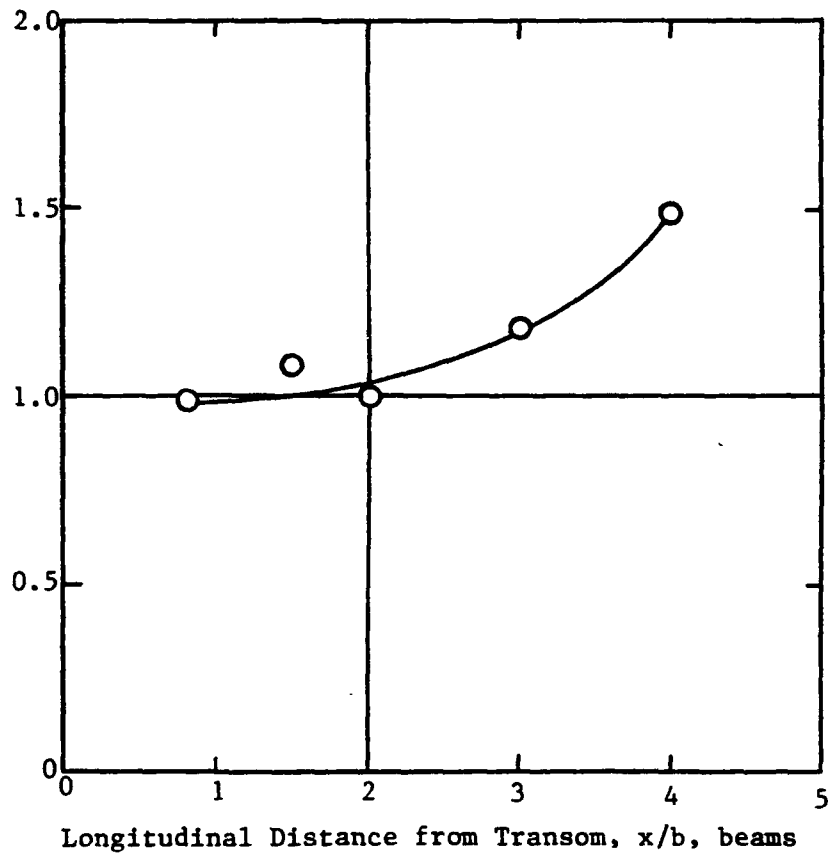
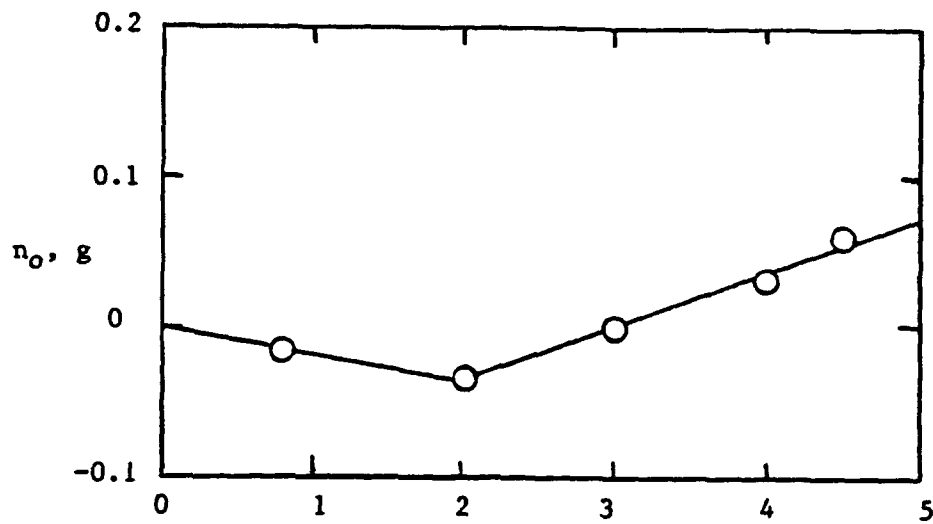


FIGURE 16 LONGITUDINAL VARIATION OF RELATIVE ACCELERATION
 110 FT WPB



$$\frac{(\text{RMS Acceleration at } x/b) - n_o}{(\text{RMS Acceleration at } x/b = 3)}$$

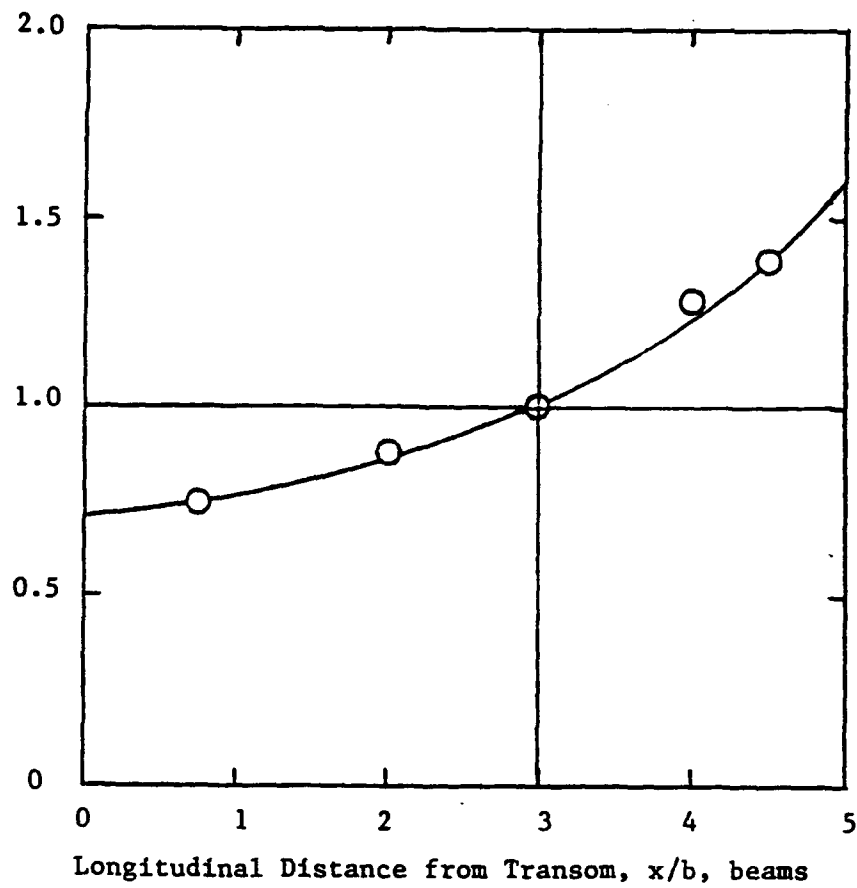


FIGURE 17 LONGITUDINAL VARIATION OF RELATIVE ACCELERATION
120 FT WPB

○ 120 FT WPB
△ 110 FT WPB

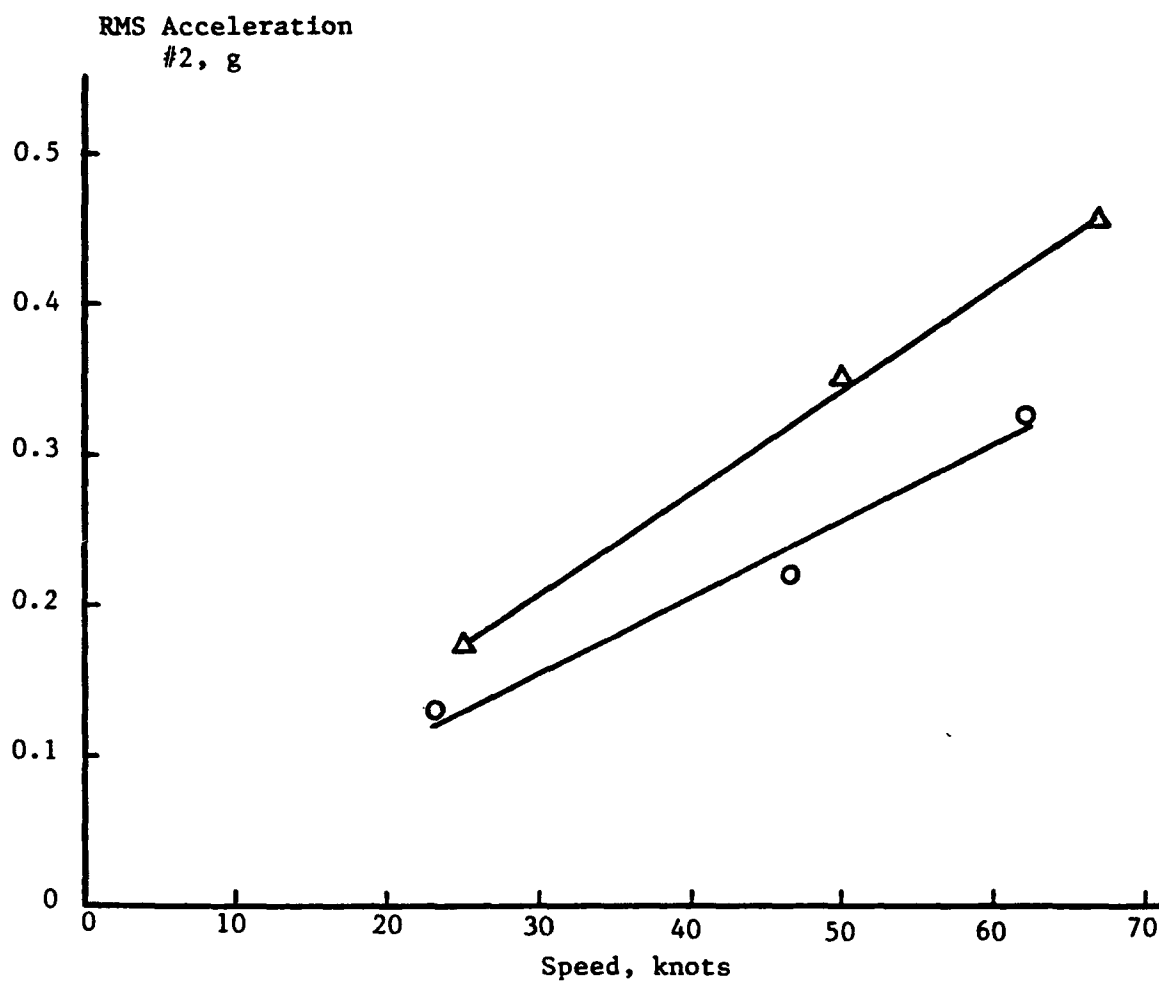


FIGURE 18 COMPARATIVE ACCELERATION CHARACTERISTICS IN IRREGULAR WAVES,
20% BEAM SIGNIFICANT HEIGHT